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MURRAY R. EDELMAN
VICE PRESIDENT
NUCLEAR

March 21, 1985
PY-CEI/NRR-0220 L

Mr. B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Perry Nuclear Power Plant
Docket Nos. 50-440; 50-441
SER License Condition (5)
Hydrogen Control

Dear Mr. Youngblood:

This letter and its attachments are provided in order to supplement the information provided in our March 1, 1985 submittal (PY-CEI/NRR-0199L) of our preliminary evaluation of the PNPP distributed igniter system. The attachments provide additional information on preoperational testing, equipment survivability and the containment response analysis.

If there are further questions, please feel free to call.

Very truly yours,

Frank R. Stead for
Murray R. Edelman
Vice President
Nuclear Group

MRE:njc

Attachments

cc: Jay Silberg, Esq.
John Stefano (2)
J. Grobe

B001
1/1

List of Changes March 21, 1985

	Page	Section	Directions
1.	10	2.6-1	Replace page 10 with revised page 10
2.	Table 2.4-1	Table 2.4-1	Replace third page of Table 2.4-1 with revised page
3.	Table 2.6.1-1	Table 2.6.1-1	Add Table 2.6.1-1
4.	13	3.1	Replace page 13 with revised page 13
5.	16	3.2	Replace page 16 with revised page 16
6.	21	4.3	Replace page 21 with revised page 21
7.	21a through 21d	Section 4.4	Add new section 4.4 including pages 21a thorugh 21d
8.	Table 4.4.2-1	Table 4.4.2-1	Add new Table 4.4.2-1
9.	Figure 4.4.2-1	Figure 4.4.2-1	Add new Figure 4.4.2-1
10.	Page 27	5-4.3	Replace page 27 with revised page 27
11.	Page 27a	5-4.3	Add page 27a
12.	Figures 5.4.3-1 through 3	Figures 5.4.3-1 through 3	Add new Figure 5.4.3-1 through 3
13.	Table 5.6-1 & 5.6-2	Table 5.6-1 & 5.6-2	Add revised Tables 5.6-1 & 5.6-2
14.	Appendix A, Page 15	Table 8	Add page 15, Table 8
15.	Appendix A, Figure 18	Figure 18	Replace Figure 18

2. The 480-208/120 volt transformers (M56-S201 and S202) are capable of providing satisfactory secondary voltages of 120 ± 12 VAC and of meeting the minimum load requirement of 15 KVA.

3. All hydrogen igniter transformers are capable of providing satisfactory hydrogen igniter voltages of 12.0 ± 1.2 VAC.

The preoperational test abstract for the hydrogen control system is provided on Table 2.6.1-1.

2.6.2 Surveillance

The HCS surveillance requirements will be included in the PNPP Technical Specifications.

2.6.3 Qualification

The qualification of the hydrogen igniter assembly is in accordance with the PNPP equipment qualification program described in FSAR sections 3.10 and 3.11. The hydrogen igniter qualification program meets the requirements of the following documents:

- IEEE Std. 323-1974, "IEEE Standard for Qualifying Class IE Equipment for Nuclear Power Generating Stations" (including the November 21, 1975 Supplement) and USNRC Regulatory Guide 1.89.
- IEEE Std. 344-1975, "IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations" and USNRC Regulatory Guide 1.100.
- IEEE Std. 381-1977, "IEEE Standard for Type Tests of Class 1E Modules Used in Nuclear Power Generating Stations".
- IEEE Std. 627-1980, "IEEE Standard for Design Qualification of Safety Equipment Used in Nuclear Power Generating Stations".
- USNRC NUREG-0588, "Interim Staff Position on Environmental Qualification of Safety-Related Electric Equipment".
- 10 C.F.R. Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants".

TABLE 2.4-1 (Continued)
HYDROGEN IGNITER LOCATIONS

IGNITER #	ESF POWER DIVISION	ELEVATION	AZIMUTH	DIMENSION TO CENTERLINE OF CONTAINMENT
IM56-088	2	745'-6"	324°	48'-0"
IM56-089	2	757'-0"	0°	1'-0"
IM56-090	2	757'-0"	180°	1'-0"
IM56-091	2	645'7"	168°	60'0"
IM56-092	1	645'-0"	172°	58'-0"
IM56-093	1	613'-4"	7°	44'-0"
IM56-094	2	612'5"	12°30'	42'8"
IM56-095	1	612'6"	343°-30'	42'6"
IM56-096	2	612'3"	350°-30'	43'6"
IM56-097	2	638'8"	289°	49'6"
IM56-098	1	658'6"	342°	53'-0"
IM56-099	2	685'-6"	17°	50'6"
IM56-100	2	686'-0"	75°	25'-0"
IM56-101	1	686'-0"	105°	25'-0"
IM56-102	1	670'-0"	350°	13'0"
IM56-103	2	670'-0"	4°	13'0"

NOTE: 1 M56-007 not used.

Table 2.6.1-1

Hydrogen Control System Test Abstract

a. Test Objective

To demonstrate the operability of the hydrogen igniter system.

b. Prerequisites

1. Electrical power is available.

2. Communications have been established between testing areas.

c. Test Procedures

1. Measure primary and secondary voltages of the 480/120 and 120/12 volt transformers with the hydrogen igniters energized.

2. Perform a load test of the 480 to 120 volt transformers.

3. Measure hydrogen igniter glow plug temperatures.

d. Acceptance Criteria

1. The 480 volt transformers are capable of supplying satisfactory secondary voltages.

2. The 120 volt transformers are capable of supplying satisfactory secondary voltages.

3. The 480/120 volt transformers are capable of meeting minimum load requirements.

4. Temperature requirements for the hydrogen igniter glow plugs are met.

3.0 CONTAINMENT AND DRYWELL ULTIMATE CAPACITIES

3.1 CONTAINMENT ULTIMATE CAPACITY

The ultimate structural capacity analysis of positive internal pressure for the PNPP Mark III containment has been evaluated. The results were transmitted to the NRC in letters dated January 25, 1982 (D.R. Davidson to R.L. Tedesco) and February 11, 1985 (M.R. Edelman to B.J. Youngblood). Local regions of the containment vessel, equipment hatch, personnel air locks, and the main steam penetrations were evaluated for static loads. The actual material strengths of ASME-SA-516, Grade 70 steel were used in the analysis to determine the mean, lower bound and upper bound values of the material yield strength and ultimate strength. Based on these material properties, the capacity of the general shell to resist statically applied pressure was determined to be 78 psig lower bound strength and 94 psig mean value strength. The limiting region of the containment shell for the analysis was found to be the dome knuckle.

The maximum allowable pressure to meet the ASME Service Level C limits was determined to be 50 psig for the most limiting containment penetration. However, use of ASME Service Level D limits (defined in the ASME Code as "limits which are permitted for combinations of conditions associated with extremely low probability postulated events") is a more realistic evaluation of the containment pressure capability, considering the nature and probability of the hydrogen generation event. Utilizing Service Level D stress limits, the maximum allowable pressure for the most limiting containment penetration was determined to be 57 psig.

PNPP Safety Evaluation Report, Supplement 1, (NUREG-0887) Section 3.8.2 discussed the results of the containment ultimate capacity analysis. The SER noted that the dome knuckle area contols the ultimate capacity at the containment vessel which starts to yield at 68 psig. Containment shell pressure capacity can be increased to 78 psig, the pressure at which hoop buckling occurs in the knuckle region, since yielding occurs at one point along the meridian at 68 psig. However, as previously discussed, the most limiting penetration establishes the ultimate capacity value for the containment.

Previous analyses performed by the Hydrogen Control Owners Group (HCOG) Mark III member utilities have demonstrated that significant margins exist between the containment ultimate positive and negative pressure capacity and the positive and negative pressures postulated as a result of hydrogen combustion. At the Grand Gulf Nuclear Station (GGNS), the ultimate capacity versus design levels are 56 psig versus 15 psig for containment

additional No. 11 vertical rebars are provided. The upper drywell wall is integrally connected to the 4'-0" thick drywell top slab.

3. A flat, horizontal, circular, reinforced concrete drywell top slab. The top slab contains a central circular opening of 31'-11.5" diameter which is closed by the drywell head.

4. The 14'-9.25" deep, steel ellipsoidal drywell head, which forms part of the drywell pressure retention boundary. The drywell head is 1-1/2" thick, type 516 grade 70 carbon steel with 10% thickness of SA-240, type 304 stainless steel cladding.

