

U.S. NUCLEAR REGULATORY COMMISSION

50289-811008  
50289-811009  
50289-811125  
50289-811116

Region I

Report No. 50-289/81-32

Docket No. 50-289

License No. DPR-50 Priority -- Category C

Licensee: GPU Nuclear Corporation

P.O. Box 480

Middletown, Pennsylvania 17057

Facility Name: Three Mile Island Nuclear Station, Unit 1

Inspection at: Middletown, Pennsylvania

Inspection conducted: November 17, 1981 - January 8, 1982

Inspectors: *D.R. Haverkamp* 1/19/82  
for J. Chung, Reactor Inspector date signed

*D.R. Haverkamp* 1/19/82  
D. Haverkamp, Senior Resident Inspector (TMI-1) date signed

*F. Young* 1/20/82  
F. Young, Resident Inspector (TMI-1) date signed

Approved by: *A. Fasano* 1/22/82  
A. Fasano, Chief, Three Mile Island Section date signed  
Projects Branch No. 2

Inspection Summary:

Inspection on November 17, 1981 - January 8, 1982 (Report Number 50-289/81-32)

Areas Inspected: Routine safety inspection by resident and regional based inspectors (282 hours) of licensee action on previous inspection findings; plant operations during long term shutdown including facility tours and log and record reviews; steam generator tube degradation; small fire in TMI-1 Auxiliary Building; IE bulletin followup; and licensee event reports - in-office review.

Results: No items of noncompliance were identified in six areas and one item of noncompliance was identified in one area (failure to follow a welding and cutting procedure, paragraph 5.c).

## Details

### 1. Persons Contacted

#### General Public Utilities (GPU) Nuclear Corporation

- B. Ballard, Manager TMI Quality Assurance (QA) Modifications/  
Operations, Nuclear Assurance
- R. Barth, Engineer-II TMI-1
- \*M. Beers, Engineering Assistant Senior II, Nuclear Assurance
- J. Colitz, Plant Engineering Director TMI-1
- \*W. Heysek, Supervisor Site QA Audit, Nuclear Assurance
- W. Miller, Nuclear Licensing Engineer, Technical Functions
- \*T. O'Conner, Lead Fire Protection Engineer TMI-1
- \*C. Stephenson, Nuclear Licensing Engineer, Technical Functions
- \*D. Shovlin, Manager of Plant Maintenance TMI-1

The inspector also interviewed several other licensee employees during the inspection. They included control room operators, maintenance personnel, engineering staff personnel and general office personnel.

\*denotes those present at the exit interview.

### 2. Licensee Action on Previous Inspection Findings

(Closed) Unresolved Item 289/79-21-01: Reactor Coolant System (RCS) Leak Rate Surveillance Procedure (SP) 1303-1.1 incorrectly accounted for operator induced changes to the Makeup Tank (MUT). The inspector reviewed SP 1303-1.1, Revision 8, August 21, 1981, Temporary Change Notices (TCNs) 1-81-0112 and 1-81-0122, and 1-81-0112 Attachment, and verified that the operator-induced changes to MUT and RCS inventory were satisfactorily incorporated into procedural and data sheet steps. The inspector further determined that temperature compensation and density corrections were properly included in the procedure. Based on these findings, this item is closed.

(Open) Noncompliance 289/79-IR-23: RCS inventory calculations for unidentified leakage produced wrong values due to an error in the calculational procedure. Surveillance Procedure 1303-1.1 was scheduled to be reviewed and changes implemented prior to restart of TMI-1. The inspector determined by review of SP 1303-1.1, Revision 8, and independent calculations that the RCS leak rate as determined by a manual calculation was adequate in the revised procedure. The inspector noted that procedural step 6.1 required use of the process computer for the RCS leak rate determination unless the process computer inputs and/or the program were inoperable. A licensee representative stated that a computer software problem was identified during hot functional tests and that the RCS leak rates were recalculated after correcting the programming problems. The inspector requested a trial run during this inspection and an additional software problem was identified. In addition, the inspector conducted independent calculations. The results are compared in the following table:

