Entergy

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Fred Dacimo
Vice President, Operations

October 2, 2003

Re: Indian Point Unit No. 2
Docket No. 50-247
NL-03-149

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop: O-P1-17
Washington, D.C. 20555-0001

SUBJECT: Licensee Event Report No. 2003-004-00
Automatic Turbine / Reactor Trip Due to 345kV
Grid Disturbance

Dear Sir:

Entergy Nuclear Operations, Inc. (Entergy) hereby submits the attached Licensee Event Report (LER), 2003-004-00, in accordance with the requirements of 10 CFR 50.73. This event is of the type defined in 10 CFR 50.73(a)(2)(iv)(A) for an event recorded in Entergy's corrective action process as Condition Report CR-IP2-2003-04933.

Entergy is making no new commitments in this LER. Should you have any questions regarding this submittal, please contact Mr. John McCann, Manager, Licensing, Indian Point Energy Center at (914) 734-5074.

Sincerely,

Fred R. Dacimo
Vice President, Operations
Indian Point Energy Center

Attachment

cc: see next page

IE22

cc: Mr. Hubert J. Miller
Regional Administrator, Region 1
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406-1415

Mr. Patrick D. Milano, Sr. Project Manager
Project Directorate I
Division of Licensing Project Management
U. S. Nuclear Regulatory Commission
Mail Stop: O-8-C2
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INPO Record Center
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U.S. Nuclear Regulatory Commission
Resident Inspector's Office
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P. O. Box 38
Buchanan, NY 10511-0038

NRC FORM 366 (7-2001)

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 7-31-2004

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 Budget, Washington, DC 20503. If a means used to impose information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

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

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
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4. TITLE

Automatic Turbine Trip / Reactor Trip Due to 345kV Grid Disturbance

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
										05000-
08	03	2003	2003	- 04 -	00	10	02	2003	FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE	N
10. POWER LEVEL	100

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

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)(A)	73.71(a)(4)
20.2203(a)(2)(i)	50.36(c)(1)(ii)(A)	50.73(a)(2)(v)(A)	73.71(a)(5)
20.2203(a)(2)(ii)	50.36(c)(2)	50.73(a)(2)(v)(B)	OTHER Specify in Abstract below or in NRC Form 366A
20.2203(a)(2)(iii)	50.46(a)(3)(ii)	50.73(a)(2)(v)(C)	
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)	

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
Richard Louie, Licensing Engineer	(914) 734-5678

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

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

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

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

On August 3, 2003, at approximately 0430 hours, Indian Point Unit 2 experienced an automatic reactor trip event {JE} initiated by a main turbine trip on auto stop oil. The auto stop oil turbine trip was caused by an electrical disturbance associated with the 345kV North Ring Bus at the Buchanan Substation. Subsequent failure of a carrier power supply {JX} prevented the generation of a transfer block signal, which would have prevented the occurrence of this event. Prior to this event, Indian Point Unit 2 was operating at 100 percent, steady-state power conditions. During the unit trip the internal 6.9kV buses were de-energized resulting in a loss of all four (4) reactor coolant pumps (RCP). This placed the plant in natural circulation. The loss of the internal 6.9kV buses resulted in the loss of 480V buses 2A and 3A as per plant design. All three (3) emergency diesel generators (EDG){EK} started and buses 2A and 3A were manually energized by 22EDG. No steam generator or pressurizer safety valves lifted and actuation of the safety injection system was not required. No radiological releases or adverse safety implications to the public occurred as a result of this event. In accordance with 10 CFR 50.72(b)(3)(iv)(A), the NRC was notified (Event Number 40045) of this event at 1110 hours on August 3, 2003. This report is submitted pursuant to 10 CFR 50.73(a)(2)(iv)(A) as an event or condition that resulted in a manual or automatic actuation of the reactor protection system.

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

DESCRIPTION OF EVENT

Note: The Energy Industry Identification System Codes are identified within brackets {}.