The general arrangement and design details of the PNPP drywell structure are consistent with those previously evaluated for the GGNS. The primary drywell structure of the GGNS drywell consists of four major components:

1. A flat, circular reinforced concrete foundation.

2. A right, vertical cylinder. The cylinder wall is 75'-0" outside diameter, 91'-6" high, and 5'-0" thick. The lower 24'-10" portion of the wall, i.e., the vent region, is of heavily reinforced, concrete composite construction. This lower region has two stiffened steel, concentric, cylindrical surface plates. The annulus between the surface plates is stiffened by vertical, radial plates and is filled with concrete. The upper wall is designed as a reinforced concrete cylinder which is supported by the steel, lower wall section and internal concrete. The lower steel section is connected integrally with the upper wall vertical and diagonal reinforcement.

c. A flat, horizontal, circular, reinforced concrete drywell roof slab, containing a central circular opening of about 32 feet. This opening is closed by the drywell head.

d. A steel ellipsoidal drywell head, approximately 15'-6" deep, which forms part of the drywell pressure retention boundary. The drywell head is 1-1/2" thick, SA-240, type 304 stainless steel.

The structural design aspects of the GGNS and PNPP drywells are functionally similar. The strength of the PNPP drywell head material is equal to or greater than the GGNS drywell head. Additionally, the drywell positive and negative design pressures for PNPP and GGNS are consistent in all material respects. See Section 5.4 of this report for a comparison of these values.

4.4 Equipment Survivability

4.4.1 Equipment Required to Survive a Hydrogen Burn

A preliminary identification and evaluation has been performed of equipment required to survive a hydrogen burn. The criteria for selecting equipment for the preliminary evaluation are consistent with the criteria submitted by Mississippi Power & Light Company (MP&L) in support of the operating license for Grand Gulf Nuclear Station (GGNS). This information was submitted by MP&L letter AECM - 82/26 dated January 19, 1982. The identification of the PNPP equipment required to survive the hydrogen burn environment was based on its functions during and after postulated degraded core accidents. The criteria for selection of equipment included:

1) Systems mitigating the consequence of the accident
2) Systems needed for maintaining the integrity of the containment pressure boundary
3) Systems needed for monitoring the core in a safe condition
4) Systems needed for monitoring the course of the accident

Using these criteria, equipment in the containment and drywell which must function during and after a hydrogen burn were identified and are part of the following list of general systems and components:

1) Containment structure, penetrations, locks & hatches
2) Hydrogen Control System
3) Combustible Gas Control System
4) Emergency Core Cooling Systems (HPCS, LPCS, LPCI, ADS)
5) RHR Containment Spray
6) Containment and Reactor monitoring instrumentation
7) Associated instruments, controls and cable

The specific list of PNPP equipment which must survive a hydrogen burn is provided in Tables 5.6-1 and 5.6-2.

4.4.2 Equipment Temperature Survivability

A preliminary evaluation of the PNPP equipment required to survive a hydrogen burn was conducted based upon a comparison of the pressure and temperature profiles of the GGNS & PNPP CLASIX-3 containment response analyses which is discussed in detail in section 5.5.

The GGNS & PNPP temperature profiles are comparable, with the exception of several minor differences which are explained in section 5.5. The temperature profile of concern is the GGNS

base case SORV (SA1) which was used for evaluation of the GGNS equipment. The peak temperature of the initial burn without sprays is slightly higher for PNPP (by approximately 170°F), however most of the burn peak temperatures later in the analysis are approximately the same (700-800°F) for the two plants.

Use of the SORV case for equipment survivability evaluations in the PNPP preliminary evaluation is appropriate because of risk studies which show that transient initiated events (such as SORV) have higher core melt frequency than the LOCA (DWB) event. Although the DWB case has a peak temperature which occurs during the extended portion of the transient, essentially the same as the peak for the SORV transient there are several reasons why it is expected that the SORV temperature profile is more limiting for equipment temperature response. The large peak burn at the end of the DWB case was "forced" at 0.065 v/o since it did not reach the 8.0 v/o ignition criteria. Therefore, this burn is somewhat artificial. In addition the spacing between burns during the DWB extended period is substantial such that the burns should provide little contribution to the peak equipment temperature. It should be noted that the time scales on the Figures for the two cases are different, with the DWB presented on a more compressed time scale. During the initial part of the transient, the DWB case has fewer burns (30) over the same time period as the SORV case (32), and has fewer above average burns (2) than the SORV case (5). Therefore, for the above reasons, the SORV wetwell temeprature profile should be more conservative for equipment temperature response.

There are two significant differences between the PNPP and GGNS SORV temperature profiles which require assessment of the effect on equipment temperature response. The first is that PNPP has burns late in the transient with higher peak temperatures than GGNS due to coincident wetwell and containment burns, and burning at higher concentrations due to insufficient oxygen concentration when hydrogen concentration reached the 8 v/o setpoint. The other principal difference is that there are fewer burns and more time between burns for PNPP due to the larger wetwell volume.

These differences when evaluating equipment response should have little overall effect. The burns with the higher peak temperature are only three burns out of the total 32 burns for PNPP. Therefore the incremental temperature increase for equipment would be small.

The most dominant effect should be the decreased number of burns and increased time between burns for PNPP. This allows more time for the containment heat removal mechanisms to remove energy and maintain lower average temperatures. It also allows time for the equipment to transfer heat back to the containment

atmosphere and cool down to average containment temperature between burns. The overall effect of these differences should be lower equipment temperatures for PNPP than for comparable GGNS equipment using the same methodology as that described in MP&L's letter, AECM-82/26.

An analysis was conducted to verify that the PNPP CLASIX-3 temperature profile will result in lower equipment temperatures than the GGNS temperature profile. The temperature response of the igniter assembly, which is identical for PNPP and GGNS, was calculated using the PNPP CLASIX-3 temperature profile and compared to the GGNS response. The igniter assembly heat transfer model and assumptions described in MP&L's letter, AECM-82/26, were used for the analysis. The HEATING heat transfer computer code was used for the comparison, however a later revision, HEATING-6, was used for PNPP instead of the HEATING-3 version used for GGNS. The heat transfer methodology and equations are essentially the same in the two versions. The major difference is some changes in HEATING-6 which improves the efficiency of the code.

A comparison of the igniter assembly temperature response to the PNPP and GGNS CLASIX-3 temperature profiles is shown in Figure 4.4.2-1. The response is based upon the GGNS and PNPP SORV base case wetwell temperature profiles which are shown in Figure 5.5-2 (also Figure 2 of MP&L letter AECM-82/26) and Figure 4 of Appendix A for GGNS and PNPP respectively.

The igniter assembly response is as expected. During the initial part of the transient the PNPP temperature response is higher due to the higher initial peak burn temperature and the greater number of burns for about the first 700 seconds of burn time. However, later in the transient, the GGNS temperature response is higher due to substantially more burns with less time between burns. This effect is dominant and much more significant than the higher PNPP peak burn temperatures at the end of the transient which result from coincident wetwell and containment burning.

MP&L, as described in AECM-82/26, evaluated the critical components with two-dimensional heat transfer computer models using the HEATING heat transfer computer code, and the SORV base case (SAI) wetwell temperature profile. As shown in section 5.6, the GGNS and PNPP equipment survivability lists contain components which are the same or very similiar. Table 4.4.2-1 compares the PNPP equipment qualification temperatures to the calculated temperature response and equipment qualification temperatures for the similar GGNS components.

In summary, using an analysis comparable to that used at GGNS, it is concluded that the PNPP required equipment would survive hydrogen deflagration burning. This conclusion is based upon:

1) The similarity between the GGNS & PNPP temperature profiles

2) The heat transfer analysis which shows lower equipment temperatures for PNPP due to the minor differences which exist betwen the GGNS & PNPP temperature profiles

3) The similarity and in many cases identical components between PNPP and GGNS required to survive

4) The significant margins between the calculated response for GGNS equipment and the GGNS & PNPP qualification temperatures

4.4.3 Equipment Pressure Survivability

A preliminary evaluation of equipment pressure survivability has been conducted. Tables 5.5-1 and 5.6-2 provide the qualification or design pressure for PNPP components required to survive a hydrogen burn. The peak pressure for the PNPP CLASIX-3 containment analysis shown in Appendix A is 21.2 psig. The peak drywell to containment differential pressure for PNPP ranges from approximately +7 psid to -11 psid. As discussed in section 3.1, containment negative differential pressure following hydrogen combustion should not exceed the design pressure of -0.8 psid. The qualification or design pressures bound the calculated peak pressures from hydrogen combustion in all cases except:

1) The containment vacuum breaker, 1M17F0010.

