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1881 - 1981

JOHN S. KEMPER
VICE-PRESIDENT
ENGINEERING AND RESEARCH

AUG 18 1983

Docket Nos. 50-277
50-278

Mr. John F. Stolz, Chief
Operating Reactors Branch #4
Division of Licensing
US Nuclear Regulatory Commission
Washington, DC 20555

Subject: Peach Bottom Atomic Power Station-Units 2&3
Mark I Containment Long-Term Program
Plant Unique Analysis Report

Dear Mr. Stolz:

Your letter of July 14, 1983, (J. F. Stolz, NRC, to E. G. Bauer, PECO) forwarded a request for additional information on the Mark I Plant Unique Analysis Report (PUAR) submitted for Peach Bottom Units 2 and 3. As requested in the letter, a meeting was held on August 2, 1983, between the NRC staff, Brookhaven National Laboratory, Philadelphia Electric Co., and Bechtel Power Corporation. Responses to the 14 items contained in your letter were provided at the meeting and are included as Attachment 1 to this letter.

All items have been closed out with the exception of items 3 and 4. For these items, additional documentation was requested concerning the scaling factors used to provide additional margins for pool swell loads as a result of performing only one quarter scale test with zero differential pressure between the drywell and wetwell. Included as Attachment 2 is a copy of General Electric letter MI-G-88 dated January 25, 1982, which provides the basis for the scaling factors used in the Peach Bottom PUAR. We will consider items 3 and 4 closed unless notified otherwise.

As a result of discussions at the August 2 meeting, revisions to some PUAR pages were determined to be required. We have made the necessary changes and have included the revised pages as Attachment 3 to this letter.



A025
1/1

We appreciate the opportunity to have met with you and expedite the resolution of these items. Should you require any further information, please do not hesitate to contact us.

Very truly yours,

Attachments

Response to NRC Questions
(Date Aug 2, 1983)

Question No.1

AC section 2.1

Section 2.1 of the Acceptance Criteria states that "as part of the PUA, each licensee shall specify procedures (including the primary system parameters monitored) by which the operator will identify the SBA, to assure manual operation of the ADS within the specified time period. Longer time periods may be assumed for the SBA in any specific PUA, provided (1) the chugging load duration is correspondingly increased, (2) the procedures to assure manual operation within the assumed time period are specified, and (3) the potential for thermal stratification and asummetry effects are addressed in the PUA." The PUAR does not specifically address the above requirement. Clarification is needed.

Response:

The requirement to manually operate ADS within ten minutes after a postulated pipe break was included in the Mark I Load Definition Report as a means to limit the duration of chugging loads that occur under SBA conditions. Section 2.1 of NUREG-0661, Appendix A, requires each licensee to identify, in the PUAR, the procedures and primary system parameters necessary for the operator to initiate ADS.

Through subsequent discussions between the Mark I Owners' Group and the Emergency Procedures Committee of the BWR Owners' Group, it was determined that the procedures used to terminate chugging would be incorporated into the EPT's. The BWROG, however, recommended the use of the drywell sprays to condense steam in the drywell as a more desirable method to terminate chugging than manual ADS operation.

In a letter from J. F. Quirk (GE) to T. A. Ippolito (NRC) (Letter MFN-169-81), GE requested that the NRC Procedures and Test Review Branch review the EPG's in place of a review of each PUA for specifying procedures for manual ADS operation. In a letter from T. A. Ippolito (NRC) to J. F. Quirk (GE) 10/16/81, the NRC concurred and eliminated the need for the PUA reviews.

General Electric evaluated the capability of the drywell spray system to condense the steam from an SBA. It was concluded that plants with a drywell spray capacity of 8200 gpm or more can effectively handle any SBA. The Peach Bottom drywell spray capacity is 8690 gpm.

The EPG's describe the actions that should be taken by the plant operator according to plant conditions. For an SBA, the Primary Containment Pressure Control Guideline Step PC/P-3 directs the operator to initiate drywell sprays on a pressure signal calculated specifically for Peach Bottom. The singular objective of step PC/P-3 is to prevent chugging in Mark I containment.

The EPG's are being implemented at Peach Bottom.