On August 3, 2003 at approximately 0430 hours, Indian Point Unit 2 experienced an automatic reactor trip event {JE} initiated by a main turbine trip on auto stop oil {TG}. The auto stop oil turbine trip was caused by an electrical disturbance associated with the 345kV North Ring Bus {FK} at the Buchanan Substation. The electrical disturbance was initiated by a trip of Feeder W93 due to a lightning strike to tower No. 51 on the feeder. Substation {FK} protective relaying tripped open Buchanan 345kV Substation North Ring Bus breakers 9 and 11 to isolate the fault. 345kV Feeder Y94 to the Ramapo Substation sensed the fault on Feeder W93 and tripped. Since the electrical fault was external to Feeder Y94 the isolation of Feeder Y94 should have been blocked. The signal to block the isolation of Feeder Y94 was not received at the Ramapo Substation, due to a failed carrier power supply. Once Y94 was lost the electrical output of the Unit 2 main generator was through 345kV/138kV Transformer TA5, a 234 MVA (Mega Volt Ampere) transformer. The loss of electrical load caused the speed of the main generator {TB} to increase. At that point, the over-frequency trip device on the output of the main generator sensed the over-frequency condition and tripped the unit at the over-frequency trip setpoint of 62.5 hertz. The internal 6.9kV buses (Buses 1 thru 4) were now out of synchronization with the external (Buses 5 and 6) 6.9kV buses. Normally on a unit trip the internal 6.9kV buses fast transfer to the external 6.9kV buses maintaining the 6.9kV loads energized. A synchronization check relay verifies the frequencies of internal 6.9kV buses and external 6.9kV buses are synchronized before this fast transfer may occur. In this case, the buses were not synchronized and the 6.9kV internal fast bus transfer was inhibited. The internal 6.9kV buses de-energized when the unit tripped. This de-energized the internal 6.9kV loads, including all four of the reactor coolant pumps (RCPs) placing the plant in a natural circulation condition. When the internal 6.9kV buses were de-energized, 480 Volt Buses 2A and 3A also de-energized, as expected. All three (3) Emergency Diesel Generators (EDG) {EK} started, as designed, on the loss of a 480 Volt bus, and Buses 2A and 3A were manually energized by 22EDG at 0440 hours. 6.9kV Buses 5 and 6 remained energized throughout the event. 21 Auxiliary Feedwater (AFW) {BA} Pump did not automatically start due to 480 Volt Bus 3A being de-energized and the initial auxiliary feedwater flow to 21 and 22 steam generators was via 22AFW Pump (steam driven). This was as expected for this type of transient. Following the trip the operators entered Emergency Operating Procedure E-0, "Reactor Trip or Safety Injection" and transitioned to ES-0.1, "Reactor Trip Response." Recovery of the internal 6.9kV buses occurred at 0517 hours. Start of 24RCP occurred at 0533 hours, at which time forced circulation to the Reactor Coolant System (RCS) {AB} was re-established. Radiation monitor data was reviewed to determine if any changes were detected. No changes in recorded data levels were noted. Secondary chemistry analysis was within expected parameters.

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

The following equipment issues were identified during the event:

- 22 and 23 Static Inverter frequencies were found low at approximately 59.4 Hz and the Inverters were not in-sync with the alternate source.
- Load Limit No. 2 minimum light indication failed to indicate.
- Main Generator over frequency relay 81/P2 did not actuate during the over frequency trip.
- Main Turbine bearing No. 8 LED was illuminated with normal indications of bearing vibration.
- Pressurizer channel No. 2 level transmitter LT-460 has 4 percent deviation from the rest of the Pressurizer level transmitters.
- The main generator GENEREX minimum light did not illuminate on generator trip.
- 22RCP lower thrust bearing temperature indication failed.

None of the above conditions precluded the return to power of Unit 2.

This event was entered into the Entergy Corrective Action Program under CR-IP2-2003-04933. A post transient evaluation was performed on August 3, 2003. Upon completion of plant restoration activities, Indian Point Unit 2 was re-started and synchronized to the grid on August 5, 2003.

CAUSE OF EVENT

The apparent cause for the reactor trip event was the failure of the transfer block signal to block the isolation of Feeder Y94. The cause of the signal failure was due to a failed carrier power supply. Had the transfer block signal operated correctly the output of the main generator would have been through Breaker 7 (Feeder Y94) and the unit would not have tripped on over-frequency. The carrier power supply is part of the Consolidated Edison 345kV system.

CORRECTIVE ACTIONS

A corrective action has been assigned to the 345kV System Engineer to follow up with Consolidated Edison and obtain their root cause report for the fault on Feeder W93 and the failure of the carrier power supply. These reports will also contain Consolidated Edison's actions to prevent re-occurrence and improve grid reliability to the Indian Point Station. (Due Date: December 31, 2003)

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

EVENT REPORTING

This report is submitted pursuant to 10 CFR 50.73(a)(2)(iv)(A) as an event or condition that resulted in a manual or automatic actuation of the reactor protection system.

Pursuant to 10 CFR 50.72(b)(3)(iv)(A), this event constitutes a 4-hour NRC notification as, "Any event or condition that results in valid actuation of…the reactor protection system…except when the actuation results from and is part of a pre-planned sequence during testing or reactor operation." A late report (Event Number 40045) was made at 1110 hours on August 3, 2003.

PAST SIMILAR EVENTS

A review of previous occurrences that involved the same underlying concern or reason as this event was performed. Within the past three years, two (2) occurrences were identified, and were reported to the NRC in the following LERs:

LER 2003-003-00: This LER reported that on April 28, 2003, Indian Point Unit 2 experienced an automatic reactor trip initiated by a turbine trip on auto oil stop. The auto stop oil trip was caused by a trip of the over-frequency relays actuated by a disturbance associated with the 345kV North Ring Bus at Buchanan Substation and the Consolidated Edison 138kV system.

LER 2001-007-00: This LER reported that on December 26, 2001, Indian Point Unit 2 experienced an automatic reactor trip initiated by a turbine trip on auto oil stop. The auto stop oil trip was caused by a trip of the over-frequency relays actuated by a disturbance associated with 345kV Bus W93. The cause for the over-frequency relays actuation was failure of the blocking relay on Consolidated Edison 345kV feeder Y94.

