U.S. NUCLEAR REGULATORY COMMISSION
REGION I

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

Three Mile Island IST Inspection 96-08

(June 3-7 and September 26-27, 1996)

The Inservice Test (IST) program at Three Mile Island, Unit 1, generally conformed with the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (the Code) and NRC requirements. The transition to the 1989 Edition of the Code was performed smoothly, and , with several exceptions, the program has been well-implemented. High quality test procedures provided clear direction and contained unambiguous acceptance criteria that, in some instances, exceeded Code requirements. Detailed performance-based independent audits of IST program implementation were performed, with good quality findings.

Several findings that reflect on the program were identified which affect full conformance with the Code. The licensee took steps to address the following deficiencies in test method: (1) full-stroke exercise of makeup and purification system stop check valves, (2) positive verification of sealed solenoid-operated valve position indication, and (3) vibration reference values for safety-related pumps. ASME Class 2 and 3 relief valves (with the exception of main steam system safety valves) were not included in the IST program. However, the approximately 28 valves affected had been tested previously as part of the licensee's preventive maintenance program and are subsequently being added to the scope of the IST program.

Two unresolved items were identified. The first item involved the exclusion of the Class 2 and 3 relief valves (**96-08-01**), representing one example of a potentially significant condition adverse to quality that had not been initially considered for formalized corrective action. The second item involved the absence of leakage rate testing of 18 reactor coolant pressure boundary isolation valves (**96-08-02**).

Report Details

M1 Conduct of Maintenance

M1.1 Inservice Test Program Review

a. Inspection Scope (73756)

The inspectors evaluated the effectiveness of GPU Nuclear Corporation's Inservice Test Program for safety-related pumps and valves at Three Mile Island Nuclear Station, Unit 1 (TMI). The inspectors focused primarily on components in the high pressure coolant injection (MU), decay heat removal (DH), and emergency feedwater (EF) systems. These risk-significant systems are needed to prevent or to mitigate the dominant core damage frequency events identified in the TMI Individual Plant Examination.

The purposes of inservice testing (IST) are to assess the operational readiness of pumps and valves, to detect degradation that might affect component operability, and to maintain safety margins with provisions for increased surveillance and corrective action. The requirements for IST are contained in TMI Technical Specification 4.2.2, which requires testing in accordance with 10 CFR 50.55a, "Codes and Standards," and Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (the Code). The inspectors reviewed administrative and surveillance procedures, engineering evaluations, and test results encompassing the previous two operating cycles at TMI.

b. Observations and Findings

GPU currently is implementing the third 10-year interval of the IST program. Testing is performed pursuant to Section XI of the Code (1989 Edition) which incorporates by reference Parts 6 (OM-6) and 10 (OM-10) of ASME/ANSI OMa-1988 for pumps and valves, respectively, and Part 1 (OM-1) of ASME/ANSI OM-1987 for pressure relief devices. The program is described in IST program update submittals to the NRC, dated September 21, 1995, and May 23, 1996, and administrative procedures AP 1041, "IST Program Requirements," and AP 1001J, "Technical Specification Surveillance Testing Program." Administrative responsibility for the program resides with the Engineering IST program coordinator, while the day-to-day implementation of the program is assigned to the Operations Department. The duties and responsibilities of the plant personnel involved in IST were defined clearly in the program documents.

With the exceptions identified in this report, the inspectors found that adequate administrative controls are in place to schedule and track the performance of tests, to ensure that reference values and acceptance criteria are met, and to assure that reference values are verified following component maintenance or replacement. The inspectors verified that testing that is deferred to cold shutdowns or refueling outages is scheduled adequately.

Overall, the safety-related pumps and valves in GPU's IST program met the Code test methods and frequency requirements. Although some relief requests remained under review by the NRC Office of Nuclear Reactor Regulation, the licensee's transition to the 1989 edition of the Code was implemented successfully. Surveillance procedures were updated properly and contained detailed instructions for test performance, unambiguous acceptance criteria, and proper guidance if the criteria were not met. However, as described in Section M1.2, the licensee did not adequately update the program to meet new IST requirements pertaining to ASME Class 2 and 3 relief valves.

c. Conclusions

With the exception of ASME Class 2 and 3 relief valves, GPU successfully made the transition of its IST program to the new requirements of the 1989 Edition of the Code.