RCS LEAK RATE GPM

<u>DATE/TIME</u>	<u>LICENSEE</u>			<u>INSPECTOR</u>
	<u>PROCESS ORIGINAL</u>	<u>COMPUTER RECALCULATION</u>	<u>CALCULATIONS</u>	<u>MANUAL</u>
8-31-81	G 2.24	--	0.169	0.18
01:59:49	U 2.01	--	-0.045	-0.10
12:19:39	G 0.34	0.15	--	0.19
	U 0.13	-0.06	--	-0.12
9-1-81	G 0.73	0.51	--	0.52
16:50:09	U 0.52	0.30	--	0.22
9-2-81	G 0.39	0.04	--	0.34
00:48:14	U 0.17	-0.17	--	-0.05
9-3-81	G 0.71	1.05	1.05	1.13
16:01:27	U 0.50	0.78	0.79	0.57
9-4-81	G 0.76	0.17	--	0.50
04:36:36	U 0.54	0.23	--	0.41
15:39:39	G 0.77	0.41	--	0.62
	U 0.54	0.17	--	0.42
9-5-81	G 0.93	0.49	--	0.70
07:58:54	U 0.71	0.27	--	0.58
9-6-81	G 0.93	1.03	0.80	0.81
08:39:37	U 0.69	0.82	0.59	0.67

NOTE: G: Gross Leak Rate  
 U: Unidentified Leak Rate

Based on these results showing that the inspector's calculations were consistent with the licensee's manual calculations, the inspector determined that the manual calculations were adequate. However, the process computer calculations were erratic. This item remains open pending an RCS Leak Rate demonstration of consistency using the process computer during a subsequent NRC:RI inspection.

3. Plant Operations During Long Term Shutdown

a. Plant Status During Inspection Period

The plant has remained in the cold shutdown condition with Reactor Coolant System (RCS) temperature less than 200°F per NRC order of August 9, 1979. At the beginning of the inspection period on November 17, 1981, the RCS was at 94°F and 0 psig

with cooling to the reactor supplied by the "B" Decay Heat Removal (DHR) Loop. The pressurizer was partially filled with a nitrogen (N<sub>2</sub>) blanket. Both Once Through Steam Generators (OTSG's) were in full wet layup. During the course of the inspection the following major plant changes or evolutions occurred.

- November 19, 1981: Formed a steam bubble in the pressurizer and raised RCS pressure to 45 psig in order to test Reactor Coolant Pump 1C. Shifted from "B" DHR Loop to "A" DHR Loop in order to perform In-Service Inspection (ISI) on Decay Heat Removal Pump 1B.
- November 21, 1981: OTSG tube leaks determined and RCS depressurized to 0 psig. (Refer to paragraph 4 for more information on OTSG tube degradation.)
- November 22, 1981: Pressurizer partially filled and N<sub>2</sub> blanket established in the pressurizer.
- November 23, 1981: Diesel Generator 1B taken out of service due to high vibration readings on the rotor.
- November 25, 1981: Performed flushes on the secondary side of the OTSG's and placed both OTSG's in wet layup.
- November 26, 1981: Drained down RCS to perform N<sub>2</sub> bubble leak test and eddy current testing on both OTSG's.
- December 1, 1981: Pressurizer partially filled and N<sub>2</sub> blanket established in the pressurizer.
- December 12, 1981: RCS was partially drained for additional inspections of the OTSG tubes. Eddy current testing program redefined and recommenced using several different type probes.
- December 20, 1981: Drained secondary side of "B" OTSG for tube removal. Portions of four tubes were removed.
- December 23, 1981: Shifted from "A" DHR Loop to "B" DHR Loop due to a packing leak on Decay Heat Closed Cooling Pump 1A.
- December 24, 1981: Temporarily plugged holes from removed OTSG tubes and placed both OTSG's in wet lay up on secondary side.
- January 5, 1982: Shifted to "A" DHR Loop from "B" DHR Loop due to Diesel Generator 1B still being out of service.

