U.S. NUCLEAR REGULATORY COMMISSION

Report No. 50-289/84-08

Docket No. 50-289

License No. DPR-50 Priority -- Category C

Licensee: GPU Nuclear Corporation
P.O. Box 480
Middletown, Pennsylvania 17057

Facility: Three Mile Island Nuclear Station, Unit 1

Inspection at: Middletown, Pennsylvania

Inspection conducted: March 13 - April 10, 1984

DCS Nos.
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Inspectors:

R Conte — 4/25/84
R. Conte, Senior Resident Inspector (TMI-1) — date signed

R Conte for — 4/25/84
F. Young, Resident Inspector (TMI-1) — date signed

Approved by: B. Kemig for — 5-10-84
E. Conner, Chief, Reactor Projects Section No. 3B, PB No. 3 — date signed

Inspection Summary:
Inspection conducted on March 13 - April 10, 1984 (Inspection Report Number 50-289/84-08)
Areas Inspected: Routine safety inspection by resident inspectors of licensee action on previous inspection findings, plant operations (shutdown mode) including reactor coolant pump repair work and repair of a decay heat system isolation valve, modification for reactor building isolation on high radiation, and licensee event reports (in-office review). The inspection involved 136 inspector-hours.

Results: No conditions adverse to nuclear safety or regulatory requirements were identified. Overall control and maintenance of the shutdown plant were good. Licensee actions to complete commitments or requirements associated with the reactor building isolation modifications were properly implemented. The licensee event reports adequately described the event and provided underlying causes with appropriate corrective action.

DETAILS

1. Persons Contacted

General Public Utilities Nuclear Corporation

*D. Atherholt, Operations Engineer, TMI-1, Division (TMI-1)
*R. Barley, Lead Mechanical Engineer, TMI-1
J. Boyer, Radwaste Operations Engineer, TMI-1
J. Colitz, Plant Engineering Director, TMI-1
R. Fenti, Operational Quality Assurance Manager, Nuclear Assurance Division (NAD)
E. Fuhrer, Plant Chemistry Manager, TMI-1
R. Harper, Corrective Maintenance Manager, TMI-1
T. Hawkins, Manager TMI-1, Startup and Test, Technical Functions Division (TFD)
H. Hukill, Director and Vice President, TMI-1
C. Incorvati, Acting TMI-1 Audit Supervisor, NAD
J. Kuehn, TMI-1 Radiological Controls Manager, Radiological and Environmental Controls Division, (R&ECD)
B. Mehler, Radwaste Manager, TMI-1
M. Nelson, Supervisor, Review Program, TMI-1
M. Ross, Manager, Plant Operations, TMI-1
D. Shovlin, Maintenance Manager, TMI-1
H. Shipman, Operations Engineer, TMI-1
*M. Knight, Engineer, TMI-1 Licensing, TFD
R. Toole, Operations and Maintenance Director, TMI-1

Other operations, maintenance, quality assurance and administrative personnel were also interviewed.

*denotes those present at the exit interview.

2. Licensee Actions on Previous Inspection Findings

(Closed) Inspector Follow Item (289/82-3C-73): Restart Modification to Provide Reactor Building Isolation on High Radiation at Certain Containment Penetrations. Details are addressed in paragraph 4.

(Closed) Inspector Follow Item (289/82-SC-09): Control Room Habitability Work for Restart. The NRC staff documented outstanding work for restart in this area in NUREG 0752 and the NRC staff verified completion of that work as documented in NRC Inspection Report No. 50-289/82-17. The licensee's long term actions associated with NRC Task Action Plan Item No. III.D.3.4, NUREG 0737, Control Room Habitability, remain under review by the NRC staff.

(Closed) Unresolved Item (289/82-19-02): Revise Inservice Test (IST) Program/Procedures to Incorporate Valves Added as a Result of Restart Modifications. On a sampling basis, the inspector reviewed the following documents: Administrative Procedure (AP) 1041, Revision 3, January 31, 1984, IST Systems List and Retest Requirements; Surveillance Procedure (SP) 1300-3H, A/B, Revision 11, September 9, 1983; Makeup Pump and Valve Functional Tests; SP 1300-3Q, Revision 17, March 19, 1984; Quarterly Inservice Testing of Valves During Normal Plant Operations; and AP 1043, Revision 6, January 10, 1984, Control of Plant Modification. With the cognizant IST engineer, the inspector also discussed the methodology for program/procedure revisions when valves within IST scope are added, deleted, or modified.