2) The hydrogen mixing compressors, 1M51C001A&B and discharge check values 1M51F0501A&B

In the case of the containment vacuum breaker and hydrogen mixing compressor discharge check valves, only the external peak design pressure which is provided and exceeded by the hydrogen burn peak pressure. Since these are check valves, and the active components are not exposed to the peak external pressures it is anticipated that this equipment will function during hydrogen burning. In the case of the hydrogen mixing compressors, identical compressors at GGNS were evaluated and were shown to survive for pressures of 24 psig in AECM 82/265, dated June 11, 1982. This bounds the PNPP peak calculated containment pressure of 21.2 psig.

In summary, based upon the preliminary evaluation described above, it can be concluded that the PNPP equipment required will survive the peak pressure during hydrogen combustion.

Table 4.4.2-1
Comparision of PNPP Qualification
Temperatures To Calculated Temperatures
For Comparable GGNS Equipment

Equipment - Limiting Component	GGNS Maximum Calculated Surface Temperature (1)	GGNS Maximum Calculated Interior (1) Temperature	GGNS Qualification or Tested Survival Temperature (1)	PNPP Qualification Temperature (2)
1. Containment Locks & Hatches - seals	216 F	--	250 F	(3)
2. Instrument Cables	300 F	275 F	320 F	385 F
3. Electrical Penetrations - cables	300 F	275 F	320 F	340 F
4. Igniter Assembly - transformer	246 F	251 F	400 F	(3)
5. Pressure Transmitter	235 F	---	303 F	318 F
6. Purge Compressor - motor	184 F	178 F	200 F	192 F
7. Hydrogen Recombiners - cable	300 F	275 F	330 F	346 F
8. Motor Actuators - motor	184 F	178 F	200 F	340 F
9. Safety Relief Valves - housing	184 F	---	349 F	355 F
10. Containment Sprays - motor actuator	208 F	158 F	200 F	340 F

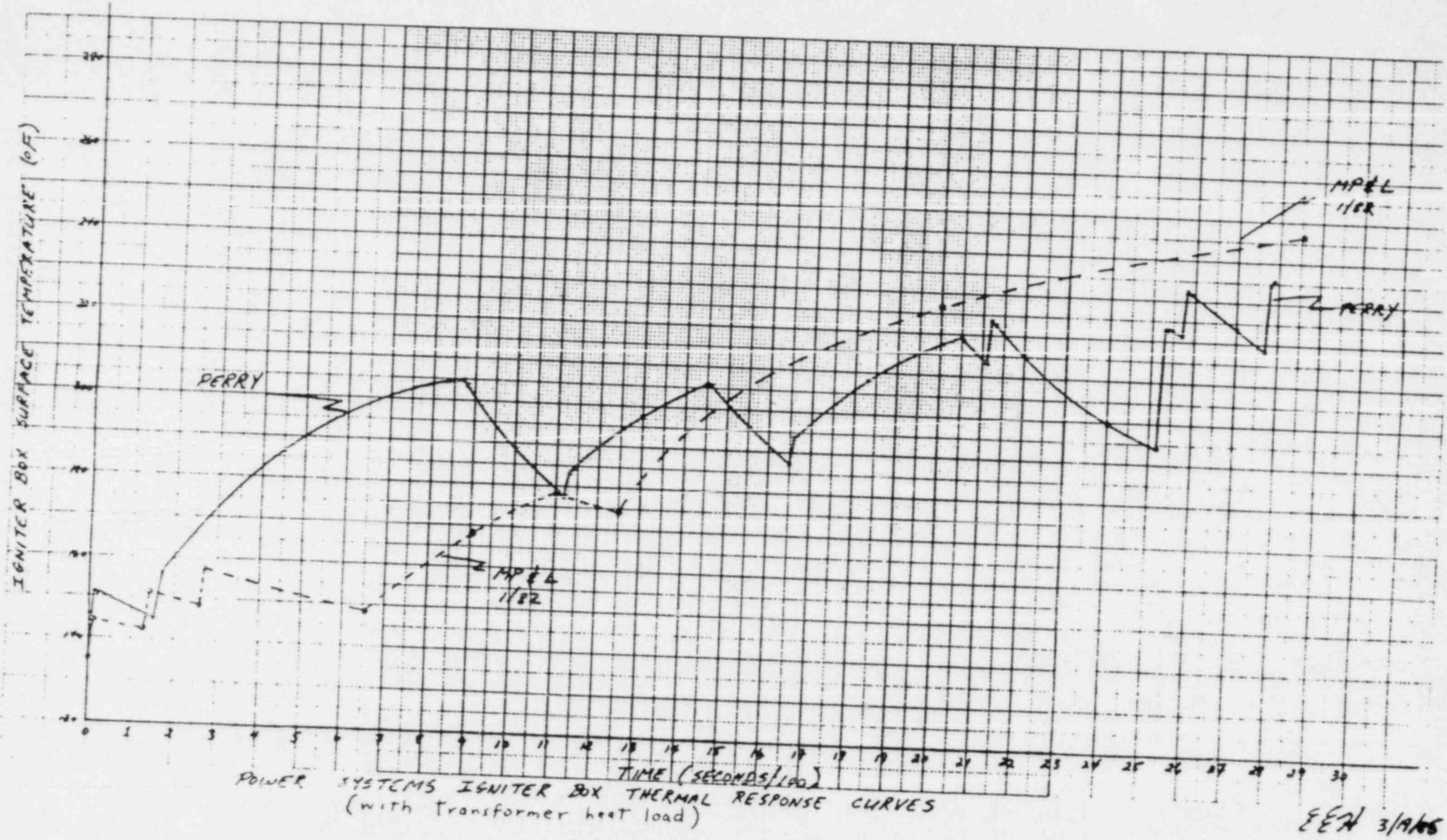
Notes:

(1) See Table 1 of MP&L letter AECM-82/26, dated January 19, 1982.
(2) See Table 5.6-1 and 5.6-2.
(3) Qualification of PNPP component in progress.

Figure 4.4.2-1

Comparison of Igniter Assembly Temperature Response

to PNPP & GGNS CLASIX-3 Temperature Profiles



a. PNPP compressors, although made by the same manufacturer and the same model number as GGNS, are rated at 546 scfm versus the 500 scfm (minimum) at GGNS (1000 scfm per GGNS Technical Specification 3/4.6.7.3).

b. The PNPP drywell purge system is manually operated, while the GGNS system is initiated either manually or automatically (LOCA signal and drywell pressure within 1.0 psid of containment pressure) due to the additional function of post-LOCA drywell vacuum relief.

c. The PNPP drywell purge discharge is 4 inches and penetrates the drywell through the drywell vacuum breaker 10 inch penetrations. The GGNS design has a separate penetration for the post-LOCA vacuum breaker lines and the drywell purge discharge line is 10 inches.

d. The GGNS drywell purge discharge lines include vaccum breakers for additional vacuum relief once the system is initiated. The PNPP design does not include this feature.

e. The PNPP drywell purge compressor and vacuum breaker discharge lines penetrate the drywell from the side of the drywell at the top of the cylinder instead of through the flat, horizontal drywell top slab as in GGNS. Figures 5.4.3-1 and 2 and Figure 5.4.3-3 show typical drywell purge and vacuum breaker inlet line arrangements for PNPP and GGNS respectively.

None of the differences identified above would have a significant effect on the analysis of the HCS. Plant specific differences in system design values were included in the containment analysis as discussed in sections 4.0 and 5.5.

Both GGNS and PNPP include two 100%-capacity hydrogen recombiners inside the containment. The hydrogen recombiners are thermal recombiners manufactured by Westinghouse, each having a capacity of 100 scfm and a power rating of 75KW. The hydrogen recombiner subsystem designs for both PNPP and GGNS are similar.

5.4.4 Suppression Pool Makeup System

The designs of the Suppression Pool Makeup System (SPMS) are essentially the same at GGNS and PNPP. The SPMS provides water from the upper containment pool to the suppression pool by gravity flow following a design basis accident (LOCA). The piping system consists of two lines, with two normally closed

motor operated valves in series in each line. The piping diagram for each system is shown in PNPP FSAR Figure 6.2-67 and GGNS FSAR Figure 6.2-82.

