U.S. NUCLEAR REGULATORY COMMISSION

REGION I

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License No:	DPR-59
Report No:	50-333/97-11
Licensee:	New York Power Authority
Facility:	James A. FitzPatrick Nuclear Power Plant
Location:	Post Office Box 41 Scriba, New York 13093
Dates:	December 15-19, 1997 and January 7, 1998
Inspector:	Leonard Cheung, Senior Reactor Engineer Gordon Hunegs, Sr. Resident Inspector
Approved by:	William Ruland, Chief Electrical Engineering Branch Division of Reactor Safety

EXECUTIVE SUMMARY

James A. FitzPatrick Nuclear Power Plant
NRC Inspection Report No. 50-333/97-11

This inspection was conducted to review the issue associated with the upgrade (replacement) of the original General Electric traversing incore probe (TIP) with a Siemens digital system. This report covered the result of a one-week onsite inspection by one region-based inspector and one resident inspector.

Engineering

- The licensee's replacement in 1991 of the original GE TIP system with a Seimens digital TIP system involved an USQ and was in violation of 10 CFR 50.59 (a) (1) and (2). (E8.1)

- The three primary containment isolation ball valves in the TIP system were inoperable from 1991 to 1996 in that these valves could be opened (by an unintended design function) when containment isolation was required. This was not in compliance with FitzPatrick Technical Specifications Section 3.7.D.1. (E8.1)

- The licensee's disposition of a Deviation/Event Report for replacement of a nonsafety-related 24 Vdc power supply in the TIP system was weak. (E8.1)

- One unresolved item is closed. (E8.1)

Operations

- Operators showed a weakness in recognizing a plant condition that required technical specification actions to be taken in response to the TIP ball valves failing open. (O4.1)

- Plant was placed in cold shutdown in accordance with technical specification requirements. (O4.1)

Report Details

Summary of Plant Status

This was a special engineering inspection to review the upgrade (replacement) of the original General Electric traversing incore probe (TIP) with a Siemens digital system. During the inspection, FitzPatrick was restarting from a forced outage to repair the safety relief valves, and was at full power at the end of the inspection.

E8 Miscellaneous Engineering Issue (92903)

E8.1 (Closed) Unresolved Item (96-06-04): Traversing Incore Probe (TIP) System Ball Valve Control Failure

a. Inspection Scope

On September 16, 1996, a human error caused a momentary loss of power to the TIP control system and the activation of the containment isolation signal. When the power was restored, the licensee found that the three primary containment isolation ball valves in the TIP system opened with a valid Group 2 containment isolation signal present. At that time, the TIPs were not being inserted or withdrawn. The licensee attributed the cause of the valve opening to a power supply failure in the torque control unit of the TIP system. The inspector reviewed pertinent licensee documents to determine licensee's compliance with safety and regulatory requirements.

b. Observations and Findings

Background

In February 1991, the licensee replaced the original General Electric (GE) TIP system with a Siemens digital system (Modification FI-88-253). The licensee stated that the Siemens system was the only one installed in the United States, therefore, there would be no generic concern for this issue.

The original GE TIP system consisted of three subsystems; each consisted of motor control and drive mechanism, and a guide tube that penetrated the primary containment, and an indexer that was inside the primary containment. Each guide tube (3/8" outside diameter) had two primary containment isolation valves (one ball valve and one shear valve) located outside the containment wall. The indexer was inside the primary containment. The GE design criteria for the containment isolation as indicated in Section 5.3.2 of GE document NEDC-22253, "BWR Owners' Group Evaluation of Containment Isolation Concerns," dated October 1982 states that:

> "Under normal operating conditions, the TIP system guide tubes do not communicate with the containment atmosphere because purge air supplied to the box surrounding the indexing mechanism effectively precludes such communication. However, following a LOCA (loss of coolant accident) or containment pressurizing event, a check valve on the box will open, resulting in direct communication between the containment atmosphere and the TIP guide tubes. Consequently, GDC (General Design Criterion) 56 is the applicable NRC requirement for TIP system isolation design."

