SOUTHERN CALIFORNIA EDISON COMPANY

SAN ONOFRE NUCLEAR GENERATING STATION

UNIT 3

REACTOR CONTAINMENT BUILDING

INTEGRATED LEAK RATE TEST

FINAL REPORT

JULY 1988 TEST

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1.0 INTRODUCTION

1.1 GENERAL

The reactor containment building Integrated Leakage Rate Test (Type A) was performed to demonstrate that the overall leakage rate through the primary reactor containment system does not exceed the allowable leakage rate as specified in the Unit 3 Technical Specification, Section 3.6.1.2. The test was performed as part of the Unit 3 Cycle 4 refueling outage.

The successful Type A and supplemental verification tests were performed in accordance with the requirements of San Onofre Nuclear Generating Station, Unit 3, Procedure SO3-V-3.12, Revision 1, Containment Integrated Leak Rate Test. The test method utilized was the absolute method described in ANSI N45.4-1972, "American National Standard Leakage-Pate Testing of Containment Structures for Nuclear Reactors, BN-TOP-1, Revision 1, "Testing Criteria for Integrated Leakage Rate Testing of Primary Containment Structures for Nuclear Power Plants", and ANSI/ANS-56.8-1981, "Containment System Leakage Testing Requirements". The leakage rate was calculated using the Total Time formulae and Mass Point method from these standards. The test results are reported in accordance with the requirements of 10CFR50, Appendix J, Section V.B.3.

1.2 TEST SYNOPSIS

Pressurization was commenced at 1830 on 7-19-88. Test pressure was obtained at 0740 on 7-20-88. Stabilization was achieved in approximately eight and a half hours. The test was commenced at 1615 on 7-20-88, and completed at 1615 on 7-21-88. The verification test was started at 1730 on 7-21-88. One hour was allowed for stabilization. The verification test was completed at 2130 on 7-21-88. Depressurization was started at 2131 on 7-21-88, and completed at 0433 on 7-22-88.

The Primary Containment Integrated Leakage Rate Test (ILRT) was successfully completed at 2130, on 7-21-88 at the San Onofre Nuclear Generating Station, Unit 3. All ILRT requirements of the Technical Specifications were satisfied.

TEST SEQUENCE	START	COMPLETION
PRESSURIZATION	1830 7-19-88	0740 7-20-88
STABILIZATION	0745 7-20-88	1530 7-20-88
TEST	1615 7-20-88	1615 7-21-88
VERIFICATION	1730 7-21-88	2130 7-21-88
BLOWDOWN	2131 7-21-88	0433 7-22-88

TOTAL TIME ANALYSIS

Analysis of the measured data taken during the test resulted in a measured leakage rate of 0.0660 %/day, a calculated leakage rate of 0.0616 %/day and a 95 % probability upper confidence limit (UCL) leakage of 0.0652 %/day using the Total Time calculation technique as recommended in ANSI 45.4-1972 and BN-TOP-1. The leakage rate at this upper confidence limit plus a 0.0016 %/day Local Leak Rate penalty (See Section 6.0) yields an overall leakage rate of 0.0668 %/day of contained air mass which satisfies the acceptance criteria of being less than 0.075 %/day.

MASS POINT ANALYSIS

Analysis of the measured data taken during the test resulted in a calculated leakage rate of 0.0607 %/day and a 95 % probability upper confidence limit (UCL) leakage of 0.0623 %/day using the Mass Point calculation technique as recommended in ANSI/ANS 56.8-1981. The leakage rate at this upper confidence limit plus a 0.0016 %/day Local Leak Rate penalty (See Section 6.0) yields an overall leakage rate of 0.0639 %/day of contained air mass which satisfies the acceptance criteria of being less than 0.075%/day.

VERIFICATION TEST

Following the completion of the ILRT measurements, a successful verification test was performed with an imposed leakage rate of 8.03 SCFM. The Total Time measured leakage rate of 0.1609 %/day and calculated leakage rate of 0.1537 %/day was within the allowable limits of 0.1366 %/day to 0.1866 %/day. The Mass Point calculated leakage rate of 0.1614 %/day established during the verification test was within the allowable limits of 0.1357 %/day to 0.1857 %/day.

