UNIT 2/3 INTEGRATED PRIMARY CONTAINMENT LEAK RATE TEST

A. PURPOSE

The purpose of this procedure is to detail the steps necessary to determine the integrated primary containment leak rate (Type A Test).

B. REFERENCES

1. Dresden Nuclear Power Station, Units 2 & 3 Final Safety Analysis Report.

2. 10 CFR Part 50, Appendix J, January 1975 - Primary Reactor Containment Leakage Testing For Water-Cooled Power Reactors.

3. ANSI N45.4 - 1972 - Leakage-Rate Testing of Containment Structures for Nuclear Reactors.

4. Bechtel Corporation Topical Report BN-TOP-1, Revision 1, November 1972 - Testing Criteria For Integrated Leakage Rate Of Primary Containment Structures For Nuclear Power Reactors.

5. Sargent and Lundy drawings:

   a. B-21, B-22, B-24, and B-26.

   b. M-7 and M-8.

6. Data Reduction & Error Analysis For The Physical Sciences, Phillip Bevington McGraw Hill.

C. PREREQUISITES

1. Notify shift prior to conducting integrated leak rate test.

2. A signed and dated events log must be initiated by the responsible Tech Staff Engineer and will be kept up to date at all times by the Cognizant Engineer on shift.

3. A familiarization by Tech Staff personnel of regulations, standards, and procedures applying to the ILRT including, but not limited to, those listed in REFERENCES.

4. All local leak rate tests on valves, seals, and penetrations of the primary containment must be completed before the ILRT can begin.

APPROVED
SEP 10 '84
D.O.S.R.

NOTE

Local leak rate tests must be done prior to and after any repair work being done on any penetration or associated isolation valve. In the special case of double gasketed seals, local leak rate tests must be done prior to opening the seal and after closing the seal.

5. All pre-test checklists must be completed and returned to the responsible Tech Staff Engineer prior to the start of the test.

NOTE

The work to be performed in these checklists involves various departments within the station. It also involves items which may be scheduled months or more in advance of the test. It is the responsibility of the cognizant Tech Staff Engineer to schedule the items and coordinate the work so as to facilitate the execution of the ILRT.

6. All instruments to be used for the ILRT will be calibrated over the full range of expected use prior to their placement in the primary containment for each test. The calibration must be in accordance with approved procedures.

7. The pressure suppression chamber water level as monitored on LI-2(3)-1602-3 on panel 902(3)-3 should indicate approximately -3.0 inches.

8. The reactor vessel water level as monitored on the WIDE RANGE GE-MAC (LI-2(3)-263-101), computer point F-286(386), should indicate approximately +50 inches.

9. To maintain Reactor Water Level (+ 50 inches), open MO(2)3-1402-25A(B) valve with ECCS fill system pump running.

10. Load and save the computer program on the computer if it is to be used.

11. If it is desirable to have CPS available throughout the test, notify the Computer Systems Department at least two weeks in advance.

APPROVED

SEP 10 '84

D.O.S.R.

12. Prepare an instrumentation error analysis for the equipment used. See the example in Appendix A, attached.

13. The test director will have on site a diagram of sensor placement within the containment and a simplified flow diagram of the ILRT computer program.

14. Contact the American Nuclear Insurers Co. prior to performing the test.

D. PRECAUTIONS

1. Warning signs shall be posted at convenient locations around the periphery of the test area. All personnel not performing any required duties shall restrict their access beyond these points.

2. All station radiation protection and safety practices and rules will be strictly followed for this test.

3. All requests for equipment out-of-service for repairs during the test must be evaluated with respect to the fact that the primary containment will be under approximately 48 psig.

4. At no time during the period of pressurization, at test pressure, or depressurization of the primary containment will travel of the reactor building crane be allowed over the reactor cavity area.

5. If use of the shutdown cooling system is anticipated at anytime during the test, it shall be run for the entire duration of the test. This is to avoid transients in the vessel water level. A vessel water temperature of approximately 135°F shall be maintained.

NOTE

If shutdown cooling is run, one branch shall be put in service, but the vessel shell temperature shall not be allowed to drop below 120°F or go above 200°F and shall vary less than ±5°F during the test. When using shutdown cooling with the reactor recirculation pumps not running, either the recirculation pump suction valve (MO-202-4A or B) or discharge valve (MO-202-5A or B) and (MO-202-7A or B) must be closed in order to insure that flow is established through the reactor vessel and not through the idle pump.

APPROVED
S

SEP 10 '84
D.O.S.P.

E. LIMITATIONS AND ACTIONS

1. The integrated leakage rate test will be conducted by pressurizing the primary containment to a pressure of at least the calculated maximum peak accident pressure of 48 psig.

2. After the preoperational leakage rate tests, a set of three type A tests shall be performed, at approximately equal intervals during each ten year service period. The third test of each set shall be conducted when the unit is shutdown for the ten year inservice inspections.

3. Successful completion of this test will obtain all of the data necessary to demonstrate the integrity of the primary containment consistent with all station, license, and Nuclear Regulatory Commission requirements.

   a. The indicated leak rate shall be less than Lt (75% La).

   b. The upper 95% confidence limit of the indicated leak rate, which includes appropriate consideration for random measurement errors, shall also be less than Lt (75% La).

4. Drywell pressurization will be discontinued if leakage above the maximum allowable rate is obvious or the drywell pressure cannot be increased. Repairs will be made and the test restarted.

NOTE

Before terminating the test, a leak rate must be determined for reporting to the NRC. If the test is thus terminated, a Reportable Occurrence must be issued.

5. During the period between the initiation of the containment inspection and the performance of this Type A test, no repairs or adjustments shall be made so that the containment can be tested in as close to the "as is" condition as practical.

6. During the period between the completion of one Type A test and the initiation of the containment inspection for the subsequent Type A test, repairs or adjustments shall be made to components whose leakage exceeds that specified in the Technical Specifications as soon as practical after identification.

APPROVED

SEP 10 '84

D.O.S.R.

7. If during a Type A test, including the supplemental induced leakage test, potentially excessive leakage paths are identified which will interfere with satisfactory completion of the test, or which result in the Type A test not meeting the acceptance criteria, the Type A test shall be terminated and the leakage through such paths shall be measured using local leakage testing methods. Repairs and/or adjustments to equipment shall be made and the Type A test restarted. The corrective action and the change in leakage rate determined from the tests and overall integrated leakage determined from the local leak and Type A tests shall be included in the report submitted to the Commission.

8. Closure of containment isolation valves for the Type A test shall be accomplished by normal operation and without any preliminary exercising or adjustments. Repairs of maloperating or leaking valves shall be made as necessary. Information on any valve closure malfunction or valve leakage that requires corrective action before the test, shall be included in the report submitted to the Commission.

9. The containment test conditions shall be allowed to stabilize for a period of at least four hours after initial pressurization. Refer to Step F.2.g. (Pressurization and Stabilization).

10. All vented systems shall be drained of water or other fluids to the extent necessary to assure exposure of the system containment isolation valves to containment air test pressure and to assure that they will be subjected to the post-accident differential pressure. Systems that are required to maintain the plant in a safe condition during the test shall be operable in their normal mode, and need not be vented. Systems that are normally filled with water and operating under post-accident conditions, such as the containment heat removal system, need not be vented. Refer to Table 1, list of non-vented systems.

11. Results of the supplemental induced leakage test are acceptable provided that the difference between the supplemental test data and the Type A test data is within 0.25 La:

$$\left| L\begin{pmatrix}\text{induced phase}\\ \text{calculated}\\ \text{leak rate}\end{pmatrix} - \left[L\begin{pmatrix}\text{measured phase}\\ \text{calculated}\\ \text{leak rate}\end{pmatrix} + L\begin{pmatrix}\text{superimposed}\\ \text{leak rate}\end{pmatrix}\right] \right| \le .25\ \text{La}$$

If results are not within 0.25 La, the reason shall be determined, corrective action taken, and a successful supplemental test performed.

APPROVED

SEP 10 '84

D.O.S.R.

12. A general inspection of the accessible interior and exterior surfaces of the primary containment structure and components shall be performed prior to any Type A test to uncover any evidence of structural deterioration which may affect either the containment structural integrity or leak tightness. If there is evidence of structural deterioration, Type A tests shall not be performed until corrective action is taken. Such structural deterioration and corrective actions taken shall be reported as part of the test report.

13. If the shutdown cooling system is required due to the reactor decay heat, it shall remain in operation throughout the test. This will help prevent transients in reactor water level.

NOTE

When using shutdown cooling with the reactor recirculation pumps not running either the recirculation pump suction valve (MO-202-4A or B) or discharge valves (MO-202-5A or B and MO-202-7A or B) must be closed in order to insure that flow is established through the reactor vessel and not through the idle pump.

14. The Integrated Primary Containment Leak Rate Test will consist of five phases. Each phase will have a definite starting and ending point and is so defined because of the different types of activities that will occur in each.

a. The preparation phase (phase 1).

b. The pressurization and stabilization phase (phase 2).

c. The measured leakage rate at 48 psig phase (phase 3).

d. The induced leakage phase at 48 psig (phase 4).

e. The depressurization phase (phase 5).

NOTE

The signed and dated events log started by the responsible Tech Staff Engineer will be kept up to date at all times by the Cognizant Engineer on shift during phases (b) through (e), or as specified by the ILRT Test Engineer. Any changes to sensor location, instrumentation, or computer program must be entered into the ILRT log book under a separate section titled "Special Changes".

APPROVED
SEP 1 0 '84
D.O.

15. Any change to instrumentation sensor placement or computer program must be reviewed at the same level as a temporary procedure change. Deletion of any data points (i.e. as a result of failed instrumentation) must also be reviewed at this level.

F. PROCEDURE

1. Test Preparation (Phase 1).

Prior to sealing the drywell and pressure suppression chamber for pressurization, the pre-test portion of the following checklists must be completed:

CHECKLIST	DEPARTMENT	VERIFIED
1.	Maintenance	________
2.	Operations	________
3.	Instrument Mechanics	________
4.	Technical Staff	________

Pretest preparation complete. ____________

2. Pressurization and Stabilization (Phase 2).

a. Complete Steps F.2.a.(1) through F.2.a.(3) only if the 1.0 PSI drywell to torus vacuum breaker test is to be performed.

(1) Perform the vacuum breaker test per DTS 1600-27.

(2) After completion of DTS 1600-27, equalize the drywell to torus differential pressure; OPEN valves AO-2(3)-1601-23 & 60.

(3) After equalization is achieved, CLOSE valves AO-2(3)-1601-23 & 60.

(4) Secure OPEN two sets (4) of vacuum breakers (Operating Dept).

(5) Begin pressurizing the containment for the ILRT.

b. After the system is at least 2 psig, begin to inspect all appropriate penetrations and valves for excessive leakage. Special attention should be paid to the drywell to corus vacuum breaker position indications, electrical penetrations, and small penetrations which cannot be local leak rate tested.

APPROVED

SEP 10 '84

D.O.S.R.

c. If sources of leakage are found or the primary containment instrumentation indicates excessive leakage, pressurization should be stopped and this leakage should be estimated. If repairs cannot be achieved without depressurization, the drywell and pressure suppression chamber should be vented to facilitate repairs.

NOTE

The results of the local leak rate test or the estimated leakage rate from all repaired leaks must be added to the results of Type A test at 48 psig leak rate calculation to determine a leakage rate at the beginning of the test. If this resultant leak rate is above La, a Reportable Occurrence must be initiated.

d. When at 15 psig hold for review of the leak rate as referenced by pressure decay indications.

e. Resume pressurizing the containment until at least a pressure of 48 psig is obtained. Temperature stabilization may require additional pressurization until a balance is achieved.

CAUTION

Containment design pressure is 62 psig. When containment pressure reaches approximately 65 psia (53.3 psig) CLOSE the 2(3)-1501-28A valve and SECURE the air compressors.

f. Remove pressurization flange at the drywell spray header and install the blind flange. It is not necessary for this to be completed before the start of the stabilization period required by Step F.2.g. below begins.

g. Stabilization can begin when the air compressor is OFF and Drywell Isolation Valve [2(3)-1501-28A] is CLOSED. Allow the containment atmosphere to stabilize until the following conditions have been met.

(1) The containment has been pressurized to greater than 48 psig at least four (4) hours or more.

AND

(2) The rate of change of the average volume weighted temperature is less than 1.0°F/hour over the last two (2) hours.

OR

APPROVED

SEP 1 0 '84

D.O.S.R.

The rate of change of temperature changes is less than 0.5°F/hour/hour averaged over the last two (2) hours.

NOTE

A continuous monitoring of the containment penetrations should be maintained during the pressurization phase. If any leaks are found, an estimate of the leakage rate must be made before any repairs are attempted.

Containment stabilization complete. ____________

h. Perform local leak rate test, at 48 psig, on personnel interlock door per DTS 1600-14.

3. Measured Leak Rate at 48 psig (Phase 3).

Either of the following methods may be used. Method A is preferred since it requires a 12 hour minimum test duration, whereas Method B requires a 24 hour minimum test duration.

NOTE

Calculation procedures for Method A are shown in Appendix A, C & D, those for Method B are shown in Appendix B, C & E.

Method A (12 hours minimum Phase 3 duration)

a. Check all accessible primary containment penetrations that exhibited leakage at 2 psig with soap solution before the start of data taking.

b. Record the following data at least once every half hour:

(1) Time and date.

(2) Ambient temperature, pressure and relative humidity of the reactor building. (Data sheets 2 and 3).

(3) Absolute pressure of the primary containment. (Data sheet 4).

(4) Air temperatures inside the drywell and pressure suppression chamber. (Data sheet 1).

(5) Dew point temperatures inside the drywell and pressure suppression chamber. (Data sheet 1).

APPROVED
SEP 10 '84
D.O.S.R.

(6) Reactor water temperature (Data sheet 2).

(7) Reactor water level. (Data sheet 2).

(8) Torus water level (LI-2(3)-1602-3 panel 902-3(903-3)). (Data sheet 2).

c. Calculate, using either the hand method (an example of which is in Appendix B & D attached) or with the aid of a computer, the following information at least once every half hour.

(1) Average temperature by volume (°F).

(2) Average vapor pressure by volume (psi).

(3) Average containment volume weighted temperature (°F).

(4) Average containment volume weighted vapor pressure (psi).

(5) Primary containment dry air pressure (psia).

(6) Mass of contained dry air (lbs).

(7) Total time measured leak rate (M_i).

(8) Calculated leak rate (L_i) and 95% confidence limits.

d. Record the information in F.3.c. (Data sheet 4).

e. Plot the information in F.3.c.(5) thru (8) as a function of time.

f. Leakage rate measurements will be made at an average (over the time period of the test) containment pressure of at least 48 psig. Data taking will continue for at least 12 consecutive hours.

g. From the third data set through the last data set, the percent leakage (measured) will be computed. The calculated leak rate is also computed by the Least Squares fit to the measured leakage data. The upper confidence limit of the calculated leak rate is then computed.

h. Compare the calculated leakage rate to Lt (1.2% per day) and La (1.6% per day). If leakage rate approaches Lt, every effort should be made to find the source of leakage and repairs made to stop it. The measured leak rate phase (Phase 3) should then be restarted.

APPROVED
SEP 10 '84
D.O.S.R.

i. The measured leak rate phase can be terminated when all of the following criteria can be simultaneously verified:

(1) The containment atmosphere is stable. Refer to Section F.2.g. (Page 8) of this procedure.

Verified______________________

(2) The calculated leak rate is stable and less than 0.75 La. Reference Topical Report BN-TOP-1, Section 2.3.B.1. if the calculated leak rate is increasing over time.

Verified______________________

(3) The last computed upper 95% confidence limit of the calculated leak rate based on Total Time calculations shall be less than 0.75 La.

Verified______________________

(4) The mean of the measured leak rates based on the Total Time calculations over the last five (5) hours of the test or twenty (20) data points, whichever provides the most data, shall be less than .75 L_A.

