U.S. NUCLEAR REGULATORY COMMISSION

REGION 1

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Licensee:	GPU Nuclear, Inc.
Facility:	Three Mile Island Station, Unit 1
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EXECUTIVE SUMMARY

Three Mile Island Nuclear Power Station
Report No. 50-289/99-08

This integrated inspection included aspects of licensee operations, engineering, maintenance, and plant support. The report covers an eight-week period of resident inspection supplemented by regional engineering and radiological inspectors.

GPU Nuclear Inc. (GPUN) operated Three Mile Island Unit 1 (TMI) at near 100 percent power until the unit was shutdown on September 10 for the Cycle 13 refueling outage (13R). Major outage activities included: once through steam generator (OTSG) tube inspections, refueling of the reactor core, and C reactor coolant pump (RC-P-1C) overhaul and rotating element replacement. The unit was restarted on October 19 and the generator was returned to the grid on October 22.

Operations

The shutdown evolution was well controlled and conducted in a safe manner. Operations management directly supervised the conduct of the evolution and provided operational experience feedback to the operating crews. (Section O1.1)

The operators properly controlled plant conditions including available decay heat removal sources and reactor coolant system (RCS) water levels during the outage. The movement of reactor fuel was performed well and in accordance with Technical Specification (TS) requirements. (Section O1.1)

Although it had no safety consequence in this instance, GPUN did not immediately begin work to install the OTSG cold leg nozzle dams after the initial RCS draindown to mid-loop with fuel still loaded in the reactor vessel. This work was delayed for approximately one shift, due to scheduling difficulties. The risk in this high decay heat, limited RCS inventory condition could have been minimized by limiting the time in this condition. (Section O1.1)

Two procedural use weaknesses were noted. First, plant administrative procedures allowed re-sequencing of proceduralized steps with shift supervisor authorization, but did not specify a method for documenting such authorization. During the RCS refilling, the shift supervisor authorized the evolution to continue without filling the letdown piping as sequenced by the procedure, but there was no documentation of a review to ensure that this would not cause a problem later on in the filling operation. Second, administrative procedures did not specify the need to document reactivity change calculations. Engineering personnel and the shift supervisor completed calculations for boron concentration changes without documenting them on the proceduralized form. (Section O1.1)

On October 19 during plant startup, GPUN personnel could not remotely operate the B main steam isolation valve (MSIV) from the control room and operated it locally without completing a TS required procedure change. This placed the unit in a situation where it was outside of the design basis. Further, management oversight was deficient in that startup was allowed to continue without an associated operating procedure change or an engineering review of this degraded condition. The degraded condition of the MSIV was subsequently determined to not be risk significant. This Severity Level IV Violation, for failing to complete the TS required procedure change, is being treated as a Non-Cited Violation (NCV 50-289/99-08-03). (Section O2.1)

GPUN established an outage shift manning schedule without sufficient contingency to allow for emergent work and job delays, thereby causing overtime usage to exceed the working hour guidelines contained in NRC Generic Letter (GL) 82-12, "Nuclear Plant Staff Working Hours." A minor violation was identified in GPUN's implementation of the TS required procedure for controlling plant staff overtime. (Section O6.1)

In a review of a previously open issue from 1989, GPUN did not meet proceduralized requirements on the availability of the boric acid mix tank as an emergency boration path in two cases. These were issues of low safety significance since the borated water storage tank was always operable as an emergency boration path. GPUN took appropriate actions to correct procedures and to fix the degraded boric acid piping heat tracing. This Severity Level IV violation is being treated as a Non-Cited Violation (NCV 50-289/99-08-01). (Section O8.1)

Maintenance

The C reactor coolant pump overhaul was performed satisfactorily. System Engineering provided good support and direction to the maintenance technicians performing the work. GPUN's evaluation of the as-found condition of the degraded fasteners on the RC-P-1C main flange seal was thorough and identified no concerns over past operability. GPUN's actions to repair the cause of the main flange seal leakage were appropriate. Visual inspections of the other reactor coolant pumps identified no other leaking main flange seals. Some minor housekeeping and radiological control issues were identified during the conduct of the maintenance that contributed to several personnel skin contaminations. (Section M1.1)

GPUN responded appropriately to a bent valve stem on the A decay heat injection valve that occurred when the motor operator torque switch failed to actuate during testing. Plant management delayed reloading the core from the spent fuel pool until repairs to the valve were completed. Inspections on the valve body to characterize the extent of damage were appropriate. At the end of the inspection period, GPUN was conducting a root cause evaluation to determine the exact cause for the failed torque switch. (Section M1.2)

GPUN identified two control rods that failed to fully insert during control rod drop time testing at the beginning of 13R. A detailed test plan determined the most probable cause to be excessive mechanical drag due to abnormal bowing of the fuel assembly guide tubes. GPUN took actions to limit future bowing of the fuel assemblies. Prior to criticality, GPUN successfully completed the TS required control rod drop time testing. (Section M2.1)

Executive Summary (cont'd)

An unresolved item was opened to review the calculation methods and engineering assumptions used to ensure the operability of the A and B decay heat removal heat exchangers following identification of degraded performance of the B heat exchanger during 13R. (Section M2.2)

GPUN properly analyzed the emergency feedwater system and completed calculations and testing to ensure its operability to meet the design basis requirements as outlined in the Updated Final Safety Analysis Report (UFSAR). Specifically, GPUN used the TS required loss of feedwater testing requirements and appropriately identified and dispositioned a deficiency in the UFSAR concerning the seismic accident response requirements and the small break loss of coolant analysis. (Section M2.3)

Replacement of the engineered safety actuation system relays in 13R was performed well. The maintenance technicians were knowledgeable of the tasks being performed. The job order and engineering work package provided adequate instruction to the workers. (Section M2.4)

GPUN conducted the observed nondestructive examination activities in accordance with TSs using appropriate procedures, techniques, and with qualified and certified personnel. (Sections M2.5, M2.6, and M2.7)

GPUN examined the OTSG tubes with eddy current techniques consistent with current industry practice. GPUN had a well-defined process for replacing Inconel 600 rolled mechanical tube plugs with Inconel 690 plugs. (Section M2.8)

Engineering

GPUN provided sufficient information to ensure that the reactor building emergency coolers (RBECs) were operable, but in a degraded state, when a building spray train was taken out of service in May 1999. (Section E2.1)

GPUN took appropriate actions to restore the RBECs to above the 25,000 cubic feet per minute (cfm) air flow per cooler in slow speed to ensure that they met their design basis assumptions and that the coolers were operable and no longer in a degraded state. (Section E2.1)

GPUN did not consider a single failure in their analysis of the maximum hypothetical accident offsite dose calculations, assuming that two coolers would be operating at 29,000 cfm each following a loss of coolant accident with fission product release to the reactor building. The assumption of only a single RBEC at 29,000 cfm resulted in an increased off-site dose, which was still within the 10 CFR 100 limits, as noted in the NRC Correction Letter to TS Amendment 215, dated October 14, 1999. (Section E2.1)

Plant Support

GPUN implemented generally acceptable radiological controls and housekeeping during the outage. Minor deficiencies in contaminated area control and posting requirements were noted. Considerable GPUN management involvement was required to establish an acceptable level of reactor building cleanliness control. GPUN personnel acknowledged the minor issues identified and quickly corrected them. (Section R1.1)

The overall planning, preparation, and use of various radiological controls were generally effective in minimizing dose and limiting the spread of contamination when performing outage-related tasks. (Section R1.2)

Radiological controls were adequately implemented as evidenced by an experienced staff implementing procedures to minimize external and internal exposure by appropriately monitoring personnel dose, adequately controlling access to radiologically controlled areas, and implementing detailed radiation work permits. (Section R1.3)

Failure of technicians to adequately maintain air sampling equipment by properly inspecting and replacing O-rings in air monitors resulted in a minor violation. (Section R1.3)

GPUN adequately monitored the implementation of the radiation protection program, worker practices, and procedural compliance through various management controls, including audits, departmental self-assessments, and routine observations. Prompt actions were taken to evaluate and correct factors that could degrade performance. (Section R7)

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Report Details

Summary of Plant Status

GPU Nuclear Inc. (GPUN) operated Three Mile Island Unit 1 (TMI) at near 100 percent power until the unit shutdown on September 10 for the Cycle 13 refueling outage (13R). Major outage activities included: once through steam generator (OTSG) tube inspections, refueling of the reactor core, and C reactor coolant pump (RC-P-1C) overhaul and rotating element replacement.