The leakage rates for this Primary Containment ILRT demonstrates that leakage through the primary reactor containment, systems and components penetrating primary containment do not exceed the allowable leakage rate specified in the SONGS 3 Technical Specifications.

1.3 DOCUMENTS AND TEST INFORMATION RETAINED AT SONGS

The following documents and test information are available for review at the San Onofre Nuclear Generating Station:

1) A listing of all containment penetrations, penetration size, and functions.

2) A listing of normal operating instrumentation used for the leakage rate test.

3) A system lineup (at the time of the test) showing required valve positions and status of piping.

4) A continuous, sequential log of events from initial survey of containment to restoration of all tested systems.

5) Documentation of instrumentation calibrations and standards.

6) The official test copy of the test procedure with sign-off of procedural steps.

7) Computer printouts of Integrated Leakage Rate Test Data and Reports along with Graphs and Plots of the data obtained during the test using Southern California Edison developed computer program.

8) P&IDs

9) Local Leak Rate Test History Files

2.0 GENERAL DATA (PLANT INFORMATION)

2.1	Owner	Southern California Edison
2.2	Docket No.	50-362
2.3	Plant	San Onofre Nuclear Generating Station, Unit 3
2.4	Location	San Onofre, California
2.5	Containment Type	Post-tensioned concrete, hemispherical dome
2.6	NSSS Supplier	Combustion Engineering, PWR

3.0 TECHNICAL DATA

3.1	Containment Net Free Air Volume	2,305,000 cubic feet
3.2	Design Pressure	60.0 PSIG
3.3	Design Temperature	300.0 degrees F
3.4	Calculated Peak Accident Pressure (Pa)	55.7 PSIG
3.5	Calculated Peak Accident Temperature	287 degrees F

4.0 TEST DATA SUMMARY

4.1	Test Method	Absolute Method
4.2	Data Analysis Techniques	
	1) Total Time	per ANSI N 45.4-1972 and BN-TOP-1, Rev. 1
	2) Mass Point	per ANSI/ANS 56.8-1981
4.3	Test Pressure	57.7 psig
4.4	Maximum Allowable Leakage Rate (La)	0.100%/day

4.5 ILRT Results

	Leakage Rate (wt. %/day) Lam	Lcalc	95% UCL	95% UCL + LL*
Total Time	0.0660	0.0616	0.0652	0.0668
Mass Point		0.0607	0.0623	0.0639

*LL= Local Leak Rate Penalty

5.0 VERIFICATION TEST DATA SUMMARY

5.1 Verification Test Leakage Rate .101 %/day (8.03 SCFM)

5.2 Verification Test Results

	Leakage Rate (wt. %/day) Limit	Rate
1) Total Time	0.1366-0.1866	0.1537
2) Mass Point	0.1357-0.1857	0.1614

6.0 LOCAL LEAK RATE TEST (LLRT) DATA SUMMARY

6.1 PENETRATIONS NOT ALIGNED TO SIMULATE POST-ACCIDENT CONDITIONS

During the ILRT, the penetrations listed below were not aligned to simulate the configuration after a postulated accident. The measured local leakage rates obtained from Test Procedure SO23-V-3.13, "Containment Penetration Leak Rate Testing", are given below and are added to the ILRT results.

PEN #	DESCRIPTION	VALVE #
10B	ILRT PRESS SENSOR	S31500MU038/S31500MU039
23C	ILRT FLOW	FLANGE
34	ILRT PRESS CONNECTION	FLANGE
42	NON-CRIT CCW INLET	3HV6211/3HV6223
43	NON-CRIT CCW OUTLET	3HV6216/3HV6236
45	CTMT NORMAL INLET	3HV9900/3HV9920
46	CTMT NORMAL OUTLET	3HV9971/3HV9921

LLRT PENALTY 0.00092528 % / day

6.2 AS FOUND / AS LEFT LLRT PENALTY

In accordance with, IE Information Notice No. 85-71, "Containment Integrated Leak Rate Tests", an As Found / As Left LLRT penalty was calculated and added to the ILRT results. The following penetrations were applicable to this calculation:

PEN #	DESCRIPTION	VALVE #
1	PZR VAPOR SAMPLE	3HV0510/3HV0511
6	SI DRAIN TO RWST	3HV9334/S31204MU099
8	CHARGING	S31208MU122/3HV9200
16-A	CONTAINMENT AIR SAMPLE	3HV0501/3HV0500
16-C	CONTAINMENT AIR SAMPLE	3HV7805/3HV7810
27-C	CONTAINMENT AIR MONITOR	3HV7806/3HV7811
30-B	CONTAINMENT AIRBORNE RADIATION MONITOR	3HV7801/3HV7800/ 3HV7816
43	NON-CRIT CCW OUTLET	3HV6216/3HV6236
74	H2 PURGE	3HV9917/3HV9918

AS FOUND / AS LEFT PENALTY = 0.00066396 %/DAY

The total LLRT penalty is the sum of the values in sections 6.1 and 6.2. In order to be consistent with the ILRT significant figures and rounding conservatively, the total LLRT penalty is:

TOTAL LLRT PENALTY = 0.0016 %/DAY

7.0 ANALYSIS AND INTERPRETATION

7.1 PRESSURIZATION

Pressurization started at 1830 on 7-19-88. The test pressure of 57.2 PSIG was achieved at 0740 on 7-20-88. The average pressurization rate was 4.34 PSI/HR over the 13.2 hour period using a 12,000 CFM diesel compressor system.

7.2 CONTAINMENT ATMOSPHERE STABILIZATION

The acceptance criteria for containment atmosphere stabilization at test pressure is that the rate of change of the containment temperature (weighted average of RTD sensors) is less than 1.0 degree F averaged over the last two hours; or, the rate of change of temperature changes is less than 0.5 degree F / hour / hour averaged over the last two hours; and that the containment atmosphere has been at test pressure for at least four hours. Temperature stabilization commenced at 0745 and was achieved at 1530 on 7-20-88.

7.3 ILRT (Total Time)

The acceptance criteria for a 24 hour ILRT is that the leakage rate determined using the 95% UCL value for the calculated leakage rate plus the local leak rate penalty must be less than 75% of the allowable leakage rate (La) at the peak accident pressure (Pa).

* The test duration was 24 hours.

* 97 data points were used in the calculations.

* Data was collected at 15 minute intervals.

* The upper bound 95% probability value for the calculated leak rate using the Total Time technique was 0.0652%/day.

* The LLRT penalty for penetrations not aligned for the ILRT and as found/as left leakage is 0.0016 %/day (See Section 6.0).

  LL = 0.0016 %/day

* 75% of the allowable leakage rate of 0.10 %/day is 0.075 %/day.

  0.75La = 0.075 %/day.

The acceptance criteria for the test using the Total Time technique is satisfied, i.e.,

95% UCL + LL < .75 LA

0.0652 %/day + 0.0016 %/day < 0.075 %/day

0.0668 %/day < 0.075 %/day

7.4 ILRT (Mass Point)

The acceptance criteria for a 24 hour ILRT is that the leakage rate determined using the 95% UCL value for the calculated leakage rate plus the local leak rate penalty must be less than 75% of the allowable leakage rate (La) at the peak accident pressure (Pa).

* The Mass Point Leakage Rate calculated with a 95% probability UCL is 0.0623 %/day.

  95% UCL = 0.0623 %/day

* The LLRT penalty for penetrations not aligned for the ILRT and as found/as left leakage is 0.0016 %/day (See Section 6.0).

  LL = 0.0016 %/day

* 75% of the allowable leakage rate of 0.10%/day is 0.075 %/day.

  75% La = 0.075 %/day

The acceptance criteria for the ILRT leakage rate using the Mass Point technique is satisfied, i.e.,

	95% UCL	+ LL <	.75 La
0.0623 %/day	+ 0.0016 %/day	<	0.075 %/day
	0.0639 %/day	<	0.075 %/day

7.5 IMPOSED LEAKAGE RATE VERIFICATION TEST

The verification test was commenced at 1730 on 7-21-88, following a one hour stabilization period. The verification test was successfully completed at 2130 on 7-21-88.

7.5.1 TOTAL TIME CALCULATIONS

The acceptance criteria for the imposed leakage verification test is given by the following equation:

$$L_{calc} + 0.75\ L_a < L_{ver} < L_{calc} + 1.25\ L_a$$

where, L_o = imposed leakage rate which must be in the range (8.03 SCFM = 0.101 %/day)

$$.75\ L_a \leq L_o \leq 1.25\ L_a$$

L_{calc} = ILRT calculated leakage rate

L_{ver} = Verification test calculated leakage rate

Furthermore, the calculations shall utilize at least 10 data points, recorded over a time span of at least 4 hours.