Verified______________________

(5) At least twenty (20) data points shall be provided for proper statistical analysis. The maximum interval between data sets shall be one (1) hour.

Verified______________________

(6) At least twelve (12) hours of data is available since the start of the measured leakage phase.

Verified______________________

j. The measured leakage phase of the test has been successfully completed. Record below the calculated leak rate for the last data sample.

Total Time Calculated Leak Rate______________________%/DAY

Verified______________________

Method B (24 hours minimum Phase 3 duration)

a. Check all accessible primary containment penetrations that exhibited leakage at 2 psig with soap solution before the start of data taking.

APPROVED

SEP 10 '84

D.O.S.

b. Record the following data at least once every hour:

   (1) Time and date.

   (2) Ambient temperature, pressure and relative humidity of the reactor building. (Data sheets 2 and 3).

   (3) Absolute pressure of the primary containment. (Data sheet 4).

   (4) Air temperatures inside the drywell and pressure suppression chamber. (Data sheet 1).

   (5) Dew point temperatures inside the drywell and pressure suppression chamber. (Data sheet 1).

   (6) Reactor water temperature (Data sheet 2).

   (7) Reactor water level. (Data sheet 2).

   (8) Torus water level (LI-2(3)-1602-3 panel 902-3(903-3)). (Data sheet 2).

c. Calculate, using either the hand method (an example of which is in Appendix B attached) or with the aid of a computer, the following information at least once every hour.

   (1) Average temperature by volume (°F).

   (2) Average vapor pressure by volume (psi).

   (3) Average containment volume weighted temperature (°F).

   (4) Average containment volume weighted vapor pressure (psi).

   (5) Primary containment dry air pressure (psia).

   (6) Mass of contained dry air (lbs).

   (7) Measured leak rate (weight %/day).

   (8) Linear least squares fit leak rate (weight %/day).

d. Record the information in F.3.c. (Data sheet 4).

e. Plot the information in F.3.c.(5) thru (8) as a function of time.

APPROVED

SEP 10 '84

D.O.S.R.

f. Leakage rate measurements will be made at an average containment pressure (over the time period of the test) of at least 48 psig. Data taking will continue for at least 24 consecutive hours.

g. Compare the 24 hour leakage rate to Lt (1.2% per day) and La (1.6% per day). If the leakage rate approaches Lt, every effort should be made to find the source of leakage and repairs made to stop it. The 24 hour phase should then be restarted.

Phase 3 ends with the calculation of the 24th hourly set of information. If the leakage rate is below Lt, at 48 psig, phase 4 can begin immediately. If not, the responsible leaks must be repaired and the phase 3 repeated.

48 psig test phase successfully completed.

95% UCL ______(wt %/Day), Calculated Leak Rate ______ (wt %/Day)

As Found Local Leak Rate ____________(wt %/Day)

As Left Local Leak Rate ____________(wt %/Day)

Total Leakage Rate As Found/As Left ________/______(wt %/Day)

Verified ______________________________

4. 48 psig Induced Leak Rate Phase (Phase 4).

Phase 4 cannot begin until at least 1 hour has passed since the completion of Phase 3. Phase 4 is the induced leakage portion of the ILRT. During this test, a deliberate leak of known magnitude will be superimposed on the leakage rate already calculated during the phase 3. This will provide reassurance against any uncertainties associated with the performance of the leak rate test. This leak should be of the same magnitude as phase 3 calculated leak rate. The new leakage rate is then calculated by the same method which was used during phase 3 and should approximately equal phase 3 leakage rate plus the induced leakage rate. This phase then acts as a verification of the accuracy of the data obtained in phase 3. If Method A was used for phase 3 calculations, phase 4 must be conducted for a length of time equal to at least one-half that of phase 3.

a. The suction to the flowmeter for the induced leakage should be taken from the return line to the CAM monitor. The moisture separator can be installed if desirable. The flowmeter discharge shall be vented to the reactor building. The induced leakage as measured on the flowmeter must be between 10.27 and 17.12 SCFM.

b. Request the Radiation Protection Department to obtain a drywell air sample. This can be obtained from the discharge of the ILRT flowmeter. (See Checklist #5, attached).

APPROVED

SEP 10 '84

D.O.S.P.

c. In conjunction with the air sampling, begin recording data as in step F.3.b. at least once every hour. In addition to the above data, also record the induced leakage flow rate.

d. Perform the calculations listed in step F.3.c. at least once every hour until sufficient data is obtained to adequately fulfill the requirements.

e. If the induced leakage cannot be accurately detected, an investigation of the cause should be made, corrective actions taken, and the induced leakage phase restarted following repressurization to 48 psig. An evaluation and the corrective actions should be included in the report to the NRC.

Superimposed Leak Rate:

$$\_\_\_\_\_\_ \text{SCFM} \; \frac{1440 \text{ MIN}}{\text{Day}} \; \frac{T+459.69°R}{519.69°R} \; \frac{14.696 \text{ PSIA}}{P} \; \frac{100\%}{VOL} = \_\_\_\_\_\_ \text{WT\%/DAY}$$

WHERE, T = Induced phase average containment temperature, ____________ °F.

P = Induced phase average containment pressure, ____________ PSIA.

VOL = Free volume of the containment. ____________ ft³

Induced phase calculated leak rate: ____________ WT%/Day

$$\left| L\begin{pmatrix}\text{Induced Phase} \\ \text{Calculated Leak Rate}\end{pmatrix} - \left[L\begin{pmatrix}\text{Measured Phase} \\ \text{Calculated Leak Rate}\end{pmatrix} + L\begin{pmatrix}\text{Superimposed} \\ \text{Leak Rate}\end{pmatrix}\right]\right| \leq 0.25(1.6)$$

$$\left| (\_\_\_\_\_\_) - [(\_\_\_\_\_\_) + (\_\_\_\_\_\_)] \right| \leq 0.4 \text{ WT\%/Day}$$

Induced leakage successfully detected. ____________

5. Depressurization (Phase 5).

Phase 5, the depressurization phase, can begin with the end of the successful completion of the induced leakage phase.

a. Isolate the ILRT flowmeter with local manual valves at flow meter.

b. Verify that the results of the air sample taken in step F.4.b. are below the allowable activity limits.

APPROVED

SEP 10 '84

D.O.S.R.

c. OPEN valve AO-2(3)-1601-24.

d. OPEN valves AO-2(3)-1601-61 and AO-2(3)-1601-62 and vent the containment through RX building vent.

e. After depressurization is complete, normal station drywell entry procedures should be followed for the initial drywell entry. One torus access hatch should be removed for torus entry.

f. With the approval of the Rad Protection Department, the first subsequent drywell entry will be by Technical Staff personnel. The purpose of this entry is to note any deviation from original position of any instrumentation or fans used for the test. Any deviations found will be noted and accounted for in the log book.

g. Only after the Technical Staff inspection will the Instrument Mechanics remove all test equipment from the primary containment.

h. The responsible Tech Staff Engineer should notify the Shift Engineer of satisfactory completion of the test so that all valves with altered position status can be returned to normal.

i. CLOSE the torus access hatch after the removal of all instrumentation. Tech Staff shall perform a final local leak rate test of that penetration.

Verified ______________________ __________

G. CHECKLISTS

1. DTS 1600-7, Mechanical Maintenance Department, Checklist 1, attached.
2. DTS 1600-7, Electrical Maintenance Department, Checklist 2, attached.
3. DTS 1600-7, Operating Department, Checklist 3, attached.
4. DTS 1600-7, Instrument Maintenance Department, Checklist 4, attached.
5. DTS 1600-7, Technical Staff, Checklist 5, attached.
6. DTS 1600-7, Radiation Protection, Checklist 6, attached.

H. TECHNICAL SPECIFICATIONS REFERENCES

1. Section 4.7.A.2.
2. Section 3.6.B.2.

APPROVED

SEP 10 '84

D.O.S.R.

MECHANICAL MAINTENANCE DEPARTMENT
CHECKLIST 1

A. Pretest Requirements

1. CLOSE equipment hatch and notify the Tech Staff to perform a local leak rate test.

Verified ______________________________

2. CLOSE both torus access hatches after verifying that the Instrument Mechanics have installed all the required instrumentation. Notify Tech Staff to perform local leak rate tests.

Verified ______________________________

3. Dry filtered air shall be supplied by air compressors to the drywell and pressure suppression chamber at penetration number X-150A. Install the air compressors including piping, manifolds, afterfilters and dryers (or equivalent) to existing penetrations (refer to Figure 1, attached).

Verified ______________________________

4. After the drywell equipment drain and floor drain sumps are OUT-OF-SERVICE, remove the covers from check valves 2(3)-2001-1A and 2(3)-2001-101A. Inform the Shift Engineer upon completion.

CAUTION

Some contaminated water will spill when the covers are removed.

Verified: ______________________________

B. Post Pressurization Requirement

Upon notification by the cognizant Tech staff person on shift, disconnect the 4" compressor discharge line and reinstall the regular drain piping and flange at penetration X-150A.

Verified ______________________________

C. Post Test Requirement

1. OPEN one torus access hatch.

Verified ______________________________

APPROVED

SEP 10 '84

D.O.S.R.

2. Disassemble all the air compressor manifold piping.

Verified ______________________

3. Upon the removal of all test instrumentation, CLOSE the open torus access hatch and request Tech Staff to perform a local leak rate test.

Verified ______________________

4. Replace the covers on the drywell equipment drain and floor drain sump discharge check valves 2(3)-2001-1A and 2(3)-2001-101A, and notify the Shift Engineer.

Verified ______________________

APPROVED

SEP 10 '84

D.O.S.R.

ELECTRICAL MAINTENANCE DEPARTMENT
CHECKLIST 2

A. Pretest Requirements

1. If fans are required in the torus and/or drywell, install them at the locations determined by the Tech Staff Engineer.

Verified: ____________ installed ____________ not required

2. Vent each indexer housing to the drywell.

Verified____________________

3. In order to prevent ECCS initiation following actions required.

Relay	Panel	Verification		
590-103A	902(3)-15	Block in	12E2464 (12E3464)	________
590-103B	902(3)-17	Block in	12E2464 (12E3464)	________
590-103C	902(3)-15	Block in	12E2464 (12E3464)	________
590-103D	902(3)-17	Block in	12E2464 (12E3464)	________
287-101A	902(3)-32	Lift Coil Wire 13	12E2461 (12E3461)	________
287-102A	902(3)-32	Lift Coil Wire 13	12E2461 (12E3461)	________
287-101B	902(3)-32	Lift Coil Wire 13	12E2462 (12E3462)	________
287-102B	902(3)-32	Lift Coil Wire 13	12E2462 (12E3462)	________
1530-108	902(3)-32	Lift Coil Wire 13	12E2437 (12E3437)	________
1530-208	902(3)-33	Lift Coil Wire 13	12E2438 (12E3438)	________
1530-109	902(3)-32	Lift Coil Wire 13	12E2437 (12E3437)	________
1530-209	902(3)-33	Lift Coil Wire 13	12E2438 (12E3438)	________
1530-134	902(3)-32	Lift Coil Wire 13	12E2437 (12E3437)	________
1530-234	902(3)-33	Lift Coil Wire 13	12E2438 (12E3438)	________
1530-199	902(3)-32	Lift Coil Wire 5 or disconnect NN-36	12E2437 (12E3437)	________
1530-299	902(3)-33	Lift Coil Wire 5 or disconnect NN-36	12E2438 (12E3438)	________

B. Post Test Requirements.

1. Remove the fans (if installed) from the torus/or drywell after completion of the test.

Verified____________________

APPROVED

SEP 10 '84

D.O.S.R.

2. Remove all the blocks and reconnect coil wires from the relays.

Relay	Panel	Verification		
590-103A	902(3)-15	Block in	12E2464 (12E3464)	________
590-103B	902(3)-17	Block in	12E2464 (12E3464)	________
590-103C	902(3)-15	Block in	12E2464 (12E3464)	________
590-103D	902(3)-17	Block in	12E2464 (12E3464)	________
287-101A	902(3)-32	Lift Coil Wire 13	12E2461 (12E3461)	________
287-102A	902(3)-32	Lift Coil Wire 13	12E2461 (12E3461)	________
287-101B	902(3)-32	Lift Coil Wire 13	12E2462 (12E3462)	________
287-102B	902(3)-32	Lift Coil Wire 13	12E2462 (12E3462)	________
1530-108	902(3)-32	Lift Coil Wire 13	12E2437 (12E3437)	________
1530-208	902(3)-33	Lift Coil Wire 13	12E2438 (12E3438)	________
1530-109	902(3)-32	Lift Coil Wire 13	12E2437 (12E3437)	________
1530-209	902(3)-33	Lift Coil Wire 13	12E2438 (12E3438)	________
1530-134	902(3)-32	Lift Coil Wire 13	12E2437 (12E3437)	________
1530-234	902(3)-33	Lift Coil Wire 13	12E2438 (12E3438)	________
1530-199	902(3)-32	Lift Coil Wire 5 or disconnect NN-36	12E2437 (12E3437)	________
1530-299	902(3)-33	Lift Coil Wire 5 or disconnect NN-36	12E2438 (12E3438)	________

3. Back to operation condition of indexer housing.

Verified ______________________

APPROVED

SEP 10 '84

D.O.S.R.

OPERATING DEPARTMENT
CHECKLIST 3

A. Pretest Requirements

1. The following items will be done in preparation for startup:

   a. Reactor recirculation loop, System A, vented and water filled.

      Verified ______________________________

   b. Reactor recirculation loop, System B, vented and water filled.

      Verified ______________________________

   c. Reactor recirculation loop cross tie header vented and water filled.

      Verified ______________________________

2. Prepare the primary containment isolation valves by positioning them as indicated on the attached list and hanging caution cards.

   NOTE

   Closure of the containment isolation valves will be done by the normal mode of operation without preliminary exercising.

   Verified ______________________________

3. Prepare the drywell equipment drain sump as follows:

   a. Pump down the drywell equipment drain sump as far as possible and then take the pumps OUT-OF-SERVICE.

   b. Close the sump pump discharge maintenance valves 2(3)-2001-2A or 2B and then take OUT-OF-SERVICE.

   c. Notify maintenance to remove the cover from the sump pump discharge check valve out of service (refer to CHECKLIST 1, Step A.4).

   d. Clear the outage on the sump pump and verify manual discharge valves 2(3)-2001-2A and 2B are OPEN.

   Verified______________________________

APPROVED

SEP 10 '84

D.O.S.R.

4. Prepare the drywell floor drain sump as follows:

   a. Pump down the drywell floor drain sump as far as possible and then take the pumps OUT-OF-SERVICE.

   b. CLOSE the sump pump discharge maintenance valves 2(3)-2001-102A or 102B and then take OUT-OF-SERVICE.

   c. Notify maintenance to remove the cover from the sump pump discharge check valve out of service (refer to CHECKLIST 1, Step A.4).

   d. Clear the outage on the sump pump and verify manual discharge valves 2(3)-2001-102A and 102B are OPEN.

   Verified ______________________

5. CLOSE valve 2(3)-1501-27A and take out of service.

6. Insure that the internal vessel atmosphere is vented to the drywell and interconnecting pressure suppression containment by OPENING 2(3)-220-48 and 2(3)-220-49 as a path to the drywell equipment drain sump. Ensure that the bulkhead hatches are open.

   Verified ______________________

7. Isolate the jockey pump from the appropriate LPCI loop by CLOSING the following valves:

   MO-2(3)-1501-32A
   2(3)-1501-66A

   Notify the maintenance department in order that the containment spray header flange can be changed to accommodate the air line.

   Verified ______________________

8. Check that the TIP detectors are in their shields, then take the TIP system out of service. The TIP ball valves should be closed and taken out of service.

   Verified ______________________

9. Verify that both core spray loops are filled with water.

   Verified ______________________

10. Turn both CRD pumps off.

   Verified ______________________

APPROVED

SEP 10 '84

D.O.S.R.