Both GGNS and PNPP systems are initiated either manually or automatically following LOCA signals and low-low suppression pool water level or 30 minutes, whichever occurs first. The quantity of water added to the suppression pool is approximately 36,400 and 32,800 cubic feet for GGNS and PNPP, respectively.

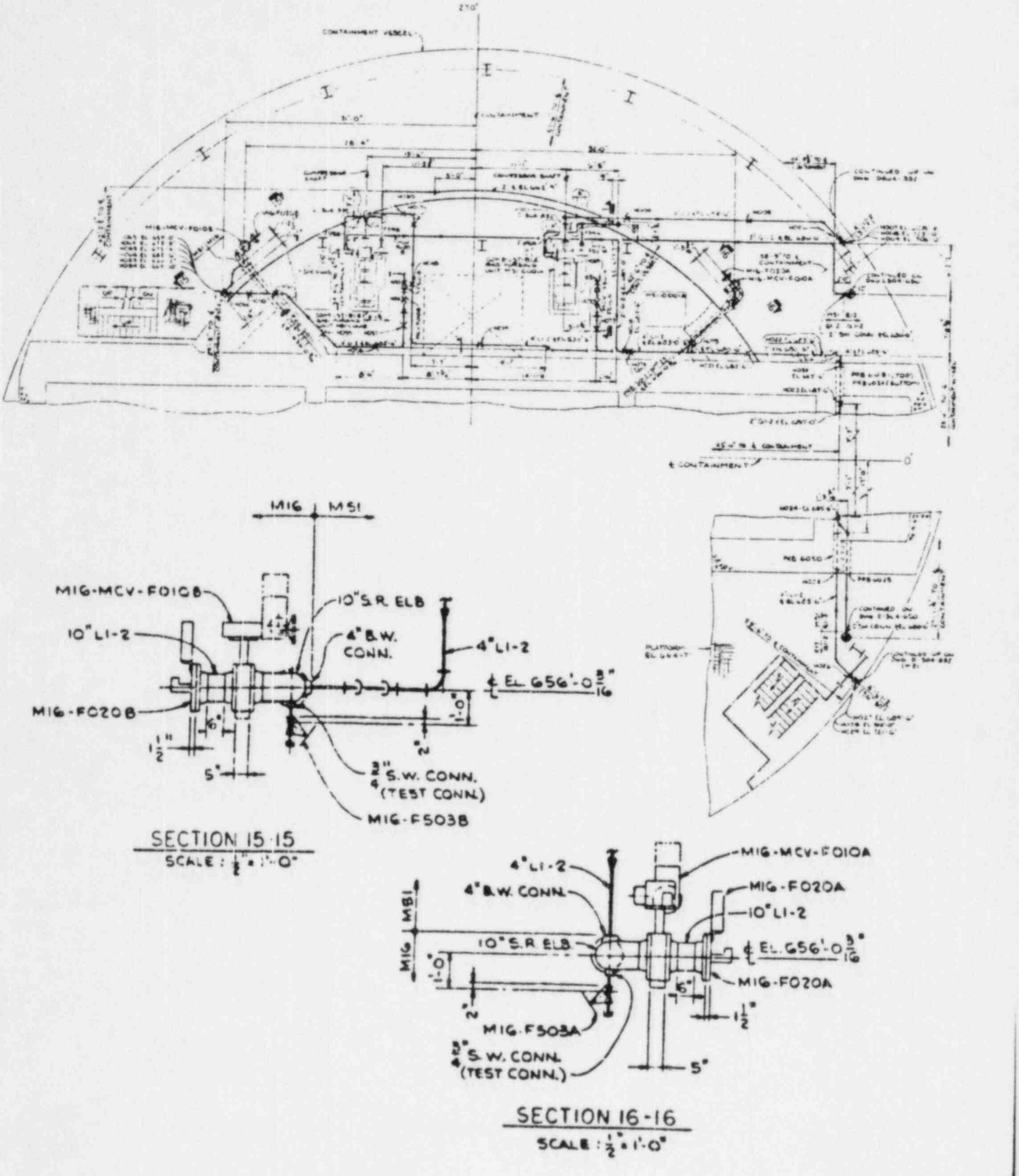


Figure 5.4.3-1

PNPP UNIT I REACTOR BUILDING
DRYWELL VACUUM BREAKER &
COMBUSTIBLE GAS CONTROL PIPING

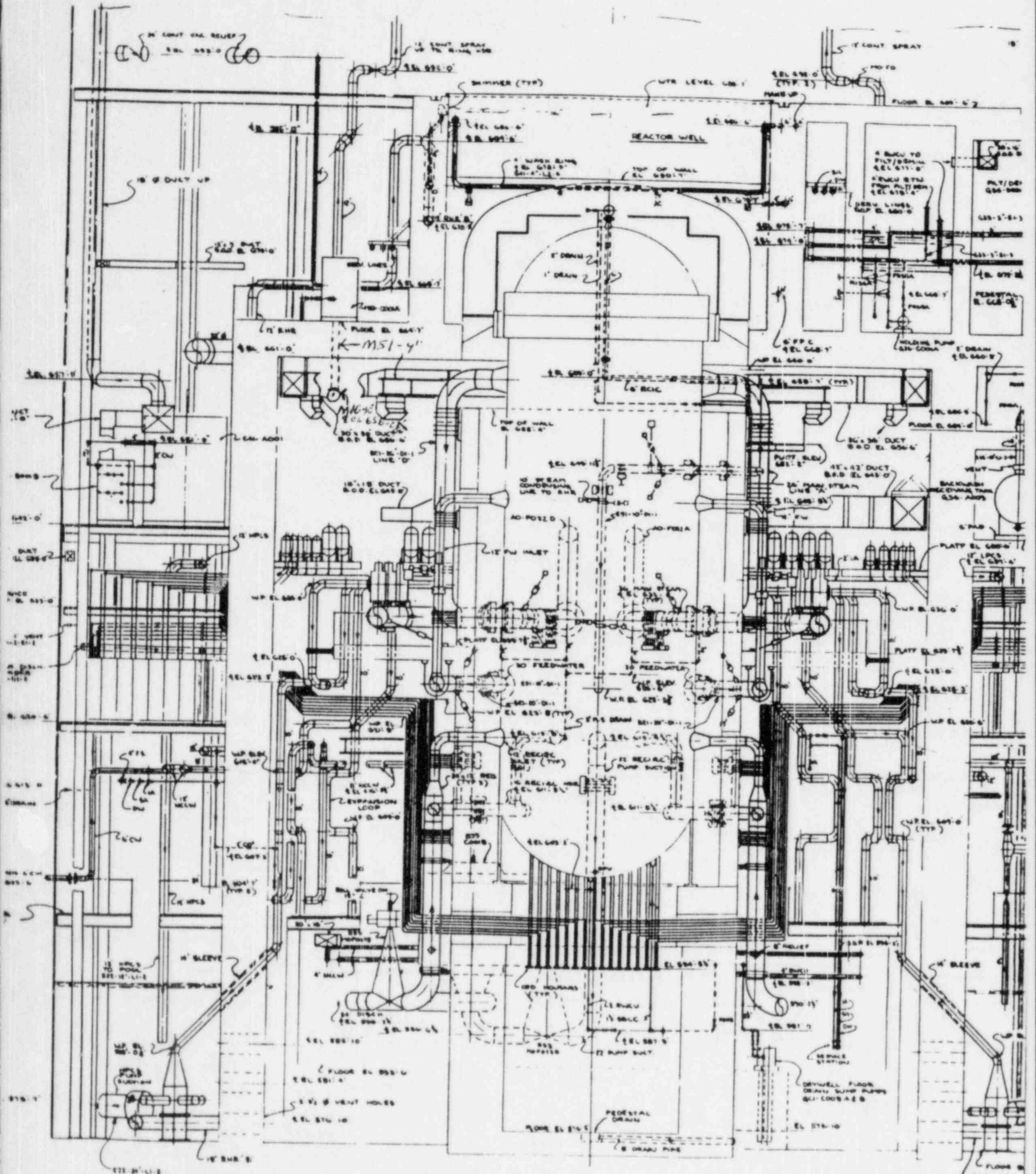
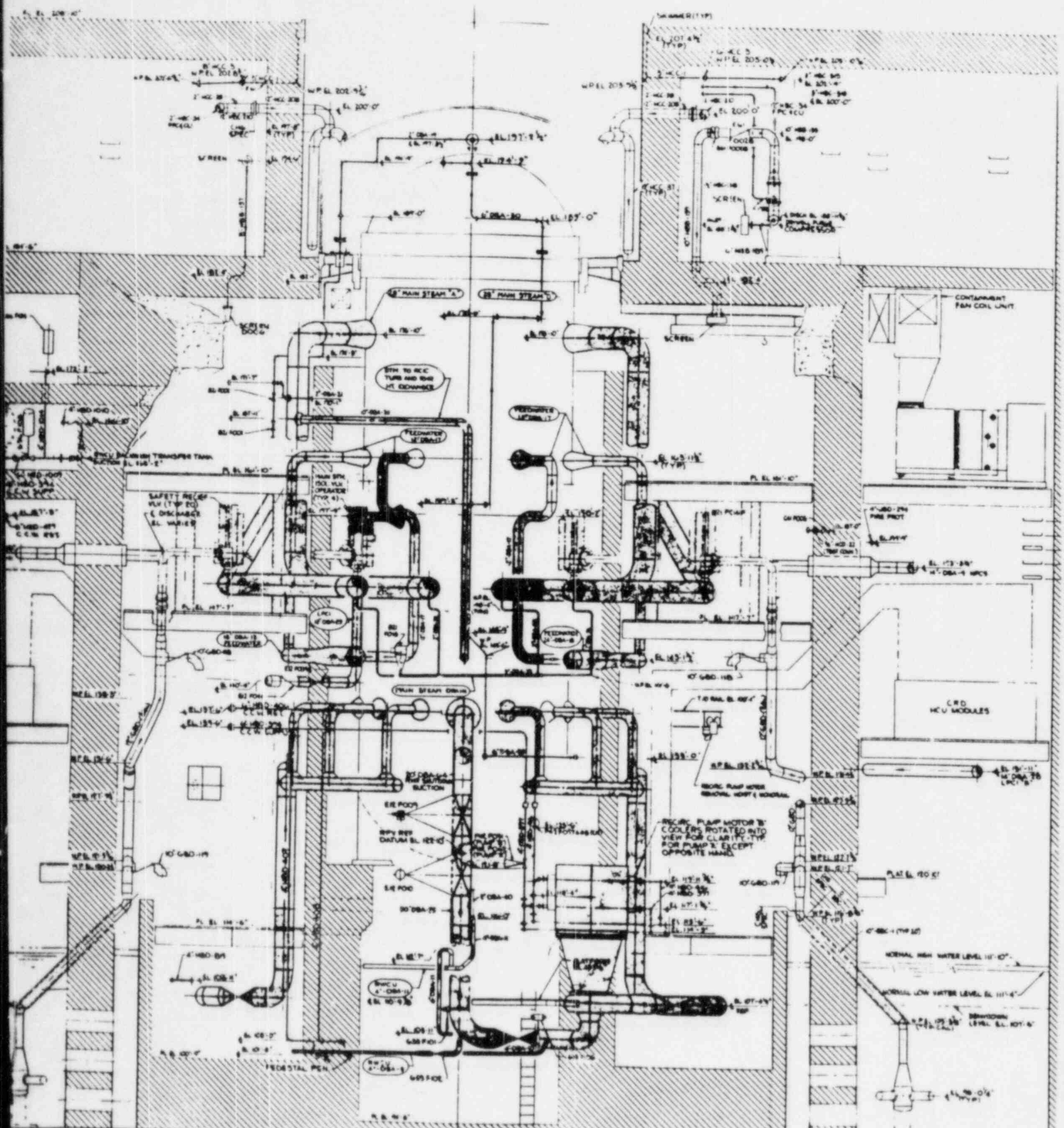


