U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Docket No.: 50-289/89-18

License No.: DPR-50

Licensee: GPU Nuclear Corporation

P. O. Box 480

Middletown, Pennsylvania 17057

Facility: Three Mile Island Nuclear Station, Unit 1

Location: Middletown, Pennsylvania

Dates: August 26 - October 4, 1989

Inspectors: R. Brady, Resident Inspector, TMI
D. Johnson, Resident Inspector, TMI
T. Moslak, Resident Inspector, TMI
F. Young, Senior Resident Inspector, TMI

Approved by: _____ 10/31/89
Curtis J. Cowgill, Chief Date
Reactor Projects Section No. 4B
Division of Reactor Projects

Inspection Summary: Inspection on August 26 - October 4, 1989 (Inspection Report No. 50-289/89-18)

Areas Reviewed: The NRC staff conducted routine safety inspections of power operations activities. The inspectors reviewed plant activities as they related to safety. Specific items reviewed included; an integrated control system (ICS) transient, engineered safety features (ESF) walkdown of the building spray system, radiation monitoring system (RMS) pump upgrade and penetration pressurization valve modifications, allegation follow-up concerning licensed operator examinations, repair of a make-up system weld joint, and licensee action on previous inspection findings.

Results: No unresolved items were identified. Licensee response to the ICS module failure and subsequent transient was good, however, these challenges to operators continue to be a problem that requires licensee resolution. Minor modification work was accomplished satisfactorily. Licensee action to resolve an unsubstantiated allegation was thorough and complete. Maintenance action to repair a weld leak was noteworthy as the repair was accomplished quickly under difficult conditions. Plant operations were conducted in a safe manner. Licensee action to resolve previous inspection findings was timely and adequate.

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*Designates NRC Inspection procedure number

DETAILS

1.0 Introduction and Overview

1.1 Licensee Activities

The licensee operated the plant at full power during the report period. No major plant transients occurred. As of October 4, 1989, the TMI reactor was at 100 percent power. The licensee has now completed 280 days of continuous power operation.

1.2 NRC Staff Activities

The purpose of this inspection was to assess licensee activities for reactor safety, safeguards and radiation protection. The inspectors made this assessment by reviewing information on a sampling basis through actual observation of licensee activities, interviews with licensee personnel, or independent calculation and selective review of applicable documents. Inspections were accomplished on both normal and back shift hours.

NRC staff inspections are generally conducted in accordance with NRC Inspection Procedures (NIPs). These NIPs are noted under the appropriate section in the Table of Contents to this report.

Back shift inspections were accomplished during the following periods:

Day/Date	Time
August 27, 1989	10:30 pm - 12:00 pm
August 28, 1989	12:00 pm - 7:00 am
September 11, 1989	6:00 am - 7:00 am
September 11, 1989	8:00 pm - 10:00 pm
September 16, 1989	9:30 am - 12:30 pm
September 23, 1989	9:00 am - 11:00 am
October 3, 1989	11:30 pm - 12:00 pm
October 4, 1989	12:00 pm - 7:00 am

1.3 Persons Contacted

-- R. Barley, Manager, Plant Engineering
-- G. Broughton, Operations/Maintenance Director
-- *J. Colitz, Manager, Plant Engineering
-- J. Fornicola, Manager, Quality Assurance
-- R. Harper, Manager Plant Material
-- *H. Hukill, Vice President and Director, TMI-1
-- C. Incorvati, TMI Audits Manager
-- *B. Knight, TMI-1 Licensing

-- M. Nelson, Manager, Safety Review
-- M. Ross, Plant Operations Engineer
-- *H. Shipman, TMI-1 Operations
-- *D. Shovlin, Plant Material Director
-- P. Snyder, Manager, Plant Material Assessment
-- C. Smyth, Manager, Licensing
-- J. Stacey, TMI Security
-- D. Hassler, TMI-1 Licensing
-- C. Hartman, Manager Plant Engineering

* Denotes attendance at final exit meeting (see Section 7.0)

2.0 Plant Operations

2.1 Facility Inspection

The resident inspectors routinely inspected the facility to determine the licensee's compliance with the general operating requirements of Section 6 of Technical Specifications (TS) in the following areas:

-- review of selected plant parameters for abnormal trends;

-- plant status from a maintenance/modification viewpoint, including plant housekeeping and fire protection measures;

-- control of ongoing and special evolutions, including control room personnel awareness of these evolutions;

-- control of documents, including log keeping practices;

-- implementation of radiological controls; and,

-- implementation of the security plan, including access control, boundary integrity, and badging practices.

