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Subject: Docket No. 50-362
Reactor Containment Building Integrated Leak Rate Test
San Onofre Nuclear Generating Station, Unit 3

An Integrated Leak Rate Test (ILRT) was performed at San Onofre Unit 3 during March 1992. The test was performed in accordance with the requirements of the Unit 3 Technical Specifications. Both the measured leak rate test and supplemental verification test met the acceptance criteria set forth in the Technical Specifications.

The enclosed ILRT report for San Onofre Unit 3 constitutes our final report and is being submitted pursuant to 10 CFR 50, Appendix J.

If additional information is required, please so advise.

Sincerely,

Enclosure

cc: C. W. Caldwell (USNRC Senior Resident Inspector, Units 1, 2 and 3)
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SOUTHERN CALIFORNIA EDISON COMPANY

SAN ONOFRE NUCLEAR GENERATING STATION

UNIT 3

REACTOR CONTAINMENT BUILDING

INTEGRATED LEAK RATE TEST

FINAL REPORT

MARCH 1992 TEST

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1.0 INTRODUCTION

1.1 GENERAL

The reactor containment building Integrated Leak Rate Test (Type A) was performed to demonstrate that the overall leakage rate through the reactor containment system does not exceed the allowable leak rate as specified in Unit 3 Technical Specification, Section 3.6.1.2. The test was performed as part of the Unit 3 Cycle 6 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-Rate Testing of Containment Structures for Nuclear Reactors"; and ANSI/ANS-56.8-1987, "Containment System Leakage Testing Requirements". The leak rate was calculated using the Total Time formulae and Mass Point method from these standards. Test duration was determined from these standards and from Bechtel Topical Report BN-TOP-1, "Testing Criteria for Integrated Leakage Rate Testing of Primary Containment Structures for Nuclear Power Plants." The test results are reported in accordance with the requirements of 10CFR50, Appendix J, Section V.B.3, and ANSI/ANS 56.8-1987.

1.2 TEST SYNOPSIS

Containment pressurization commenced on 3-7-92 at 22:15 and test pressure was obtained on 3-8-92 at 1345. The Primary Containment Integrated Leakage Rate Test (ILRT) was successfully completed on 3-9-92 at 1100 for San Onofre Nuclear Generating Station, Unit 3. All ILRT requirements of the Technical Specifications were satisfied.

<u>TEST SEQUENCE</u>	<u>START</u>	<u>COMPLETION</u>
PRESSURIZATION	2215 3-7-92	1345 3-8-92
STABILIZATION	1345 3-8-92	2200 3-8-92
TEST	2200 3-8-92	0600 3-9-92
VERIFICATION		
(Stabilization)	0600 3-9-92	0700 3-9-92
(Test)	0700 3-9-92	1100 3-9-92
BLOWDOWN	1105 3-9-92	2000 3-9-92

TOTAL TIME ANALYSIS

From Total Time calculations of test data, recommended in ANSI 45.4-1972, BN-TOP-1, the measured leak rate was 0.0516 %/day, the calculated leak rate was 0.0427 %/day and the 95% probability upper confidence limit (UCL) leak rate was 0.0649. The upper confidence limit leak rate, plus a 0.0003 %/day, as left, and a 0.0032 %/day, as found, Local Leak Rate penalties, gives overall leak rates of 0.0652 %/day, as left, and a 0.0681 %/day, as found. This meets the acceptance criterion of less than 0.075 %/day.

MASS POINT ANALYSIS

This section is provided for information only. Mass Point Analysis is not used to determine test acceptability in BN-TOP-1 Short Duration Tests. Mass Point Analysis of test data gave a calculated leak rate of 0.0457 %/day and a 95 % probability upper confidence limit (UCL) leak rate of 0.0504 %/day. The upper confidence leak rate, plus a 0.0003 %/day, as left, and a 0.0032 %/day, as found, Local Leak Rate penalties, gives overall leak rates of 0.0507 %/day, as left, and a 0.0536 %/day, as found. This meets the acceptance criterion of less than 0.075 %/day.

