DRESDEN UNIT 2 REACTOR CONTAINMENT BUILDING INTEGRATED LEAK RATE TEST

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DRESDEN UNIT 2 ILRT REPORT

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ABSTRACT

The 1979 Dresden Unit 2 Integrated Leak Rate Test (ILRT) was performed in accordance with the requirements of 10 CFR Part 50, Appendix J, Section V.B.3 from April 21 to April 23. Type A, B, and C test yielded a total containment leakage of .3858 WT%/day, which was well below the Dresden Technical Specification for the allowable operational leak rate of 1.2 WT%/day.

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A. INTRODUCTION

A.1. Purpose of Test

The purpose of the Dresden Unit 2 Integrated Leak Rate Test is to measure the reactor primary containment leak rate while at a test pressure equal to that which would occur during loss of coolant accident conditions. This report is designed to give a detailed description of the test efforts and the final results. These results are reported in accordance with 10 CFR 50, Appendix J, "Primary Reactor Containment Leakage Testing For Water Cooled Power Reactors."

A.2. Test Requirements

All Leak Rate Tests performed during the recent refueling outage were done in accordance with schedules and acceptance criteria established by 10 CFR Part 50, Appendix J, American National Standard ANSI N45.4 1972, and by the Unit Technical Specifications. The maximum acceptable leak rates are:

Type A Test

a. 24-Hour Phase

1. 1.6 weight %/Day (L_{to}) Maximum Allowable

2. 1.2 weight %/Day (L_p) Maximum Operational

b. Supplemental Phase

$\pm$ 0.40 weight %/Day ($0.25\ L_p$)

Type B and C Tests

a. Double-gasketed seals
10% L_{to} total combined leakage

b. Testable penetrations and isolation valves 30% L_{to} total combined leakage.

c. Any one penetration or isolation valve except the main steam isolation valves.
5% L_{to}

d. Any one main steam isolation valve 11.5 SCFM @ 25 PSIG.

The Type A test was conducted in accordance with Technical Staff surveillance procedure DTS-1600-7, revision 3. This procedure incorporates all the test requirements.

A.3. Summary of Results

The Dresden Unit 2 total primary containment integrated leak rate was found to be 0.3858 weight %/Day at a test pressure of 48 PSIG. This total leak rate includes the 24-hour phase Type A test result and several Type C

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test results for process lines not drained and vented as required by 10 CFR Part 50, Appendix J. The associated upper 95% confidence limit was 0.3935 weight %/day.

The supplemental test result was 0.4530 weight %/day with an upper 95% confidence limit of 0.5054 weight %/day. This result is to be compared with the sum of the 24-hour phase uncompensated result of 0.2515 weight %/day and the induced leakage of 0.2515 weight %/day.

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B. TEST METHOD UTILIZED

B.1. Basic Technique

Two techniques may be used in performing the Type A test. The first technique, which is no longer used at Dresden, is the Reference Vessel Method. This method was last used for the Unit 1 Type A test performed in 1974. The second technique is the Absolute Method. The Absolute Method, which was used on the most recent Unit 2 Type A test, uses the ideal gas law to calculate changes in dry air mass as a function of pressure and temperature. Compensation for water vapor pressure is taken into account when the dry air mass within the containment is calculated. Leakage of mass (which is assumed to be constant) from the containment during the Type A test interval can be determined by establishing the rate of mass loss.

B.2. Supplemental Verification Test

The verification test (induced leakage) was performed by intentionally inducing a controlled leak of a magnitude approximately equal to that measured during the 24-hour phase of the Type A test. This induced leak was superimposed on the previously determined leak rate. The degree of detectability of the combined leakage provided a basis for resolving any uncertainties associated with the 24-hour phase of the test.

B.3. Linear Regression Analysis

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.

A "Least Square" statistical analysis was performed to establish a regression line for the mass versus time parameters after each set of data was obtained. The slope of the regression line is called the statistically averaged leak rate. It was this quantity that was compared to the Technical Specification Limit L_{to}.

Associated with the statistical leak rate is an upper 95% confidence limit leak rate. The calculation of this upper limit is based on the standard deviation of the regression lines and the one-sided Student's T-Distribution function. A procedural requirement specified that the 95% confidence limit was to be less than the Technical Specification Limit L_p.

Both the regression line and the associated confidence limit were calculated after each set of data was obtained.

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C. TEST INSTRUMENTATION AND CALIBRATION

C.1. Types of Sensors Used

Two types of sensors were placed inside of the primary containment during the test. The first type of sensor used was a resistance temperature device (RTD) designed to measure dry bulb temperature. The RTD's used during the test were supplied by two different manufacturers. Burns Engineering, Inc. of Minneapolis, Minnesota, supplied 18 RTD's; while Hy-Cal Engineering of Santa Fe Springs, California, supplied the remaining 12 RTD's. The RTD detects changes in temperature through varying amounts of resistance within a platinum wire, responding linearly to ΔT. The second type of sensor used during the test was manufactured by the Foxboro Company, Foxboro, Massachusetts. It was designed to measure dew point, using a lithium chloride salt and a heating element in conjunction with a RTD, which as a unit responds to ambient dew point. There were 8 dew cells used during the ILRT.

C.2. ILRT Console

All primary containment dry bulb termperatures, reactor level pressures, and dew point temperatures in addition to test time were permanently recorded and digitally displayed on the Volumetrics ILRT console 14627. LED displays enabled the console operator to visually monitor the raw data as it appeared at regular scan intervals or manually select specific channels for specific data. The operator also received, at regular intervals, two permanent records of the scan data. One record was a typed paper tape displaying the raw test data. The second appeared in the form of a binary punched tape which was fed into the on-site process computer in order to perform all required test calculations.

In addition to the display electronics enclosed in the console, there were two precision pressure gages and two clocks. The clocks and pressure gages were redundant features included within the console to insure reliability.

A diagram of the ILRT console and related electronics is shown in Figure C.2.a. All sensor information sent to the data acquisition console was transmitted through shielded cable penetrating the primary containment.

C.3. Data Acquisition System

The ILRT Volumetric Console, sensors, and multiplexer comprise the ILRT Data Acquisition System, which was used to perform the Type A test at Dresden. A description of the ILRT console and sensors was given in Section C.1. and C.2. The system would not be complete without the multiplexer located within the containment throughout the test.

In order to minimize the number of conductors penetrating the primary containment, the Data Acquisition System Instrumentation was subdivided into two major parts. The multiplexer unit was the focal point for all the resistance temperature detectors (RTD) and the dewcells. This subsystem consisted of the solid state signal conditioning bridge circuit boards that are used to calibrate the system and the dual redundant electronic scanners which feed the sensor signal through the primary containment to the console

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outside. The second major part of the system was the Data Acquisition Unit (DAU). The DAU assembled all the scan data and produced two permanent records.

These components seen as a whole system provide a full automatic multi-point data measuring and processing system capable of measuring absolute pressure, dewpoint temperature, dry bulb temperature, and test duration. During the supplemental test, it also monitored the induced leak rate. (See figure C.3.a for a block diagram of the system interconnections.)

C.4. Instrument Calibration

A major portion of the time spent in preparation for the U-2 ILRT was devoted to instrument calibration. All RTD's were calibrated to within $\pm$ .5°F of actual temperature by using an oil bath and an RTD standard which is traceable to the National Bureau of Standards (NBS). The dew cells were calibrated to within $\pm$ 3.0°F of actual temperature by using a dew point hygrometer (traceable to NBS) and various atmospheres maintaining constant relative humidities.

The precision pressure gages were calibrated to within $\pm$ .015 PSIA of actual pressure using a portable standard traceable to NBS.

The flowmeter used for the induced leakage portion of the ILRT was calibrated using a transfer standard which was traceable to NBS and accurate to within $\pm$ .25 SCFM.

Table C.4.a shows the specifications for the instrumentation utilized in the Type A test. All of the instruments were calibrated prior to use, as required by ANSI N45.4-1972. The quantity of sensors used was based on the containment size and the system error analysis.

Throughout the test, ambient atmospheric conditions were monitored as required by ANSI N45.4-1972. All of the instruments used were calibrated prior to the test and were calibrated using a minimum of 3 reference points to establish an accurate calibration curve.

C.5. Instrumentation Error Analysis - Application

To ensure that the instrumentation used during the ILRT was accurate enough to measure minute changes in containment mass, an instrumentation error analysis was performed prior to the test in accordance with ANSI N45.4-1972. The instrumentation system error was calculated in two parts. The first, and most important calculation, was performed to determine the error due to system repeatability; the second, to determine the error due to system accuracy. The results were 0.00175 WT%/Day and 0.14902 WT%/Day, respectively. Combining these two errors yielded a total system error of 0.14903 WT%/Day.

The instrumentation error is used only to illustrate the system's capability to measure the required parameters that are necessary for calculation of the primary containment leak rate. The instrumentation error is always present in the data and is incorporated in the 95% confidence limit in the form of data scatter. Procedures required that the error due to accuracy and repeatability be less than .25 L_p (0.4 WT%/Day).

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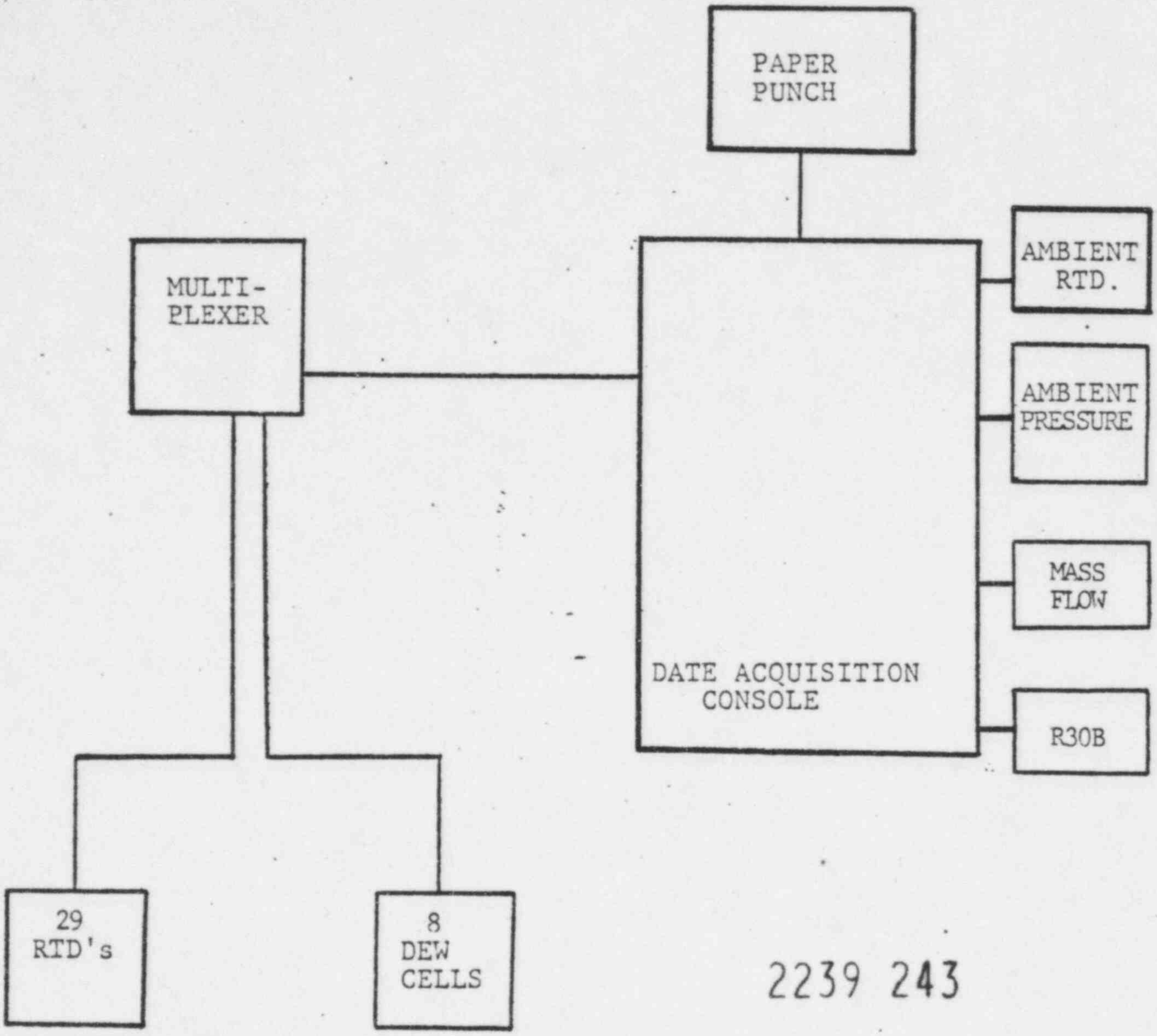