Figure 5.4.3-2
PNPP DRYWELL PURGE/VACUUM BREAKER INLET LINES



SECTION B

Figure 5.4.3-3

GGNS DRYWELL PURGE INLET LINES

DRYWELL EQUIPMENT SURVIVABILITY LIST[1]

TABLE 5.6-1

EQUIPMENT IDENTIFICATION NUMBER	EQUIPMENT DESCRIPTION	FUNCTION	ELEVATION	AZI-MUTH	Rx CEN-TERLINE DISTANCE	QUALIFICATION TEMP(F)	QUALIFICATION DURATION	MANUF.	MODEL	QUALIFICATION PRESSURE (PSI
1B21F0041A	Automatic Depressurization System Valve[2]	RPV Pressure Relief/ADS	636' 5"	51	20'	355	3 hrs	Dikkers	G471-6/125.04	60
1B21F0041B	" "	" "	636' 5"	277	26'	"	"	"	"	"
1B21F0041E	" "	" "	636' 5"	31	21'	"	"	"	"	"
1B21F0041F	" "	" "	636' 5"	289	26'	"	"	"	"	"
1B21F0047D	" "	" "	636' 5"	308	20	"	"	"	"	"
1B21F0047H	" "	" "	636' 5"	322	21'	"	"	"	"	"
1B21F0051C	" "	" "	636' 5"	88	25'	"	"	"	"	"
1B21F0051G	" "	" "	636' 5"	71	26'	"	"	"	"	"
1B21F0410A	Automatic Depressurization System Valve Solenoid[2]	" "	Location Same as Valves			Qualification in Progress		Seitz	6A33	QUALIFICATION IN PROGRESS
1B21F0410B	" "	" "	"	"	"	"	"	"	"	"
1B21F0411A	" "	" "	"	"	"	"	"	"	"	"
1B21F0411B	" "	" "	"	"	"	"	"	"	"	"
1B21F0414A	" "	" "	"	"	"	"	"	"	"	"
1B21F0414B	" "	" "	"	"	"	"	"	"	"	"
1B21F0415A	" "	" "	"	"	"	"	"	"	"	"
1B21F0415B	" "	" "	"	"	"	"	"	"	"	"
1B21F0422A	" "	" "	"	"	"	"	"	"	"	"
1B21F0422B	" "	" "	"	"	"	"	"	"	"	"
1B21F0425A	" "	" "	"	"	"	"	"	"	"	"
1BS1F0425B	" "	" "	"	"	"	"	"	"	"	"
1B21F0442A	" "	" "	"	"	"	"	"	"	"	"
1B21F0442B	" "	" "	"	"	"	"	"	"	"	"
1B21F0444A	" "	" "	"	"	"	"	"	"	"	"
1B21F0444B	" "	" "	"	"	"	"	"	"	"	"
1D23N0100A	Drywell RTD	Drywell Temp. Monitoring	642'	315	17'	485	3 hrs	Weed	611	70
1D23N0100B	" "	" "	642'	135	16'	"	"	"	"	"
1P23N0110A	" "	" "	620' 6"	308	36' 6"	"	"	"	"	"
1D23N0110B	" "	" "	620' 6"	145	36' 6"	"	"	"	"	"
1D23N0120A	" "	" "	599' 9"	308	36' 6"	"	"	"	"	"
1D23N0120B	" "	" "	599' 9"	150	36' 6"	"	"	"	"	"

DRYWELL EQUIPMENT SURVIVABILITY LIST

TABLE 5.6-1 (Cont.)