In general, the inspector determined that the licensee, from a housekeeping and fire protection perspective, was maintaining the plant in good condition. Overall, management attention toward plant safety continued to be noted.

Specific issues in the area of plant operations that warranted closer review are addressed below.

2.2 Integrated Control System Transient

On September 1, 1989, the plant experienced a minor transient due to a component failure in the integrated control system (ICS). The component (a module) that failed caused both main feed water pumps to

increase speed which caused a minor overcooling of the steam generators. Operators recognized the problem and took manual control of the feedwater pumps and feedwater regulating valves to restore pump speed and steam generator level.

During the transient, pressurizer pressure varied from 2110 psig to 2215 psig. Average reactor coolant temperature (AVE) varied from 577 to 581 degrees F. Reactor Power reached 102% for a brief interval and was manually reduced to 92% and subsequently stabilized at approximately 95%. This response was normal considering the fluctuation in feedwater flow which resulted from the ICS module failure and subsequent operator action to regain control of the plant.

The plant remained in manual ICS control until the Instrumentation and Control (I&C) Department began trouble-shooting the ICS system. It was determined, from review of the transient monitoring system information, that the output of ICS module 10-5-12 (FW pump Differential Pressure (Delta P) error signal) had slowly increased to maximum output. I&C trouble shooting determined that ICS module 10-4-1 (FW valve Delta P auctioneer) had failed low, probably due to failure of electrolytic capacitors in the module. Because the output of module 10-4-1 is a signal inverter, the failure of module 10-4-1 caused module 10-5-12 to increase to maximum output. The module (10-4-1) was replaced with a previously tested spare and the ICS was returned to normal, approximately two hours after the initial event. The plant was then returned to full power operation.

The inspector discussed this failure (module 10-4-1) and previous failures with Plant Material Department personnel. Previous failures included the following:

- January 18, 1988: ICS Unit Load Demand Module malfunction resulting in a 100% to 101% power transient;

- January 28, 1988; Feedwater demand signal processor malfunction resulting in a 100% to 97% power transient;

- October 11, 1988, Unit Load Demand analog memory module failure resulting in a 4% power reduction;

- June 4, 1989 Unit Load Demand module failed to mid-scale resulting in power reduction from 100% to 90%.

At present the licensee is evaluating these failures for a root cause. The licensee suspects that capacitor failure may be the cause for most of the transients along with module contact pin connection problems. The license is studying the possibility of capacitor replacement.

The inspector concluded that licensee response to this event was appropriate and a plant trip was avoided. Operator response was

timely and the maintenance personnel response was also good. The time that the ICS was required to operate manually was minimized by quick action and previous preparation to maintain adequate spare ICS modules.

2.3 Engineered Safety Features Walk Down (Building Spray System)

The inspector performed a comprehensive verification of the reactor building spray (BS) system operability. The inspector reviewed the systems design and operational requirements as specified in the Final Safety Analysis Report (FSAR) and Technical Specifications (TS). The inspector reviewed the following licensee documents:

-Operating Procedures (OP 1104-5) Reactor Building Spray System
-DWG. C-302-712 (Rev. 26) Piping Diagram - BS system

The inspector verified that enclosure 1 (Startup Valve Checklist) of OP 1104-5 reflected the as built drawing and that the checklist was comprehensive.

The inspector performed a field walkdown of all accessible portions of the BS system. The inspector verified the as-installed condition of the BS system conformed with the as-built drawing and that the system valve positions were in accordance with the licensee's valve lineup procedure and as-built drawing. The inspector noted some minor deficiencies during the BS system walkdown and provided them to licensee operations management. The inspector noted that most deficiencies were previously identified by the licensee and placed in their work tracking system. Those items not previously identified by the licensee were promptly placed on the work tracking system. The licensee also assigned an operations engineer to evaluate and dispose the deficiencies. The inspector noted that none of the deficiencies prevented the system from performing its design function. The inspector also concluded the licensee disposition of the identified items was adequate.

The inspector also reviewed the licensee surveillance procedures to ensure requirements outlined in TS were being properly implemented and at the required frequency. The inspector verified that system component and chemistry requirements were in accordance with TS requirements.