GPUN began unit restart on October 19 and returned the generator to the grid on October 22, completing 13R.

I. Operations

O1 Conduct of Operations (71707, 60710)

O1.1 Refueling Outage

a. Inspection Scope

The inspectors observed the plant shutdown for 13R. GPUN conducted plant simulator training on the shutdown procedures prior to the outage start date.

The inspectors reviewed the controls in place for the establishment of outage plant conditions including: the initial mid-loop draining, disassembly of the reactor vessel, establishment of defueling conditions and defueling, defueled mid-loop operations to allow work on the RC-P-1C, establishment of refueling conditions and refueling, reassembly of the reactor vessel, and final fill and vent of the reactor coolant system (RCS).

The inspectors observed the restart activities including: establishment of the initial boron concentration and the withdrawal of control rods to achieve reactor criticality, and portions of the subsequent core physics testing and power ascension.

b. Findings and Observations

Shutdown
Simulator training in preparation for the shutdown was a good initiative by GPUN. Operations management was actively involved with the simulator training and provided operating experience feedback to the operating crews. Some minor simulator inconsistencies with the actual plant configuration for the digital turbine control system were identified by the operating crew during the training.

The operating crew conducted the shutdown evolution in a well controlled and safe manner. The Operations Director developed detailed task assignments for the work activities to be accomplished during the first weekend of the outage. This included the conduct of the emergency electrical system testing and control rod drop testing (see Sections M1 and M2.1)

Outage Activities
The plant operators properly controlled the entry into the different water level conditions necessary for completion of the outage. Further, control of available decay heat removal systems was in accordance with GPUN proposed Technical Specification (TS) Change Request 265, dated June 4, 1999.

During the first mid-loop condition, the removal of the OTSG manways for installation of the cold-leg nozzle dams, which permits filling the reactor cavity while still allowing OTSG work, was slow to occur. Planning for the removal of the manways could have been better, limiting the time in the reduced inventory state with fuel still loaded in the reactor vessel. GPUN maintained two decay heat systems operable, with one in service.

Following installation of the cold-leg nozzle dams, the establishment of the refueling conditions was handled well. This included the decision to re-drain down below the reactor vessel flange to repair a leak in a nuclear instrument seal plate.

Defueling and refueling operations were properly conducted. Shift staffing for fuel movements in the reactor building and the fuel handling building was appropriate, and the engineered safety ventilation system was operated in accordance with TS.

The inspector found that during refilling and venting of the RCS, the portion of the procedure for filling the letdown line was postponed to allow continued work on the letdown isolation valve. While it was appropriate for the shift supervisor to allow the steps to be performed out of sequence, no log entry was made nor were the procedure steps annotated to state why it was acceptable in this instance.

Restart
Control room operators and shift supervision properly supported a reactor operator trainee's withdrawal of control rods to achieve core criticality.

Determination of the approach to core criticality was proper, and the use of plots to determine the estimated critical position was appropriate.

Boron concentration controls were appropriate; however, the documentation of calculations for changes both up and down in boron concentration, a reactivity change, were, in several cases, written on scrap sheets of paper. These calculations were properly reviewed by the shift supervisor, but not documented on the proceduralized form. In this case, the form is not required for use by the procedure usage guideline.

c. <u>Conclusions</u>

The shutdown evolution was well controlled and conducted in a safe manner. Operations management directly supervised the conduct of the evolution and provided operational experience feedback to the operating crews.

The operators properly controlled plant conditions including available decay heat removal sources and RCS water levels during the outage. The movement of reactor fuel was performed well and in accordance with TS requirements.

Although it had no safety consequence in this instance, GPUN did not immediately begin work to install the OTSG cold leg nozzle dams after the initial RCS draindown to mid-loop with fuel still loaded in the reactor vessel. This work was delayed for approximately one shift, due to scheduling difficulties. The risk in this high decay heat, limited RCS inventory condition could have been minimized by limiting the time in this condition.

Two procedural use weaknesses were noted. First, plant administrative procedures allowed re-sequencing of proceduralized steps with shift supervisor authorization, but did not specify a method for documenting such authorization. During the RCS refilling, the shift supervisor authorized the evolution to continue without filling the letdown piping as sequenced by the procedure, but there was no documentation of a review to ensure that this would not cause a problem later on in the filling operation. Second, administrative procedures did not specify the need to document reactivity change calculations. Engineering personnel and the shift supervisor completed calculations for boron concentration changes without documenting them on the proceduralized form.

O2 Operational Status of Facilities and Equipment (71707)

O2.1 Main Steam Isolation Valve Operator Motor Failure

a. Inspection Scope

The inspector reviewed GPUN actions associated with a failed main steam isolation valve (MSIV) operator motor. During plant startup on October 19, the B MSIV (MS-V-1B) was manually opened locally, following identification that it would not open electrically from the control room due to a failed motor. The failed motor rendered MS-V-1B incapable of remote operation from the control room. GPUN removed the valve operator motor, had it rewound, reinstalled it, and partially stroke tested the valve to restore it to an operable status on October 25.

b. Observations and Findings

On October 19, during plant startup from the refueling outage, operators found that MS-V-1B would not open remotely from the control room due to a failed motor. The shift supervisor directed that the valve be opened using the manual handwheel and a hand-held electric motor. Operators manually opened the valve locally, and continued the plant startup. On October 20, the inspector identified that the plant was started up without the ability to remotely close the valve from the control room. Also, the valve had not been declared inoperable. The Plant Review Group (PRG) met on October 20 to review the MS-V-1B motor failure, and identified that, with the valve not being operable remotely, the plant was operating outside its design basis, and a one hour 10 CFR 50.72 NRC notification was made.

The inspector was concerned that, although the valve's motor had been declared inoperable, MS-V-1B had not been declared inoperable. Additionally, the inspector questioned if TS 3.6.6, which discusses operability of reactor building isolation valves, was applicable, since MS-V-1B was listed as a Type III containment isolation valve (CIV) in Updated Final Safety Analysis Report (UFSAR) Table 5.2.3. The definition of a Type III valve is a valve external to the reactor building that is remotely operated, which can isolate a line not directly connected to the RCS or not open to the reactor building atmosphere. After discussions with the NRC, plant management agreed that the MSIVs were CIVs, and that MS-V-1B should be declared inoperable. However, the PRG determined that TS 3.6.6 only applied to automatic CIVs, and not to remotely operated manual CIVs. The NRC could not conclude that TS 3.6.6 applied because TS 3.6.6 did not specifically refer to the MSIVs. Plant management put in place contingency plans for manual, local operation of the valve when needed, by issuing Night Orders to the operators and temporarily changing the appropriate procedures associated with operation of the valve. On October 25, MS-V-1B was declared operable after the motor was repaired and replaced, and the valve was partially stroke tested.