M1.2 IST Program Scope

a. Inspection Scope

The inspectors used GPU's IST program submittals, the TMI-1 Updated Final Safety Analysis Report (UFSAR) and technical specifications, system drawings, and surveillance test procedures to verify that pumps and valves that perform a safety function were included in the IST program.

b. Observations and Findings

OM-10, "Inservice Testing of Valves in Light-Water Reactor Power Plants," Section 1.1, states the program scope requirements for safety-related valves. The valves covered are those that are required to perform a specific function in shutting down a reactor, maintaining the shutdown condition, or in mitigating the consequences of an accident. The pressure relief devices covered are those for protecting systems or portions of systems that perform the required functions.

The inspectors identified several instances in which the program scope requirements were not met. For example, decay heat removal pump casing vent solenoid valves DH-V75A\B and DH-V76A/B were not included within the program scope. The safety function of the valves is described in UFSAR section 9.5.2.a, which states that remotely operated vent valves provide for venting of air and noncondensibles from the pump casings after an accident when the decay heat removal vaults are not accessible. The inspectors noted that the valves are tested per Technical Specification 4.5.2.2.a every refueling outage, and concluded that the test provided current assurance of valve functionality. However, the licensee did not test the valves on a quarterly basis as required by OM-10.

The inspectors also noted that, with the exception of the main steam system code safety valves, the IST program did not include any ASME Class 2 or 3 relief valves. The licensee stated that the relief valves were tested under the preventive maintenance program at least once every six years. (The relief valve test procedure is compared with OM-1 in Section M3.1) In addition, the licensee provided written justifications and engineering evaluations that described the reasons for excluding relief valves from the program, including variously: (1) the valves provide only thermal overpressure protection, (2) the valves are not required to function during design-basis accidents, (3) no credible single failures of tested components existed that would challenge the relief valves, and (4) the safety consequences of relief valve failure to operate were acceptable.

The inspectors noted that GPU's rationale that the valves were not required to function to mitigate the consequences of an accident was contrary to the explicit wording of the OM-10 scope statement pertaining to relief valves. Clarification of the Code requirement also is provided in section 4.3.1 of NUREG 1482, in which expansion of the OM-10 scope statement to include valves that protect accident mitigation systems is discussed. The NRC staff also addressed preventive maintenance programs as an alternative to IST in Appendix G of NUREG 1482. The NUREG states that "...although the proposed alternative has merit, approval of the alternative would be required because the proposal does not meet the requirements of the 1989 Edition of the Code." GPU did not request the NRC to consider its relief valve preventive maintenance program as an alternative to the Code requirements in its IST program submittals.

The overpressure protection functions of several excluded emergency core cooling and main steam system relief valves are described or credited (implicitly or explicitly) in the TMI-1 UFSAR, GPU's response to Generic Letter (GL) 87-06, "Periodic Verification of Leak Tight Integrity of Pressure Isolation Valves," dated June 12, 1987 and other documents:

- Valves DH-V13A\B and DH-V18A\B are located on the pump suction and discharge piping, respectively, of the decay heat removal system. UFSAR Section 6.1.2.8, pertaining to the makeup and purification, decay heat removal, and core flood emergency core cooling systems, states that relief valves are provided to protect the low pressure piping and components from overpressure. The relief valves are set to protect system components consistent with their design pressures. Also, Licensee Event Report 93-007 contained an assessment of the safety consequences of a failure of pressure isolation valve DH-V22B to seat tightly in which GPU discussed the role of these valves in protecting the affected low pressure piping against overpressurization.

- Valve DH-V37 is located between pressure isolation valves DH-V2 and DH-V3 in the decay heat removal system suction piping from the reactor coolant system loop B hot leg. Valve DH-V67 is located in the decay heat removal system auxiliary spray line. GL 87-06 required a description of periodic tests or other measures performed to assure the integrity of pressure isolation

valves designed to prevent interfacing system loss of coolant accidents. In its response to the GL, GPU stated that leakage past untested pressure isolation valves would be passed by the relief valves to the reactor coolant drain tank and be detected (and mitigated) by plant operators.

- Valves CF-V21A\B are installed on the core flood tanks. UFSAR Section 6.1.2.1 states that each core flooding tank is protected from overpressurization by a relief valve installed directly on the tank. The size of these relief valves is based upon maximum water makeup rate to the tank.

- Valves MS-V22A\B are installed in the main steam supply piping to the turbine driven emergency feedwater pump. FSAR section 10.7.4 states that the valves are provided to prevent overpressurization of the turbine.