Actual Test Data is as follows:

L_o	=	0.101 %/day (8.03 SCFM)
0.75 L_a	=	0.075 %/day
1.25 L_a	=	0.125 %/day
L_{calc}	=	0.0616 %/day
L_{ver}	=	0.1537 %/day (Total Time)
Data Points	=	17

The acceptance criteria for the Total Time technique of determining the imposed leakage rate is satisfied, i.e.,

$$L_{calc} + 0.75\ L_a < L_{ver} < L_{calc} + 1.25\ L_a$$

$$0.0616 + 0.075 < 0.1537 < 0.0616 + 0.125$$

$$0.1366 < 0.1536 < 0.1866$$

7.5.2 MASS POINT CALCULATIONS

The acceptance criteria for the imposed leakage verification test using the Mass Point technique is the same as Total Time technique defined in Section 7.5.1.

Actual Test Data is as follows:

Lo	=	0.101 %/day (8.03 SCFM)
0.75 La	=	0.075 %/day
1.25 La	=	0.125 %/day
Lcalc	=	0.0607 %/day
Lver	=	0.1614 %/day (Total Time)
Data Points	=	17

The acceptance criteria for the Mass Point technique of determining the imposed leakage rate is satisfied, i.e.,

$$L_{calc} + .75\ La < L_{ver} < L_{calc} + 1.25\ La$$

$$0.0607 + 0.075 < 0.1614 < 0.0607 + 0.125$$

$$0.1357 < 0.1614 < 0.1857$$

8.0 LOCAL LEAK RATE TESTING SUMMARY

Penetration (Type B and C) testing was accomplished in accordance with the requirements of the Technical Specification 3/4.6.1 and per SO23-V-3.13. The penetrations were tested using the pressure decay method, make up method, and local test panels. The allowable leakage for all penetrations is 0.06%/day (0.6 La) of the mass of air in the containment at 55.7 psig.

The following is an Operational History of Unit 3 since the previous ILRT, conducted in November 1985. The through penetration leakage is expressed in %/day, using IE Information Notice No. 85-71 methods for determining the through penetration leakage. At no time during plant modes requiring containment integrity (Modes 1 through 4), did the Local Leakage Rate Test results exceed 0.6 La.

DATE	DESCRIPTION	%/DAY
11-25-85	Completed ILRT Cycle 2 Refueling Outage	0.006
01-04-86	Entered Mode 4	0.005
02-28-86	Entered Mode 5	0.005
03-13-86	Entered Mode 4	0.005
10-01-86	Entered Mode 5	0.006
10-17-86	Entered Mode 4	0.007
01-04-87	Entered Mode 5	0.007
03-01-87	Entered Mode 4	0.003
05-01-88	Entered Mode 5, Cycle 4 Refueling Outage	0.003

ATTACHMENT 1

Southern California Edison Company

San Onofre Nuclear Generating Station

UNIT 3

LOCAL LEAKAGE RATE TEST RESULTS OF PENETRATIONS WHICH CAUSED THE TOTAL LEAKAGE FOR ALL PENETRATIONS TO EXCEED 0.6 La (0.06 %/DAY)

1.0 INTRODUCTION

Leakage test results of penetrations which failed to meet the acceptance criteria of 0.6 La (0.06 %/day) are given below. The values given were calculated in accordance with SO23-V-3.13, "Containment Penetration Leak Rate Testing." At no time during plant modes requiring containment integrity (Modes 1 through 4), did the Local Leakage Rate Test results exceed 0.6 La.

1.1 CONTAINMENT PENETRATION 18 CONTAINMENT PURGE SUPPLY

On 12-7-85, while in Mode 5, a Local Leakage Rate Test (LLRT) of Penetration 18 was conducted. The LLRT was unsuccessful because the penetration never achieved test pressure. The valve 3HV-9821, which is an eight inch mini purge valve located outside of containment, was determined to leak excessively. Following rework of the actuator for 3HV-9821, a successful retest of Penetration 18 was conducted on 12-11-85.