Based on the above review, a program exists to assure that pump and valves within IST scope are identified and that revisions to the program as a result of modifications are accomplished. The AP 1043 assures routing of completed modification information to the cognizant engineers for program/procedure revision including IST drawings. The AP 1041 identifies plant components within IST scope. This AP reflects the valve additions of selected restart modifications: RCS high point vents; containment hydrogen monitor and recombiner isolation valves; and valves added to the Decay Heat River Water System and Reactor Building Emergency Cooling (River Water) System. The inspector concludes that adequate measures exist to identify components within and make revisions to the IST program.

3. Plant Operations During Long Term Shutdown

3.1 Routine Review

The resident inspectors periodically inspected the facility to assess compliance with general operating requirements of Section 6 of the Technical Specifications in the following areas:

-- licensee review of selected plant parameters for abnormal trends;

-- plant status from a maintenance/modification viewpoint including plant cleanliness;

-- licensee 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,

-- licensee implementation of the security plan including access controls/boundary integrity and badging practices.

The inspectors reviewed the following specific items:

-- Random inspections of the control room during regular and back shift hours were conducted which included the selected sections of the shift foreman's log and control room operator's log for the period March 13 - April 10, 1984, and selected sections of other control room daily logs for the period from midnight to the time of review;

-- Inspections of areas outside the control room occurred on March 15, 21, 22, 28, April 5, 6, 1984.

-- Selected licensee planning meetings.

3.2 Reactor Coolant Pump Repair

3.2.1 Background

NRC Inspection Report No. 50-289/84-07 documented a review of licensee activities on the Reactor Coolant Pump (RC-P-1B) Internal Examination. The licensee initiated that examination as a result of excessive vibrations from this RCP on January 31, 1984. As previously reported, there was excessive erosion on the RC-P-1B impeller. During this inspection period, the inspectors continued the review of licensee activities associated with the repair and re-installation of the RC-P-1B pump internals.

Between March 9 and 16, 1984, the licensee conducted the disassembly of the RCP internals, and simultaneously obtained radiological data on various internal components. On March 9, upon lift of the internals assembly and before internals hydrolazing, the licensee obtained radiation measurements and took chemical swipes of the diffuser adapter assembly and the impeller. The contact radiation readings from the diffuser-adapter assembly ranged from 700 mR/HR to 1500 mR/HR (beta-gamma). The chemical swipes were sent offsite for analysis. During the weekend of March 10, 1984, the licensee hydrolazed the internal assembly in the deep end of the refueling canal to reduce contamination and radiation levels; this reduced the contact radiation levels approximately 200-300 mR/HR. Disassembly of the pump internals occurred in a "clean room" on a pump stand in the shallow end of the refueling canal. Total calculated exposure for the repair work as of April 13, 1984, was 13.33 person-rem (by TLD readings).

On or about March 15, 1984, after the removal of the thermal sleeve from a section of the RCP shaft, the licensee visually identified a hairline crack that ran through one of two thermal sleeve pin holes and transversed a path about 270° around the shaft. The thermal sleeve was at the shaft thermal sleeve

shoulder between the impeller section and the lower radial bearing journal. The sleeve was attached to the shaft by welded pins that fit into the two 3/8 inch drilled holes in the shaft. The licensee cut out a 6-foot section (approximately) of the shaft that contained the crack and shipped it off site for further metallurgical evaluation. The licensee installed the spare shaft and impeller into the pump internals assembly along with refurbished radial bearing and shaft seal assemblies. On March 30, 1984, the licensee re-installed the RC-P-1B internal assembly into the reactor coolant system and began the reinstallation of support equipment and interference structures around the pump area. After completing an extensive list of preventive maintenance items on the motor, the licensee re-installed the motor during the week of April 2, 1984.