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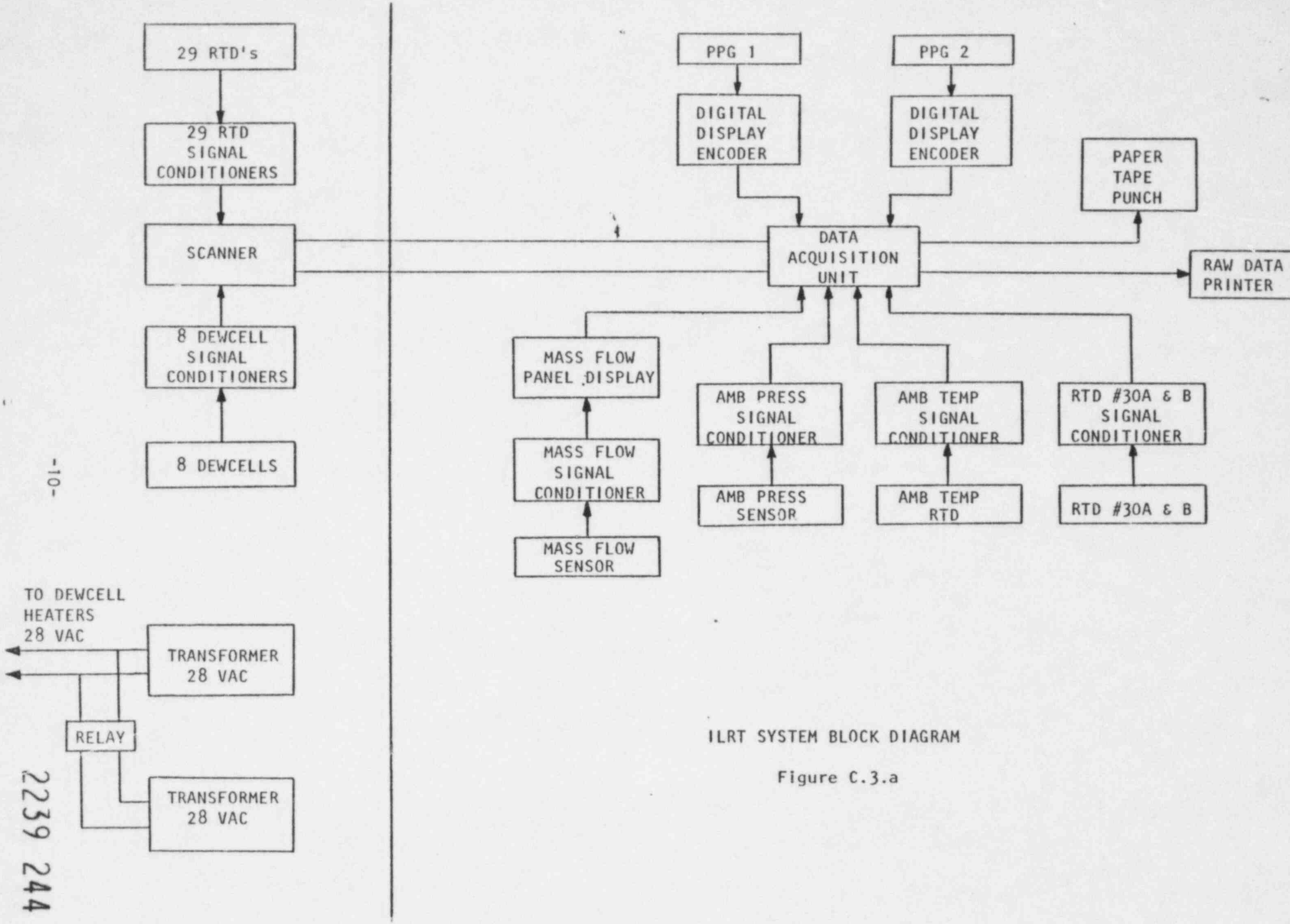
ILRT CONSOLE AND INPUT SYSTEMS

FIGURE C.2.a



ILRT SYSTEM BLOCK DIAGRAM

Figure C.3.a

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TABLE C.4.a

INSTRUMENT	QUANTITY/USAGE	RANGE	ACCURACY	REPEATABILITY
Precision Pressure Gauge	2 - Containment Pressure	0-100 psia	± 0.015 psia	± 0.001 psia
RTD	30 - Containment Temp.	32-250° F	± 0.38° F	± 0.05° F
Dewcell	8 - Containment Dewpoint	32-140° F	± 2.74° F	± 0.05° F
Mass Flow Meter	1 - Induced Leak Rate	0-10 SCFM	± .25 SCFM	± 0.0 SCFM
Ambient Temp. RTD	1 - Ambient Temp.	32-250° F	± 0.38° F	± 0.05° F
Ambient Press.	1 - Ambient Press.	0-20 psia	---	---
Sling Psychrometer	1 - Relative Humidity	0-100% R.H.	---	---

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D. CONTAINMENT REPRESENTATION

D.1. Structural Data

The Unit 2 primary containment provides a multibarrier pressure suppression containment employing containment-in-depth principles in design. The containment systems are composed of a primary containment and the Pressure Suppression System, which when taken together enclosed a total free air space of 288966 ft^3. The primary containment consists of a drywell, which encloses a reactor vessel, a pressure suppression chamber which stores a large volume of water, a connecting vent system between the drywell and the water pool, isolation valves, containment cooling systems, and other service equipment. See Figure D.2.a.

The performance objectives of the primary containment system are: (1) to provide a barrier which in the unlikely event of a loss-of-coolant accident, will control the release of fission products to the secondary containment, and (2) to rapidly reduce the pressure in the containment resulting from the loss-of-coolant accident. In order to meet these objectives, the containment was designed to withstand a design pressure of 62 psig with a leakage of 0.5 WT%/Day. To assure that the containment could structurally meet these criteria, the drywell was designed using a steel pressure vessel with a spherical lower portion and a cylindrical upper portion. See Figure D.2.a. The steel head and shell of the drywell are fabricated of SA-212 GRB plate manufactured to A-300 requirements. The top head closure is made with a double tongue and grove seal, which will permit periodic checks for tightness without pressurizing the entire vessel. The drywell is enclosed in reinforced concrete for shielding purposes and to provide additional resistance to deformation and buckling of the drywell over areas where concrete backs up the steel shell.

An integral part of the containment is the pressure suppression chamber, which is also pressurized during the ILRT. The pressure suppression chamber is a steel pressure vessel in the shape of a Torus below and encircling the drywell which contains 112,203 $ft.^3$ of water in its 109 ft. major diameter. The Torus free air volume is 118529 ft^3.

D.2. Containment Survey

In order to establish the containment temperature and humidity tendencies for regional variations, an area survey was performed. This survey complied with ANSI N45.4-1972 and was performed by Technical Staff personnel prior to the instrumentation installation. The sensor locations as specified by this survey are indicated in Table D.2.a. (Refer to Figure D.2.a for an idealized view of the containment structure and the zoning configuration used.)

D.3. Instrumentation Placement

Figures D.3.a through D.3.g indicate exactly where the RTD's and dew cells were placed within the primary containment. The dew cell placement is indicated by the initial D, and the RTD placement is indicated by the initial R.

To avoid local temperature variations, all RTD's and dew cells were placed at least three feet from any pipe, wall, pump, motor, etc.

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All sensors were placed in the containment immediately before the ILRT to minimize the possibility of sensor wire or sensor damage due to maintenance and cleanup work being performed while the containment was open.

A special effort was made to place two RTD's in that subvolume between the reactor and the biological shield. See Figure D.3.b. This was done to minimize the transients in test data caused by ΔT change, in that subvolume due to changes in reactor temperature.

Two fans were placed inside the Torus as indicated in Figure D.3.g. To insure that RTD 26 and RTD 28 were not affected by the draft caused by the fans, they were placed off to the side of the fans at a distance greater than 3 feet.

Due to the impracticality of installing temperature and humidity sensors inside the vessel (Subvolume 10), several assumptions were made concerning the air space within. The reactor vessel air space was assumed to be saturated and at an equilibrium temperature with the water. To measure the reactor water temperature, an RTD was placed in the shutdown cooling loop between the shutdown cooling pump and the heat exchanger. This temperature was then used as the drybulb and wetbulb temperature for subvolume 10.

D.4. Pressurization System

Primary containment pressurization was accomplished with two 3000 SCFM electric compressors connected to a 4" pressurization line.

A condenser-after cooler was located outside the reactor building with the air compressors. Refer to Figure D.4.a for a plan view.

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TABLE D.2.a

DRESDEN U-2 ILRT SENSOR LOCATION

SENSOR TYPE	I.D. NUMBER	SUBVOLUME ZONE	ELEVATION	AZIMUTH
RTD	R1	1	601'	190°
RTD	R2	1	601'	10°
Dewcell	D1	1	601'	190°
RTD	R3	2	556'	330°
RTD	R4	2	556'	150°
RTD	R5	3	574'	270°
RTD	R6	3	574'	30°
RTD	R7	3	574'	150°
Dewcell	D2	3	574'	270°
RTD	R8	4	545'	350°
RTD	R9	4	545'	220°
RTD	R10	4	545'	120°
Dewcell	D3	4	545'	120°
RTD	R11	5	531'	0°
RTD	R12	5	531'	190°
RTD	R13	5	531'	270°
RTD	R14	5	531'	90°
Dewcell	D5	5	531'	260°
RTD	R15	6	520'	165°
RTD	R16	6	520'	60°
RTD	R17	6	520'	300°
Dewcell	D6	6	520'	165°
RTD	R18	7	505'	5°
RTD	R19	7	505'	185°
RTD	R20	8	509'	140°
RTD	R21	8	509'	230°
RTD	R22	8	509'	50°
RTD	R23	8	509'	320°
Dewcell	D4	8	509'	50°
RTD	R24	9	504'	223°
RTD	R25	9	504'	168°
RTD	R26	9	504'	280°
RTD	R27	9	504'	336°
RTD	R28	9	504'	101°
RTD	R29	9	504'	45°
Dewcell	D9	9	504'	168°
Dewcell	D10	9	504'	336°
RTD	R30B	10	Located in Shutdown Cooling Loop B	

