

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-289/84-10

Docket No. 50-289

License No. DPR-50 Priority -- Category B

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

Facility Name: Three Mile Island Nuclear Station Unit 1

Inspection At: Middletown, Pennsylvania

Inspection Conducted: April 11-19, 1984

Inspectors: *D. J. Vito* 5/15/84
D. J. Vito, Reactor Engineer date
J. W. Chung 5/15/84
J. W. Chung, Lead Reactor Engineer date
Approved by: *L. H. Bettenhausen* 5/18/84
L. H. Bettenhausen, Chief date
Test Programs Section

Inspection Summary: Inspection on April 11-19, 1984 (Report No. 50-289/84-10)

Areas Inspected: Routine, unannounced inspection of Reactor Building
Integrated Leak Rate Testing. The inspection involved 57 hours on site by
two region-based inspectors.

Results: Noncompliances: None

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1. Persons Contacted

Principal Licensee Employees

- * D.W. Atherholt, Operations Engineer, TMI-1
- * R. Barley, TMI-1 Lead Mechanical Engineer
- * R. Bensei, TMI-1 M&C Technical Support Manager
- * R. Fenti, Operations QA Manager
- * H. Hukill, Vice President and Director, TMI-1
- * E. Kellogg, QA Auditor
- * J. Marsden, QA Engineering Manager
- F. Paulewicz, Mechanical Engineer, TMI-1
- * M. Ross, Manager, Plant Operations, TMI-1
- R. Szczeck, Licensing Engineer
- * C. Smyth, TMI-1 Licensing Manager
- * R. Summers, Mechanical Engineer - ILRT Test Director
- * R. Toole, O&M Director, TMI-1
- G. Wert, I&C Maintenance Foreman
- H. Wilson, Supervisor, Preventative Maintenance
- R. O'Donnell, Shift Maintenance Foreman

Volumetrics

D. Richardson

Ingersoll-Rand

T. Fleece

United States Nuclear Regulatory Commission

* R. Conte, Senior Resident Inspector

* denotes those present at exit interview on April 19, 1984

2. Local Leakage Rate Testing

2.1 Documents Reviewed

- 10 CFR 50, Appendix J, Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors
- ANSI/ANS 56.8 - 1981 Containment System Leakage Testing Requirements
- ANSI N45.4 - 1972 Leakage Rate Testing of Containment Structures
- TMI-1 FSAR Section 5.7
- TMI-1 Technical Specification 4.4

- TMI-1 Surveillance Procedure SP 1303-11.18, Revision 26, December 18, 1983; Reactor Building Local Leak Rate Test
- Temporary Change Notices for SP 1303-11.18
 - No. 1-84-0057
 - No. 1-84-0064
- Records/Text Results of approximately 10% of the most recent Type B & C tests.
- Records of equipment calibration of Type B & C test equipment.

2.2 Scope of Review

The inspector reviewed the above listed documents and witnessed those local leak rate tests described in the following section to ascertain that the licensee's local leak rate testing program was being conducted in compliance with the regulatory requirements of 10 CFR 50 Appendix J and the Technical Specifications.

2.3 Test Witnessing

On April 12, 1984, the inspector witnessed Type C local leak rate tests performed on Penetrations 210 and 211 (OTSG Drain Penetrations - blank flanged on both sides of containment) and Intermediate Closed Cooling System Containment Isolation Valve IC-V-3. The test results for Penetrations 210 and 211 were within acceptance criteria. The tests were declared successful.

Test results for IC-V-3, however, indicated excessive leakage around the valve's wedge-type gate. The inspector had witnessed the lapping of the valve gate disc surface and a successful bluing fitness check. After the mechanical repair of the valve gate and the readjustment of the valve actuator, the valve was reassembled for local leak rate testing. The test failed with an indicated leak rate of greater than 70,000 sccm (the initial failed LLRT which prompted the maintenance action indicated approximately 21,000 sccm). The valve was exempted during the Type A test pending further maintenance on the valve and successful completion of a local leak rate test and inclusion of these test results in the Type A test results. This is an unresolved item (50-289/84-10-01). During the unsuccessful testing of IC-V-3, the inspector noted that the mid-range rotameter in the test stand was marked with an out of date calibration sticker (due 8/83) and the high-range rotameter had no calibration sticker at all. The low-range rotameter was properly calibrated (due 4/16/84). The inspector was informed by I&C personnel that the calibration standard for the higher range instruments was at the manufacturer for verification and that the uncalibrated rotameters would be calibrated upon its return and the test results amended to reflect the results of the calibration. The inspector noted that this was an unusual practice

and could pose problems if the accepted leak rate was to be determined from one of the higher range meters for the following reasons:

- a. The possibility for violating the Technical Specification surveillance interval on a particular containment isolation valve is increased if an incomplete test is done using uncalibrated rotameters and the surveillance interval expires before the calibration standard is returned and the test results completed.
- b. If, when the calibration standard is returned, the calibration of the rotameters is found to be off in the non-conservative direction, not only should the data on a particular LLRT be changed, but every LLRT performed with that rotameter since its last successful calibration will have to be altered and analyzed as well.