VERIFICATION TEST

Following the completion of the ILRT test, a successful verification test was performed with an imposed leakage of 7.9 SCFM. The Total Time measured leak rate of 0.1513 %/day and calculated leak rate of 0.1599 %/day were within the allowable limits of 0.1183 %/day to 0.1683 %/day. The Mass Point calculated leakage, presented for information only, of 0.1609 %/day during the verification test, was within the allowable limits of 0.1212 %/day to 0.1712 %/day.

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

1.3 DOCUMENTS AND TEST INFORMATION RETAINED AT SONGS

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

- 1) A listing of all containment penetrations, penetration sizes, and functions.
- 2) A listing of normal operating instrumentation used in the leak rate test.
- 3) All system test lineups showing required valve positions and status of piping.
- 4) A sequential log of events from initial survey of containment to restoration of all tested systems.
- 5) Documentation of instrument calibrations and standards.
- 6) The official test copy of the test procedure with sign-off of procedural steps.
- 7) Computer printouts from the Southern California Edison program of the Integrated Leak Rate Test data reports, graphs, and plots.
- 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 Metal Temperature | 300.0 degrees F |

- 3.4 Calculated Peak Accident Pressure (Pa) 55.7 PSIG
- 3.5 Calculated Peak Accident Vapor Temperature 287.0 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 56.8-1987
- 4.3 Test Pressure 57.7 PSIG + 0.2, -0.0 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 + LLaf*	95% UCL + LLal*
Tot Time: 0.0516		0.0427	0.0649	0.0681	0.0652
Mass Pt:		0.0457	0.0504	0.0536	0.0507

*LLaf/al = Local Leak Rate Penalty (as found/as left)

5.0 VERIFICATION TEST DATA SUMMARY

- 5.1 Verification Test Leakage Rate .1006%/day (7.9 SCFM)
- 5.2 Verification Test Results Leakage Rate (wt. %/day)
- | | Limits | Calculated |
|---------------|------------------|------------|
| 1) Total Time | 0.1183 to 0.1683 | 0.1599 |
| 2) Mass Point | 0.1212 to 0.1712 | 0.1609 |

6.0 LOCAL LEAK RATE TEST DATA SUMMARY6.1 PENETRATIONS NOT ALIGNED TO POST-ACCIDENT CONDITIONS

During the ILRT, the penetrations listed below were not aligned to their post accident configuration. The total for the measured local leak rates, for the following penetrations, obtained from Test procedure SO3-V-3.13, "Containment Penetration Leak-Rate Testing," is given below. It is added to the ILRT results as the As Left penalty and as a portion of the As Found penalty.

<u>PEN #</u>	<u>DESCRIPTION</u>	<u>VALVE #</u>
10C	ILRT PRESSURE SENSOR	S31500MU038 S31500MU039
23C	ILRT FLOW CONNECTION	N/A
34	ILRT TEST CONNECTION	N/A
42	COMPONENT COOLING WATER	3HV-6211 3HV-6223
43	COMPONENT COOLING WATER	3HV-6216 3HV-6236
45	NORMAL A/C CHILL WATER	3HV-9900 3HV-9920
46	NORMAL A/C CHILL WATER	3HV-9921 3HV-9971

LLRT AS LEFT PENALTY = 0.0003 %/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 apply to this calculation:

<u>PEN #</u>	<u>DESCRIPTION</u>	<u>VALVE #</u>
3C203	ESCAPE HATCH	SEALS
3C406	PERSONNEL AIRLOCK	SEALS
3C501	EQUIPMENT HATCH	SEALS
2	LETDOWN LINE	3TV-9267
		3HV-9205
4	HOT LEG SAMPLE	3HV-0508/09/17
8	CHARGING LINE	S31208MU122
		3HV-9200
13	CONTAINMENT SUMP	3HV-5803/04
14	FIRE PROTECTION	S32301MU061
		3HV-5686
15	FUEL TRANSFER TUBE	BELLOWS/GASKET
18	CNTMT PURGE SUPPLY	3HV-9821/23/48/49
19	CNTMT PURGE EXHAUST	3HV-9824/25/50/51
21	SERVICE AIR	S32423MU017
		S32423MU055
23A	NITROGEN SUPPLY	S32418MU002
		3HV-5437
26	RCDT DISCHARGE	3HV-7512/13
45	A/C CHILL WATER	3HV-9900/20
46	A/C CHILL WATER	3HV-9921/71
47	WASTE GAS VENT HDR	3HV-7258/59
53	CNTMT SPRAY INLET	S31206MU006
		3HV-9368
67	HOT LEG INJECTION	S31204MU157
		3HV-9434
68	AUX SPRAY BYPASS	S31201MU129
		S31208MU130

