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MANGAN,C.V. Niagara Mohawk Power Corp.
RECIP.NAME RECIPIENT AFFILIATION
SCHWENCER,A. Licensing Branch 2

SUBJECT: Forwards responses to SER Open Items 120,147,181,182a,182b, 182c,183,184 & 185.Responses will be included in next FSAR amend.W/16 oversize tables.Aperture cards available in PDR.

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NIAGARA MOHAWK

NIAGARA MOHAWK POWER CORPORATION/300 ERIE BOULEVARD WEST, SYRACUSE, N.Y. 13202/TELEPHONE (315) 474-1511

September 21, 1984
(NMP2L 0165)

Mr. A. Schwencer, Chief
Licensing Branch No. 2
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Re: Nine Mile Point Unit 2
Docket No. 50-410

Dear Mr. Schwencer:

Enclosed for your use and information are the Nine Mile Point Unit 2 responses to the Nuclear Regulatory Commission's Safety Evaluation Report open items. This information has been previously discussed with your staff and is submitted to aid your review of the Unit 2 license application for the resolution of these open items. This submittal includes information for Safety Evaluation Report open items 120, 147, 181, 182a, 182b, 182c, 183, 184, 185.

The enclosed will be included in the next Final Safety Analysis Report Amendment.

Very truly yours,

C. V. Mangan
Vice President
Nuclear Engineering & Licensing

NLR:ja
Enclosure
xc: Project File (2)

B001
1/1

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
Niagara Mohawk Power Corporation	)	Docket No. 50-410
(Nine Mile Point Unit 2)	)	

AFFIDAVIT

C. V. Mangan, being duly sworn, states that he is Vice President of Niagara Mohawk Power Corporation; that he is authorized on the part of said Corporation to sign and file with the Nuclear Regulatory Commission the documents attached hereto; and that all such documents are true and correct to the best of his knowledge, information and belief.

CV Mangan

Subscribed and sworn to before me, a Notary Public in and for the State of New York and County of Onondaga, this 21st day of September 1984.

Christine Austin
Notary Public in and for
Onondaga County, New York

My Commission expires:

CHRISTINE AUSTIN
Notary Public in the State of New York
Qualified in Onondaga Co. No. 4787687
My Commission Expires March 30, 1985

CHRISTINE AUSTIN
Notary Public in the State of New York
Qualified in Onondaga Co. No. 4707687
My Commission Expires March 30, 19__

SER#120

QUESTION F470.7 (12.4) 1.12

Section 12.4 indicates that the dose assessment is in 1.13
progress and that doses and details of the man-rem
evaluation will be provided in an amendment. The bases and 1.15
details of the dose assessment, as specified in Regulatory
Guide 1.70, Revision 3, and Standard Review Plan 12.3-12.4 1.17
(NUREG-0800), should be supplied. Either provide this 1.18
information or a schedule for submitting the information.

RESPONSE 1.21

See revised Section 12.4. 1.22

QUESTION F471.11 1.10

Subsection 12.4.2.1, Man-Rem Evaluation, states that the 1.11
Man-Rem evaluation is in progress, the details of which will 1.12
be included as an amendment to the Unit 2 FSAR. 1.14

Provide this information. 1.15

RESPONSE 1.16

See revised Section 12.4. 1.17

12.4 DOSE ASSESSMENT 1.10

Radiation exposures in the plant are primarily from 1.12
components and equipment containing radioactive fluids, and 1.13
to a lesser extent from the presence of airborne
radionuclides. Inplant radiation exposures during normal 1.14
operation, refueling, and anticipated operational 1.15
occurrences are discussed in Section 12.4.2. Radiation 1.17
exposures at onsite locations outside the plant are
discussed in Section 12.4.3.

12.4.1 Design Criteria 1.19

The criteria for doses to plant personnel during normal 1.20
operation and anticipated operational occurrences, including 1.21
refueling, are based on the requirements discussed in 1.22
10CFR20. The design radiation levels during normal 1.24
operation, refueling, and anticipated occupational 1.25
occurrences are shown on Figures 12.3-34 through 12.3-66. 1.26

Radiation exposures to operating personnel are within 1.27
10CFR20 limits. Radiation protection design features 1.28
(Section 12.3) and the health physics program (Section 12.5)
assure that the occupational radiation exposures (ORE) to 1.30
operating personnel during normal operation, refueling, and
anticipated operational occurrences are as low as is 1.31
reasonably achievable (ALARA).

12.4.2 Exposures Within the Plant 1.40

12.4.2.1 Man-Rem Evaluation 1.42

The occupational radiation dose assessment for Unit 2 is 1.45
performed using the guidelines of Regulatory Guide 8.19[1]. 1.46
The bases for the annual man-rem estimates are Unit 1 1.48
operating data are modified to account for design 1.49
differences and improvements in Unit 2. The projected 1.50
radiation dose rates throughout the plant facilities are
based on assumed radiation conditions after 5 yr of plant 1.51
operation and expected radiation dose rates. Operational 1.52
data from several BWRs[2] (which show that the average
annual man-rem per unit over several operating years is 1.53
948 man-rem per year) are presented in Table 12.4-12. These 1.54
data indicate that, in recent years, occupational radiation
exposures have been much larger than the radiation exposures 1.55
reported for operating BWR plants in the mid-1970's. The 1.56
primary reason for the increase in radiation exposure has
been the increase in manpower necessary to support the 1.57
expanding special maintenance activities.

Table 12.4-13 shows the distribution of annual occupational 1.58
radiation exposures by work functions for a all BWRs over 2.1
several years as suggested in Regulatory Guide 8.19[1]. The 2.2
average values indicate that operating BWR plants have
approximately 76 percent annual occupational exposure 2.3
attributed to routine maintenance (40 percent) and special 2.4
maintenance (36 percent). In recent years, plant 2.5
modifications attributed to feedwater sparger repairs,
inspection, repair and replacement of recirculation piping, 2.6
TMI lessons-learned modifications, and increased snubber and 2.7
pipe hanger inspections have contributed to the growing 2.8
amount of occupational radiation exposures associated with 2.9
special maintenance work functions. Design features 2.10
described in Sections 12.1 and 12.3 for the Unit 2 BWR 5
plant should minimize the special maintenance work 2.11
experienced at earlier-designed operating BWR plants.

Unit 2 design improvements that are expected to reduce the 2.12
occupational radiation exposures include the following: 2.13

1. Incorporation of flush connections on the CRD scram 2.15
discharge volume header permits condensate flushing 2.16
of piping to minimize corrosion product holdup in a 2.17
high personnel access area.

2. Use of filtered condensate water for CRD hydraulic 2.18
fluid and the reactor recirculation pump seal purge 2.19
provides a clean water source that should extend
pump seal life.

3. Installation of permanent hoisting system and 2.20
access platforms for the recirculation pumps, main 2.21
steam isolation valves, and safety-relief valves
minimizes maintenance time in the drywell. 2.22

4. An improved refueling platform makes fuel handling 2.23
activities more efficient, therefore less time is 2.24
spent on the platform.

5. A multistud tensioner reduces the amount of 2.25
man-hours necessary to handle the reactor vessel 2.26
head studs.

6. A new handling tool and platform for the removal of 2.27
CRDs from beneath the reactor vessel reduces crew 2.28
size and time spent in the high radiation area.

7. Improved fuel design minimizes the buildup of 2.29
radiation levels near reactor coolant systems and 2.30

reduces the amount of fuel assembly sipping activities.

8. Improved piping material for the recirculaiton 2.31
system eliminates the special maintenance that was 2.32
required on older BWR recirculation piping due to
stress corrosion cracking.

9. Inservice inspection access is improved by remote 2.33
equipment development and access doors for reactor 2.34
vessel and nozzle weld inspection.

10. The main steam isolation valves are ball valves 2.35
with greatly reduced maintenance requirements and 2.36
smaller leakage rates which reduce the amount of
man-hours spent servicing and inspecting the 2.37
valves.

11. A decontamination platform is provided to wash the 2.38
walls of the reactor cavity pit and internals pool 2.39
to minimize contribution from this source.

12. Use of separate shielded cubicles for locating 2.40
redundant components and highly radioactive 2.41
components minimizes radiation exposures during
maintenance activities.

13. Use of mechanical snubbers should reduce the 2.42
frequency of necessary inspection compared to 2.43
hydraulic-operated snubbers.

14. Installation of a CRD flush tank removes highly 2.44
radioactive corrosion and fission products from CRD 2.45
internals prior to rebuilding.

The occupational radiation exposure for Unit 2 is determined 2.47
for each of the Regulatory Guide 8.19[1] work function 2.48
categories by identifying specific tasks within each of the 2.49
seven work function categories and determining the time and
manpower requirements for those tasks. This information is 2.51
used with the expected dose rates in areas where work is
performed to determine the radiation exposure from each 2.52
activity. Tables 12.4-5 through 12.4-11 provide estimates 2.53
of occupational exposures based on the identification of 2.54
specific tasks within each of the seven work function 2.55
categories: routine operations and surveillance, nonroutine
operations and surveillance, routine maintenance, radwaste 2.56
processing, refueling, inservice inspection, and special 2.57
maintenance. Table 12.4-4 summarizes the occupational dose 2.58
estimates for the seven work functions. A comparison 3.1

between Tables 12.4-4 and 12.4-12 shows that the Unit 2 occupational exposure is consistent with the operating plants data for the period of 1974-1979 (before the TMI accident). The higher occupational exposures for the period of 1980-1982 are not expected at Unit 2 because plant modifications that caused the increases have been incorporated into the original design of Unit 2.

12.4.2.2 Estimates of Inhalation Thyroid Doses

Inhalation doses during full-power operations will be negligible in every area except the reactor, turbine, and radwaste building areas. Potential airborne activities for these areas are given in Section 12.2.2. These concentrations are based upon data given in NUREG-0016 and EPRI-495. The inhalation thyroid doses that result are given in Table 12.4-2.

Thyroid dose rates in Table 12.4-2 are calculated according to:

$$D_t = \sum_i (B.R.)(A_i)(C)(K_i)$$

References 1.10

1. Regulatory Guide 8.19, Occupational Radiation Dose Assessment in Light-Water Reactor Power Plants Design Stage Man-Rem Estimates, Revision 1, June 1979. 1.12 1.13

2. NUREG-0713, Volume 4, Occupational Radiation Exposure at Commercial Nuclear Power Reactor 1982, December 1983. 1.14

TABLE 12.4-4

ESTIMATED OCCUPATIONAL RADIATION DOSE BY WORK FUNCTIONS FOR UNIT 2

Function	Annual Dose (Man-Rem/Yr)	Percentage of Total Dose
Routine Operations and Surveillance	56.0	10.6
Non-routine Operations and Surveillance	32.0	6.1
Routine Maintenance	191.0	36.2
Waste Processing	54.0	10.2
Refueling	23.0	4.3
Inservice Inspection	107.0	20.3
Special Maintenance	65.0	12.3
Total	528.0	100.0

TABLE 12.4-5

OCCUPATIONAL DOSE ESTIMATES DURING ROUTINE OPERATIONS AND SURVEILLANCE

Activity	Avg. Dose Rate (mrem/hr)	Exposure Time (hr)	No. of Workers	Frequency	Dose (mrem/Yr)
Operations Surveillance					
Reactor Building	1.3	1.5	1	2/shift	4.0
Turbine Building	4.0	2.0	1	2/shift	18.0
Chemistry Surveillance	0.5	5.5	10	Daily	10.0
Security Surveys	1.0	0.50	1	1/hr	4.0
Instrumentation and Controls	0.1	6.00	40	1/day	9.0
Radiation Protection Surveillance	11.0	19.0	1	1/wk	11.0
				Total	56.0

TABLE 12.4-6

OCCUPATIONAL DOSE ESTIMATES DURING NON-ROUTINE OPERATIONS AND SURVEILLANCE

Activity	Avg. Dose Rate (mrem/hr)	Exposure Time (hr)	No. of Workers	Frequency	Dose (mrem/yr)
Equipment Operations					
RWCU System	1.0	60.0	2	1/yr	0.10
Condensate System	2.2	8.0	2	1/day	13.0
RHS System	0.2	2.0	2	1/month	0.01
SFC System	1.0	6.0	2	1/yr	0.01
ECCS System	0.2	2.5	2	1/month	0.01
SLS System	1.0	3.0	2	1/month	0.10
Instrument Calibration					
Instrumentation and Controls	0.2	6.0	40	1/day	18.0
Radiation Monitors					
Linearity Checks	1.0	50.0	1	2/yr	0.10
Calibration	1.0	225.0	2	1/1.5 yr	0.30
				Total	32.00

TABLE 12.4

OCCUPATIONAL DOSE ESTIMATES DURING ROUTINE MAINTENANCE

ACTIVITY	AVG. DOSE RATE (MREM/HR)	EXPOSURE TIME (HR)	NO. OF WORKERS	FREQUENCY	DOSE (MAN-REM/YR)
1. MINOR REACTOR BLDG. REPAIRS	1.0	20	2	1/WEEK	2.1
2. VENTILATION & AIR CONDITIONING	1.0	20	1	1/WEEK	1.0
3. CONTROL ROD DRIVE	75.0	8	21	1/1.5 YR	8.4
4. RECIRCULATION PUMPS	100.0	20	5	2/1.5 YR	13.0
5. RECIRCULATION SYSTEM VALVES	100.0	2	2	1/YR	0.4
6. REACTOR WATER CLEANUP PUMP	90.0	25	4	1/1.5YR	6.0
7. REACTOR WATER CLEANUP VALVES	90.0	8	2	1/YR	1.4
8. CONDENSATE SYSTEM	5.0	200	7	1/YR.	7.0
9. RESIDUAL HEAT REMOVAL SYSTEM	90.0	25	8	1/YR	18.0
10. SAFETY RELIEF VALVES	100.0	60	5	1/1.5 YR	20.0
11. MAIN STEAM ISOLATION VALVES	100.0	100	6	1/YR	60.0
12. SNUBBERS	20.0	100	5	1/YR	10.0
13. MINOR TURBINE BLDG. REPAIRS	1.0	8	1	1/DAY	2.9
14. TURBINE OVERHAUL	1.0	240	10	1/1.5YR	1.6
15. DRAIN COOLERS	100.0	40	2	1/YR	8.0
16. STEAM JET AIR EJECTORS	5.0	40	2	1/YR	0.4
17. OFF-GAS SYSTEM	20.0	40	2	6/YR	9.6
18. MISC. RADWASTE PUMP REPAIRS	20.0	40	2	6/YR	9.6
19. MISC. RADWASTE VALVE REPAIRS	20.0	40	2	6/YR	9.6
20. FILTERS AND DEMINERALIZERS	20.0	30	3	1/YR	1.8
21. STANDBY LIQUID CONTROL SYSTEM	1.0	60	2	1/1.5 YR	0.1
22. RADIATION MONITERS	1.0	40	2	2/1.5 YR	0.1
				TOTAL	191.0

TABLE 12.4-8

OCCUPATIONAL DOSE ESTIMATES DURING WASTE PROCESSING (RADWASTE OPERATIONS)

Activity	Avg. Dose Rate (mrem/hr)	Exposure Time (hr)	No. of Workers	Frequency	Dose (mrem/yr)
Operation of Liquid Radwaste System	0.5	6.0	3	1/shift	10.0
Operation of Solid Radwaste System	0.5	6.0	3	1/shift	10.0
DAW Compacting	3.5	6.0	2	2/day	31.0
Radwaste Shipments	1.0	6.0	2	1/wk	1.0
DAW Shipments	5.0	16.0	2	1/month	2.0
				Total	54.0

TABLE 12.4-9

OCCUPATIONAL DOSE ESTIMATES DURING REFUELING

Activity	Avg. Dose Rate (mrem/hr)	Exposure Time (hr)	No. of Workers	Frequency (yr)	Dose (mrem/yr)
Reactor Disassembly	12.0	75.0	10	1/1.5	6.0
Reactor Assembly	12.0	150.0	10	1/1.5	12.0
Fuel Unload	2.0	200.0	8	1/1.5	2.0
Fuel Load	2.0	180.0	8	1/1.5	2.0
Fuel Preparation	2.0	100.0	7	1/1.5	1.0
				Total	23.0

TABLE 12.4-10

OCCUPATIONAL DOSE ESTIMATES DURING INSERVICE INSPECTION

Activity	Avg. Dose Rate (mrem/hr)	Exposure Time (hr)	No. of Workers	Frequency (yr)	Dose (mrem/yr)
Reactor Building - Primary Containment	100.00	150	7	1/1.5	70.0
Reactor Building - Secondary Containment	10.00	580	8	1/refueling	31.0
Turbine and Miscellaneous Buildings	10.00	110	8	1/1.5	6.0
				Total	107.0

TABLE 4-11

OCCUPATIONAL DOSE ESTIMATES DURING SPECIAL MAINTENANCE

ACTIVITY	AVG. DOSE RATE (MREM/HR)	EXPOSURE TIME (HR)	NO. OF WORKERS	FREQUENCY	DOSE (MAN-REM/YR)
1. OFF-GAS SYS. CHARCOAL OVERHAUL	100.0	100	2	1/20 YR	1.0
2. SPECIAL MAINTENANCE REACTOR WATER CLEANUP SYSTEM	90.0	100	4	1/10 YR	3.6
3. SPECIAL MAINTENANCE SPENT FUEL COOLING	500.0	100	5	1/10 YR	25.0
4. MISC. RCIC REPAIRS	9.0	140	4	1/10 YR	0.5
5. CRD DISPOSAL	1.0	400	10	3/YR	12.0
6. RADWASTE FLATBED FILTER MAIN.	400.0	8	3	2/YR	19.0
7. SPARGER REPLACEMENT	15.0	75	14	*	
8. FEEDWATER HEATER REPAIR	1.0	80	10	1/10 YR	0.1
9. RECIRC. PUMP OVERHAUL	30.0	225	5	1/10 YR	3.4
				TOTAL	65.0

* SHOULD NOT BE NECESSARY

TABLE 12.4-12

OPERATIONAL MAN-REM PER YEAR FOR
SELECTED BWR PLANTS

Plant	1974	1975	1976	1977	1978	1979	1980	1981	1982
Dresden 1,2,3	1,662	3,423	1,680	1,693	1,529	1,800	2,105	2.802	2,923
Monticello	349	1,353	263	1,000	375	157	531	1,004	993
Nine Mile Point	824	681	428	1,383	314	1,497	591	1,592	1,264
Peach Bottom 2,3	-	228	840	2,036	1,317	1,388	2,302	2,506	1,977
Quad Cities 1,2	482	1,618	1,651	1,031	1,618	2,158	4,838	3,146	3,757
Vermont Yankee	216	153	411	258	339	1,170	1,138	731	205
Pilgrim 1	-	798	2,648	3,142	1,327	1,015	3,626	1,836	1,539
Millstone Point 1	1,430	2,022	1,194	392	1,239	1,793	2,158	1,496	929
Oyster Creek	984	1,140	1,078	1,614	1,279	467	1,733	917	865
Brunswick 1,2	-	-	-	-	1,004	2,602	3,870	2,638	3.792
Brown Ferry 1,2,3	-	-	-	-	1,792	1,667	1,825	2,380	2,220
Fitzpatrick	-	-	-	1,080	909	859	2,040	1,425	1,190
Avg. mrem/unit	594	878	784	974	686	872	1,419	1,183	1,140

Overall avg. of 948 mrem/year-unit

Reference: NUREG-0713, Volume 4

TABLE 12.4-13

DISTRIBUTION OF ANNUAL MAN-REM BY
WORK FUNCTIONS BASED ON OPERATING BWR DATA

Work Function	1978	1979	1980	1981	1982	Avg
Reactor Operations and Surveillance	12.3	13.4	7.6	7.5	9.1	10.0
Routine Maintenance	43.2	39.3	42.8	42.2	33.7	40.2
Waste Processing	5.8	4.3	3.1	11.0	6.2	6.1
Refueling	2.0	4.4	5.2	2.5	2.7	3.4
Inservice Inspection	2.6	7.3	3.3	3.7	4.3	4.2
Special Maintenance	34.1	31.2	38.1	33.1	44.0	36.1

References:

NUREG-0594, "Occupational Radiation Exposure at Commerical Nuclear Power Reactors, 1978," November, 1979.

NUREG-0710, Volume 1, "Occupational Radiation Exposure at Commercial Nuclear Power Reactors, 1979," March, 1981.

NUREG-0713, Volume 2, "Occupational Radiation Exposures of Commerical Nuclear Power Reactors, 1980," December, 1981.

NUREG-0713, Volume 3, "Occupational Radiation Exposure at Commercial Nuclear Power Reactors, 1981," November, 1982.

NUREG-0713, Volume 4, "Occupational Radiation Exposure at Commercial Nuclear Power Reactors, 1982," December, 1983.

SEE 147

Waste gas includes headers and cover gas system outside of containment in addition to decay or storage system. Include a list of systems containing radioactive materials that are excluded from the program and provide justification for exclusion.

Testing of gaseous systems should include helium leak detection or equivalent testing methods.

A program should be considered to reduce leakage potential release paths due to design and operator deficiencies as discussed in our letter dated October 17, 1979, to all operating nuclear power plants regarding North Anna and related incidents.