11. If the reactor vessel water temperature can remain at approximately 135°F without the use of the shutdown cooling throughout the test duration, this system shall be isolated; otherwise, one loop shall be put into operation using both suction and discharge lines.

Verified: ______________ ______________
SDC required SDC not required

12. Immediately prior to pressurizing the primary containment, make a general announcement over the plant public address system stating that the ILRT is about to begin.

Verified ______________________________

13. OPEN the VALVE 2-1501-28A(3-1501-28B) for containment pressurization.

Verified ______________________________

14. Turn off all drywell coolers.

Verified ______________________________

Performance of this checklist will put the systems affecting primary containment in the following configuration:

SYSTEM	CONDITION
Main Steam	Isolated, Drained, Vented
Reactor Feedwater	Isolated (Water filled, ready for operation)
Reactor Building Closed Cooling Water to Drywell	Supply closed, Return Open
Pressure Suppression	Isolated, Vented
Core Spray	Isolated
Low Pressure Coolant Injection	Isolated
High Pressure Coolant Injection	Isolated
Reactor Cleanup	Isolated. Filter demin ready for service.
Shutdown Cooling	Isolated, unless operation required to maintain 135°F reactor vessel water temperature.
Clean Demin to Drywell	Isolated
Drywell Floor & Equipment Drains	Isolated, Vented
Service Air to Drywell	Isolated
Drywell Pneumatic	Isolated,Vented
Isolation Condenser	Isolated, Vented
Reactor Recirculation	Filled, Pumps Off
Head Cooling	Isolated, Vented
CRD Return	Isolated

APPROVED
SEP 10 '84
D.O.S.R.

B. Post Pressurization Requirements

1. CLOSE VALVE 2-1501-28A(3-1501-28B) upon notification from the Tech Staff.

   Verified ______________________________

2. From now until the end of the test, maintain as constant as possible a water temperature of 135°F.

   NOTE

   Once a suitable shutdown cooling flow rate is established, the 2(3)-1001-4 valves are not to be throttled. All temperature control is to be done with the 2(3)-3704 valve and/or the appropriate RBCCW manual shutdown cooling heat exchanger inlet valve.

   Verified ______________________________

3. After the Maintenance Department removes the temporary flange from the containment spray line, OPEN the following valves:

   MO-2(3)-1501-32A
   2(3)-1501-66A

   Verified ________________ ____________

C. Post Test Requirements

1. Return all previously altered equipment back to its normal state.

   Verified______________________________

APPROVED

SEP 10 '84

D.O.S.R.

UNIT 2 VALVE LINEUP

P&ID	PENT NO.	LOCATION ELEV.	AZI.	LINE SIZE	VALVE NUMBER	DESIRED NORMAL VALVE POSITION	DESCRIPTION
12	105A	517-6	5	20	AO-2-203-1A	C	Primary Steam
					AO-2-203-2A	C	Primary Steam
				3/4	2-220-7A	C	(Gland Seal Leak-Off)
					2-220-9A	C	(Vlv Body Drain)
					2-220-10A	C	(Vlv Body Drain)
					-	C	(MSL Test Conn - 2 Valves)
12	105B	517-6	10	20	AO-2-203-1B	C	Primary Steam
					AO-2-203-2B	C	Primary Steam
				3/4	2-220-7B	C	(Gland Seal Leak-Off)
					2-220-9B	C	(Vlv Body Drain)
					2-220-10B	C	(Vlv Body Drain)
					-	C	(MSL Test Conn - 2 Valves)
12	105C	517-6	350	20	AO-2-203-1C	C	Primary Steam
					AO-2-203-2C	C	Primary Steam
				3/4	2-220-7C	C	(Gland Seal Leak-Off)
					2-220-9C	C	(Vlv Body Drain)
					2-220-10C	C	(Vlv Body Drain)
					-	C	(MSL Test Conn - 2 Valves)
12	105D	517-6	355	20	AO-2-203-1D	C	Primary Steam
					AO-2-203-2D	C	Primary Steam
				3/4	2-220-7D	C	(Gland Seal Leak-Off)
					2-220-9D	C	(Vlv Body Drain)
					2-220-10D	C	(Vlv Body Drain)
					-	C	(MSL Test Conn - 2 Valves)
12	106	515-0		2	MO-2-220-1	C	MSL Drain
					MO-2-220-2	C	MSL Drain
				3/4	2-220-5	C	(MSL Drain Test Conn)
					2-220-6	C	(MSL Drain Test Conn)
				2	MO-2-220-90A	O	(MSL Vent Path)
					MO-2-220-90B	O	(MSL Vent Path)
					MO-2-220-90C	O	(MSL Vent Path)
					MO-2-220-90D	O	(MSL Vent Path)
					MO-2-220-3	O	(MSL Vent Path)
					2-3025-500	C	(MSL Drain Hose Conn)
					2-3025-501	O	(MSL Drain Hose Conn)
12	115B	513-9	275	3/4	2-220-11A	O	MSL Flow Instr.
					2-220-12A	O	

APPROVED
SEP 1 0 '84
D.O.S.R.

UNIT 2 VALVE LINEUP (Cont'd.)

P&ID	PENT NO.	LOCATION ELEV. AZI.	LINE SIZE	VALVE NUMBER	DESIRED NORMAL VALVE POSITION	DESCRIPTION
12	115B	513-9 275	3/4	2-220-11B	O	MSL Flow Instr
				2-220-12B	O	
				2-220-11C	O	
				2-220-12C	O	
				2-220-11D	O	
				2-220-12D	O	
20	123	513-9 45	6	MO-2-3702	C	RBCCW Inlet
20	124	513-9 48	6	MO-2-3703	O	RBCCW Outlet
				MO-2-3706	O	
25	131A	528-0 110	3/4	2-1601-4A	O	ECCS & Auto Blowdown Sensors
	131B	115		2-1601-4B	O	
	131C	290		2-1601-4C	O	
	131D	295		2-1601-4D	O	
25	126	513-0 332	18	AO-2-1601-21	C	N_2 Purge & Vent
				AO-2-1601-22	C	
				AO-2-1601-55	C	
				AO-2-1601-56	C	
			3/4	2-1699-72	C	(Test Connection)
			4	2-8599-544	O	(Pumpback Syst)
				2-8599-545	O	
			1½	MO-2-1601-57	C	N_2 Make-Up
				AO-2-1601-58	C	
				AO-2-1601-59	C	
			1/4	2-8599-526	C	(Test Connection)
			1	2-8599-558	O	(Pumpback Syst)
				2-8599-552	O	
25	304	509-0 270	18	AO-2-1601-20A	C	Torus Vacuum Relief
				AO-2-1601-20B	C	(NOTE: FAIL OPEN)
			3/4	2-1699-50	C	(Test Conn - 2 Valves)
				2-1699-51	C	(Test Conn - 2 Valves)
			D/W	Cooler Damper Control N_2 Supply	C	
25	125	572-0 145	18	AO-2-1601-23	C	Drywell Vent
				AO-2-1601-24	C	
			2	AO-2-1601-62	C	
			6	AO-2-1601-63	C	
			3/4	-	C	(Test Connection @ EL 570-0 near 1601-23 vlv.)
25	318	509-0 95	18	AO-2-1601-60	C	Torus Vent

APPROVED

SEP 10 '84

D.C.S.R.

UNIT 2 VALVE LINEUP (Cont'd.)

P&ID	PENT NO.	LOCATION ELEV.	AZI.	LINE SIZE	VALVE NUMBER	DESIRED NORMAL VALVE POSITION	DESCRIPTION
25	318	509-0	95	2	AO-2-1601-61	C	Torus Vent
				3/4	2-1699-002A	C	Test Connect
					2-1699-002B		@ EL 509-0
25	309A	498-7	155	1/2	FCV-2-8501-1A	C	Torus Air Sample
					FCV-2-8501-1B	C	
25	204	532-6	190	1	FCV-2-8501-3A	C	Sample Return
					FCV-2-8501-3B	C	
25	143	547-6	120	1/2	FCV-2-8501-5A	C	Drywell Air Sample
					FCV-2-8501-5B	C	
					FCV-2-9205A	C	
					FCV-2-9205B	C	
					FCV-2-9206A	C	
					FCV-2-9026B	C	
					2-2252/47/1	C	(2 Valves)
					2-2252/47/2	C	(2 Valves)
					2-2252/47/3	C	(2 Valves)
					2-2252/47/4	C	(2 Valves)
					2-2252/47/5	C	(2 Valves)
					2-2252/47/6	C	(2 Valves)
					2-2252/47/7	C	(2 Valves)
					2-2252/47/8	C	(2 Valves)
					2-2252/47/9	C	(2 Valves)
					2-2252/47/10	C	(2 Valves)
					2-2252/47/11	C	(2 Valves)
					2-2252/47/12	C	(2 Valves)
					2-2252/47/13	C	(2 Valves)
					2-2252/47/14	C	(2 Valves)
					2-2252/47/15	C	(2 Valves)
					2-2252/47/16	C	(2 Valves)
					2-2252/47/[illegible]	C	(2 Valves)
					2-22[illegible]/18	C	(2 Valves)
					2-[illegible]/19	C	(2 Valves)
					[illegible]/20	C	(2 Valves)
					[illegible]/21	C	(2 Valves)
					2-2252/47/22	C	(2 Valves)
					2-2252/47/23	C	(2 Valves)
					2-2252/47/24	C	(1 Valve)
26	147	564-0	295	2½	FCV-2-205-2-3	O	Rx Head Cooling
					MO-2-205-2-4	C	
				3/4	2-205-2-1	O	(Drain)
					2-205-2-2	O	(Drain)
					2-205-2-5	C	(Test Connection)
					2-205-2-6	C	(Test Connection)

APPROVED
SEP 10 '84
D.O.S.R.

UNIT 2 VALVE LINEUP (Cont'd.)

P&ID	PENT NO.	LOCATION ELEV. AZI.	LINE SIZE	VALVE NUMBER	DESIRED NORMAL VALVE POSITION	DESCRIPTION
				2-2099-323	C	(Drain)
				2-2099-324	C	(Drain)
				2-2099-325	C	(Drain)
				2-2099-326	C	(Drain)
				2-2099-327	C	(Test Connection)
				2-2099-328	C	(Test Connection)
26	135A	563-0 70	1	2-220-53	0	Rx Vessel Instr
	127A	560-0 70	1	2-263-2-10	0	
	128A	565-0 210	1	2-263-2-12B	0	
	128B	565-0 210	1	2-263-2-14B	0	
	129A	564-0 70	1	2-263-2-12A	0	
	129B	564-0 70	1	2-263-2-14A	0	
	129C	564-0 70	1	2-263-2-16A	0	
	129D	564-0 70	1	2-263-2-18A	0	
				2-263-41A	0	
	129E	564-0 210	1	2-263-2-16B	0	
	129F	564-0 210	1	2-263-2-18B	0	
				2-263-41B	0	
	142A	540-0 75	1	2-263-2-30B	0	
				2-263-2-30C	0	
				2-263-2-30D	0	
				2-263-2-30E	0	
				2-263-2-30G	0	
				2-263-2-30H	0	
				2-263-2-30J	0	
				2-263-2-30K	0	
				2-263-2-21A	0	
				2-263-2-21B	0	
				2-263-2-22A	0	
				2-263-2-22B	0	
37	136A-E	517-6 270	3/8	Tip Ball Valves (5)	C	
				Tip Drive Power (MCC 29-1) Switches 19, 21, 23 and 20, 22, 24	OFF	
				Drywell O_2 Anal. Cab Bkr. Switches #1	OFF	
				#2	OFF	
				#3	OFF	
				#4	OFF	
	142B	540-0 245	1	2-263-2-30M	0	
				2-263-2-30N	0	
				2-263-2-30P	0	
				2-263-2-30R	0	
				2-263-2-30T	0	
				2-263-2-30U	0	
				2-263-2-30V	0	

APPROVED

SEP 10 '84

D.O.S.R.

UNIT 2 VALVE LINEUP (Cont'd.)

P&ID	PENT NO.	LOCATION ELEV. AZI.	LINE SIZE	VALVE NUMBER	DESIRED NORMAL VALVE POSITION	DESCRIPTION
	142B	540-0 245	1	2-263-2-30W	O	
				2-263-2-21C	O	
				2-263-2-21D	O	
				2-263-2-22C	O	
				2-263-2-27D	O	
	131A	528-0 110	1	2-263-2-24	O	
	131B	528-0 115	1	2-263-2-26	O	
	131C	528-0 290	1	2-263-2-32	O	
	146	541-0 105	1	2-220-66A	O	
				2-220-66B	O	
				2-220-66C	O	
				2-220-66D	O	
	208	536-0 205	1	2-220-66E	O	
				2-220-66F	O	
				2-220-66G	O	
				2-220-66H	O	
	133A	510-0 90	1	2-220-15A	O	
	133B	510-0 90	1	2-220-16A	O	
	133C	510-0 270	1	2-220-15B	O	
	133D	510-0 270	1	2-220-16B	O	
	132A	510-0 90	1	2-262-2-4A	O	
	132B	510-0 90	1	2-262-2-3A	O	
	132C	510-0 270	1	2-262-2-4B	O	
	132D	510-0 270	1	2-262-2-3B	O	
	134A	510-0 90	1	2-220-13A	O	
	134B	510-0 90	1	2-220-14A	O	
	134C	510-0 270	1	2-220-13B	O	
	134D	510-0 270	1	2-220-14B	O	
26	122	548-8 265	3/4	AO-2-220-44	C	Rx Water Sample
				AO-2-220-45	C	
				2-220-102	O	
				2-220-42	C	(Test Connection)
				2-220-43	C	(Test Connection)
				2-220-48	O	(Head Vent)
				2-220-49	O	(Head Vent)
27	149A	564-9 20	10	2-1402-6A	O	Core Spray
			3/4	2-1402-35A	C	(Drain)
				2-1402-46A	C	(Gland Seal Leak-Off)
				2-1402-32A	C	(Test Connection)
				2-1402-33A	C	
			10	MO-2-1402-25A	C	
			3/4	2-1402-5A	C	(Drain/Test Connection)
				2-1402-52A	C	(Drain/Test Connection)
				2-1402-7A	C	(Drain)

APPROVED
SEP 10 '84
D.O.S.R.

UNIT 2 VALVE LINEUP (Cont'd.)

P&ID	PENT NO.	LOCATION ELEV. AZI.	LINE SIZE	VALVE NUMBER	DESIRED NORMAL VALVE POSITION	DESCRIPTION
27	149A	564-9 20	3/4	2-1402-14A	C	(Drain)
				2-1402-15A	C	(Pump Drain)
			16	MO-2-1402-3A	O	
				2-1402-29A	O	Manual Isol.
			12	2-1402-2A	C	
				2-1402-29B	O	Manual Isol.
				2-1402-10A	C	
				2-1402-10B	C	
27	149A	564-9 155	10	2-1402-6B	O	Core Spray
			3/4	2-1402-35B	C	(Drain)
				2-1402-46B	C	(Gland Seal Leak-Off)
				2-1402-32B	C	(Test Connection)
				2-1402-33B	C	
			10	MO-2-1402-25B	C	
			3/4	2-1402-5B	C	(Drain/Test Connection)
				2-1402-52B	C	(Drain/Test Connection)
				2-1402-7B	C	(Drain)
				2-1402-14B	C	(Drain)
				2-1402-15B	C	(Pump Drain)
			16	MO-2-1402-3B	O	
			12	2-1402-2B	C	
27	310A	509-0 118	8	MO-2-1402-4A	C	Core Spray Test Line
	310B	509-0 238	8	MO-2-1402-4B	C	
28	141A	542-6 160	14	MO-2-1301-1	O	Isolation Condenser
				MO-2-1301-2	O	
			3/4	2-1301-34	C	(Test Connection)
				2-1301-35	C	(Test Connection)
				2-1301-505	C	(Gland Seal Leak-Off)
				2-1301-506	C	(Gland Seal Leak-Off)
			1	2-1301-21	O	(Instrumentation)
				2-1301-22	O	(Instrumentation)
				2-1301-27	O	(Instrumentation)
				2-1301-28	O	(Instrumentation)
			3/4	AO-2-1301-17	C	(Vent)
				2-1301-606	C	(Drain)
				2-1301-607	C	(Drain)
				AO-2-1301-20	C	(Vent)
				2-1301-14	C	(Vent)
				2-1301-15	C	(Vent)
28	109A	547-10 178	12	MO-2-1301-3	C	(Isolation Condenser)
				2-1301-600	C	(Vent)
				2-1301-601	C	
				MO-2-1301-4	C	(Drain)
			3/4	2-1301-18	C	(Drain)
				2-1301-19	C	(Drain)
				2-1301-32	C	(Test Connection)
				2-1301-33	C	(Test Connection)

APPROVED

SEP 10 '84

D.O.S.R.

