U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 87-12

Docket No. 50-412

License No. CPPR-105 Priority _____ Category _____

Licensee: Duquesne Light Company
P.O. Box 4
Shippingport, Pennsylvania 15077

Facility Name: Beaver Valley Power Station, Unit No. 2

Inspection At: Shippingport, Pennsylvania

Inspection Conducted: February 9 - 14, 1987

Inspectors: Joseph A. Golla 3-11-87
Joseph A. Golla, Reactor Engineer date

Anthony A. Varela 3-11-87
Anthony A. Varela, Lead Reactor Engineer date

Approved by: Clifford J. Anderson 3/11/87
Clifford J. Anderson, Chief date
Plant Systems Section, EB

Inspection Summary:
Inspection on February 9 - 14, 1987 (Inspection Report No. 50-412/87-12).

Areas Inspected: Routine unannounced inspection of procedure review, test witnessing and preliminary results evaluation of preoperational containment structural acceptance test and containment integrated leak rate test.

Results: No violations or deviations were identified.

DETAILS

1.0 Persons Contacted

Duquesne Light Company

*N. Daugherty, Director Systems Testing
*C. Davis, Director Quality Assurance
J. Dusenberry, QA Surveillance
*S. Fenner, Director Quality Control
*J. Godleski, SR Test Engineer
J. Miller, Senior QA Engineer
**J. Patterson, Test Engineer
J. Perry, Test Engineer
*L. Rabenau, Lead Compliance Engineer
R. Swiderski, Startup Manager
*G. Wargo, Assistant Director QC

Stone & Webster Engineering Corporation

*R. Bernier, Test Engineer
A. Dasenbrock, Senior Construction Manager
R. Faust, Principal Structural Engineer
**E. Harper, Test Engineer
**F. Koski, Test Engineer
**K. Maloney, Test Engineer
**R. Parry, Supervisor
*J. Pierro, Principal Structural Engineer
*P. Talbot, Assitant Superintendent Engineering
*A. Wong, Lead Structural Engineer
*R. Wittschen, Licensing Engineer

Weiss, Janey & Elstner (WJE)

C. Paulson, Project Engineer
R. Krause, Project Manager

Nuclear Regulatory Commission

*A. Asars, Resident Inspector
*J. Beall, Sr. Resident Inspector

*Indicates those present at the exit meeting held on February 11, 1987.

**Indicates those present at the exit meeting held on February 14, 1987.

2.0 Observation of Primary Containment Structural Acceptance Test

2.1 Introduction

The concrete primary containment structure is required to be tested for structural integrity by subjecting it to an air pressure test having a maximum pressure level of 52 psig. This is 115 percent of the internal design pressure of 45 psig. The test cycle consists of pressurization from atmosphere to 52 psig and depressurization back to atmospheric, in four near equal increments. The levels of the pressurization cycle from atmospheric are 13 psig, 26 psig, 39 psig and 52 psig. The containment is depressurized in similar cycles. Each level is maintained at least one hour before the deflections and strains are recorded and as long thereafter as required for the contractor to make his measurements and observations in mapping the pattern of concrete cracks that exceed 0.01 inch in width. Concrete cracks are mapped at each of four designated painted areas.

2.2 Inspection Activities

The conduct of the structural acceptance test (SAT) was inspected. Preparations for the test and the pressurization and depressurization increments were observed to be in accordance with the licensee's FSAR commitment to NRC Regulatory Guide number 1.18. The technical requirements governing the SAT and the implementing procedures and acceptance criteria were reviewed by the inspector. These are identified in attachment 1 to this report. Prior to the test the inspector performed a walkdown inspection inside the containment to familiarize himself with the locations and specific details of installed instruments. Areas painted and grid marked for the purpose of measuring concrete cracks on the containment exterior wall were also observed prior to the test.

Additionally the following elements and equipment were inspected.

- oil free compressors with after coolers
- instrumentation to measure and record ambient conditions during the test
- instrumentation to measure deflections; strain gages and their readout for structural response monitoring, recording and data conversion.
- certification of calibration of the above
- adequacy of managerial, engineering and technical staff personnel to supply continuous attention at each shift during the test.