The inspectors verified through review of preventive maintenance documents that the relief valves had been tested, providing some assurance of valve functionality. (Relief valve testing and documentation of results are discussed in Sections M3.1 and M3.2.) The licensee agreed that the decay heat removal pump casing vent valves should be added to the IST program. GPU also committed to add at least 26 to 28 relief valves in various safety-related systems to the program, including the valves discussed above. (Attachment 1 lists the valves subject to this commitment)

GPU's failure to include the decay heat removal pump casing vent valves and the ASME Class 2 and 3 relief valves in the IST program was a technical noncompliance with the Code. Section 7 of NUREG 1482 discusses the identification of components that must be added to the IST program, as well as the treatment of a Code noncompliance and a nonconforming condition. In the context of program scope, the inspectors concluded that the failure to either include the valves in the program or to obtain NRC approval of an alternative method had limited safety consequence because: (1) the vent valves were tested per TS, (2) the relief valves were tested pursuant to the preventive maintenance program at about twice the periodicity required by the Code, (3) GPU committed to add the valves to the IST program, (4) ample time remained to comply with the test frequency provisions of OM-1, Section 1.3.4, and (5) current test results were acceptable. Therefore, this is being treated as a non-cited violation, consistent with Section IV of the NRC's Enforcement Policy.

However, with respect to the broader question of corrective action, the inspectors noted that the licensee did not initiate a quality deficiency report (QDR) when apprised of the program scope deficiencies. Thus, notwithstanding the immediate actions taken, no formal causal analysis was performed to consider the broader, programmatic implications of the inspection findings, and no actions to prevent recurrence were developed or documented as of the end of this inspection.

The inspectors reviewed Plan No. 1000-PLN-7200.01, "GPU Nuclear Operational Quality Assurance Plan," (the Plan) Section 8, "Control of Corrective Actions and Nonconformances," which implements 10 CFR 50, Appendix B, Criterion XVI, "Corrective Action." Section 8.2.1 of the plan defines nonconformances as

including nonhardware problems such as failure to comply with the Operating License or Technical Specifications, procedures, regulations, and/or other established requirements. The inspectors noted that IST is required by NRC regulations (10 CFR 50.55a) and TMI-1 TS 4.2.2.

Section 8.2.5 of the Plan requires procedures to be established which detail and implement the requirements for identification and control of nonconforming activities, and for the identification of the cause of the conditions and the actions to be taken to correct the conditions to prevent recurrence. Section 8.2.2 states that it is the responsibility of all individuals and organizations to identify and report all nonconformances within the scope of the Plan.

The licensee informed the inspectors that, "...to avoid duplication of paperwork" preliminary NRC or independent audit observations are not entered into the formal corrective action process until they are documented formally in a report. Thus the inspectors' findings regarding IST program scope were not considered by the licensee to be "findings" requiring initiation of a nonconformance or QDR. The inspectors considered that GPU's interpretation created the potential for conditions adverse to quality to persist uncorrected, or for actions to prevent recurrence to go unevaluated with respect to root cause and for potential adverse trends. As of October 11, 1996, the licensee had initiated an "Event Capture" form (No. 96-264) to document the finding, although the inspectors noted that this is not considered a QA corrective action, as yet. Because this represented but one example and since the licensee has since indicated an Even Capture form to begin the process of causal analysis, this issue is considered unresolved pending additional NRC review of the licensee's corrective action program. (**URI 96-08-01**)

c. Conclusion

Safety-related valves were excluded from the IST program with inadequate justification, and, in some cases, for reasons contrary to the functions described in the UFSAR. No corrective action program mechanisms were initiated to evaluate the Code noncompliance. An unresolved item was opened to evaluate the GPU corrective action program.

M1.3 Testing of ASME Class 1 and Main Steam Safety Valves

a. Inspection Scope

The IST program invoked OM-1 (1987) test requirements for ASME Class 1 and main steam system safety/relief valves. The inspectors reviewed procedures 1303-11.2, "Pressurizer Code Safety Valves Setpoint Verification," 1300-3V, "PORV IST," and 1303-11.3, "Main Steam Safety Valves Surveillance Procedure," against the test frequency, methodology, and corrective action requirements contained in OM-1. The inspectors also reviewed two Wyle Laboratories Certification Test Reports pertaining to the pressurizer safety valves and the pressurizer power-operated relief valve (PORV).

b. Observations and Findings

Wyle Laboratories Report Nos. 42249-1 and 43393-0 detailed the "as-found" setpoints of pressurizer safety valves RC-RV1A\B and pressurizer PORV RC-RV2, described the necessary refurbishments, and contained the "as-left" certification data. The inspectors found that GPU's procedures met the methodology requirements of OM-1 and specified a shorter test interval than required by the Code. The test frequency also conformed to Technical Specification Table 4.1-2, which requires fifty percent of the valves to be tested on al alternating refueling cycle periodicity. The inspectors also determined through review of test results for several main steam safety valves that all Code requirements were satisfied.

c. Conclusion

The IST program satisfied the Code requirements for ASME Class 1 and main steam system pressure relief devices.