AS FOUND / LEFT PENALTY = 0.0029 %/DAY

The total as found LLRT penalty is the sum of the values in sections 6.1 and 6.2, or:

TOTAL AS FOUND LLRT PENALTY = 0.0032 %/DAY

7.0 ANALYSIS AND INTERPRETATION

7.1 PRESSURIZATION

Pressurization started at 2215 on 3-7-92. Test pressure of 72.6 PSIA was achieved at 1345 on 3-8-92. Average pressurization rate was 3.7 PSI/HR using a 12,000 SCFM diesel compressor system.

7.2 CONTAINMENT ATMOSPHERE STABILIZATION

The acceptance criteria for containment atmosphere temperature stabilization at test pressure are provided by ANSI/ANS 56.8-1987 and BN-TOP-1. These criteria ensure that the rate of change of the containment temperature is proportional to the rate of change of containment pressure and that containment atmosphere is at test pressure for at least four hours. An additional criterion for mass stabilization was also used. This required mass differentials to be trending towards a constant, negative value to ensure that temperature and pressure were moving together. Stabilization commenced at 1345 and was achieved at 2200. All ANSI/ANS 56.8-1987, BN-TOP-1 and mass stabilization criteria were met.

Unit 3 Cycle 6 stabilization facts:

- * The stabilization duration was 8.25 hours.
- * 34 data points were used in the calculations.
- * Data was collected at 15 minute intervals.
- * The rate of change of temperature was less than 1.0 F/hour, averaged over the last two hours.
- * The rate of change of temperature changes was less than 0.5 F/hour/hour, averaged over the last two hours.
- * Plots of average temperature and pressure versus time were maintained.
- * Individual sensor plots were maintained and reviewed prior to completion of stabilization.

7.3 ILRT (Total Time)

The ILRT leak rate is determined using the 95% UCL for Total Time, plus the sums of the measured leak rates for penetrations not included in the ILRT and the difference between as found/as left leakage rates for all penetrations. This must be less than 75% of the allowable leakage rate (L_a) at the peak accident pressure (P_a).

SONGS Unit 3 Cycle 6 ILRT Test Facts:

- * The test duration was 8.0 hours.
- * 33 data points were used in the calculations.
- * Data was collected at 15 minute intervals.
- * The Total Time double bounded 95% UCL calculated leak rate was 0.0649%/day.
- * The as left penalty was 0.0003 %/day and the as found penalty was 0.0032 %/day (see Section 6.0).
- * 75% of the allowable leak rate of 0.10%/day is 0.075%/day.
- * The 20 data point mean leak rate was 0.0588 %/day with an established downward trend.

The acceptance criterion for the ILRT, using the Total Time technique, is satisfied, i.e.,

95% UCL + Penalty (as left or as found)	< .75 L_a
(as found) 0.0649%/day + 0.0032%/day	< 0.075%/day
	0.0681%/day < 0.075%/day
(as left) 0.0649%/day + 0.0003%/day	< 0.075%/day
	0.0652%/day < 0.075%/day

7.4 ILRT (Mass Point)

The acceptance criteria for a short duration ILRT does not allow the use of the Mass Point Method. Data is supplied for information only.

SONGS Unit 3 Cycle 6 Mass Point Facts:

- * The Mass Point Leakage Rate calculated with a 95% probability UCL is 0.0504%/day.

- * The LLRT penalty, for penetrations not included in the ILRT, and the as found/as left leakage is 0.0032 %/day (See Section 6.0).
- * 75% of the allowable leakage rate of 0.10%/day is 0.075%/day.