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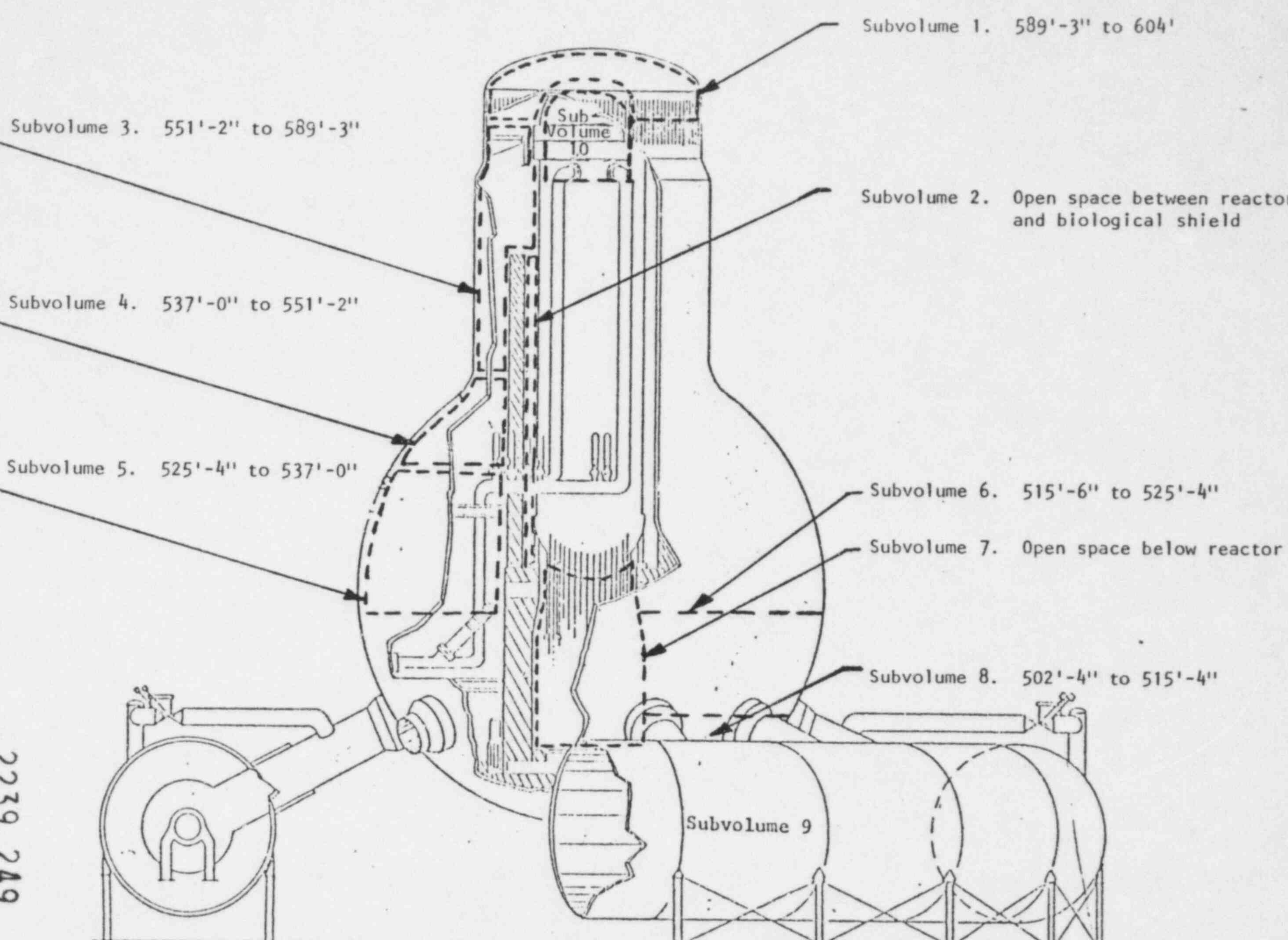
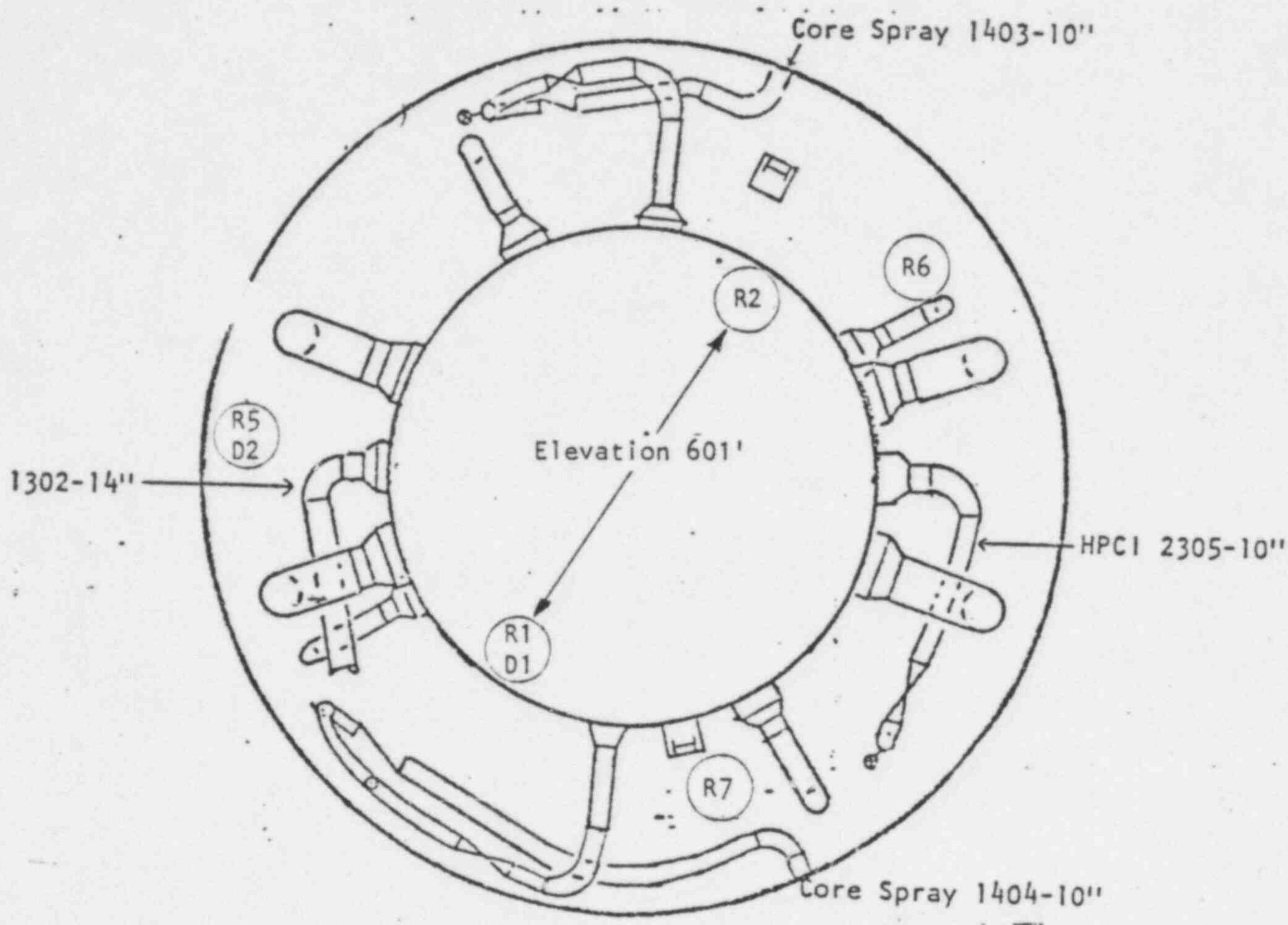


UNIT 2. PRESSURE SUPPRESSION CONTAINMENT SYSTEM

FIGURE D.2.a



POOR ORIGINAL

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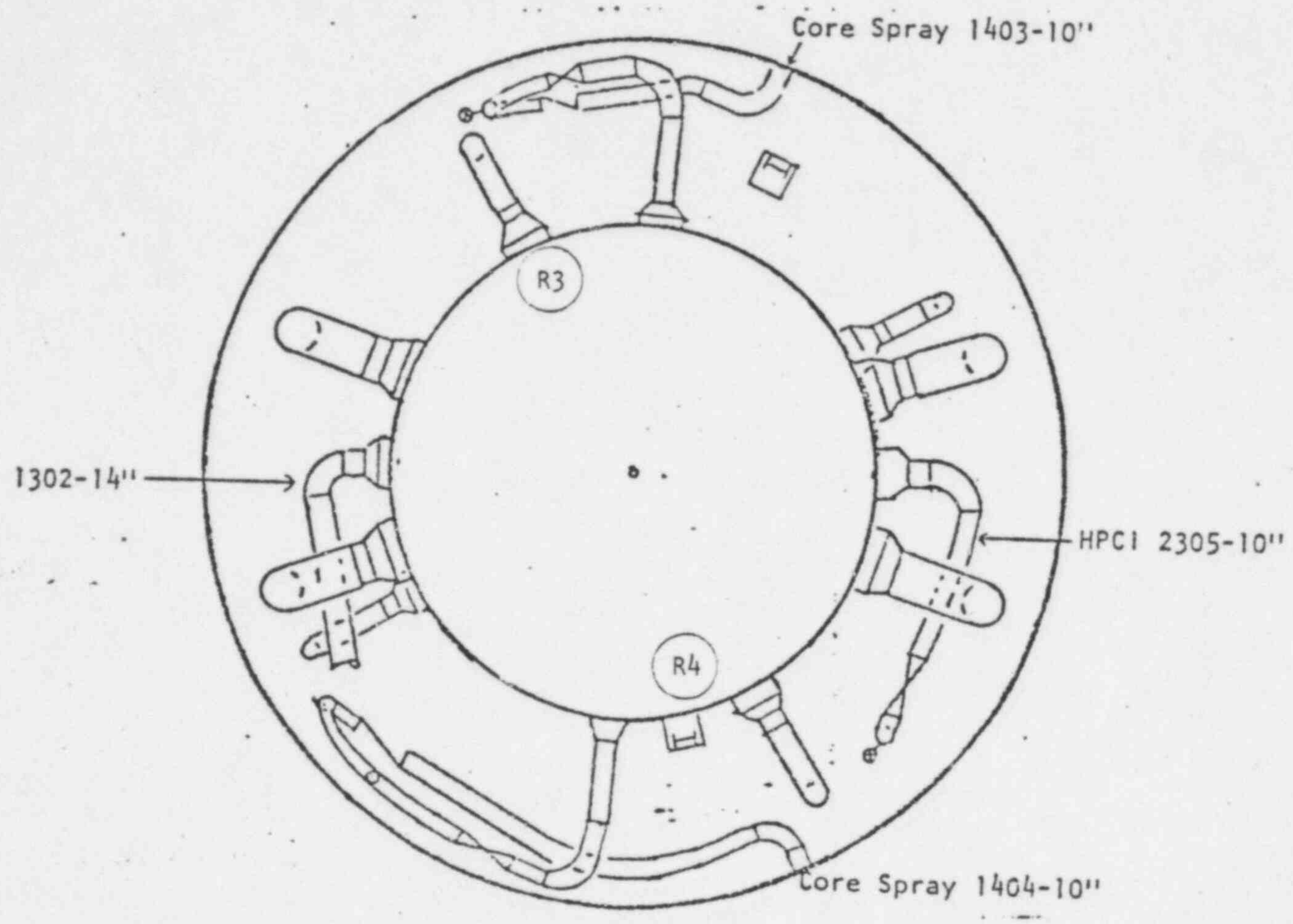
UNIT 2 DRYWELL

ELEVATION 574'

FIGURE D.3.a



UNIT 2 DRYWELL

ELEVATION 556'

FIGURE D.3.b

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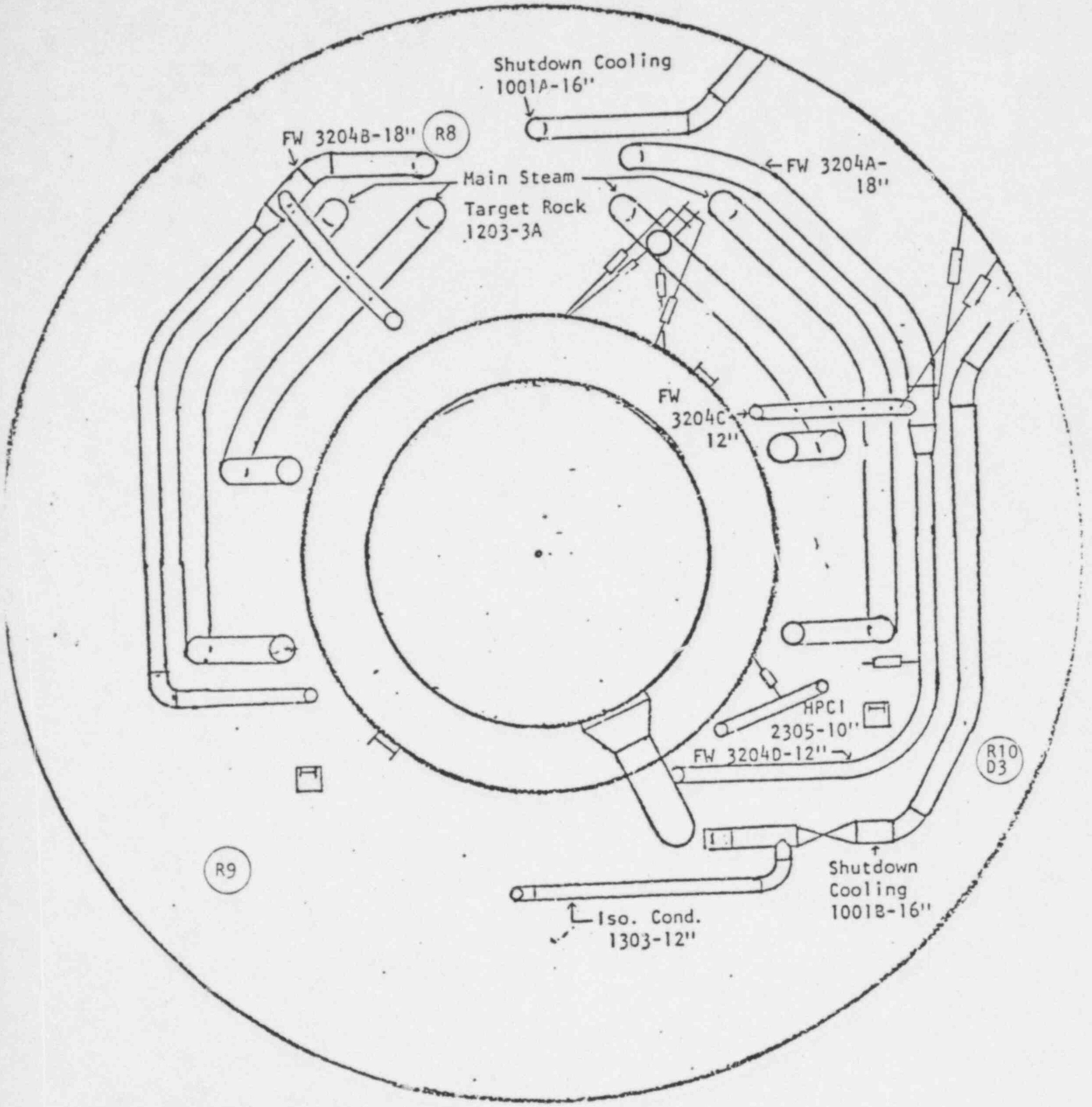