Coincident with the repair activities on the RC-P-1B, the licensee representatives entered the reactor coolant system piping to obtain visual, photographic, and video information on the other RCP impellers (1A, 1C, 1D) for evidence of excessive erosion. Utilizing a photoenhancing technique, the licensee preliminarily determined that there was no excessive erosion on the other RCP impellers. The licensee also obtained ultrasonic test (UT) data on the pump shafts as installed in the RCS (including the 1B pump with new shaft and impeller). The UT data was primarily for baseline information for future reference since that type of information was not previously known during initial UT examination of the 1B shaft.

No load testing for RC-P-1B is scheduled for the week of April 8, 1984, with an interruption in RCP work for the containment integrated leak rate test, scheduled for mid to late April 1984. Cold testing of RC-P-1B is scheduled for early May 1984, with hot functional testing of the RCPs and other restart work to start in the middle of May 1984, to be completed by June 1, 1984.

3.2.2 Review and Findings

On a sampling basis, the inspectors reviewed the licensee's control of the pump inspection and reassembly activities. This review included: attendance at various licensee planning meetings; visual observations at the work site and in the control room; review of related documents; radiological survey information on the RCP work and other radiological records, and discussions with lead maintenance personnel on this task. The numerous RCP inspection and reassembly activities were well planned. The Preventive Maintenance Supervisor continued to be in charge of the job. He developed a detailed schedule and list of prerequisite activities and concurrent activities,

and he presented these items daily at the plan-of-the-day meetings to upper management. He maintained close communications with the pump vendor representatives throughout the disassembly evolution.

From a radiological planning viewpoint, licensee representatives contacted representatives of Northern States Power (NSP), who completed similar repairs to their RCP in 1981-82. The NSP representatives were cooperative and provided photographic and radiological information to assist GPUNC in planning for the RCP work. Throughout the repair process, there was consistent evidence that licensee management attempted to minimize exposure by properly planning the work.

The development and use of controlling procedures complemented the well planned activities. Licensee management re-reviewed the generic maintenance procedures for the RCP disassembly/assembly prior to the start of the activity. The review resulted in changes to make the procedures current and more workable. Controlled copies of applicable procedures were at the job site and in use. The licensee management indicated that a report will be sent to the NRC on the RCP failure by April 10, 1984. Additional RCP work and this report will be routinely followed by the resident inspectors.

3.3 Internal Parts Replacement of Decay Heat Isolation Valve

3.3.1 Background

During the 1976 refueling, the licensee installed a higher strength valve stem in a Decay Heat Removal (DHR) System Isolation Valve, DH-V1, in accordance with vendor recommendations. After valve reassembly, the nickel pressure seal ring on the valve bonnet leaked. In previous years, valve repair (disassembly) required defueling of the reactor for DHR considerations. (This valve is the first valve off the RCS in the suction drop line of the DHR System and the piping does not have a parallel path that can be used for removal of decay heat.) The leakage (approximately 0.5 gpm) continued for approximately 5 months until the licensee evaluated the use of Furmanite leak sealing compound in the seal ring area. The Furmanite was successful in eliminating all visible leakage. In September 1981, the leakage started again but reinjection of Furmanite was again successful. In October 1983, the bonnet seal ring started to leak for the third time, and Furmanite reinjection was no longer effective.

Because of the length of the present shutdown, the licensee performed an engineering evaluation to determine if the valve repair could proceed without defueling the reactor. The lic-

ensee concluded that since there was a relatively small amount of decay heat generated from the reactor and since the decay heat was removed by losses to ambient, repairs to this valve could proceed with DHR inoperable.

3.3.2 Review and Findings

On a sampling basis, the inspector reviewed selected sections of the work package associated with DH-V1 repairs and the corresponding safety evaluation/inter-office memoranda. The package adequately addressed the evolution and plant conditions required to perform the task. The licensee conducted several planning meetings and set up major prerequisites prior to starting the job. Key personnel, designated in writing, adequately managed the job. The special operating procedure indicated the establishment of adequate control of plant conditions. The maintenance procedure was updated to make the procedure current and easier to accomplish. The QA department completed receipt inspections of new valve parts used in the reassembly of the valve. Overall, the inspector concluded that the licensee had adequately controlled and performed this evolution.