The inspector expressed concern over the calibration of these LLRT instruments and identified this as an unresolved item (50-289/84-10-02).

3. ILRT Pre-Test Review

3.1 Documents Reviewed

- TMI-1 Surveillance Procedure No. 1303-6.1, Reactor Building Integrated Leak Rate Test, Revision 12, April 13, 1984.
- Performance Test Report for the Integrated Leak Rate Monitoring System for Three Mile Island, Volumetrics, April 2, 1984.
- Instruction Manual for Installation, Operation and Maintenance of Volumetrics Integrated Leak Rate Monitoring System.
- Temporary Change Notice to 1303.6-1;
 - No. 1-84-0093
 - No. 1-84-0088
 - No. 1-84-0087
- TMI-1 FSAR Section 5.7
- TMI-1 Technical Specification 4.4
- GAI Drawings E-311-851, E-311-853, E-311-852, E-311-850, C-302-725, and C-302-845.
- Test Director Log Book

- Control Room Shift Supervisor Log Book

3.2 Scope of Review

The inspector reviewed the reactor building integrated leak rate testing procedure and procedure changes for conformance with Technical Specifications, Station Administrative Control Procedures, and Appendix J of 10 CFR 50 to verify that:

- Procedures and changes were reviewed and approved.
- Procedures were technically adequate and included sufficient details, such as; air pressurization method for each penetration on valve; venting of internally isolated volumes; initial pressure plateau; prerequisites, limits, precautions, and acceptance criteria.
- Design modifications were incorporated into the test procedure.
- Test equipment and instruments were calibrated and in service.

3.3 Findings

Inspector determined that the R.B. ILRT procedure SP 1303-6.1 was technically adequate to perform the test satisfactorily, and the procedure specified sufficient details including;

- Initial conditions and prerequisites,
- Test duration (24 hours) and stabilization period (4 hours),
- Supplemental instrument verification test (8 hours),
- Calculational methods, and
- Valve and system lineups.
 - a. The inspector noted and the licensee agreed that 10 CFR 50, Appendix J should be included as a reference in the procedure since it is the basis for the leak rate acceptance criteria.
 - b. After attending one of the shift meetings discussing valve lineups and test readiness, the inspector informed the test coordinator that some of the items he mentioned in the meeting (checking the positioning of lay-flat tubing and checking for artificial boundaries) were not mentioned in the procedure. The test coordinator agreed to incorporate these.

These items (a. and b.) are an inspector followup item for NRC review of the revised procedure (50-289/84-03).

- c. Item 8.5.A of the procedure specified that data points would be recorded by the computer printout at least every half hour. Considering possible data fluctuation due to instrument noises and uncertainties as well as expected diurnal perturbation, the licensee agreed to record data every 15 minutes.
- d. The data center was enclosed and the room was air-conditioned to prevent possible heatup of the electronic components and data acquisition system circuits.
- e. The inspector verified by review of Test Change Notices (TCNs) that correct valve lineups were incorporated into the test procedure.

4. Administrative Controls and Quality Assurance

4.1 Scope of Review

The inspector interviewed selected licensee personnel and reviewed qualifications and training records for conformance with Technical Specifications; Station Administrative Control Procedures; ANSI N18.7 "Administrative Controls for Nuclear Power Plants"; ANSI N18.1-1971 "Selection and Training of Nuclear Power Plant Personnel"; Regulatory Guide 1.33 "Quality Assurance Program Requirements". The inspector also observed conduct of testing and reviewed data/log sheets to verify that:

- R.B. ILRT was conducted in accordance with the test procedure.
- Review and documentation were in accordance with the station procedures.
- QA surveillances were performed.
- Personnel participating in the test were qualified and had been given proper training.

4.2 Findings

- a. The inspector attended one shift meeting with auxiliary operators designated to perform ILRT valve lineups. The test coordinator reviewed the test completely and emphasized the importance of correct valve lineups.
- b. The inspector verified that physical examinations were given to those people who were designated to enter the reactor building for the 12 psig inspection per ILRT Procedure Section 5.4.