M1.4 Pump IST Observation

a. Inspection Scope

The inspectors observed quarterly IST of the B decay heat removal pump to verify conformance to the requirements of OM-6, "Inservice Testing of Pumps in Light-Water Reactor Power Plants."

b. Observations and Findings

Section 4.6.4(a) of OM-6 requires vibration measurements to be taken in the axial direction on each accessible pump thrust bearing housing. GPU did not consider the decay heat removal pump thrust bearing housing to be accessible, and thus did not take the axial vibration measurement. The inspectors considered that notwithstanding a coupling cover that appeared to preclude direct access to the thrust bearing housing, there may be other locations on the pump skid where a vibration probe could be placed to obtain a valid axial thrust reading. For example, the inspectors noted that GPU had performed minor modifications to the boric acid injection pumps, including attaching a metal pad to the pump, to facilitate vibration testing. The licensee agreed to evaluate the feasibility of taking the measurement from an installed support plate.

c. Conclusion

The inspectors concluded that because of the inaccessibility of the pump bearing housing, valid axial thrust measurements were not obtained during IST testing of the decay heat removal pumps. The licensee is evaluating the feasibility of using an installed support plate to facilitate this measurement in future IST.

M3 Maintenance Procedures and Documentation

M3.1 Relief Valve Test Procedure Review

a. Inspection Scope

The inspectors reviewed preventive maintenance procedure 1410-V-3, "Relief Valve Maintenance." The purpose of the review was to determine the extent to which the preventive maintenance program relief valve test provisions agreed with the requirements of OM-1 (1987), "Requirements for Inservice Performance Testing of Nuclear Power Plant Pressure Relief Devices."

b. Observations and Findings

The inspectors found that the maintenance procedure contained several provisions that were more stringent than the requirements of OM-1, including: (1) test periodicity, (2) accuracy of set pressure measurement instrumentation, and (3) the minimum number of consecutive valve lifts needed to establish repeatable performance. In addition, the procedure included detailed guidance for verifying and setting blowdown nozzle rings. The guidance was responsive to the industry operating experience discussed in NRC Information Notice 92-64, "Nozzle Ring Settings on Low Pressure Water Relief Valves."

However, many of the provisions of OM-1 were not contained in GPU's procedure. The inspectors observed that in the aggregate, the unaddressed OM-1 requirements potentially could affect the pressure settings and leak tightness acceptability of ASME Class 2 and 3 relief valves in liquid service. However, the inspectors did not consider that the differences significantly challenged the current functionality of the valves. The following deviations from OM-1 were identified:

- Section 8.1.3 requires that valves be tested with the normal system operating fluid and temperature for which they are designed. Alternate liquids or different temperatures may be used provided a correlation by test is performed per Section 8.3 and documented per Section 9.4. The correlation is intended to verify the adequacy of the alternate test medium in meeting the established acceptance criteria. The inspectors noted that many of the decay heat removal system relief valves were tested with nitrogen rather than water. The licensee did not have test documentation establishing the acceptability of the alternate medium.

- Section 8.1.3.5 requires that the ambient temperature of the operating environment be simulated during the set pressure test. If the effect of ambient temperature on set pressure can be established for a particular valve type, the valve may be set pressure tested using an ambient temperature different from the operating ambient temperature. Correlations of the setpoints shall be established through test per Section 8.3 and documented per Section 9.4. The maintenance procedure does not require a check of ambient temperature during set pressure testing. However, the procedure

discusses use of manufacturer-specified "cold" set pressures that differ from the settings under normal operating conditions. The licensee did not have sufficient information to verify that the correlations provided by the valve manufacturers were certified properly as required by OM-1. The ASME has found that some relief valve manufacturers have no engineering or test bases for the correlations, and has established a task force to determine standardized criteria for the correlations. Since the difference between the "cold" and operating set pressure typically is small, the inspectors concluded that the discrepancy was not an immediate safety concern.

- Section 7.3.2.2 specifies a sequence for valve testing: (1) visual examination, (2) seat tightness determination (when practical per NUREG 1482, Section 4.3.9.(4)), (3) set pressure determination, and (4) determination of compliance with the owner's seat tightness criteria. The licensee's procedure performs seat leakage tests following performance of the lift setting checks rather than "as-found". Clarification 4.3.9 of NUREG 1482 states that seat tightness is to be determined before determining the set pressure if practical. GPU did not justify its practice on the basis of impracticality.