The containment SAT was successfully performed starting at 3:30 a.m. January 10, 1987. The first plateau of 13 psig was reached at 6:30 a.m.. The inspector observed that this pressure was maintained at least one hour before deflections and strains were recorded. Continued holding lasted for approximately two more hours. During

this time the contractor, Weiss, Janey and Elstner (WJE) made his measurements and performed the required concrete crack-mapping at each of four painted areas. Prior to start of pressurization to 26 psig WJE obtained SWEC structural engineering written approval to proceed. This quality assurance requirement and control was observed throughout the test. Additionally, test records maintained by WJE were supervised by SWEC. QA surveillance throughout the test was performed by DLC. The NRC inspector observed that adequate controls were exercised during the 26 psig plateau and in pressurization from 39 psig to a maximum pressure of 52 psig. This was accomplished at 11:35 p.m. January 10, 1987. At this pressure the inspector verified crack mapping by WJE and he independently performed crack width measurements with an optical comparametor. No abnormalities were observed.

2.3 Findings

Based on the above observations, augmented by interviews with SWEC, WJE and DLC engineers during the test, the inspector determined that the SAT conformed to prescribed requirements of R.G. 1.18. The containment response measurements appear adequate for SWEC engineering evaluation of the containment structural integrity. No unacceptable conditions were identified.

The NRC will review the final report approved by the licensee. Structural integrity of the primary containment will be evaluated based on a comparisor of radial, vertical and strain gage responses and the estimated accuracy of the measurements and deviations. The containment's safety margin will be deduced from the test results.

3.0 Containment Integrated Leak Rate Test (CILRT)

During the period February 12 through February 15, 1987 the preoperational containment integrated leak rate test was performed at Beaver Valley Power Station, Unit 2. The test was performed in accordance with Test Procedure No. PO-2.47.07, Issue 1, "Containment Type A Leak Rate Test". The inspector reviewed the test procedure and witnessed preparations and various portions of the preoperational CILRT.

The purpose of the inspection was to ascertain that the CILRT was conducted in compliance with the requirements and commitments referenced in the following sections, and that the test results met the acceptance criteria specified in the station procedures and Appendix J, 10 CFR 50. The procedures were reviewed for their technical adequacy to perform the intended activities.

3.1 References

*Beaver Valley Power Station, Unit No. 2 Technical Specifications.

*10 CFR; Part 50, Appendix J, Primary Reactor Containment Leakage Testing for Water Cooled Power Reactors.

*Final Safety Analysis Report (FSAR).

*ANSI/ANS 56.8-1981, Containment Systems Leakage Testing Requirements.

*USNRC I&E Information Notice NO. 85-71; Containment Integrated Leak Rate Tests.

3.2 Documents Reviewed

*PO-2.47.07, Containment Type A Leak Rate Test, Issue 1.

*Calibration records for CILRT Instrument by EG&G and Westinghouse.

*Stone & Webster calculation No. 12241-US(B)-192 "Temperature and Humidity Sensor Placement Analysis".

*Official Type A log of events.

*Instrumentation selection guide calculation.

3.3 Pretest Activities

A preliminary walkdown inspection was conducted on February 12, 1987 to verify the positions of RTD's and dewcells to be used for the containment integrated leak rate test. The inspector verified the position of a sample of RTD's and moisture elements. He also performed a general observation of the accessible interior and exterior surfaces of the containment structure in order to identify evidence of deterioration which may effect leak tightness. The inspector observed the containment pressurization system to be used for the test and the means for venting the system from containment during the test.

No unacceptable conditions were identified.

3.4 Administrative Control of CILRT and Procedure Review

The inspector reviewed controlled test procedures, procedural sign-offs, official Type A log of events, data taking, and observed test activities to verify that:

* The test procedure was adequate.

* Test prerequisites were met.

* Test directors were designated and their responsibilities were defined.

* The test was conducted in accordance with the procedure.

* Required plant parameters were being recorded on at least an hourly basis.