POOR ORIGINAL

UNIT 2 DRYWELL

ELEVATION 545'

FIGURE D.3.c

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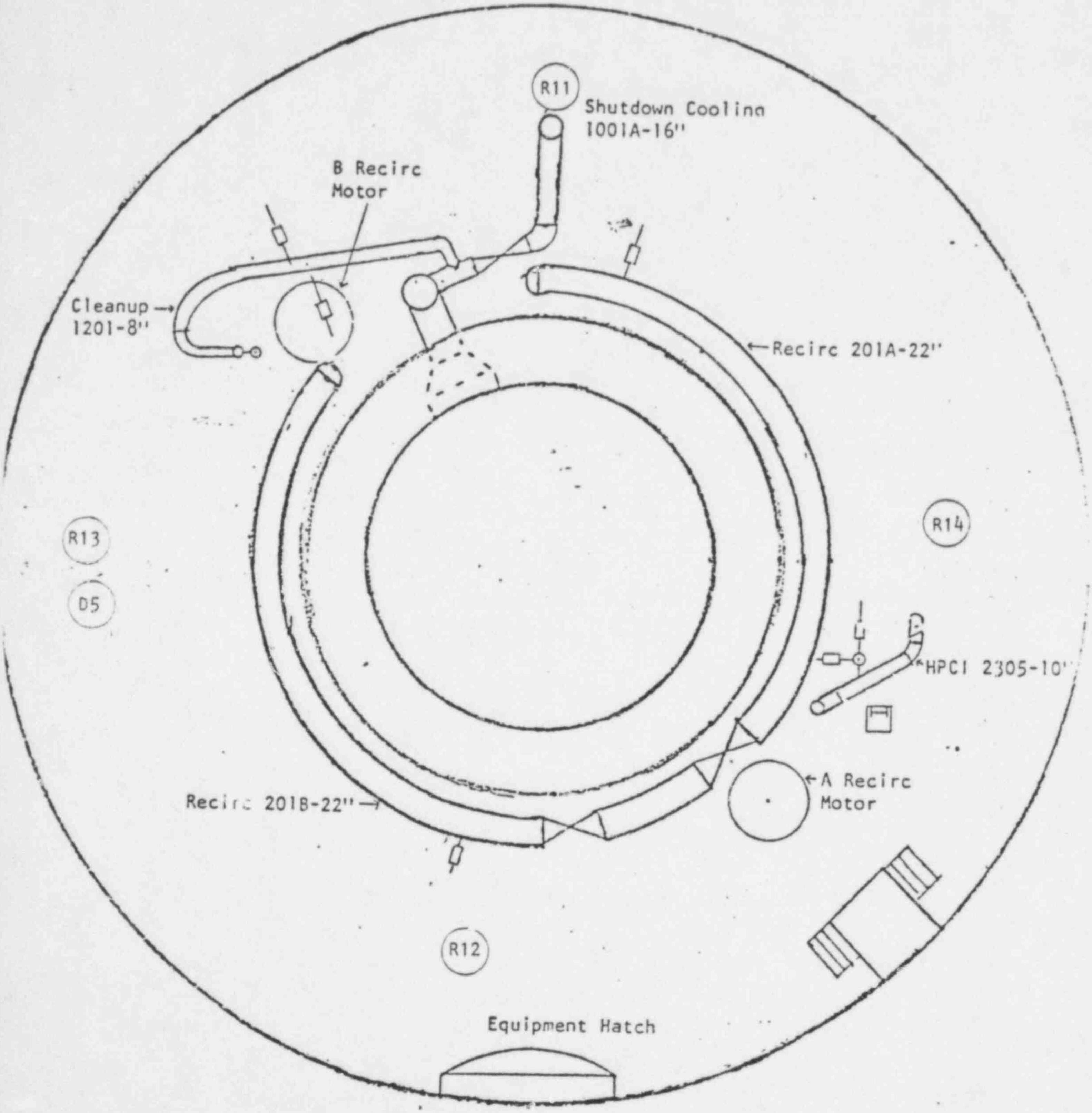

UNIT 2 DRYWELL
ELEVATION 531'
FIGURE D.3.d

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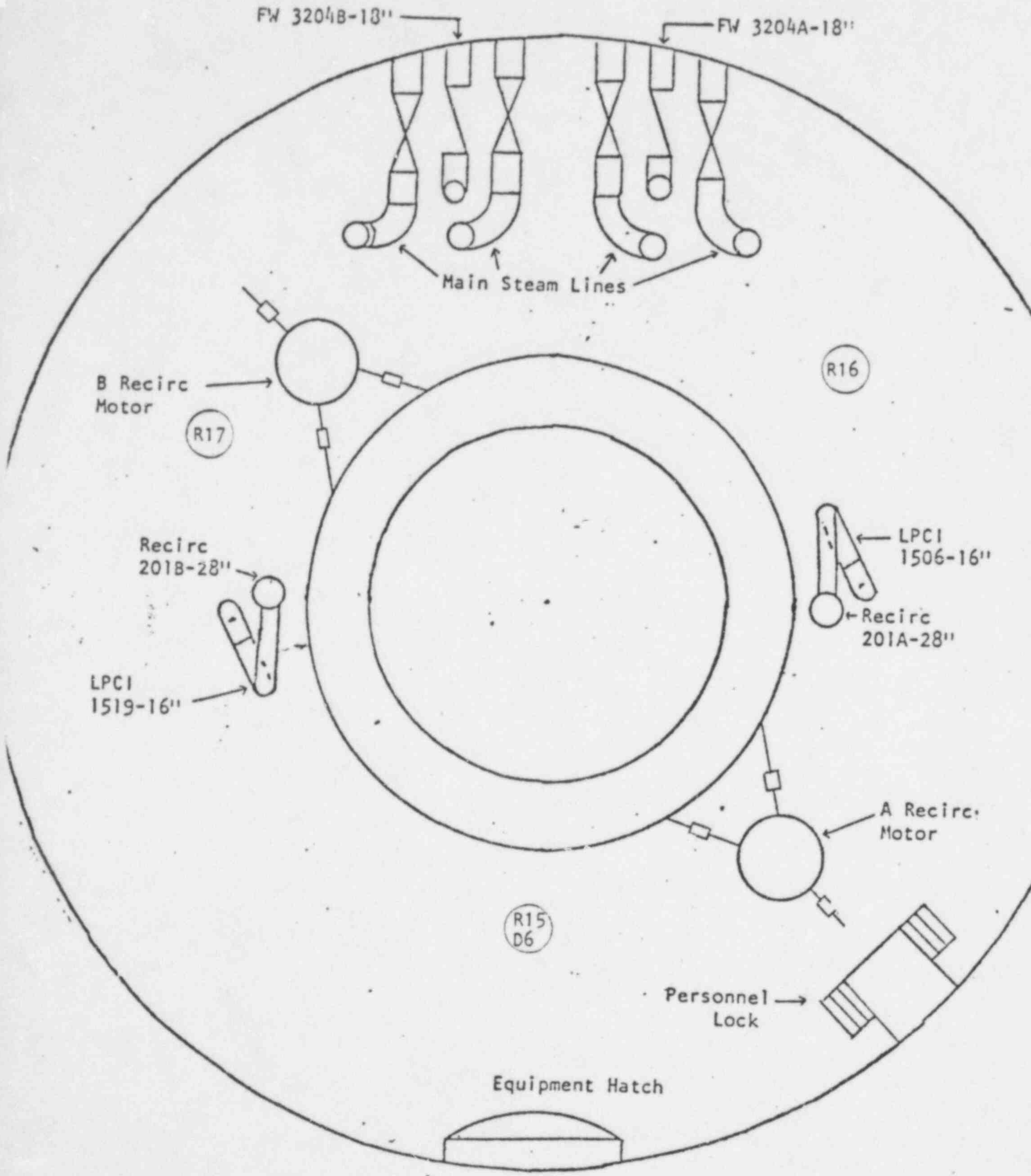

UNIT 2 DRYWELL
ELEVATION 520'
FIGURE D.3.e

POOR ORIGINAL

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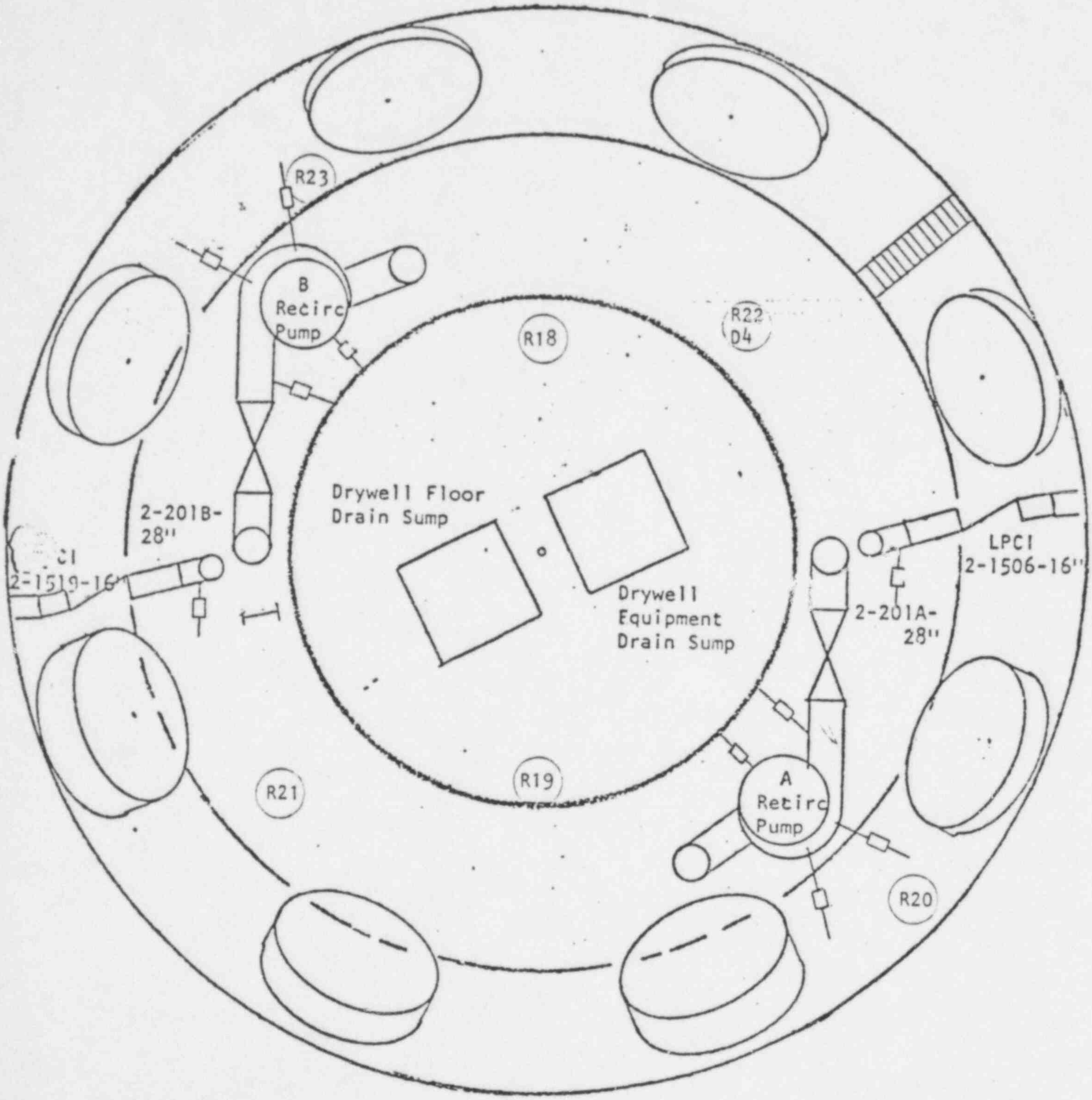