The inspector identified several issues associated with the manner in which plant personnel handled the MS-V-1B motor failure. The reactor startup procedure required that the main steam (MS) system be aligned in accordance with the MS operating procedure, which had prerequisites that the 480 volt switchgear was energized and the associated MSIV circuit breakers were closed. The turbine generator operating procedure required that the MSIVs be open or verified open in preparation for warming the turbine and placing the generator on the grid. The operating crew apparently did not recognize the local, manual operation of MS-V-1B as requiring a procedure change as required by TS 6.8.2, and initially did not recognize the MS-V-1B remote operation failure as a maintenance rule functional failure. Additionally, the operating crew did not promptly recognize the need to perform an operability evaluation after the failed motor was identified and did not contact Engineering to determine the suitability of opening the valve manually. The shift supervisor initially determined that valve operability was not affected. Plant management did not question the operability determination until the following day.

Corrective actions taken by plant management included issuing Night Orders to operators, initially providing guidance on how to close the valve if needed, and then subsequently making procedure changes. GPUN wrote an additional CAP to cover the identified problems with the operability determination, the lack of a procedure or analysis for plant operation without MS-V-1B remote control from the control room, and the fact that engineering was not contacted prior to opening the valve locally.

The inspectors found that, on October 19, the shift operating crew, and then station management, did not adequately review the local opening of MS-V-1B manually and the subsequent inability to remotely close the valve from the control room. The operation of MS-V-1B in this manner amounted to a change in the operation of the valve as defined in operating procedures. As such, GPUN made an undocumented, intent change to the procedures for the MS system and turbine generator start-up, both of which are required to be implemented and maintained by TS 6.8.1. TS 6.8.2 requires that each procedure required by TS 6.8.1, and substantive changes thereto, shall be reviewed and approved prior to implementation; this was not done for the change in operation of MS-V-1B on October 19. Engineering provided information indicating that the MSIV closure was not risk significant and that downstream valves were available to isolate the OTSGs if necessary. This Severity Level IV violation is being treated as a Non-Cited Violation (NCV) consistent with Section VII.B.1.a of the NRC Enforcement Policy. This violation is in the licensee's corrective action process as CAP T1999-1086.

During the October 22 call with the NRC, GPUN committed to review the TS for MSIVs and CIVs that do not receive automatic isolation signals and document any corrective actions they believe necessary in the Licensee Event Report (LER) concerning MS-V-1B being outside its design basis.

c. Conclusions

On October 19 during plant startup, GPUN personnel could not remotely operate the B main steam isolation valve (MSIV) from the control room and operated it locally without completing a TS required procedure change. This placed the unit in a situation where it was outside of the design basis. Further, management oversight was deficient in that startup was allowed to continue without an associated operating procedure change or an engineering review of this degraded condition. The degraded condition of the MSIV was subsequently determined to not be risk significant. This Severity Level IV Violation, for failing to complete the TS required procedure change, is being treated as a Non-Cited Violation **(NCV 50-289/99-08-03)**.

O6 Operations Organization and Administration (71707)

O6.1 Use of Overtime

a. Inspection Scope

The inspectors reviewed GPUN's procedures and controls for limiting the number of hours worked by plant staff performing safety-related functions during 13R. TS 6.8.1 required GPUN to establish a written procedure covering plant staff overtime in accordance with NRC Generic Letter (GL) 82-12, "Nuclear Power Plant Staff Working Hours." GPUN Administrative Procedure (AP) 1031, "Nuclear Plant Staff Working Hours," defined limitations on working hours to incorporate the guidelines provided in GL 82-12.

b. Observations and Findings

In the event of unforeseen problems, or during extended periods of shutdown for refueling, AP 1031 established guidelines on the amount of overtime that may be worked. AP 1031 allowed the Director of Operations and Maintenance to authorize, in advance, deviations from these guidelines. This was consistent with GL 82-12. One of the guidelines listed in AP 1031 is that an individual shall not be permitted to work more than 72 hours in a 7 day week. GL 82-12 stated this guideline as no more than 72 hours in any 7 day period. The inspectors found that GPUN was not authorizing overtime deviations for each day an individual exceeded the 72 hour limit in a rolling 7 day period. GPUN authorized deviations only when an individual exceeded 72 hours in a 7 day calendar week and restarted the 72 hour time clock at the beginning of the next week. This was contrary to TS 6.8.1 which required GPUN to establish a written procedure covering plant staff overtime in accordance with GL 82-12. The inspectors found that during 13R, one crew of operators, consisting of a senior reactor operator and four control room operators, worked eleven straight twelve hour days utilizing a single deviation request. This failure to adequately implement the TS required overtime work controls is a violation of minor significance not subject to formal enforcement action. GPUN entered this issue into its corrective action process as CAP T1999-1070.

Due to unforeseen manpower shortages, GPUN identified, prior to the start of 13R, that personnel assigned to the electrical maintenance department would be required to work continuous 12 hour days for the duration of the outage in order to complete the required work scope. This exceeded the guidelines established in AP 1031 and was authorized in advance by the Director of Operations and Maintenance. The inspectors did not identify any electrical maintenance work practice errors during the 13R refueling outage that were directly attributable to worker fatigue.

The inspectors reviewed overtime deviations approved during 13R for licensed operators. Thirty-two individual deviations were approved by the Director of Operations and Maintenance. All the deviations were for exceeding 72 hours in a 7 day work week. The Operations Director stated the large number of deviations was caused by schedule delays due to unforeseen equipment problems. The shift manning schedule developed prior to the outage was not flexible enough to accommodate schedule changes. The inspectors found this to be a weakness in GPUN's administration of shift manning to prevent excessive use of overtime by licensed operators.

c. Conclusions

GPUN established an outage shift manning schedule without sufficient contingency to allow for emergent work and job delays, thereby causing overtime usage to exceed the working hour guidelines contained in GL 82-12. A minor violation was identified in GPUN's implementation of the TS required procedure for controlling plant staff overtime.

O8 Miscellaneous Operations Issues (71707, 90712)

O8.1 (CLOSED) LER 99-01 and Escalated Enforcement Item (EEI) 98-09-01: Emergency Boration Flowpath

EEI 98-09-01 was opened following identification by the inspector that GPUN did not comply with their procedure for having either the boric acid mix tank (BAMT) or the reclaimed boric acid tank (RBAT) available for emergency boration with water temperature at least 10° F above the solidification temperature anytime the reactor was critical. Specifically, the inspector identified deficiencies in the heat tracing of boric acid transfer pump discharge piping and with the controls over the boric acid transfer pumps.

LER 99-01 adequately discussed the issues around the inadequate heat tracing on the boric acid line and made commitments to enhance operating procedures. The inspectors performed an in-office review of the LER and determined that it accurately documented the event. The inspector reviewed the changes to Operating Procedure (OP) 1103-4, "Soluble Poison Concentration Control." These changes included revising the requirement that the BAMT or the RBAT "shall" be operable to "should" be operable. The changes also included specific guidance on how to use the borated water storage tank (BWST) as an emergency boration path, in addition to the BAMT or the RBAT.