At the close of this inspection period the RCS was at 120°F and 0 psig with cooling to the reactor core from "A" DHR Loop. The RCS was partially drained for eddy current testing and preparation for additional tube removal. Both OTSG's were in full wet layup.

b. Plant Logs and Operating Records

The inspector reviewed selected portions of the following plant procedures to determine the licensee established requirements in this area in preparation for a review of selected logs and records.

- Administrative Procedure (AP) 1007, "Control of Records," Revision 4
- AP 1010, "Technical Specification Surveillance Program," Revision 18
- AP 1012, "Shift Relief and Log Entries," Revision 14
- AP 1033, "Operating Memos and Standing Orders," Revision 2
- AP 1037, "Control of Caution and [Do Not Operate] DNO Tags," Revision 2
- AP 1044, "Event Review and Reporting Requirements," Revision 2

The inspector reviewed the following plant logs and operating records.

- Shift Foreman Log and Control Room Log Book
- Shift Turnover Checklist
- Temporary Change Notice (TCN) Log Book
- Active Tagging Application Book
- Locked Valve Log
- Night Order Book
- Do Not Operate and Caution Tag Log

Plant logs and operating records were reviewed to verify the following items.

- Log keeping practices and log book reviews are conducted in accordance with established administrative controls.

- Log entries involving abnormal conditions provide sufficient detail to communicate equipment status, lockout status, correction and restoration.
- Operating orders do not conflict with Technical Specifications (TS) requirements.
- Tagging operations are conducted in conformance with established administrative controls.

No items of noncompliance were identified.

c. Facility Tours

During the course of the inspection, the inspector conducted tours of the following plant areas.

- Control Room (daily)
- Auxiliary Building (November 18, 20 and December 2, 19)
- Intermediate Building (November 17 and December 16)
- Vital Switchgear Rooms (November 19, 30 and December 14)
- Diesel Generator Building (November 18 and December 1, 30)
- Yard Area (November 20 and December 2, 9)
- Site Perimeter (November 20 and December 2, 9)
- Reactor Building (November 24 and December 1, 10, 15, 23)

The following observations/discussions/determinations were made.

- Control room annunciators: Selected lighted annunciators (Radiation Alarm, B Diesel Trouble Alarm, Uninterruptable Power Supply Trouble Alarm) were discussed with control room operators to verify that the reasons for them were understood and corrective action, if required, was being taken.
- Control room manning: By frequent observation during the inspection, the inspector verified that control room manning requirements of 10 CFR 50.54(k) and the Technical Specifications were being met. In addition, the inspector observed shift turnovers to verify that continuity of system status was maintained.

- Technical Specifications: Through log review and direct observation during tours, the inspector verified compliance with Technical Specification LCO's associated with Decay Heat Removal System and Fire Protection Pump requirements during shutdown plant operation.
- Plant housekeeping conditions: Unsatisfactory plant housekeeping conditions observed by the inspector had been identified previously by station personnel and corrective action had been initiated as necessary.
- Monitoring instrumentation: The inspector verified that selected instruments (Source Range Instruments NI1 and NI2, Auxiliary Stack Monitor RMA8, and RCS pressure) were functional and indicated that parameters were within Technical Specification limits.
- Valve positions: The inspector verified that selected valves were in the position or condition required by Technical Specifications for the applicable plant mode. This verification included control board indication and field observation of valve positions for the Decay Heat Removal System and the Core Flood System.
- Fluid leaks: Fluid leaks observed by the inspector had been identified previously by station personnel and corrective action had been initiated as necessary.
- Piping snubbers/restraints: Selected pipe hangers and seismic restraints were observed and no adverse conditions were noted.
- Equipment tagging: The inspector selected plant components (Core Flood Tanks) for which valid tagging requests were in effect and verified that the tags were in place and the equipment in the condition specified.
- Security: During the course of this inspection, observations relative to protected and vital area security requirements were made, including access controls, boundary integrity, search, escort, and badging. No adverse conditions were noted.
- Licensee meetings: The inspector frequently attended the Plan-of-the-Day (POD) morning meetings and the daily status afternoon meetings held by licensee management and supervisory personnel. The inspector observed the meetings to assess licensee evaluation of plant conditions, status and problems and to review the licensee's plans for conducting certain major plant operations and maintenance activities. The inspector also attended bi-weekly project status meetings to assess licensee progress and difficulties related to plant modifications required for restart.