NRC Question 2:

Section 2.13.8 of the Acceptance Criteria states that as part of the PUAR each licensee is required to either demonstrate the previously submitted pool temperature analyses are sufficient or provide plant-specific pool temperature response analyses to assure that SRV discharge transients will not exceed certain pool temperature limits. No such discussion has been found in the PUAR and must therefore be provided. Also include a description of the pool temperature monitor system.

Response:

An analysis of the suppression pool temperature response to SRV discharge was performed using proprietary General Electric models. Seven events were analyzed. These events bound those required by the NRC:

1A. Stuck-open SRV during power operation with one RHR loop available.

1B. Stuck-open SRV during power operation assuming reactor isolation due to main steam isolation valve (MSIV) closure.

2A. Isolation/scram and manual depressurization with one RHR loop available.

2B. Isolation/scram and manual depressurization with failure of an SRV to reclose (SORV).

2C. Isolation/scram and manual depressurization with 2 RHR loops available.

3A. Small break accident (SBA) with manual depressurization - accident mode with 1 RHR loop available.

3B. Small break accident (SBA) with manual depressurization and failure of the shutdown cooling system.

The analysis concluded that the NRC pool temperature limit of 200°F was not exceeded for any of these events.

The verification of the GE models is being reviewed on a generic basis.

A suppression pool temperature monitoring system has been designed and installed to meet the requirements of NUREG-0661. The system meets the Acceptance Criteria requirements in the following ways:

a) Separate, redundant sensors have been installed at 13 locations shown on the attached figure. There is a sensor location on the reactor side of the torus adjacent to the downstream arm of each tee quencher as well as in two additional locations to insure that no two adjacent bays are without sensors.

b) The sensors are installed approximately 6 feet below the pool water level to assure an accurate measure of the bay's temperature.

c) The average temperature is indicated and recorded in the control room.

d) Alarms are provided to assist the operators in implementing procedures which are affected by suppression pool temperature.

e) The temperature monitoring equipment is powered by an onsite source.

f) The sensors are seismically qualified to withstand the effects of the safe shutdown earthquake and remain functional.

Each of the two redundant temperature monitoring systems consists of the following equipment:

1) 13 Temperature Elements - Resistance Temperature Detectors installed in thermowells at 13 locations around the torus shell.

2) Microprocessor/indicator/printer - A microprocessor based device located in the control room which averages the outputs of the thirteen elements, providing an average or bulk temperature for the suppression pool. This temperature is locally displayed and periodically printed out by the device. The device contains malfunction detection circuits which continuously monitor internal functions and temperature inputs for out of range or intermittent signals. Alarm indication and outputs are provided for 95°, 110° and 120° and for a system failure.

4) Annunciation - Control room annunciation is provided for the following:

   a) System Failure or 95°F - the Tech. Spec. Limit for continuous power operation.

   b) 110°F - the Tech. Spec. limit for maintaining reactor at power.