While the inspector found that GPUN had violated OP 1103-4 in two instances, the inspector found that these were issues of low safety significance since the BWST was always available as an emergency boration path. Further, GPUN took appropriate actions to correct procedures and to fix the degraded boric acid piping heat tracing. This Severity Level IV violation is being treated as a Non-Cited Violation consistent with Section VII.B.1.a of the NRC Enforcement Policy. This violation is in the licensee's corrective action process as CAP T1999-0052. **(NCV 50-289/99-08-01)**

II. Maintenance

M1 Conduct of Maintenance (62707)

During observed maintenance and testing activities, the inspectors found that technicians properly used procedures and the quality verification oversight was present as needed.

The inspector observed performance of the emergency diesel generator power transfer surveillance. The test verified the operability of each diesel generator to automatically start and load sequence in response to the loss of its associated safety-related 4160 volt bus. The testing was well controlled and performed in accordance with the approved surveillance test procedure.

M1.1 C Reactor Coolant Pump Overhaul and Main Flange Seal Leakage

a. Inspection Scope

The inspectors closely followed the RC-P-1C overhaul and rotating element replacement. During initial disassembly, GPUN identified that the pump casing seal had been a contributor to the unidentified RCS leakage during the last operating cycle. Boron buildup and associated degradation of the main flange bolting was identified.

b. Observations and Findings

GPUN first identified leakage at the RC-P-1C main flange seal in 1993 during the Cycle 10 refueling outage. The leakage was very minor and stopped when the plant was heated up to normal operating temperature. More extensive leakage was identified in 1997 during the Cycle 12 refueling outage. Once again, the leakage stopped when the plant was returned to normal operating temperature. In early 1998, during the last operating cycle, the RCS unidentified leakrate increased to 0.2 gallons per minute (gpm). GPUN concluded that leakage from the RC-P-1C main flange seal was a major contributor to the increased leakrate. Over one thousand pounds of dried boron crystals were removed from the pump flange and inlet piping during 13R.

During 13R, GPUN identified that 12 of the 24 carbon steel fasteners used to secure the main pump flange to the casing had experienced substantial boric acid corrosion as a result of the flange leakage. The nominal diameter of each fastener is 4.31 inches. The 12 fasteners that exhibited the worst corrosion had as-found diameters of 3.75 inches or less. The two most degraded fasteners had as-found diameters of 3.625 inches. GPUN completed an evaluation of the as found condition and determined that, even in the degraded condition, the bolting satisfied the minimum American Society of Mechanical Engineers (ASME) Code requirements for operability.

GPUN identified the cause of the main flange seal leakage to be relaxation of the carbon steel fasteners during normal operation and a distorted pump casing. The pump casing and flange were machined prior to reassembly and the fastener design was changed to allow more positive control of the bolt torque and force applied to the flange seal during reassembly.

Visual inspections of the other three reactor coolant pumps (RCPs) identified no leakage on any of the other main flange seals. Visual inspections of the RCS pressure boundary components that were contacted by the leakage from the RC-P-1C main flange seal identified no degradation other than the flange fasteners.

During the conduct of the work, the inspectors noted numerous housekeeping concerns that contributed to several personnel skin contaminations.

c. Conclusions

The RC-P-1C overhaul was performed satisfactorily. System Engineering provided good support and direction to the maintenance technicians performing the work. GPUN's evaluation of the as-found condition of the degraded fasteners on the RC-P-1C main flange seal was thorough and identified no concerns over past operability. GPUN's actions to repair the cause of the main flange seal leakage were appropriate. Visual inspections of the other reactor coolant pumps identified no other leaking main flange seals. Some minor housekeeping and radiological control issues were identified during the conduct of the maintenance that contributed to several personnel skin contaminations.

M1.2 Stem on Decay Heat Injection Valve Bent During Testing

a. Inspection Scope

While performing motor operated valve (MOV) testing on the A decay heat train injection valve (DH-V-4A) the valve stem was damaged. The inspectors observed GPUN's response to this event and actions to return the valve to service.

b. Observations and Findings

On October 2, during a closed stroke test of DH-V-4A the motor operator torque switch failed to open resulting in an overthrust condition on the valve. The valve disc was fused into the valve seat and the valve stem was bent. The valve stem was bent to the extent that it could not be reused, and the valve disc had to be destructively removed from the valve body. At the time of the event, the core was offloaded to the spent fuel pool and the decay heat removal system was not in service. Core reload was delayed until the valve was repaired.

After the valve disc was removed, the valve body was examined for damage. No indications were found. The valve stem and disc were replaced with new components and the valve was reassembled. The motor operator, which was also damaged, was repaired. The fully assembled MOV was subsequently retested and returned to service.

GPUN entered the event into the CAP (T1999-0955). The apparent cause for the failure of the torque switch was that the cotter pin holding the torque limiter plate in place was removed by a maintenance technician to aid in installation of the MOV diagnostic test equipment. After stroking the valve several times, the plate came loose and did not allow the torque limiter to actuate the torque switch and prevent the overthrust condition. GPUN was conducting a root cause evaluation to determine why the cotter pin was removed and to assign appropriate corrective actions.

c. Conclusions

GPUN responded appropriately to the bent valve stem on DH-V-4A that occurred when the motor operator torque switch failed to actuate during testing. Plant management delayed reloading the core from the spent fuel pool until repairs to the valve were completed. Inspections on the valve body to characterize the extent of damage were appropriate. At the end of the inspection period, GPUN was conducting a root cause evaluation to determine the exact cause for the failed torque switch.

M2 Maintenance and Material Condition of Facilities and Equipment (62707, 73753, 90712)

M2.1 (Closed) LER 99-011, Control Rod Drop Time Testing

a. Inspection Scope

The inspectors reviewed GPUN's actions to address two control rods that failed to fully insert during post shutdown control rod drop time testing. One control rod stopped at approximately 27 percent withdrawn and the other at approximately 7 percent withdrawn. The control rod that stopped at 7 percent withdrawn met the TS required insertion time limit from fully withdrawn to 25 percent withdrawn. The control rod that stopped at 27 percent withdrawn did not insert to 25 percent and, thus, did not meet the TS insertion time requirement and was declared inoperable. In both cases, operators were able to subsequently fully insert the control rods using their normal drive mechanisms.

b. Observations and Findings

GPUN engineering developed a detailed test plan to determine the most likely cause of the control rods failing to fully insert. Based on pull testing of the control rod and lead screws, the cause was determined to be excessive mechanical drag between the control rods and their associated fuel assembly guide tubes.

After defueling, GPUN examined the subject fuel assemblies identifying that they had bowed, causing contact between the control rod and the fuel assembly guide tube. GPUN continued a root cause investigation to determine the reason for the bowed fuel assemblies. GPUN documented this assessment in LER 99-011.

The inspector found LER 99-011 acceptable in its documentation of the most probable cause and in the corrective actions taken to limit the bowing of fuel assemblies in the future. The inspectors performed an in-office review of the LER and determined that it accurately documented the event. GPUN also planned to meet with the NRC Office of Nuclear Reactor Regulation (NRR) on October 27 to discuss the root causes and the possible need for a mid-cycle outage to test control rod drop times.

Following completion of refueling, prior to criticality, GPUN successfully completed the TS required control rod drop time testing.

c. Conclusions

GPUN identified two control rods that failed to fully insert during control rod drop time testing at the beginning of 13R. A detailed test plan determined the most probable cause to be excessive mechanical drag due to abnormal bowing of the fuel assembly guide tubes. GPUN took actions to limit future bowing of the fuel assemblies. Prior to criticality, GPUN successfully completed the TS required control rod drop time testing.