- c. Prior to the Reactor Building Integrated Leak Rate Testing, the test director held a briefing session with the test personnel who would participate in the testing. The scope and details of the testing were discussed. However, at one point, one trainee who was not authorized to operate the Data Acquisition System (DAS) and on-line RBILRT computer was operating the computer during the test. Also, due to the lack of training, two data points were erased from the computer during the test and were recovered from the DAS file manually. This inadequacy was discussed with the management and test director. The inspector verified by review of the pre-test training that this was an isolated case.
- d. At 0220, April 18, 1984, the industrial cooler was placed in manual control due to minor temperature transients. However, the system operations were not specified in the test procedure, and the inspector raised a concern regarding the procedural inadequacy. The licensee stated that the procedure would be revised to incorporate the operational aspects of the leak rate testing into the procedure.

The inspector noted that the test manual provided with the Volumetrics DAS and computer display system were reviewed and approved by site QA. It was also observed that the DAS and computer system were integral parts of the test and included information directly related to the performance of the test, such as:

- Operational instructions.
- Sensor and instrument calibration records.
- Conversion and parametric tables, which were necessary to convert or to perform the leak rate calculations.

However, the Volumetrics manual was not incorporated into the test procedure and was not reviewed by the Plant Operations Review Committee (PORC). The licensee stated that the manual would be reviewed and incorporated into the test procedure.

This is an inspector followup item (IFI) and will be included in IFI 50-289/84-10-03.

- e. The inspector observed the following QA activities during the R.B. Leak Rate Testing:
- Reviewed OQA Monitoring Reports --
- 194-84 on Pressure Indicators; 193-84 on TCN; 750-84 on computer printouts; 757-84 on pressurization; 749-84 on

logging; eleven reports on maintenance works; 6 reports on RBILRT data taking and test briefing.

- During the 4 hour stabilization period, the 24 hour leak rate testing period, and the 8 hour supplemental test, the inspector toured the intermediate building, control room, auxiliary building and the outside penetration areas of the reactor building on several occasions. However, there was no objective evidence that QA/QC surveillance field inspection had been conducted. The inspector raised a concern regarding QA/QC implementation during the test. In fact, the inspector requested QA personnel to conduct a visual inspection tour during the test and inspected the pressure penetration areas with a QA inspector.

Based on the inspector observation of the QA/QC coverage of the leak rate testing, the inspector concluded that QA/QC surveillance on records and document audits were adequate, but field surveillance inspection was not evident. This item was referred to the Management Program Section of NRC:RI for further review.

- The inspector observed the calibration stickers on the test equipments and instrumentation:
 - a). Heise Gauges, PI-392 and PI-393, calibrated on 2-16-84 and 2-27-84 respectively.
 - b). Volumetrics DAS, PI-390 and PI-391, calibrated on 3-30-84
 - c). Barometer, calibrated on 3-1-84

5. Reactor Building Integrated Leak Rate Testing

5.1 Scope of Review

The inspector reviewed the inspection checkoff/signoff sheets and log books, and conducted direct observation inspections of test activities to verify that:

- Test prerequisites were met,
- Proper plant systems were in service and valves were lined up in accordance with the test procedures,
- Temperature elements and Dewcells were positioned per drawings and test procedures, and

- Data collections, deduction, calibration, and calculations were technically correct and were in accordance with the requirements specified in the Appendix J of 10 CFR 50.

a. Closeout Inspection

Prior to containment pressurization, the licensee's final closeout inspection was conducted on April 15, 1984. The inspector performed independent tours to verify that locations of test equipment, system/component lineups and other conditions were in conformance with the requirements specified in the test procedure. No unusual conditions were noted.

b. 12 PSIG Inspection

Immediately following the closeout inspection, the reactor building pressurization was commenced at a rate of 1.9 psig/hour. The following items were identified during the walkdown inspection:

- One of 24 RTD's were inoperable and the air volume assigned to the inoperable RTD was evenly distributed to other 23 operable RTD's. The inoperable RTD was identified as TE-655V, and was not included in the mass point calculations.
- Ten Dewcells were placed and the corresponding air volumes inside the Reactor Building were proportionally assigned to individual Dewcells in order to give a properly weighted air masses for each Dewcell and to estimate a close-to-true partial pressure of the vapor inside the reactor building.
- During the visual walkdown inspection, "H" dewcell and two RTD's (P and U) were found in the storage positions. The dewcell and two RTD's were subsequently relocated to the corresponding test positions.
- Several manometers were placed on pressure penetration lines per STCN's.

c. Stabilization - 4 hours

One air compressor was secured at 0800, April 17, 1984. The other operating pump was pressurizing the reactor building at a rate of 0.9 psi/hour. At 0925, pressure inside the reactor building attained 50.8 psig, and the second pump was secured. The stabilization period commenced at 1130 after brief repressurization at 1040 for 40 minutes, and the stabilization period ended at 1600. An

average temperature variation during the last 2 hours of the stabilization period was 0.11 °F/last 2 hours. The acceptance criteria required less than 1°F/hour variation during the last 2 hours of stabilization.