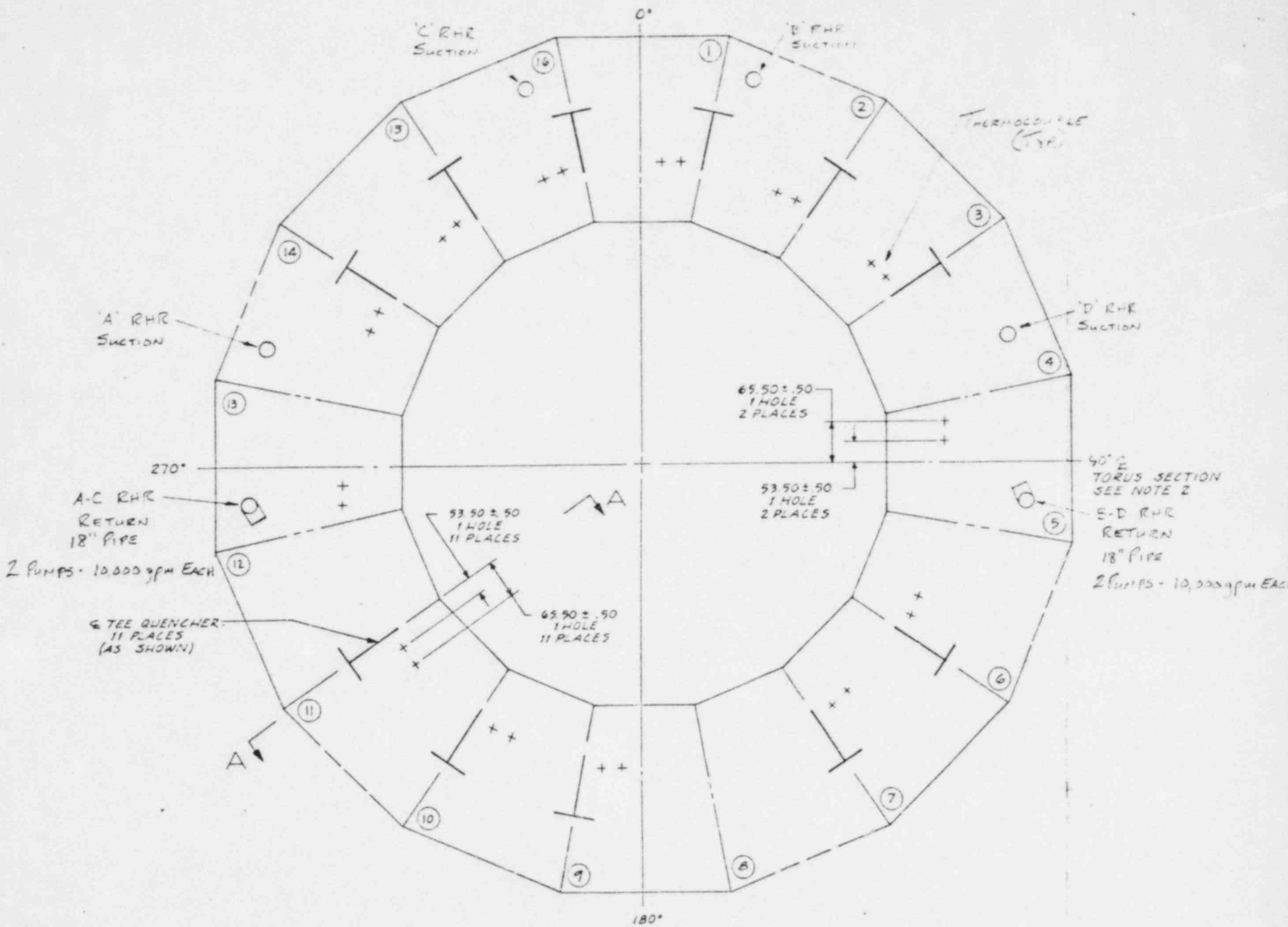
   c) 120°F - the Tech. Spec. limit for maintaining reactor pressure.

The equipment satisfies the requirements of Regulatory Guide 1.97, Revision 2, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident." The suppression pool temperature is both a Category I, Type A variable and a Category II, Type D variable and the system complies with the requirements by providing, in addition to the above provisions, the following:

a) Redundant, quality assured systems that are environmentally and seismically qualified and installed as an engineered safeguard system. Seismic qualification of sensors also includes the hydro-dynamic loadings which will be experienced during a safety relief valve discharge.

2) Self test features to assure detection and removal of a failed component to prevent conflicting data from being presented to the operator.

4/4




PEACH BOTTOM 2 & 3

TEMPERATURE MONITOR LOCATIONS

Question No.3

PUAR section 7.2.3, AC section 2.3

The LDR and NUREG-0661 specify a minimum of four tests as a data base for obtaining net torus vertical loads. NEDE-21944-P shows that of the 1/4-scale tests for Peach Bottom, four were done with a $\Delta p$ of 7.61 inches $H_2O$, and only one test was conducted at zero $\Delta$ p. The Peach Bottom PUAR states that both units 2 and 3 operate with no pressure differential between drywell and wetwell. Therefore, this appears to be a significant exception to the AC. Were other tests at zero $\Delta$p conducted for Peach Bottom? How were the loads arrived at? Justification of this above comments apply not only to the net torus vertical loads but to all loads for which the QSTF tests at zero $\Delta$p played a crucial role, such as impact and drag loads, etc.

Question No.4

PUAR section 6.2.2.1, AC section 2.3

Are the empirical scale factors used to provide additional margins for the pool swell loads as mentioned on p. 6-5 of the PUAR the same as those in the AC?