- Section 8.1.3.7 requires that a minimum of 10 minutes elapse between successive valve openings. The licensee's procedure does not specify a minimum lift test interval.

- Section 8.2 requires seat tightness tests to be performed using the same fluid as the set pressure test except where a correlation between different test media has been verified per Section 8.3. As noted above, for valves tested with nitrogen, the licensee has not verified the correlation of nitrogen to water by documented test. Also, Section 8.2.3 requires that seat tightness test acceptance criteria be either the original valve equipment design specification acceptance criteria or established by the owner. The maintenance procedure does not specify a leakage limit. The inspectors also noted that the procedure accepts "very slight leakage" for valves tested with air or nitrogen. Although the job supervisor is required to determine the acceptability of a valve that leaks in this manner prior to installation in the system, there is no criterion for this review.

- Table 4 requires a 10-minute test period when volumetric or weight measurement liquid leakage tests are performed. The maintenance procedure specifies a 5-minute test period for liquid volumetric checks.

c. Conclusions

The inspectors identified several deviations between the licensee's relief valve maintenance procedure and the provisions of OM-1. While the deviations could, in the aggregate, affect relief valve settings, the current functionality of the relief valves was reasonably assured by the existing test methods. GPU incorporated industry operational experience into the relief valve maintenance procedure.

M3.2 Relief Valve Test Documentation

a. Inspection Scope

The inspectors reviewed the maintenance test data sheets for the decay heat removal system relief valves listed below. The tests were performed in accordance with various revisions of procedure 1410-V-3, "Relief Valve Maintenance," between 1990 and 1995. The valves were chosen due to their role in mitigating the potential for interfacing system loss of coolant accidents in the event of pressure isolation valve leakage.

- DH-V13A\B Decay heat removal pump suction
- DH-V18A\B Decay heat removal pump discharge
- DH-V37 Decay heat removal suction from loop B hot leg
- DH-V67 Decay heat removal to auxiliary spray

b. Observations and Findings

The inspectors found that in all but two instances, the test data sheets documented acceptable relief valve performance. For valves DH-V13B (on August 14, 1992) and DH-V37 (on February 3, 1990), however, the "as-left" test results were incorrectly evaluated against a desired lift pressure of 459 psig plus or minus ten percent vice ten psig as required by the procedure. Consequently, the valves were set nonconservatively by about 15 psig. The conditions persisted until subsequent routine tests performed in 1993.

Notwithstanding the acceptable settings of the reviewed valves, the inspectors noted several discrepancies and weaknesses in the licensee's documentation of test results:

- No valve seat leakage test results were indicated in some data sheets. The inspector was unable to determine whether the seat leakage tests were performed.

- Where acceptable leakage test results were indicated on the data sheets, it was unclear whether the results referred to seat leakage or post-installation boundary leakage tests.

- In one case, the results of a post-installation leakage test were not documented per Section 8.10 of the maintenance procedure.

- In a January 1991 test of valve DH-V18A, the "as-found" lift pressure did not meet the acceptance criterion. The licensee noted in the remarks section of the data sheet that the valve was found "dirty" and was cleaned. However, there was no documented discussion concerning the cause of the condition or whether it contributed to the test failure.

- The test medium (e.g. water, air, nitrogen) employed in the tests is not documented in the data sheets.

c. Conclusions

The inspectors concluded that the sampled relief valves currently were set properly, and that there were no significant safety consequences associated with the historical discrepancies found in the test data sheets. However, the inspectors also concluded that the data sheets revealed some instances of poor test implementation, documentation, and data review.

M3.3 Pump Testing

a. Inspection Scope

The inspectors reviewed surveillance procedures and performance records against the OM-6 requirements for test periodicity, quantities measured, and allowable ranges. The review included the decay heat removal, decay heat river water, reactor building emergency cooling, emergency feedwater, and the nuclear services river and component cooling water systems.

b. Observations and Findings

Safety-related pump test frequencies conformed to Code requirements, and acceptance criteria for the quantities measured met or exceeded those specified by OM-6. However, the inspectors identified concerns regarding vibration reference values.