EQUIPMENT IDENTIFICATION NUMBER	EQUIPMENT DESCRIPTION	FUNCTION	ELEVATION	AZIMUTH	Rx CENTERLINE DISTANCE	QUALIFICATION TEMP(F)	QUALIFICATION DURATION	MANUF.	MODEL	QUALIFICATION PRESSURE
1M56S008	Hydrogen Ignition System [3]	Hydrogen Ignition	629' 1-1/2"	12	36' 6"	345	3 hrs	Power Systems	6043	IN PROGRESS
1M56S009	" "	"	637' 0"	41	36' 6"	"	"	"	"	"
1M56S010	" "	"	636' 3-1/2"	90	36' 6"	"	"	"	"	"
1M56S011	" "	"	636' 7"	137	36' 6"	"	"	"	"	"
1M56S012	" "	"	632' 3"	180	36' 6"	"	"	"	"	"
1M56S013	" "	"	631' 5"	221	36' 6"	"	"	"	"	"
1M56S014	" "	"	636' 10"	273	36' 6"	"	"	"	"	"
1M56S015	" "	"	630' 9-1/2"	322	36' 6"	"	"	"	"	"
1M56S016	" "	"	660' 0"	0	31' 6"	"	"	"	"	"
1M56S017	" "	"	659' 8"	57	29' 6"	"	"	"	"	"
1M56S018	" "	"	659' 8"	114	30' 0"	"	"	"	"	"
1M56S019	" "	"	659' 8"	172	30' 0"	"	"	"	"	"
1M56S020	" "	"	659' 8"	225	28' 0"	"	"	"	"	"
1M56S021	" "	"	660' 0"	280	30' 0"	"	"	"	"	"
1M56S022	" "	"	660' 0"	317	31' 0"	"	"	"	"	"
1M56S102	" "	"	670' 0"	350	13' 0"	"	"	"	"	"
1M56S103	" "	"	670' 0"	4	13' 0"	"	"	"	"	
	Control Cable and Small Power Cable		Drywell (Various Locations)			346	"	Rockbestos III	Firewall	113
	Instrument Cable		"	"		385	"	Brand-Rex	16 & 20 AWG	113
	Drywell Personnel Airlock Seal		603' 1"	105	36' 6"		In Progress	W. J. Wooley		IN PROGRESS
	Drywell Equipment Hatch Seal		605'	227	36' 6"		"	"		"

NOTES: (1) All components on this list will be qualified or justification for interim operation provided in accordance with 10 CFR 50.49. This justification will address appropriate considerations for the equipment required to survive hydrogen combustion.

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NOTES (cont'd): (2) Demonstration of equipment survivability for these components will be applicable to all safety releif valves.

(3) PNPP Igniter qualification in progress. Identical igniter assembly qualified (GGNS) to 70 psig for 10 minutes and 330 F.

CONTAINMENT EQUIPMENT SURVIVABILITY LIST[1]
TABLE 5.6-2

EQUIPMENT IDENTIFICATION NUMBER	EQUIPMENT DESCRIPTION	FUNCTION	ELEVATION	AZI-MUTH	Rx CEN-TERLINE DISTANCE	QUALIFICATION TEMP(F)	QUALIFICATION DURATION	MANUF.	MODEL	QUALIFICATION PRESSURE (psig)
1D23N0130A	Containment RTD	Containment Temperature Monitoring	689' 0"	272	60'	485	"	Weed	611	70
1D23N0130B	"	"	720' 0"	95	60'	"	"	"	"	"
1D23N0140A	"	"	664' 0"	45	60'	"	"	"	"	"
1D23N0140B	"	"	664' 0"	210	60'	"	"	"	"	"
1D23N0150A	"	"	642' 0"	55	60'	"	"	"	"	"
1D23N0150B	"	"	642' 0"	250	60'	"	"	"	"	"
1D23N0160A	"	"	599' 9"	67	60'	"	"	"	"	"
1D23N0160B	"	"	599' 9"	250	60'	"	"	"	"	"
1E12F0028A	Containment Spray Valve (MO)	Containment Spray	643' 6"	37	48' 6"	340	"	Limitorque	SMB	105
1E12F0028B	" "	"	643' 9"	335	42' 9"	"	"	"	"	"
1E12F0042A	RHR LPCI Inboard Isolation Valve (MO)	Low Pressure Coolant Injection	624' 0"	41	44' 0"	"	"	"	SMB	" "
1E12F0042B	" "	"	620' 0"	315	55' 0"	"	"	"	"	"
1E12F0537A	Containment Spray Isolation Valve (MO)	Containment Spray	689' 0"	40	58' 0"	"	"	"	"	" "
1E12F0537B	" "	"	689' 0"	320	58' 0"	"	"	"	"	"
1M16F0010A	Drywell Vacuum Relief System	Drywell Isolation Butterfly Valve	652'	325	36' 6"	250	"	Henry Pratt	NRS	"
1M16F0010B	" "	" "	652'	222	36' 6"	250	"	"	"	"
1M16F0020A	" "	Drywell Isolation Check Valve	652'	324	36' 6"	250	"	GPE Controls	LD240-339	21 psid/25psi
1M16F0020B	" "	" "	652'	225	36' 6"	250	"	"	"	"
1M17F0010	Containment Vacuum Relief System	Containment Vacuum Releif Check Valve	664'	58	60'	250	"	"	LD240-337	0.8psid/15ps
1M17F0020	" "	" "	664'	150	60'	250	"	"	"	"
1M17F0030	" "	" "	664'	302	60'	250	"	"	"	"
1M17F0040	" "	" "	664'	315	60'	250	"	"	"	"

CONTAINMENT EQUIPMENT SURVIVABILITY LIST
TABLE 5.6-2 (Cont'd)

EQUIPMENT IDENTIFICATION NUMBER	EQUIPMENT DESCRIPTION	FUNCTION	ELEVATION	AZI-MUTH	Rx CEN-TERLINE DISTANCE	QUALIFICATION TEMP(F)	QUALIFICATION DURATION	MANUF.	MODEL	QUALIFICATION PRESSURE(PSIG
1M51C0001A	Hydrogen Mixing Compressor and Motor (3)	Hydrogen Mixing	664'	300	24'	192	2 days	Turbonetics Compressor Reliance Motor	SC-6 Type P	24 (3)
1M51C0001B	" "	" "	664'	245	25'	192	"	"	"	"
1M51D0001A	Hydrogen Recombiner	Removal of Hydrogen by Hydrogen and Oxygen Recombination	664'	304	37'	1700-1750 (Heater Element)	21 days	Westinghouse	Model A	45.3
1M51D001B	" "	"	664'	236	37'	"	"	"	"	"
1M51F0010A	Hydrogen Mixing Compressor Isolation Valve (MO)	Isolation Valve for Drywell Purge Compressor	670'	309	25'	340	3 hrs	Limitorque	SMB-00-5	105
1M51F0010B	" "	"	670'	245	20'	340	"	"	"	"
1M51F0501A	Hydrogen Mixing Compressor Check Valve	Check Valve for for Drywell Purge Compressor	664'	305	25'	350	"	TRW Mission	K15ACEFV73	15.3 (2
1M51F0501B	" "	"	"	250	21'	350	"	"	"	"
1M56S001	Hydrogen Igniter System (4)	Hydrogen Ignition	613' 4"	355	49' 0"	345	3 hrs	Power Sys. Division	6043	IN PROGRES
1M56S002	" "	" "	613' 4"	5	51' 0"	"	"	"	"	"
1M56S003	" "	" "	619' 6"	63	51' 8"	"	"	"	"	"
1M56S004	" "	" "	619' 6"	89	52' 0"	"	"	"	"	"
1M56S005	" "	" "	664' 0"	34	57' 0"	"	"	"	"	"
1M56S006	" "	" "	689' 0"	34	52' 0"	"	"	"	"	"
1M56S023	" "	" "	619' 6"	54	52' 0"	"	"	"	"	"
1M56S024	" "	" "	619' 6"	118	51' 8"	"	"	"	"	"
1M56S025	" "	" "	619' 6"	152	51' 0"	"	"	"	"	"
1M56S026	" "	" "	619' 6"	186	52' 0"	"	"	"	"	"
1M56S027	" "	" "	619' 6"	221	51' 8"	"	"	"	"	"
1M56S028	" "	" "	619' 6"	255	51' 4"	"	"	"	"	"
1M56S029	" "	" "	619' 6"	289	52' 0"	"	"	"	"	"

CONTAINMENT EQUIPMENT SURVIVABILITY LIST
TABLE 5.6-2 (Cont'd)