Nine Mile Point Unit 2 Position

A program has been developed to monitor leakage from systems outside the containment which could be used to transport highly radioactive fluids in a post-accident condition. This program includes the following features:

1. The implementation of a periodic visual inspection program consisting of a combination of general inspections and detailed system walkdown of liquid systems. These inspections shall be performed on accessible portions of applicable systems during system operational testing or by evaluation of leakage at lower pressures during operation.

2. Systems containing gases are to be tested by use of tracer gases (helium, freon or DOP) by pressure decay testing or by metered makeup tests.

3. An aggressive maintenance program will be used to assign high priorities to leakage-related Maintenance Work Requests (MWRs).

4. Preparation of systems list, identifying specific methods used to test systems, the system involved, and frequency of testing.

5. Records shall be maintained on the tests and inspections performed and leakage related MWRs. These records shall be used to identify chronic and generic leakage problems in order to implement modifications and/or corrective maintenance measures to keep leakage as low as practical.

These measures will be implemented approximately four months prior to full power operation. Prior to fuel Load ~~At that time~~, NMPC will submit a report to the NRC Staff of all recorded leakage and all preventive maintenance performed as a direct result of the evaluation of this leakage. The report will also identify general leakage criteria to be applied during the first fuel cycle as the basis for instituting a corrective action in the form of preventative maintenance. Prior to the start of the second fuel cycle, NMPC will revise the general criteria as necessary based on the experience gained during the Unit 2 first fuel cycle. The revised criteria shall then be used as the basis for long-term leakage monitoring activity at Unit 2.

SER#181

2. Adequate NPSH to the RHR pumps is provided with 50 percent of the strainer area clogged.

3. Strainers are designed to withstand any loads during suppression pool transients, such as temperature, pressure, and water level. Strainers are designed to withstand a pressure differential of 25 psi. All strainers are seismically qualified.

Insulation

Types of insulation used for piping and equipment within the drywell and suppression chamber are discussed in the following paragraphs.

For piping and equipment located within the drywell, that require insulation to minimize heat loss, primarily metal-reflective-type insulation is used.

Metal-reflective insulation is an all-metal construction-type insulation that has a stainless steel inside and outside jacket which encapsulates multiple layers of stainless steel insulation material. Metal-reflective insulation is installed in sections with overlapping edges and quick-release latches with keepers.

Two other types of insulation are used inside the drywell for special and limited application: Min-k and Temp-Mat insulation. Min-k is a powder-type insulation used where space is limited and is encapsulated in stainless steel so as to be watertight. Temp-Mat is a borated, spun glass, blanket-type insulation used where it is necessary to lower the neutron flux (i.e., at the primary shield wall penetration) and is also encapsulated in stainless steel. (See Table 6.2-64).
No anti-sweat insulations are used within the primary containment.

The mechanism for transport of any insulation debris from the drywell into the suppression pool following an accident involves a series of unlikely occurrences, as discussed in the following paragraphs.

In the event of a postulated pipe break, some insulation in the immediate vicinity of the break could possibly be removed by direct jet impingement. Since the insulation is fabricated and installed in overlapping sections, only sections in the immediate vicinity of the break would likely be affected. The stainless steel jacket minimizes the

TABLE 6.2-64

MATERIAL	VOLUME	25% MARGIN
Temp-Mat	122.25 $ft.^3$	153 $ft.^3$
Min-K	91.5 $ft.^3$	115 $ft.^3$

Adjustments are then made to compensate for differences in test (air) and LOCA environment (steam/air) mediums and standard (scf) leak rates converted to drywell temperature and pressure conditions.

The instantaneous leakage rate is then plotted against time for 30 days. The maximum bypass leakage rate is determined by taking the area under this plot. The maximum bypass leakage rate contributed by the isolation valve is 268.93 cf distributed over 30 days. The calculated maximum bypass leakage volume following a design basis LOCA is 2,269 cf over 30 days. The individual and total line leakage volume for selected periods during the 30 days are given in Table 6.2-55.

6.2.3.3 Design Evaluation

6.2.3.3.1 LOCA Temperature and Pressure Transient

During normal plant operation the reactor building and auxiliary bays are maintained at a negative pressure relative to atmosphere of 0.25 in W.G. by the reactor building ventilation system described in Section 9.4. In the event of a LOCA, the reactor building ventilation system is isolated and the standby gas treatment system (SGTS) is initiated upon receipt of any of the three signals listed in Section 6.2.3.2.2. Details of the SGTS are provided in Section 6.5.1.

The reactor building and auxiliary bays are considered one volume which is at a uniform pressure.

6.2.3.3.1.1 Summary and Conclusions

The post-LOCA transient response of the reactor building and auxiliary bays atmosphere has been analyzed for a duration of 96 hr, as shown on Figure 6.2-77. The temperature and pressure stabilize prior to 96 hr. The characteristics of the transient responses may be summarized as follows:

1. The transient responses of the reactor building and auxiliary bays pressure and temperature are shown on Figures 6.2-76 and 6.2-77, respectively.

2. The SGTS centrifugal exhaust fan characteristics are shown on Figure 6.2-78.

3. The reactor building and auxiliary bays pressure reaches a peak value of 0.03 in W.G. 42 seconds after the LOCA. The pressure then decreases as a result of SGTS and unit cooler initiation to a value of -0.25 in W.G. at 90 seconds. The pressure continues to decrease to a minimum value of -0.52 in W.G at 400 seconds. The pressure then rises to a value of -0.26 in W.G. at 3600 seconds before decreasing to a constant value of -0.31 in W.G. at 10,000 seconds.

4. The reactor building and auxiliary bay temperature will increase from 104 °F to a temperature of 104.4 °F at 42 seconds. The temperature then decreases to a minimum value of 101.57 °F at 2350 seconds before increasing to a maximum and constant temperature of 105.47 °F. This behavior is the result of the variation in unit cooler heat removal with temperature.

5. The capacity of one SGTS train, 3600 cfm, is adequate to restore and maintain the reactor building and auxiliary bays pressure at or below -0.25 in W.G., relative to atmosphere after a LOCA, as shown on Figure 6.2-76.

6. The period during which the pressure profile is greater than -0.25 in W.G. is indicated on Figure 6.2-76 and lasts approximately 75 sec.

The analytical results, based on the assumptions in Section 6.2.3.3.1.3, show that the SGTS will accomplish its design objective of maintaining a pressure equal to or below -0.25 in W.G. within the reactor building and auxiliary bays following a LOCA.

6.2.3.3.1.2 Calculation Approach

The analysis was performed assuming that the reactor building and auxiliary bays are one large constant volume. One SGTS filter train was considered in operation. The inleakage was assumed to be 100 percent of the reactor building and auxiliary bays volume per day at the design outside air temperature of 93°F. The heat transfer between the outside environment and the reactor building and auxiliary bays was considered since this results in a net positive heat gain to the reactor building and auxiliary bays.

The heat loads used in this analysis were separated into the following time periods:

1. 0 - 25 seconds
2. 25 - 345,600 seconds (96 hr)

During the 0 - 25 second period the heat load was considered to be the result of transmission sources (i.e., primary containment wall, interior walls, exterior walls, primary containment inleakage, and the spent fuel pool) and mechanical equipment, piping, and electrical cables that are in operation before and after the LOCA.

During the 25 - 345,600 second period the heat load was considered to be from transmission sources, mechanical equipment, piping, electrical cables, and unit cooler fan motors that are in operation

6.2.3.3.1.3 Assumptions

Some of the assumptions applied to this analysis were:

1. A LOCA and loss of offsite power are assumed to occur simultaneously. Emergency power is assumed to be supplied by two of the three diesel generators, considering the failure of either the Division I or Division II diesel generator.

2. Nonadiabatic boundary conditions are assumed for the surface of the reactor building and auxiliary bays structure exposed to the outside environment. Nonadiabatic boundary conditions result in a net positive heat gain which is more conservative than adiabatic boundary conditions.

3. For the first 25 seconds following a LOCA and a loss of offsite power, the heat gain was assumed to be the result of transmission sources (i.e., primary containment walls, interior walls, exterior walls, primary containment inleakage, and spent fuel pool) and mechanical equipment, piping, and electrical cables that are in operation before and after the LOCA.

4. After the first 25 seconds, the heat gain is assumed to be from transmission sources, mechanical equipment, piping, electrical, and unit cooler fan motors that are in operation.

5. It is assumed that one-half of the electrical heat gain from cables is due to electrical Divisions I and III operating and one-half due to electrical Divisions II and III operating.

6. The heat gain from the spent fuel pool is based on the maximum normal spent fuel pool temperature of 125°F.

7. The reactor building is assumed to be sufficiently leaktight to limit the inleakage to 100 percent of the reactor building and auxiliary bays volume per day with a -0.25-in water differential pressure under neutral wind loading conditions.

8. For mechanical equipment and its associated piping, which operates only on Division I or Division II power, it is assumed that there will be no heat gain when the equipment is not energized as a result of the failure of the respective division diesel generator.

9. During a large break LOCA, it is assumed that there will be no flow or heat gain to the suppression pool through the high pressure core spray pump test return line.

10. It is assumed that the recirculation loop of the SGTS does not operate during the analysis.

11. The compressive effect of primary containment expansion is assumed to be insignificant.

12. The primary containment wall heat gain is assumed to increase linearly from the normal heat gain at time zero to the full emergency heat gain at 24 hours to account for the heat storage capacity of the 5.25 foot thick concrete wall.

13. The ECCS piping heat gain is assumed to increase linearly from zero at 25 seconds to the full emergency heat gain (212°F pool temperature) at 3600 seconds (1 hr) to account for the effects of suppression pool temperature. The LOCA analysis predicts peak pool temperature in about 8 hrs

14. The heat removal rate of the unit coolers is assumed to vary linearly with reactor building temperature.

6.2.3.3.2 High Energy Line Break Evaluation

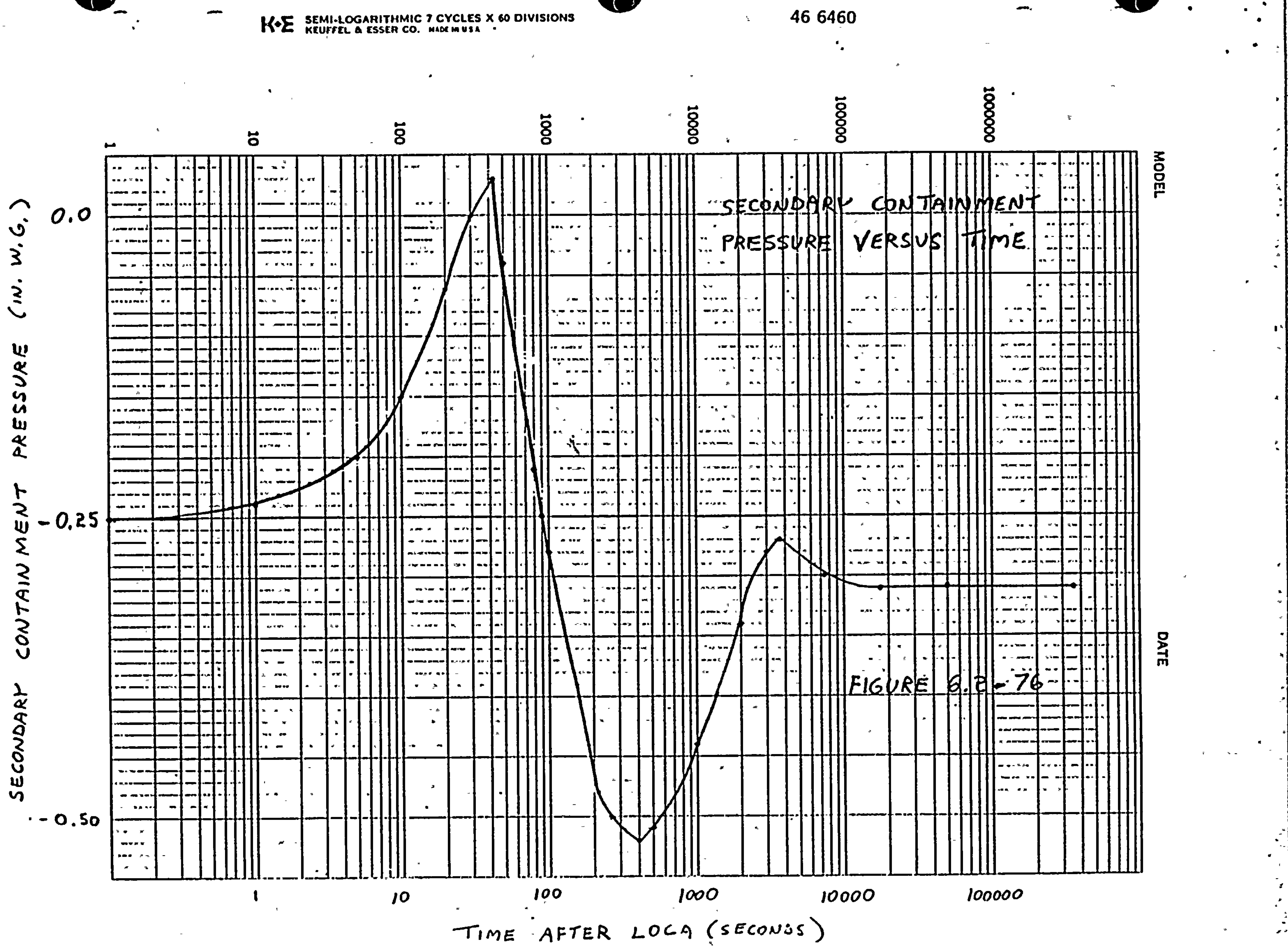
All high energy lines within the reactor building and the analysis of line rupture for any of these lines are discussed in Sections 3.6.1 and 3.6.2.

6.2.3.4 Test and Inspection

Tests and inspections of the reactor building ventilation system and the SGTS will be performed prior to initial fuel load and periodically thereafter in accordance with technical specification requirements.

6.2.3.5 Instrumentation Requirements

A reactor building negative air pressure of 0.25 in W.G. is automatically maintained under normal operating conditions by the reactor building ventilation system. Normally, modulating air dampers automatically recirculate supply air to maintain negative pressure in the reactor building. During accident conditions (LOCA), isolation dampers in the air supply and air exhaust ducts will close automatically;



K•E SEMI-LOGARITHMIC 7 CYCLES X 60 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 6460
MODEL
DATE
SECONDARY CONTAINMENT
PRESSURE VERSUS TIME
FIGURE 6.2-76
SECONDARY CONTAINMENT PRESSURE (IN. W.G.)
0.0
-0.25
-0.50
1
10
100
1000
10000
100000
TIME AFTER LOCA (SECONDS)

46 6460

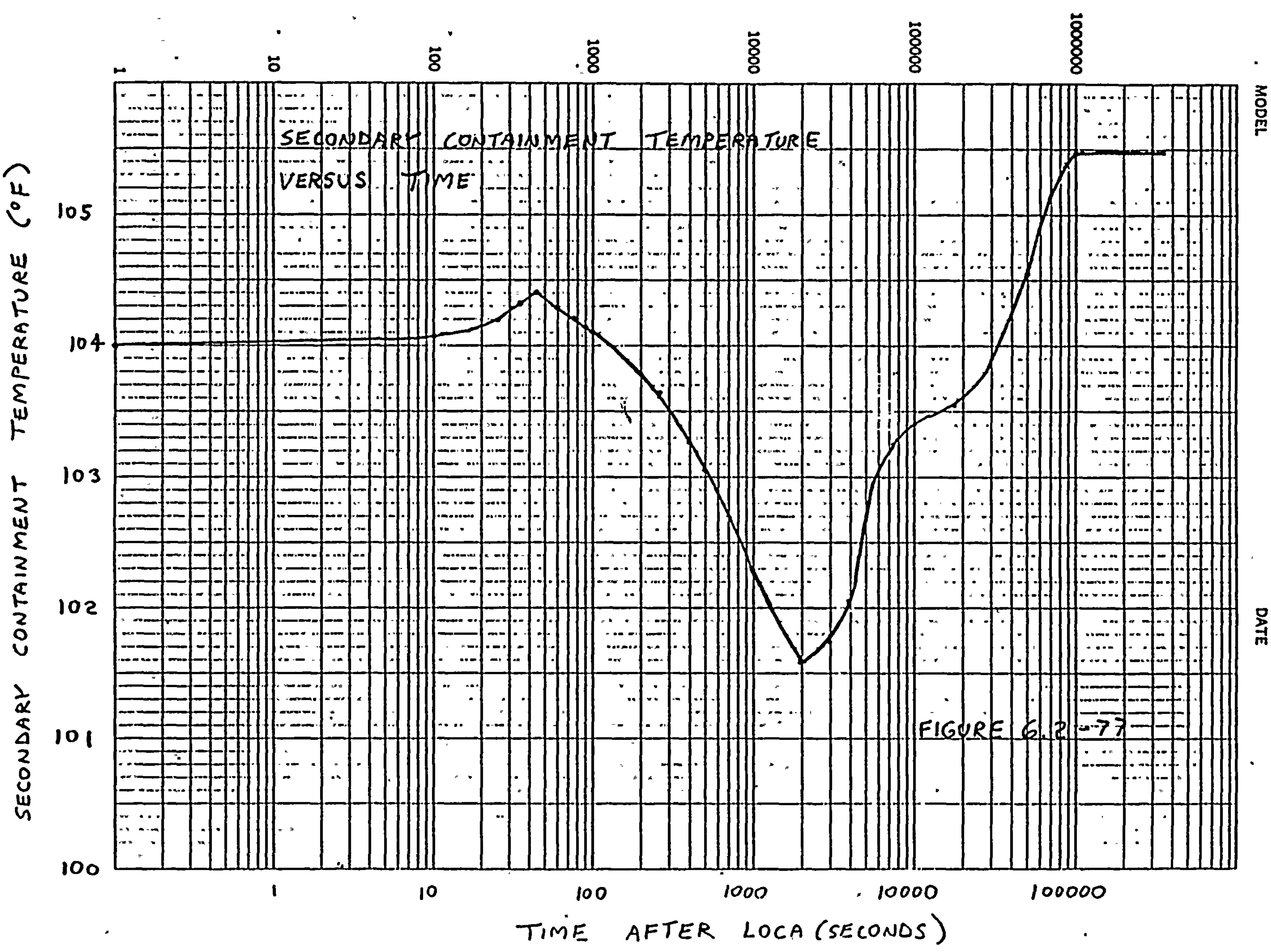


FIGURE 6.2-77

The applicant has committed to perform pre-operational and periodic tests of the standby gas treatment system to verify that each train will attain 3,500 ft^3/min rated flow and will meet its design objective. The staff will require that, as part of this test acceptance criteria, the applicant make provisions to determine the secondary containment depressurization time, verify the inleakage rate of 3,160 ft^3/min, the uniformity of negative pressure throughout the secondary containment, and the potential for exfiltration. The staff will report on this in a supplement to this report.

a) See Revised Test Abstract 14.2-77.

b) See Revised Test Abstract 14.2-77

c) The Emergency Recirculation System ensures mixing throughout the reactor building atmosphere.

d) See Section 6.2.3.3

TABLE 14.2-77

STANDBY GAS TREATMENT AND SECONDARY CONTAINMENT LEAKAGE TEST 12

System 61 12

Preoperational Test (N2-POT-61B)

Test Objectives

1. To demonstrate the reliable operation of the standby gas treatment system and components.

2. To verify that the standby gas treatment system can maintain the proper reactor building pressure and that reactor building leakage rate is within design limits. 12

Safety Precaution

Follow all NMPC safety rules and proper procedures during testing.

Prerequisites

1. All applicable preliminary tests are completed and approved.

2. All applicable motor control centers to supply electric power to motors, control circuits, and instrumentation are available.

3. All valve lineups are completed.

4. Reactor building ventilation system is operable, and all reactor building doors and hatches are closed. 12

Test Procedure

1. The test procedure will verify that the two gas treatment filter trains operate according to design specifications under normal and transient conditions.

2. Various system auto initiations will be demonstrated.

3. System annunciators, control instrumentation, and interlocks will be tested. 12

4. Standby gas treatment fan operation will be verified.

TABLE 14.2-77 (Cont)

5. The test will verify that the SGTS will accomplish its design objective of reestablishing the Reactor Building pressure equal to our below -0.25 in W.G. within the required time interval.

12 6. With the standby gas treatment system in operation and all doors and hatches controlled in the closed position, secondary containment leakage rate will be verified as within allowable limits.

Acceptance Criteria

1. Each standby gas treatment system train and its associated equipment, valves, motors, filters, etc, will function as designed according to SWEC logic drawings.

2. System interlocks, control instrumentation, and annunciators function as designed according to SWEC design drawings.

12 3. Reactor building ventilation system isolation functions as designed according to system logic drawings.