Section 4.3 of OM-6 requires vibration reference values to be determined from the results of preservice testing or the initial inservice test. Section 4.6.4(c) that vibration readings be taken in the horizontal, vertical, and axial directions on the upper motor bearing housing of vertical line shaft pumps. The inspectors found that GPU established vibration reference values based on engineering judgement rather than measured values. For example, surveillance procedure 1300.3I for the nuclear services river water (NR) pumps established the same reference value [0.12 inches per second (ips)] for all three directions, and the alert and required action ranges were established based on the single reference value. (Recent testing of pump NR-P1A recorded vibration values orthogonal to the pump shaft of 0.146 ips and 0.109 ips, and the axial vibration measurement was 0.06 ips.) GPU IST personnel stated that reference values based on engineering judgement seemed to be a reasonable approach.

Although OM-6 does not state explicitly that vibration reference values must be established in each direction based on preservice or inservice test results, bearing vibration measurements are direction-specific. The NRC has granted relief from the absolute alert vibration limits specified in OM-6 provided that the licensee assign new vibration alert limits based on several factors, including historical data, only in the direction where higher vibration values have been measured. For example,

TMI-1 IST program relief request P4 (decay heat removal pump B), currently under review by the NRC, requests relief from the Code absolute alert range limit in the vertical direction. Permitting the establishment of reference values uniformly over all directions by averaging or other means potentially could allow an increase in vibration in a particular direction to exceed Code limits.

GPU agreed with the inspectors' observations and stated that it would revise its vibration criteria to conform to the Code.

c. Conclusions

The inspectors concluded that GPU had no documented basis for establishing a single vibration reference value representing all three orthogonal directions.

M3.4 Valve Testing

a. Inspection Scope

The inspectors reviewed surveillance procedures and test frequencies, methods, and acceptance criteria for several types of valves in the IST program. In addition, the inspectors reviewed the licensee's treatment of reactor coolant system pressure boundary isolation valves, and GPU's response (GPUN letter 5211-87-2115, stated June 12, 1987) to NRC Generic Letter (GL) 87-06, "Periodic Verification of Leak Tight Integrity of Pressure Isolation Valves."

b. Observations and Findings

Limiting Values of Full Stroke Time

Sections 4.2.1.2 and 4.2.1.4 of OM-10 require power-operated valves to be full stroke exercised to the position(s) required to fulfil their safety functions, and that the limiting value of full stroke time be specified. The inspectors verified that GPU had established appropriate values for limiting stroke times and acceptance criteria based on reference stroke time values. Two instances were identified in which valves that appeared to have safety functions in the close direction according to the TMI-1 FSAR were not tested in the IST program. The IST program submittal states that normally-open reactor building emergency cooling valves RR-V3A\B\C have safety functions only to open, and this valve stroke is tested per procedure 1300-3K. However, the system single failure analysis contained in the FSAR describes the capability of the valves to close to isolate a system rupture if leakage is detected. High pressure injection control valves MU-V16A\B\C\D open to admit cooling water to the reactor coolant system during an accident, and this function is checked during IST. However, FSAR Section 9.1.2.1 states that the valves also may be closed for containment isolation. Justifications for excluding the apparent closed safety functions of these valves from IST were not provided in the licensee's program documents. The licensee agreed at the conclusion of the inspection to evaluate the inspector's observations.

Full Stroke Verification of Stop Check Valves

GPU exercised makeup pump recirculation stop check valves MU-V193A\B\C to the open position during quarterly IST. The inspectors noted that the flow rate through the valves during the test was not known. OM-10, Section 4.3.2.2 requires each check valve to be exercised or examined in a manner that verifies obturator travel to the position required to fulfil its safety function. GL 89-04, Position 1, clarified that a full stroke exercise may be verified by passing the maximum required accident flow through the valve; a flow rate test at less than the verified accident flow is a partial stroke test that must be supplemented periodically by a full stroke exercise or disassembly and inspection. The licensee agreed to characterize the quarterly test as a partial stroke exercise, and to verify the full valve stroke each refueling outage. The inspectors concluded that GPU's actions met Code requirements.

Solenoid-Operated Valve Position Indication Verification

Positive verification of valve position indicators is important because they are used during periodic exercise tests to assess valve performance. OM-10, Section 4.1, requires valves with remote position indicators to be observed locally at least once every two years to verify that operation is indicated accurately. Where local observation is not possible, other indications must be used. Section 4.2.5 of NUREG 1482 clarifies that for sealed solenoid-operated valves (SOVs) where direct observation of obturator or stem motion is not possible, other operational parameters, such as flow, pressure, or differential pressure, must be employed.

GPU utilized Procedure 1300-3R, "IST of Valves During Shutdown and Remote Indication Check," to verify the position indicators of seven reactor coolant system vent SOVs. The inspectors found that the licensee's method, using a stethoscope to verify a "hard metallic click" through the solenoid cover, did not positively verify obturator position. The licensee agreed to change its IST method to conform to the provisions of OM-10 and NUREG 1482.