d. ILRT

The reactor building integrated leak rate testing commenced immediately following the stabilization period and continued for 24 hours, ending at 1600, April 18, 1984. Containment pressure and RTD readings were digitized and periodically (every 15 minutes) updated through the Volumetrics' DAS. The coded digital counts from the sensors were then decoded and converted into the physical parameters. The computer software converted the sensor readings into the desired properties, such as containment pressure, average containment temperature, pressure, and air mass points. The computer display CRT would then display the accumulated data points on the CRT screen by scanning the stored data points. The attached traces (Figure 1) are a copy of the final data points as displayed on the computer CRT screen.

The inspector independently calculated the R.B. Integrated Leak Rate by taking a straight line correlation of the scanned final data points: the independently obtained value was 0.0406%/day. The computer calculation was 0.0407%/day; the acceptance criteria required 0.075%/day.

During the test, pressurizer level was decreasing at a rate of 1"/hr, indicative of a water leak. At the end of superimposed leak supplemental test, the pressurizer water level remained well over 120 inches. However, the reactor building sump level indication did not show a commensurate level increase. Based on the level changes in the BWST, the licensee suspected a leak in DH-V-5B. This suspected leak and licensee corrective action will be followed by the inspector (50-289/84-10-4).

e. ILRT Instrument Verification Test

After test completion and preliminary analysis, the licensee superimposed a known leak rate of 3.27 ft³/min. (196.2 ft³/hour) on the calculated leakage for 8 hours. The verification test commenced at 2000, April 18, 1984 and completed by 0400, April 19, 1984, with resulting total leak of 0.0872%/day. The difference between the superimposed test and the type "A" ILRT was 0.0073%/day: acceptance criteria required a difference of less than 0.025%/day.

f. Summary of Test ResultsAcceptance Criteria

$$\text{24 hour Test} : L_{am} < 0.75 L_a$$

$$\text{Superimposed} : | L_{am} - (L_c - L_o) | < 0.25 L_a$$

where,

$$L_a = \text{Maximum allowable Leak Rate} = 0.1\%/day$$

$$L_{am} = \text{Measured Leak Rate} = 0.0407\%/day$$

$$L_o = \text{Superimposed Leak Rate} = 196.2 \text{ ft}^3/\text{hr} = 0.054\%/day$$

$$L_c = \text{Total Measured Superimposed Leak Rate} = L_o + L_{am} = 0.0872\%/day$$

Results

$$\text{24 Hour Test} : 0.0407\%/day < 0.075\%/day$$

$$\begin{aligned} \text{Superimposed} : | L_{am} - (L_c - L_o) | &= | 0.0407 - \\ &(0.0872 - 0.054) | \\ &= 0.0073\%/day < 0.025\%/day \end{aligned}$$

g. Post-Test Review

After review of the test results and a control room check of the valve lineups, the inspector determined that the ILRT appeared to be satisfactory, pending the final review of the licensee's report.

6. Reactor Building ILRT Chronology

<u>Date</u>	<u>Time</u>	<u>Events</u>
4/15	1500	Closeout Inspection
	1817	Commence pressurization : 1.9 psig/hr.
4/16	0057	Attained 12 psig
	1045	Completion of 12 psig Inspection
	1059	Commenced repressurization to 50.6 psig
4/17	0800	Secured one compressor

	0925	Secured second compressor; 50.8 psig Required: 50.7 psig, +0.1, -0.0.
	1200	Commenced Stabilization Period
	1600	Ended Stabilization: $\Delta T = 0.11$ °F/last 2 hours Commenced 24 hour ILRT
4/18	0220	Industrial cooler in manual
	1600	Ended 24 hour ILRT: the leak rate = 0.0405%/day Acceptance criteria $\leq 0.075\%$ /day
	1620	Sampling
	2000	Started Superimposed Test
4/19	0400	Ended Superimposed Test: Leak Difference = 0.0073%/day Acceptance $\leq 0.025\%$ /day
	0835	Commenced depressurization

7. Tours

The inspector made several tours of the plant including the reactor building, intermediate building, auxiliary building, turbine building, control room and plant exterior (compressor area and containment) in order to follow the activities related to the preparation for and performance of both the local and integrated leak rate tests. The inspector noted no unusual conditions except for a significant amount of water and mud in the outside area around the reactor building equipment hatch.

8. Exit Interview

The inspector met with licensee management representatives on April 19, 1984 and summarized the scope and findings of the inspection at that time. At no time during the inspection was written material provided to the licensee by the inspector.

FIGURE 1