The Siemens system also consisted of three subsystems similar to the GE system, except that the guide tube size was 10 mm instead of 3/8". The Siemens system also contained three new indexers. As documented in Section 6.2 of a FitzPatrick report (JAF-RPT-NMS-01511, Revision 1, dated December 6, 1996), the provision for the indexer design was as follows:

> "Under normal operating conditions, the TIP system guide tubes do not communicate with the containment atmosphere because the indexing mechanism is sealed against containment atmosphere and effectively precludes such communication. However, following a LOCA (loss of coolant accident) or a guide tube break inside containment, direct communication between the containment atmosphere and the TIP guide tubes is established. Consequently, GDC 56 is the applicable NRC requirement for TIP system isolation design."

The Siemens system used four programmable logic controllers (PLC); one in the central control unit in the main control room, and one in each subsystem. This system also used a common torque control unit, which had a 24 Vdc power supply (115 Vac input).

Following the September 16, 1996, event, the licensee found that the power supply for the torque control unit had failed. The licensee's evaluation determined that this power supply failure had caused the TIP position indication to go to zero. Subsequently, the computer software (as designed) opened all three primary containment isolation ball valves on a TIP position indication of zero, in spite of a valid Group 2 containment isolation signal. The licensee also determined that all PLCs functioned as designed. The inspector found that this design function had not been analyzed by the licensee during the 1991 design change (TIP system replacement) process.

The licensee had issued a Nuclear Safety Evaluation (JAF-8E-89-146, Traversing Incore Probe Upgrade, dated September 12, 1990) to support the 1991 TIP system design change. The inspector reviewed this safety evaluation and found that it did not analyze the failure mode of the system components (nonsafety-related) that could cause a malfunction in the safety-related containment isolation valves. The safety evaluation also did not discuss the hardware or the software (or firmware) of the four PLCs, nor the verification and validation of the software.

Design Basis and Technical Specifications Requirements

The inspector reviewed FitzPatrick Final Safety Analysis Report (FSAR), and found that the design basis for the three primary containment isolation ball valves (07SOV-104A,B,C) in the TIP system was specified in the FSAR as follows: 1) Notes 16 to FSAR Table 7.3-1 for these three primary containment isolation valves states, "During normal power operation the TIP ball valves are closed except during LPRM (local power range monitor) calibration operations when the TIP is inserted or withdrawn to measure reactor power at various locations within the reactor core"; and 2) FSAR section 7.5.9.2 (Revision 4, dated July 1993) states that (for each TIP subsystem) a guide tube (primary containment isolation) ball valve opens only when the TIP is being inserted.

10 CFR 50.59(a)(1) states that a licensee may make changes in the facility as described in the safety analysis report, without prior NRC approval, unless the proposed change involves an unreviewed safety question (USQ). 10 CFR 50.59(a)(2) states that a proposed change is deemed to involve a USQ if a possibility for a malfunction of a different type than any evaluated previously in the safety analysis report may be created.

However, in 1991, the licensee made a change to the TIP system that involved a USQ without prior NRC approval. Specifically, the licensee's replacement in 1991 of the original General Electric TIP system with a Siemens digital TIP system involved a USQ in that the Siemens digital system contained an unintended function which caused, on September 16, 1996, a malfunction of a different type for the three primary containment isolation ball valves in the TIP system. The three ball valves opened in the presence of a valid Group 2 containment isolation signal and the TIPs were not being inserted or withdrawn. The ball valves could not be closed until the next day when a 24 Vdc power source was temporary connected to the torque control unit of the TIP system. This incident occurred when the power supply to the TIP system was lost and subsequently restored. The unintended function in the Siemens digital system was not previously evaluated in the FSAR nor in the safety evaluation (JAF-SE-89-146, dated September 12, 1990) associated with TIP system replacement. This is a violation. **(EEI 50-333/97-11-01)**

The inspector reviewed Licensee Event Report (LER) 96-010-01 and found that the inadvertent opening of the three primary containment isolation ball valves with a valid containment isolation signal present was discussed briefly in this LER. However, the condition that FitzPatrick potentially operated the three ball valves outside the design basis was not reported.

The inspector's review of FitzPatrick Technical Specifications (TS) indicated that section 3.7.A.2 requires that primary containment integrity shall be maintained at all times when the reactor is critical or the reactor water temperature is above 212°F, and fuel is in the reactor vessel, except while performing low power physics tests at atmospheric pressure at power levels not to exceed 5 MWt. TS section 3.7.D.1 requires that whenever primary containment integrity is required, containment isolation valves shall be operable. TS section 4.7.D identified the containment isolation valves as those listed in FSAR section 7.3, which included the three primary containment isolation ball valves (07SOV-104A,B,C) in the TIP system.