Documentation of Test Results

Hydrogen recombiner isolation SOVs HR-V22A\B and HR-V23A\B have safety functions in the open and closed directions. The inspectors found that the licensee verified operation in the open direction per procedure 1303-11.46, "Hydrogen Recombiner Functional Test," by observing flow through the valve. For the close direction, the licensee credited local leak rate test procedure 1303-11.18. The inspectors observed that the latter procedure did not specify a method for verifying valve position and did not document the results of the test. GPU provided work order documentation associated with the surveillance from which successful closure of the SOVs could be inferred. However, the inspectors did not consider the records to comport fully with the documentation requirements of OM-10, Section 6.3. The licensee agreed to enhance its documentation of these SOV tests.

Reactor Coolant Pressure Boundary Isolation Valve Tests

Pressure isolation valves (PIVs) isolate the high pressure reactor coolant system from low pressure systems, overpressurization and rupture of which would potentially result in a loss of coolant accident that bypasses the containment (referred to as interfacing systems or Event V). An NRC Order dated April 20, 1981, required GPU to perform periodic leakage rate tests of four "Event V" check valves in the decay heat removal and core flood systems at a differential pressure greater than 150 psid. The valves are tested pursuant to Technical Specification 4.2.7 and procedure 1300-3T, "Pressure Isolation Test of CF-V4A\B, -5A\B, and DH-V22A\B." The inspectors verified that the four check valves were included in the IST program and individually tested per OM-10, Section 4.2.2.3.

GL 87-06, "Periodic Verification of Leak Tight Integrity of Pressure Isolation Valves," requested GPU to list all of the PIVs at TMI-1, along with a description of the periodic tests or other measures performed to assure the integrity of the valves as an independent barrier, acceptance criteria for leakage, operational limits, and the frequency of test performance. In its response to GL 87-06, GPU identified 18 valves in the decay heat removal, makeup and purification and reactor coolant systems as PIVs, including, for example, DH-V1 and DH-V2 on the decay heat removal drop line, and RC-V4 and RC-V23 in the pressurizer auxiliary spray line. None of those 18 valves are tested specifically for leakage, and there are no TS or administrative requirements to do so. The response to GL 87-06 stated that the leak tightness of the reactor coolant pressure boundary was verified by a daily system leakage calculation, and that further assurance was provided by operational experience (valve maintenance history), and reactor coolant drain tank level and temperature indication.

Category A valves are those for which a specific leakage limit is established. The inspectors found that the 18 valves of interest were characterized in the IST program as Category B or C valves which, per OM-10, are those for which seat leakage in the closed position is inconsequential for fulfillment of their required functions. Thus GPU does not leak test the valves either as containment isolation valves per 10 CFR 50, Appendix J and OM-10, Section 4.2.2.2, or as PIVs per OM-10, Section 4.2.2.3. While acknowledging that GPU's current operational practices provided a measure of assurance that pressure boundary leakage could be identified and ameliorated by plant operators, the inspectors were concerned that the valves were not classified as Category A valves, and verified periodically to be "leak tight." This matter is therefore unresolved pending further NRC review of GPU's position. **(URI 96-08-02)**

c. Conclusions

With some exceptions, GPU satisfied the requirements of OM-10 for IST of safety-related valves, and agreed to address the discrepancies identified during the inspection. While the licensee currently meets its licensing basis with respect to PIVs, an unresolved item was opened concerning leakage rate testing of 18 reactor coolant pressure boundary isolation valves.

M7 Quality Assurance In Maintenance Activities

M7.1 Assurance of Quality of the IST Program

a. Inspection Scope

The inspectors reviewed the following licensee IST program audits to verify that the requirements of Technical Specification 6.5.3.1 and the GPU Nuclear Operational Quality Assurance Plan were met:

- S-TMI-93-08 Plant Engineering October 1, 1993
- S-TMI-94-13 TMI Operations November 16, 1994
- S-TMI-95-08 Plant Engineering November 13, 1995

b. Observations and Findings

The inspectors found that audits of the IST program are performed by GPU as an element of plant engineering or operations. The audits were performed at the frequency specified in the GPU Quality Assurance Plan by appropriately independent auditors, and in accordance with pre-established checklists. The audits covered essential program elements and contained good quality findings. However, the inspectors also noted that the licensee focused on implementation of existing plant administrative and surveillance procedure requirements, and that there appeared to be little independent, "second-level" review of the program's consistency with Code requirements. Thus, the licensee's quality assurance program was not effective in identifying the types of Code deviations and nonconformances found during the inspection. The inspector discussed this observation with the TMI Nuclear Safety Assessment Manager, who stated that a Monitoring Program overview of IST was planned in the near future as a result of the findings of this inspection.

c. Conclusions

Detailed independent audits of IST program implementation were performed, with good quality findings. While the Quality Assurance program provided comprehensive evaluation of existing IST program controls, it was not fully effective in identifying deviations from ASME Code requirements.