In addition, the inspector reviewed several inter-office memoranda addressing the inspection of the internal components of DH-V1. Preliminary evaluation by visual inspection concluded that the Furmanite or any other deleterious agent did not cause any degradation of the valve parts. The replaced internal components have been shipped to a consulting laboratory where specific metallurugical analysis will be performed. The final report on this analysis was not yet completely reviewed by the licensee. This is unresolved pending review in a subsequent NRC inspection (289/84-08-01).

3.4 Based on this sampling review of the various licensee activities noted above, the inspector did not identify any conditions adverse to nuclear safety or regulatory requirements. Personnel stationed in the control room presented a posture of overall control of daily activities. Licensee intermediate managers showed awareness of daily activities, including problem areas that needed resolution. The planning meetings indicated an attempt to proceed safely with daily activities and to resolve any inter-department interface problems. Licensee upper management continued their detailed involvement in site activities.

4. Reactor Building Isolation on High Radiation

4.1 Modification Review

As a result of the Commission's Shutdown Order of August 1979 (Item No. 8), the licensee committed to provide diversified signals for Reactor Building (RB) Containment Isolation, such as on Reactor Trip, on Pipe

Break in the Nuclear Services/Intermediate Closed Cooling Systems, and on High Radiation from certain sample or process lines from RB penetrations. This review was on Modification Package (RM-5B), RB Isolation on High Radiation. The main Engineering Change Memorandum (ECM-S-059), Revision 3B, directed the installation of general area radiation detectors (ionization chambers), cables, logic relays, power supplies, enable/defeat switches, and meters for the following penetration/piping:

-- RM-G16/17, A/B Steam Generator Sample Lines in the Heater Bay Basement of the Turbine Building;

-- RM-G18, Pressurizer and Reactor Coolant Sample Lines, RCP Seal Return Cubicle 305' elevation of the Auxiliary Building (AB);

-- RM-G19, Reactor Coolant Pump Seal Return Line, RCP Seal Return Cubicle, 305' elevation of the AB (Alarm only, operator action required procedurally);

-- RM-G20, Reactor Coolant Drain Tank Vent and Pump Discharge, Intermediate Closed Cooling Cubicle, 305' elevation of the AB;

-- RM-G21, Reactor Building Sump, 281' elevation of the Reactor Building;

-- RM-L1 (existing liquid monitor) Seal Return Cooler Area, 305' elevation of AB (isolation function added).

No new isolation valves were added, but existing valve control circuits were modified to include a contact from a relay associated with the appropriate detector. The contact was wired into the closing circuit of the valve controller to close the valve on actuation of the relay (on high radiation).

On a sampling basis, the inspector reviewed the documentation associated with RM-5B (ECM-050) Modification Package to verify that the changes were consistent with licensee commitments and that the design, installation, and testing of the modification was performed in accordance with applicable licensee procedures. In addition, the inspector conducted a walk-down of the system to verify component installation was as described in applicable design documents. Selected sections of the following specific documents were reviewed in detail:

-- System Design Description (SDD) 642-A Revision 0, July 13, 1981, Partial RB Isolation on High Radiation;

-- Technical Data Report (TDR) 083, Revision 9, June 19, 1979, Evaluation of Containment Isolation Signals;

-- Test Procedure (TP) 366/2, Revision 0, July 22, 1981, Containment Isolation on High Radiation Valve Functional Test, Test Results Evaluated May 3, 1983;

-- TP 366/1, Revision 0, October 23, 1981, Containment Isolation on High Radiation-Calibration, Test Results Evaluation June 11, 1982;

-- Operating Procedure (OP) 1101-2.1, Revision 10, September 28, 1983, Radiation Monitoring System Setpoints (TCN No. 1-84-0021, dated February 1, 1984);

-- Surveillance Procedure 1303-4.15, Revision 34, February 13, 1984, Radiation Monitoring System (Monthly Test), Data obtained in January 1984 using a previous revision of the procedure; and,

-- Inter-Office Memorandum, dated January 6, 1982, G. Sadauskas to I. Porter, Containment Isolation on High Radiation (RM-5(B) (Setpoints)

4.2 Findings

Based on the above review, the inspector verified proper completion on this modification. However, as noted below, additional information was needed to verify the design basis for the high radiation interlock setpoints for these monitors.