UNIT 2 VALVE LINEUP (Cont'd.)

P&ID	PENT NO.	LOCATION ELEV.	LOCATION AZI.	LINE SIZE	VALVE NUMBER	DESIRED NORMAL VALVE POSITION	DESCRIPTION
29	116A	513-9	83	16	MO-2-1501-22A	C	LPCI Injection
					2-1501-26A	O	
				1/2	2-1501-91A	C	(Drain)
				3/4	2-1501-23A	C	(Test Connection)
					2-1501-79A	C	(Vent)
					2-1599-15A	C	(Drain)
29	116B	513-9	263	16	MO-2-1501-22B	C	LPCI Injection
					2-1501-26B	O	
				1/2	2-1501-91B	C	(Drain)
				3/4	2-1501-23B	C	(Test Connection)
					2-1501-79B	C	(Vent)
					2-1599-15B	C	(Drain)
29	310A	509-0	118	14	MO-2-1501-20A	C	LPCI Test
					MO-2-1501-38A	C	
				3/4	2-1501-87A	C	(Test Connection)
29	310B	509-0	238	14	MO-2-1501-20B	C	LPCI Test
					MO-2-1501-38B	C	
				3/4	2-1501-87B	C	(Test Connection)
	145	547-6	210	10	MO-2-1501-27B	C	LPCI DW Spray
					MO-2-1501-28B	C	
					2-1501-29B	C	
				3/4	2-1501-30B	C	(Test Connection)
					2-1501-45B	C	(Vent)
29	150A	527-1	160	10	MO-2-1501-27A	C	LPCI DW Spray
					2-1501-28A	C	
				3/4	2-1501-45A	C	(Vent)
					MO-2-1501-32B	O	
					2-1501-29A	C	(Test Connection)
					2-1501-30A	C	(Test Connection)
29	311A	509-0	120	6	MO-2-1501-18A	C	LPCI Torus Spray
					MO-2-1501-19A	C	
				3/4	2-1501-40A	C	(Drain/Test Connection)
29	311B	509-0	240	6	MO-2-1501-18B	C	
					MO-2-1501-19B	C	
				3/4	2-1501-40B	C	(Drain/Test Connection)
29	-	-	-	14	MO-2-1501-5A	O	LPCI Suction
					MO-2-1501-5B	O	
					MO-2-1501-5C	O	
					MO-2-1501-5D	O	
					2-1501-6D	C	
					2-1501-6A	C	

APPROVED
SEP 10 '84
D.O.S.R.

UNIT 2 VALVE LINEUP (Cont'd.)

APPROVED
SEP 10 '84
D.O.S.R.

[illegible]	PENT NO.	LOCATION ELEV.	LOCATION AZI.	LINE SIZE	VALVE NUMBER	DESIRED NORMAL VALVE POSITION	DESCRIPTION
	-	-	-	14	2-1501-73A	C	
					2-1501-73B	C	
					2-1501-70B	C	
					2-1501-70A	C	
					2-1599-27A	C	
					2-1599-27B	C	
					2-1501-31A	C	
					2-1501-31B	C	
					2-1501-31C	C	
					2-1501-31D	C	
					2-1501-66A	C	ECCS Fill
					2-1501-66B	C	
30	113	547-10	300	10	MO-2-1201-1	C	Rx Cleanup
					MO-2-1201-2	C	
					MO-2-1201-3	C	
				2	MO-2-1201-1A	C	
				1/2	2-1299-4	C	(Drain/Test Connection)
					2-1299-5	C	
					2-1299-6	C	
					2-1201-31	C	(Vent on Clean-Up Aux Pump)
					2-1201-32	C	
					2-1299-11	C	CU Hdr Test Tap
32	111A	530-8	25	16	MO-2-1001-1A	C	Shutdown Cooling
				3/4	2-1001-88A	C	(Gland Seal Leak-Off)
					2-1001-46A	C	(Drain)
					2-1001-45A	C	(Drain)
				14	MO-2-1001-2A	C	(Pump Suction)
					MO-2-1001-2B	C	(Pump Suction)
				3/4	2-1001-92A	C	(Drain/Gland Seal)
					2-1001-92B	C	(Drain/Gland Seal)
					2-1001-93A	C	(Drain)
					2-1001-93B	C	(Drain)
					2-1001-47A	C	(Vent)
					2-1001-48A	C	(Vent)
					2-1001-206A	C	Manual Bypass Around 2A Valve
					2-1001-206B	C	Manual Bypass Around 2B Valve
32	111B	530-8	70	16	MO-2-1001-1B	C	Shutdown Cooling
				3/4	2-1001-88B	C	(Gland Seal Leak-Off)
					2-1001-46B	C	(Drain)
					2-1001-45B	C	(Drain)
				14	MO-2-1001-2C	C	(Pump Suction)
				3/4	2-1001-92C	C	(Drain/Gland Seal)
					2-1001-93C	C	(Drain)
					2-1001-47B	C	(Vent)
					2-1001-48B	C	(Vent)
					2-1001-200	C	
					2-1001-206C	C	Manual Bypass Around 2C Valve
32	116A	513-9	83	14	MO-2-1001-5A	C	Shutdown Cooling
				3/4	2-1001-14A	C	(Gland Seal Leak-Off)
					2-1001-10A	C	
					2-1001-28A	O	SDC to HRSS
32	116B	513-9	263	14	MO-2-1001-5B	C	Shutdown Cooling

UNIT 2 VALVE LINEUP (Cont'd.)

P&ID	PENT NO.	LOCATION ELEV.	AZI.	LINE SIZE	VALVE NUMBER	DESIRED NORMAL VALVE POSITION	DESCRIPTION
32	116B	513-9	263	3/4	2-1001-14B	C	(Gland Seal Leak-Off)
					2-1001-10B	C	
					2-1001-28B	C	(Drain)
33	130	581-0	340	1-1/2	2-1101-1	O	SBLC
				1/2	2-1199-104	C	(Drain)
					2-1199-105	C	
					2-1199-103	C	(Test Connection)
					2-1199-102	C	
					2-1199-107	C	(Test Connection)
					2-1199-106	C	
34	144	547-6	150	3/4	2-301-96	C	CRD (Return Test Conn)
					2-301-97	C	
				1/2	2-301-500	C	CRD (Return Test Conn)
					2-301-501	C	
35	119	527-6	275	3	2-4327-500	C	Clean Demin Water
37	112A	547-5	8	1/4	-	C	Drywell Cooler Damper Control (11 Valves)
				1/4	-	C	(5 Valves)
	112B	547-5	21	1/4	-	C	(25 Valves)
37	121	527-6	283	1	2-1601-4B	O	DW Pneumatic
					AO-2-4722	C	
				1/4	-	C	(Test Connection by 4722)
					2-4741-20C	O	(Test Vent)
37	139D	537-6	280	1	AO-2-4720	C	DW Pneumatic
					AO-2-4721	C	
				1/4	-	C	(Test Connection between 4720 and 4721)
					2-4771-500	O	(Test Vent)
					2-4771-501	O	(Test Vent)
38	120	527-6	280	3	2-4630-500	C	Service Air
				3	2-4609-501	C	
		510-0			-	O	(Hose Conn Col H-42)
		480-0			-	O	(Hose Conn Col G-42)
39	118	512-3	45	3	AO-2-2001-5	C	DW Equip Drain
					AO-2-2001-6	C	
				3/4	2-2005-506	C	(Test Connection)
				3	AO-2-2001-3	O	
39	117	512-3	165	3	AO-2-2001-105	C	DW Floor Drain

APPROVED
SEP 10 '84
D.O.S.R.

UNIT 2 VALVE LINEUP (Cont'd.)

P&ID	PENT NO.	LOCATION ELEV.	AZI.	LINE SIZE	VALVE NUMBER	DESIRED NORMAL VALVE POSITION	DESCRIPTION
39	117	512-3	185		AO-2-2001-106	C	DW Floor Drain
				3/4	2-2001-500	C	(Test Connection)
49		561		18	MO-2-7503	O	U-2 Rx Bldg Normal Vent
51	115A	513-9	97	10	MO-2-2301-3	O	HPCI
					MO-2-2301-4	C	
					MO-2-2301-5	C	
				3/4	2-2301-16	C	
					2-2301-17	C	(Test Connection)
					2-2301-72	C	(Gland Seal Leak-Off)
				1	SO-2-2301-31	O	
					SO-2-2301-28	C	
					SO-2-2301-29	C	
					SO-2-2301-30	C	
					2-2301-43	C	Test between AO-2301-29 and AO-2301-30
					2-2301-44	C	
51	141A	542-6	160	3/4	2-2301-24	O	HPCI Instrumentation
					2-2301-25	O	
	317A	509-10	190	3/4	2-2301-41A	C	HPCI Cond Return
				3/4	2-2301-42A	C	(Test Conn)
51	312	497-0	200	3/4	2-2301-41B	C	HPCI Drain Pot Drain
				3/4	2-2301-42B	C	(Test Conn)
				2	2-2301-33	O	
					2-2301-47	O	
				1	SO-2-2301-32	C	
51	310A	509-0	118	4	MO-2-2301-14	C	HPCI Min Flow
					BKR for 2301-14	Racked Open	
51	-	-	-	16	MO-2-2301-35	C	HPCI Suction
					MO-2-2301-36	C	
					MO-2-2301-6	O	
					2-2301-93	C	Drain
					2-2301-94	C	Drain
					2-2301-37	C	Test Conn
					2-2301-38	C	Test Conn
707 Sh 1 of 2	204B	532	195°	1"	AO-2-2599-2B	C	ACAD
				3/4"	2-2599-11B	C	ACAD
				3/4"	2-2599-12B	C	ACAD
	204B	532	195°	1"	2-2599-25B	O	ACAD

APPROVED
SEP 10 '84
D.O.S.R.

UNIT 2 VALVE LINEUP (Cont'd.)

P&ID	PENT NO.	LOCATION ELEV.	LOCATION AZI.	LINE SIZE	VALVE NUMBER	DESIRED NORMAL VALVE POSITION	DESCRIPTION
707 Sh 1 of 2	316B	Torus	305	1"	AO-2-2599-3B	C	ACAD
				3/4"	2-2599-14B	C	ACAD
				3/4"	2-2599-13B	C	ACAD
	316A	Torus	55°	1"	AO-2-2599-3A	C	ACAD
				3/4"	2-2599-14A	C	ACAD
				3/4"	2-2599-13A	C	ACAD
	202V	534	165°	1"	AO-2-2599-2A	C	ACAD
				3/4"	2-2599-11A	C	ACAD
				3/4"	2-2599-12A	C	ACAD
				1"	2-2599-25A	O	ACAD
				1"	2-2599-21	O	ACAD
	ACAD AIR COMPRESSOR				OFF		AIR PRESSURE DRAIN
	125	572	145°	1"	AO-2-2599-4A	C	
					FCV-2-2599-5A	C	
					AO-2-2599-4B	C	
					FCV-2-2599-5B	C	
				3/4"	2-2599-15A	C	
					2-2599-16A	C	
					2-2599-15B	C	
					2-2599-16B	C	
707 Sh 2 of 2	202V	534	165°	1/2"	SO-2-2499-2A	C	CAM
				1/2"	SO-2-2499-1A	C	CAM
				1/2"	2-2499-7A	C	CAM

APPROVED
SEP 10 '84
D.O.S.R.

UNIT 2 VALVE LINEUP (Cont'd.)

P&ID	PENT NO.	LOCATION ELEV.	AZI.	LINE SIZE	VALVE NUMBER	DESIRED NORMAL VALVE POSITION	DESCRIPTION
707 Sh 2 of 2				1/2"	2-2499-8A	C	CAM
	316A	Torus	55°	1/2"	SO-2-2499-4A	C	CAM
				1/2"	SO-2-2499-3A	C	CAM
				1/2"	2-2499-10A	C	CAM
				1/2"	2-2499-9A	C	CAM
	204B	532	195°	1/2"	SO-2-2499-2B	C	CAM
				1/2"	SO-2-2499-1B	C	CAM
				1/2"	2-2499-7B	C	CAM
				1/2"	2-2499-8B	C	CAM
	316B	Torus	305°	1/2"	SO-2-2499-4B	C	CAM
				1/2"	SO-2-2499-3B	C	CAM
				1/2"	2-2499-10B	C	CAM
				1/2"	2-2499-9B	C	CAM

APPROVED
SEP 10 '84
D.O.S.R.

UNIT 3 VALVE LINEUP

P&ID	PENT NO.	LOCATION ELEV.	LOCATION AZI.	LINE SIZE	VALVE NUMBER	DESIRED NORMAL VALVE POSITION	DESCRIPTION
356	X-115A	528-0	110	3/4	3-1601-4A	O	ECCS & AUTO Blowdown
	X-115B		115		3-1601-4B	O	
	X-127D		290		3-1601-4C	O	
	X-127E		295		3-1601-4D	O	
353	X-123	513-9	45	6	MO-3-3702	C	RBCCW INLET
353	X-124	513-9	48	6	MO-3-3703	O	RBCCW OUTLET
					MO-3-3706	O	
360	X-116A	513-9	83	16	MO-3-1501-22A	C	LPCI INJECTION
	X-116B		263		MO-3-1501-22B	C	
				3/4	3-1599-2A	C	DRAIN
					3-1599-2B	C	
360	X-310A	509-0	118	14	MO-3-1501-20A	C	LPCI TEST LINE
					MO-3-1501-38A	C	
					MO-3-1501-87A	C	TEST CONN
	X-310B		238		MO-3-1501-20B	C	
					MO-3-1501-38B	C	
					MO-3-1501-87B	C	TEST CONN
3	X-311A	509-0	120	6	MO-3-1501-18A	C	LPCI TORUS SPRAY
					MO-3-1501-19A	C	
	X-311B		240		MO-3-1501-18B	C	
					MO-3-1501-19B	C	
360	X-150A	547-6	210	10	MO-3-1501-27B	C	LPCI DW SPRAY
					MO-3-1501-28B	C	
					3-1501-30B	C	
					3-1501-29B	C	
	X-145				MO-3-1501-27A	C	
					MO-3-1501-28A	C	
					3-1501-30A	C	TEST CONN
					3-1501-29A	C	
360				24	MO-3-1501-5A	O	
					MO-3-1501-5B	O	
					MO-3-1501-5C	O	
					MO-3-1501-5D	O	
				14	3-1501-31A	C	
				14	3-1501-31B	C	
				14"	3-1501-31C	C	
					3-1501-31D	C	
345	X-105A	517-6	5	20"	AO-3-203-1A	C	PRIMARY STEAM
					AO-3-203-2A	C	

APPROVED
SEP 10 '84
D.O.S.R.

UNIT 3 VALVE LINEUP (Cont'd.)