Responses to Questions 3 & 4

AC specifies the following margins for the net torus vertical pressure loads.

$$UP = UP_{mean} + 0.215 (UP_{mean})$$

$$DOWN = DOWN_{mean} + 2 \times 10^{-5} (DOWN_{mean})^2$$

for Peach Bottom this becomes

$$UP = 1.21 \ UP_{mean}$$

$$DOWN = 1.10 \ DOWN_{mean}$$

where, 'mean' refers to the average of four QSTF plant specific tests results.

Peach Bottom had only one QSTF test for zero $\Delta$p Therefore the UP and DOWN loads were increased as follows.

$$UP = UP_1 + 0.28 (UP_1)$$

$$DOWN = DOWN_1 + (4 \times 10^{-5})(DOWN_1)^2$$

or

$UP = 1.28\ UP_1$

$DOWN = 1.21\ DOWN_1$

For stress evaluation 31.5% margin on upload and 21% margin on down load was used. (See attached marked up page 6-6 of PUAR).

For impact and drag loads on vent header and other structures, pool swell loads are not governing and therefore an increase of about additional 10% margin in the loads will not significantly change the stresses reported.

Question No.5

PUAR section 6.2.2.4, AC sections 2.11.1, 2.12.1

What is the plant unique multiplication factor based on pool to vent area ratio used for CO torus shell loads for Peach Bottom? Are total responses to CO and post chug loadings obtained by absolute summing all the individual frequency responses? Were pre-chug loads calculated as specified in the LDR?

Response

The plant unique multification factors based on pool to vent area ratio used for CO torus shell loads were calculated in accordance with LDR. This multiplication factor for torus support loads is 0.90 and 0.95 for the shell loads. However, 0.95 factor was used for all stress calculations.

Harmonic analyses at the natural frequencies of the torus were performed for all CO shell pressures. Four highest responses were added by absolute sum method and the remainder were added by the SRSS method. Because harmonic analysis was used for all frequencies, the 15% increase recommended for time-history analysis is not applicable to Peach Bottom.

The total response for post chugging loads was obtained by the absolute sum on all the component responses.

A 22 1/2° model was used to calculated pre-chug loads.

For both symmetric and asymmetric distributions, ± 2.0 psi as specified in Figure 4.5.1-2 of the LDR was used.

Pre-chug loads are not governing. The net lateral loads were small.

Question No. 6

PUAR Section 6.2.3, AC,Section 2.13.9

To measured peak pressures of the in-plant SRV discharge tests mentioned on p. 6-9 of the PUAR are higher than the values in Table 6-3 for design case torus pressures. Clarify this apparent discrepancy.

Response

Calibration factors for QBUBBS based on tests varied from 1.33 to 2.11 (Table 6-2). QBUBBS pressure amplitude without calibration factors or multiple valve factor varied from 6.67 psi to 7.53 psi (Table 6-3). To obtain design pressures, the pressures in Table 6-3 must be multiplied by a calibration factor of 2.11 and a multiple valve factor of 1.35. (Table 6-3 will be revised to show this).

Question No. 7

PUAR Section 6.2.3, AC Section 2.13.3.3
On p. 6-13 the PUAR states that the "multiple valve design case pressure was calculated as 1.2 times the SRSS of pressures due to six adjacent valves". This is an exception to the AC and needs clarification and justification.

Response

The multiple valve factor was based on test data. The calculations are shown in the attached table.