The inspector noted two administrative deficiencies in the test procedure. They were both a matter of a lack of explicit wording concerning important aspects of the test. One deficiency concerned a statement about the performance of an insitu check of the CILRT sensing instruments. This is required per industry standard ANSI/ANS-56.8-1981 and is accepted industry practice. Provisions did appear in the procedure to perform the instrument operability check but the word "Insitu" did not appear. This led to confusion about the intent of the activity described. The other deficiency concerned a statement about CILRT valve lineup. A precautionary statement such as the following was needed to provide clarity of intent: "The CILRT valve lineup is specified to prevent the creation of artificial leakage barriers (such as water loop seals in vent valve tubing) that could not be expected to exist following the DBA." The test director responded to the inspectors concern by issuing procedural changes which added the necessary statements. The inspector verified that the test procedure included other pertinent statements and information such as: venting of internal isolated volumes required, Local Leak Rate Testing Information Specified, Instrument Calibration Requirements Specified, Isolation valve closing mode specified to be the normal mode, etc. The inspector noted that containment isolation valves were tagged out for the test to preclude inadvertent operation.

3.5 Test Instrumentation

The inspector reviewed the calibration records of the CILRT instrumentation to ascertain that the instruments had been calibrated within the 6-month period prior to the test, as per industry standard ANSI/ANS-56.8-1981. The calibrations were traceable to the National Bureau of Standards. The inspector also verified that the instrument system satisfied the specifications given in the instrument selection guide of ANSI/ANS-56.8-1981. The inspector observed the operation of the automatic data collection system during the conduct of the test.

Under ANSI/ANS-56.8-1981, a minimum of 1 pressure sensor and 3 dewpoint sensors are required. The limitation on drybulb temperature sensors is that no sensor may represent a volume fraction greater than 10% during the test. The following is a summary of the CILRT sensors:

Sensor	Minimum	Actual
Drybulb Temperature	10	18
Dewpoint Temperature	3	5
Pressure	1	2

No unacceptable conditions were identified.

3.6 Containment Inspection and Test Boundary Verification

The inspector conducted several tours independently and with licensee personnel before and during the CILRT. The containment was inspected for the existence of artificial boundaries and boundaries showing evidence of leakage. Two significant leaks were identified and isolated by the licensee. They were the recirculation spray system valve 2RSS*V4 and the Swagelock Fitting at the Recirculation Spray System "B" Pump. Local leakage from these two sources will be added to the Type A test result after repair.

No unacceptable conditions were identified.

3.7 Test Witnessing

The inspector witnessed portions of the following test activities:

(1) Pretest "Leak Chasing" by Licensee

(2) Containment Atmospheric Stabilization

(3) 24 hour CILRT Data Acquisition

(4) 4 hour Instrument Verification

These activities were witnessed to verify that the CILRT was conducted in accordance with the test procedure and within the regulatory requirements of 10 CFR 50, Appendix J. Additionally, several parameters were monitored during the course of the CILRT and are listed as follows: Steam Generator secondary pressure, pressurizer relief tank level, and primary drains tank. Other RCS related water levels were monitored such as pressurizer and

accumulators A, B, C. These levels would not have had significance because the RCS was empty for the test. The objective was to monitor the inventory of water in these sources for prompt identification of leaks and to chase leaks. These parameters showed no meaningful changes.

3.8 Atmosphere Stabilization

After reaching test pressure and allowing a minimum of 4 hours to stabilize, the containment atmosphere must meet the following criteria per test procedure No. PO-2.47.07: When the rate of temperature change over the last hour, does not deviate by more than 0.5F per hour from the rate of temperature change averaged over the last 4 hours, temperature stabilization can be assumed. The inspector calculated a deviation of 0.21 °F/HR between the rate of temperature change averaged over the last hour and the last 4 hours.

This meets the criteria for atmosphere stabilization. Also, the inspector noted that containment fans were not used during any portion of the test.

3.9 CILRT Chronology

February 12, 1987

0015 Opened containment airlock following depressurization from structural integrity test. Entered containment for interior inspection.