P&ID	PENT NO.	LOCATION ELEV.	AZI.	LINE SIZE	VALVE NUMBER	DESIRED NORMAL VALVE POSITION	DESCRIPTION
345	X-105A	517-6	5	3/4"	3-220-7A	C	GLAND SEAL LEAK-OFF
					3-220-8A	C	GLAND SEAL LEAK-OFF
					3-220-9A	C	VLV BODY DRAIN
					3-220-10A	C	VLV BODY DRAIN
					-	C	2 HSL TEST CONN
					D/W Cooler Damper Control N_2 Supply	C	
					Inst. Air Supply	C	
					Air Supply at Hdr	C	
					Air Supply Drain	C	
345	X-105B	517-6	10	20"	AO-3-203-1B	C	PRIMARY STEAM
					AO-3-203-2B	C	
				3/4"	3-220-7B	C	GLAND SEAL LEAK-OFF
					3-220-8B	C	GLAND SEAL LEAK-OFF
					3-220-9B	C	VLV BODY DRAIN
					3-220-10B	C	
					-	C	2 MSL TEST CONN
345	X-105C	517-6	350	20	AO-3-203-1C	C	PRIMARY STEAM
					AO-3-203-2C	C	
				3/4"	3-220-7C	C	GLAND SEAL LEAK-OFF
					3-220-8C	C	GLAND SEAL LEAK-OFF
					3-220-9C	C	(VLV BODY DRAIN)
					3-220-10C	C	(VLV BODY DRAIN)
					-	C	(2 MSL TEST CONN)
345	X-105D	517-6	355	20"	AO-3-203-1D	C	PRIMARY STEAM
					AO-3-203-2D	C	
				3/4"	3-220-7D	C	GLAND SEAL LEAK-OFF
					3-220-8D	C	GLAND SEAL LEAK-OFF
					3-220-9D	C	VLV BODY DRAIN
					3-220-10D	C	
					-	C	(2 MSL TEST CONN)
345	X-106	515-0	0	2"	MO-3-220-1	C	MSL DRAIN
					MO-3-220-2	C	
					MO-3-220-3	O	
					MO-3-220-4	C	
				3/4"	3-220-5	C	(TEST CONN)
					3-220-6	C	
				2"	MO-3-220-90A	O	
					MO-3-220-90B	O	
					MO-3-220-90C	O	
					MO-3-220-90D	O	

APPROVED

SEP 10 '84

D.O.S.R.

UNIT 3 VALVE LINEUP (Cont'd.)

P&ID	PENT NO.	LOCATION ELEV.	AZI.	LINE SIZE	VALVE NUMBER	DESIRED NORMAL VALVE POSITION	DESCRIPTION
345	X-106	515-0	0	2"	3-3025-500	O	(MSL DRAIN HOSE CONN)
					3-3025-501	O	
345	X-135B	513-9	275	3/4"	3-220-11A	O	MSL FLOW INSTR
	X-135C				3-220-12A	O	
	X-135E				3-220-11B	O	
	X-135F				3-220-12B	O	
	X-129B				3-220-11C	O	
	X-129C				3-220-12C	O	
	X-129E				3-220-11D	O	
	X-129F				3-220-12D	O	
356	X-126	513-0	332	18"	AO-3-1601-21	C	N_2 PURGE LINE
					AO-3-1601-22	C	
					3-1601-504	C	TEST CONN
					-	C	D/W TORUS VENT
				4"	AO-3-1601-55	C	
				18"	AO-3-1601-56	C	
				3"	3-8502-500	C	BYPASS VLV
				1½"	MO-3-1601-57	C	N_2 MAKE UP
					AO-3-1601-58	C	N_2 MAKE UP
					AO-3-1601-59	C	
				"	3-1601-500A	C	TEST CONN. BY 20A
356	X-304	509-0	270	18"	AO-3-1601-20A	C	TORUS VACUUM RELIEF
					AO-3-1601-20B	C	(NOTE: FAIL OPEN)
					3-1601-500B	C	(TEST CONN. 1@)
356	X-125	572-0	145	18"	AO-3-1601-23	C	DRYWELL VENT
					AO-3-1601-24	C	(TO EXHAUST FANS)
				2"	AO-3-1601-62	C	BYPASS VENT RELIEF
				6"	AO-3-1601-63	C	TO STBY GAS
				3/4"	-	C	TEST CONN EL 570'
356	X-318	509	95	18"	AO-3-1601-60	C	TORUS VENT
				2"	AO-3-1601-61	C	BYPASS VENT RELIEF
				3/4"	3-1601-52	C	(TEST CONN EL 510') NEAR
					and 53	C	1601-60 and 61
					3-1601-527	C	TEST CONN NEAR N_2 MAKE UP
356	X-309A	498-7	155	1/2"	FCV-3-8501-1A	C	TORUS SAMPLE
					FCV-3-8501-1B	C	
					-	C	
356	X-204	532-6	190	1	FCV-3-8501-3A	C	SAMPLE RETURN
					FCV-3-8501-3B	C	
					-	C	

APPROVED

SEP 10 '84

D.O.S.R.

UNIT 3 VALVE LINEUP (Cont'd.)

P&ID	PENT NO.	LOCATION ELEV.	AZI.	LINE SIZE	VALVE NUMBER	DESIRED NORMAL VALVE POSITION	DESCRIPTION
356	X-143	547-6	120	1/2"	FCV-3-8501-5A	C	DRYWELL SAMPLE
					FCV-3-8501-5B	C	
					FCV-3-9205A	C	
					FCV-3-9205B	C	
					FCV-3-9206A	C	
					FCV-3-9206B	C	
					3-8507-500	C	
					3-8507-501	C	
					3-8507-502	C	
					3-8507-503	C	
					3-8507-504	C	
					3-8507-505	C	
					3-8507-506	C	
					3-8507-507	C	
					3-8507-508	C	
					3-8507-509	C	
					3-8507-510	C	
					3-8507-511	C	
					3-8507-512	C	
					3-8507-513	C	
					3-8507-514	C	
					3-8507-515	C	
					3-8507-516	C	
					3-8507-517	C	
					3-8507-518	C	
					3-8507-519	C	
					3-8507-520	C	
					3-8507-521	C	
					3-8507-522	C	
					3-8507-523	C	
367	X-136A-E	517-6	90	3/8"	A Tip Ball Vlv	C	
					B Tip Ball Vlv	C	
					C Tip Ball Vlv	C	
					D Tip Ball Vlv	C	
					E Tip Ball Vlv	C	
					Tip Power (MCC 38-1) Switches 19, 21, 23	OFF	
					Tip Power (MCC 38-1) Switches 20, 22, 24	OFF	
357	X-147	564-0	295	2½"	3-205-2-3	O	Rx HEAD COOLING
					MO-3-205-2-4	C	
				3/4"	3-205-2-1	O	DRAIN
					3-205-2-2	O	DRAIN
					3-205-2-5	C	TEST CONN.
					3-220-48	O	Rx HEAD VENT
					3-220-49	O	
	X-133A	563-0	70	1"	3-220-53	O	Rx VESSEL INSTR

APPROVED
SEP 10 '84
D.O.S.R.

UNIT 3 VALVE LINEUP (Cont'd.)

P&ID	PENT NO.	LOCATION ELEV.	LOCATION AZI.	LINE SIZE	VALVE NUMBER	DESIRED NORMAL VALVE POSITION	DESCRIPTION
357	X-133D	560-0	70	1"	3-263-2-10	0	Rx Vessel Instr.
	X-134B	565-0	70	1"	3-263-2-12B	0	
	X-134C			1"	3-263-2-14B	0	
	X-133B	564-0	70	1"	3-263-2-12A	0	
	X-133C			1"	3-263-2-14A	0	
	X-133E			1"	3-263-2-16A	0	
	X-133F			1"	3-263-2-18A	0	
					3-263-41A	0	
	X-134E			1"	3-263-2-16B	0	
	X-134F			1"	3-263-2-18B	0	
					3-263-41B	0	
	X-142A	540-0	75	1"	3-263-2-21A	0	
					3-263-2-21B	0	
					3-263-2-22A	0	
					3-263-2-22B	0	
					3-263-2-30B	0	
					3-263-2-30C	0	
					3-263-2-30D	0	
					3-263-2-30E	0	
					3-263-2-30G	0	
					3-263-2-30H	0	
					3-263-2-30J	0	
					3-263-2-30K	0	
	X-142B		245	1"	3-263-2-21C	0	
					3-263-2-21D	0	
					3-263-2-22C	0	
					3-263-2-22D	0	
					3-263-2-30M	0	
					3-263-2-30N	0	
					3-263-2-30P	0	
					3-263-2-30R	0	
					3-263-2-30T	0	
					3-263-2-30U	0	
					3-263-2-30V	0	
					3-263-2-30W	0	
357	X-141A	541-0	145	1"	3-220-66A	0	
					D/W O_2 Anal Cab Switches #1	OFF	
					#2	OFF	
					#3	OFF	
					#4	OFF	
					3-220-66B	0	
					3-220-66C	0	
					3-220-66D	0	
	X-151	530-0	205	1"	3-220-66E	0	

APPROVED
SEP 10 '84
D.O.S.R.

UNIT 3 VALVE LINEUP (Cont'd.)

P&ID	PENT NO.	LOCATION ELEV.	AZI	LINE SIZE	VALVE NUMBER	DESIRED NORMAL VALVE POSITION	DESCRIPTION
357	X-151	530-0	205	1"	3-220-66F	O	
					3-220-66G	O	
					3-220-66H	O	
	X-130B	510-0	90	1"	3-220-15A	O	
	X-130C			1"	3-220-16A	O	
	X-131B	270		1"	3-220-15B	O	
	X-131C			1"	3-220-16B	O	
					3-262-2-4A	O	
	X-130A			1"	3-262-2-3A	O	
	X-131A			1"	3-262-2-3B	O	
	X-130E			1"	3-220-13A	O	
	X-130F			1"	3-220-14A	O	
	X-131D			1"	3-262-2-4B	O	
					3-263-2-24	O	
					3-263-2-26	O	
					3-263-2-32	O	
	X-131E			1"	3-220-13B	O	
	X-131F			1"	3-220-14B	O	
357	X-122	548-8	265	3.4"	AO-3-220-44	C	Rx WATER SAMPLE
					AO-3-220-45	C	
					3-220-42	C	TEST CONNECTION
					3-220-43	C	
358	X-149A	564-9	20	10"	3-1402-6A	O	CORE SPRAY
					MO-3-1402-25A	C	
				3/4"	3-1402-32A	C	TEST CONN
					3-1402-33A	C	
				16	MO-3-1402-3A	O	
				12	3-1402-2A	C	
					3-1402-46A	C	
					3-1402-35A	C	
358	X-149B	564-9	155	10"	3-1402-6B	O	CORE SPRAY
					MO-3-1402-25B	C	
				3/4"	3-1402-32B	C	TEST CONN
					3-1402-33B	C	
				16	MO-3-1402-3B	O	
					3-1402-2B	C	
358	X-310A	509-0	118	8"	MO-3-1402-4A	C	CORE SPRAY TEST LINE
	X-310B		238	8"	MO-3-1402-4B	C	
					3-1402-46B	C	
					3-1402-35B	C	
359	X-108A			14"	MO-3-1301-1	O	
					MO-3-1301-2	O	
				3/4"	3-1301-34	C	(TEST CONN)

APPROVED
SEP 10 '84
D.O.S.R.

UNIT 3 VALVE LINEUP (Cont'd.)

P&ID	PENT NO.	LOCATION ELEV.	AZI	LINE SIZE	VALVE NUMBER	DESIRED NORMAL VALVE POSITION	DESCRIPTION
359	X-108A			3/4"	3-1301-35	C	(TEST CONN)
					-	C	2 VLVS GLAND SEAL LEAK-OFF
				1"	3-1301-21	O	
					3-1301-22	O	
	X-132D				3-1301-27	O	
	X-132A				3-1301-28	O	
	X-108A			3/4"	AO-3-1301-17	C	
					AO-3-1301-20	C	
					3-1301-602	C	TEST CONN
					3-1301-603	C	
					3-1301-14	C	(VENT)
					3-1301-15	C	
					3-1301-501	C	
					3-1301-500	C	
359	X-109A	547-10	178	12"	MO-3-1301-3	C	ISOLATION COND
					MO-3-1301-4	C	
				3/4"	3-1301-32	C	(TEST CONN)
					3-1301-33	C	
					3-1301-18	C	(DRAIN)
					3-1301-19	C	2 VLVS RWCU HDR DRAIN
					-	C	2 VLVS RWCU HDR DRAIN
361	X-113	547-10	300	10"	MO-3-1201-1	C	Rx CLEANUP
					MO-3-1201-2	C	
					MO-3-1201-3	C	
				2	MO-3-1201-1A	C	
				3/4"	3-1201-31	C	
					3-1201-32	C	
					3-1299-13	C	
					3-1299-7	C	DW TEST CONN
					3-1299-8	C	
363	X-111A	530-8	25	16"	MO-3-1001-1A	C	SHUTDOWN COOLING
				3/4"	3-1001-45A	C	DRAIN
					3-1001-46A	C	
					3-1001-47A	C	DRAIN
					3-1001-48A	C	
				14"	MO-3-1001-2A	C	
					MO-3-1001-2B	C	
				3/4"	3-1001-92A	C	(DRAIN)
					3-1001-9[illegible]B	C	DRAIN
					3-100[illegible]A	C	GLAND SEAL LEAK-OFF
363	X-111B	530-7	70	16"	MO-3-1001-1B	C	SHUTDOWN COOLING
				3/4"	3-1001-45B	C	DRAIN

APPROVED

SEP 10 '84

D.O.S.R.

UNIT 3 VALVE LINEUP (Cont'd.)

P&ID	PENT NO.	LOCATION ELEV.	LOCATION AZI.	LINE SIZE	VALVE NUMBER	DESIRED NORMAL VALVE POSITION	DESCRIPTION
363	X-111B	530-7	70	3/4"	3-1001-46B	C	DRAIN
					3-1001-47B	C	
					3-1001-48B	C	
				14"	MO-3-1001-2C	C	
				3/4"	3-1001-92C	C	DRAIN
					3-1001-88B	C	GLAND SEAL LEAK-OFF
363	X-116A	513-9	83	14"	MO-3-1001-5A	C	SHUTDOWN COOLING
				3/4"	3-1001-10A	C	GLAND SEAL LEAK-OFF
					3-1001-14A	C	
					3-1001-28A	C	
					3-1001-29A	C	
363	X-116B	513-9	263	14"	MO-3-1001-5B	C	SHUTDOWN COOLING
				3/4"	3-1001-10B	C	GLAND SEAL LEAK-OFF
					3-1001-14B	C	
					3-1001-28B	C	
					3-1001-29B	C	
364	X-138	581-0	340	1½"	3-1101-1	O	SBLC
				3/4"	3-1159-005	C	2 Vlvs VENT: IN DW
					-006	C	TEST CONN
					3-1159-9	C	2 Vlvs TEST CONN: IN DW
					-10	C	2 Vlvs TEST CONN: IN DW
					-003, 004	C	2 Vlvs TEST CONN: OUT DW
					-3, 4	C	2 Vlvs TEST CONN: OUT DW
365	X-109B	547	185	4"	3-301-500	C	CRD RETURN
					3-301-501	C	CRD RETURN
					3-301-93	C	CRD RETURN
					3-301-96	C	CRD RETURN
					3-301-97	C	CRD RETURN
367	X-121	527-6	283	1"	3-4741-20B	C	DW PNEUMATIC SYSTEM
					3-1601-4B	O	
				2"	AO-3-4722	C	
				¼"	Top Test Conn.	C	
					3-4741-20C	O	(VENT) REMOVE CAP
367	X-1390	536-6	280	1"	AO-3-4720	C	DW PNEUMATIC SYSTEM
				¼"	Test Conn.	C	
					AO-3-4721	C	
					3-4771-500	O	VENT PATH
					3-4771-501	O	
368	X-120	527-6	280	1"	3-4640-500	C	SERVICE AIR
				4"	-	O	VENT VALVE OFF OF LINE 4609A-4"

APPROVED

SEP 10 '84

D.O.S.R.

UNIT 3 VALVE LINEUP (Cont'd.)