# COMPARISON BETWEEN SRSS SUM AND ABSOLUTE SUM FOR MULTIPLE VALVE ACTUATION

| Test | PEAK POSITIVE PRESSURE AT GAGE LOCATION (psid) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | $P_2$ | $P_3$ | $P_5$ | $P_6$ | $P_7$ | $P_8$ | $P_9$ | $P_{10}$ | $P_{11}$ | $P_{12}$ | $P_{13}$ |
| Line K | | | | | | | | | | | |
| K-Cold 1 | 7.22 | 4.40 | 3.20 | 6.66 | 4.02 | 1.44 | 4.79 | 3.00 | 1.32 | 2.70 | 1.84 |
| K-Cold 2 | 7.34 | 3.62 | 3.12 | 6.38 | 3.08 | 1.38 | 4.11 | 2.56 | 1.22 | 2.49 | 1.83 |
| K-Cold 3 | 6.94 | 3.92 | 3.22 | 6.94 | 4.16 | 1.48 | 4.77 | 3.13 | 1.49 | 2.74 | 1.95 |
| K-Cold 4 | 6.05 | 3.54 | 3.51 | 7.06 | 3.55 | 1.09 | 4.94 | 2.86 | 1.45 | 2.84 | 1.75 |
| $K_{avg}$ | 6.89 | 3.87 | 3.26 | 6.76 | 3.70 | 1.35 | 4.65 | 2.89 | 1.37 | 2.69 | 1.84 |
| Line H | | | | | | | | | | | |
| H-Cold 1 | 1.02 | 0.79 | 1.56 | 3.36 | 2.21 | 1.10 | 5.76 | 2.89 | 3.54 | 8.19 | 3.19 |
| H-Cold 2 | 0.69 | 0.54 | 1.32 | 2.47 | 1.45 | 0.74 | 4.49 | 1.91 | 3.10 | 6.73 | 2.51 |
| $H_{avg}$ | 0.86 | 0.67 | 1.44 | 2.92 | 1.83 | 0.92 | 5.13 | 2.40 | 3.32 | 7.46 | 2.85 |
| Line G | | | | | | | | | | | |
| G-Cold 1 | 0.42 | 0.27 | 0.36 | 0.46 | 0.67 | 0.46 | 0.72 | 0.81 | 0.49 | 1.14 | 0.84 |
| G-Cold 2 | 0.36 | 0.36 | 0.44 | 0.51 | 1.00 | 0.62 | 0.59 | 0.77 | 0.38 | 0.66 | 0.67 |
| $G_{avg}$ | 0.39 | 0.32 | 0.40 | 0.49 | 0.84 | 0.54 | 0.66 | 0.79 | 0.44 | 0.90 | 0.76 |
| Lines (K + H) | | | | | | | | | | | |
| K+H-Cold 1 | 8.75 | 4.39 | 3.56 | 8.00 | 2.69 | 1.27 | 4.08 | 3.00 | 2.13 | 3.40 | 2.97 |
| K+H-Cold 2 | 6.93 | 3.68 | 4.96 | 10.16 | 6.62 | 1.66 | 6.76 | 5.59 | 2.15 | 4.64 | 3.86 |
| $(K+H)_{avg}$ | 7.84 | 4.04 | 4.26 | 9.08 | 4.66 | 1.47 | 5.42 | 4.30 | 2.14 | 4.02 | 3.42 |
| $(K_{avg} + H_{avg})$ | 7.75 | 4.54 | 4.70 | 9.68 | 5.53 | 2.27 | 9.78 | 5.29 | 4.69 | 10.15 | 4.69 |
| $\sqrt{K_{avg}^2 + H_{avg}^2}$ | 6.94 | 3.93 | 3.57 | 7.36 | 4.13 | 1.63 | 6.92 | 3.76 | 3.59 | 7.93 | 3.39 |
| $1.2 * \sqrt{K_{avg}^2 + H_{avg}^2}$ | 8.33 | 4.72 | 4.28 | 8.83 | 4.96 | 1.96 | 8.30 | 4.51 | 4.31 | 9.52 | 4.07 |
| Lines H + G | | | | | | | | | | | |
| H+G - Cold 1 | 0.93 | 0.72 | 1.25 | 3.00 | 1.80 | 0.87 | 5,06 | 2.46 | 3,02 | 7,15 | 3.27 |
| $(H_{avg} + G_{avg})$ | 1.25 | 0.98 | 1.84 | 3.40 | 2.67 | 1.46 | 5.78 | 3.19 | 3.78 | 8.36 | 3.61 |
| $\sqrt{H_{avg}^2 + G_{avg}^2}$ | 0.94 | 0.74 | 1.50 | 2.96 | 2.01 | 1.07 | 5.17 | 2.53 | 3.35 | 7.51 | 2.95 |
| $1.2 * \sqrt{H_{avg}^2 + G_{avg}^2}$ | 1.3 | 0.89 | 1.82 | 3.55 | 2.41 | 1.28 | 6.20 | 3.04 | 4.02 | 9.01 | 3.54 |

Question No.8

PUAR section 7.2.3.2, AC section 2.6

Have pool swell loads on the vent header in the Peach Bottom vent bays (those without vent header deflectors) been calculated? How do these loads compare to the loads on the protected vent headers in the non-vent bays?