UNIT 2 DRYWELL
ELEVATION 509'
FIGURE D.3.f

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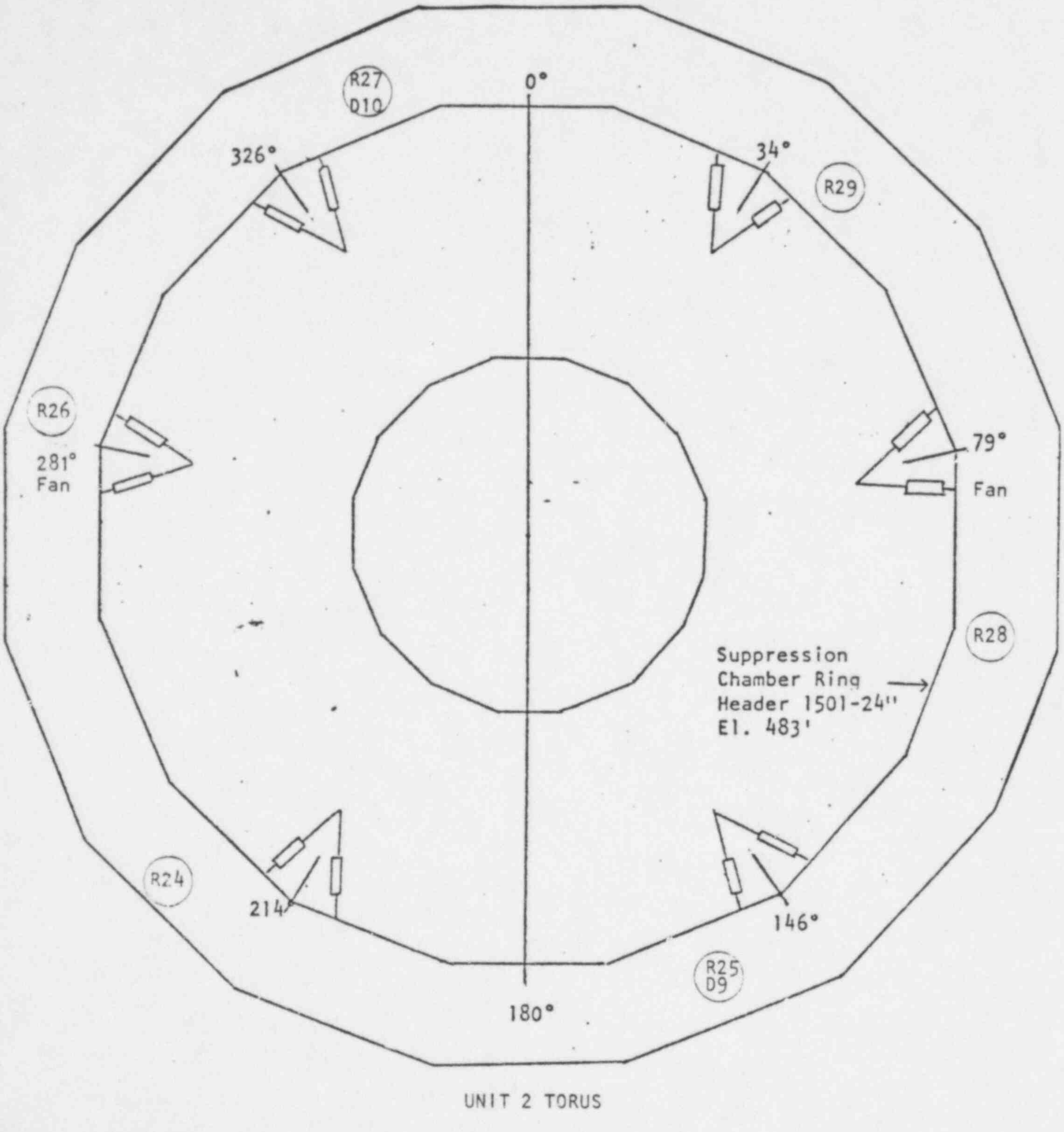

UNIT 2 TORUS

FIGURE D.3.g

POOR ORIGINAL

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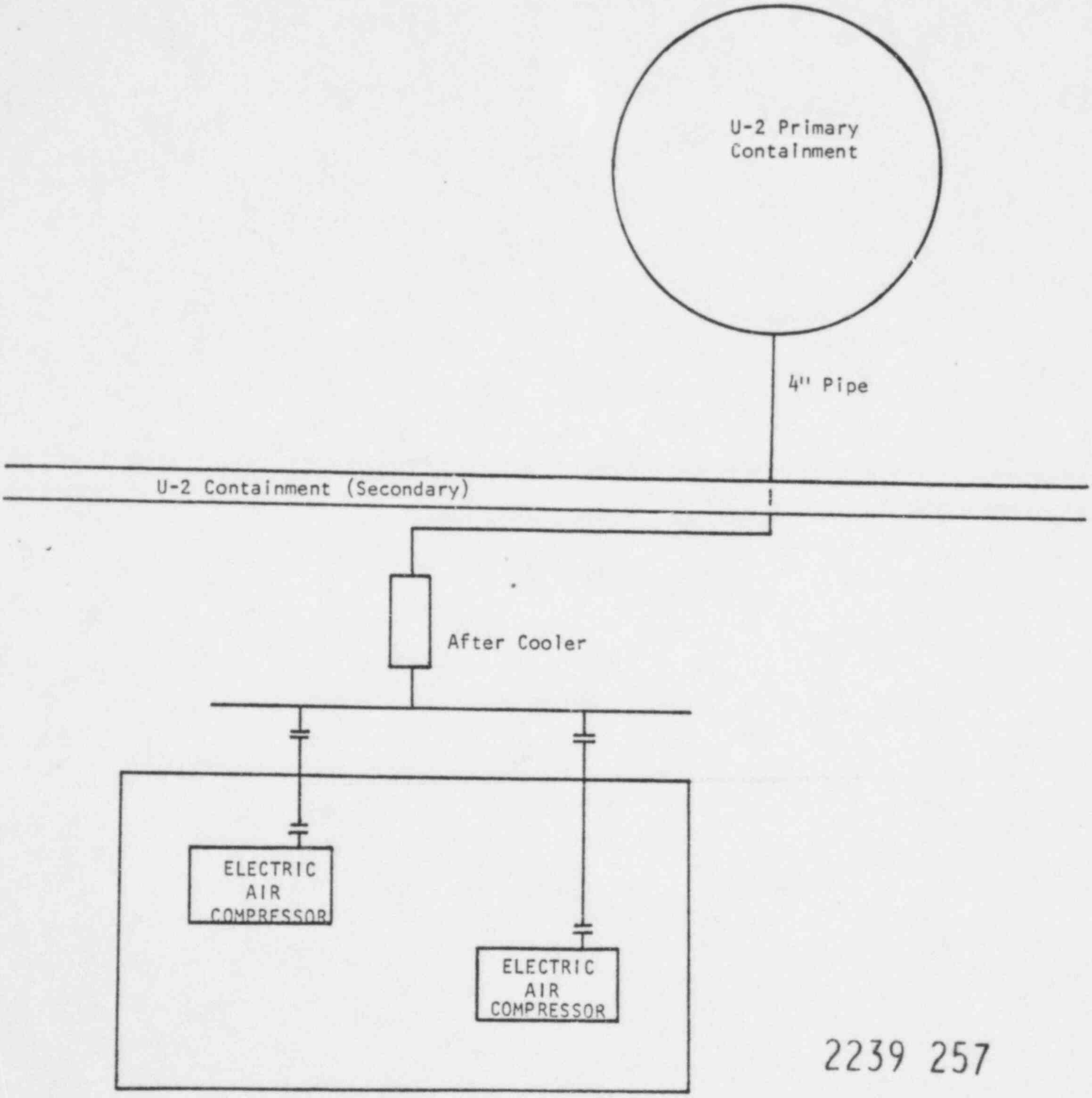

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CONTAINMENT PRESSURIZATION SYSTEM

FIGURE D.4.a

E. CALCULATIONS PERFORMED

E.1. Volume Weighting Factors

Due to the size and shape of the primary containment, a mathematical model was developed to account for the effects of temperature stratification and local temperature variations. The containment volume was theoretically divided into ten subvolumes with weighting factors assigned to each. (The value of the weighting factor is equivalent to the fractional part of the total containment volume occupied by the associated subvolume.) The volumes of the larger pieces of equipment were taken into account when calculating the subvolumes. (See Figure D.2.a for a diagram of the idealized containment and zoning configuration used.) Table E.1.a lists the subvolume weighting factors associated with each zone.

E.2. Data Reduction

Before the ideal gas law could be applied for obtaining the contained dry air mass, the raw data had to be reduced to a single dry air pressure and temperature. The total containment absolute pressure was determined by arithmetically averaging the two precision pressure gauges. The average containment temperature and dewpoint were obtained by utilizing the same application of the volume weighting factors. Like sensors within a subvolume were arithmetically averaged to determine the mean atmospheric conditions for the subvolume. Any subvolume void of a sensor type was assumed to have the same average value as the next subvolume in sequence. The sum of the products of the subvolume averages and respective weighting factors yielded the average containment temperature and dewpoint. The dewpoint was then converted to vapor pressure and subtracted from the average total containment pressure, yielding absolute dry air pressure. The following mathematical expressions summarize the data reduction process.

Average Subvolume Temperature and Dewpoint.

$$Tj = \frac{\Sigma(\text{all operable RTD's in } j^{th} \text{ subvolume})}{\text{Number of operable RTD's in the } j^{th} \text{ subvolume}} \ {}^\circ F$$

$$D.P.j = \frac{\Sigma(\text{all operable dewcells in the } j^{th} \text{ subvolume})}{\text{Number of operable dewcells in } j^{th} \text{ subvolume}} \ {}^\circ F$$

where Tj = average temperature of the j^{th} subvolume
$D.P.j$ average dewpoint of the j^{th} subvolume

Primary Containment Temperature and Dry Air Pressure

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

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 $j = NVOL$

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

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

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

$X = 647.27 - D.P.\ (^{\circ}K)$

$A = 3.2437814$

$Z = 5.86826 \times 10^{-3}$

$C = 1.1702379 \times 10^{-8}$

$D = 2.1878462 \times 10^{-3}$

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

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

$$Pt = \frac{P_1 + P_2}{2}\ \text{PSIA}$$

$$P = Pt - Pv\ \text{PSIA}$$

$$W = \frac{(28.97)(144)(P)((\text{total volume} - (\text{level} - 50)(28.635))}{1545.33\ (T + 459.69)}\ \text{Lbs.}$$

where: NVOL = number of primary containment subvolumes
VFj = volume weighting factor of the jth subvolume
T = volume weighted containment temperature
D.P. = volume weighted containment dewpoint
X, A, Z, C, D, EXPON = dewpoint to vapor pressure conversion constants and coefficients
Pv = volume weighted containment vapor pressure
Pt = total absolute containment pressure
P = contained dry air absolute pressure
W = contained dry air mass
Level = reactor water level

NOTE: The subvolume numbering sequence is from the top to the bottom of the containment.