P&ID	PENT NO.	LOCATION ELEV.	LOCATION AZI.	LINE SIZE	VALVE NUMBER	DESIRED NORMAL VALVE POSITION	DESCRIPTION
					4" Service Air Stop Outside Sludge Tank Rm Top Valve	C	
					-	O	VENT SERVICE ON 517' LEVEL WEST
					Service Air Stop just inside the Sludge Tank Rm.	O	
					-	C	VALVE ON LINE 3-4609-A4
369	X-118	512-3	45	3"	AO-3-2001-105	C	DW EQUIP DRAIN
					AO-3-2001-106	C	
	X-117	512-3	185	3"	AO-3-2001-5	C	DW FLOOR DRAIN
					AO-3-2001-6	C	
					AO-3-2001-3	O	
374	X-128	513-9	97	10"	MO-3-2301-3	C	HPCI
					MO-3-2301-4	C	
					MO-3-2301-5	C	
					MO-3-2301-6	O	
				3/4"	3-2301-16	C	TEST CONN.
					3-2301-17	C	
					MO-3-2301-35	C	
				16"	MO-3-2301-36	C	
				3/4"	3-2301-93	C	DRAIN
					3-2301-94	C	
				1"	SO-3-2301-31	O	
					SO-3-2301-29	C	
					SO-3-2301-30	C	
					3-2301-43	C	TEST CONN.
					3-2301-44	C	
374	X-132C	542-6	160	3/4"	3-2301-24	O	HPCI INSTR
	X-132B				3-2301-25	O	
	X-317A	509-10	190	3/4"	3-2301-41A	C	HPCI (TEST CONN)
					3-2301-42A	C	
					SO-3-2301-28	C	
		497-0	200	3/4"	3-2301-41B	C	HPCI (TEST CONN)
					3-2301-42B	C	
				1"	SO-3-2301-32	C	
					3-2301-50	O	UNMARKED BYPASS VALVE
					3-2301-74	O	AROUND 3-2301-33 AND
					MO-3-2301-14	C	3-2301-47
					BKR for 2301-14		RACKED OPEN
707 Sh 2 of 2	125	572	215	3/4"	3-2599-15A	C	ACAD
					3-2599-15B	C	ACAD
					3-2599-16A	C	ACAD
					3-2599-16B	C	ACAD
				1"	AO-3-2599-4A	C	ACAD

APPROVED

SEP 10 '84

D.O.S.P.

UNIT 3 VALVE LINEUP (Cont'd.)

P&ID	PENT NO.	LOCATION ELEV.	LOCATION AZI.	LINE SIZE	VALVE NUMBER	DESIRED NORMAL VALVE POSITION	DESCRIPTION
707 Sh 2 of 2	125	572	215	1"	AO-3-2599-5A	C	ACAD
					AO-3-2599-4B	C	ACAD
					AO-3-2599-5B	C	ACAD
	146	541	105		3-2599-25A	O	ACAD
					AO-3-2599-2A	C	ACAD
	140B	530	310	3/4"	3-2599-11A	C	ACAD
					3-2599-12A	C	ACAD
	316A	504	60	1"	AO-3-2599-3A	C	ACAD
				3/4"	3-2599-13A	C	ACAD
					3-2599-14A	C	ACAD
	127	531	245	1"	3-2599-25B	O	ACAD
					3-2599-21	O	RECEIVER DRAIN VALVE
	127	531	245		AO-3-2599-2B	C	ACAD
				3/4"	3-2599-11B	C	ACAD
					3-2599-12B	C	ACAD
	316B	504	280	1"	AO-3-2599-3B	C	ACAD
				3/4"	3-2599-13B	C	ACAD
					3-2599-14B	C	ACAD
	146	541	105	1/2"	SO-3-2499-2A	C	CAM
					SO-3-2499-1A	C	CAM
				1/2"	3-2499-7A	C	CAM
				1/2"	3-2499-8A	C	CAM
	316A	Torus	65°	1/2"	SO-3-2499-4A	C	CAM
					SO-3-2499-3A	C	CAM
				1/2"	3-2499-10A	C	CAM
				1/2"	3-2499-9A	C	CAM
	127	532	245	1/2"	SO-3-2499-2B	C	CAM
					SO-3-2499-1B	C	CAM
				1/2"	3-2499-7B	C	CAM
				1/2"	3-2499-8B	C	CAM
	316B	Torus	305°	1/2"	SO-3-2499-4B	C	CAM
					SO-3-2499-3B	C	CAM
				1/2"	3-2199-10B	C	CAM
				1/2"	3-2199-9B	C	CAM

APPROVED
SEP 10 '84
D.O.S.R.

INSTRUMENT MAINTENANCE DEPARTMENT
CHECKLIST 4

A. Pretest Requirements

1. Obtain and supply to the responsible Tech Staff Engineer a calibration curve for the read-out of sensor LI-2(3)-263-101.

2. Take the "A" Pumpback air compressor OUT-OF-SERVICE and then disconnect and vent the low suction pressure switch trip sensing line to atmosphere.

Verified ______________________________

3. Install and connect all instrumentation (includes both plumbing and electrical connections) both inside and outside the containment.

Verified ______________________________

4. Install the cable from the LT 2(3)-263-61 to I.L.R.T. console channel 5 (for Rx. water level).

Verified ______________________________

5. Remove existing temperature sensor from the 2(3)-1045 A & B well then insert volumetric RTD's in A & B loop (SDC pump room).

Verified ______________________________

B. Test Requirements

1. During the full duration of the test, no surveillances shall be conducted that have the potential of causing a scram.

Verified ______________________________

C. Post Test Requirements

1. Disconnect and remove all ILRT temporary instrumentation.

Verified ______________________________

2. Connect the "A" Pumpback air compressor low suction pressure switch trip sensing line and clear the system outage.

Verified ______________________________

APPROVED

SEP 10 '84

D.O.S.R.

3. Calibrate the following pressure sensors after completion of the test.

PS-3-1621A	PS-3-1632A	PS-1501-62A	PS-3-1628A
PS-3-1621B	PS-3-1632B	PS-1501-62B	PS-3-1628B
PS-3-1621C	PS-3-1632C	PS-1501-62C	PS-3-1629A
PS-3-1621D	PS-3-1632D	PS-1501-62D	PS-3-1629B

Verified____________________

4. Remove the cable from the LT 2(3)-263-61.

Verified____________________

5. Remove the RTD's from 2(3)-1045 A & B and reinstall the existing temperature sensors.

Verified____________________

APPROVED

SEP 10 '84

D.O.S.R.

TECHNICAL STAFF
CHECKLIST 5

A. Pretest Requirements

1. Arrange for the calibration of the instrumentation to be used.

Verified ______________________

2. Make a survey of the primary containment for the purpose of establishing any tendencies for regional variations in temperature. This survey will be used in determining where to place the temperature sensing devices.

Verified ______________________

NOTE

Where testing experience with a given containment structure has previously established appropriate locations for temperature sensors, temperature surveys may be eliminated.

3. At the same time as the temperature survey, conduct a survey for the purpose of determining the placement of the humidity indicators so that a representative sampling of the primary containment air can be made.

Verified ______________________

NOTE

As in the case of the temperature survey, this humidity survey may be eliminated for a containment structure which has known and characteristic humidity patterns.

4. Determine the placement of all temperature and humidity sensing devices from the surveys in steps 2 and 3 above.

Verified ______________________

5. Obtain the instrument accuracies for all instruments and readout devices to be used in the ILRT. Perform an error analysis to verify that the accuracy of the collected data is consistent with the magnitude of the specified leakage rate. This analysis must be done prior to the placement of any instrumentation in the primary containment for the test. (See Appendix A, attached, for a sample calculation.)

APPROVED

SEP 10 '84

D. . .R.

INTERPRETATION

Specifically, the combined instrument repeatability error should be less than 25% of La, the maximum allowable leak rate.

Verified ____________________

6. Arrange for the availability of the air compressors for use in pressurizing the containment.

Verified ____________________

7. Examine LLRT results for all tests and verify that all Technical Specification limits have been met prior to the start of the ILRT. Also, obtain the total calculated leakage from the primary containment penetrations both prior to and after repairs (in the case of double gasketed seals, before and after opening the seal). This information will be required when the results of the ILRT are analyzed.

Verified ____________________

8. Arrange with the Instrument Mechanics for placement of the calibrated instrumentation in the primary containment and its connection to read-out devices outside the primary containment. Verify the location and operability status of the instrumentation.

Verified ____________________

9. Verify the availability of instrumentation for the recording of ambient changes in the reactor building. These devices need only be of such accuracy that they will indicate gross barometric variations for correlation to test results.

Verified ____________________

10. Determine the volume of the primary containment associated with each temperature and humidity sensing device. This information will be used during the test for volume weighting the data.

Verified ____________________

11. Ensure that the air compressors, piping, manifolds and connections to the penetrations are installed by the Maintenance Department as required. Also verify proper operation of the compressors.

Verified ____________________

12. Conduct a thorough examination of the drywell and pressure

APPROVED
SEP 10 '84
D.O.S.R.

suppression containment to remove any pressurized vessels, gas pressure cylinders, sealed or semi-sealed containers, and anything which, in the judgement of the Test Director, could be damaged by the pressure test atmosphere or have a direct bearing on the results of the leakage rate measurement.

Verified ______________________

13. Verify valve line-up of Operating Department Checklist prior to starting the test.

Verified ______________________

14. Verify that the personnel air lock is closed and locked.

Verified ______________________

15. Direct the Operations Department in the pressurizing of the primary containment.

Verified ______________________

16. Initiate a dated log of events and pertinent observations. This log must be maintained for the duration of the ILRT.

Verified ______________________

17. Prepare graph paper for the plotting of the appropriate data.

Verified ______________________

18. Ensure that the following penetrations are closed and have been local leak rate tested.

Equipment Hatch
CRD Removal Hatch
Torus Access Hatches
Drywell Head

Verified ______________________

19. Fill out Figure 2 by specifying the number and location of each RTD in within the subvolumes indicated inside of the containment.

Verified ______________________

20. Record sump levels in the drywell equipment drain sump and the drywell floor drain sump.

Equip Sump Level ______________ inches

Floor Dr Sump Level ____________ inches

APPROVED

SEP 10 '84

D.O.S.R.

B. Post Test Requirements

1. Verify that all temporary instrumentation is removed.

   Verified ______________________

2. Verify that the torus access hatch that was opened for the removal of instruments is again local leak rate tested upon final closure.

   Verified______________________

3. Record pump levels in the drywell equipment drain sump and the drywell floor drain sump.

   Equip Sump Level ____________________

   Floor Dr Sump Level __________________

4. Verify that the following pressure switches have been calibrated after completion of the test

PS-3-1621A	PS-3-1621B	PS-3-1621C	PS-3-1621D
PS-3-1632A	PS-3-1632B	PS-3-1632C	PS-3-1632D
PS-3-1501-62A	PS-3-1501-62B	PS-3-1501-62C	PS-3-1501-62D
PS-3-1628A	PS-3-1628B	PS-3-1629A	PS-3-1629B

   Verified__________________________

RADIATION PROTECTION
CHECKLIST 6

1. Prior to any venting of the primary containment, an air sample must be taken for analysis.

   Verified ___________________________

APPROVED
SEP 10 '84
D.O.S.R.

APPROVED

SEP 10 '84

D.O.S.R.

DATA SHEET 1

TEMPERATURE SENSOR READINGS (°F)

DATE________________

UNIT________________

HOUR	RTD-1	RTD-2	RTD-3	RTD-4	RTD-5	RTD-6	RTD-7	RTD-8	RTD-9	RTD-10	RTD-11	RTD-12	RTD-13	RTD-14	RTD-15

APPROVED
SEP 10 '84
D.O.S.R.

DATA SHEET 1 (Cont'd.)
TEMPERATURE SENSOR READINGS (°F)

DATE________________

UNIT________________

HOUR	RTD-16	RTD-17	RTD-18	RTD-19	RTD-20	RTD-21	RTD-22	RTD-23	RTD-24	RTD-25	RTD-26	RTD-27	RTD-28	RTD-29	RTD-30

APPROVED
SEP 10 '84
D.O.S.R.

DATA SHEET 1 (Cont'd.)
DEWPOINT READINGS

DATE_______________

UNIT_______________

HOUR	DEWPOINT 1 (°F)	DEWPOINT 2 (°F)	DEWPOINT 3 (°F)	DEWPOINT 4 (°F)	DEWPOINT 5 (°F)	DEWPOINT 6 (°F)	DEWPOINT 7 (°F)	DEWPOINT 8 (°F)	DEWPOINT 9 (°F)

APPROVED

SEP 10 '84

D.O.S.R.

DATA SHEET 2
DATA TABULATION

DATE ____________

UNIT ____________

HOUR	AVERAGE AMBIENT TEMPERATURE (°F)	AMBIENT PRESSURE (psia)	AMBIENT RELATIVE HUMIDITY (%)	AMBIENT RELATIVE HUMIDITY (%)	REACTOR WATER TEMPERATURE (°F)	REACTOR WATER LEVEL (In above 0")	TORUS WATER LEVEL (In above 0")	SUPERIMPOSED LEAK RATE (SCFM)	

APPROVED

SEP 10 '84

D.O.S.R.

DATA SHEET 3
DATA TABULATION
REACTOR BUILDING TEMPERATURE SENSOR READINGS (°F)

DATE________________

UNIT________________

HOUR	LOCATION 1	LOCATION 2	LOCATION 3	LOCATION 4	LOCATION 5	LOCATION 6

APPROVED

SEP 10 '84

DATA SHEET 4
CALCULATED INFORMATION FOR THE ILRT D.O.S.R.

DATE________________

UNIT________________

HOUR	PRIMARY CONTAINMENT PRESSURE (psia)	PARTIAL PRESSURE OF H_2O IN P.C. (psia)	DRY AIR PRESSURE IN PRIMARY CONTAINMENT (psia)	AVERAGE TEMPERATURE IN PRIMARY CONTAINMENT (°F)

APPROVED

SEP 10 '84

D.O.S.R.

DTS 1600-7
Revision 7

DATA SHEET 4 (Cont'd.)
CALCULATED INFORMATION FOR ILRT

DATE ______________________

UNIT ______________________

HOUR	MEASURED CONTAINED DRY AIR MASS (lbs)	MEASURED LEAK RATE WT %/DAY			STATISTICAL LEAK RATE WT %/DAY		95% CONFIDENCE LIMIT WT %/DAY	
		24 HOURS		BN-TOP-1				
		TOTAL	POINT		24 HOURS	BN-TOP-1	24 HOURS	BN-TOP-1

APPENDIX A

A. INSTRUMENT ACCURACY ERROR ANALYSIS

Per Topical Report BN-TOP-1 the measured total time leak rate (M) in weight percent per day is computed using the Absolute Method by the formula

$$M = (100)\frac{24}{H}\left[1 - \frac{T_1\,\bar{P}_n}{T_n\,\bar{P}_1}\right]$$

where:

$\bar{P}_1 = P_1 - PV_1$ = total containment atmosphere absolute pressure, in psia, at the start of test, corrected for water vapor pressure.

$\bar{P}_n = P_n - PV_2$ = total containment atmosphere absolute pressure, in psia, at data point n after start of the test, corrected for water vapor pressure.

T_1, T_n = containment mean atmospheric temperature in or at the start and at data point n, respectively.

H = test interval in hours between time 1 and time n.

R = gas constant.

The change or uncertainty interval in M due to uncertainties in the measured variables is given by:

$$M = \frac{2400}{H}\left[\left(\frac{dM}{dP_2}\cdot\delta P_2\right)^2 + \left(\frac{dM}{dP_1}\cdot\delta P_1\right)^2 + \left(\frac{dM}{dT_1}\cdot\delta T_1\right)^2 + \left(\frac{dM}{dT_2}\cdot\delta T_2\right)^2\right]^{1/2} \quad (2)$$

where δ is the standard error for each variable. This formula assumes that all errors are systematic rather than random in character. Even though the formula is deterministic it does, however, allow assessment of figure of merit for various equipment to be used in the measuring system without the need for assembling and calibrating the system as an entity.

APPROVED

SEP 10 '84

[.].O.S.R.