However, from 1991 to September 1996, when primary containment integrity was required to be maintained, the three primary containment isolation ball valves in the TIP system were inoperable, in that these valves could be opened by an unintended design function in the TIP system in the presence of a valid containment isolation signal. The inspector determined that the 1991 replacement of the TIP system also violated FitzPatrick TS as discussed above. **(EEI 50-333/97-11-02)**

Licensee's Corrective Actions

Following the September 16, 1996, event, the licensee made a change to the control of the three ball valves in the TIP system. The licensee placed the circuit breakers that control power to these valves into normally "open" position (except during TIP operation). The licensee also completed a revised version of Nuclear Safety Evaluation JAF-SE-89-146 on December 6, 1996, and revised the affected surveillance procedures to reflect the change. Implementing the above change would preclude the ball valves from being opened by errant digital signals. The inspector's review of these documents found them generally acceptable. However, the revised safety evaluation still did not discuss the "validation and verification" of the PLC software, and did not recognize that the 1991 TIP system replacement involved an USQ.

The licensee also completed an evaluation (Report No. JAF-RPT-NMS-02511, Assessment of the TIP System Containment Isolation Design, Revision 1) on December 6, 1996. This document referred to a FitzPatrick report (JAF-RPT-NMS-02511, Revision 1, dated December 5, 1996), which again refer to another FitzPatrick document, JAF-CALC-RAD-00057, entitled "Potential Radiological Consequences of the TIP System Failure to Isolate Under Normal and Accident Conditions." The results of these analyses indicated that the maximum bounding radiological release was within the 10 CFR 100 limit.

The other three associated containment isolation valves (explosive-operated shear valves) are normally open and do not automatically close when containment isolation signal is initiated. They are to be manually closed by the operators.

During this inspection, the licensee still had not yet determined the cause of the power supply failure in the torque control unit. Following the September 16, 1996, event, the licensee ordered two power supplies (all nonsafety-related); one for replacement of the failed unit and one for spare, from the vendor. The licensee received the first unit about four days later, and without understanding the installation instructions, which was in German, the licensee promptly installed the unit. The licensee failed to recognize that this power supply was a dual input voltage (115/230 Vac) unit and that the shipped unit was configured for 230 Vac installation. On December 4, 1996, the licensee measured the output voltage of the spare power supply and found that the maximum output voltage that could be adjusted was 20.16 Vdc, much lower than the specified output of 24 Vdc. The licensee stated that the TIP system was still operable even though the torque control unit power supply was configured incorrectly. The inspector's review of Siemens specifications confirmed the licensee's statement, indicating the acceptable input voltage to the torque control unit ranged from 13 - 33 Vdc.

During a November 14, 1997, telephone call, to the vendor, the licensee was informed that for 115 Vac input voltage, jumper BR.1 must be installed on the output of the full wave bridge in the power supply unit, as indicated in the German installation instruction. Subsequently, the licensee issued a Deviation/Event Report (DER No. 97-1558) to address this issue. The inspector reviewed this DER, which was closed on November 26, 1997, and found the disposition to be weak, even for a nonsafety-related item, whose failure had already caused an inadverte opening

of the containment isolation valves. For the corrective actions, the resolution was: WR 96-06511-05 had been initiated to replace existing power supply with a correctly configured power supply. There were no actions taken to ensure that personnel performing installation must read and understand installation instructions before starting installation. During the December 19, 1997, exit meeting, the licensee management stated that additional follow-up was needed for this DER.

c. Conclusion

The inspector concluded that the licensee's replacement in 1991 of the original GE TIP system with a Seimens digital TIP system involved an USQ and was in violation of 10 CFR 50.59(a)(1) and (2). The inspector also concluded that the three primary containment isolation ball valves in the TIP system were inoperable from 1991 to 1996 in that these valves could be opened (by an unintended design function) when containment isolation was required. This constituted a violation of FitzPatrick Technical Specifications Section 3.7.D.1.

The licensee's disposition of DER 97-1558 for replacement of a nonsafety-related 24 Vdc pwoer supply in the TIP system was weak.