E.3. Least Squares Fit

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.

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

$W = At + B$

where W = contained dry air mass at time t (lbs)

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where 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 data, whiie maintaining minimum round-off error, are:

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

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

Be 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:

$Ls = (-A)(2400)/(B)$ (weight %/day)

In order to calculate the 95% confidence limit of the statistically average leak rate, the standard deviation of the least squares slope and the Student's T-Distribution function are used as follows:

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

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

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

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

E.4. Computer Program

In order to expedite the data reduction and statistical computations, the Unit 2/3 process computer was utilized. The raw data was recorded on paper tape by means of a paper punch system connected to the ILRT console. The complete data set was then transferred to the computer room where it was fed into the computer by a paper tape reader. The number of sensors within a subvolume and the associated weighting factors were programmable constants established prior to the start of the test. Once entered, the raw data was duplicated for verification, stored in memory for future reference, reduced, and statistically analyzed. All pertinent computational results were printed with the data verification checklist. Data was recorded and analyzed at 10 minute intervals.

In addition to the above mentioned computations, included with each data set output were the "total time" and "point-to-point" measured leak rates.

These quantities are based on the following expressions:

$$Lm(TOTAL) = \left[\frac{W\ Base - Wi}{t_i}\right] \left[\frac{2400}{W\ Base}\right] \quad \%/day$$

$$Lm(POINT) = \left[\frac{W_{i-1} - Wi}{t_i - t_{i-1}}\right] \left[\frac{2400}{W_{i-1}}\right] \quad \%/day$$

where W Base = mass of contained air at t = 0 (lbs)
Wi = mass of contained air at t = i hours (lbs)
ti = test duration at the ith data set (hours)

E.5. Leak Rate Compensation for Non-Vented Penetrations

The actual result of the Type "A" test as performed was .2515 weight %/day with a 95% confidence level of .2592 weight %/day. The test was performed with the following penetrations not drained and vented. Included with each penetration listed is the maximum through leakage as determined by Type C testing.

Penetration	Leak Rate SCFH	Leak Rate Weight %/day
X 107 A&B Feedwater Check Valves	27.10	0.05533
X 149 A&B Core Spray	6.90	0.01408
X 145/150 LPCI	15.69	0.03204
X 111 A&B Shutdown Cooling	0.00	0.0
X 138 SBLC	1.26	0.00257
X 122 Primary Sample	0.02	0.00004
X 108 Isolation Condenser	1.61	0.00328
CAM Sample	0.78	0.00159
CRD Return	4.04	0.00825
Reactor Cleanup	8.36	0.01707
Total	65.76	0.1343

2239 261

TABLE E.1.a

TEMPERATURE AND HUMIDITY WEIGHTING FACTORS

SUB VOLUME	VOLUME (FT^3)	WEIGHTING FACTOR
1	11373	0.03936
2	3081	0.01066
3	20281	0.07018
4	23043	0.07974
5	30819	0.10665
6	26363	0.09123
7	7226	0.02501
8	41828	0.14475
9	118529	0.41018
10	6423	0.02223

2239 262

F. CONTAINMENT PRESSURIZATION

F.1. Preparation

The following major events were completed prior to containment pressurization as required by 10 CFR Part 50, Appendix J, and ANSI N45.4-1972:

1. Satisfactory completion of all Type B & C Leak Rate Tests.

2. Primary containment temperature and humidity survey.

3. Calibration of all instrumentation.

4. Instrumentation error analysis calculation.

5. Visual containment inspection.

6. Venting of the reactor vessel to the primary containment atmosphere.

Two fans were installed in the torus to provide air recirculation. This was done to comply with earlier recommendations made by Sargent and Lundy.

Training was provided to all technical personnel involved in the ILRT. The six hours of training was designed to familiarize personnel with the test instrumentation, computer program, and necessary scheduling for the successful completion of the 1979 ILRT.

Two 3000 SCFM 4KV electric compressors were brought on site to supply clean dry air to the primary containment through a four-inch pipe tied into the LPCI system. These compressors not only served as a source of oil free air but enabled Dresden personnel to realize 48 PSIG containment pressure in a minimal amount of time. To reduce air temperature out of the compressor from 100° F to 60° F, a 4800 SCFM water cooled aftercooler was placed between the electric compressor and the containment.

F.2. Containment Instrumentation

ILRT sensors were placed within the containment shortly before the test. Care was taken so as to place the sensors in those areas dictated by the temperature and humidity survey performed before the test.

All sensors were kept at a distance of three feet or farther from any pump, motor, or piece of piping. This was done so local temperature variations would not overly influence the real average subvolume temperature recorded by the sensor in that subvolume.

In preparation for the test, special care was taken to keep all sensors out of any airflow which might be caused by the compressor during pressurization or the ventilation fans placed in the torus.

F.3. Log Entries From ILRT Pressurization

At 1925 hours on April 21, drywell pressurization began. Subsequent proceeding events are as follows:

2239 263

ILRT LOG

Day	Time	Event
4/21/79	1925	Started pressurizing
	1935	Reached 2 psig. Technical Staff personnel began "snooping" for leaks.
	2045	Compressor shut down after containment reached 15 psig.
4/22/79	0040	Completed 15 psig hold. Containment is stabilized.
	0050	Started to pressurize after 15 psig hold point
	0400	Containment pressure is 49.8 psig. Compressors are being shut down holding for stabilization.

2239 264

G. TWENTY-FOUR HOUR TEST EXECUTION

G.1. Twenty-Four Hour Test Log

The Unit 2 primary containment stabilized at test pressure from 0412 hours to 0912 hours on 4/22/79.

4/22/79	0912	Containment was stabilized and 24-hour test was begun. Reactor water level 51". Torus water level -3". Shutdown cooling temperature 139° F.
	1200	Calculated leak .4744 Wt%/Day UCL .5366 Wt%/Day
	2102	Calculated leak .3484 Wt%/Day UCL .3641 Wt%/Day
	2115	Reactor water level 51" Torus water level -2.7" Shutdown cooling temperature 134° F
4/23/79	0912	24-hour test complete. 144 data sets taken during test.
	0912	Calculated leak .2515 Wt%/Day UCL .2592 Wt%/Day

G.2. Final Calculated Leak Rate

The final calculated leak rate was found to be .2515 Wt%/Day. The upper 95% confidence limit was .2592 Wt%/Day. Since these values are well within the Technical Specification limit of 1.2 Wt%/Day for reactor start-up, the Unit 2 primary containment integrity remains intact.

2239 265

H. SUPPLEMENTAL TEST

H.1. Purpose of Test

The purpose of the induced portion of the ILRT is intended to verify that instrumentation and method which was used and recorded during the 24-hour portion of the ILRT is valid. The Supplemental Test portion of the ILRT procedure involves placing the calibrated leak system into operation after the leakage-rate test in progress is completed. The flowmeter readings are then recorded at least hourly. Concurrently, readings from the ILRT data acquisition system are analyzed to determine the magnitude of the total containment leakage. If the criteria established by the following equation is satisfied, the ILRT calculated leakage is considered acceptable and the test is terminated.

$$L\ \text{(induced phase total containment calculated leak rate)} - \left[L\ \text{(24 hour phase) calculated leak} + L\ \text{(Superimposed) Leak Rate} \right] \leq 0.25\ Lp$$

H.2. Magnitude of Induced Leakage

The induced portion of the ILRT began at 1020 hours on 4/23/79 and was terminated at 1512 hours on 4/23/79. A flow of 2.07 SCFM was induced to an ambient pressure of 14.7 Psi. The new calculated leak rate was 0.4530 Wt%/Day with an upper 95% confidence limit of 0.5054 Wt%/Day. The induced leakage was allowed to run for more than four hours to account for transients which occurred as a result of valving adjustments in the reactor shutdown cooling loop. During the induced portion of the test, adjustments were made to the lineup of the Rx Building Closed Cooling Water System, which caused a change in the shutdown cooling water temperature.

The 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 Lp. Since the difference recorded during the test was 0.05 WT%/Day, all requirements were met to stay within the 0.4 Wt%/Day limits.

2239 266

I. TEST EVALUATION

Both the statistical leak rate and the upper confidence limit, corrected for process lines not vented or drained, were well within all Technical Specification limits.

Reactor vessel temperature transients were minimized by leaving the shutdown cooling system (B heat exchanger) in steady-state operation throughout the test. Reactor water temperature was controlled by varying the reactor building closed cooling water (RBCCW) supply flow rate to the heat exchanger. Remote throttling of the RBCCW discharge valve provided this method for stabilizing reactor water temperature.

Approximately 2 hours and 30 minutes into the induced leakage portion of the test, the reactor water temperature decreased from 139° F to 131° F in 20 minutes. By throttling the RBCCW discharge valve, the temperature was stabilized at 131° F and then slowly increased to 135° F, where it remained until the end of the test. This temperature transient was attributed to the change over of RBCCW pumps and HT exchangers by the Operating Department.

Upon depressurization, the drywell access lock and one torus access hatch were opened for removal of test instrumentation. A Type "B" Local Leak Rate Test was performed on both the drywell access lock and torus access hatch after final closure. Both tests exhibited zero leakage.

The station considers the test method to have met or exceeded all Type A test requirements; therefore, the calculated containment leak rate of 0.3858 Wt%/Day is considered to be a valid result which compares favorably with the operational limit of 1.2 Wt%/Day.

2239 267

APPENDIX A

TYPE A TEST INSTRUMENT ACCURACY ERROR ANALYSIS

2239 268

APPENDIX A

INSTRUMENT ACCURACY ERROR ANALYSIS

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

$$L(\%) = \left[\frac{24}{H}\right](100)\left[\frac{W_1 - W_2}{W_1}\right] = \frac{2400}{H}\left[1 - \frac{T_1P_2}{T_2P_1}\right]$$

where L = primary containment leak rate (%/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 the contained dry air mass at test data set #2 (lbs)
T_1 = volume weighted primary containment temperature at test data set #1 (°R)
T_2 = volume weighted 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:

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

substituting H = 24 hours

$$\frac{\partial L}{\partial P_1} = \frac{T_1P_2}{T_2P_1^2} \simeq \frac{1}{P_1}$$

$$\frac{\partial L}{\partial P_2} = \frac{T_1}{-T_2P_1} \simeq -\frac{1}{P_1}$$

$$\frac{\partial L}{\partial T_1} = \frac{P_2}{-T_2P_1} \simeq -\frac{1}{T_2}$$

2239 269

$$\frac{\partial L}{\partial T_2} = \frac{T_1P_2}{T_2P_1} \simeq \frac{1}{T_2}$$

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

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

Therefore,

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

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

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

where VFj = the volume weighting factors

NVOL = the number of containment subvolumes

Tave, j = the average absolute temperature in the jth subvolume

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

where Ti,j = the absolute temperature of the ith RTD in the jth subvolume

Nj = number of RTD's in the jth subvolume

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

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

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

$$\delta(Tave,\ j) = \frac{\text{RTD accuracy}}{(Nj)^{\frac{1}{2}}}$$

therefore,

$$\delta(\overline{T}) = \sum_{j=1}^{NVOL} (VFj)\ \frac{\text{RTD accuracy}}{(Nj)^{\frac{1}{2}}}$$

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

$$\delta(\overline{P}) = \left[\delta(P_T)^2 + \delta(P_V)^2\right]^{\frac{1}{2}}$$

where P_T = total absolute primary containment pressure

P_V = partial pressure of water vapor in the primary containment

substituting $\delta(P_T) = \dfrac{\text{PPG accuracy}}{(\#\text{ of PPG's})^{\frac{1}{2}}}$. 2239 270

$$\delta(P_V) = \sum_{J-1}^{NVOL} (VFj)\ \frac{(\text{Dewcell accuracy})}{(Nj)^{\frac{1}{2}}}$$

where PPG = precision pressure gage
Nj = number of dewcells in the jth subvolume

therefore,

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

3. The above analysis was performed twice; once for system accuracy and once for system repeatability. The following chart shows the various sensor errors as determi ed by pretest calibration.