The error in M after differentiating is:

$$e_M = \frac{2400}{H}\left[\left(-\frac{T_1}{\bar{P}_1 T_2} \cdot e_{\bar{P}_2}\right)^2 + \left(\frac{\bar{P}_2 T_1}{\bar{P}_1{}^2 T_2} \cdot e_{\bar{P}_1}\right)^2 + \left(-\frac{\bar{P}_2}{\bar{P}_1 T_2}\, e_T\right)^2 + \left(\frac{\bar{P}_2 T_1}{\bar{P}_1 T_2{}^2}\, e_T\right)^2\right]^{\frac{1}{2}}$$

where:

$$e_{\bar{P}_1} = \delta_{P_1}$$

$$e_{\bar{P}_2} = \delta_{P_2}$$

$$e_T = e_{T_1} = e_{T_2}$$

For the purpose of developing a finite rumber for e_M using equation (3), it is necessary to assume certain containment conditions made.

1. For purposes of comparison to other tests H = 24 hours.
2. Containment leak rate is essentially zero, that is:

$T_1 = T_2 = \bar{\bar{T}}$ where $\bar{\bar{T}}$ is the average volume weighted primary containment air temperature (°R) during the test;

$P_1 = P_2$ where P is the total containment atmospheric pressure (psia);

$PV_1 = PV_2$ where PV is the partial pressure of water vapor in the primary containment;

Equation (3) becomes:

$$e_M = \frac{2400}{H}\left[2\left(\frac{e_P}{\bar{P}}\right)^2 + 2\left(\frac{e_T}{\bar{\bar{T}}}\right)^2\right]$$

APPROVED

SEP 10 '84

D.O.S.R.

where:

e_P = the error in pressure which accounts for the error in the total pressure measurement system; both total absolute pressure and water vapor pressure.

$$e_P = \left[(e_{P_T})^2 + (e_{P_V})^2 \right]^{1/2}$$

e_{P_T} = inst. accuracy error/ $\sqrt{\text{no. inst.}}$ = error in total absolute pressure in psia.

e_{P_V} = inst. accuracy error/ $\sqrt{\text{no inst.}}$ = error in water vapor pressure (dewpoint) indicator in psia at 70°F.

e_T = inst. accuracy error/ $\sqrt{\text{no. inst.}}$ = error in temperature, °R.

APPROVED
SEP 10 '84
D.O.S.R.

APPENDIX B

A. INSTRUMENT ACCURACY ERROR ANALYSIS

Per ANSI N45.4-1972, the computation of the leak rate is given by the equation.

$$L(\%) = \left(\frac{24}{H}\right)(100)\left(\frac{W_1 - W_2}{W_1}\right) = \frac{2400}{H}\left(1 - \frac{T_1 P_2}{T_2 P_1}\right)$$

where L = primary containment leak rate (wt %/day)
H = time interval between data sets #1 & #2 (hours)
W_1 = weight of the contained dry air mass at test data set #1 (lbs)
W_2 = weight of primary containment temperature at test data set #2 (lbs)

T_1 = volume weighed primary containment temperature at test data set #1 (°R)
T_2 = volume weighed primary containment temperature at test data set #2 (°R)
P_1 = dry air absolute pressure at test data set #1 (psia)
P_2 = dry air absolute pressure at test data set #2 (psia)

The standard variation on L due to the uncertainties in the measured variables is given by:

$$\delta(L) = \frac{2400}{H}\left[\left(\frac{\partial L}{\partial P_1}\delta(P_1)\right)^2 + \left(\frac{\partial L}{\partial P_2}\delta(P_2)\right)^2 + \left(\frac{\partial L}{\partial T_1}\delta(T_1)\right)^2 + \left(\frac{\partial L}{\partial T_2}\delta(T_2)\right)^2\right]^{\frac{1}{2}}$$

substituting H = 24 hours

$$\frac{\partial L}{\partial P_1} = \frac{T_1}{T_2}\frac{P_2}{P_1^2} \simeq \frac{1}{P_1}$$

$$\frac{\partial L}{\partial P_2} = -\frac{T_1}{T_2 \; P_1} \simeq -\frac{1}{P_1}$$

$$\frac{\partial L}{\partial T_1} = -\frac{P_2}{T_2 \; P_1} \simeq -\frac{1}{T_2}$$

$$\frac{\partial L}{\partial T_2} = \frac{T_1}{T_2^2}\frac{P_2}{P_1} \simeq \frac{1}{T_2}$$

assuming $P_1 = P_2 = \overline{P}$ and $T_1 = T_2 = \overline{T}$

where $\overline{P}$ = average absolute dry air pressure (psia)
$\overline{T}$ = average volume weighed primary containment absolute temperature (°R)

Therefore,

APPROVED

SEP 10 '84

D.O.S.R.

$$\delta(L) = 100[2(\frac{\delta(\overline{P})}{\overline{P}})^2 + 2(\frac{\delta(\overline{T})}{\overline{T}})^2]^{1/2}$$

1. Calculation of $\delta(\overline{T})$

$$\overline{T} = \sum_{j=1}^{NVOL} (VF_j)\ (Tave,_j)$$

where VF_j = the volume weighing factors

NVOL = the number of containment subvolumes

$Tave,_j$ = the average absolute temperature in the j<u>th</u> subvolume

$$Tave, = \sum_{i=1}^{N_j} \frac{Ti,j}{Nj}$$

where Ti,j = the absolute temperature of the i<u>th</u> RTD in the j<u>th</u> subvolume

Nj = number of RTD's in the j<u>th</u> subvolume

Now, $\delta(\overline{T})$ is calculated from

$$\delta(\overline{T}) = \sum_{j=1}^{NVOL} \frac{\overline{T}}{\delta Tave,j}\ \delta(Tave,j)$$

where $\frac{\partial \overline{T}}{\partial Tave,j} = VFj$

$$\partial(Tave,j) = \frac{RTD\ accuracy}{(N_j)^{1/2}}$$

Therefore,

$$\delta(T) = \sum_{j=1}^{NVOL} (Vfj)\ (\frac{RTD\ accuracy}{(Nj)})$$

2. Calculation of $\delta(\overline{P})$

$$\delta(P) = [\delta(P_T)^2 + \delta(P_V)^2]^{1/2}$$

where P_T = total absolute primary containment pressure

P_V = partial pressure of water vapor in the primary containment

APPROVED
SEP 10 '84
D.O.S.R.

substituting $\delta(PT) = \frac{\text{PPG accuracy}}{(\#\text{ of PPG's})^{1/2}}$

$$\delta(PV) = \sum_{j=1}^{NVOL} (VFJ) \left(\frac{\text{dewcell accuracy}}{(Nj)^{1/2}}\right)$$

where PPG = precision pressure gage

Nj = number of dewcells in the jth subvolume

Therefore,

$$\delta(\overline{P}) = \left[\left(\frac{\text{PPG accuracy}}{(\#\text{ of PPG's})^{1/2}}\right)^2 + \left(\sum_{j=1}^{NVOL} (VFj) \left(\frac{\text{dewcell accuracy}}{(Nj)^{1/2}}\right)\right)^2\right]^{1/2}$$

3. Determine the appropriate variable quantities and perform the above analysis twice - once for the system accuracy and once for the system repeatability.

APPROVED

SEP 10 '84

D.O.S.R.

APPENDIX C
CALCULATIONS PERFORMED

Data collected from pressure sensors, dewcells, and RTD's located in the containment are processed using the following calculations for containment temperature and dry air pressure.

A. Average Subvolume Temperature and Dewpoint.

$$Tj = \frac{\Sigma(\text{all RTD's in } j^{th} \text{subvolume})}{\text{Number of RTD's in the } j\underline{th} \text{ subvolume}} \quad °F \qquad (1)$$

$$D.P.j = \frac{\Sigma(\text{all dewcell in } j^{th} \text{ subvolume})}{\text{Number of dewcells in } j\underline{th} \text{ subvolume}} \quad °F \qquad (2)$$

where Tj = average temperature of the j<u>th</u> subvolume
D.P.j = average dewpoint of the j<u>th</u> subvolume

NOTE

By definition $D.P.j \leq Tj$)

B. Primary Containment Temperature and Dry Air Pressure

$$T = \sum_{j=1}^{NVOL} (VFj)\ (Tj)\ °F \qquad (3)$$

If Tj = undefined, then
Tj = T (j + 1) for $1 \leq j \leq (NVOL-2)$
Tj = T (j - 1) for j = NVOL-1
Tj = estimate, for j = NVOL

$$D.P. = \sum_{j=1}^{NVOL} (VFj)(D.P.j)\ °F \qquad (4)$$

If D.P.j = undefined, then
D.P.j = D.P. (j + 1) for $1 \leq j \leq (NVOL-2)$
D.P.j = D.P. (j - 1) for j = NVOL-1
D.P.j = estimate, for j = NVOL

$$D.P.(°K) = 273.16 + \frac{D.P.(°F) - 32}{1.8}$$

$$X = 647.27 - D.P.\ (°K)$$

$$EXPON = \frac{X(A + ZX + CX^3)}{(D.P.(°K))(1+DX)}$$

$$A = 3.2437814$$

$$Z = 5.86826.10^{-3}$$

$$Pv = \frac{(218.167)\ (14.696)}{e^{(EXPON\ \ln\ 10)}} \quad PSI$$

$$C = 1.1702379.10^{-8}$$

$$D = 2.1878462.10^{-3}$$

$$P = \frac{\Sigma(\text{All absolute pressure gauges})}{\text{Number of absolute pressure gauges}} - PV\ Psia \qquad (5)$$

where: NVOL = number of primary containment subvolumes
VFj = volume weighing factor of the j<u>th</u> subvolume
T = volume weighed containment temperature
D.P. = volume weighed containment dewpoint
X,A,Z,C,D,EXPON = dewpoint to vapor pressure conversion constants & coefficients

APPROVED

SEP 10 '84

D.O.S.R.

Pv = volume weighed containment vapor pressure
P = contained dry air absolute pressure

NOTE

The subvolume numbering sequence is from the warmest to the coolest subvolume. (Assuming top to bottom due to stratification.)

APPROVED

SEP 10 '84

D.O.S.R

APPENDIX D
CALCULATIONS PERFORMED FOR IPCLRT DATA FOR TEST DURATION AT LEAST 12 HOURS

Data collected from pressure sensors, dew cells, and RTD's located in the containment are processed using the following equations. Some data needs to be analyzed using equations in Appendix C prior to use. Those equations are referenced by equation number. The primary reference for these calculations is the Topical Report BN-TOP-1 Revision 1.

A. MEASURED LEAK RATE (Total Time)

From BN-TOP-1 Rev. 1, Section 4.5 the following equation is given for the measured leak rate using the total time procedure:

$$M_i = \frac{2400}{H}\left(1 - \frac{T_o\bar{P}_i}{T_i\bar{P}_o}\right) \quad (\%\ \text{per day})$$

where M_i = measured leak rate in weight % per day for the i^{th} data point.

H = time interval, in hours, between measurements.

T_o, T_i = mean absolute temperature, °R, of the containment atmosphere at the beginning and the end of test interval (H) respectively.

P_o, P_i = mean total absolute pressure, psia, of the containment atmosphere at the beginning and end of the test interval (H) respectively.

Using the following relationship derived in ANSI N45.4 - 1972 Appendix B given below:

$$\frac{W_o - W_i}{W_o} = 1 - \frac{T_o\bar{P}_i}{T_i\bar{P}_o}$$

where W_o, W_i = dry air mass of the containment at the beginning of the test and data point i, respectively.

And substituting in the calculation of the containment dry air mass that corrects for a change in Reactor Water level gives the following expression for the measured leakage:

$$M_i = \frac{2400}{h}\left(1 - \frac{T_o\bar{P}_i\,(\text{volume} - (\text{LEVEL}_i - 50)(28.635))}{T_i\bar{P}_o\,(\text{volume} - (\text{LEVEL}_o - 50)(28.635))}\right)$$

where LEVEL_o, LEVEL_i = reactor water level in inches at beginning of the test and the data point i, respectively.

APPROVED
SEP 10 '84
D.O.S.R.

B. CALCULATED LEAK RATE

The method of "Least Squares" is a statistical procedure for finding the best fitting regression line for a set of measured data. The criterion for the best fitting line to a set of data points is that the sum of the squares of the deviations of the observed points from the line must be a minimum. When this criterion is met, a unique best fitting line is obtained based on all of the data points in the ILRT. The value of the leak rate based on the regression is called the statistically average leak rate.

Since it is assumed that the leak rate is constant during the testing period; a plot of the measured contained dry air mass versus time would ideally yield a straight line with a negative slope (assuming a non-zero leak rate). Obviously, sampling techniques and test conditions are not perfect and consequently the measured values will deviate from the ideal straight line situation.

Based on this statistical process, the calculated leak rate is obtained from the equation:

$$L_i = A + B \times t_i$$

where t_i = time in hours since the beginning of the test to the i^{th} data set point.

The values of the constants A and B such that the regression line is best fitting to the ILRT data are

$$B = \frac{[n\Sigma(t_i)(M_i)] - [(\Sigma t_i)(\Sigma M_i)]}{[n\,\Sigma(t_i)^2 - (\Sigma t_i)^2]}$$

$$A = \frac{\Sigma M_i - B\Sigma_i t_i}{n}$$

In order to reduce the round-off error in the above calculations, the equations are rearranged such that:

$$B = \frac{n\Sigma t_i M_i - (\Sigma t_i)(\Sigma M_i)}{n\Sigma(t_i)^2 - (\Sigma t_i)^2}$$

$$A = \frac{(\Sigma M_i)(\Sigma t_i^2) - (\Sigma t_i)(\Sigma t_i M_i)}{n\Sigma t_i^2 - (\Sigma t_i)^2}$$

APPROVED

SEP 10 '84

D.O.S.R.

C. 95% CONFIDENCE LIMITS

To determine the value of the confidence limits the following statistical information is required; the variance, standard deviation, and students' T-distribution.

$$S^2 = \frac{SSQ}{n-2}$$

where $SSQ = (M_i - L_i)^2$

S^2 = variance

S = standard deviation based (n-2) degrees of freedom.

The standard deviation has more practical significance since computing the standard deviation returns the measure of variability to the original units of measurement. Additionally, it can be shown that given a normal distribution of measurements, approximately 95% of the measurements will fall within two standard deviations of the mean.

The number of standard deviations either side of the regression line which establish a 95% confidence interval are more accurately determined using a statistical table called a "Table of Percentage Points of the T-Distribution" and provide increased confidence in outcomes for small and large sample sizes.

The Table of T-Distributions has been formulized for use by the computer program as follows:

$$TD = 1.95996 + \frac{2.37226}{(n-2)} + \frac{2.8225}{(n-2)^2}$$

where TD = value of T-Distribution for the 95% confidence limit and (n-2) degrees of freedom.

n = number of data points including the i^{th} data point.

The application of the additional factor to the variance formula yields:

$$\sigma^2 = S^2 \left[1 + \frac{1}{n} + \frac{(t_p - \bar{t})^2}{\Sigma(t_i - \bar{t})^2} \right]$$

$$\sigma = S \left[1 + \frac{1}{n} + \frac{(t_p - \bar{t})^2}{\Sigma(t_i - \bar{t})^2} \right]^{1/2}$$

APPROVED

SEP 10 '84

D.O.S.R.

where t_p = time after start of test

$$\bar{t} = \frac{\Sigma t_i}{n}$$

$$UCL = L_i + TD \times \sigma$$

APPROVED

SEP 10 '84

D.O.S.R.

APPENDIX E
CALCULATIONS PERFORMED FOR IPCLRT DATA FOR TEST DURATION AT LEAST 24 HOURS

Data collected from pressure sensors, dew cells, and RTD's located in the containment are processed using the following equations. Some data needs to be analyzed using equations in Appendix C prior to use of these equations.