1027 Began pressurization for CILRT to 46 psig or 60.2 psia.

1530 Containment pressure at 38.240 psia. Pressurizing at a rate of 4.42 PSI/HR.

2340 Secured the air compressors.

February 13, 1987

0005 Commenced stabilization period.

0405 Temperature stabilized as per requirements. Waiting additional time before starting test.

0600 Early indications of computer data indicate a substantial leak.

0630 Made a complete inspection of the recirculation spray system and identified significant leakage from vent valves 2RSS*V101, 102.

0930 A program to identify the leak path has initiated. 2RSS*V8 was shut (in series with 2 RSS*V4) and the leakage from 2RSS*V101 stopped. 2RSS*V4 was therefore identified as the leaking valve.

1715 Secured 2RSS*MOV155B to commence isolating the recirculation Spray B header because of leakage at stainless swagelok fitting used to pressurize the pump seals.

1905 Official start of Type A Leak Rate Test.

February 14, 1987

0100 Continued leaking of Swagelok fitting. Leakage rate however is acceptable.

1300 Containment Type A Leak Rate UCL is acceptable, (<0.75La).

1930 Completed Type A Leak Rate Test.

2205 Start of superimposed Leak Rate Test.

February 15, 1987

0205 Superimposed Leak Rate Test complete, data is acceptable.

0240 Started depressurization of the containment building.

3.10 Test Results

The licensee computed the containment leakage using both the total time method (TTM) of ANS-N45.4-1972 and the mass point method (MPM) of ANSI/ANS-53.6-1981. The inspector also computed the leakage from the licensee's averaged data utilizing an NRC CILRT computer program.

The licensee and NRC Computations were in good agreement. The results initially indicate a successful CILRT. Note that the inspector did not independently calculate the corrections for Type B & C leakage. A plot of the leakage trend may be seen on Attachment 2. The results are subject to additional "as-left" local leakage from recircu-lation spray system valve No. 2RSS*V4 and the recircu-lation spray system B header, which were isolated for the test due to leakage. A final test evaluation is pending NRC review of the licensee's summary technical report. This will remain an open Item No. 87-12-01.

The inspector informed the licensee that the mass point calculational method is not sanctioned for use in 10 CFR 50, Appendix J and will not be evaluated as the official test result.

The 24 hour CILRT was followed by a successful 4 hr. superimposed leak verification test.

4.0 Personnel Training and Qualifications

The Qualification and training of selected test personnel were discussed with a licensee representative. In addition the inspector evaluated the performance of test engineers during the test.

The inspectors reviewed the test engineers qualifications against the requirements specified in ANSI N 18.1-1971 "Selection and training of nuclear power plant personnel". They were knowledgeable of their responsibilities and technical aspects of leak testing.

No unacceptable conditions were identified.

5.0 QA/QC Coverage

The inspector discussed coverage of the containment integrated leak rate test with a QA/QC representative and reviewed QA inspection documentation concerning the CILRT. The inspector verified QA/QC involvement in test monitoring. QA was present to provide coverage for assigned witness points during the test including several test prerequisites and to verify that test performance was being properly executed.

No unacceptable conditions were identified.

6.0 Exit Meetings

Licensee management was informed of the purpose and scope of the inspection at the entrance interview. The findings of the inspection were periodically discussed and were summarized at the exit meetings on February 11, 1987 and February 14, 1987.

Attendees at the exit meetings are listed in Section 1.0 of this report. At no time during the inspection was written material provided to the licensee by the inspectors.