The Mass Point acceptance criterion for ILRT leakage is satisfied, i.e.,

95% UCL + Penalty (as left or as found) < .75 La
 (as found) $0.0504\%/day + 0.0032\%/day < 0.075\%/day$
 $0.0536\%/day < 0.075\%/day$
 (as left) $0.0504\%/day + 0.0003\%/day < 0.075\%/day$
 $0.0507\%/day < 0.075\%/day$

7.5 IMPOSED LEAKAGE VERIFICATION TEST

7.5.1 TOTAL TIME CALCULATIONS

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

$$Lo + Lcalc - .25 La \leq Lver \leq Lo + Lcalc + .25 La$$

where, Lo = imposed leak rate which must be in the range
 $.75 La \leq Lo \leq 1.25 La$

$Lcalc$ = ILRT calculated leakage rate at the end of the test

$Lver$ = Verification test calculated leakage rate

Additional criteria are:

- * Calculations shall utilize at least 10 data points,
- * The imposed leak shall be allowed to stabilize for one hour.
- * Verification test duration, as required by BN-TOP-1, shall be at least five hours which is approximately one half the test duration.

Actual Test Data are as follows:

Lo	=	0.1006%/day (7.9 SCFM)
0.25 La	=	0.025%/day
Lcalc	=	0.0427%/day
Lver	=	0.1599%/day
Data Points	=	17
Duration	=	4.0 hours

The acceptance criterion for the Total Time technique for determining the imposed leak rate was satisfied, i.e.,

$$\begin{aligned} Lo + Lcalc - .25 La &\leq Lver \leq Lo + Lcalc + .25 La \\ 0.1006 + 0.0427 - 0.025 &\leq 0.1599 \leq 0.1006 + 0.0427 + 0.025 \\ 0.1183 &\leq 0.1599 \leq 0.1683 \end{aligned}$$

7.5.2 MASS POINT CALCULATIONS

The acceptance criterion for the imposed leakage verification test using the Mass Point technique is the same as Total Time technique defined in Section 7.5.

Actual Test Data are as follows:

Lo	=	0.1006%/day (7.9 SCFM)
0.25 La	=	0.025%/day
Lcalc	=	0.0457%/day
Lver	=	0.1609%/day
Data Points	=	17
Duration	=	4.0 hours

The acceptance criterion for the Mass Point technique for determining the imposed leakage was satisfied, i.e.,

$$\begin{aligned} Lo + Lcalc - .25 La &\leq Lver \leq Lo + Lcalc + .25 La \\ 0.1006 + 0.0457 - 0.025 &\leq 0.1609 \leq 0.1006 + 0.0457 + 0.025 \\ 0.1213 &\leq 0.1609 \leq 0.1713 \end{aligned}$$

NOTE: As a result of using four significant figures, 0.1213 and 0.1713 reflect round off errors. The ILRT program used eight significant figures and did not get this error, resulting in 0.1212 and 0.1712 being used as limits in the ILRT.

8.0 LOCAL LEAK RATE TESTING SUMMARY

Penetration (Type B and C) testing was accomplished in accordance with the requirements of the Technical Specification 4.3.1 and per SO3-V-3.13. The penetrations were tested using the pressure decay and make up methods. The allowable leakage for all penetrations is 0.060 wt%/day (0.6 La) of containment air mass at 57.7 PSIG. Leakages in excess of the Unit 3 Technical Specification limit of 0.005 wt%/day for Penetration 18, Purge Valve Supply, were detected and repaired during the quarterly surveillances performed on 5/15/89 and on 7/24/89. Neither of these events resulted in an overall containment leakage rate in excess of 60% La, or 0.060 wt%/day.

The following is an Operational History of Unit 3 since the previous ILRT (conducted in July 1988) and the through penetration leakage expressed in wt%/day.

<u>DATE</u>	<u>DESCRIPTION</u>	<u>LEAKAGE (wt%/DAY)</u>
8-8-88	ENTERED MODE 4	0.011
4-16-90	ENTERED MODE 5	0.010
7-7-90	ENTERED MODE 4	0.009
1-26-92	ENTERED MODE 5	0.008