M2.2 Decay Heat Removal Heat Exchanger Testing

a. Inspection Scope

As part of GPUN's commitment to GL 89-13, GPUN conducted heat exchanger performance testing and data analysis during 13R on the decay heat removal (DH) heat exchangers. On the B heat exchanger (DH-C-1B), the licensee determined that the overall heat transfer coefficient was less than that assumed in the UFSAR. The inspectors reviewed the GPUN response to CAP T1999-1002 written on this subject.

The DH removal heat exchangers are a shell and tube type heat exchanger with decay heat closed (DC) water flowing on the shell side and RCS DH water flowing through the tubes. The DC water is cooled in a second shell and tube heat exchanger with DC water flowing on the shell side and decay river (DR) water flowing through the tubes.

b. Observations and Findings

In response to the CAP, GPUN conducted a chemical cleaning of DH-C-1B with a trisodium phosphate solution to remove possible deposits on the outer tube (DC) surfaces. The cleaning was conducted using a procedure that was reviewed by the PRG prior to use.

Following the cleaning, GPUN conducted a special test procedure to ensure that DH-C-1B was as efficient at removing heat as A decay heat removal heat exchanger (DH-C-1A). This test was accomplished by establishing a constant RCS heat source with two RCPs running and establishing a stable RCS temperature with the A decay heat removal train in service. The B decay heat removal train was then placed in service under identical conditions and the A decay heat removal train was secured. The acceptance criteria for the test was to monitor RCS temperature with only the B decay heat removal train in service. If the RCS temperature did not increase, the B decay heat removal train could be proven to be as efficient as the A decay heat removal train. GPUN completed this testing and declared DH-C-1B operable.

In review of the special test procedure, the inspector found that the testing was based on DH-C-1A having acceptable performance. A review of 13R and 12R data indicated that the overall heat transfer coefficient for this heat exchanger was also below the design value, but some discussion was included justifying the continued operability of DH-C-1A. The inspector considered this item unresolved pending further review of the calculation methods and the acceptability of the A and B decay heat removal heat exchangers to perform its design function of ensuring that the environmental qualification profile of the reactor building is not exceeded following a design basis loss of coolant accident (LOCA).

c. Conclusions

An unresolved Item was opened to review the calculation methods and engineering assumptions used to ensure the operability of the A and B decay heat removal heat exchangers following identification of degraded performance of the B heat exchanger during 13R. **(URI 99-08-02)**

M2.3 Emergency Feedwater System Outage Testing

a. Inspection Scope

The inspector reviewed the outage surveillance test acceptance criteria calculation and the conduct of the testing for the emergency feedwater (EFW) system. TS Amendment 214, dated August 19, 1999, included specific system minimum flow and pump developed head requirements.

The inspector reviewed GPUN actions following Engineering's identification that the EFW system was credited in the UFSAR following a seismic event with a single motor driven pump supplying 400 gpm to the OTSGs. This requirement was not previously recognized to exist and was different than the loss of feedwater (LOFW) event which assumed any two pumps supplying 550 gpm (275 gpm each) to the OTSGs.

b. Observations and Findings

The original calculations to support the 275 gpm per EFW pump was acceptable as indicated by approval of the TS Amendment 214. This requirement was appropriately transferred into the test procedure. The test procedure, used to ensure that the EFW pumps could meet the TS flow requirement, was well prepared and supported by a properly prepared calculation.

GPUN Engineering performed well in identifying and resolving the seismic accident flow requirements of the EFW system. In review of this issue, GPUN found that the contractor performing the small break LOCA analysis had used 400 gpm EFW flow as an input criteria for the 20 percent OTSG tube plugging analysis. Engineering then used the previously developed system/pump hydraulic analysis to determine the minimum flow for a single pump that would also satisfy the two pump configuration requirements of the TS. GPUN determined that 314 gpm was acceptable and then supplied this information to the small break LOCA contractor for evaluation. This evaluation indicated that the requirements of 10 CFR 50.46 were still met.

GPUN appropriately analyzed that this 314 gpm requirement was bounded by the TS required flowrate of 275 gpm for two pump operation (i.e., if the 275 gpm with the developed head as stated in the TS was achieved, the 314 gpm requirement would also be achievable). The inspector found this acceptable.

The testing was properly conducted and supervised by a senior reactor operator. Test results proved that the EFW pumps exceeded the TS flow and developed head requirements.

c. Conclusions

GPUN properly analyzed the EFW system and completed calculations and testing to ensure its operability to meet the design basis requirements as outlined in the UFSAR. Specifically, GPUN used the TS required LOFW testing requirements and appropriately identified and dispositioned a deficiency in the UFSAR concerning the seismic accident response requirements and the small break LOCA analysis.

M2.4 (UPDATE) Inspection Followup Item 98-08-02 - Failure of Engineered Safeguards Actuation System Relays to Properly Energize

a. Inspection Scope

The inspectors continued to follow GPUN's actions to address Engineered Safeguards Actuation System (ESAS) relay failures as documented in this inspection followup item (IFI). The inspectors observed GPUN's actions during 13R to replace the ESAS relays identified as being most susceptible to failure.

b. Observations and Findings

GPUN previously identified the failure of ESAS relays was due to aging of components and loosening of mounting set screws which resulted in increased mechanical resistance preventing the relay from fully repositioning in the energized state after being de-energized.

During 13R, 64 of 137 ESAS actuation relays were replaced. The relays that were replaced were identified as being most susceptible to failure based on the number and configuration of contacts that resulted in the highest mechanical resistance for the relay to fully reposition in the energized state. Where possible on the replacement relays, the contact configuration was modified to provide more optimal conditions for reducing the mechanical resistance to repositioning the relay. The mounting screws on the relays that were not replaced were checked for tightness and, when necessary, tightened in accordance with the manufacturer's recommendation.

The replacement relays and contacts were purchased as individual commercial grade components and assembled, tested, and dedicated as an assembled unit prior to installation. The inspectors observed portions of the relay assembly and testing prior to installation as well as installation of the relays into the ESAS cabinets. The work was conducted in accordance with an approved job order which incorporated the related engineering evaluation request and safety evaluation. The inspectors observed good supervision of the field work activities. GPUN conducted post-maintenance testing of the entire ESAS, including the replacement relays, prior to start-up from 13R.

This IFI will be reviewed for closure in the upcoming corrective actions program inspection scheduled for November 1999.

c. Conclusions

Replacement of the ESAS relays in 13R was performed well. The maintenance technicians were knowledgeable of the tasks being performed. The job order and engineering work package provided adequate instruction to the workers.

M2.5 Inservice Inspection - Nondestructive Examination / Liquid Penetrant Activities

a. Inspection Scope

During 13R, GPUN scheduled 220 Liquid Penetrant (PT) examinations to satisfy the third period of the second 10 Year Inservice Inspection (ISI) Intervals scope, which was based on TS and ASME Section XI Code requirements.

The inspector reviewed the pertinent documentation, conducted interviews with the cognizant personnel and performed direct observations of the in-progress nondestructive examination (NDE) PT activities. The examinations reviewed included welds No. MUO131, No. MUO132, and No. MUO133. These welds were located on the High Pressure Injection (HPI) piping. HPI welds were selected based on Probabilistic Risk Assessment insights.

b. Observations and Findings

The three weld locations were well defined and documented in ISI isometric drawing No. 1D-ISI-MU-034, Revision 1, "MU System High Pressure Injection to RCS 'A' Loop." Component and examination information records were properly documented and kept in a controlled filing system. The NDE/PT examinations were conducted in accordance with approved procedure No. NDE-PT-01T, Revision 0, dated August 17, 1999. In this procedure, the materials and equipment used in the PT examinations were defined and controlled. The different types of cleaners, penetrants, and developers were clearly specified.