Sensor	RTD Zone 1-10	PPG	DEWCELL
Accuracy	±0.38°F	+0.015 PSIA	±2.74°F
Repeatability	±0.013°F	+0.001 PSIA	±0.0092°F

Using the above quantities, the system error due to instrument accuracy was found to be ±0.14902 weight%/day. Similarly, the system error due to instrument repeatability was ±0.00175 weight %/day. A total system error of ±0.14903 weight%/day was determined by the following identity.

$$(L) = \left[\delta(L)^2 \text{ accuracy} + \delta(L)^2 \text{ repeatability}\right]^{\frac{1}{2}}$$

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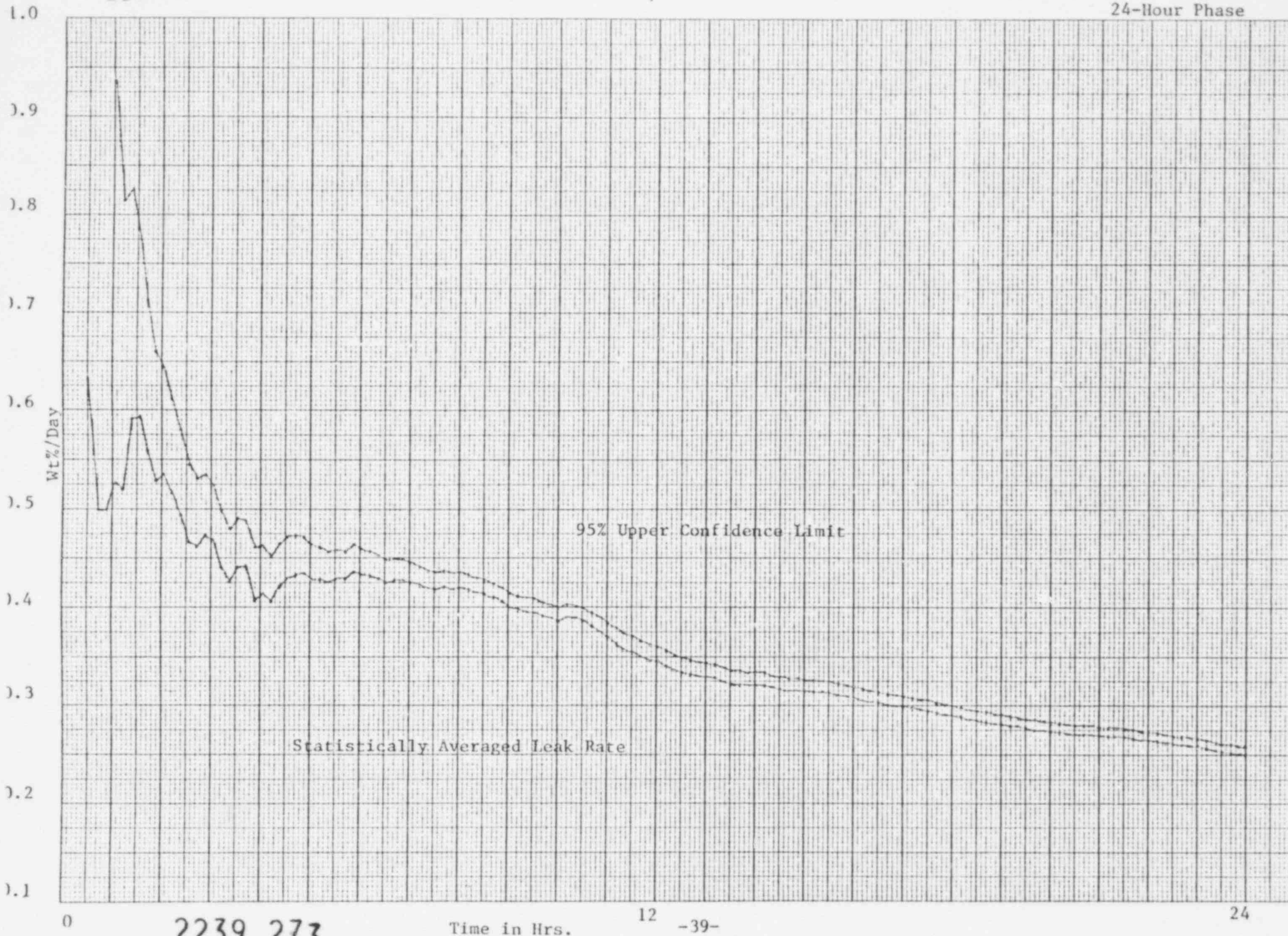
APPENDIX B

TYPE A TEST GRAPHS

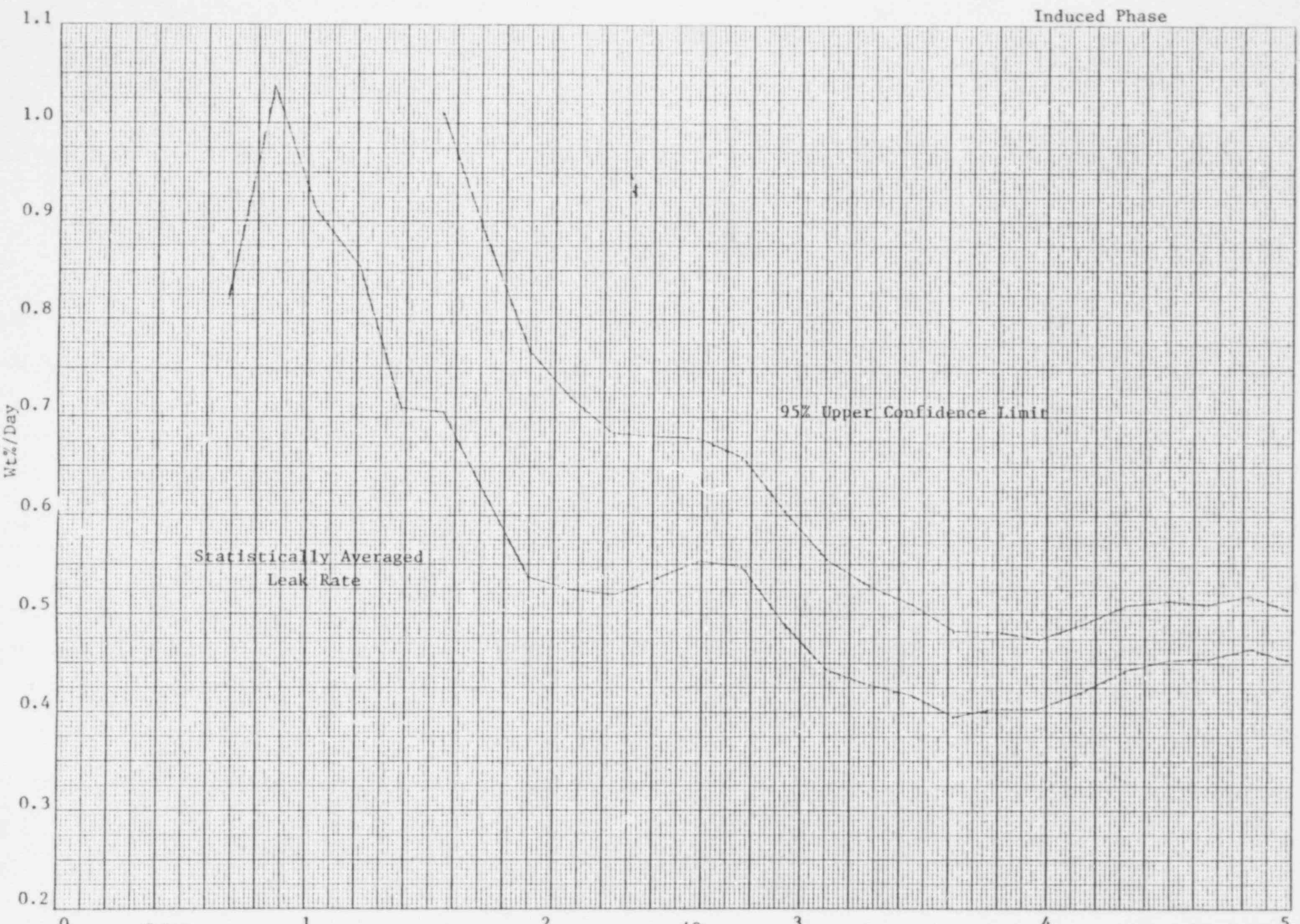
2239 272

461510



2239 273

POOR ORIGINAL



2239 274

APPENDIX C

TYPE B AND C TEST RESULTS

2239 275

LOCAL LEAK RATE TESTS PERFORMED DURING THE UNIT 2 REFUELING OUTAGE OF 1979

TYPE OF PENETRATION: MAIN STEAM ISOLATION VALVES
TESTED AT 25 PSIG

TEST NUMBER	PENETRATION NUMBER	VOLUME BEING TESTED	INITIAL LEAK RATE WT %/DAY	INITIAL THRU LEAKAGE WT %/DAY	FINAL LEAK RATE WT %/DAY	FINAL THRU LEAKAGE WT %/DAY
1	X-105A	203-1A* & 203-2A	.00441/2.16	.00110/0.54	---	.00110/0.54
2	X-105A	203-1A & 203-2A	.00551/2.70	---	---	---
3	X-105B	203-1B* & 203-2B	.00582/2.85	.00582/2.85	---	.00582/2.85
4	X-105B	203-1B & 203-2B	.01340/6.56	---	---	---
5	X-105C	203-1C* & 203-2C	.00729/3.57	.00223/1.09	---	.00223/1.09
6	X-105C	203-1C & 203-2C	.00952/4.66	---	---	---
7	X-105D	203-1D* & 203-2D	.00290/1.42	.00102/0.50	---	.00102/0.50
8	X-105D	203-1D & 203-2D	.00392/1.92	---	---	---
TOTAL THRU LEAKAGE FOR PAGE						

2239 276

*Indicates waterhead present on one side of valve

LOCAL LEAK RATE TESTS PERFORMED DURING THE UNIT 2 REFUELING OUTAGE OF 1979

TYPE OF PENETRATION: ISOLATION VALVES

TEST NUMBER	PENETRATION NUMBER	VOLUME BEING TESTED	INITIAL LEAK RATE WT %/DAY	INITIAL THRU LEAKAGE WT %/DAY	FINAL LEAK RATE WT %/DAY	FINAL THRU LEAKAGE WT %/DAY
9	X-147	205-2-4 & Blind Flange	.00504	.00504	---	.00504
10	X-147	205-2-7 & Blind Flange	.03241	---	---	---
11	X-106	220-1 & 220-2	.00051	.00027	---	.00027
12	X-122	220-44 & 220-45	.00008	.00004	---	.00004
13	X-107A	220-57A* & 220-58A	.04280	---	---	---
14	X-107A	220-57A* & 220-62A	.03243	.03243	---	.03243
15	X-107B	220-57B* & 220-58B	.04297	---	---	---
16	X-107B	220-57B* & 220-62B	.02291	.02291	---	.002291
17	X-109B	301-95 & 301-99*	.01027	---	---	---
18	X-109B	301-98 & 301-99*	.00825	.00825	---	.00825
19	X-111A, 111B	1001-1A*, 1B*, 2A, 2B & 2C	0	0	---	0
20	X-138	1101-1* & 1101-15	.00257	.00257	---	.00257
21	X-138	1101-1* & 1101-16	.00347	---	---	---
22	X-113	1201-1, 2 & 3	.01707	.01707	---	.01707
23	X-108A	1301-1 & 1301-2	.00208	.00104	---	.00104
24	X-109A	1301-3 & 1301-4*	.00225	.00225	---	.00225
25	X-108A, 109A	1301-17 & 1301-20	.00006	.00004	---	.00004
26	X-310A	1402-4A, 8A*, 25A & 36A*	.01174	.01174	---	.01174
27	X-149A	1402-24A & 1402-25A	.01632	---	---	---
28	X-310B	1402-4B, 8B*, 25B & 36B*	.00235	.00235	---	---
29	X-149B	1402-24B & 1402-25B	0	---	---	---
		TOTAL THRU LEAKAGE FOR PAGE		0.10600		0.10600