Response

Yes, Pool Swell loads on the vent header have been calculated in the Peach Bottom vent bays where there are no vent header deflector. Sample comparison of peak pressure on the vent header between the above load and those in the deflector protected non-vent bay is presented below.

A. Non-vent bay, area between adjacent downcomer pairs.

    1. 0° from bottom of vent header - 0.2 psi

    2. 30° from bottom of vent header - 26 psi

B. Vent bay, area near miter joint and area between downcomer and main vent

    1. 0° from bottom of vent header - 253 psi

    2. 30° from bottom of vent header - 63 psi

Question No. 9

PUAR section 7.2.3.2, AC section 2.6

Figure 7-8 of the PUAR showing the pool swell impact loading sequence needs clarification. Are the pool surfaces and impact times labeled correctly in this figure?

Response

When deflectors are installed, the pool hits the deflector first and gets deflected. The deflected pool hits the vent header first at or about 30° from bottom dead center and spreads on either side from the point of impact. Thus the depiction of pool surface in Figure 7-8 of the PUAR is correct as is.

Question No. 10

Item 10: PUAR section 7.2.3 and 7.2.4, AC section 2.11, 2.12

Vent system CO and chugging loads are mentioned briefly in section 7.2.3.5 and 7.2.3.6 of the PUAR. SRV discharge drag loads on the vent system are mentioned in 7.2.4. The implication in the PUAR is that all these loads were calculated exactly as given in the LDR and the AC. Is this correct? For instance, were multivent chugging loads calculated based on an exceedance probability of $10^{-4}$ per LOCA as specified in the AC?

Response

All loads on vent system have been calculated as given in the LDR and the AC. Multivent chugging loads were based on a non exceedance probability of $10^{-4}$ per LOCA.

The RSEL for FSTF = 3.05 kips.
Fmax for Peach Bottom = 6.63 kips

For two downcomers 6.63 kips were applied in the same direction, conservatively, without applying any reduction factor. For more than two downcomers, the effect of lateral loads on the vent system response was small.

Question No. 11

PUAR Section 7.2.4, AC section 2.16.4

The PUAR mentions T-quencher bubble drag loads on the downcomers but does not specifically mention drag loads on the SRV lines. Were these calculated along with other submerged structure drag loads? If not, why was it felt to be unnecessary?

Response

T-quencher bubble drag loads were calculated in accordance with the LDR for the SRV lines along with the other applicable submerged structure drag loads as follows:

a) LOCA bubble drag loads
b) CO and chugging drag loads
c) SRV T-quencher bubble drag loads

In addition, the poolswell loads (impact, drag, and fallback) on the portion above the normal water level were also determined per the LDR requirements.