4. Each standby gas treatment system train can maintain reactor building pressure equal to or below -0.25 wg.

5. The reactor building leakage rate is not greater than 3,160 cfm.

6. The secondary containment drawdown time to -0.25 in. W.G. is less than 90 seconds.

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QUESTION F480.22 (6.2.3)

Bypass leakage is defined as that leakage from the primary containment which can circumvent the secondary containment boundary and escape directly to the environment, i.e, bypassing the leakage collection and filtration system of the secondary containment. FSAR Table 6.5-56 indicates that most piping lines are not potential bypass path. List the lines so designated and indicate why they are not bypass leakage paths. Systems lines may be excluded from consideration as potential bypass paths for reasons such as: the lines terminate in the secondary containment, an air or water sealing system is provided to process or eliminate leakage, or a closed system is proposed for the leakage boundary. If a closed system is proposed as the leakage boundary to preclude bypass leakage verify that the following provisions of SRP 6.2.3 are satisfied. The system should:

a. Either (1) not directly communicate with the containment atmosphere, or (2) not directly communicate with the environment, following a loss-of-coolant accident.

b. Be designed in accordance with Quality Group B standards, as defined by Regulatory Guide 1.26. (Systems designed to Quality Group C or D standards that qualify as closed systems to preclude bypass leakage will be considered on a case-by-case basis.)

c. Meet seismic Category I design requirements.

d. Be designed to at least the primary containment pressure and temperature design conditions.

e. Be designed for protection against pipe whip, missiles, and jet forces in a manner similar to that for engineered safety features.

f. Be tested for leakage, unless it can be shown that during normal plant operations the system integrity is maintained.

Specify the estimated bypass leakage for penetrations which must be considered as bypass paths.

RESPONSE

SEE REVISED TABLE 6.2-56

Revised

TABLE 6.2-56 (Cont)

KEY TO ISOLATION SIGNALS:

A = Low reactor vessel water level 3

B = Low reactor vessel water level 2

C = High main steam line radiation

D = High main steam line flow

E = High main steam line tunnel area ambient temperature

F = High drywell pressure

G = Low reactor vessel water level 2 or high drywell pressure

J = High reactor water cleanup system equipment area differential and ambient temperatures

K = Reactor core isolation cooling high pipe routing and equipment area temperature, low steam supply pressure. High steam line differential pressure, high turbine exhaust diaphragm pressure

L = High reactor vessel pressure

M = High residual heat removal system equipment area differential and ambient temperatures

P = Low main steam line turbine inlet pressure

R = Low main condenser vacuum

S = Standby liquid control system actuated

T = High main steam line tunnel differential and ambient temperatures

U = High reactor water cleanup system differential flow

W = High reactor water cleanup system nonregenerative heat exchanger outlet temperature

LC = Locked closed

RM = Remote manual switch from control room

TABLE 6.2-56 (Cont)

LMC = Local manual control, locked closed, position indication in control room

T.I.P. = TIP WITHDRAWAL SIGNAL (CONTAINMENT ISOLATION). COMPRISE OF SIGNAL A & F.

(a) PURGE VALVE CLOSED UPON TIP WITHDRAWAL SIGNAL.

(b) BALL VALVE CLOSED UPON TIP RETURNING INTO SHIELD. (TIP WITHDRAWAL SIGNAL AND TIP DETECTOR PROXIMITY SWITCH)

NOTES:

(1) Type C testing is discussed on Figure 6.2-70 which shows the isolation valve arrangement.

(3) Normal status position of valve (open or closed) is the position during normal power operation of the reactor (see Normal Position column).

(4) Primary containment and reactor vessel isolation signals are indicated by letters. Isolation signals generated by the individual system process control signals or for remote manual closure based on information available to the operator are discussed in the referenced notes in the Isolation Signal column.

(5) The specified closure rates are as required for containment isolation or system operation, whichever is less. Reported times are in seconds.

(6) The standard minimum closing rate is 12 in/min of nominal valve diameter for gate valves and 4 in/min of valve stem travel for globe valves. For example, a 12-in gate valve will close in 1 min.

(7) Ac motor-operated valves required for isolation functions are powered from the ac standby power buses. Dc-operated isolation valves are powered from safety related station batteries.

(8) A main steam isolation valve requires that one spring latch be released to close the valve. Two springs are provided for redundancy. The valves are designed to fully close within 3 to 5 sec.

TABLE 6.2-56 (Cont)

(9) All isolation valves are Category I.

(10) All motor-operated isolation valves remain in the as-is position upon failure of valve power (FAI = Fail as is). All air-operated valves close on motive air failure in the safe position.

(11) Testable check valves are designed for remote opening with zero differential pressure across the valve seat. The valves will close on reverse flow even though the test switches may be positioned for open. The valves open when pump pressure exceeds reactor pressure even though the test switch may be positioned for close.

(13) These valves are the ECCS and drywell spray suction and discharge isolation valves. ECCS operation is essential during the LOCA period; therefore, there are no automatic isolation signals. A high level alarm in the appropriate reactor building sump indicates excessive ECCS leakage into the secondary containment.

(14) Suppression POOL SPRAY valves have interlocks that allow them to be manually reopened after automatic closure. This setup permits suppression pool spray, for high drywell pressure conditions. When automatic signals are not present, these valves may be opened for test or operating convenience.

(15) Due to redundancy within the ECCS, some subsystems may be secured during the long-term cooling period. In addition, RHR Loops A and B have several discharge paths (LPCI, drywell spray, suppression chamber spray, suppression pool cooling) which the operator may select during the 30-day post-LOCA period.

(16) The RCIC steam exhaust valve, 2ICS*MOV122, is normally open at all times. Should a leak occur, it would be detected and alarmed by the RCIC room high temperature leak detection system.

(17) Criterion 55 concerns lines of the reactor coolant pressure boundary (RCPB) that penetrate the primary reactor containment. The CRD insert and withdraw lines are not part of the RCPB. The classification of the

TABLE 6.2-56 (Cont)

insert and withdraw lines is Quality Group B, and therefore they are designed in accordance with ASME Section III, Safety Class 2. The basis to which the CRD lines are designed is commensurate with the safety importance of isolating these lines. Since these lines are vital to the scram function, their operability is of utmost concern.

In the design of this system, it has been accepted practice to omit automatic valves for isolation purposes as this introduces a possible failure mechanism. As a means of providing positive actuation, manual shutoff valves are used. In the event of a break on these lines, the manual valves may be closed to ensure isolation. In addition, a ball check valve located in the insert line inside the CRD is designed to automatically seal this line in the event of a break.

(18) The operator's indication that remote-manual closure of the TIP shear valves is required is failure of the TIP ball valves to close.

(19) Since the traversing incore probe (TIP) system lines do not communicate freely with the containment atmosphere or the reactor coolant, General Design Criteria 55 and 56 are not directly applicable to this specific class of lines. The basis to which these lines are designed is more closely described by Criterion 57, which states in effect that isolation capability of a system should be commensurate with the safety importance of that isolation. Furthermore, even though the failure of the TIP system lines presents no safety consideration, the TIP system has redundant isolation capabilities.

The safety features were reviewed by the NRC for BWR/4 (Duane Arnold), BWR/5 (Nine Mile Point Unit 2) and BWR/6 (GESTAR II), and it was concluded that the design of the containment isolation system meets the objectives and intent of the general design criteria.

Isolation is accomplished by a seismically qualified solenoid-operated ball valve that is normally closed. To ensure isolation capability, an explosive shear valve is installed in each line. Upon receipt of a signal (manually initiated by the operator), this explosive valve will shear the TIP cable and seal the guide tube.

Revised

TABLE 6.2-56 (Cont)

When the TIP system cable is inserted, the ball valve of the selected tube opens automatically so that the probe and cable can advance. A maximum of five valves can be opened at any one time to conduct calibration, and any one guide tube is used, at most, a few hours per year.

If closure of the line is required during calibration, a signal causes a cable to be retracted and the ball valve to close automatically after completion of cable withdrawal. If a TIP cable fails to withdraw or a ball valve fails to close, the explosive shear valve is actuated. The ball valve position is indicated in the control room.

The Unit 2 TIP system design specifications require that the maximum leakage rate of the ball and shear valves be in accordance with the Manufacturer's Standardization Society (hydrostatic testing of valves).

The TIP isolation valve and the shear valve both have a leak integrity requirement of 10^{-3} atm cc/sec for air-water combination and water alone. This leakage rate represents less than 10^{-3} cc/sec of fluid at the following conditions:

Air-water combinations: 0-125 psig and 300°F

Water: 1,250 psig and <450°F

As stated above, the penetration is automatically closed following use. During normal operation the penetration will be open approximately 8 hr/month to obtain TIP information. If a failure occurred, such as inability to withdraw the TIP cable, the shear valve could be closed to isolate the penetrations. Installation requirements are that the guide tube/penetration flange/ball and shear valve composite assembly not leak at a rate greater than 10^{-4} atm cc/sec at 125 psig. Further leak testing of the shear valves is not recommended since destructive testing would be required.

Leak testing of the ball valves also is not recommended since the guide tube terminates in a sealed indexer housing that is kept under a positive pressure by a nitrogen purge. The purge makeup is indicative of system leakage. Note that the TIP ball valve is normally closed and thus is a part of the leakage

TABLE 6.2-56 (Cont)

barrier being monitored. Consequently, the personnel exposure required to conduct Type C tests from inside the containment is not warranted.

(20) Removable spool piece that is removed during normal operation; it is installed when the plant is down and fire protection is needed inside the primary containment.

(21) Air-operated valves 104 and 106 are manually operated before personnel entry into the primary containment. Line length is given for the most remote valve.

(22) System isolation valves are normally closed. The system is placed in operation only if the hydrogen monitors detect hydrogen buildup after a LOCA. The operator has flow indication, in the main control room, of gas leaving and entering the containment. Should these flows vary significantly from one another, it would be detected in the main control room and the process loop in service could be shut down.

The valve is open only during steam condensing mode. Valve position is indicated in the main control room to provide the operator confirmation of valve status.

(23) This line consists of the following inputs from these valves:

2RHS*SV34A and 2RHS*SV62A - steam condensing line safety valves.

2RHS*RV56A - RHR heat exchanger shell side relief valve.

2RHS*MOV26A and 2RHS*MOV27A - RHR heat exchanger vent line isolation valves.

2RHS*V20 and 2RHS*V19 - vacuum breaker line.

The valve is open only during steam condensing mode. Valve position is indicated in the main control room to provide the operator confirmation of valve status.

Revised

TABLE 6.2-56 (Cont)

(24) This line consists of the following inputs from these valves:

2RHS*SV34B and 2RHS*SV62B - steam condensing line safety valves.

2RHS*RV56B - RHR heat exchanger shell side relief valve.

2RHS*MOV26B and 2RHS*MOV27B - RHR heat exchanger vent line isolation valves

2RHS*V117 and 2HS*V118 - RCIC vacuum breaker line.

The valve is open only during steam condensing mode. Valve position is indicated in the main control room to provide the operator confirmation of valve status.

(25) Normally closed. Opened only when testing wetwell to drywell vacuum breakers.

(26) Penetrations Z-99A,B,C,D, and Z-100A,B,C,D contain lines for the hydraulic control of the reactor recirculation flow control valve. These lines contain hydraulic fluid used to position the reactor recirculation flow control valve.

These lines inside the containment are Category I and Quality Group B. They have failed-closed automatic isolation valves outside the containment which receive an automatic isolation signal on high drywell pressure.

These lines meet the requirement of General Design Criterion 57 and therefore require only single automatic isolation valves outside the containment. They also meet the requirement of Standard Review Plan 6.2.4.

They are designed to Category I, Code Group B, and the following criteria:

a. Do not communicate with either the reactor coolant system or the containment atmosphere.
b. Are protected against missiles and pipe whip.
c. Will withstand temperatures at least equal to the containment design temperature.

Revised

TABLE 6.2-56 (Cont)

(24) This line consists of the following inputs from these 1.15
valves:

2RHS*SV34B and 2RHS*SV62B - steam condensing 1.17
line safety valves. 1.18

2RHS*RV56B - RHR heat exchanger shell side 1.22
relief valve. 1.23

2RHS*MOV26B and 2RHS*MOV27B - RHR heat 1.27
exchanger vent line isolation valves 1.28

2RHS*V117 and 2HS*V118 - RCIC vacuum breaker 1.32
line. 1.33

The valve is open only during steam condensing mode. 1.37
Valve position is indicated in the main control room to 1.38
provide the operator confirmation of valve status.

(25) Normally closed. Opened only when testing wetwell to 1.42
drywell vacuum breakers.

(26) Penetrations Z-99A,B,C,D, and Z-100A,B,C,D contain lines 1.45
for the hydraulic control of the reactor recirculation
flow control valve. These lines contain hydraulic fluid 1.47
used to position the reactor recirculation flow control
valve.

8

Revised

TABLE 6.2-56 (Cont)

d. Will withstand the external pressure from the containment structural acceptance test.
e. Will withstand the LOCA transient and environment.

Even if the failed-closed valve were to not shut there would be no leakage of containment atmosphere through the hydraulic control lines since the piping inside the primary containment would remain intact. There are no active component failures that would compromise the integrity of the closed system inside the primary containment. Integrity of the closed system inside the primary containment is, essentially, constantly monitored since the system is under a constant operating pressure of 1,800 psig. Any leakage through this system would be noticed because operation would be erratic and because of indications provided on the HCU. In addition, in order to perform Type C tests on these lines, the system would have to be disabled and drained of hydraulic fluid. This is considered to be detrimental to the proper operation of the system since possible damage could occur in establishing the test condition or restoring the system to normal. These lines and associated isolation valves should therefore be considered to be exempt from containment testing.

(27) Instrument lines that penetrate primary containment conform to Regulatory Guide 1.11. The lines that connect to the reactor pressure boundary include a restricting orifice inside containment, are Category I, and terminate in instruments that are Category I. The instrument lines also include manual isolation valves and excess flow check valves or equivalent. These penetrations will not be Type C tested since the integrity of the lines is continuously demonstrated during plant operations where subject to reactor operating pressure. In addition, all lines are subject to the Type A test pressure on a regular interval. Leaktight integrity is also verified with completion of functional and calibration surveillance activities as well as by visual observations during operator tours.

(28) Deleted

(29) This path does not constitute a bypass leakage path, because a closed piping system outside the primary containment provides a leakage boundary. The piping/components outside the primary containment qualify as a closed system for the following reasons.

The system leakage boundary:

a. leak path does not directly communicate with the environment following a loss-of-coolant accident.

b. Piping/Components are designed in accordance with Quality Group B standards as defined by Regulatory Guide 1.26.

c. Is designed to meet Seismic Category I design requirements.

d. Is designed to at least the primary containment pressure and Temperature design conditions.

e. Is designed for protection against pipe whip, missles, and jet forces in a manner similar to that for engineered safety features.

f. Is Tested for Leakage unless system integrity is demonstrated to be maintained during normal plant operations.

(30) This line/path is excluded from further consideration as a potential bypass leakage path because a water or nitrogen seal is provided to prevent leakage from bypassing the secondary containment. There is sufficient fluid available to maintain the seal for at least 30 days following a Loss-of-Coolant Accident. Refer to FSAR Section 6.2.3.2.3 for seal details.

(31) This line/path is excluded from further consideration as a potential bypass leakage path because (per Branch Technical Position CSB 6-3 section A) leakage from the primary containment cannot circumvent the secondary containment boundary and escape directly to the environment. That is, leakage cannot bypass the leakage collection and filtration systems of the secondary containment. Filtration of leakage is assured because either the piping terminates in the secondary containment or leakage is directly routed

to the filtration systems.

QUESTION F480.29 (6.2.4)

Describe the provisions to insure that debris will not become entrained in the purge valves and prevent their closure. Guidance is provided below which, if followed, would represent an acceptable debris screen design:

a) The debris screen should be seismic Category I and installed typically about one pipe diameter away from the inner side of the inboard isolation valve.

b) The piping between the debris screen and the valve should also be seismic Category I design.

c) The debris screen should be designed to withstand the LOCA differential pressure.

d) The debris screen openings should be about 2 inches by 1 3/16 inches.

A suggested debris screen design is enclosed as Figure 1.

RESPONSE

Debris screens, in general accordance with the design referenced above as Figure 1, are provided.

See revised Sections 6.2.4.3.2 and 9.2.4.

would be insignificant. Suppression pool makeup during normal plant conditions is from the condensate water storage tank.

The elevations of the ECCS pump suction centerlines and the suppression pool minimum drawdown level are 195'-0" and 197'-8", respectively.

<u>Influent and Effluent Lines from Drywell and Suppression Chamber Free Volume</u>

1. <u>Primary Containment Purge Lines</u> The drywell and suppression chamber purge lines have isolation capabilities commensurate with the importance to safety of isolating these lines. Each line has two normally closed/fail closed valves - one located inside (nitrogen operated) and one located outside (air operated) the primary containment. The inboard end of each 12-in and 14-in valve located inside the primary containment is provided with a QA Category I debris screen to prevent entrainment of foreign matter in the valve seat. The isolation valves are interlocked to preclude opening of the valves while a primary containment isolation signal exists (Table 6.2-56).

2. <u>Primary Containment Atmosphere Monitoring System Sampling Lines</u> The primary containment atmosphere monitoring system consists of radiation and hydrogen/oxygen monitoring lines. Each line, suction and discharge, penetrates the primary containment and continuously monitors the radiation level and hydrogen/oxygen concentration during normal operation. These lines are equipped with two solenoid-operated isolation valves, one inside the primary containment and the other outside, located as close as possible to the primary containment. The hydrogen/oxygen monitoring lines are also used to continuously monitor the primary containment air during the post-LOCA period. Each isolation valve receives isolation signals. The isolation valves for hydrogen/oxygen monitoring lines are provided with individual keylock switches to override the isolation signal and initiate system operation, during the post-LOCA period.

space and stairways into the return air system located at each floor level. The emergency recirculation system ensures mixing throughout the reactor building atmosphere, including the spent fuel pool area.

The intake duct connection for the SGTS (Section 6.5.1) is taken at the discharge side of the emergency recirculation unit cooler to maintain the reactor building at a negative pressure.

Unit space coolers with sufficient capacity to satisfy the cooling requirements of the emergency safeguard equipment provide cooling to handle the heat gain load of the respective safeguard equipment. Cooling for general areas is provided by unit space coolers.

HVAC equipment and components that operate following a LOCA are designed to Category I and Safety Class 2 and 3 criteria. Equipment motors and controls in the safety-related portion of the system are supplied from their respective independent emergency power sources and have sufficient redundancy to satisfy the single-failure criterion.

9.4.2.3 Safety Evaluation

The safety features of the reactor building HVAC system are as follows:

1. All safety-related components are designed to Safety Class 2 and 3 criteria and Category I requirements. Safety-related components are located so that failure of a portion of other nonessential systems does not prevent operation of any safety-related system.

2. Safety-related components have sufficient redundancy to meet the single active failure criteria. The Failure Modes and Effects Analysis (FMEA) of the reactor building HVAC system is provided in the FSAR FMEA report.

3. Redundant isolation valves in each line penetrating the primary containment are in accordance with ASME Section III. The piping between the isolation valves is Safety Class 2 and both the valves and piping are designed to Category I. All other system piping is seismically supported. The inboard end of each 12-in and 14-in CPS isolation valve located inside the primary containment is

provided with a QA Category I debris screen to prevent entrainment of foreign matter in the valve seat. 1.58 2.1

4. All primary containment penetrations associated with the reactor building HVAC have redundant 2.2

QUESTION F480.24

Indicate what mechanisms are available to control drywell and wetwell pressure perturbations during normal operation.

Would this system be open to the SGTS in the event of a LOCA? If so, show that the SGTS is capable of withstanding the LOCA pressure and the system filters are capable of radionuclide exposure and will still perform its intended function post-LOCA.

RESPONSE

SEE REVISED SECTION 9.4.2.2.2

QUESTION F480.38 (6.2.4)

The FSAR does not specifically identify the extent of drywell-suppression chamber purging that may be necessary during normal plant operations. Discuss the manner in which Nine Mile Point 2 conforms to the requirements of Branch Technical Position CSB 6-4. Indicate how small pressure perturbations will be accommodated in the containment.

RESPONSE

SEE REVISED SECTIONS 6.2.5.2.4 AND 9.4.2.2.2

accident. Once placed in operation, the system continues to operate until it is manually shut down when an adequate margin below the hydrogen or oxygen concentration design limit is reached.

The operation of the system can be tested from the control room. The test consists of energizing the blower and heaters and observing system operation to see if components are performing properly. Flow and pressure measurement devices are periodically calibrated.

Cooling water required for operation of the system is taken from the service water system. The cooling water is used to cool the water vapor and the residual gases leaving the recombiner prior to returning them to the primary containment.

During normal operation the recombiner system will be maintained in an inerted condition with nitrogen, ready for immediate startup.

6.2.5.2.3 Primary Containment Nitrogen Inerting System

Oxygen control within primary containment during normal plant operation is achieved by means of the nitrogen inerting system. During normal plant operation, oxygen concentration is maintained at or below 4 volume percent using this system.

The system is designed to supply nitrogen to the primary containment for initial inerting and for makeup during normal operation.

6.2.5.2.4 Primary Containment Purge

Primary containment purge capability is provided in accordance with Regulatory Guide 1.7 and as an aid in cleanup following an accident. This function is fulfilled by the combined operation of the primary containment purge system (CPS) AND THE STANDBY GAS TREATMENT SYSTEM (SGTS).