A. Contained Dry Air Mass.

$$W = \frac{(28.97)(144)(P)[(\text{volume}) - (\text{LEVEL}-50)(28.635)]}{1545.33\ (T + 459.69)} \text{ lbs.}$$

LEVEL = reactor water level in inches from instrument zero (28.635 ft/in)
Volume = primary containment volume (ft) with:
Rx level @ 50.0 inches, Torus level @ - 3.0 inches.

B. Measured Leak Rates.

$$Lm(\text{TOTAL}) = \frac{W_{Base} - W_i}{t_i - t_{Base}} \ \frac{2400}{W_{Base}} \ \frac{\%}{\text{Day}}$$

$$Lm(\text{POINT}) = \frac{W_{i-1} - W_i}{t_i - t_{i-1}} \ \frac{2400}{W_{i-1}} \ \frac{\%}{\text{Day}}$$

where, W_{BASE} = mass of contained air at t=0 (lbs)
W_i = mass of contained air at t=i hrs (lbs)
t_i - test duration at the ith data set (hrs)

C. Statistical Leak Rate and Confidence Limits.

LINEAR LEAST SQUARES FITTING OF THE IPCLRT DATA

The method of "Least Squares" is a statistical procedure for finding the best fitting regression line for a set of measured data. The criterion for the best fitting line to a set of data points is that the sum of the squares of the deviations of the observed points from the line must be a minimum. When this criterion is met, a unique best fitting line is obtained based on all of the data points in the ILRT. The value of the leak rate based on the regression is called the statistically average leak rate.

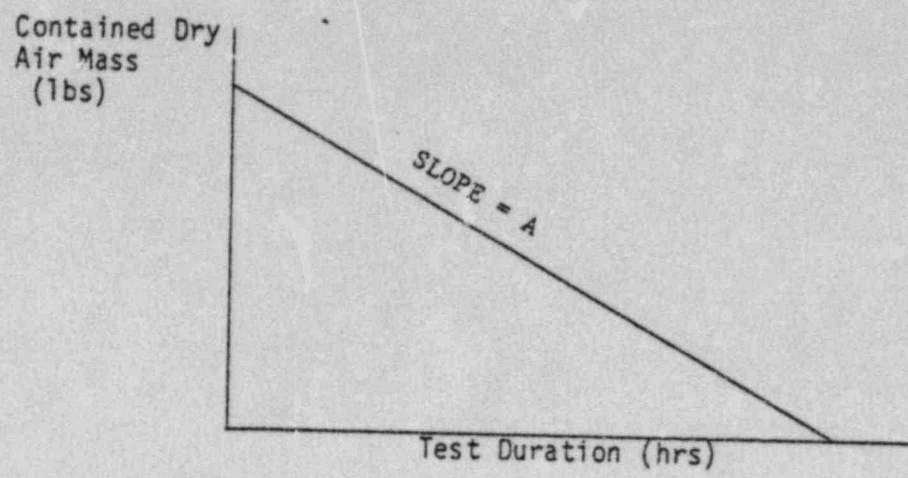
Since it is assumed that the leak rate is constant during the testing period; a plot of the measured contained dry air mass versus time would ideally yield a straight line with a negative slope (assuming a non-zero leak rate). Obviously, sampling techniques and test conditions are not perfect and consequently the measured values will deviate from the ideal straight line situation.

APPROVED
SEP 10 '84
D.O.S.R.

Based on this statistical process, the calculated leak rate is obtained from the equation:

$$W = At + B$$

where W = contained dry air mass at time t (lbs)
B = calculated contained dry air mass at time t= 0 (lbs)
A = calculated leak rate (lbs/hr)
t = test duration (hours)



The values of the constants A and B such that the regression line is best fitting to the ILRT data are

$$A = \frac{[N\Sigma(ti)\ (Wi)] - [(\Sigma ti)\ (\Sigma Wi)]}{[N\Sigma(ti)^2 - (\Sigma ti)^2]}$$

$$B = \frac{\Sigma Wi - A\Sigma ti}{N}$$

In order to reduce the round-off error in the above calculations, the equations are rearranged such that:

$$A = \frac{\Sigma[(ti-\bar{t})(Wi-\bar{W})]}{[\Sigma(ti-\bar{t})^2]}$$

$$B = \frac{[(\Sigma(ti)^2)(\Sigma Wi)] - [(\Sigma ti)(\Sigma(ti)(Wi))]}{[N\Sigma(ti)^2 - (\Sigma ti)^2]}$$

By definition, leakage out of the primary containment is considered positive leakage; therefore, the statistically average leak rate in weight percent per day is given by:

$$Ls = (-A)(2400)/B \qquad \text{(weight \%/day)}$$

APPROVED
S 10 '84
D.O.S.R.

Statistical Uncertainties

In order to calculate the 95% confidence limits of the statistically

average leak rate, the standard deviation of the least squares slope and the Student's T-Distribution function are used as follow:

$$\sigma = \left[\frac{1}{(N-2)}\left[\frac{N\Sigma(Wi)^2-(\Sigma Wi)^2}{N\Sigma(ti)^2-(\Sigma ti)^2} - A^2\right]\right]^{\frac{1}{2}}$$

$$UCL = L_s + \frac{\sigma(TE)(2400)}{B}$$

$$\text{where } TE = 1.645 + \frac{1.5068}{(N-2)} + \frac{1.7136}{(N-2)^2}$$

N = number of data sets
ti = test duration of the ith data set
Wi = contained dry air mass at the ith data set
σ = standard deviation of least squares slope
TE = value of the single-sided T-Distribution function with 2 degrees of freedom
Ls = calculated leak rate in %/day
UCL = 95% upper confidence limit in %/day

APPROVED

SEP 10 '84

D.O.S.R.

APPENDIX F
IPCLRT DEFINITIONS
(48 PSIG TEST PRESSURE)

Maximum Allowable Leakage Rate (La)

La = 1.6% of containment volume per day

$= (0.016)(288{,}966\ ft^3)/24\ hrs.$

$= 192.644\ ft^3/hr.$

$= 192.644\ \frac{48 + 14.696}{14.696}\quad SCFH$

= 821.857 SCFH

Maximum Allowable Operation Leakage Rate (L_t)

L_t = 75% of Maximum Allowable Leakage Rate

= (0.75) (821.857) SCFH

= 616.392 SCFH

Maximum Allowable Leakage for any One Main Steam Isolation Valve

11.5 SCFH @ 25 psig test pressure

Maximum Allowable Leakage Rate for all testable penetrations and isolation valves except main steam isolation valves is 60 percent of L_a.

(60%) (821.857) = 493.114 SCFH

Maximum Allowable Leakage Rate of the personnel interlock door is 3.75 percent of La.

(3.75%) (821.857) = 30.820 SCFH

APPROVED

SEP 10 '84

D.O.S.R.

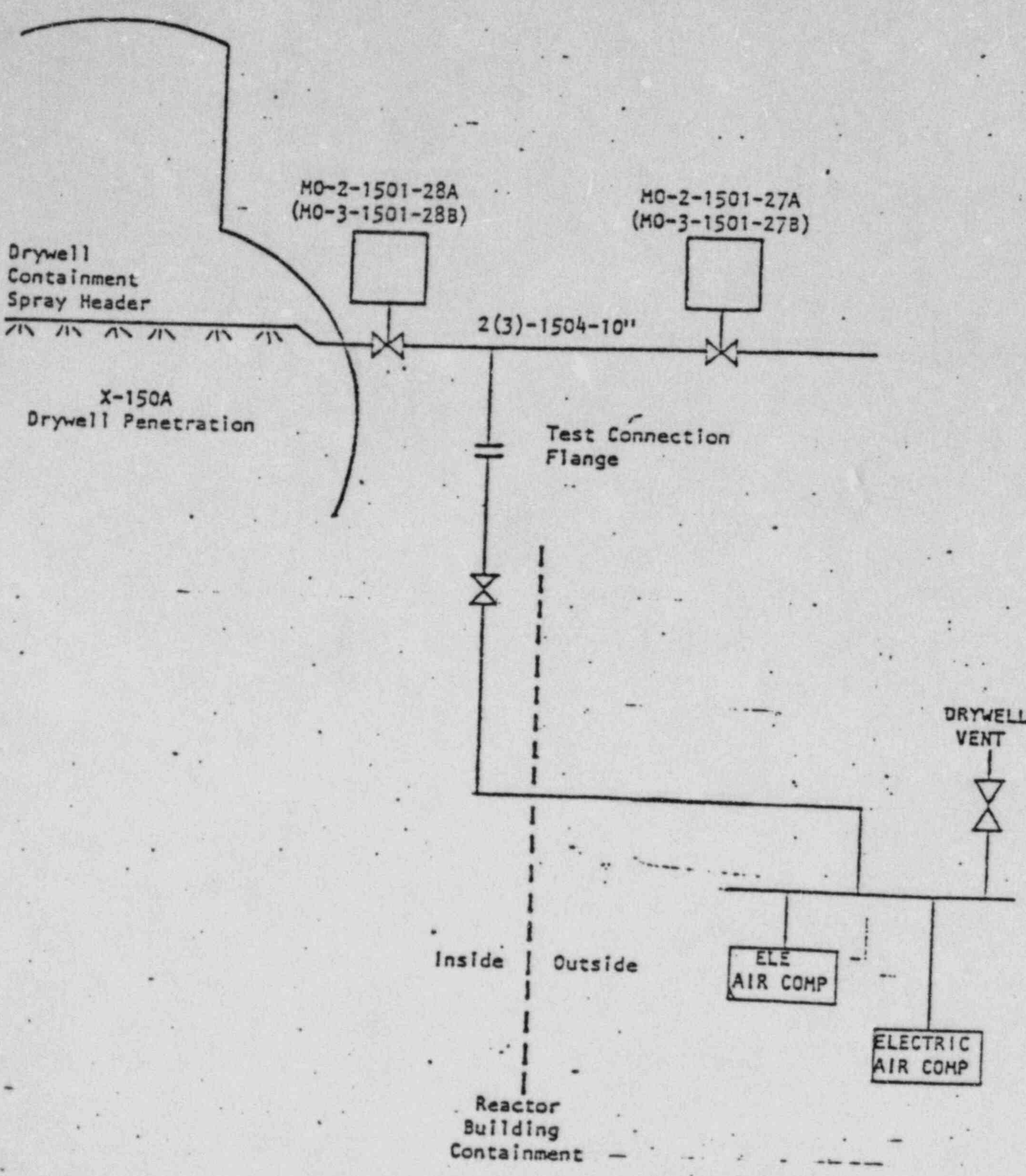
TABLE I
List of Non-Vented System

SYSTEM NO.	PENETRATION NO.	LEAK RATE (SCFH)
220-57A & 220-58A	X-107B	
220-57A & 220-62A	X-107B	
220-57B & 220-58B	X-107A	
220-57B & 220-62B	X-107A	
301-95 & 301-99	X-109B	
301-98 & 301-99	X-109B	
1001-1A,1B,2A,2B & 2C	X-111A/X-111B	
1101-1 & 1101-15	X-138	
1101-1 & 1101-16	X-138	
1201-1, 2 & 3	X-113	
1301-3 & 1301-4	X-109A	
1402-4A,8A,25A & 36A	X-310A	
1402-24A & 25A	X-149B	
1402-4B,8B,25B & 36B	X-310B	
1402-24B & 25B	X-149A	
1501-18A & 19A	X-311A	
1501-18B & 19B	X-311B	
1501-20A & 1501-38A	X-310A	
1501-20B & 1501-38B	X-310B	
1501-22A,26A & 1001-5A	X-116A	
1501-25A & 1501-26A	X-116A	
1501-22B,26B & 1001-5B	X-116B	
1501-25B & 1501-26B	X-116B	
1501-27A & 1501-28A	X-145	
1501-27B & 1501-28B	X-150A	
2301-45 & 2301-74	X-317	
220-44 & 45	X-122	
9207A & 9207B	X-101	
9208A & 9208B	X-101	
	TOTAL	

APPROVED
SEP 10 '84
D.O.S.R.

FIGURE 1

SUGGESTED



APPROVED

SEP 10 '84

D.O.S.R.

IDEALIZED VIEW OF THE PRIMARY CONTAINMENT
USE FOR VOLUME CALCULATION

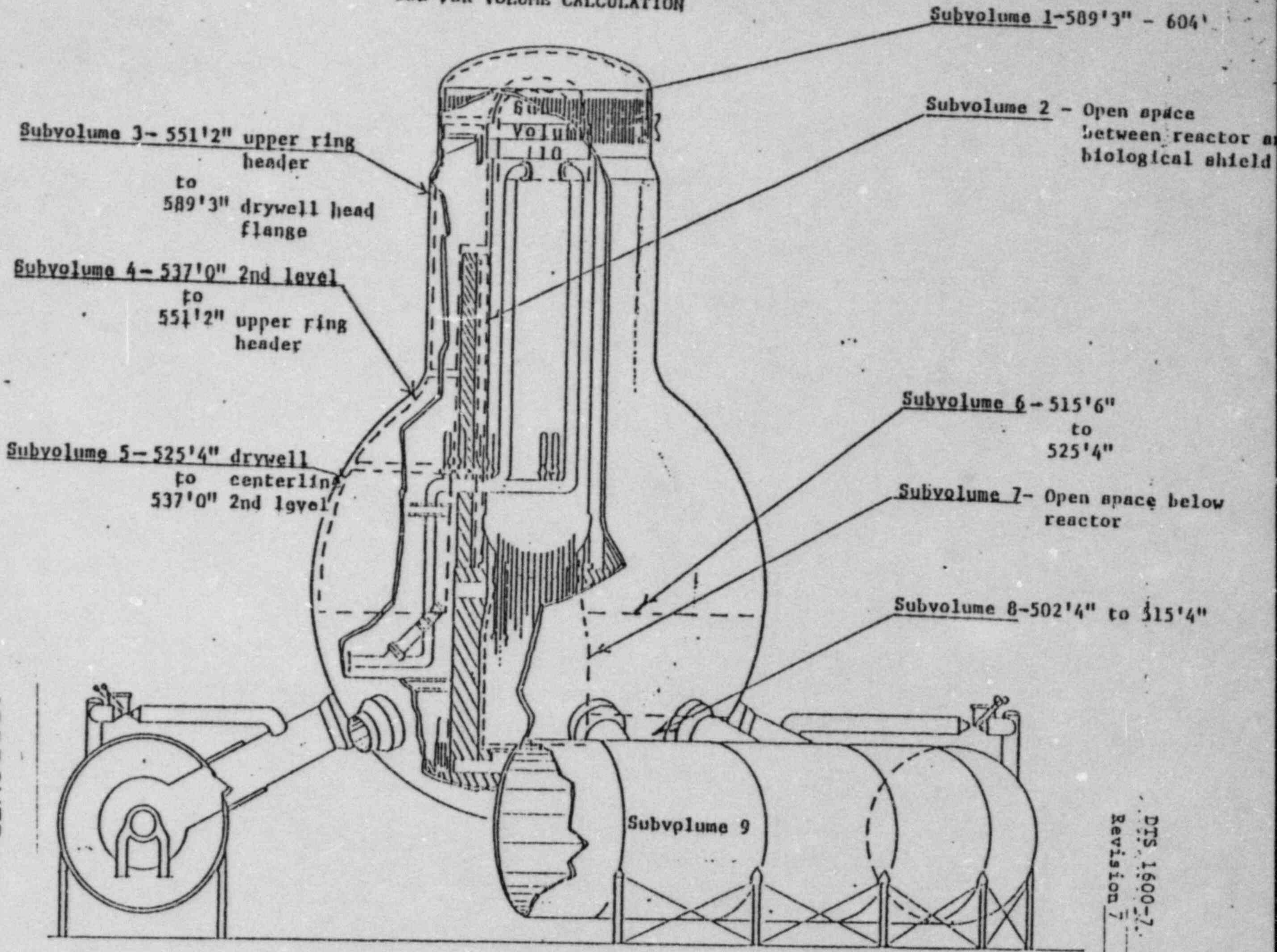


Figure 2 Pressure Suppression Containment System