A technical basis for the monitor setpoints (RM-G16 to 21 and RM-L1) was not available at the time of the inspection. The SDD 642-A, Table 2, listed the setpoints for isolation signals in terms of specific uCi/cc in the monitored pipe, but the design basis for these setpoints was not clear in the SDD. The TPs and SPs referenced above reflect actual setpoints for the isolation functions of: 1000 mR/HR for RM G16-20, 10,000 mR/HR for RM-G21, and 8,000 cpm for RM-L1. Licensee representatives could not immediately provide a correlation between these actual setpoints in terms of mR/HR (general area radiation near pipe) to the SDD setpoints in terms of uCi/cc (radioactive concentration inside the pipe).

Subsequently, licensee representatives indicated this area warranted further review. The inspector acknowledged the above and indicated the item was unresolved pending completion of the licensee's further review and subsequent Region I review (289/84-08-02).

5. Licensee Event Reports (LERs) In-Office Review

The inspector reviewed the LERs listed below, which were submitted to the NRC Region I office, to verify that the details of the event were clearly reported, including the accuracy of the description of cause and the adequacy of corrective action. The inspector determined whether further information was required from the licensee, whether the event should be classified as an

Abnormal Occurrence, whether the information involved with the event should be submitted to Licensing Boards, whether generic implications were indicated, and whether the event warranted on-site followup.

*-- LER 83-031/03L-0 on September 30, 1983, dated October 28, 1983. Review of Engineered Safeguards Actuation System (ESAS) surveillance practices revealed a deficiency in loading sequence and component test and high pressure injection logic channel test surveillance. Alternate pumps MU-P-1B, NR-P-1B and NS-P-1B are not tested to verify operability on ES start signal, thereby not satisfying the quarterly test requirements of Technical Specification (TS) 4.5.2.4 (289/83-LO-31).

-- LER 83-033/03L-0 on September 28, 1983, dated October 28, 1983. While in hot shutdown conditions for non-critical steam generator testing, the reactor building high pressure switch setpoint on RPS channel "A" was found during a surveillance to be 4.2 psig, which is less conservative than the 4.0 psig limit specified in TS Table 2.3-1. The remaining three channels were within TS limits.

*-- LER 83-034/03L-0 on October 4, 1983, dated November 3, 1983. While degassing the Reactor Coolant System for normal plant cooldown, hydrogen concentration in the miscellaneous waste storage tank exceeded the 2% limit per TS 3.22.2.5. Nitrogen purging ensured that hydrogen concentration did not exceed 2% for more than 1 hour. Other points monitored in the waste gas system did not exceed 2% hydrogen by volume. Oxygen concentration remained below 4% throughout this event, therefore, a combustible concentration was not present at any time (289/83-LO-34).

-- LER 83-035/03L-0 on October 4, 1983, dated November 4, 1983. During a scheduled surveillance test of 30 halon bottles of the air intake halon system, one bottle was found to be underweight. The bottle weighed 152 lbs. while the minimum weight was 157.5 lbs. (TS 3.18.5). The 29 other halon bottles weighed within the limit.

*-- LER 83-036/03L-0, on October 6, 1983, dated November 8, 1983. While shutdown, during performance of the fire barrier seal inspection (Procedure 1303-12.9), 3 fire seals were determined to be inoperable. This is a violation of TS 3.18.7 because fire seals are required to be functional "at all times" (289/83-LO-36).

-- LER 83-037/03L-0, on October 13, 1983, dated November 14, 1983. During degassification of the reactor coolant system, the waste gas system H_2O_2 monitor became inoperable. Per TS 3.21-2, grab samples were taken and analyzed within 4 hours. Results indicated that hydrogen and oxygen concentrations were within TS limits. Nitrogen was being added to the waste gas vent header to control hydrogen concentration within TS limits. The vent header pressure exceeded the maximum analyzer discharge pressure.