DURING NORMAL PLANT OPERATION THE CPS SYSTEM ALSO FUNCTIONS, IN CONJUNCTION WITH THE NITROGEN INERTING SYSTEM (GSN) AND THE SGTS, TO MAINTAIN THE PRIMARY CONTAINMENT PRESSURE AT 0.5 TO 1.0 psig AND TO MAINTAIN OXYGEN CONCENTRATION AT OR BELOW 4 VOLUME PERCENT. THIS IS ACCOMPLISHED BY INJECTING THE REQUIRED QUANTITY OF NITROGEN INTO PRIMARY CONTAINMENT THROUGH THE CPS AND/OR EXTRACTING THE REQUIRED VOLUME OF GAS THROUGH CPS EXHAUST. THE EXHAUST FLOW IS ROUTED THROUGH PIPING TO THE SGTS, WHERE IT PASSES THROUGH THE SGTS FILTERS AND A RADIATION MONITOR BEFORE BEING RELEASED FROM THE PLANT STACK TO THE ENVIRONMENT. ALL CPS PRIMARY CONTAINMENT ISOLATION VALVES ARE AUTOMATICALLY CLOSED WHEN A HIGH RADIATION LEVEL IS DETECTED IN THE EXHAUST FLOW.

The primary containment purge system P&ID

DBE. The system is designed to nonnuclear safety standards and is not required for safe shutdown of the plant.

9.4.2.1.2 Primary Containment Purge

Power Generation Design Basis

1. Provide sufficient purging capability for the primary containment to permit entry of personnel within 16 hr of a reactor cold shutdown.

2. Provide a means of maintaining the primary containment at positive pressure during normal operation so that any leakage can be monitored.

   with nitrogen

   Provide the piping interconnection between the nitrogen inerting system (GSN) and the drywell and suppression chamber to permit inerting of the primary containment and for

3. Provide a backup system to the redundant hydrogen recombiners for the dilution of hydrogen following a loss-of-coolant accident (LOCA). The hydrogen recombiners are described in Section 6.2.5.

Safety Design Basis

Provide seismically qualified piping and valves to protect adjacent safety-related equipment in the event of a DBE. The system is designed to nonnuclear safety standards and is not required for safe shutdown of the plant.

9.4.2.1.3 All Other Reactor Building Areas

Power Generation Design Basis

1. Provide an environment that ensures habitability of the areas served and optimum performance of equipment, within the temperature limits shown in Table 9.4-1.

2. For normal plant operation, provide a once-through ventilation system, utilizing outdoor air with controlled discharge of exhaust air to the atmosphere.

3. Exhaust more air from the reactor building than is being supplied, thereby maintaining the area at a negative pressure to inhibit the exfiltration of airborne contaminants.

4. Provide the capability to clean up the reactor pressure vessel (RPV) head during the refueling operation with the help of the reactor head evacuation filter assembly.

ADD INSERT 9.4-23A

9.4.2.2.2 Primary Containment Purge

The primary containment purge system is shown schematically on Figure 9.4-8.

The system is divided into two subsystems. The first subsystem purges the primary containment and consists of one 100-percent capacity centrifugal fan, piping, valves, controls, and accessories. The fan draws makeup air from the reactor building ventilation system and discharges through pipe ducts to the primary containment. The SGTS (Section 6.5.1) takes suction through pipe ducts to exhaust the primary containment. This subsystem also provides a connection for a portable compressor that performs the integrated leak rate test.

The second subsystem pressurizes the primary containment. It consists of piping, valves, controls, and accessories, and provides for pressurization of the drywell and the suppression chamber. The drywell is thereby maintained at a pressure ranging from 0.5 to 1.0 psig.

9.4.2.2.3 All Other Reactor Building Areas

The HVAC subsystem is shown schematically on Figure 9.4-8.

The system has the following modes of operation:

1. Normal operation.

2. Emergency operation.

<u>Normal Operation</u>

The supply ventilation air handling unit assembly consists of an air intake, prefilter, filter, heating coil, cooling coil, dampers, controls, and supply fans. Three 50-percent capacity vaneaxial fans are provided; two operate normally while one is in standby.

The prefilter and filter are of the extended surface disposable type. The glycol heating coil preheats the supply air to the required discharge air temperature. Glycol is supplied to the heating coil from the plant glycol heating system (Section 9.4.11). The cooling coil maintains the required discharge air temperature. Cooling water is supplied to the cooling coil from the service water system (Section 9.2.1).

INSERT 9.4-23A

THE SYSTEM IS COMPRISED OF A PURGE SUBSYSTEM AND A PRESSURIZATION SUBSYSTEM, AS FOLLOWS:

PURGE SUBSYSTEM:

THE PURGE SUBSYSTEM CONSISTS OF ONE 100-PERCENT CAPACITY CENTRIFUGAL FAN, PIPING, VALVES, CONTROLS, AND ACCESSORIES. PIPING PENETRATIONS THROUGH THE PRIMARY CONTAINMENT (PENETRATIONS Z-48, Z-49, Z-50, AND Z-51, AS LISTED IN TABLE 6.2-56) ARE EACH PROTECTED WITH REDUNDANT SAFETY-RELATED NORMALLY CLOSED, FAIL CLOSED ISOLATION VALVES. VALVES INSIDE THE PRIMARY CONTAINMENT ARE NITROGEN OPERATED; VALVES OUTSIDE ARE AIR OPERATED. TO PROTECT THE ISOLATION VALVES, THE OPEN END OF EACH 12 INCH AND 14 INCH PURGE SUBSYSTEM LINE (SUPPLY AND EXHAUST) WITHIN THE PRIMARY CONTAINMENT IS PROVIDED WITH A DEBRIS SCREEN.

QA CAT. I

THE PURGE SUBSYSTEM IS UTILIZED TO INERT THE PRIMARY CONTAINMENT ATMOSPHERE WITH NITROGEN PRIOR TO ASCENSION TO FULL POWER. NITROGEN IS SUPPLIED FROM THE NITROGEN INERTING SYSTEM (GSN) THROUGH MANUALLY CONTROLLED VALVES TO THE DRYWELL AND SUPPRESSION CHAMBER UTILIZING, RESPECTIVELY, 14 INCH AND 12 INCH CONTAINMENT PURGE SYSTEM (CPS) SUPPLY LINES. THE GSN SYSTEM IS DESCRIBED IN SECTION 6.2.5.2.5 AND SECTION 9.3.1.5.

THE PURGE SUBSYSTEM ALSO IS UTILIZED TO PURGE THE PRIMARY CONTAINMENT OF NITROGEN PRIOR TO PERSONNEL RE-ENTRY, BEGINNING NOT MORE THAN 24 HOURS BEFORE DECENDING TO 15 PERCENT OF FULL POWER. DURING PURGING, MAKEUP AIR IS FAN-SUPPLIED FROM THE REACTOR BUILDING VENTILATION SYSTEM AND IS DELIVERED TO THE DRYWELL AND SUPPRESSION CHAMBER THROUGH THE 14 INCH AND 12 INCH CPS SUPPLY LINES. PURGE EXHAUST IS DRAWN BY THE STANDBY GAS TREATMENT SYSTEM (SGTS, SECTION 6.5.1) FROM THE DRYWELL AND SUPPRESSION

CHAMBER, RESPECTIVELY, THROUGH 14 INCH AND 12 INCH CPS EXHAUST LINES FOR MONITORED RELEASE THROUGH THE MAIN STACK. DURING ASCENSION TO FULL POWER OR DURING NORMAL OPERATION THE PURGE SUBSYSTEM AND SGTS CAN BE OPERATED TO RELIEVE PRIMARY CONTAINMENT PRESSURE EXCURSIONS THAT MAY OCCUR, OR TO VENT THE PRIMARY CONTAINMENT, AS NECESSARY, IF NITROGEN IS ADDED DURING NORMAL OPERATION TO OFFSET LOSSES OR TO MAINTAIN THE OXYGEN CONCENTRATION LIMIT (REFER TO PRESSURIZATION SUBSYSTEM). ALL ISOLATION VALVES ARE AUTOMATICALLY INITIATED TO CLOSE (AND FAIL CLOSED) ON A LOCA SIGNAL.

A CONNECTION TO THE PURGE SUBSYSTEM IS INCLUDED FOR ATTACHMENT OF A PORTABLE AIR COMPRESSOR WHICH IS REQUIRED FOR PERFORMANCE OF THE INTEGRATED LEAK-RATE TEST.

PRESSURIZATION SUBSYSTEM:

THE PRESSURIZATION SUBSYSTEM CONSISTS OF 2 INCH PIPING, VALVES, CONTROLS, AND ACCESSORIES. PIPING PENETRATIONS THROUGH THE PRIMARY CONTAINMENT (PENETRATIONS Z-58, Z-59; TABLE 6.2-56) ARE EACH PROTECTED WITH REDUNDANT SAFETY-RELATED NORMALLY CLOSED, FAIL CLOSED SOLENOID ISOLATION VALVES.

THE PRESSURIZATION SUBSYSTEM IS UTILIZED DURING NORMAL OPERATION TO MANUALLY ADD NITROGEN TO THE PRIMARY CONTAINMENT TO EITHER MAINTAIN PRIMARY CONTAINMENT PRESSURE WITHIN THE RANGE OF 0.5 TO 1.0 PSIG OR TO MAINTAIN THE OXYGEN CONCENTRATION LIMIT AT 4 VOLUME PERCENT OR LESS.

SER # 185

2. A recombiner mixes the drywell atmosphere and the 1.10
suppression chamber atmosphere. Prior to 1.11
initiation of the recombiner, the drywell and the
suppression chamber will be mixed uniformly due to
natural convection and molecular diffusion. Mixing 1.13
will be further promoted by operation of the
containment sprays. The operator actuates the 1.15
containment sprays within 30 minutes after the
LOCA. The criteria for the operation of 1.16
containment sprays is specified in Section 6.2.1.1. 1.17

3. The recombiners will be started manually by the 1.18
operator when the hydrogen or oxygen concentration 1.19
exceeds a value of 4.5 volume percent. An alarm is 1.20
provided to aid the operator when drywell and
suppression chamber monitors indicate a value of
4.5 volume percent of hydrogen or oxygen. 1.21

4. Two identical Category I recombiners are provided 1.22
to limit oxygen or hydrogen concentration.
Operation of either recombiner will limit 1.23
combustible gas concentration to a safe value. 1.24

5. The components of the CGCS are protected from 1.25
missiles and pipe whip to assure proper operation
under accident conditions as required for safety- 1.26
related systems. The recombiners and monitors are 1.27
located outside the primary containment.

6. The components of the CGCS are designed as 1.28
Category I and Safety Class 2.

7. All components that are subjected to primary 1.30
containment atmosphere will be capable of
withstanding the humidity, temperature, pressure, 1.32
and radiation conditions in the containment
following a LOCA.

8. The CGCS can be inspected or tested during normal 1.33
plant conditions.

9. The recombiners are located in the reactor 1.34
building.

5. All controls for operating the CGCS (i.e., hydrogen 1.13
recombiner system and monitoring system) are
located in the main control room. 1.14

6. A tabulation of the design and performance data for 1.15
each system component is listed in Table 6.2-57.

7. Environmental qualification information for safety- 1.16
related equipment is given in Section 3.11. 1.18

8. Electrical requirements for equipment associated 1.19
with this system are in accordance with IEEE
Class 1E standard. 1.20

The combustible gas control system is considered an 1.27
extension of the primary containment in post-LOCA conditions
and consequently will be included within the boundary of the 1.28
Type A test (Section 6.2.5). The DBA hydrogen recombiner 1.29
(HCS) system meets the criteria of Standard Review
Plan 6.2.3 for closed loop systems as follows: 1.30

1. Containment atmosphere does not directly 1.32
communicate with the environment following a LOCA.

2. Designed in accordance with Quality Group C 1.33
standards.

3. Meets Category I design requirements. 1.34

4. Is designed to primary containment pressure and 1.35
temperature design conditions as applicable.

5. Is designed for protection against pipe whip, 1.36
missiles, and jet forces.

6. Is tested for leakage. 1.37

6.2.5.2.1 Atmospheric Mixing 1.40

The function of post-LOCA mixing in the drywell and 1.43
suppression chamber is performed by the primary containment
spray system, recombiner system, and natural processes. At 1.44
approximately 30 min following the postulated accident, the
redundant containment spray systems in the drywell and 1.45
suppression chamber can be initiated to depressurize the
containment. The turbulence induced by the spray ensures a 1.46
well mixed primary containment atmosphere. In addition to 1.47
the spray system, the blowdown of steam and water through
the broken pipe creates a large degree of turbulence and 1.49
promotes mixing of the entrained hydrogen and oxygen with

to be greater than the bulk oxygen concentration. The other 1.12
two subcompartments are the control rod drive area in the
drywell and the volume enclosed by the pedestal wall in the 1.14
suppression chamber. Due to the large open area between 1.15
these two subcompartments and the bulk atmosphere,
significant concentration gradients are unlikely. 1.16

6.2.5.2.2 Hydrogen Recombiner System 1.18

The long-term control of hydrogen and oxygen is achieved by 1.19
means of two identical 150-scfm thermal hydrogen
recombiners, located in the reactor building and controlled 1.22
from the main control room. The recombiner system removes 1.23
gas from the drywell or suppression chamber, recombines the
hydrogen with oxygen, and returns the gas mixture along with 1.25
the condensate to the suppression chamber. Flow from the 1.26
suppression chamber atmosphere to the drywell through the
vacuum breakers prevents the suppression chamber pressure 1.27
from exceeding the drywell pressure by more than 0.25 psi.

Operation of any one recombiner will provide effective 1.34
control over combustible gases within primary containment.
Figure 6.2-72a and b shows the P&ID of the recombiner 1.35
system. The manufacturer of the hydrogen recombiner is the 1.36
Atomics International Division, Energy Systems Group of
Rockwell International. 1.37

The recombiner unit is skid mounted and is an integral 1.38
package. All pressure containing equipment including piping 1.39
between components is considered an extension of the
containment, and, therefore, is designed to ASME 1.40
Section III, Safety Class 2 requirements. The skid and the 1.41
equipment mounted on it are designed to meet Category I
requirements.

The recombiner unit consists of a blower, electric heater, 1.42
reaction chamber, and water spray cooler. The reaction 1.43
chamber is capable of processing 150 scfm of gas containing 1.44
up to either 2 1/2 volume percent of oxygen and unlimited 1.45
excess hydrogen or 5 volume percent of hydrogen with excess
oxygen. Under these conditions, recombination efficiency is 1.46
virtually 100 percent. The recombiner is not designed to 1.47
operate when hydrogen concentration exceeds 5 volume percent 1.48
with excess oxygen.

The recombination process takes place within the recombiner 1.49
as a result of high temperature. The resulting water vapor 1.50
is then cooled along with other gases and returned to the
suppression chamber.

The recombiner unit, which requires a 1 1/2-hr warmup 1.52
period, is initiated manually from the control room prior to
primary containment oxygen or hydrogen concentrations reach- 1.53
ing 4.5 volume percent. This occurs for the hydrogen con- 1.55
centration, approximately 2.75 days after the design basis

1. Oxygen and hydrogen sources in a post-accident environment. 1.10

2. Distribution of oxygen and hydrogen in the drywell and the suppression chamber. 1.11

3. Primary containment pressure and temperature during the containment cooldown phase of the accident. 1.12

6.2.5.3.1 Sources of Oxygen and Hydrogen 1.20

Short-Term Hydrogen Generation 1.21

In the period immediately after the LOCA, hydrogen is 1.22
generated by both radiolysis and metal-water reaction.
However, the short-term contribution from radiolysis is 1.24
insignificant compared to that of the metal-water reaction. 1.25
The metal-water reaction of steam with the zirconium fuel 1.26
cladding which produces hydrogen is: 1.27

$$Zr + 2H_2O \longrightarrow ZrO_2 + 2H_2 \quad (6.2\text{-}14)$$ 1.28

Based on LOCA calculational procedures and analysis of ECCS 1.30
performance in conformance with 10CFR50.46 and Appendix K of 1.31
10CFR50, the extent of the chemical reaction is estimated to
be 0.14 percent of the fuel cladding material. The metal- 1.32
water reaction generated hydrogen based on a core-wide
penetration of 0.00023 inch results in a metal-water 1.34
reaction that is less than five times the calculated value
of 0.14 percent (0.7 percent). Therefore, 0.7 percent of 1.35
the fuel cladding is assumed to react with water to produce 1.36
hydrogen in accordance with Regulatory Guide 1.7. The 1.37
duration of this reaction is assumed to be 120 sec with a
constant reaction rate. The resulting hydrogen is assumed 1.38
to be uniformly distributed in the drywell. Figures 6.2-72D 1.39
and 6.2-72E show hydrogen generation rates and integrated
values as a function of time following the accident. 1.40

Short-Term Oxygen Source 1.42

The only source of air addition to primary containment, is 1.43
the operation of relief valves inside the primary
containment. These relief valves are part of the breathing 1.45
and service air systems, and are normally isolated during 1.47
reactor operation. Due to high temperature following a LOCA 1.48
inside primary containment, a portion of these systems
(inside primary containment) becomes pressurized and 1.50
relieves pressure by expelling about 126 standard cu ft of
air into the primary containment.

The primary containment does not have any provision for storage of portable air packs for breathing. The operating procedures would have appropriate controls for the use of portable air packs. 1.51 1.52

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The automatic depressurization system (ADS) valves are 1.12
nitrogen operated; therefore, operation of these valves will
not result in addition of oxygen in the primary containment. 1.13
The short-term oxygen source has not been considered in the 1.15
oxygen concentration evaluation, as it is very small. 1.16

<u>Long-Term Hydrogen/Oxygen Generation</u> 1.18

Hydrogen and oxygen are produced by decomposition of water 1.19
due to absorption of the fission product decay energy 1.21
immediately after a LOCA. Generation of hydrogen and oxygen 1.22
due to radiolysis of core cooling water is an important 1.23
factor in determining the long-term gas mixture composition
within the primary containment. A fission product 1.24
distribution model as outlined in Regulatory Guide 1.7 is
used to calculate hydrogen/oxygen generation rates. The 1.26
incore radiolysis (due to core gammas) contributes hydrogen
and oxygen to the drywell, and radiolysis due to fission 1.27
products contributes hydrogen and oxygen directly to the 1.30
suppression chamber and the drywell atmospheres. The 1.31
division of hydrogen and oxygen between the suppression
chamber and the drywell depends upon the fraction of water 1.32
holdup on the drywell floor and water in the reactor vessel.

Hydrogen can also be formed by corrosion of metals and 1.39
decomposition of organic materials in the primary
containment. The significant portion of this source is from 1.40
the corrosion of zinc, which is included in the analysis. 1.41
The temperature dependent hydrogen production rate is based 1.42
on NUREG/CR -2812[4]. The temperature-dependent hydrogen 1.43
generation rate is shown in Table 6.2-59C for demineralized
water. The galvanized steel and zinc primer surface area 1.44
exposed to sprays is shown in Table 6.2-59D. The surface 1.45
area used in the analysis is about 15 percent higher than
the tabulated values. The corrosion of aluminum in 1.46
demineralized water is very small. The Griess and Creek[5] 1.47
test data suggest the hydrogen production rate to be between 1.48
4.76×10^{-5} to 3.23×10^{-3} Std. cu ft of H_2 per sq ft per hour.
Assuming that the corrosion in the Griess and Creek test is 1.49
mainly due to 285°F and 212°F water temperature, the average 1.50
rate is 4×10^{-4} Std. cu ft of H_2 per sq ft per hour.
Considering the aluminum surface area directly exposed to 1.51
the spray environment and the above H_2 generation rate, a 1.52
total of 125 SCF of hydrogen would be evolved within 20 days 1.53
following a LOCA. This being very small compared to other 1.54
sources of hydrogen, Al corrosion and associated hydrogen 1.55
production is ignored in the analysis.

Figures 6.2-72D through 6.2-72G show hydrogen and oxygen 1.56
generation rates and integrated values. The quantity of 1.57

hydrogen initially contained within the reactor coolant system is negligible; hence, it is neglected.

6.2.5.3.2 Accident Description 2.1

Following the postulated recirculation suction line double- 2.2
ended rupture, the metal-water reaction begins in the core
region and produces hydrogen immediately. The reaction is 2.7
assumed to last 2 min, during which 0.7 percent of the
active zircaloy fuel cladding reacts. The radiolysis of 2.8
coolant in the core region, water on the drywell floor, and
suppression pool water begins immediately. The hydrogen and 2.10
oxygen thus generated evolve to the drywell and suppression
chamber atmospheres.

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The combustible gases in the drywell and the suppression 1.10
chamber would approach the flammability limit, if 1.11
uncontrolled, after 4.75 days. Prior to this, pressure and 1.12
temperature within the primary containment are shown by
analysis (Section 6.2.1) to have dropped to a level that 1.13
will permit operation of the recombiner. The recombiner 1.15
system is manually activated when oxygen or hydrogen
concentration reaches 4.5 percent. The recombiner system 1.16
takes suction from the primary containment atmosphere,
recombines the hydrogen and oxygen to form water vapor, and 1.18
returns the exhaust to the suppression chamber. This 1.19
results in a small pressure buildup in the suppression
chamber that causes the opening of the vacuum breaker valves 1.21
between the drywell and suppression chamber. As a result, 1.22
the flow of the gas mixture from the suppression chamber to
the drywell is established. This arrangement of recombiner 1.23
suction and discharge promotes mixing of the two volumes in
the primary containment.