Acceptance criteria for the above items included inspector judgement and requirements of 10 CFR 50.54(k), Regulatory Guide 1.114, Technical Specifications, and the following procedures.

- AP 1002, "Rules for the Protection of Employees Working on Electrical and Mechanical Apparatus," Revision 22
- AP 1008, "Good Housekeeping," Revision 7
- AP 1037, "Control of Caution and DNO Tags," Revision 2

No items of noncompliance were identified.

#### 4. Steam Generator Tube Degradation

##### a. Background

Late on November 20, 1981, routine chemistry sampling of the Once Through Steam Generators (OTSG's) detected radioactivity on the secondary side of the "B" OTSG. The primary system was at 45 psig pressure in anticipation of raising pressure to 300 psig to run a reactor coolant pump. On November 21, 1981, a Reactor Coolant System (RCS) leak rate surveillance indicated that the "B" OTSG had a primary to secondary leak between 0.3 gpm and 0.5 gpm. The plant was immediately depressurized from 45 psig to atmospheric pressure. Nitrogen (N<sub>2</sub>) bubble testing was performed on both OTSG's to evaluate the extent of tube failure. The licensee determined that there were 38 leaking tubes in the "B" OTSG and 86 leaking tubes in the "A" OTSG. A flush of both OTSG's upper tube sheet crevices was done to aid in arresting the corrosion attack. After the flush, a second N<sub>2</sub> bubble test was conducted on both OTSG's and an additional six tube leaks were identified in the "B" OTSG. Portions of four tubes have been removed and shipped to B&W in Lynchburg, Virginia (two tubes) and Battelle in Columbus, Ohio (two tubes) for metallurgical analysis.

Due to the severity of the problem, the Vice President and Director of TMI-1 established an OTSG Tube Leak Task Force. The task force is composed of representatives from TMI-1 (engineering, operations and maintenance), Technical Functions (corporate engineering and plant licensing), Maintenance and Construction, Nuclear Assurance, Radiological Controls, Communications and Babcock and Wilcox (NSSS engineering). The purpose of this task force is to coordinate and direct all actions regarding the investigations and repairs to the steam generator tube leaks. At the close of this inspection the task force was still compiling data to identify the failure mode and establish the program to repair the OTSG's.

b. Review

Due to the significance and severity of the OTSG tube degradation, the inspector has been closely monitoring the licensee's OTSG leakage evaluation program and initiated a review to verify the below listed items.

- Corrective action is appropriate to correct the cause of the tube degradation
- Responsibility has been assigned to ensure proper management attention in correcting the problem
- The leakage/tube failures did not cause violation of Technical Specifications, license conditions or regulatory requirements
- Information related to the event submitted to NRC is accurate
- Stability of plant conditions, including provision for decay heat removal
- Proper review and implementation of radiological controls including ALARA

Selected sections of the following documents were reviewed.