The original unresolved item is closed.

O4 Operator Knowledge and Performance

O4.1 Operator Actions Associated With Spurious Opening of Traverse Incore Probe (TIP) System Valves During September 16, 1996 Event

a. Inspection Scope

The inspector reviewed post trip logs, operator logs, work requests and deficiency and event reports associated with the TIP system. Additionally, discussions were held with operation department staff members.

b. Observations and Findings

The following describes the sequence of events associated with the TIP ball valves:

On September 16, 1996, at 1:04 p.m. the TIP ball valves received a group II isolation signal due to low reactor pressure vessel water level and initially closed. Operators verified and logged that all Group II containment isolation valves were closed. At 1:35 p.m., the TIP ball valves inadvertently opened following energization of a electrical bus. At approximately 2:00 p.m., operators recognized that the TIP ball valves were open. Operations shift management discussed the need to isolate the TIP penetrations using the shear valves and decided that the action was not necessary. Plant design provides for a shear valve that can cut through the TIP cable and isolate the penetration if the ball valves are unable to close because of a TIP cable fouling the valves. The decision to not close the shear valve was based, in part, on plant conditions, which showed that the conditions in containment did not indicate a need for isolation, and that the TIP system had not been in use prior to the event. However, the TIP ball valves were not declared

inoperable, nor was a limiting condition for operation (LCO) of Technical Specifications Section 3.7.D.2, Primary Containment Isolation Valves, entered at that time. Shift management requested assistance to get the TIP ball valves shut. Reactor engineering was unable to shut the valves and at approximately 9:00 p.m. the operations support center dispatched an emergency repair team which identified a power supply problem in the TIP control logic system. On September 17, at 6:00 a.m., the reactor was in cold shutdown. Subsequently, the TIP ball valves were closed after a 24 Vdc power source was temporary connected to the torque control unit of the TIP system. At 6:00 p.m., the TIP ball valves were declared inoperable and the LCO was entered.

Technical Specifications Section 3.7.D.2 requires that, with one or more of the containment isolation valves inoperable, actions be taken within 4 hours to restore the valve, or isolate the penetration. If this can not be met, the reactor shall be in cold shutdown within 24 hours. Since the shear valves were not closed within 4 hours then the plant was required to proceed to cold shutdown.

c. Conclusions

Operators showed weakness in recognizing a plant condition that required technical specification actions be taken in response to the TIP ball valves failing open. The reactor was placed in cold shutdown within 24 hours while operators made attempts to shut the TIP ball valves. Although operators did not declare the valves inoperable upon discovering they were open and could not be shut, nor did they use the shear valves to isolate the penetration, the plant was placed in cold shutdown in accordance with technical specification requirements.

E9 FSAR Reviews

A recent discovery of a licensee operating their facility in a manner contrary to the updated final safety analysis (UFSAR) description highlighted the need for a special, focused review that compares plant practices, procedures and/or parameters to the UFSAR descriptions.

While performing the inspections discussed in this report, the inspectors reviewed the applicable portions of the UFSAR that related to the areas inspected, including FSAR Table 7.3-1 and Section 7.5.9.2, that pertained to the design basis for the three primary containment isolation ball valves in the TIP system. The inspector verified that other reviewed sections of the FSAR wording were consistent with the observed plant practices, procedures and/or parameters.

XI Exit Meeting

The inspector met with the licensee personnel at the conclusion of the site inspection on December 19, 1997, and summarized the scope of the inspection and the inspection results. No proprietary information was knowingly included in this report from those documents. The licensee acknowledged the inspection findings at that meeting.

The inspector amended the exit meeting in a January 7, 1998, telephone call to Messrs. A. Zarenba and M. Abramski of the New York Power Authority. The inspector stated that the unintended function in the Siemens digital system had also caused the three primary containment isolation ball valves in the TIP system inoperable from February 1991 to 1996 as discussed in Section E8.1.b of this report.

PARTIAL LIST OF PERSONS CONTACTED

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NRC

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ITEMS OPENED AND CLOSED

Opened

50-333/97-11-01	EEI	USQ for TIP system replacement
50-333/97-11-02	EEI	TIP system containment isolation valves inoperable

Closed

50-333/96-06-04	URI	TIP system ball valve control failure