M8 Miscellaneous Maintenance Issues

M8.1 Final Safety Analysis Report Review

A recent discovery of a licensee operating their facility in a manner contrary to the updated final safety analysis report (UFSAR) description highlighted the need for additional verification that licensees were complying with UFSAR commitments. All reactor inspections will provide additional attention to UFSAR commitments and their incorporation into plant practices, procedures and parameters.

While performing the inspection of the GPU IST program, the inspectors reviewed the applicable portions of the TMI-1 UFSAR that related to the areas inspected. The inconsistencies noted by the inspectors between the wording of the TMI-1 UFSAR and the plant practices and procedures (viz. inclusion of certain relief valves with overpressure protection function into the IST program) are documented in Sections M1.2 and M3.4.

V. Management Meetings

X1 Exit Meeting Summary

The inspectors met with the principals listed below to summarize preliminary findings on June 7 and September 27, 1996. The licensee acknowledged the preliminary findings presented, although considerable discussion occurred regarding the corrective action finding (UNR 96-08-01). The bases for the inspection conclusions did not involve proprietary information, and none was included in this inspection report.

PARTIAL LIST OF PERSONS CONTACTED

GPU Nuclear Corporation

J. Knubel, Vice President, TMI
L. Noll, Plant Operations Director
J. Wetmore, Manager, Regulatory Affairs
G. Skillman, Technical Functions Site Director
P. Walsh, Engineering Director
D. Hosking, Nuclear Safety Assessment Manager

U. S. Nuclear Regulatory Commission

S. Hansell, Resident Inspector, TMI
J. Colaccino, Mechanical Engineer, NRR/EMEB
P. Eselgroth, Chief, Projects Branch No. 7, DRP
L. Dudes, Reactor Engineer
M. Bugg, Reactor Engineer (Intern)

INSPECTION PROCEDURES USED

IP 73756: Inservice Testing of Pumps and Valves

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-289/96-08-01	URI	Corrective action program issues
50-289/96-08-02	URI	Leakage rate testing of pressure isolation valves

LIST OF ACRONYMS USED

ASME	American Society of Mechanical Engineers
BS	Reactor building spray
BWST	Borated water storage tank
CF	Core flood
CFR	Code of Federal Regulations
DH	Decay heat removal
EF	Emergency feedwater
EMEB	Mechanical Engineering Branch
FSAR	Final Safety Analysis Report
GL	Generic Letter
IP	Inspection Procedure
ips	inches per second
IST	Inservice test
LOCA	Loss of coolant accident
MS	Main steam
MU	Makeup and purification
NR	Nuclear service river water
NRR	Office of Nuclear Reactor Regulation
NS	Nuclear services closed cycle cooling water
PIV	Pressure isolation valve
PORV	Power-operated relief valve
psid	pounds per square inch differential
psig	pounds per square inch gage
TMI	Three Mile Island
TS	Technical Specifications
UFSAR	Updated Final Safety Analysis Report
URI	Unresolved item

ASME CLASS 2 AND 3 RELIEF VALVES ADDED TO IST PROGRAM

BS-V45A\B	BS-P1 Suction relief
BS-V63A\B	DH\BS Suction header relief
CF-V21A\B	Core flood tank relief
DH-V13A\B	DH-P1 Suction relief
DH-V18A\B	DH injection relief
DH-V57A/B	BWST to DH-P1 suction relief
DH-V37	DH drop line relief
DH-V67	DH to PZR spray line relief
EF-V35	EF-P1 bearing cooling and pump seal relief
EF-V39A\B	EF-P2A bearing cooling and pump seal relief
IC-V8A\B*	EF-P2A bearing cooling and pump seal relief
MS-V22A\B	Main steam to EF-P1 safety relief
MR-RV1	Makeup tank relief
MU-V104	Seal return cooler inlet relief
MU-V105	Letdown relief to vent header
MU-V180	Seal return line relief
MU-V204A\B	MU-K1 outlet relief
NS-V47	Nuclear services surge tank relief

*Still under evaluation