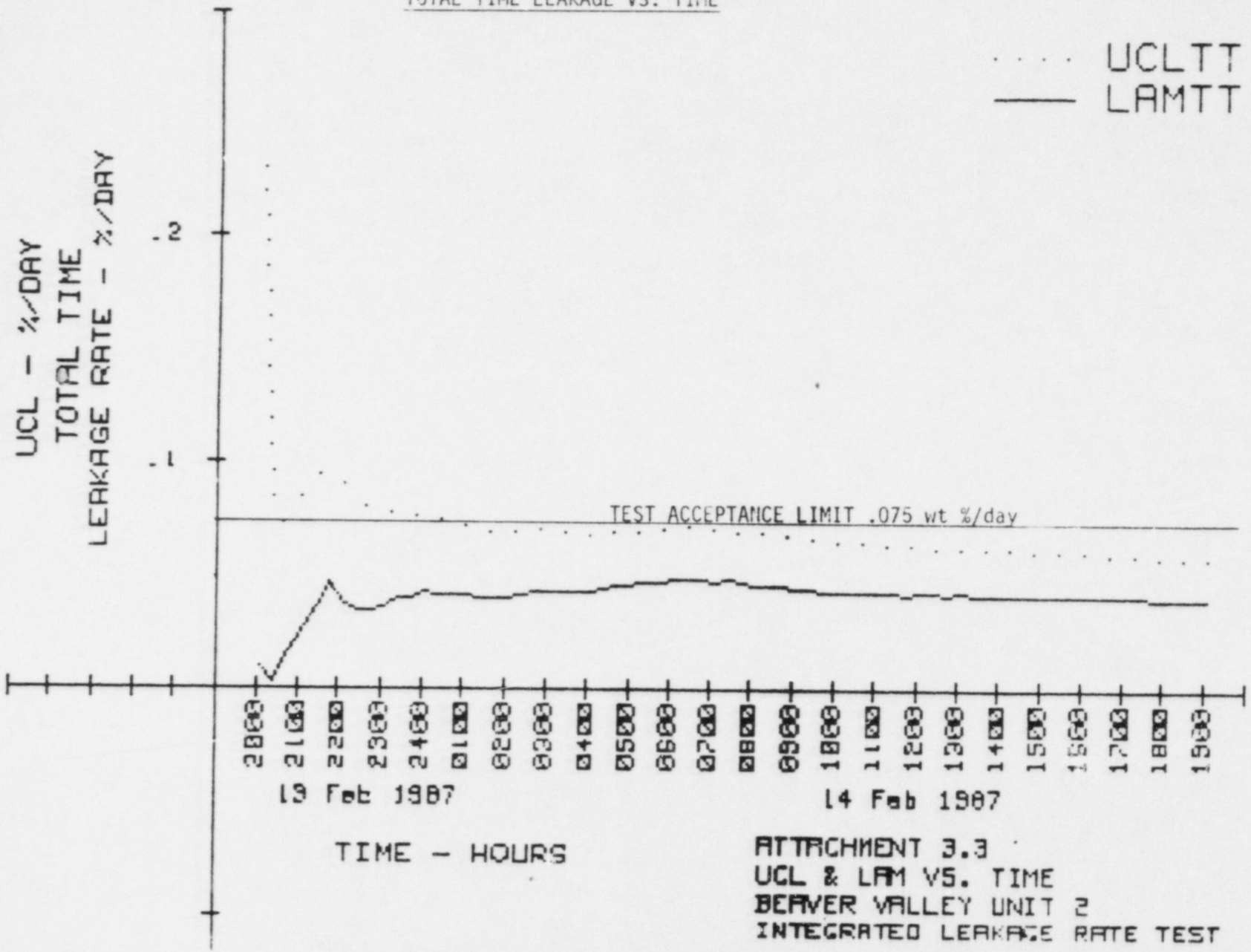
ATTACHMENT 1

DOCUMENTATION REVIEWED

Document	Description
PO-2.47.06	SWEC Test Procedure for Containment Structural Integrity Test (SIT)- Visual Observation of Reactor Containment Structure Prior to Structural Acceptance Test (SAT)
2BVS-424	SWEC specifications for Structural Acceptance Test for Concrete Primary Containment for BV2
OP-10	Weiss, Janey & Elstner (WJE) Procedures Manual for Installation of Strain Gages on Steel Surfaces for the SAT
OP-37-BV2	WJE Procedures Manual for Structural Acceptance Test
IP-6.15	DLC Quality Assurance/Surveillance of Reactor Containment Structural Acceptance Test:

ATTACHMENT 2

TOTAL TIME LEAKAGE VS. TIME



ATTACHMENT 3.3
UCL & LAM VS. TIME
BEAVER VALLEY UNIT 2
INTEGRATED LEAKAGE RATE TEST