- Radiation Work Permits (RWP's) associated with initial entries into the upper portions of both OTSG's
- ALARA review conducted for OTSG N<sub>2</sub> bubble testing, installation of video equipment and eddy current testing in OTSG's
- Administrative Procedure (AP) 1103-11, "Draining and N<sub>2</sub> Blanketing RC System," Revision 12
- AP 1104-4, "Decay Heat Removal System," Revision 32
- AP 1106-16, "OTSG Secondary Fill Drain and Layup," Revision 20

In addition to conducting interviews with personnel involved, the inspector attended several licensee Steam Generator Tube Leak Task Force meetings to assess the status of actions being taken. The inspector also conducted field observation of N<sub>2</sub> bubble testing in the "B" OTSG, Eddy Current testing on both OTSG's on several occasions and fiber optics video recording on the "A" OTSG to independently evaluate the situation.

c. Findings

- (1) On December 11, 1981, at 1:25 PM, the inspector entered the Control Room on a daily tour. While reviewing the status of the Steam Generator tube leak problem, the inspector noticed that the pressurizer heaters were not tagged out as required by Operating Procedure (OP) 1103-11, step 2.1.3. At the time the licensee was in the process of draining both OTSG's in accordance with OP 1103-11. The inspector informed the shift supervisor who immediately ordered a tagout to be issued for the pressurizer heaters. Discussion with control room operators revealed that the tagout of the heaters were to back up a low level pressurizer heater cutout switch. The inspector concluded that there had not been a degradation in plant safety and considered the item to be an isolated case. On December 14, 1981, the inspector audited the tagout for pressurizer heaters and found it to be correctly performed in accordance with the applicable station procedure. The inspector had no further comments in this area.
- (2) On January 5, 1982, a meeting was held on site between NRC representatives and key members of the Steam Generator Tube Leak Task Force to review the scope and status of the licensee's program. At the conclusion of the meeting it was determined that substantial work remained and that another meeting will be required after more data has been collected.

At the close of the inspection, the tube failure and repair program was still in the developmental stage. The licensee's continuing efforts to identify the cause of tube degradation and to complete adequate corrective measures will be reviewed during subsequent NRC inspections (289/81-32-01).

5. Small Fire in Unit 1 Auxiliary Building

a. Background

At 1:35 PM on December 16, 1981, during welding on the 305' elevation of the auxiliary building, weld slag material fell through an open penetration to the 281' elevation and ignited a cloth (Chem-wipe) laying on a cable tray below. The fire watch immediately put the fire out using a dry chemical extinguisher. The licensee responded to the fire which included dispatching the onsite fire team and sounding the onsite fire alarm. No offsite assistance was needed. Dust and smoke resulted in the area necessitating local evacuation.

The welding was on a support for a shield with respect to the additional pipe shielding restart modification. The licensee reported no significant damage to the cables in the cable tray. Also, there were no indications of explosive gas or a release of radioactivity. An investigation has been conducted by the TMI Safety and Health Department staff. Several recommendations were made in the investigation which have not been implemented fully at this time.

b. Review

Licensee activities in response to the fire were reviewed to assess items listed below.

- Safety significance of the event, and compliance with TS or other licensee requirements
- Reportability of the event and licensee plans regarding a press release
- Amount of radioactivity released, if applicable
- Event internal management review and followup including event description, cause and systems or plant components affected and overall sequence of events
- Immediate and subsequent corrective action

c. Findings

After the fire alarm was activated, the inspector proceeded to the Unit 1 Control Room and then observed the licensee's actions to extinguish a small fire on the 281' elevation of the auxiliary building. The inspector noted that licensee response to putting out the fire was timely and adequate. All members of the fire brigade were present at the scene of the fire with designated equipment as defined in the licensee's procedures.

Followup fire site observation by the inspector revealed that a floor opening located within 40 feet of the welding location had not been covered. This is a violation of item D listed on the Welding and Cutting permit which had been completed and signed by proper site personnel. The failure to cover the floor penetration is also a violation of section 6.3.1.c of TMI-1 Maintenance Procedure 1410-Y-26, Revision 5, "Control of Welding, Flame Cutting, Grinding, Brazing and Soldering. Although the fire was not severe, the failure to follow these fire prevention procedures is a serious matter and is considered an item of noncompliance with respect to 10 CFR 50, Appendix B, Criterion V (289/81-32-02).