6.2.5.3.3 Analysis 1.25

Based on the preceding hydrogen and oxygen generation 1.26
sources and the accident description, the oxygen and 1.28
hydrogen concentration in the drywell and suppression
chamber is obtained as a function of time. To calculate the 1.29
redistribution of the hydrogen and oxygen between the
drywell and suppression chamber, a two-region computer model 1.30
of the primary containment system is used. This model takes 1.32
into consideration hydrogen and oxygen generation from the
metal-water reaction and radiolysis. The calculation 1.33
determines the inventory, partial pressure, and mole
fraction of each atmospheric constituent in both regions as 1.35
a function of time.

Tables 6.2-58, 6.2-59, 6.2-59C, and 6.2-59D present the parameters 1.36
used in the analysis of the oxygen and hydrogen buildup 1.37
within the primary containment. Figures 6.2-72H and 6.2-72I 1.39
present hydrogen and oxygen concentration transients in the
primary containment, assuming only one recombiner is 1.40
operating. The recombiner is required to be functional 1.41
approximately 2.75 days after the design basis accident.

6.2.5.3.4 Failure Modes and Effects Analysis 1.11

The failure modes and effects analysis (FMEA) for the CGCS 1.12
is provided in the Nine Mile Point Unit 2 FSAR FMEA Report. 1.13

6.2.5.4 Tests and Inspections 1.16

Each active component of the CGCS is testable during normal 1.17
reactor power operation. This system will be tested 1.19
periodically to assure that it will operate correctly 1.20
whenever required. Preoperational tests of the CGCS are 1.22
conducted during the final stages of plant construction
prior to initial startup. These tests assure correct 1.23
functioning of all controls, instrumentation, recombiners,
piping, and valves. System reference characteristics such 1.24
as pressure differentials and flow rates are documented
during the preoperational tests and will be used as base 1.25
points for measurement in subsequent operational tests.

During normal operation, the recombiner system piping, 1.26
valves, instrumentation, wiring, and other components can be 1.27
inspected visually at any time, since they are outside the
primary containment. Further information may be found in 1.28
Chapter 14.

6.2.5.5 Instrumentation Requirements 1.30

<u>Description</u> 1.31

Safety-related instruments and controls are provided for 1.32
automatic and manual control of the hydrogen recombiners. 1.33
The controls and monitors described below are located in the 1.35
main control room. The control logic is shown on 1.36
Figure 6.2-72K.

Instrumentation requirements for the primary containment 1.37
purge system and the SGTS portions of the CGCS are described 1.39
in Sections 9.4.2.5 and 6.5.1.5, respectively.

<u>Operation</u> 1.41

The hydrogen recombiner inlet and outlet isolation valves 1.42
close automatically on a LOCA or manual isolation signal and 1.44
can be opened manually during a LOCA by means of the
associated hydrogen recombiner LOCA override keylock switch. 1.45

6.2.7 References 1.13

1. Models used in LOCTVS - A Computer Code to Determine 1.15
Pressure and Temperature Response of Vapor Suppression
Containments Following a Loss-of-Coolant Accident, 1.16
Topical Report SWECO 8101, 1981. 1.17

2. Maximum Flow Rate of a Single Component Two-Phase 1.18
Mixture, APED-4378, October 25, 1963.

3. Sharma, D. F. Technical Description Annulus 1.19
Pressurization Load Adequacy Evaluation, NEDO-24548,
January 1979. 1.20

4. NUREG/CR-2812 (January 1984), The Relative Importance of 1.22
Temperature, pH and Boric Acid Concentration on Rates of
H_2 Production from Galvanized Steel Corrosion. 1.23

5. BNL-NUREG-24532 (Informal Report, May 1978), Hydrogen 1.25
Release Rates from Corrosion of Zinc and Aluminum.

TABLE 6.2-59

PLANT PARAMETERS USED IN POST-DBA
COMBUSTIBLE GAS CONCENTRATION ANALYSIS

Reactor power	3,467 MW	1.16
Drywell free volume	303,418 ft^3	1.25
Suppression chamber free volume (at high pool water level)	192,028 ft^3	1.27 1.28
Initial drywell pressure	15.45 psia	1.30
Initial drywell temperature	135°F	1.32
Initial drywell relative humidity	40%	1.34
Initial suppression chamber pressure	15.45 psia	1.36 1.37
Initial suppression chamber temperature	90°F	1.39 1.40
Initial suppression chamber relative humidity	100%	1.42 1.43
Weight of zircaloy in core (active fuel)	93,246 lbm	1.45 1.46
Zircaloy reaction with steam	0.7%	1.48
Duration of reaction	120 sec	1.50
Fraction of water in drywell and reactor vessel	5.9%	1.52 1.53
Downcomer submergence at high pool water level	11 feet	1.55 1.56
Vacuum breaker set point	0.25 psid	1.58
Initial O_2 concentration	4 volume percent	2.2
Recombiner capacity	150 scfm	2.4

TABLE 6.2-59 (Cont)

Recombination efficiency	~100%	2.6
Temperature transient for primary containment (recirculation suction line DER)	Figure 6.2-8	2.9 2.10 2.11 2.12

TABLE 6.2-59C

CORROSION RATES

Material	Corrosion Rate (SCF/ft^2-hr)	Applicable Temperature Range
Aluminum	4.0×10^{-4} (constant)	Up to 285°F
Zinc	$0.6764 \exp \frac{-5113.25}{(460 + T)}$	$119.12°F \le T \le 224.06°F$
	$2.8245 \times 10^{11} \exp \left[\frac{-23416.67}{460 + T)}\right]$	$224.06°F \le T \le 334.22°F$

TABLE 6.2-59D

ALUMINUM AND ZINC INVENTORY EXPOSED TO SPRAYS

Material	Surface Area (ft^2)	Weight (lb)	
			1.14
Aluminun	650	41,500	1.16
Galvanized steel	58,540	6,968	1.18
Zinc primer	2,400	230	1.20