2.4 Operations Summary

Operations continue to be conducted in a safe manner. Operator response to the ICS module failure was good. Plant management involvement was good in the troubleshooting and repair of the failed ICS module, however final resolution of the ICS problems require licensee action. System walkdown of reactor building spray system determined that the system was properly maintained and could perform its designated function if required.

3.0 Equipment Operability

On a sampling basis, the inspector selected a surveillance and maintenance activity to ensure that specific programmatic elements described below were being met. Details of this review are documented in the following sections.

3.1 Surveillance Observations

The inspector observed performance of the following surveillance test to determine that: the test conformed to Technical Specification requirements; administrative approvals and tagouts were obtained before initiating the surveillance; testing was accomplished by qualified personnel in accordance with an approved procedure; test instrumentation was calibrated; limiting conditions for operations were met; test data was accurate and complete; removal and restoration of the affected components was properly accomplished; test results met Technical Specification and procedural requirements; deficiencies noted were reviewed and appropriately resolved; and the surveillance was completed at the required frequency.

This observation included:

- Reactor Protection System Channel "A" (RPS) weekly calibration on September 6, 1989.

No unacceptable conditions were identified. Generally, surveillance activities continue to be conducted safely.

3.2 Maintenance Observations

The inspector observed portions of selected maintenance activities to determine that the work was conducted in accordance with approved procedures, regulatory guides, Technical Specifications, and industry codes or standards. The following items were considered during this review: Limiting conditions for operation were met while components or systems were removed from service; required administrative approvals were obtained prior to initiating the work; activities were accomplished using approved procedures and QC hold points were established where required; functional testing was performed prior to declaring the particular component(s) operable; activities were accomplished by qualified personnel; radiological controls were implemented; fire protection controls were implemented; and the equipment was verified to be properly returned to service.

These observations included:

- Repair of the IE inverter on October 30, 1989
- BS-P-1B preventative maintenance on September 9, 1989
- Repair of RM-A-2 particulate Detector on September 11, 1989
- Repair of EHC power supply on September 27, 1989

No unacceptable conditions were identified.

3.3 Weld Failure on Instrument Line

On September 6, 1989, a small leak was identified in the weld on the low pressure side line of the seal injection differential pressure (dp) instrument (MU-42-DPT). MU-42-DPT is the differential pressure transmitter that monitors seal injection flow to the reactor coolant pumps. The low pressure side line of the flow orifice (MU-42-FE) is a one (1) inch diameter schedule 160 pipe that reduces to 1/2" diameter schedule 160 pipe into MU-V-1045 (root instrument isolation valve). The leak was at weld (No. 60d-5) which is the valve (MU-V-1045) to pipe (1/2 inch) socket weld on the make up (MU) line orifice tap side of the valve. The licensee estimated the leak to be 5 to 10 drops per minute.

The Plant Review Group (PRG) performed a review to determine the significance of the leak. Through this review, the PRG concluded that the leak could be isolated from the reactor coolant system, if needed, and, as such, not reportable under the Plant Technical Specifications.

The leak was successfully repaired by grinding out the affected area of the weld and re-welding. In order to accomplish the repair, the leak was isolated from the seal injection line by using an "ice plug" (liquid nitrogen freeze seal). Repair was successfully completed on September 8, 1989. Following completion of the repair, a satisfactory visual inspection and penetrant test was performed. The weld was then leak tested successfully under operating pressure.

The inspector reviewed the licensee's failure analysis report for the failed weld. Through this review and through discussions with licensee's representatives, the inspector determined that the most probable cause of the failure was fabrication related, i.e., porosity or tungsten inclusion. In determining the probable cause, the licensee also evaluated other possible causes such as inter-grannular stress corrosion cracking (IGSCC) and fatigue cracking, and concluded that these causes were highly unlikely by the observed characteristics of the leak.

The inspector also reviewed the licensee's evaluation of the weld failure to determine if it was indicative of a generic problem. Although the licensee concluded that the failure appeared not to be a generic problem, the licensee is taking actions to assure the integrity of similar welds and attempt to preclude any similar leaks in the future. These actions include verifying, during plant operation, that excessive line vibration does not exist on any of the MU system instrument root valve installations. Additionally, the licensee stated that during the next outage, a visual and dye penetrant examination would be performed on a sample number of similar joints.

Through review of control room logs, PRG notes and discussions with licensee representatives, the inspector determined that the licensee management had properly evaluated the safety significance of the pinhole leak within the four hour period as specified in Technical Specification (TS) 3.1.6.6. Specifically, the inspector conducted that the weld was performed in a safe manner.