2239 277

*Indicates waterhead present on one side of valve

LOCAL LEAK RATE TESTS PEI ORMED DURING THE UNIT 2 REFUELING OUTAGE OF 1979

TYPE OF PENETRA ION: ISOLATION VALVES

TEST NUMBER	PENETRATION NUMBER	VOLUME BEING TESTED	INITIAL LEAK RATE WT %/DAY	INITIAL THRU LEAKAGE WT %/DAY	FINAL LEAK RATE WT %/DAY	FINAL THRU LEAKAGE WT %/DAY
30	X-311A	1501-18A & 1501-19A	.00415	.00208	---	.00208
31	X-311B	1501-18B & 1501-19B	.00929	.00466	---	.00466
32	X-310A	1501-20A & 1501-38A	.00415	.00208	---	.00208
33	X-310B	1501-20B & 1501-38B	.00578	.00290	---	.00290
34	X-116A	1501-22A, 26A* & 1001-5A	.00278	---	---	---
35	X-116A	1501-25A & 1501-26A*	.00265	.00265	---	.00265
36	X-116B	1501-22B, 26B* & 1001-5B	.00133	.00133	---	.00133
37	X-116B	1501-25B & 1501-26B*	.03343	---	---	---
38	X-145	1501-27A & 1501-28A	.02573	.01287	.02218	.01109
39	X-150A	1501-27B & 1501-28B	.01048	.00525	---	.00527
40	X-304	1601-20A & 1601-31A	0	0	---	0
41	X-304	1601-20B & 1601-31B	.00104	.00053	---	.00053
42	X-126, 304	1601-21, 22, 55 & 56	.00274	.00137	---	.00137
43	X-125, 318	1601-23, 24, 60, 61, 62 & 63	3.39006	3.39006	.03941	.01971
44	X-126, 304	1601-57, 58 & 59	.00006	.00004	---	.00004
45	X-118	2001-5 & 2001-6	.00210	.00106	---	.00106
46	X-117	2001-105 & 2001-106	.00325	.00163	.00404	.00202
47	X-128	2301-4 & 2301-5	.00476	.00239	.00504	.00253
48	X-312	2301-34 & 2301-71	.03339	.01670	---	.01670
49	---	2301-35 & 230-36	0	0	---	0
50	X-317	2301-45 & 2301-74	.01728	.00864	---	.00864
		TOTAL THRU LEAKAGE FOR PAGE		3.45624		.08466

2239 278

*Indicates overhead present on one side of valve

LOCAL LEAK RATE TESTS PERFORMED DURING THE UNIT 2 REFUELING OUTAGE OF 1979

TYPE OF PENETRATION: ISOLATION VALVES

TEST NUMBER	PENETRATION NUMBER	VOLUME BEING TESTED	INITIAL LEAK RATE WT %/DAY	INITIAL THRU LEAKAGE WT %/DAY	FINAL LEAK RATE WT %/DAY	FINAL THRU LEAKAGE WT %/DAY
51	X-202V	2499-1A & 2499-2A	.00014	.00008	---	.00008
52	X-204B	2499-1B & 2499-2B	.00061	.00031	---	.00031
53	X-316A	2499-3A & 2499-4A	.00006	.00004	---	.00004
54	X-316B	2499-3B & 2499-4B	.00022	.00012	---	.00012
55	X-202V	2599-2A & 2599-23A	.03563	.00018	---	.00018
56	X-204B	2599-2B & 2599-23B	.00086	.00043	---	.00043
57	X-316A	2599-3A & 2599-24A	.00102	.00051	---	.00051
58	X-316B	2599-3B & 2599-24B	.00006	.00004	---	.00004
59	X-125, 318	2599-4A & 2599-5A	.00053	.00027	---	.00027
60	X-125, 318	2599-4B & 2599-5B	.00006	.00004	---	.00004
61	X-139D	4720 & 4721	.00008	.00004	---	.00004
62	X-121	4722 & Check Valve	.00696	.00349	---	.00349
63	X-309A	8501-1A & End of Line	.00082	---	---	---
64	X-309A	8501-1B & End of Line	.00043	.00043	---	.00043
65	X-204	8501-3A & 8501-3B	.00327	.00163	---	.00163
66	X-143	8501-5A & End of Line	.00010	---	---	---
67	X-143	8501-5B & End of Line	.00002	.00002	---	.00002
68	X-143	9205A & End of Line	.00012	.00012	---	.00012
69	X-143	9205B & End of Line	.00841	---	---	---
70	X-143	9206A & End of Line	.00823	.00823	---	.00823
71	X-143	9206B & End of Line	.00854	---	---	---
		TOTAL THRU LEAKAGE FOR PAGE		.01598		.01598

2239 279

Indicates w(?)erhead present on one side of valve

LOCAL LEAK RATE TESTS PERFORMED DURING THE UNIT 2 REFUELING OUTAGE OF 1979

TYPE OF PENETRATION: ISOLATION VALVES

TEST NUMBER	PENETRATION NUMBER	VOLUME BEING TESTED	INITIAL LEAK RATE WT %/DAY	INITIAL THRU LEAKAGE WT %/DAY	FINAL LEAK RATE WT %/DAY	FINAL THRU LEAKAGE WT %/DAY
72	X-101	9207A & End of Line	.00656	---	---	---
73	X-101	9207B & End of Line	.00067	.00067	---	.00067
74	X-101	9208A & End of Line	.00092	.00092	---	.00092
75	X-101	9208B & End of Line	.00707	---	---	---
76	X-136E	TIP Purge Check Valve	.00071	.00071	---	.00071
77	X-136J	Tip Ball Valve A	.00027	.00027	---	.00027
78	X-136F	TIP Ball Valve B	.00161	.00161	---	.00161
79	X-136E	TIP Ball Valve C	.00349	.00349	---	.00349
80	X-136H	TIP Ball Valve D	.00104	.00104	---	.00104
81	X-136E	TIP Ball Valve E	.00061	.00061	---	.00061
82	X-313A	East Torus Drain Valves	.00010	.00006	---	.00006
83	X-313B	West Torus Drain Valves	.00067	.00035	---	.00035
84	X-101	Personnel Air Lock	.11156	.05579	.03557	.01779
		TOTAL THRU LEAKAGE FOR PAGE		.06552		.02752

2239 280

Indicates [illegible]erhead present on one side of valve

LOCAL LEAK RATE TESTS PERFORMED DURING THE UNIT 2 REFUELING OUTAGE OF 1979

TYPE OF PENETRATION: ELECTRICAL

TEST NUMBER	PENETRATION NUMBER	VOLUME BEING TESTED	INITIAL LEAK RATE WT %/DAY	INITIAL THRU LEAKAGE WT %/DAY	FINAL LEAK RATE WT %/DAY	FINAL THRU LEAKAGE WT %/DAY
85	X-200A	CRD Indication	.00065	.00033	---	.00033
86	X-200B	LV Power & Control	.00263	.00133	---	.00133
87	X-202B	HV Power	.00033	.00016	---	.00016
88	X-202BB	CRD Indicators	.00312	.00157	---	.00157
89	X-202D	HV Power	.00029	.00014	---	.00014
90	X-202F	Thermocouples	.00196	.00098	---	.00098
91	X-202J	Neutron Monitor	.00084	.00043	---	.00043
92	X-202N	Neutron Monitor	.00039	.00020	---	.00020
93	X-202Q	LV Power & Control	.00110	.00055	---	.00055
94	X-202S	CRD Indicators	.00[illegible]88	.00194	---	.00194
95	X-202W	CRD Indicators	.00065	.00033	---	.00033
96	X-202X	Core Vibration Measurement	0	0	---	0
97	X-203A	CRD Indicators	0	0	---	0
98	X-203B	LV Power & Control	.00198	.00098	---	.00098
99	X-204E	Neutron Monitor	.00090	.00045	---	.00045
100	X-204H	Neutron Monitor	.00039	.00020	---	.00020
101	X-204P	HV Power	.00006	.00004	---	.00004
102	X-204Q	HV Power	0	0	---	0
103	X-204S	LV Power & Control	.00045	.00022	---	.00022
104	X-204T	CRD Indicators	.37493	0	.00466	0
105	X-205E	LV Power & Control	.00331	.00165	---	.00165
		TOTAL THRU LEAKAGE FOR PAGE		.01150		.01150

2239 281

Indicates Overhead present on one side of valve

LOCAL LEAK RATE TESTS PERFORMED DURING THE UNIT 2 REFUELING OUTAGE OF 1979

TYPE OF PENETRATION: DRYWELL BELLOWS SEALS

TEST NUMBER	PENETRATION NUMBER	VOLUME BEING TESTED	INITIAL LEAK RATE WT %/DAY	INITIAL THRU LEAKAGE WT %/DAY	FINAL LEAK RATE WT %/DAY	FINAL THRU LEAKAGE WT %/DAY
106	X-109B	Iso. Cond. Condensate Return	0	0	---	0
107	X-149A	Core Spray	.00486	.00243	---	.00243
108	X-149B	Core Spray	.00133	.00067	---	.00067
109	X-144	CRD Return	.00186	.00094	---	.00094
110	X-105A	Main Steam Line				
111	X-105B	Main Steam Line				
112	X-105C	Main Steam Line				
113	X-105D	Main Steam Line				
114	X-106	Main Steam Drain				
115	X-107A	Feedwater				
116	X-107B	Feedwater				
117	X-111A	Shutdown Cooling	.00088	.00045	---	.00045
118	X-111B	Shutdown Cooling				
119	X-115A	HPCI Steam Line				
120	X-116A	LPCI Injection				
121	X-116B	LPCI Injection				
122	X-123	RBCCW Inlet				
123	X-124	RBCCW Outlet				
124	X-126	Vent to Drywell				
		TOTAL THRU LEAKAGE FOR PAGE		.00449		.00449

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Indicates [illegible]erhead present on one side of valve

LOCAL LEAK RATE TESTS PERFORMED DURING THE UNIT 2 REFUELING OUTAGE OF 1979

TYPE OF PENETRATION: DRYWELL BELLOWS SEALS

TEST NUMBER	PENETRATION NUMBER	VOLUME BEING TESTED	INITIAL LEAK RATE WT %/DAY	INITIAL THRU LEAKAGE WT %/DAY	FINAL LEAK RATE WT %/DAY	FINAL THRU LEAKAGE WT %/DAY
125	X-108A	Iso. Cond. Steam Line				
126	X-113	Cleanup				
127	X-125	Vent from Drywell	0	0	---	0
128	X-130	Standby Liquid Control				
129	X-147	Reactor Head Spray				
		TOTAL THRU LEAKAGE FOR PAGE		0		0

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*Indicates v[illegible]erhead present on one side of valve

LOCAL LEAK RATE TESTS PERFORMED DURING THE UNIT 2 REFUELING OUTAGE OF 1979

TYPE OF PENETRATION: DOUBLE GASKETED SEALS

TEST NUMBER	PENETRATION NUMBER	VOLUME BEING TESTED	INITIAL LEAK RATE WT %/DAY	INITIAL THRU LEAKAGE WT %/DAY	FINAL LEAK RATE WT %/DAY	FINAL THRU LEAKAGE WT %/DAY
150	X-301F	Torus Vacuum Breaker 1601-33A	.00071	.00037	---	.00037
151	X-301F	Torus Vacuum Breaker 1601-33B	.00047	.00025	---	.00025
152	X-301E	Torus Vacuum Breaker 1601-33C	.00751	.00376	---	.00376
153	X-301E	Torus Vacuum Breaker 1601-33D	.00149	.00076	---	.00076
154	X-301D	Torus Vacuum Breaker 1601-33E	.18163	.00014	.00065	.00033
155	X-301D	Torus Vacuum Breaker 1601-33F	.00118	.00059	---	.00059
156	X-306A	East Torus Access Hatch	.00002	.00002	0	0
157	X-306B	West Torus Access Hatch	.00002	.00002	0	0
158	X-313A	East Torus Drain	.00012	.00006	---	.00006
159	X-313B	West Torus Drain	.00016	.00008	---	.00008
160		Shear Lug Hatch	0	0	---	0
161		Shear Lug Hatch	0	0	---	0
162		Shear Lug Hatch	0	0	---	0
163		Shear Lug Hatch	0	0	---	0
164		Shear Lug Hatch	0	0	---	0
165		Shear Lug Hatch	0	0	---	0
166		Shear Lug Hatch	0	0	---	0
167		Shear Lug Hatch	.01540	0	---	0
		TOTAL THRU LEAKAGE FOR PAGE		.00605		.00619

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*Indicates overhead present on one side of valve