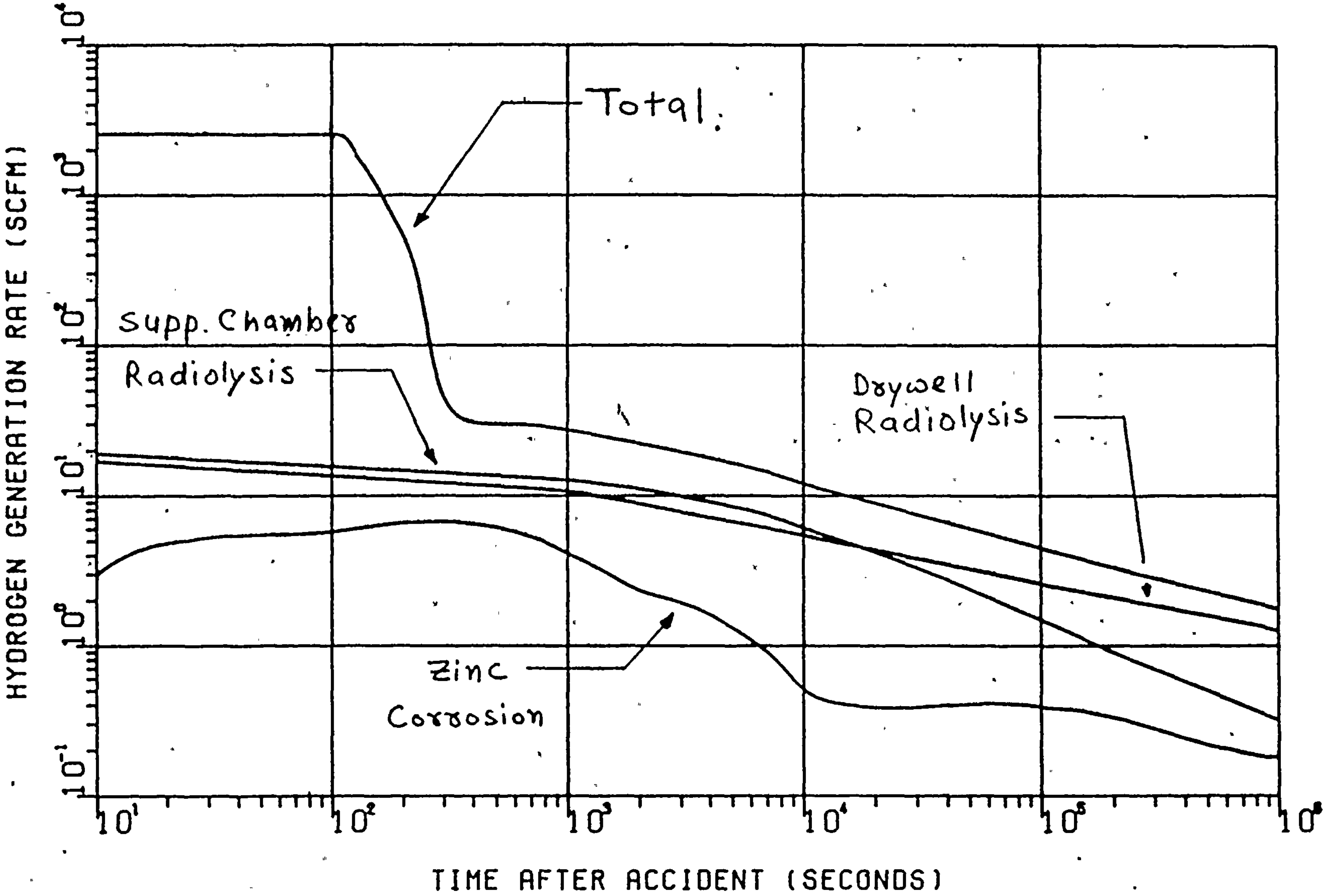

FIGURE 6.2-72D

HYDROGEN GENERATION RATES FOLLOWING DBA

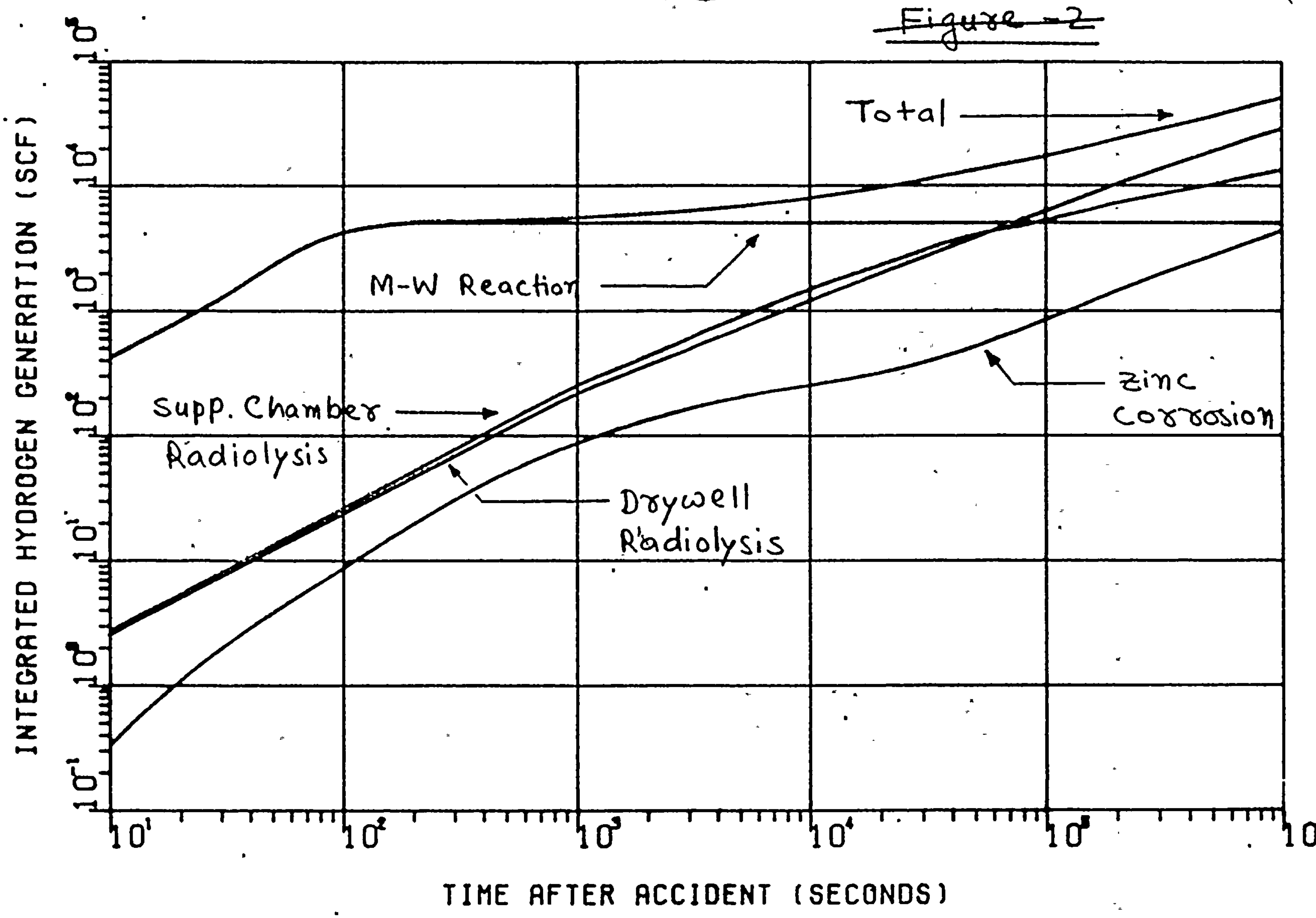

FIGURE 6.2-72E

INTEGRATED HYDROGEN GENERATION FOLLOWING DBA

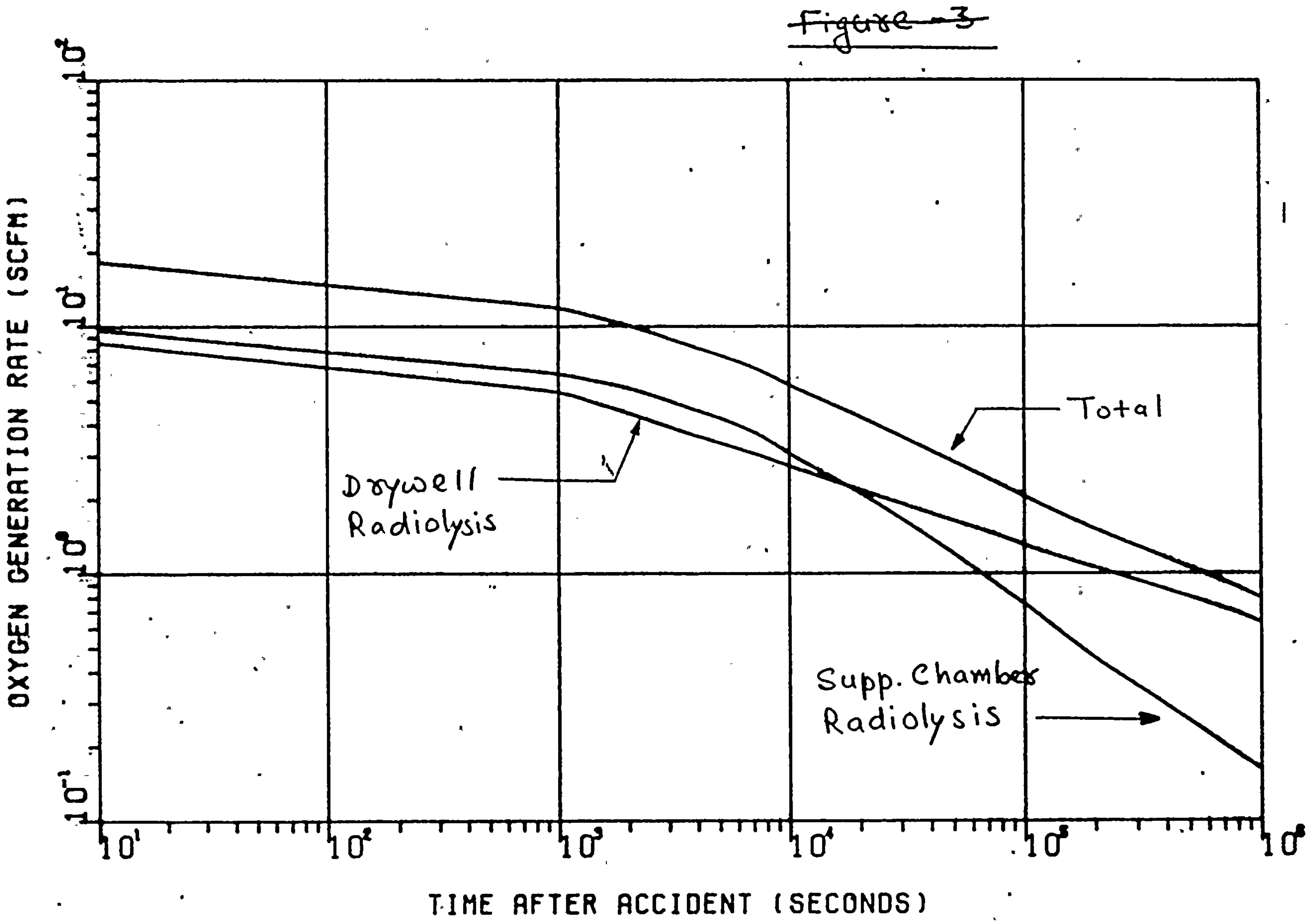

FIGURE 6.2-72F

OXYGEN GENERATION RATES FOLLOWING DBA

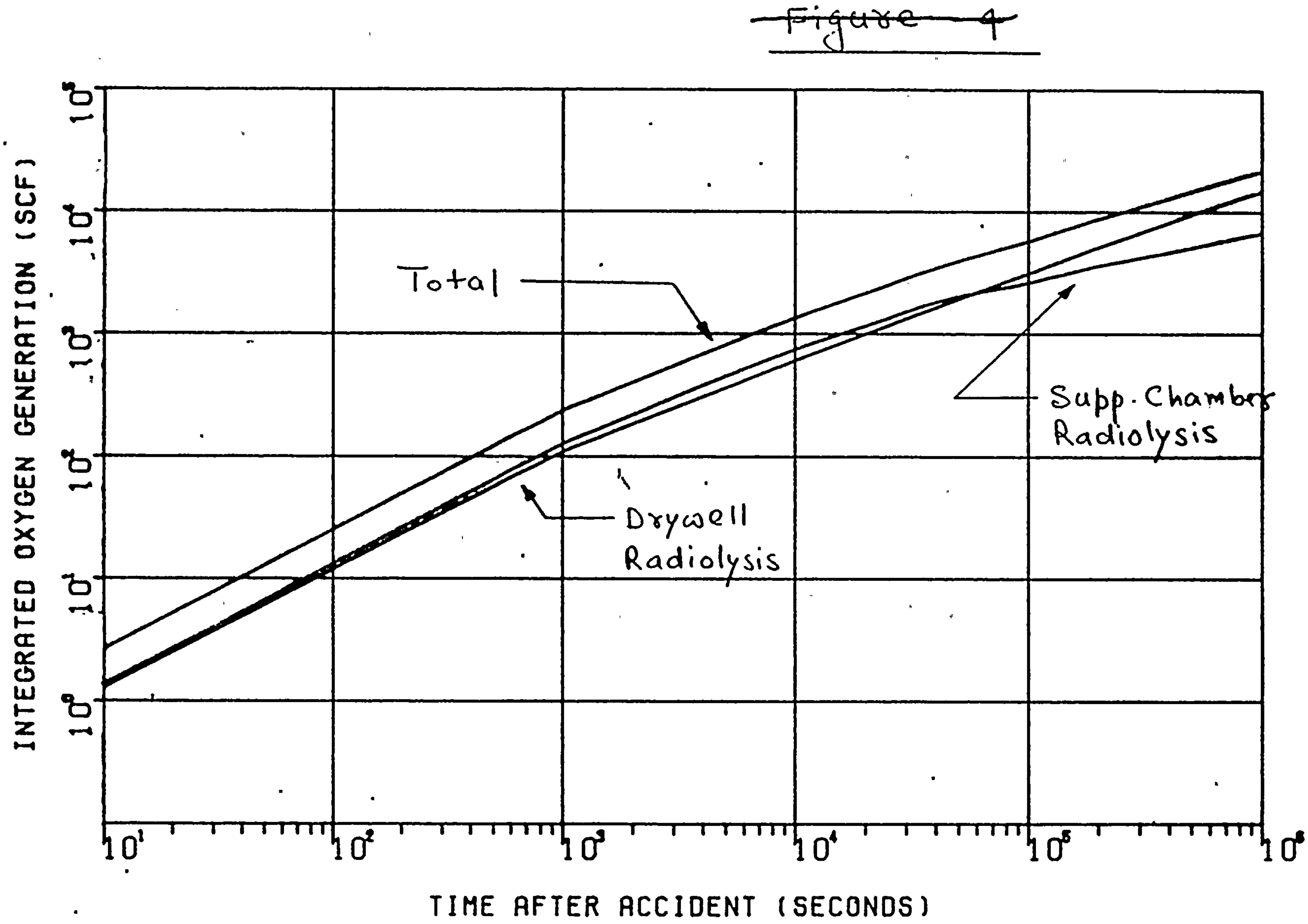

FIGURE 6.2-72G

INTEGRATED OXYGEN GENERATION FOLLOWING DBA

Remove Grid Lines

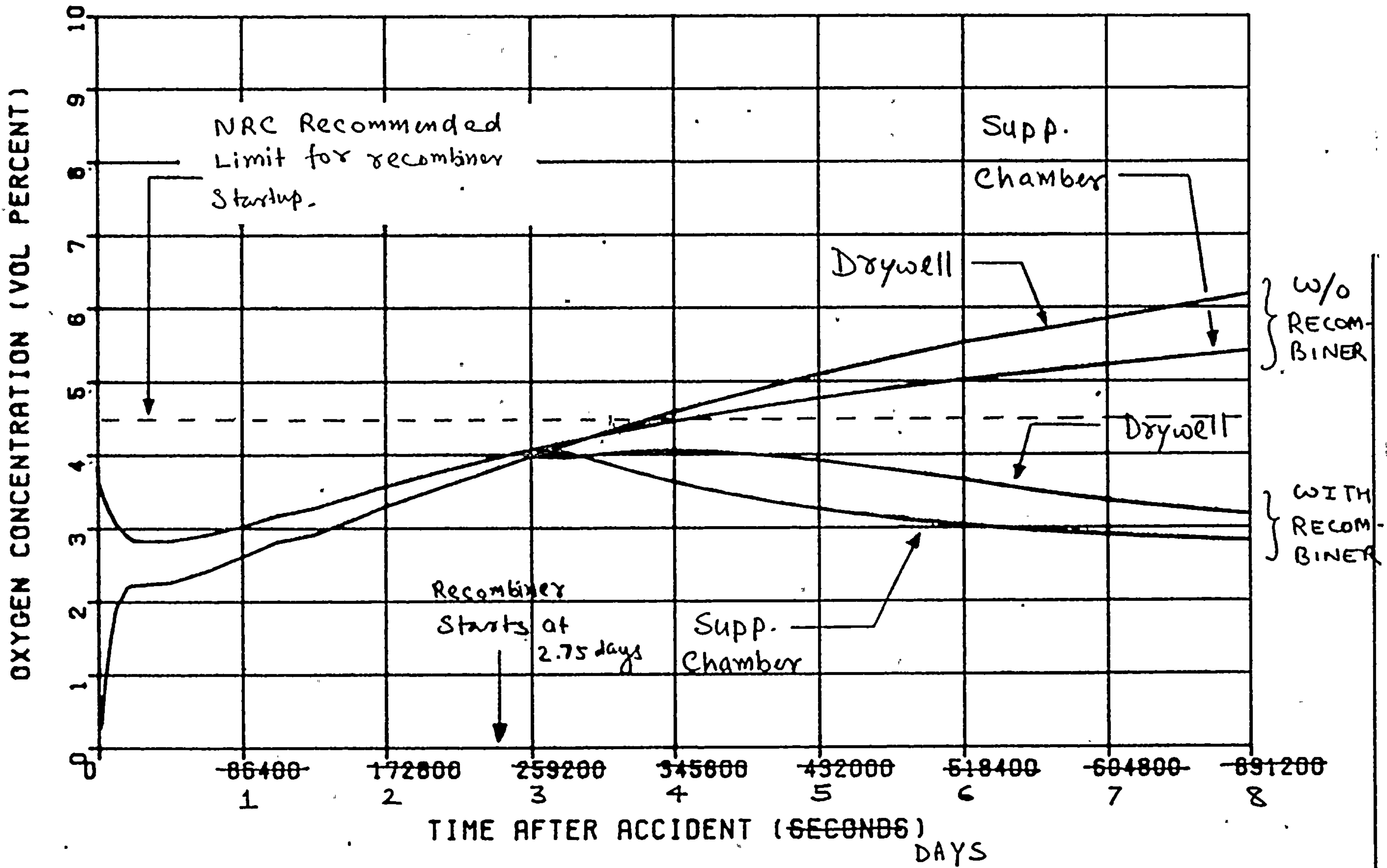

FIGURE 6.2-72H

OXYGEN CONCENTRATION FOLLOWING DBA

Remove Grid Lines

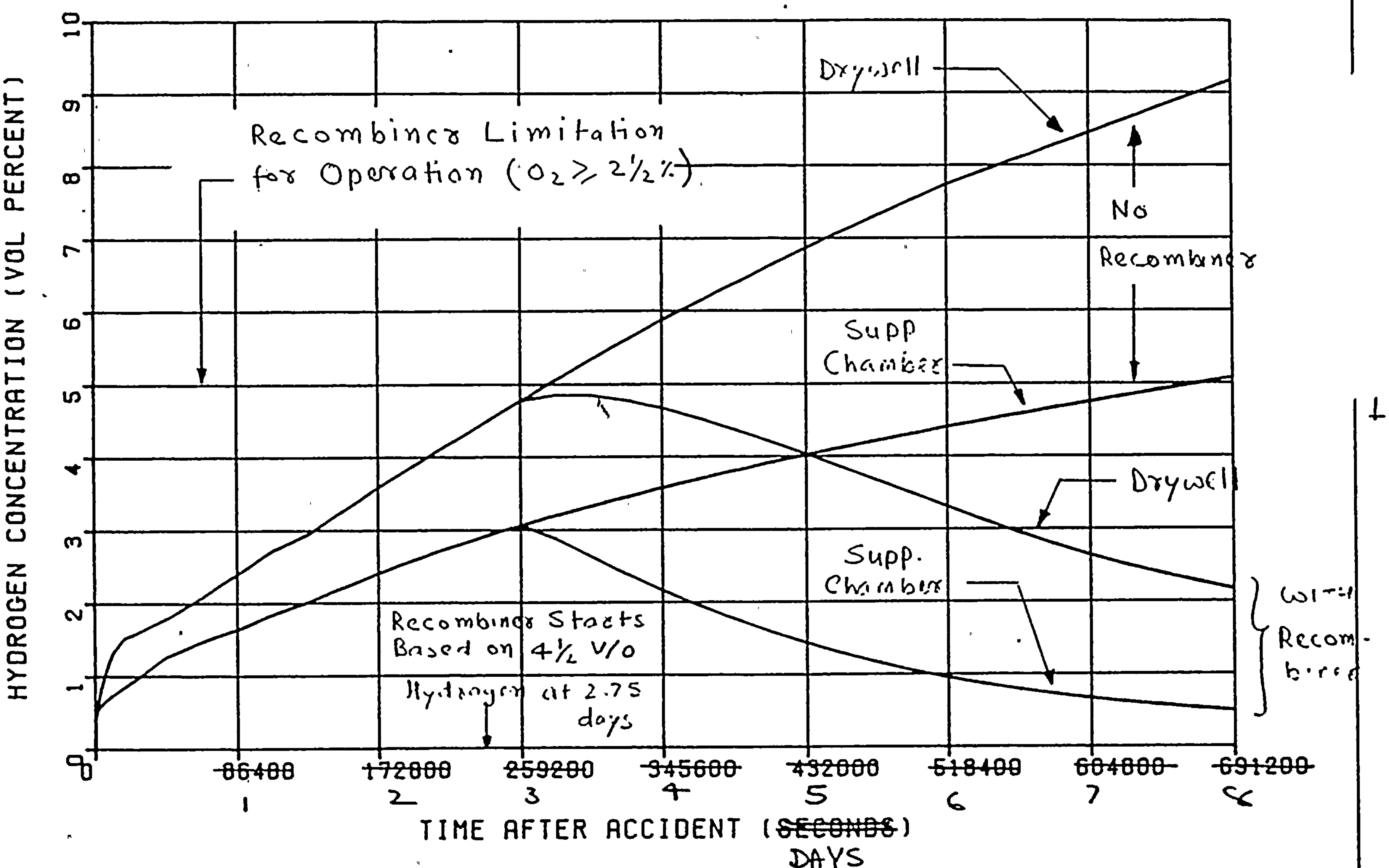

FIGURE 6.2-72I

HYDROGEN CONCENTRATION FOLLOWING DBA

50-410 Revised

TABLE 6.2-56

CONTAINMENT ISOLATION PROVISIONS FOR FLUID LINES

Pene-tration No.	System Designation	GDC or Reg. Guide	ESF System	Fluid	Size (in)	FSAR Arrange-ment Figure(4)	Location of valve Inside/Outside Primary Contain-ment	Length of Pipe - Con-tainment to Outermost Isolation Valve	Type Test (1)	Potential Bypass Leakage Path(2)	Valve (9): Number	Valve: Type	Valve: Oper-ator	Actuator Mode: Primary	Actuator Mode: Secondary	Position: Normal (3)	Position: Shutdown	Position: Post-Accident	Position: Power(10) Failure	Isola-tion Signal (4)	Closure Time (5,6)	Power Source (7)	Notes
Z-1A	Main steam Line A	55	No	Steam	26	6.2-70 Sh. 1	Inside Outside	5'-2"	C C	Yes	2MSS*HYV6A 2MSS*HYV7A	Ball Ball	HYV HYV	Hydraulic to open; spring to close	N/A	Open	Closed	Closed	Closed	B,C,D, E,P,T, R,RM	3 to 5 sec	N/A	8
	Main steam Line A drain line						Outside Outside				2MSS*A0V93A 2MSS*MOV208	Globe Globe	AOV MOV		Closed Closed	Closed Closed	Closed Closed	Closed Closed	N/A FAI	RM B,C,D, F,E,P, T,R,RM		N/A N/A	
Z-1B	Main steam Line B	55	No	Steam	26	6.2-70 Sh. 1	Inside Outside	5'-2"	C C	Yes	2MSS*HYV6B 2MSS*HYV7B	Ball Ball	HYV HYV	Hydraulic to open; spring to close	N/A	Open	Closed	Closed	Closed	B,C,D, E,P,R, T,RM	3 to 5 sec	N/A N/A	8
	Main steam Line B drain line						Outside				2MSS*AOV93B	Globe	ACV			Closed	Closed	Closed	Closed	RM		N/A	
Z-1C	Main steam Line C	55	No	Steam	26	6.2-70 Sh. 1	Inside Outside	5'-2"	C C	Yes	2MSS*HYV6C 2MSS*HYV7C	Ball Ball	HYV HYV	Hydraulic to open; spring to close	N/A	Open	Closed	Closed	Closed	B,C,D, E,P,T, R,RM	3 to 5 sec	N/A	8
	Main steam Line C drain line						Outside				2MSS*AOV93C	Globe	AOV			Closed	Closed	Closed	Closed	RM		N/A	
Z-1D	Main steam Line D	55	No	Steam	26	6.2-70 Sh. 1	Inside Cutside	5'-2"	C C	Yes	2MSS*HYV6D 2MSS*HYV7D	Ball Ball	HYV HYV	Hydraulic to open; spring to close	N/A	Open	Closed	Closed	Closed	B,C,D, E,P,T, R,RM	3 to 5 sec	N/A	8
	Main steam Line D drain line						Outside				2MSS*AOV93D	Globe	AOV			Closed	Closed	Closed	Closed	RM			
Z-2	Main steam drain line	55	No	Steam	6	6.2-70 Sh. 2	Inside Outside	1'-0"	C C	Yes	2MSS*MOV111 2MSS*MOV112	Globe Globe	MOV MOV	Elec. Elec.	Manual Manual	Closed Closed	Closed Closed	Closed Closed	FAI FAI	B,C,D F,E,P, T,R,RM		Div II Div I	
Z-3	Spare								A														

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TABLE 6.2-56 (Cont)

Pene-tration No.	System Designation	GDC or Reg. Guide	ESF System	Fluid	Size (in)	FSAR Arrange-ment Figure(1)	Location of valve Inside/ Outside Primary Contain-ment	Length of Pipe - Con-tainment to Outermost Isolation Valve	Type Test (1)	Potential Bypass Leakage Path(2)	Valve(9) Number	Type	Oper-ator	Actuator Mode Primary	Actuator Mode Secondary	Position Normal (3)	Position Shutdown	Position Post-Accident	Position Power Failure(10)	Isola-tion Signal (4)	Closure Time (5,6)	Power Source (7)	Note
Z-4A	Feedwater line A to RPV	55	No	Water	24	6.2-70 Sh. 3	Outside	2'-1"	C	yes (No) (30)	2FWS*AOV23A	Swing Check	AOV	Pneumatic	N/A	Open	Closed	Closed	Closed	Reverse flow	The time it takes for one valve volume to pass through the valve	N/A	11
							Inside	0'-0"	C		2FWS*V12A	Swing Check	N/A	Flow	N/A	Open	Closed	Closed	Closed				
Z-4B	Feedwater line A to RPV	55	No	Water	24	6.2-70 Sh. 3	Inside	0'-0"	C	yes (No) (30)	2FWS*V12B	Swing Check	N/A	Flow	N/A	Open	Closed	Closed	N/A	Reverse flow	The time it takes for one valve volume to pass through the valve		11
							Outside	2'-1"	C		2FWS*AOV23B	Swing Check	AOV	Pneumatic	N/A	Open	Closed	Closed	N/A				
Z-5A	RHS Pump A suction from suppression pool	56	Yes	Water	24	6.2-70 Sh. 4	Outside	5'-6"	C	No (29)	2RHS*MOV1A	Tricen-tric butter-fly	MOV	Elec.	Manual	Open	Closed	Open	FAI	RM	45	Div I	13
Z-5B	RHS Pump B suction from suppression pool	56	Yes	Water	24	6.2-70 Sh. 4	Outside	20'-9"	C	No (29)	2RHS*MOV1B	Tricen-tric butter-fly	MCV	Elec.	Manual	Open	Closed	Open	FAI	RM	45	Div II	13
Z-5C	RHS Pump C suction from suppression pool	56	Yes	Water	24	6.2-70 Sh. 4	Outside	9'-9"	C	No (29)	2RHS*MOV1C	Tricen-tric butter-fly	MOV	Elec.	Manual	Open	Closed	Open	FAI	RM	45	Div II	13
Z-6A	RHS test line Loop B to sup-pression pool	56	Yes	Water	18	6.2-70 Sh. 6	Outside	9'-1 5/16"	C	No (29)	2RHS*MOV30B	Tricen-tric butter-fly	MOV	Elec.	Manual	Open	Closed	Closed	FAI	RM	*	Div I	15

Revised

TABLE 6.2-56 (Cont)

Penetration No.	System Designation	GDC or Reg. Guide	ESF System	Fluid	Size (in)	FSAR Arrangement Figure(1)	Location of valve Inside/ Outside Primary Containment	Length of Pipe - Containment to Outermost Isolation Valve	Type Test (1)	Potential Bypass Leakage Path(2)	Valve(9) Number	Type	Operator	Actuator Mode Primary	Actuator Mode Secondary	Position Normal (3)	Position Shutdown	Position Post-Accident	Position Power Failure(10)	Isolation Signal (4)	Closure Time (5,6)	Power Source (7)	Notes
Z-6B	RHS test line Loop A to suppression pool	56	Yes	Water	18	6.2-70 Sh. 6	Outside	9'-3"	C	No (29)	2RHS*MOV30A	Tricentric butterfly	MOV	Elec.	Manual	Open	Closed	Closed	FAI	RM	*	Div II	15
Z-7A	RHS containment spray Loop A to suppression pool	56	Yes	Water	4	6.2-70 Sh. 7	Outside	18'-3"	C	No (29)	2RHS*MOV33A	Globe	MOV	Elec.	Manual	Closed	Closed	Open	FAI	G	23	Div I	14,15
Z-7B	RHS containment spray Loop B to suppression pool	56	Yes	Water	4	6.2-70 Sh. 7	Outside	4'-6"	C	No (29)	2RHS*MOV33B	Globe	MOV	Elec.	Manual	Closed	Closed	Open	FAI	G	23	Div II	14,15
Z-8A	RHS containment spray Loop A to drywell	56	Yes	Water	16	6.2-70 Sh. 8	Outside Outside	2'-0"	C	No (29)	2RHS*MOV25A	Gate	MOV	Elec.	Manual	Closed	Closed	Open	FAI	RM	89	Div I	15
Z-8B	RHS containment spray Loop B to drywell	56	Yes	Water	16	6.2-70 Sh. 8	Outside Outside	2'-3"	C	No (29)	2RHS*MOV25B	Gate	MOV	Elec.	Manual	Closed	Closed	Open	FAI	RM	89	Div II	1 15
Z-9A	RHS/LPCI Loop A to RPV	55	Yes	Water	12	6.2-70 Sh. 9	Outside Inside	7'-0"	C C	No (29)	2RHS*MOV24A 2RHS*AOV16A	Gate Check	MOV ACV	Elec. Process	Manual N/A	Closed Closed	Closed Closed	Open Open	FAI Closed	RM Reverse flow	19.5 @ 5.0	Div I	1 15
Z-9B	RHS/LPCI Loop B to RPV	55	Yes	Water	12	6.2-70 Sh. 9	Outside Inside	6'-6"	C C	No (29)	2RHS*MOV24B 2RHS*AOV16B	Gate Check	MOV AOV	Elec. Process	Manual N/A	Closed Closed	Closed Closed	Open Open	FAI Closed	RM Reverse flow	19.5 @ 5.0	Div II N/A	1 15,11
Z-9C	RHS/LPCI Loop C to RPV	55	Yes	Water	12	6.2-70 Sh. 9	Outside Inside	6'-6"	C C	No (29)	2RHS*MOV24C 2RHS*AOV16C	Gate Check	MOV AOV	Elec. Process	Manual N/A	Closed Closed	Closed Closed	Open Open	FAI Closed	RM Reverse flow	19.5 @ 5.0	Div II N/A	1 15,11,

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TABLE 6.2-56 (Cont)

Penetration No.	System Designation	GDC or Reg. Guide	ESF System	Fluid	Size (in)	FSAR Arrangement Figure(1)	Location of valve Inside/Outside Primary Containment	Length of Pipe - Containment to Outermost Isolation Valve	Type Test (1)	Potential Bypass Leakage Path(2)	Valve (9): Number	Type	Operator	Actuator Mode: Primary	Actuator Mode: Secondary	Position: Normal (3)	Position: Shutdown	Position: Post-Accident	Position: Power Failure (10)	Isolation Signal (4)	Closure Time (5,6)	Power Source (7)	Note
Z-10A	RHS shutdown return Loop A to reactor recirc Loop A	55	No	Water	12	6.2-70 Sh. 13	Outside	6'-0"	C	No (29)	2RHS*MOV40A	Globe	MOV	Elec.	Manual	Closed	Open	Closed	FAI	A,L,M, RM	25	Div I	
							Inside				2RHS*AOV39A	Check	ACV	Process	N/A	Closed	Open	Closed	Closed	Reverse flow	@5.0	Div I	11
	RHS shutdown cooling return line inboard valve bypass line	55	No	Water	2	6.2-70 Sh. 13	Inside		C		2RHS*MOV67A	Globe	MOV	Elec.	Manual	Closed	Closed	Closed	FAI	A,L,M, RM	9	Div I	
Z-10B	RHS shutdown return Loop B to reactor recirc Loop B	55	No	Water	12	6.2-70 Sh. 13	Outside	6'-0"	C	No (29)	2RHS*MOV40B	Globe	MOV	Elec.	Manual	Closed	Open	Closed	FAI	A,L,M, RM	25	Div I	
							Inside				2RHS*AOV39B	Check	AOV	Process	N/A	Closed	Open	Closed	Closed	Reverse flow	@5.0	Div I	11
	RHS shutdown cooling return line inboard valve bypass line	55	No	Water	2	6.2-70 Sh. 13	Inside		C		2RHS*MOV67B	Globe	MOV	Elec.	Manual	Closed	Closed	Closed	FAI	A,L,M, RM	9	Div I	
Z-11	RHS shutdown supply from reactor recirc	55	No	Water	20	6.2-70 Sh. 14	Outside	6'-0"	C	No (29)	2RHS*MOV113	Gate	MOV	Elec.	Manual	Closed	Open	Closed	FAI	A,L,M, RM	27	Div I	
							Inside		C		2RHS*MOV112	Gate	MOV	Elec.	Manual	Closed	Open	Closed	FAI	A,L,M, RM	27	Div II	
							Inside		C		2RHS*RV152 (1 corrected to 2)	Relief	N/A	Auto	N/A	Closed	Closed	Closed	Closed	N/A	N/A	N/A	
Z-12	CSH suction from suppression pool	56	Yes	Water	20	6.2-70 Sh. 5	Outside	2'-2"	C C	~~No~~ Yes (30)	2CSH*MOV118	Gate	MOV	Elec.	Manual	Closed	Closed	Open	FAI	RM	16	Div III	
Z-13	CSH test return to suppression	56	Yes	Water	12	6.2-70 Sh. 15	Outside	50'-0"	C	No (29)	2CSH*MOV111	Globe	MOV	Elec.	Manual	Closed	Closed	Closed	FAI	B,F,RM	STD	Div III	
	HPCS min flow bypass		Yes	Water	4		Outside	45'-6"	C		2CSH*MOV105	Gate	MCV	Elec.	Manual	Closed	Closed	Closed	FAI	RM	STD	Div III	