Subsequent to the fire, an investigation was conducted by the TMI Safety and Health Department staff. The following findings were identified by the licensee in the investigation report.

- Welding permit had been filled out correctly and signed by the proper site personnel
- Floor openings located directly beneath the welding location were not tightly covered which was in direct violation of the welding permit and Site Procedure 1410-Y-26. Plywood had been used to cover two of the three floor penetrations and one penetration was not covered at all
- Contrary to the welding permit, combustible materials were located within 40 feet of the welding operation with no protection provided by asbestos curtains, metal guards or flame proof covers
- Flameproof cloth covers were not available for use in sufficient quantities from the licensee's maintenance tool room
- Fire extinguisher issued to the fire watch failed to function properly. It was subsequently determined that the extinguisher had a faulty CO<sub>2</sub> charge cartridge
- Source of the fire was apparently a muslin cloth laying on top of a cable tray located underneath the penetration. It was surmised that the fire was produced by welding sparks dropping through the floor penetrations and igniting the muslin cloth

The following recommendations were made by the Safety Department to plant management.

- Contractor should be required to describe in detail what actions will be taken to prevent a recurrence of this event
- Fire Protection Engineering should be tasked with reviewing contractor's action for adequacy
- An adequate supply of welding cloths should be established and maintained in both the licensee's and the contractor's tool room

At the close of the inspection, management's final evaluation and corrective actions were still under review. Immediate steps taken by the contractor had been to terminate the employment of the two craftsmen responsible for the fire.

6. IE Bulletin Followup

The inspector reviewed the licensee's followup action regarding the IE Bulletins (IEB) listed below.

- IEB 80-24, "Prevention of Damage due to Water Leakage Inside Containment," dated November 21, 1980
- IEB 81-01, "Surveillance of Mechanical Snubbers," dated January 27, 1981
- IEB 81-02, "Failure of Gate Type Valves to Close Against Differential Pressure," dated August 18, 1981

With respect to the above bulletins, the inspector verified that licensee management forwarded copies of the bulletin response to appropriate onsite management representatives, that information and corrective action discussed in the reply was accurate and implemented as described, and that the reply was submitted within the time period described in the bulletins.

Acceptance criteria for the above review included inspector judgement and requirements of applicable Technical Specifications and facility procedures. Licensee followup to the above bulletins was acceptable.

7. Licensee Event Reports (LER's) - In-Office Review

The inspector reviewed the LER's 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 onsite followup.

The following LER's were reviewed:

- LER 81-010/03L-0, dated November 10, 1981 (Quality control audit determined that a Reactor Building prestressing tendon had an unacceptable lift-off force. Technical Specifications require that two adjacement tendons be inspected, which was not performed)
- LER 81-011/01T-0, dated November 4, 1981 (Review of a catwalk structure for application of additional loads revealed that seismic design calculations were not performed by the original architect engineer)

- LER 81-012/04T-0, dated November 30, 1981 (River Water Chlorinator malfunctioned causing Environmental Technical Specification limiting condition for total chlorine concentration to be exceeded)
- LER 81-013/01T-0, dated December 9, 1981 (Primary to secondary tube leakage occurred in both Once Through Steam Generators)

Several blocks and codes on LER 81-010/03L-0 and LER 81-011/01L-0 were noted to have minor errors. The discrepancies were identified to the licensee and the licensee is in the process of resubmitting corrections to both LER's. The inspector has reviewed the draft resubmittals and found them to be correct. The above LER's are closed based on this in-office review and correction of reporting errors.

8. Exit Interview

Meetings were held with senior facility management periodically during the course of the inspection to discuss the inspection scope and findings. The inspectors met with the licensee representatives (denoted in paragraph 1) at the conclusion of the inspection on January 8, 1982, and summarized the purpose and scope of the inspection and the findings. The licensee representatives acknowledged the findings.