EQUIPMENT IDENTIFICATION NUMBER	EQUIPMENT DESCRIPTION	FUNCTION	ELEVATION	AZIMUTH	Rx CENTERLINE DISTANCE	QUALIFICATION TEMP(F)	QUALIFICATION DURATION	MANUF.	MODEL	QUALIFICATION PRESSURE(PS
1M56 030	Hydrogen Igniter System (5)	Hydrogen Ignition	619' 6"	32[illegible]	51' 11"	345	3 hrs	Power Systems Division	6043	IN PROGRESS (4)
1M56S031	" "	" "	638' 0"	358	41' 6"	"	"	"	"	"
1M56S032	" "	" "	640' 0"	155	46' 0"	"	"	"	"	"
1M56S033	" "	" "	640' 0"	186	46' 0"	"	"	"	"	"
1M56S034	" "	" "	640' [illegible]	324	53' 6"	"	"	"	"	"
1M56S035	" "	" "	640' 4-3/4"	61	51' 6"	"	"	"	"	"
1M56S036	" "	" "	640' 5-1/2"	118	51' 6"	"	"	"	"	"
1M56S037	" "	" "	640' 5"	227	46' 0"	"	"	"	"	"
1M56S038	" "	" "	639' 4"	260	54' 0"	"	"	"	"	"
1M56S039	" "	" "	651' 1"	286	41' 6"	"	"	"	"	"
1M56S040	" "	" "	647' 4"	2	41' 6"	"	"	"	"	"
1M56S041	" "	" "	650' 6-3/4"	41	50' 6"	"	"	"	"	"
1M56S042	" "	" "	650' 6"	87	49' 0"	"	"	"	"	"
1M56S043	" "	" "	651' 0"	101	49' 0"	"	"	"	"	"
1M56S044	" "	" "	660' 0"	86	44' 6"	"	"	"	"	"
1M56S045	" "	" "	660' 6"	95	48' 6"	"	"	"	"	"
1M56S046	" "	" "	664' 0"	54	51' 0"	"	"	"	"	"
1M56S047	" "	" "	665' 0"	114	52' 0"	"	"	"	"	"
1M56S048	" "	" "	662' 6"	147	53' 0"	"	"	"	"	"
1M56S049	" "	" "	662' 7-3/4"	218	51' 0"	"	"	"	"	"
1M56S050	" "	" "	664' 7"	251	49' 6"	"	"	"	"	"
1M56S051	" "	" "	661' 6"	289	50' 0"	"	"	"	"	"
1M56S052	" "	" "	661' 6"	324	49' 6"	"	"	"	"	"
1M56S053	" "	" "	669' 6"	0	54' 6"	"	"	"	"	"
1M56S054	" "	" "	684' 9"	355	52' 6"	"	"	"	"	"
1M56S055	" "	" "	686' 0"	75	48' 0"	"	"	"	"	"
1M56S056	" "	" "	686' 0"	85	47' 0"	"	"	"	"	"
1M56S057	" "	" "	686' 0"	95	47' 0"	"	"	"	"	"
1M56S058	" "	" "	686' 0"	105	48' 0"	"	"	"	"	"
1M56S059	" "	" "	686' 0"	75	35' 0"	"	"	"	"	"
1M56S060	" "	" "	686' 0"	105	35' 0"	"	"	"	"	"
1M56S061	" "	" "	689' 6"	45	48' 0"	"	"	"	"	"

CONTAINMENT EQUIPMENT SURVIVABILITY LIST
TABLE 5.6-2 (Cont'd)

EQUIPMENT IDENTIFICATION NUMBER	EQUIPMENT DESCRIPTION	FUNCTION	ELEVATION	AZIMUTH	Rx CENTERLINE DISTANCE	QUALIFICATION TEMP(F)	QUALIFICATION DURATION	MANUF.	MODEL	QUALIFICATION PRESSURE (PSIG
1M56 062	Hydrogen Igniter System[4]	Hydrogen Ignition	689' 6"	130	41' 0"	345	3 hrs	Power Systems Division	6043	IN PROGRESS[4]
1M56S063	" "	" "	689' 6"	229	48' 0"	"	"	"	"	"
1M56S064	" "	" "	689' 6"	252	43' 6"	"	"	"	"	"
1M56S065	" "	" "	689' 6"	289	43' 0"	"	"	"	"	"
1M56S066	" "	" "	689' 6"	310	48' 6"	"	"	"	"	"
1M56S067	" "	" "	715' 6"	359	58' 9"	"	"	"	"	"
1M56S068	" "	" "	715' 6"	27	58' 9"	"	"	"	"	"
1M56S069	" "	" "	715' 6"	62	58' 9"	"	"	"	"	"
1M56S070	" "	" "	715' 6"	87	58' 9"	"	"	"	"	"
1M56S071	" "	" "	715' 6"	119	58' 9"	"	"	"	"	"
1M56S072	" "	" "	715' 6"	151	58' 9"	"	"	"	"	"
1M56S073	" "	" "	715' 6"	178	58' 9"	"	"	"	"	"
1M56S074	" "	" "	715' 6"	209	58' 9"	"	"	"	"	"
1M56S075	" "	" "	715' 6"	241	58' 9"	"	"	"	"	"
1M56S076	" "	" "	715' 6"	273	58' 9"	"	"	"	"	"
1M56S077	" "	" "	715' 6"	300	58' 9"	"	"	"	"	"
1M56S078	" "	" "	715' 6"	331	58' 9"	"	"	"	"	"
1M56S079	" "	" "	745' 6"	359	48' 0"	"	"	"	"	"
1M56S080	" "	" "	745' 6"	34	48' 0"	"	"	"	"	"
1M56S081	" "	" "	745' 6"	72	48' 0"	"	"	"	"	"
1M56S082	" "	" "	745' 6"	102	48' 0"	"	"	"	"	"
1M56S083	" "	" "	745' 6"	143	48' 0"	"	"	"	"	"
1M56S084	" "	" "	745' 6"	180	48' 0"	"	"	"	"	"
1M56S085	" "	" "	745' 6"	216	48' 0"	"	"	"	"	"
1M56S086	" "	" "	745' 6"	252	48' 0"	"	"	"	"	"
1M56S087	" "	" "	745' 6"	287	48' 0"	"	"	"	"	"
1M56S088	" "	" "	745' 6"	324	48' 0"	"	"	"	"	"
1M56S089	" "	" "	757' 0"	0	1' 0"	"	"	"	"	"
1M56S090	" "	" "	757' 0"	180	1' 0"	"	"	"	"	"
1M56S091	" "	" "	645' 7"	168	60' 0"	"	"	"	"	"
1M56S092	" "	" "	645' 0"	172	58' 0"	"	"	"	"	"
1M56S093	" "	" "	613' 4"	7	44' 0"	"	"	"	"	"

CONTAINMENT EQUIPMENT SURVIVABILITY LIST
TABLE 5.6-2 (Cont'd)

EQUIPMENT IDENTIFICATION NUMBER	EQUIPMENT DESCRIPTION	FUNCTION	ELEVATION	AZI-MUTH	Rx CEN-TERLINE DISTANCE	QUALIFICATION TEMP(F)	QUALIFICATION DURATION	MANUF.	MODEL	QUALIFICATION PRESSURE(PSIG)
1M56-094	Hydrogen Igniter System	Hydrogen Ignition	612' 5"	13	42' 8"	345	3 hrs	Power Systems Division	6043	(4 IN PROGRESS
1M568095	" "	"	612' 6"	344	42' 6"	"	"	"	"	"
1M56S096	" "	"	612' 3"	351	43' 6"	"	"	"	"	"
1M56S097	" "	"	638' 8"	289	49' 6"	"	"	"	"	"
1M56S098	" "	"	685' 6"	342	53' 0"	"	"	"	"	"
1M56S099	" "	"	685' 6"	17	50' 6"	"	"	"	"	"
1M56S100	" "	"	686' 0"	75	25' 0"	"	"	"	"	"
1M56S101	" "	"	686' 0"	105	25' 0"	"	"	"	"	"
1R72S0001	Electrical Penetrations	Containment Boundary	659' 0"	221	60'	340	3 hrs	Westinghouse	WX33328	108
1R72S0002	" "	"	659' 0"	228	"	"	"	"	WX33328	"
1R72S0003	" "	"	656' 3"	221	"	"	"	"	WX33329	"
1R72S0004	" "	"	657' 1-1/2'	248	"	"	"	"	WX33329	"
1R72S0005	" "	"	656' 3"	228	"	"	"	"	WX33330	"
1R72S0006	" "	"	657' 1-1/2"	242	"	"	"	"	WX33331	"
1R72S0007	" "	"	651' 6"	221	"	"	"	"	WX33332	"
1R72S0008	" "	"	649' 9"	221	"	"	"	"	WX33333	"
1R72S0009	" "	"	651' 6"	248	"	"	"	"	WX33332	"
1R72S0010	" "	"	649' 9"	248	"	"	"	"	WX33333	"
1R72S0011	" "	"	657' 1-1/2"	235	"	"	"	"	WX33334	"
1R72S0012	" "	"	651' 6"	228	"	"	"	"	WX33335	"
1R72S0013	" "	"	649' 9"	228	"	"	"	"	WX33333	"
1R72S0014	" "	"	651' 6"	242	"	"	"	"	WX33335	"
1R72S0015	" "	"	649' 9"	242	"	"	"	"	WX33333	"
1R72S0016	" "	"	643' 3"	221	"	"	"	"	WX33336	"
1R72S0017	" "	"	641' 6"	221	"	"	"	"	WX33337	"
1R72S0018	" "	"	643' 3"	228	"	"	"	"	WX33338	"
1R72S0019	" "	"	641' 6"	228	"	"	"	"	WX33339	"
1R72S0020	" "	"	643' 3"	248	"	"	"	"	WX33336	"
1R72S0021	" "	"	641' 6"	241	"	"	"	"	WX33363	"
1R72S0022	" "	"	643' 3"	242	"	"	"	"	WX33340	"
1R72S0023	" "	"	641' 6"	248	"	"	"	"	WX33341	"