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Control # 8409250352
Date 9/21/84 of Document
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TABLE 6.2-56 (Cont)

Penetration No.	System Designation	GDC or Reg. Guide	ESF System	Fluid	Size (in)	FSAR Arrangement Figure(1)	Location of valve Inside/Outside Primary Containment	Length of Pipe - Containment to Outermost Isolation Valve	Type Test (1)	Potential Bypass Leakage Path(2)	Valve (9) Number	Type	Operator	Actuator Mode Primary	Actuator Mode Secondary	Position Normal (3)	Position Shutdown	Position Post-Accident	Position Power(10) Failure	Isolation Signal (4)	Closure Time (5,6)	Power Source (7)	Note
Z-14	CSH to RPV	55	Yes	Water	12	6.2-70 Sh. 9	Inside	1'	C	No (29)	2CSH*AOV108	Check	AOV	Process	Air	Closed	Closed	Open	Closed	Reverse flow	5	N/A	1 13
							Outside		C		2CSH*MOV107	Gate	MOV	Elec.	Manual	Closed	Closed	Open	FAI	RM	27	Div III	
Z-15	CSL suction from suppression pool	56	Yes	Water	20	6.2-70 Sh. 4	Outside	1'-8"	C	No (29)	2CSL*MOV112	Butterfly	MOV	Elec.	Manual	Open	Open	Open	FAI	RM	90	Div I	13,
Z-16	CSL to RPV	55	Yes	Water	12	6.2-70 Sh. 10	Inside	1'	C	No (29)	2CSL*AOV101	Check	AOV	Process	Air	Closed	Closed	Open	Closed	Reverse flow	N/A	N/A	11 13
							Outside				2CSL*MOV104	Gate	MOV	Elec.	Manual	Closed	Closed	Open	FAI	RM	≤37	Div I	
Z-17	ICS suction from suppression pool	56	Yes	Water	6	6.2-70 Sh. 5	Outside	9"	C	~~No~~ Yes (30)	2ICS*MOV136	Gate	MOV	Elec.	Manual	Closed	Closed	Open	FAI	RM	30	120VDC	
Z-18	ICS minimum flow to suppression pool	56	Yes	Water	2	6.2-70 Sh. 11	Outside	6"	C	No (29)	2ICS*MOV143	Globe	MOV	Elec.	Manual	Closed	Closed	Open	FAI	RM	5	120VDC	
Z-19	ICS turbine exhaust to suppression pool	56	Yes	Steam	12	6.2-70 Sh. 12	Outside	2.75'	C	No (29)	2ICS*MOV122	Gate	MOV	Elec.	Manual	Open	Open	Open	FAI	RM	61	120VDC	1
	ICS turbine exhaust vacuum breaker	56	Yes	Steam	1 1/2	6.2-70 Sh. 12	Outside		C		2ICS*MOV164	Globe	MOV	Elec.	Manual	Open	Open	Open	FAI	F,RM,H	10		
Z-20	Spare		No		3/4				A														

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Pene-tration No.	System Designation	GDC or Reg. Guide	ESF System	Fluid	Size (in)	FSAR Arrange-ment Figure(1)	Location of valve Inside/ Outside Primary Contain-ment	Length of Pipe - Con-tainment to Outermost Isolation Valve	Type Test (1)	Potential Bypass Leakage Path(2)	Valve(9) Number	Type	Oper-ator	Actuator Mode Primary	Actuator Mode Secondary	Position Normal (3)	Position Shutdown	Position Post-Accident	Position Power(10) Failure	Isola-tion Signal (4)	Closure Time (5,6)	Power Source (7)	Not
Z-21A	Steam to ICS turbine and RHS heat exchangers		Yes	Steam	10	6.2-70 Sh. 16	Outside Inside	9" 1"	C C	No (29)	2ICS*MOV121 2ICS*MOV128	Gate Gate	MOV MOV	Elec. Elec.	Manual Manual	Open Open	Closed Closed	Open Open	FAI FAI	K,RM K,RM	14.5 14.5	Div I	
	ICS turbine steam supply bypass to inboard isolation valve			Steam			Inside	1"	C		2ICS*MOV170	Globe	MOV	Elec.	Manual	Open	Closed	Open	FAI	K,RM	10.5		
Z-21B	Spare		No		4				A														
Z-22	ICS to RPV	55	Yes	Water	6	6.2-70 Sh. 17	Outside Inside	4.25"	C	No (29)	2ICS*AOV156 2ICS*AOV157	Check Check	AOV AOV	Process Process	Air Air	Closed Closed	Closed Closed	Open Open	Closed Closed	Reverse flow Reverse flow	5 5	120VDC	
Z-23	WCS supply from RCS & RPV	55	No	Water Water	8 8	6.2-70 Sh. 18	Inside Outside	15"	C	~~No~~ Yes (30)	2WCS*MOV102 2WCS*MOV112	Globe Globe	MOV MOV	Elec. ELec.	Manual Manual	Open Open	Open Open	Closed Closed	FAI FAI	U,B,RM U,B,J, S,W,RM	14 14	Div I Div I	
Z-24	Spare		No		3				A														
Z-25	RDS lines to RPV 53 Insert 53 Withdrawal		Yes	Water	1 3/4	N/A	Outside Outside	125' 125'		NO (29)						See Note 17							
Z-26	RDS lines to RPV 39 Insert 39 Withdrawal		Yes	Water	1 3/4	N/A	Outside Outside	125' 125'		No (29)						See Note 17							
Z-27	RDS lines to RPV 54 Insert 54 Withdrawal		Yes	Water	1 3/4	N/A	Outside Cutside	125' 125'		No (29)						See Note 17							

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Pene-tration No.	System Designation	GDC or Reg. Guide	ESF System	Fluid	Size (in)	FSAR Arrange-ment Figure(1)	Location of valve Inside/Outside Primary Contain-ment	Length of Pipe - Con-tainment to Outermost Isolation Valve	Type Test (1)	Potential Bypass Leakage Path(2)	Valve(9) Number	Valve Type	Oper-ator	Actuator Mode Primary	Actuator Mode Secondary	Position Normal (3)	Position Shutdown	Position Post-Accident	Position Power(10) Failure	Isola-tion Signal (4)	Closure Time (5,6)	Power Source (7)	Note
Z-28	RDS lines to RPV 39 Insert 39 Withdrawal		Yes	Water	1 3/4	N/A	Outside Outside	125' 125'		NO (29)						See Note 17							
Z-29	SLCS to RPV	55	Yes	Boron solu-tion	1 1/2		Inside Outside	*	C C	No (31)	2SLS*V10 2SLS*MOV5A	Check Stop check globe	N/A MOV	Process Elec.	N/A Manual	Closed	Closed Closed	Closed Closed	N/A Closed	Reverse flow Reverse flow	N/A N/A	N/A N/A	
							Outside		C		2SLS*MOV5B	Stop check globe	MCV	Elec.	Manual		Closed	Closed	Closed	Reverse flow	N/A	N/A	
Z-30A	Spare		No		3				A														
Z-30B	Spare		No		3				A														
Z-31A	TIP drive guide tube to RPV	57	No	Note 19	1 1/2	6.2-70 Sh. 19	Outside Outside	1'-3/4"	C	No (31)	N/A N/A	Ball Shear	SCV N/A	Elec. N/A	Elec. N/A	Closed Open	Closed Open	Closed Open	Closed Open	TIP rm	N/A	120 VAC 125 VDC	18,19
Z-31B	TIP drive guide tube to RPV	57	No	Note 19	1 1/2	6.2-70 Sh. 19	Outside Outside	1'-3/4"	C	No (31)	N/A N/A	Ball Shear	SOV N/A	Elec. N/A	Elec. N/A	Closed Open	Closed Open	Closed Open	Closed Open	TIP rm	N/A	120 VAC 125 VDC	18,19
Z-31C	TIP drive guide tube to RPV	57	No	Note 19	1 1/2	6.2-70 Sh. 19	Outside Outside	1'-3/4"	C	No (31)	N/A N/A	Ball Shear	SOV N/A	Elec. N/A	Elec. N/A	Closed Open	Closed Open	Closed Open	Closed Open	TIP rm	N/A	120-VAC 125 VDC	18,19
Z-31D	TIP drive guide tube to RPV	57	No	Note 19	1 1/2	6.2-70 Sh. 19	Outside Outside	1'-3/4"	C	No (31)	N/A	Ball Shear	SCV N/A	Elec. N/A	Elec. N/A	Closed Open	Closed Open	Closed Open	Closed Open	TIP rm	N/A	120-VAC 125 VDC	18,19
Z-31E	TIP drive guide tube to RPV	57	No	Note 19	1 1/2	6.2-70 Sh. 19	Outside Outside	1'-3/4"	C	No (31)	N/A	Ball Shear	SOV N/A	Elec. N/A	Elec. N/A	Closed Open	Closed Open	Closed Open	Closed Open	TIP rm Reverse flow	N/A	120-VAC 125 VDC	18,19
Z-32	N_2 purge to TIP index mechanism	57	No	N_2	1 1/2	[illegible]	Outside OUTSIDE	1'-0" 23'-0"	C C	No (31) NO (31)	N/A N/A	Check GLOBE	Simple check SOV	N/A ELEC	N/A ELEC	OPEN Closed OPEN	Closed CLOSED	Closed CLOSED	Closed CLOSED	TIP	N/A	N/A 120 VAC	
Z-33A	CCP supply to RCS Pump A	56	No	Water	4	6.2-70 Sh. 20	Inside Outside	7'-0"	C C	No (31) No	2CCP*MOV94A 2CCP*MOV4A (17A)	Globe Globe	MOV MOV	Elec. Elec.	Manual Manual	Open Open	Open Open	Closed Closed	FAI FAI	B,F,RM B,F,RM	22 23	Div II Div I	16

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Penetration No.	System Designation	GDC or Reg. Guide	ESF System	Fluid	Size (in)	FSAR Arrangement Figure(1)	Location of valve Inside/ Outside Primary Containment	Length of Pipe - Containment to Outermost Isolation Valve	Type Test (1)	Potential Bypass Leakage Path(2)	Valve(9) Number	Valve Type	Operator	Actuator Mode Primary	Actuator Mode Secondary	Position Normal (3)	Position Shutdown	Position Post-Accident	Position Power(10) Failure	Isolation Signal (4)	Closure Time (5,6)	Power Source (7)	Notes
Z-33B	CCP to RCS Pump B	56	No	Water	4	6.2-70 Sh. 20	Inside Outside	 7'-0"	C C	No (31)	2CCP*MOV94B 2CCP*MOV4B	Globe Globe	MOV MOV	Elec. Elec.	Manual Manual	Open Open	Open Open	Closed Closed	FAI FAI	B,F,RM B,F,RM	22 23	Div II Div I	
Z-34A	CCP return from RCS Pump A	56	No	Water	4	6.2-70 Sh. 21	Inside Outside	 7'-0"	C C	No (31)	2CCP*MOV21A 2CCP*MOV5A	Globe Globe	MOV MOV	Elec. Elec.	Manual Manual	Open Open	Open Open	Closed Closed	FAI FAI	B,F,RM B,F,RM	23 23	Div II Div I	
Z-34B	CCP return from RCS Pump B	56	No	Water	4	6.2-70 Sh. 21	Inside Outside	 7'-0"	C C	No (31)	2CCP*MOV21B 2CCP*MOV5B	Globe Globe	MOV MOV	Elec. Elec.	Manual Manual	Open Open	Open Open	Closed Closed	FAI FAI	B,F,RM B,F,RM	23 23	Div II Div I	
Z-35	Spare				4				A														
Z-36	Service air to drywell	56	No	Air	2	6.2-70 Sh. 22	Outside Inside	7"	C	No (31)	2SAS*HCV161 2SAS*HCV163	Globe Globe	Manual Manual	Manual Manual	N/A N/A	Closed Closed	Closed Closed	Closed Closed	Closed Closed	LMC,LC LMC,LC	N/A N/A	Div I Div II	
Z-37	Breathing air to drywell	56	No	Air	2	6.2-70 Sh. 22	Outside Inside	7"	C C	No (31)	2AAS*HCV134 2AAS*HCV136	Globe Globe	Manual Manual	Manual Manual	N/A N/A	Closed Closed	Closed Closed	Closed Closed	Closed Closed	LMC,LC LMC,LC	N/A N/A	Div I Div II	
Z-38A	RDS to recirc pump A seal	55	No	Water	3/4	6.2-70 Sh. 23	Inside Outside Outside	 <5'-0" 	C C 	No (29)	2RCS*V60A 2RCS*V90A 2RCS*V59A	Check Check Check	N/A N/A N/A	Flow Flow Flow	N/A N/A N/A	Open Open Open	Closed Closed Closed	Closed Closed Closed	N/A N/A N/A	Reverse flow Reverse flow Reverse flow	N/A N/A N/A	N/A	
Z-38B	RDS to recirc Pump A seal	55	No	Water	3/4	6.2-70 Sh. 23	Inside Outside Outside	<5'-0" 	C C 	No (29)	2RCS*V60B 2RCS*V90B 2RCS*V59B	Check Check Check	N/A N/A N/A	Flow Flow Flow	N/A N/A N/A	Open Open Open	Closed Closed Closed	Closed Closed Closed	N/A N/A N/A	Reverse flow Reverse flow Reverse flow	N/A N/A N/A	N/A	
Z-39	Drywell floor drain tank vent line	56	No	Air		6.2-70 Sh. 24	Inside Outside	*	C C	yes (30)	2DFR*MOV121 2DFR*MOV120	Gate Gate	MOV MOV	Elec. Elec.	Manual Manual	Open Open	Closed Closed	Closed Closed	FAI FAI	B,F,RM B,F,RM	28 28	Div II Div I	
Z-40	Equipment drains from drywell	56	No	Water	4	6.2-70 Sh. 24	Inside Outside	4'-2 1/2"	C C	yes (30)	2DER*MOV119 2DER*MOV120	Gate Gate	MOV MOV	Elec. Elec.	Manual Manual	Open Open	Closed Closed	Closed Closed	FAI FAI	B,F,RM B,F,RM	21.3 21.3	Div II Div I	

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TABLE 6.2-56 (Cont)

Penetration No.	System Designation	GDC or Reg. Guide	ESF System	Fluid	Size (in)	FSAR Arrangement Figure(1)	Location of valve Inside/Outside Primary Containment	Length of Pipe - Containment to Outermost Isolation Valve	Type Test (1)	Potential Bypass Leakage Path(2)	Valve(9) Number	Type	Operator	Actuator Mode Primary	Actuator Mode Secondary	Position Normal (3)	Position Shutdown	Position Post-Accident	Position Power Failure(10)	Isolation Signal (4)	Closure Time (5,6)	Power Source (7)	Notes
Z-41	Reactor coolant recirc to sample cooler	55	No	Water	3/4	6.2-70 Sh. 25	Inside		C	No (31)	2RCS*SOV104	Globe	SCV	Elec.		Closed	Closed	Closed	Closed	B,F,RM	<1.5	Div II	
							Outside	<2'-0"	C		2RCS*SOV105	Globe	SOV	Elec.		Closed	Closed	Closed	Closed	B,F,RM	<1.5	Div I	
Z-42A	Fire protection for reactor recirc pump	56	No	Water	2	6.2-70 Sh. 26	Inside		C	No (31)	2FPW*SOV219	Gate	SOV	Elec.	N/A	Closed	Closed	Closed	Closed	B,F,RM	2		
							Outside	*	C		2FPW*SOV218	Gate	SOV	Elec.	N/A	Closed	Closed	Closed	Closed	B,F,RM	2		
Z-42B	Fire protection water for reactor recirc pump	56	No	Water	2	6.2-70 Sh. 26	Inside		C	No (31)	2FPW*SOV221	Gate	SOV	Elec.	N/A	Closed	Closed	Closed	Closed	B,F,RM	2		
							Outside	*	C		2FPW*SOV220	Gate	SOV	Elec.	N/A	Closed	Closed	Closed	Closed	B,F,RM	2		
Z-43	Drywell floor drains	56	No	Water	6	6.2-70 Sh. 27	Inside	*	C	~~No~~ Yes (30)	2DFR*MOV140	Gate	MOV	Elec.	Manual	Open	Closed	Closed	FAI	B,F,RM	14.2		
					6		Outside	*	C		2DFR*MOV139	Gate	MOV	Elec.	Manual	Open	Closed	Closed	FAI	B,F,RM	14.2		
Z-44A	Capped spare				3				A														
Z-44B	Capped spare				3				A														
Z-44C	Capped spare				3				A														
Z-44D	Capped spare				3				A														
Z-44E	Service air to drywell	56	No	Air	2	6.2-70 Sh. 22	Outside	5"	C	No (31)	2SAS*HCV160	Globe	Manual	Manual	N/A	Closed	Closed/ Open	Closed	Closed	LMC,LC	N/A	Div I	
							Inside		C		2SAS*HCV162	Globe	Manual	Manual	N/A	Closed	Closed/ Open	Closed	Closed	LMC,LC	N/A	Div II	
Z-44F	Breathing air to drywell	56	No	Air	2	6.2-70 Sh. 22	Outside	5"	C	No (31)	2AAS*HCV135	Globe	Manual	Manual	N/A	Closed	Closed/ Open	Closed	Closed	LMC,LC	N/A	Div I	
							Inside		C		2AAS*HCV137	Globe	Manual	Manual	N/A	Closed	Closed/ Open	Closed	Closed	LMC,LC	N/A	Div II	
Z-45	Equipment drain tank (2DER-TK1) vent to drywell	56	No	Air	2	6.2-70 Sh. 27	Inside	*	C	~~No~~ Yes (30)	2DER*MOV130	Globe	MOV	Elec.	Manual	Open	Closed	Closed	FAI	B,F,RM	8.5	Div II	
							Outside		C		2DER*MOV131	Globe	MOV	Elec.	Manual	Open	Closed	Closed	FAI	B,F,RM	8.5	Div I	
Z-46A	CCP supply to drywell space cooler	56	No	Water	8	6.2-70 Sh. 28	Inside	7'-0"	C	No (31)	2CCP*MOV273	Gate	MOV	Elec.	Manual	Open	Open	Closed	FAI	B,F,RM	40	Div II	
							Outside		C		2CCP*MOV265	Gate	MOV	Elec.	Manual	Open	Open	Closed	FAI	B,F,RM	40	Div I	

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TABLE 6.2-56 (Cont)

Pene-tration No.	System Designation	GDC or Reg. Guide	ESF System	Fluid	Size (in)	FSAR Arrange-ment Figure(1)	Location of valve Inside/ Outside Primary Contain-ment	Length of Pipe - Con-tainment to Outermost Isolation Valve	Type Test (1)	Potential Bypass Leakage Path(2)	Valve(a) Number	Type	Oper-ator	Actuator Mode Primary	Actuator Mode Secondary	Position Normal (3)	Position Shutdown	Position Post-Accident	Position Power(10) Failure	Isola-tion Signal (4)	Closure Time (5,6)	Power Source (7)	Not
Z-46E	Capped spare				4				A	No													
Z-46C	Fire protection water for containment hose reel standpipe						See Note 20			No (31)													
Z-46D	Capped spare				4				A														
Z-47	CCP return from drywell space cooler	57	No	Water	8	6.2-70 Sh. 28	Inside	7'-3"	C	No (31)	2CCP*MOV122	Gate	MOV	Elec.	Manual	Open	Open	Closed	FAI	B,F,RM	40	Div II	
							Outside		C		2CCP*MOV124	Gate	MOV	Elec.	Manual	Open	Closed	Closed	FAI	B,F,RM	40	Div I	
Z-48	Purge exhaust from drywell	56	No	Air	14	6.2-70 Sh. 29	Inside		C	No (31)	2CPS*AOV108	Butter-fly	AOV	Pneu-matic	Manual	Closed	Closed	Closed	Closed	B,F,RM	5	Div II	
							Outside		C		2CPS*AOV110	Butter-fly	AOV	Pneu-matic	Manual	Closed	Closed	Closed	Closed	B,F,RM	5	Div I	
Z-49	Purge inlet to drywell	56	No	~~Air~~ Air/N2	14	6.2-70 Sh. 29	Inside		C	No (31)	2CPS*AOV106	Butter-fly	AOV	Pneu-matic	Manual	Closed	Closed	Closed	Closed	B,F,RM	5	Div II	
							Outside		C		2CPS*AOV104	Butter-fly	AOV	Pneu-matic	Manual	Closed	Closed	Closed	Closed	B,F,RM	5	Div I	
Z-50	Purge inlet to wetwell	56	No	~~Air~~ Air/N2	12	6.2-70 Sh. 29	Inside		C	No (31)	2CPS*AOV107	Butter-fly	AOV	Pneu-matic	Manual	Closed	Closed	Closed	Closed	B,F,RM	5	Div II	
							Outside		C		2CPS*AOV105	Butter-fly	AOV	Pneu-matic	Manual	Closed	Closed	Closed	Closed	B,F,RM	5	Div I	
Z-51	Purge exhaust from wetwell	56	No	Air	12	6.2-70 Sh. 29	Inside		C	No (31)	2CPS*AOV109	Butter-fly	AOV	Pneu-matic	Manual	Closed	Closed	Closed	Closed	B,F,RM	5	Div II	
							Outside		C		2CPS*AOV111	Butter-fly	AOV	Pneu-matic	Manual	Closed	Closed	Closed	Closed	B,F,RM	5	Div I	
Z-52A	Capped spare				1				A														
Z-52B	Capped spare				1				A														
Z-53A	Instrument air to ADS valve accumulators	56	No	~~Air~~ N2	1 1/2	6.2-70 Sh. 30	Outside	1'-0"	C	~~No~~ Yes (30)	2IAS*SOV164	Globe	SOV	Elec.	N/A	Open	Open	Closed	Closed	B,F,RM	~~5~~ 8 < 5.0	Div I	
							Inside	1'-0"	C		2IAS*V448	Check	N/A	Process	N/A	Closed	Open	Closed	Closed	B,F,RM	N/A	N/A	