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

EVENT SAFETY SIGNIFICANCE

Loss Of External Load

Loss of load is described in the UFSAR Section 14.1.8. This event was initiated when approximately 100 percent of Indian Point 2's output was rejected by the loss of transmission lines. The UFSAR reviews this type of event noting that the transient is bounded by two existing UFSAR analyzed events. The UFSAR states as follows:

"Normal power for the reactor coolant pumps is supplied through buses from a transformer connected to the generator. On a generator trip, other than a generator over-frequency trip, the buses are automatically transferred to a transformer supplied from external power lines, and the pumps will continue to supply coolant flow to the core. When the generator is tripped by a generator over-frequency trip the transfer is blocked by an over-frequency transfer interrupt circuit. This scenario is similar to the UFSAR analysis of loss of all AC power to the station auxiliaries per Section 14.1.12, and loss of reactor coolant flow per Section 14.1.6."

Loss of Station Auxiliary Power

The loss of power to station auxiliaries is described in Section 14.1.12. This design event as described in the UFSAR results in a loss of offsite power for both 6.9kV and 480 Volt buses. In this event, loss of power was limited to four of the six 6.9kV buses and a momentary loss of two of the four 480 Volt buses. 480 Volt Bus 2A and 3A were both provided emergency power from 22EDG. 6.9kV Buses 5 and 6 were maintained throughout the event. As such, this event is bounded by the UFSAR analysis. The UFSAR states as follows:

"Results of the analysis show that, for the loss of offsite power to the station auxiliaries event, all safety criteria are met. The AFW capacity is sufficient to prevent water relief through the pressurizer relief and safety valves; this assures that the RCS is not overpressurized.

The analysis also demonstrates that sufficient long term heat removal capability exists by the natural circulation capability of the RCS following reactor coolant pump coastdown to prevent fuel or clad damage."

The loss of power to the 6.9kV buses was caused by the actuation of the main generator over-frequency protection. This design feature was incorporated into the overall unit protection scheme after a 1997 loss of external load event, which resulted in a challenge to RCS parameters (Reactor Coolant Pump speed and Reactor Core Flow increase). 480 Volt Buses 5A and 6A remained energized from offsite sources, while 480 Volt Bus 2A and 3A lost power as they were aligned to the inside (6.9kV) power source. Operators manually restored Buses 2A and 3A by closing the output breaker on 22EDG. Plant response was as expected for the actuation of the over-frequency relays.

The over-frequency protection feature was added to the original 6.9kV bus fast transfer synchronization check relay design, which consisted of interlocks provided by phase angle check relays (25X1 Bus 5, 25X2 Bus 6) to verify synchronism between the buses.

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Reactor Coolant Pump Over-speed

Both reactor coolant pump overspeed and the effect of the reactor coolant pump overspeed are described in the UFSAR Section 4.2.2.4, Reactor Coolant Pumps. Based on a review of the Reactor Coolant System flow response, a 3 percent flow increase occurred during this event. This is attributed to the actuation of the over-frequency trip relays. The UFSAR describes this protection as follows:

"On most electrical events, which cause the turbine to be tripped, the reactor coolant pump buses are transferred to offsite power and the unit is tripped simultaneously and the pumps will therefore not exceed their normal running speed. If for some unlikely reason the only plant trip is a turbine over-speed trip an over-frequency trip relay circuit is provided that will trip the turbine-generator. This trip circuit first locks out the 6.9kV dead bus transfer at 62.2+0.1Hz (1866 + 3rpm) and then trips the main generator at 62.5+0.1 Hz (1875 + 3 rpm). Termination of power to the in-house 6.9kV buses 1 through 4 limits the reactor coolant pumps overspeed to maintain the RCS flow condition below the design limit per Section 4.2.2.5.4.

The primary coolant pumps run at 1189 rpm and may operate briefly at overspeeds up to 109 percent 1296 rpm during loss of offsite load. For conservatism, however, 125 percent of operating speed was selected as the design speed for the primary coolant pumps. For the overspeed condition, which would not persist for more than 30 sec, pump operating temperature would remain at about the design value. However, the limiting condition for the RCS system components is the effect the excess RCS flow has on the reactor internals. This limit is statistically derived RCS flow value of 115.8 percent at a confidence level of 95 percent."

Turbine Over-speed

Main turbine overspeed design basis is determined in Section 14.1.13 of the UFSAR. Main turbine speed for this event remained under design limits. Indian Point Unit 2 has fully integrated low-pressure turbine rotors. The fully integrated design eliminates the disk bores and keyways of the earlier design, reducing peak stresses and transferring the location of peak stresses to the blade fastening locations on the rotor.

During the trip the main turbine increased in speed over the normal trip setting. Speed indication for this event was 2200 rpm.

The mechanical design limit for the main turbine/generator is 132 percent of rated speed or 2376 rpm. This speed was used by Westinghouse study, "Review Study of the LP Steam Dump System for Turbine-Generator Over Speed Protection", ES 501040 May 1989. This study included the GE generator and the FI LP rotors.