CONTAINMENT EQUIPMENT SURVIVABILITY LIST
TABLE 5.6-2 (Cont'd)

EQUIPMENT IDENTIFICATION NUMBER	EQUIPMENT DESCRIPTION	FUNCTION	ELEVATION	AZI-MUTH	Rx CEN-TERLINE DISTANCE	QUALIFICATION TEMP(F)	QUALIFICATION DURATION	MANUF.	MODEL	QUALIFICATI(PRESSURE(PSI(
1R72S0024	Electrical Penetrations	Containment Boundary	643' 3"	235	60'	340	3 hrs	Westinghouse	WX33342	108
1R72S0025	" "	"	651' 6"	235	"	"	"	"	WX33337	"
1R72S0026	" "	"	638' 4"	221	"	"	"	"	WX33343	"
1R72S0027	" "	"	638' 4"	228	"	"	"	"	WX33344	"
1R72S0028	" "	"	641' 6"	223	"	"	"	"	WX33345	"
1R72S0029	" "	"	656' 3"	223	"	"	"	"	W-34147	"
1R72S0030	" "	"	643' 3"	223	"	"	"		W34488	"
1R72S0031	" "	"	649' 9"	223	"	"	"	"	W-34489	"
1R72S0033	" "	"	649' 9"	235	"	"	"	"	W-34490	"
1R72S0035	" "	"	641' 6"	242	"	"	"	"	W-34491	"
1R72S0036	" "	"	649' 9"	241	"	"	"	"	W-34492	"
1R72S0038	" "	"	651' 6"	241	"	"	"	"	W-34493	"
	Upper Personal Airlock Seals	"	692' 10"	225	60'	Qualification In Progress		J. Wooley		IN PROGRE:
	Lower Personal Airlock Seals	"	603' 1"	241	"		"	"		"
	Equipment Hatch Seals		629' 6"	133	"		"	"		"
	Terminal and Fuse Block Assemblies		Containment (Various Locations)			346	3 hrs	Buchanan	NBQ, NQO, NQO-361	113
	Control Cable and Small Power Cable		"			346	"	Rockbestos	Firewall III	113
	Instrument Cable		"			385	"	Brand-Rex	16 and 20 AWG	113
	Pressure/Level/DP Transmitters		"			318	"	Rosemont	1153	73

NOTES: (1) All components on this list will be qualified or justification for interim operation provided in accordance with 10 CFR 50.49.

NOTES (cont'd): This justification will address appropriate considerations for the equipment required to survive hydrogen combustion.
(2) Design values
(3) Demonstrated qualification to 14.9 for PNPP. Capability demonstrated to 24 psig at GGNS for identical compressor. GGNS compressor demonstrated qualification to 15.3 psig.
(4) Demonstration of equipment survivability for these components will be applicable to all safety relief valves.

TABLE 8

Perry CLASIX-3 Input

Suppression Pool Parameters

Pool surface area in drywell (ft^2)	482
Pool surface area in wetwell (ft^2)	5900
Weir height above water level (ft)	5.667
Pool Water Density (lbm/ft^3)	62.11
Mass (lbm)	7.349×10^6
Temperature (^oF)	90
Heat Capacity (Btu/lb-^oF)	1.0

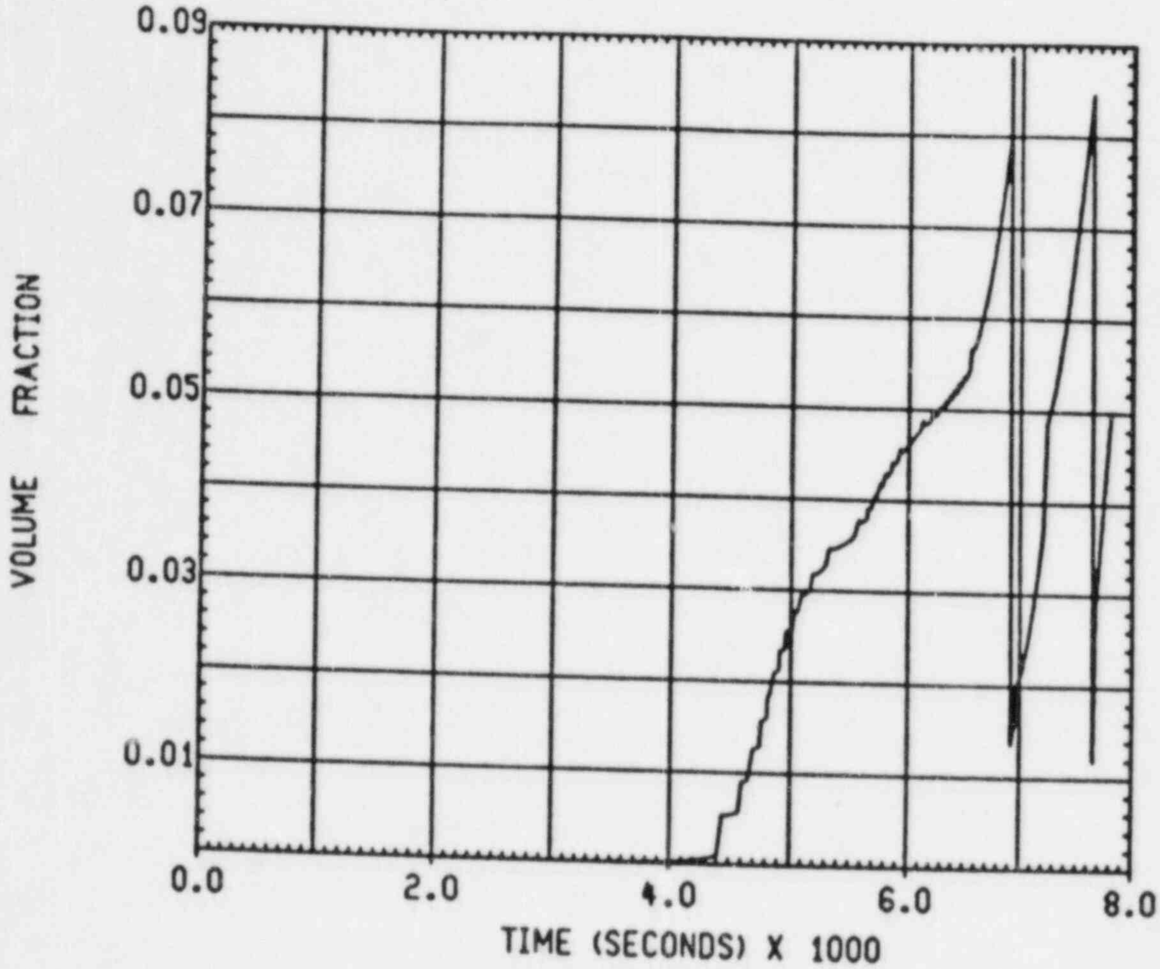
	Row 1	Row 2	Row 3
Number of vents	40	40	40
Flow area per vent (ft^2)	4.125	4.125	4.125
Vent length (ft)	7.458	7.458	7.458
Depth of vent bottom (ft)	8.646	13.146	17.646
Additional vent length (ft)*	2.87	2.87	2.87
Turning loss coefficient	2.3	3.9	9.6
Gas loss coefficient	2.5	2.5	2.5

Drywell Holdup Volume (ft^3)**	40,564
Drywell Holdup Surface Area (ft^2)	2617

*Accounts for acceleration of fluid.

**Net free volume in drywell, inside and below the top of the weir wall.

3/21/85



CLEVELAND ELECTRIC ILLUMINATING
PERRY NUCLEAR STATION SORV
CONTAINMENT H2 GAS CONCENTRATION

FIGURE 18

3/21/85