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TABLE 6.2-56 (Cont)

Penetration No.	System Designation	GDC or Reg. Guide	ESF System	Fluid	Size (in)	FSAR Arrangement Figure(1)	Location of valve Inside/Outside Primary Containment	Length of Pipe - Containment to Outermost Isolation Valve	Type Test (1)	Potential Bypass Leakage Path(2)	Valve(9) Number	Type	Operator	Actuator Mode Primary	Actuator Mode Secondary	Position Normal (3)	Position Shutdown	Position Post-Accident	Position Power Failure(10)	Isolation Signal (4)	Closure Time (5,6)	Power Source (7)	Notes
Z-53B	Instrument air to ADS valve accumulators	56	No	~~Air~~ N_2	1 1/2	6.2-70 Sh. 30	Outside Inside	1'-0" 1'-0"	C C	~~No~~ yes (30)	2IAS*SOV165 2IAS*V449	Globe Check	N/A SOV	Elec. Process	N/A N/A	Open Closed	Open Open	Closed Closed	Closed Closed	B,F,RM B,F,RM	<5.0 N/A	Div I N/A	
Z-53C	Instrument air to MSRV accumulator tank	56	No	~~Air~~ N_2	1 1/2	6.2-70 Sh. 30	Outside Inside	1'-0" 1'-0"	C C	~~No~~ yes (30)	2IAS*SOV166 2IAS*SOV184	Globe Globe	SOV SOV	Elec. Process	N/A N/A	Open Closed	Open Open	Closed Closed	Closed Closed	B,F,RM B,F,RM	<5.0 <5.0	Div I Div II	
Z-54A	Capped spare				3				A														
Z-55A	Hydrogen recombiner 1A supply to wetwell	56	Yes	Air	3	6.2-70 Sh. 31	Inside Outside		C C	No (31)	2HCS*MOV4A 2HCS*MOV1A	Globe Globe	MOV MOV	Elec. Elec.	Manual Manual	Closed Closed	Closed Closed	Open Open	FAI FAI	B,F,RM B,F,RM	18.5 18.5	Div I Div I	22
Z-55B	Hydrogen recombiner 1B supply to wetwell	56	Yes	Air	3	6.2-70 Sh. 31	Inside Outside		C C	No (31)	2HCS*MOV4B 2HCS*MOV1B	Globe Globe	MOV MOV	Elec. Elec.	Manual Manual	Closed Closed	Closed Closed	Open Open	FAI FAI	B,F,RM B,F,RM	18.5 18.5	Div II Div II	22
Z-56A	Hydrogen recombiner 1A return from drywell	56	Yes	Air	3	6.2-70 Sh. 31	Inside Outside		C C	No (31)	2HCS*MOV6A 2HCS*MOV3A	Globe Globe	MOV MOV	Elec. Elec.	Manual Manual	Closed Closed	Closed Closed	Open Open	FAI FAI	B,F,RM B,F,RM	18.5 18.5	Div I Div I	22
Z-56B	Hydrogen recombiner 1B return from drywell	56	Yes	Air	3	6.2-70 Sh. 31	Inside Outside		C C	No (31)	2HCS*MOV6B 2HCS*MOV3B	Globe Globe	MOV MOV	Elec. Elec.	Manual Manual	Closed Closed	Closed Closed	Open Open	FAI FAI	B,F,RM B,F,RM	18.5 18.5	Div II Div II	22
Z-57A	Hyrdogen recombiner 1A return from wetwell	56	Yes	Air	3	6.2-70 Sh. 31	Inside Outside		C C	No (31)	2HCS*MOV5A 2HCS*MOV2A	Globe Globe	MOV MOV	Elec. Elec.	Manual Manual	Closed Closed	Closed Closed	Open Open	FAI FAI	B,F,RM B,F,RM	18.5 18.5	Div I Div I	22
Z-57B	Hyrodgen recombiner 1B return from wetwell	56	Yes	Air	3	6.2-70 Sh. 31	Inside Outside		C C	No (31)	2HCS*MOV5B 2HCS*MOV2B	Globe Globe	MOV MOV	Elec. Elec.	Manual Manual	Closed Closed	Closed Closed	Open Open	FAI FAI	B,F,RM B,F,RM	18.5 18.5	Div II Div II	22
Z-58	Containment purge to drywell	56	No	Air	2	6.2-70 Sh. 29	Inside Outside		C C	No (31)	2CPS*SOV122 2CPS*SOV120	Globe Globe	SOV SOV	Elec. Elec.	Manual Manual	Closed Closed	Closed Closed	Closed Closed	Closed Closed	B,F,RM B,F,RM	5 5	Div II Div I	

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TABLE 6.2-56 (Cont)

Penetration No.	System Designation	GDC or Reg. Guide	ESF System	Fluid	Size (in)	FSAR Arrangement Figure(1)	Location of valve Inside/Outside Primary Containment	Length of Pipe - Containment to Outermost Isolation Valve	Type Test (1)	Potential Bypass Leakage Path(2)	Valve(9) Number	Type	Operator	Actuator Mode Primary	Actuator Mode Secondary	Position Normal (3)	Position Shutdown	Position Post-Accident	Position Power Failure(10)	Isolation Signal (4)	Closure Time (5,6)	Power Source (7)	Notes
Z-59	Containment purge to wetwell	56	No	Air	2	6.2-70 Sh. 29	Inside Outside		C C	No (31)	2CPS*SOV121 2CPS*SOV119	Globe Globe	SOV SCV	Elec. Elec.	Manual Manual	Closed Closed	Closed Closed	Closed Closed	Closed Closed	B,F,RM B,F,RM	5 5	Div II Div I	
Z-60A	CMS from drywell	56	No	Air	3/4	6.2-70 Sh. 32	Inside Outside	*	C	No (31)	2CMS*SOV61A 2CMS*SOV60A	Globe	SOV	Elec.	Elec.	Open	Closed	Open	Closed	B,F,RM	<1.5	Div I	
Z-60B	CMS from drywell	56	Yes	Air	3/4	6.2-70 Sh. 32	Inside Cutside	*	C	No (31)	2CMS*SOV24A 2CMS*SOV24C	Globe	SOV	Elec.	Elec.	Open	Closed	Open	Closed	B,F,RM	<1.5	Div I	
Z-60C	CMS to drywell	56	No	Air	3/4	6.2-70 Sh. 32	Inside Outside	*	C	No (31)	2CMS*SOV63A 2CMS*SOV62A	Globe	SOV	Elec.	Elec.	Open	Closed	Open	Closed	B,F,RM	<1.5	Div I	
Z-60D	CMS to drywell	56	Yes	Air	3/4	6.2-70 Sh. 32	Inside Outside	*	C	No (31)	2CMS*SOV33A 2CMS*SOV32A	Globe	SCV	Elec.	Elec.	Open	Closed	Open	Closed	B,F,RM	<1.5	Div I	
Z-60E	CMS from drywell	56	No	Air	3/4	6.2-70 Sh. 32	Inside Outside	*	C	No (31)	2CMS*SOV61B 2CMS*SOV60B	Globe	SCV	Elec.	Elec.	Open	Closed	Open	Closed	B,F,RM	<1.5	Div II	
Z-60F	CMS from drywell	56	Yes	Air	3/4	6.2-70 Sh. 32	Inside Outside	*	C	No (31)	2CMS*SOV24B 2CMS*SOV24D	Globe	SOV	Elec.	Elec.	Open	Closed	Open	Closed	B,F,RM	<1.5	Div II	
Z-60G	CMS to drywell	56	No	Air	3/4	6.2-70 Sh. 32	Inside Outside	*	C	No (31)	2CMS*SOV63B 2CMS*SOV62B	Globe	SOV	Elec.	Elec.	Open	Closed	Open	Closed	B,F,RM	<1.5	Div II	
Z-60H	CMS to drywell	56	Yes	Air	3/4	6.2-70 Sh. 32	Inside Cutside	*	C	No (31)	2CMS*SOV33B 2CMS*SOV32B	Globe	SOV	Elec.	Elec.	Open	Closed	Open	Closed	B,F,RM	<1.5	Div II	
Z-61A	Capped spare				3/4				A														
Z-61B	CMS from wetwell	56	Yes	Air	3/4	6.2-70 Sh. 32	Inside Outside	*	C	No (31)	2CMS*SOV26A 2CMS*SOV26C	Globe	SOV	Elec.	Elec.	Open	Closed	Open	Closed	B,F,RM	<1.5	Div I	
Z-61C	CMS to wetwell	56	Yes	Air	3/4	6.2-70 Sh. 32	Inside Outside	*	C	No (31)	2CMS*SOV34A 2CMS*AOV35A	Globe	SOV	Elec.	Elec.	Open	Closed	Open	Closed	B,F,RM	<1.5	Div I	
Z-61D	Capped spare				3/4				A														
Z-61E	CMS from wetwell	56	Yes	Air	3/4	6.2-70 Sh. 32	Inside Outside	*	C	No (31)	2CMS*SOV26B 2CMS*SOV26D	Globe	SCV	Elec.	Elec.	Open	Closed	Open	Closed	B,F,RM	<1.5	Div II	

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TABLE 6.2-56 (Cont)

Penetration No.	System Designation	GDC or Reg. Guide	ESF System	Fluid	Size (in)	FSAR Arrangement Figure(1)	Location of valve Inside/Outside Primary Containment	Length of Pipe - Containment to Outermost Isolation Valve	Type Test (1)	Potential Bypass Leakage Path(2)	Valve(9) Number	Type	Operator	Actuator Mode Primary	Actuator Mode Secondary	Position Normal (3)	Position Shutdown	Position Post-Accident	Position Power Failure(10)	Isolation Signal (4)	Closure Time (5,6)	Power Source (7)	Notes
Z-61F	CMS to wetwell	56	Yes	Air	3/4	6.2-70 Sh. 32	Inside Outside	*	C	No (31)	2CMS*SOV34B 2CMS*SOV35B	Globe	SOV	Elec.	Elec.	Open	Closed	Open	Closed	B,F,RM	<1.5	Div II	
Z-67	ATWS backup HPCS SPARE			Air	10				A														
Z-68	Capped spare				10				A														
Z-69	Spare				6																		
Z-70	Capped spare				6				A														
Z-71	Spare				3				A														
Z-72	Capped spare				14				A														
Z-73	RHS relief valve discharge to suppression pool	56	No	Water	6	6.2-70 Sh. 33	Outside	48'-6"	A	No (29)	2RHS*RV108 2RHS*RV20C	RV	N/A	N/A	N/A	N/A	N/A	N/A	N/A	None	N/A	N/A	
Z-74	Capped spare				6				A														
Z-75	Capped spare				3				A														
Z-76	Capped spare				3				A														
Z-77	Capped spare				1 1/2				A														
Z-78	Capped spare				1 1/2				A														
Z-79	Capped spare				1 1/2				A														
Z-80	Spent fuel pool cooling	56	No	Water	1 1/2	6.2-70 Sh. 40	Outside Inside	*	C	No (31)	2SFC*V203 2SFC*V204	Globe	Manual	Manual	Manual	Closed	Closed	Closed	Closed	Closed	N/A	N/A	
Z-81	Capped spare				1 1/2				A														
Z-82	Capped spare				1				A														

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TABLE 6.2-56 (Cont)

Penetration No.	System Designation	GDC or Reg. Guide	ESF System	Fluid	Size (in)	FSAR Arrangement Figure(1)	Location of valve Inside/ Outside Primary Containment	Length of Pipe - Containment to Outermost Isolation Valve	Type Test(1)	Potential Bypass Leakage Path(2)	Valve(9) Number	Type	Operator	Actuator Mode Primary	Actuator Mode Secondary	Position Normal(3)	Position Shutdown	Position Post-Accident	Position Power Failure(10)	Isolation Signal(4)	Closure Time(5,6)	Power Source(7)	Notes
Z-83	Capped spare				1				A														
Z-85	Capped spare				1				A														
Z-86	Capped spare				1				A														
Z-87	Capped spare				1				A														
Z-88A	RHS safety valve discharge to suppression pool	56	Yes	Steam	12	6.2-70 Sh. 34	Outside	116'2"	A	No (29)						See Note 23 24							
Z-88B	RHR safety valve discharge to suppression pool	56	Yes	Steam	12	6.2-70 Sh. 34	Outside	106'-2 3/4"	A	No (29)						See Note 23 24							
Z-89A	LMS from drywell	56	No	Air	3/4	6.2-70 Sh. 35	Inside Outside	*	C	No (31)	2LMS*SOV152 2LMS*SOV153	Globe	SOV	Elec.	Elec.	Closed	Closed	Closed	Closed	B,F,RM	<1.5	Div II Div I	
Z-89B	Capped spare				3/4				A														
Z-89C	LMS from wetwell	56	No	Air	3/4	6.2-70 Sh. 35	Inside Outside	*	C	No (31)	2LMS*SOV156 2LMS*SOV157	Globe	SOV	Elec.	Elec.	Closed	Closed	Closed	Closed	B,F,RM	<1.5	Div II Div I	
Z-89D	Capped spare				3/4				A														
Z-90	ICS vacuum breaker		Yes	Air	1 1/2	6.2-70 Sh. 36	Outside Outside	13'	C C	No (29)	2ICS*MOV148 2ICS*MOV164	Globe Globe	MOV MOV	Elec. Elec.	Manual Manual	Open Open	Closed Closed	Open Open	FAI FAI	F,RM None	10 10	Div II Div I	
Z-91A	Instrument air to drywell	56	No	Air N2	1 1/2	6.2-70 Sh. 37	Outside Inside	1'-0" 1'-0"	C	Yes No (30)	2IAS*SOV167 2IAS*SOV185	Globe Globe	SOV SOV	Elec. Elec.	Manual	Open Open	Open Open	Closed Closed	Closed Closed	B,F,RM B,F,RM	<5.0 <5.0	Div I Div II	
Z-91B	Instrument air to drywell	56	No	Air N2	1 1/2	6.2-70 Sh. 37	Outside Inside	1'-0" 1'-0"	C	Yes No (30)	2IAS*SOV168 2IAS*SOV180	Globe Globe	SOV SOV	Elec. Elec.	Manual	Open Open	Open Open	Closed Closed	Closed Closed	B,F,RM B,F,RM	<5.0 <5.0	Div I Div II	
Z-91C	Capped spare				1 1/2				A														
Z-91D	Capped spare				1 1/2				A														

Revised

TABLE 6.2-56 (Cont)

Pene-tration No.	System Designation	GDC or Reg. Guide	ESF System	Fluid	Size (in)	FSAR Arrange-ment Figure(1)	Location of valve Inside/Outside Primary Contain-ment	Length of Pipe - Con-tainment to Outermost Isolation Valve	Type Test (1)	Potential Bypass Leakage Path(2)	Valve(9) Number	Type	Oper-ator	Actuator Mode Primary	Actuator Mode Secondary	Position Normal (3)	Position Shutdown	Position Post-Accident	Position Power Failure	Isola-tion Signal (4)	Closure Time (5,6)	Power Source (7)	Not
Z-92	SPARE		NO		1				A														
Z-96	SPARE		NO		1				A														
Z-98A	RHR relief valve discharge to suppression pool	56	Yes	Water	3	6.2-70 Sh. 38	Outside	207'-6"	A	No (29)	2CSL*RV123 2CSL*RV105 2RHS*RV61A 2RHS*RV110 2RHS*RV139	RV	N/A	N/A	N/A	N/A	N/A	N/A	N/A	None	N/A	N/A	
Z-98B	RHR relief valve discharge to suppression pool	56	Yes	Water	3	6.2-70 Sh. 38	Outside	89'-8"	A	No (29)	2CSH*RV114 2CSH*RV113 2RHS*RV61B 2RHS*RV61C 2RHS*RV20B	RV	N/A	N/A	N/A	N/A	N/A	N/A	N/A	None	N/A	N/A	
Z-99A	Hydraulic unit from recirc flow control valve HYV 17A (drain line)	57	No	Hy-draulic	3/4	6.1-70 Sh. 39	Outside	<5'-0"	N/A	No (31)	2RCS*SOV68A	Globe	SOV	Auto	Remote manual	Open	Closed	Closed	Closed	B,F,RM	<1.5	N/A	,2
Z-99B	Hydraulic unit to recirc flow control valve HYV 17A (open line)	57	No	Hy-draulic	3/4	6.2-70 Sh. 39	Outside	<5'-0"	N/A	No (31)	2RCS*SOV67A	Globe	SOV	Auto	Remote manual	Open	Closed	Closed	Closed	B,F,RM	<1.5	N/A	,26
Z-99C	Hydraulic unit to recirc flow control valve HYV 17A (pilot line)	57	No	Hy-draulic	3/4	6.2-70 Sh. 39	Outside	<5'-0"	N/A	No (31)	2RCS*SOV66A	Globe	SOV	Auto	Remote manual	Open	Closed	Closed	Closed	B,F,RM	<1.5	N/A	,26

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TABLE 6.2-56 (Cont)

Penetration No.	System Designation	GDC or Reg. Guide	ESF System	Fluid	Size (in)	FSAR Arrangement Figure(1)	Location of valve Inside/ Outside Primary Containment	Length of Pipe - Containment to Outermost Isolation Valve	Type Test(1)	Potential Bypass Leakage Path(2)	Valve(9) Number	Type	Operator	Actuator Mode Primary	Actuator Mode Secondary	Position Normal(3)	Position Shutdown	Position Post-Accident	Position Power Failure(8)	Isolation Signal(4)	Closure Time(5,6)	Power Source(7)	Notes
Z-99D	Hydraulic unit to recirc flow control valve HYV 17A (closed line)	57	No	Hydraulic	3/4	6.2-70 Sh. 39	Outside	<5'-0"	N/A	No (31)	2RCS*SOV65A	Globe	SOV	Auto	Remote manual	Open	Closed	Closed	Closed	B,F,RM	<1.5	N/A	,26
Z-100A	Hydraulic unit from recirc flow control valve HYV 17B (drain line)	57	No	Hydraulic	3/4	6.2-70 Sh. 39	Outside	<5'-0"	N/A	No (31)	2RCS*SOV68B	Globe	SOV	Auto	Remote manual	Open	Closed	Closed	Closed	B,F,RM	<1.5	N/A	,26
Z-100B	Hydraulic unit to recirc flow control valve HYV 17B (open line)	57	No	Hydraulic	3/4	6.2-70 Sh. 39	Outside	<5'-0"	N/A	No (31)	2RCS*SOV67B	Globe	SOV	Auto	Remote manual	Open	Closed	Closed	Closed	B,F,RM	<1.5	N/A	,26
Z-100C	Hydraulic unit to recirc flow control valve HYV 17B (pilot) line)	57	No	Hydraulic	3/4	6.2-70 Sh. 39	Outside	<5'-0"	N/A	No (31)	2RCS*SOV66B	Globe	SOV	Auto	Remote manual	Open	Closed	Closed	Closed	B,F,RM	<1.5	N/A	,26
Z-100D	Hydraulic unit to recirc flow control valve HYV 17B (closed line)	57	No	Hydraulic	3/4	6.2-70 Sh. 39	Outside	<5'-0"	N/A	No (31)	2RCS*SOV65B	Globe	SOV	Auto	Remote manual	Open	Closed	Closed	Closed	B,F,RM	<1.5	N/A	,26
	All instrument lines from reactor vessel	R.G. 1.11	No	Air/ Water	3/4	6.2-70 Sh. 41	Outside	As close as possible to containment	A	No (31)	EF check valves	EFV	N/A	Auto	N/A	Open	Open	Open	Open	Excess flow	N/A	N/A	27
	All instrument lines penetrating primary containment	R.G. 1.11	No	Air/ Water	3/4	6.2-70 Sh. 41	Outside	As close as possible to containment	A	No (31)	EFV	EFV	N/A	Auto	N/A	Open	Open	Open	Open	Excess flow	N/A	N/A	27

*To be supplied in an amendment