The individuals that performed the tests were properly qualified and certified as PT Level II. The inspector observed the surface preparation of the weld for the PT examination and the application of the penetrants and developers, and noted they were performed in accordance with the procedure. No indications were identified.

c. Conclusions

GPUN conducted the observed NDE/PT activities in accordance with TS using appropriate procedures, techniques, and with qualified and certified Level II personnel.

M2.6 Inservice Inspection - Assessment Nondestructive Examination/ Ultrasonic Activities

a. Inspection Scope

During 13R, TMI scheduled 170 ultrasonic (UT) examinations to satisfy the third period of the second Ten Year ISI Interval scope, which was based on TS and ASME Section XI Code requirements. In addition, GPUN performed UT augmented examination of selected welds.

The inspector reviewed the pertinent documentation, conducted interviews with the cognizant personnel and performed direct observations of NDE/UT activities inside containment that were performed on a High Pressure Injection System weld No. MU-0953BM (Safe End to Nozzle).

b. Observations and Findings

The weld location was well defined and documented in ISI isometric drawing No. 1D-ISI-MU-034, Revision 1, "MU System High Pressure Injection to RCS 'A' Loop." Component and examination information records were properly documented and kept in a controlled filing system. The NDE/UT examination was conducted in accordance with an approved procedure No. NDE-UT-16T, Revision 0, dated August 17, 1999, containing appropriate guidance and acceptance criteria. The inspector observed and verified that the calibration requirements were met prior to performing the UT. The gauges used in the calibration were properly calibrated, and the individuals that performed the test and the actual examination of weld No. MU-0953BM were properly qualified and certified as UT Level II.

c. Conclusions

GPUN conducted the observed augmented NDE/UT activities in accordance with appropriate procedures, using calibrated gauges, appropriate technique, and with qualified and certified Level II personnel.

M2.7 Inservice Inspection - Assessment Nondestructive Examination / Visual Activities

a. Inspection Scope

During 13R, TMI scheduled to perform 270 visual (VT) examinations to satisfy the third period of the second 10 Year ISI interval scope, which was based on TS and ASME Section XI Code requirements.

The inspector reviewed the documentation record for VT examination of hydraulic snubber No. DHH-188 located in the decay heat removal system.

b. Observations and Findings

The hydraulic snubber location, orientation, and configuration were well defined and documented in ISI Drawing ID-ISI-DH-019, Revision 2, and shop drawing No. DH-210. These drawings, along with the VT examination information record, were kept in a controlled file. Engineering/NDE/ISI Procedure No. NDE-VIS-02T, Revision 0, dated August 17, 1999, was found acceptable. Section 2.4 of the procedure contained the necessary attributes for the performance of snubber visual inspection.

The contractor VT-3 inspector was very familiar with Section 2.4 of procedure NDE-VIS-02T, Revision 0, and was knowledgeable about hydraulic snubbers and their use in power plants. Records showed this individual to be qualified and certified as a Level II inspector to perform this VT-3 examination.

c. Conclusions

GPUN conducted the NDE/VT-3 activities in accordance with appropriate procedures, and with qualified and certified Level II VT-3 personnel.

M2.8 Inservice Inspection of the Steam Generator Nondestructive - Eddy Current Activities

a. Inspection Scope

The inspector reviewed the eddy current examination of the OTSG tubes.

b. Observations and Findings

Review of the preliminary eddy current examination results identified inside diameter intergranular attack (ID IGA) and circumferentially orientated indications in the upper tubesheet and kinetically expanded areas. The licensee explained that this damage was residual damage from the unintentional injection of sodium thiosulfate from the reactor building spray system into the primary system. This intrusion, which occurred in the early 1980's, affected the uppermost region of the tubing in the upper tube sheet and was the reason for the repair of tubes using the kinetic expansion process in the upper tubesheet. In 13R, GPUN examined approximately 40 percent of the kinetic expansions with motorized rotating pancake coil probe and 100 percent of the tubes with bobbin coil examination techniques.

At the time of the exit meeting, four ID circumferential indications were identified in the upper tube sheet between the secondary face and the expansion transition. These tubes were to be removed from service by plugging. To date, seven tube support plate wear indications have been identified and measured to have depths less than the TS defective tube definition of less or equal to 40 percent through wall depth. These were preliminary results and GPUN continued to examine the tubes with eddy current techniques consistent with current industry practice used for Babcock and Wilcox designed OTSGs.

GPUN has a well-defined and well-planned process of replacing the Inconel 600 rolled plugs with plugs manufactured of Inconel 690, a material more resistant to stress corrosion cracking. GPUN has plans and approved procedures for repairing plugs with indications in the pressure boundary of Inconel 600 plugs. The inspector verified that TMI General Maintenance Procedure No. 1401-4.8, Revision 12, dated September 15, 1999, provided direction for installing or removing rolled mechanical tube plugs. To remove plugs with indications, GPUN performed weld relaxation on the plug. This process was qualified based on extensive mockup testing. In the event that Inconel 600 rolled plug removal was not successful, GPUN had well-defined contingency plans and procedures in place.

The inspector walked through the eddy current data acquisition and data analysis facility at TMI-1 and interviewed personnel engaged in these operations. Data acquisition was being performed by a contractor. Data was being acquired with equipment that was properly qualified following industry guidelines.

The levels of reviews and the independence in the reviews of the data collected met the industry guidelines. Primary and secondary data analysis were being performed by independent contractors at remote locations (offsite at the vendor's offices). The resolution analysis was being performed onsite at TMI. The licensee has designated two independent data analysts to review the final analysis results (third party review). The inspector verified that the licensee has reviewed and qualified the eddy current techniques and documented the review in a report retained by the licensee.

c. Conclusions

GPUN examined the OTSG tubes with eddy current techniques consistent with current industry practice. GPUN had a well-defined process for replacing Inconel 600 rolled mechanical tube plugs with Inconel 690 plugs.

III. Engineering

E2 Engineering Support of Facilities and Equipment (37550, 90712)

E2.1 (Closed) URI 99-03-02 and LER 99-08: Reactor Building Emergency Cooler Operation/Maximum Hypothetical Accident Review

a. Inspection Scope

The inspectors reviewed that actions taken by GPUN to address the degradation of the reactor building emergency coolers (RBEC) identified as reactor building (RB) temperatures increased to near the TS limit of 130°F in June 1999. The inspector also reviewed the GPUN assumptions for the minimum RBEC operation assumed in the maximum hypothetical accident (MHA) offsite dose calculation as a basis for NRC TS Amendment 215, dated August 24, 1999.

This item remained open pending inspector review of a GPUN calculation to ensure that the RBECs were operable when one train of building spray was removed from service in May 1999.

b. Observations and Findings

GPUN completed calculation C-1101-823-E520-012 to evaluate the operability of the RBEC during the period when one building spray system was removed from service. Engineering determined that each of the coolers was degraded based on the UFSAR requirement of 25,000 cubic feet per minute (cfm), at 95 °F river water. However, based on a river water temperature below 85°F at the time the degraded flow conditions were identified, an acceptable minimum flow was 15, 000 cfm. Based on known fan curves, fan laws, and measured flow data, GPUN concluded that the two engineered safeguards selected fans A and B were above the 15,000 cfm required to be considered operable in accordance with the TS, but in a degraded condition. The inspector concluded that the TS was not violated since the two required RBEC would have been able to perform their design function based on the degraded flows and lower than design river water temperatures.