*-- LER 83-038/03L-0, on October 17, 1983, dated November 16, 1983. While in cold shutdown conditions with reactor building purge in progress, an auxiliary operator found valve V-2 on RM-A-9 in position 2 rather than position 1. Thus, Reactor Building purge sample flow had been shut off. The RM-A-9 was out of service with Reactor Building purge in progress resulting in a degraded mode permitted by the limiting conditions for operation as defined in T.S. 3.21.2 (289/83-LO-38).

-- LER 83-039/01T-0, on October 18, 1983, dated November 2, 1983. While in cold shutdown, RCS at 134F and 329 psig, it was discovered that the waste gas system H_2 monitor had been removed from service without a sample having been taken, contrary to TS Table 3.21-2.

-- LER 83-040/01T-0, on October 24, 1983, dated November 8, 1983. Licensee Amendment 88 on plant liquid effluent monitor RM-L12 was issued as immediately effective, but was not provided to the licensee until 7 days later. During the 7 day period, the amendment requirements were not met.

*-- LER 83-041/99X-0, on October 25, 1983, dated January 4, 1984. While in cold shutdown, cracking was observed on the molded rubber seat ring of containment purge isolation valve AH-V1B. The valve seats did not fail to perform their containment isolation function. Root cause was that there was insufficient adhesion between the plies of the seat material. The cracked seat segment was replaced in AH-V1B. (Inplant review of this LER was completed and documented in Inspection Report 50-289/84-02).

-- LER 83-042/99X-0, on October 4, 1983, dated December 13, 1983. While in hot shutdown and performing the shift walkthrough of the "A" Battery Room, a CRO observed cell No. 29 was leaking. Based upon the amount of leakage out of the cell, the crack was suspected to be very small. Cell voltage and specific gravity remained within surveillance limits.

-- LER 83-043/03L-0, on November 6, 1983, dated November 23, 1983. While in cold shutdown conditions, emergency feedwater pump EF-P-2 failed to start during a surveillance test. The degraded condition was considered to have existed since an oil change on October 2, 1983, which spanned a period of time during hot shutdown greater than the time allowed by TS 3.4.2.

*-- LER 83-044/01T-0, on November 14, 1983, dated November 28, 1983. During investigation into a field questionnaire (FQ-C-8267), it was noted that, contrary to safety grade design criteria for electrical separation, EFW Auto Initiation redundant circuits (Red, Green) were routed in the same cable bundle. (Inplant review of this LER was completed and documented in Inspection Report 50-289/84-01).

-- LER 83-045/03L-0, on November 13, 1983, dated December 13, 1983. During cold shutdown, the plant effluent flowmeter (FT-146) was taken out of service for inspection due to erratic indication. While the flowmeter was out of service, the minimum number of channels was less than required by T.S. 3.21-1.

*-- LER 83-046/01T-0, on December 14, 1983, dated January 31, 1984. A Nuclear Safety related circuit for the make-up pump lube oil pressure trip was found to be incorrectly routed (MU-P1C). The green marked cable was routed in the red channel tray. Some of the cables for the makeup pump lube oil pressure trip circuit for MU-P1A, B and C are routed in non-safety trays. (Inplant review of this LER was initiated in NRC Inspection 50-289/84-01 and it remains open) (289/83-LO-46).

*-- LER 83-047/03L-0, on December 19, 1983, dated January 23, 1984. While in cold shutdown during telephone circuit rerouting, 2 cable fire seals were identified with no seal material inside the conduits. A fire watch was posted within 1 hour of discovery per T.S. 3.18.7.2 (289/83-LO-47).

The NRC review of the above LERs is considered complete based on satisfactory in-office review except those LERs selected for on-site followup as denoted by (*) asterisk. Those marked LERs will be reviewed in a subsequent inspection.

6. Inspector Follow Items

Inspector follow items are matters that warrant NRC verification of licensee completion as a result of commitments made to the NRC for restart. Inspector follow items are addressed in paragraph 2.

7. Unresolved Items

Unresolved items are findings about which more information is needed to ascertain whether they are acceptable items, violations, or deviations. Unresolved items are discussed in paragraphs 3.3 and 4.2.

8. Exit Interview

The inspectors met periodically with the licensee representatives (denoted in paragraph 1) and at the conclusion of the inspection on April 10, 1984, discussed the inspection scope and findings.