Question No. 12

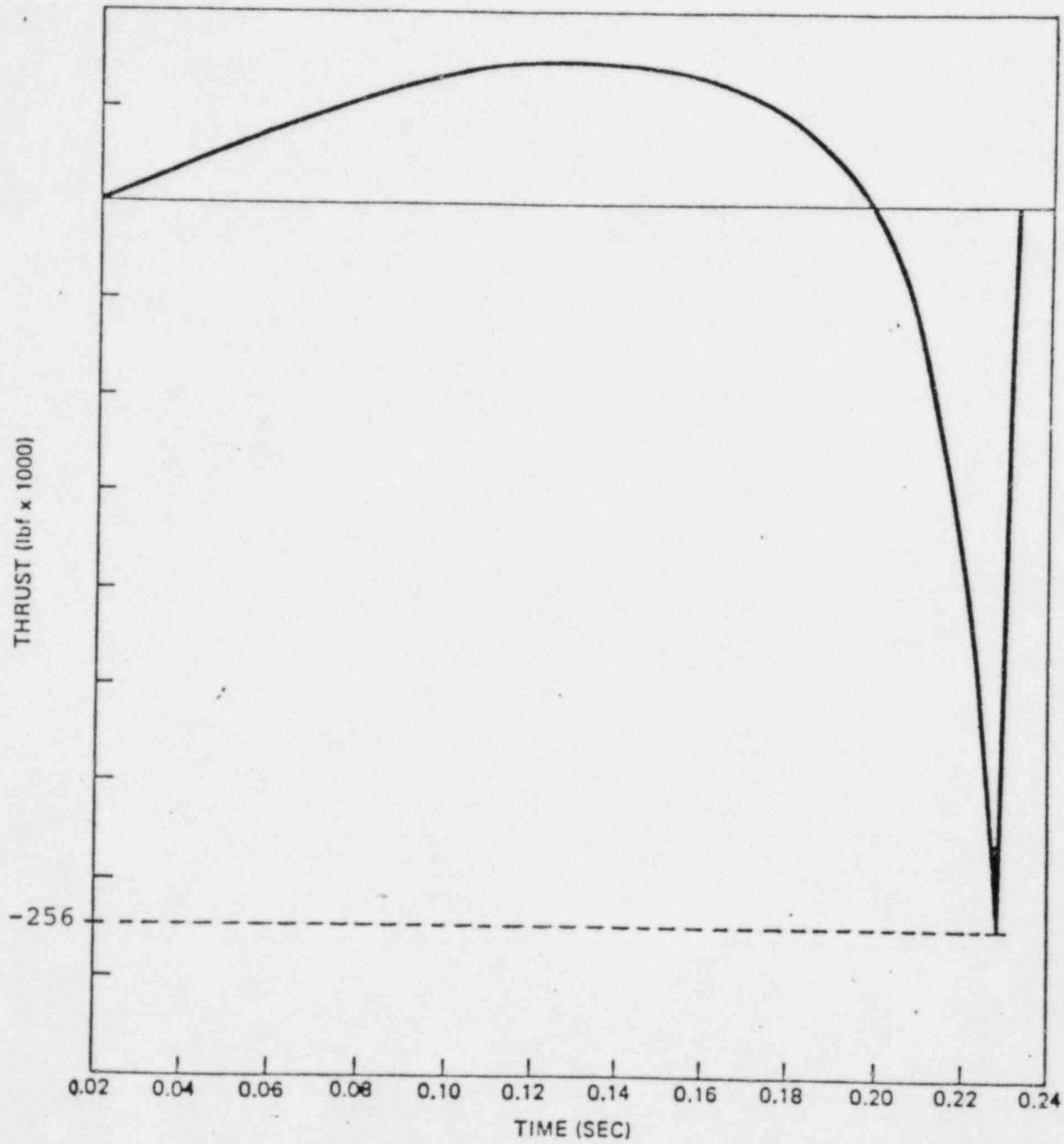
AC Section 2.13

Line clearing and thrust loads on the T-quencher are not specifically mentioned in the PUAR. Were these loads calculated and what values were obtained?

Response

The peak water clearing thrust load on the ramshead of the T-quencher is 256 kips as shown in the attached figure.

T-55/15(8/2/83)




RAMSHEAD WATER CLEARING THRUST LOADS

Question No. 13

PUAR sections 8.23, 8.24, AC section 2.7, 2.8, 2.9, 2.14

Sections 8.2.3 and 8.2.4 briefly mention LOCA and SRV loads on torus internal structures were calculated "based on LDR methodology". Does this mean complete compliance with LDR and AC specifications with no deviations? For instance, have FSI affects for submerged structure loadings been accounted for as specified in the AC?

Response

All hydrodynamic loads on the torus internal structures were calculated in accordance with LDR and AC specifications. Specifically, the following items have been taken into account.

a) FSI effects

b) Interference effects due to neighboring structures and the proximity of the torus shell.

c) Dynamic nature of the various loads.

Question No. 14

Indicate whether all loads covered by the LDR and the AC have been considered during the plant unique analysis and provide justification if any load has been neglected.

RESPONSE:

All loads in table 3.0-3 of the LDR except the environmental temperature on SRV piping have been considered. The justification for not including this load is as follows:

The SRV piping in the wetwell were analysed for a maximum temperature of 400°F. This is much higher than the environmental temperature expected in the wetwell. Therefore, these loads were not considered in the analysis of SRV piping.