3.4 Summary

Maintenance activities were carried out in a safe manner. Maintenance personnel's immediate response to emerging plant problems contributed to overall safe plant operation.

4.0 Testing Discrepancy During a SRO License Examination

On July 5, 1989, the licensee, informed the NRC of an allegation associated with potential testing discrepancies that occurred during a senior reactor operator license exam in March of 1987.

The licensee conducted an investigation and concluded that the was no possibility of exam discrepancies.

This information was consolidated into a report. This report, and NRC records associated with the two exams were reviewed by the NRC staff of Region I. Independent review of these documents concurred with the licensee findings associated with this allegation. Based on this information, NRC considered this allegation to be unsubstantiated and is considered closed.

5.0 Engineering Support

5.1 RMS Pump Upgrade and Modification

The inspector reviewed the activities surrounding an upgrade to the station radiation monitoring system (RMS). The licensee commenced a modification program to replace all the RMS pumps with a new model. These pumps are used in seven applications throughout the plant, in particulate, iodine and noble gas air monitoring systems. The containment, auxiliary building fuel handling building, and plant ventilation exhaust stack are places where these systems are used. The inspector witnessed activities surrounding the pump replacement and sampling tubing modification for the RM-A-2 monitor, which samples the containment atmosphere.

The modifications consisted of replacement of a three phase 480 VAC roots pump with a new single phase 120 VAC Eberline pump. Additionally, the radiator hose system inside the monitor was replaced with stainless steel tubing. A new transformer was installed along with a new relay to operate locally mounted red and green indicating lights.

The inspector reviewed safety evaluation SE 128068-059 prepared by engineering for this modification. The evaluation was complete and included an adequate evaluation of the affect of this modification on the plant. The reduction in capacity of the new pump, was well within system operating demands. The new design provided a zero leakage pump which reduces the potential for radioactive airborne contamination in the containment from communicating with the intermediate building atmosphere.

The work was completed under job order 05659 and contained appropriate QC hold/witness points. The inspector observed that the evolution was well controlled, plant material management was present and QC coverage was as prescribed. The evolution was carried out in a timely manner so as to minimize the manual sampling of the containment that was required when RM-A-2 was out of service for the modification.

5.2 Penetration Pressurization System Valve Modification

The licensee performed a modification to replace four air operated valves in the penetration pressurization (PP) system with manually operated valves. Associated solenoid operated valves, tubing pressure gages and fittings were removed from the system. Activities in support of the removal of electrical components both locally and in the control room was not reviewed in this report.

The inspector reviewed change modification request package, CMR-89-036, which was prepared by plant engineering. The package contained a safety environmental determination which concluded that there would be no affect on plant safety.

The inspector's review of the documentation associated with this modification concluded that the licensee prepared package was complete and adequate. Additionally, the review of completed work on the 4 valves revealed no discrepancies. The inspector witnessed a portion of the ongoing work and no problems were identified. Generally, this modification was completed in an adequate and professional manner.

5.3 Engineering Support Summary

The inspector review of two plant modification concluded that engineering support was adequate. Safety evaluations were completed and the modification paperwork was adequate to complete the work. Work activities were completed in a safe manner during power operation.

6.0 Licensee Action on Previous Inspection Findings

The inspector reviewed licensee action on previous inspection findings to ensure that the licensee took appropriate action in response to the findings or by self-initiative and that the licensee's action was timely.

6.1 (Closed) Unresolved Item (289/89-13-04) Licensee Evaluate Action for Repeated Electrical Breaker Trips

This item concerned a situation where maintenance personnel had repeatedly attempted to close an electrical breaker in an energized circuit and the breaker would not remain closed. The inspector questioned this practice and reviewed licensee policy in this area. The licensee established a formal policy to be used by all station personnel when closing electrical breakers. After a breaker trips on initial closure, a visual examination should be made of the breaker for obvious problems. After this, an attempt to re-close the breaker can be made. If this second attempt fails, then further attempts to close the breaker cannot be made until complete troubleshooting is accomplished. This guideline is compatible with normal safe industry practice. The inspector concluded that the licensee policy established in this area was adequate. This item is closed.

7.0 Management Meeting

The inspectors discussed the inspection scope and findings with licensee management weekly and at a final meeting on October 4, 1989. Those personnel marked by an asterisk in paragraph 1.3 were present at the final management meeting.