In reviewing the design basis for the RBEC, the inspector noted that the offsite doses calculations for the MHA assumed two RBEC operating, each providing 29,000 cfm. The inspector found that the NRC Safety Evaluation for TS Amendment 215 was also based on two RBEC operating during the MHA. This was not conservative since the two cooler operation did not account for a single failure. A single cooler, at 29,000 cfm, should have been the proper assumption to yield the most conservative offsite dose. This issue was discussed with the NRR technical staff and the GPUN staff. The NRC Safety Evaluation for TS Amendment 215 was amended to include a subsequent NRR calculation showing the increase in offsite dose as a result of the single cooler operation following the MHA. The assumption of only a single RBEC at 29,000 cfm resulted in an increased off-site dose, that was still within the 10 CFR 100 limits, as noted in the NRC Correction Letter to TS Amendment 215, dated October 14, 1999.

During 13R, GPUN undertook an extensive effort to clean the RBECs and restore the air flow to above the design basis flow of 25,000 cfm per cooler in slow speed. GPUN also installed additional instrumentation on the RBECs to allow for better monitoring of system performance during the operating cycle.

The inspectors reviewed GPUN's LER 99-08 on this issue and found it adequately discussed the cause and corrective actions for the degraded performance of the RBECs and provided appropriate measures for monitoring the long term performance of the system.

c. Conclusions

GPUN provided sufficient information to ensure that the RBECs were operable, but in a degraded state, when a building spray train was taken out of service in May 1999. This allowed the closure of an unresolved item.

GPUN also took appropriate actions to restore the RBECs to above the 25,000 cfm air flow per cooler in slow speed to ensure that they met their design basis assumptions and that the coolers were operable and no longer in a degraded state.

GPUN did not consider a single failure in their analysis of the maximum hypothetical accident offsite dose calculations, assuming that two coolers would be operating at 29,000 cfm each following a LOCA with fission product release to the reactor building. The assumption of only a single RBEC at 29,000 cfm resulted in an increased off-site dose, that was still within the 10 CFR 100 limits, as noted in the NRC Correction Letter to TS Amendment 215, dated October 14, 1999.

E8 Miscellaneous Engineering Issues

E8.1 Year 2000 Readiness (TI 2515/141)

On July 1, and October 1, 1999, GPUN responded to NRC GL 98-01 to provide information concerning Year 2000 (Y2K) readiness at TMI Generating Station. The inspector verified completion of the Y2K readiness for the ETUDE software system for controlling personnel qualifications, the REM/AACS/CICO integrated software for managing personnel radiation exposure and controlling access to radiologically controlled areas, and the digital turbine control system.

IV. Plant Support

R1 Radiological Protection and Chemistry Controls (71750, 83750)

R1.1 General Outage Radiation Protection and Housekeeping

a. Inspection Scope

The inspectors conducted routine tours of radiologically controlled areas as GPUN prepared for and conducted 13R, observing contamination controls, postings, and general housekeeping.

b. Observations and Findings

Plant radiological conditions were generally acceptable. However, the inspectors noted numerous minor radiological contamination control poor practices such as:

- Tools and other materials being left across contaminated areas boundaries
- Water running from a high contamination area to an area of lower contamination

- Face shield and headsets being put down in contaminated areas without any protection from becoming contaminated

The inspectors found that radiological postings were proper. However, in the reactor building a high contamination area step off pad was left in an area after that area had been cleaned up, and a high contamination area was posted solely with a "Keep Out" posting.

Housekeeping in the auxiliary building was good, but regarding the reactor building, personnel needed continuous GPUN management pressure to ensure that materials were not inadvertently left in the area. Transient plastic tie wraps and nails were the largest concerns.

It should be noted that GPUN personnel took appropriate actions to address each of these minor issues as the inspectors identified them.

c. Conclusions

GPUN implemented generally acceptable radiological controls and housekeeping during the outage. Minor deficiencies in contaminated area control and posting requirements were noted. Considerable GPUN management involvement was required to establish an acceptable level of reactor building cleanliness control. GPUN personnel acknowledged the minor issues identified and quickly corrected them.

R1.2 Outage Exposure Reduction Efforts

a. Inspection Scope

The implementation of the As Low As Is Reasonably Achievable (ALARA) program, relative to planning and controlling work conducted during the refueling outage, was reviewed during the period. The inspection included evaluation of performance related to implementing radiological controls as contained in Radiation Work Permits (RWPs), job-specific ALARA reviews, and associated procedures. The inspector interviewed staff and selected workers, and directly observed radiological controls established for tasks performed in the reactor building, auxiliary building, and other radiologically controlled areas. Tasks observed included testing of core flood tank discharge valves, removal of insulation and boric acid deposits from the C RCP suction line, a steam generator bowl closeout inspection, and refueling operations.

Performance was evaluated relative to the applicable requirements contained in 10 CFR 20 and related licensee procedures.

b. Observations and Findings

The overall planning and preparations to minimize dose and to limit the spread of contamination when performing outage tasks were generally effective. System flushes, installation of temporary shielding, use of remote cameras and use of specialized shielding were effective ALARA measures. The Radiological Controls Department provided effective oversight by implementing detailed RWPs, developing comprehensive ALARA reviews, and integrating requisite radiological controls into the work planning process. Specific ALARA reviews adequately detailed the radiological controls for dose intensive activities including replacement of the C RCP internals, various steam generator tasks, and scaffold installation/disassembly in the reactor building.

For the outage, an occupational exposure goal of 170 person-rem had been established. Total cumulative exposure (113 person-rem) was maintained below the projected estimate of 133 person-rem for the first 27 days of the outage. Although the overall cumulative dose was below the projected estimate, the actual dose for tasks associated with the C RCP was expected to exceed the initial estimate by a factor of about two due to job scope increases resulting from problems associated with fit-up of the new internals, removal of additional insulation, and cleaning of boric acid deposits.

The frequency of low level personnel contaminations was more than initially anticipated by the licensee. In general, the licensee concluded that increases in reactor building airborne concentrations following reactor shutdown, emergent work associated with the C RCP, and poor radiological practices exhibited by radiological workers contributed to the increased frequency. The contamination incidents did not result in significant personnel exposure.

Tasks that had the potential of resulting in elevated dose, such as the core flood tank discharge tests, steam generator bowl inspections, and reactor piping clean-up were properly planned and conducted. Comprehensive pre-job briefings, conservative use of protective clothing and respiratory protection equipment, and direct coverage by technicians at the job site provided the appropriate radiological controls.

c. Conclusions

The overall planning, preparation, and use of various radiological controls were generally effective in minimizing dose and limiting the spread of contamination when performing outage related tasks.

R1.3 Applied Radiological Controls

a. Inspection Scope

The inspector accompanied the Radiological Controls Department management and staff on tours, and independently toured site areas, including the reactor building, the auxiliary building, and instrument calibration facility, to observe radiological practices, postings, access controls, and to confirm radiation survey measurements. Technicians and workers were interviewed to assess their knowledge of radiological controls applied to their job and work area conditions.

Performance was evaluated relative to the requirements contained in 10 CFR 20 and applicable licensee procedures.

b. Observations and Findings

Radiologically controlled areas (RCA) were properly posted and access was appropriately controlled. Locked high radiation areas (LHRA) were properly posted, physical barriers were in place, and doors were secured. Keys to LHRAs were accounted for and appropriately controlled.

Daily source checks of survey instruments were performed and issuance of instruments was adequately controlled.

Dosimetry was appropriately worn in the RCA. Extremity dosimetry and multi-badging were appropriately designated for tasks commensurate with the radiological conditions at the job site, such as entry into the steam generator. Dosimetry records were current. Whole body counting was conservatively performed.

RWPs were complete with current survey data referenced, appropriate dosimetry designated, conservative electronic dosimetry setpoints established, and protective clothing requirements stated. Through interviews, the inspector found laborers and technicians generally knowledgeable of RWP requirements, and current radiological and plant conditions.

Shift turnovers between radiological controls supervision and technicians were comprehensive with current job status and emergent issues thoroughly discussed.

During a tour of the Auxiliary Building, the inspector identified that the sampling flow rate at an airborne radiation monitoring station (RM-S-4, A-Makeup Pump Cubicle) was significantly lower than other stations in the area. The licensee placed this problem into the corrective action system (CAP No. T1999-0982) to further evaluate the off-normal condition. Subsequent investigation by the licensee determined that the flowrate was reduced (30 liters per minute vice the calibrated flow rate of 50 liters per minute) as a result of degraded O-rings on the instrument's sample holder. The license evaluated the extent of this condition and determined that O-rings on other monitors were also degraded (no flow deficiencies were evident) as a result of inconsistent technician practices. This failure to assure that O-rings were in satisfactory condition indicates that the requirement contained in Radiological Controls Procedure 6610-INS-4200.01, TMI Rad Con Instrument Operations Manual, for technicians to routinely check the O-rings for lubrication and damage was not effectively performed. Failure to properly implement this procedure is contrary to the requirements contained in Technical Specification 6.8.1 a. which specifies, in part, that procedures (e.g., airborne radioactivity monitoring procedures) contained in Regulatory Guide 1.33 be implemented. This failure constitutes a violation of minor significance and is not subject to formal enforcement action.

c. Conclusions

Radiological controls were adequately implemented as evidenced by an experienced staff implementing procedures to minimize external and internal exposure by appropriately monitoring personnel dose, adequately controlling access to radiologically controlled areas, and implementing detailed radiation work permits.

Failure of technicians to adequately maintain air sampling equipment by properly inspecting and replacing O-rings in air monitors resulted in a minor violation.

R7 Quality Assurance in Radiological Protection and Chemistry Activities (83750)

a. Inspection Scope

A Nuclear Safety Assessment (NSA) audit, Radiological Control Department self-assessments, management observations, and NSA monitoring reports were reviewed to determine the adequacy of identifying, evaluating, and correcting deficiencies related to the implementation of the radiation protection program.

b. Observations and Findings

Audit Report (S-TMI-99-09) of TMI radiological controls was a comprehensive assessment of personnel training and qualifications, instrumentation, dosimetry, implementing procedures, and corrective action follow-up. The performance based audit included observations of supervisory and technician performance, verification that regulatory requirements were addressed by procedure, and the evaluation of management controls. Factors that could degrade program effectiveness were identified and appropriately resolved.

Departmental self-assessments of the radiological controls program adequately addressed the instrument calibration program, daily logs/record keeping, and the adequacy of radiation surveys. Deficiencies were appropriately entered into the corrective action process and areas for improvement were identified.

Management observations of in-progress jobs were routinely conducted. The quality of pre-job briefings, field activity performance, and turnovers were systematically evaluated. Additionally, during plant tours, radiological controls management challenged technician knowledge of RWP content and radiological conditions in the work area.

c. Conclusions

GPUN adequately monitored the implementation of the radiation protection program, worker practices, and procedural compliance through various management controls, including audits, departmental self-assessments, and routine observations. Prompt actions were taken to evaluate and correct factors that could degrade performance.

V. Management Meetings

X1 Exit Meeting Summary

Following completion of the inspection period, the resident inspectors conducted an exit meeting with GPUN managers on November 4, 1999. GPUN staff comments concerning the issues in this report were documented in the applicable report sections. No proprietary information was included.

INSPECTION PROCEDURES USED

IP37550	Engineering
IP60710	Refueling Activities
IP62707	Maintenance Observation
IP71707	Plant Operations
IP71750	Plant Support Activities
IP73753	Inservice Inspection
IP83750	Occupational Radiation Exposure
IP90712	In-Office Review of Written Reports of Nonroutine Events at Power Reactor Facilities
TI2515/141	Review of Year 2000 Readiness of Computer Systems at Nuclear Power Plants

ITEMS OPENED, CLOSED AND DISCUSSED

<u>Opened</u>:

99-08-01	NCV	Failure to Follow Soluble Boron Control Procedure (Section O8.1)
99-08-02	URI	Decay Heat Removal Heat Exchanger Testing (Section M2.2)
99-08-03	NCV	Inability to Remotely Close B Main Steam Isolation Valve (Section O2.1)

<u>Closed</u>:

98-09-01	EEI	Failure to Follow Soluble Boron Control Procedure (Section O8.1)
99-03-02	URI	Operation with Degraded Reactor Building Emergency Cooler with A Building Spray System Removed From Service for Maintenance (Section E2.1)
99-08-01	NCV	Failure to Follow Soluble Boron Control Procedure (Section O8.1)
99-08-03	NCV	Inability to Remotely Close B Main Steam Isolation Valve (Section O2.1)
99-08	LER	Reactor Building Emergency Cooling System Outside Design Basis (Section E2.1)
99-11	LER	Incomplete Control Rod Insertion During Trip Insertion Time Testing (Section M2.1)
99-01	LER	Boric Acid Mix Tank Piping Heat Trace Problems Caused by Misplacement of Sensing Elements and Insulation that Caused Short Sections of Piping to be Below the Temperatures Specified in FSAR Section 9.2.1.2. (Section O8.1)

<u>Discussed</u>:

98-08-02	IFI	Failure of Engineered Safeguards Actuation System Relays to Properly Energize (Section M2.4)

LIST OF ACRONYMS USED

13R	Cycle 13 Refueling Outage
ALARA	As Low As Is Reasonably Achievable
AP	Administrative Procedure
ASME	American Society of Mechanical Engineers
BAMT	Boric Acid Mix Tank
BWST	Borated Water Storage Tank
CAP	Corrective Action Process
cfm	cubic feet per minute
CIV	Containment Isolation Valve
DC	Decay Heat Closed
DH	Decay Heat Removal
DR	Decay River
EEI	Escalated Enforcement Item
EFW	Emergency Feedwater
ESAS	Engineered Safeguards Actuation System
GL	Generic Letter
gpm	gallons per minute
GPUN	GPU Nuclear, Inc.
HPI	High Pressure Injection
ID IGA	Inside Diameter Intergranular Attack
IFI	Inspection Followup Item
ISI	Inservice Inspection
LER	Licensee Event Report
LHRA	Locked High Radiation Areas
LOCA	Loss of Coolant Accident
LOFW	Loss of Feedwater
MHA	Maximum Hypothetical Accident
MOV	Motor Operated Valve
MS	Main Steam
MS-V-1B	B MSIV
MSIV	Main Steam Isolation Valve
NCV	Non-Cited Violation
NDE	Nondestructive Examination
NRC	Nuclear Regulatory Commission
NRR	Office of Nuclear Reactor Regulation
NSA	Nuclear Safety Assessment
OTSG	Once Through Steam Generator
PDR	Public Document Room
PRG	Plant Review Group
PT	Liquid Penetrant
RB	Reactor Building
RBAT	Reclaimed Boric Acid Tank
RBEC	Reactor Building Emergency Coolers
RC-P-1C	C Reactor Coolant Pump
RCA	Radiological Control Area

RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
RWP	Radiation Work Permit
TMI	Three Mile Island Unit 1
TS	Technical Specification
UFSAR	Updated Final Safety Analysis Report
UT	Ultrasonic
VT	Visual
Y2K	Year 2000