ATTACHMENT 2

GENERAL ELECTRIC

INSTALLATION AND SERVICE ENGINEERING DIVISION

GENERAL ELECTRIC COMPANY . . . . . . 3 PENN CENTER PLAZA
PHILADELPHIA, PENNSYLVANIA 19102

MI-G-88
January 25, 1982

Mr. R. H. Logue
Philadelphia Electric Co.
2301 Market St.
Philadelphia, PA 19101

Subject: MARK I CONTAINMENT PROGRAM
PULD Revision for Drywell/Wetwell Zero ΔP

Dear Mr. Logue:

At the 7/14-7/15/81 Mark I A/E meeting several plants indicated that they would operate without a ΔP control system. Hence, they would operate under Drywell/Wetwell Zero ΔP conditions. This letter describes our estimate of the impact of the Zero ΔP operation on the LOCA loads, and identifies the changes required to update PULDs.

o <u>ZERO ΔP IMPACT</u>

Analysis results for DBA (at Zero ΔP condition) show slight changes in drywell and wetwell pressures and temperature magnitudes compared with those at operating ΔP results. The only significant change is that the vents take a longer time to clear, hence at the time of vent clearing the Zero ΔP case results in higher drywell pressure. For IBA and SBA transients which are not very sensitive to ΔP, no significant changes in the pressure and temperature transients were observed.

In general, pool swell and vent thrust loads at Zero ΔP will be higher than those at the positive drywell-to-wetwell ΔP condition. For most Mark I plants, these loads are calculated at both Zero and positive ΔP conditions and documented in the PULDs. For the plants which have QSTF tests conducted at Zero ΔP, only Zero ΔP loads are in the PULDs. For plants which only had a single QSTF test conducted at Zero ΔP, additional margin above that specified by the NRC will be required in order to cover the larger uncertainty. The NRC imposed margin was based on 4 tests in the data base which has one-half the uncertainty in terms of standard deviation of a single test. See Attachment 1 for a detailed description of this single test basis.

GENERAL ELECTRIC

To be applicable for Zero ΔP condition, PULDs will require updating/revision to incorporate DBA pressure and temperature transients and pool swell displacement and velocity transients, and changed initial conditions. In addition, the plant unique containment data specification will require updating to include changed initial conditions.

We are nearing completion of our Mark I PULD revision effort and would like to have your concurrence that the list of plants below are those that require the PULD to contain data for Zero ΔP operation. This list of plants was obtained at the recent AE meetings. If your plant is not listed below and you desire us to include your plant in those for Zero ΔP operation data in your PULD, please notify Bob Mapes at (408) 925-2894 by January 29, 1982.

Plants with Zero ΔP PULD

| | |
|---|---|
| Hatch 1 & 2 | Peach Bottom 2 & 3 |
| Oyster Creek | Dresden 2 & 3 |
| Cooper | Quad Cities 1 & 2 |

Zero ΔP data is available for DBA pressure and temperature transients for Peach Bottom 2, Oyster Creek, Cooper and Hatch 1 and is being provided as Attachment 2 to this letter to the utility and AE for these plants.

Attachment 1 Single QSTF Test Pool Swell Margins.

Attachment 2 DBA Pressure & Temperature Data for Zero ΔP.

Very truly yours,

for
H. T. Ayres
Service Manager - Nuclear

HTA:RMH:cal
Attachments

cc: R. Elias

Pool swell load margins for a single test basis.

RESPONSE

The downward and upward net vertical pressure loads on the torus are derived from the series of plant-specific QSTF (Quarter Scale Test Facility) tests. For the downward pressure loads, the variance was found to be a function of the load magnitude and has been expressed as a quadratic function of the peak downward load (i.e. $2 \times 10^{-5}$ times the square of the QSTF mean peak downward load). For the upward pressure loads, the variance was found to be approximately linear with load magnitude; therefore, a constant percentage margin has been specified (6.5 percent). An additional margin of 15 percent on the upward load has been specified to conservatively account for three dimensional effects absent from the TWO-Dimensional testing program.

The margins above were found for a four test basis. Since the single test basis is a decrease by a factor of four of the sample number, the uncertainty of the pool swell load doubles (ie. by $\sqrt{4}$). The margin for the downward load then becomes $4 \times 10^{-5}$ times the square of the QSTF downward load. The margin for the upward load becomes 13 percent for the uncertainty plus the 15 percent from the 2-D testing program.

$$UP = UP_1 + 0.28\ (UP_1)$$

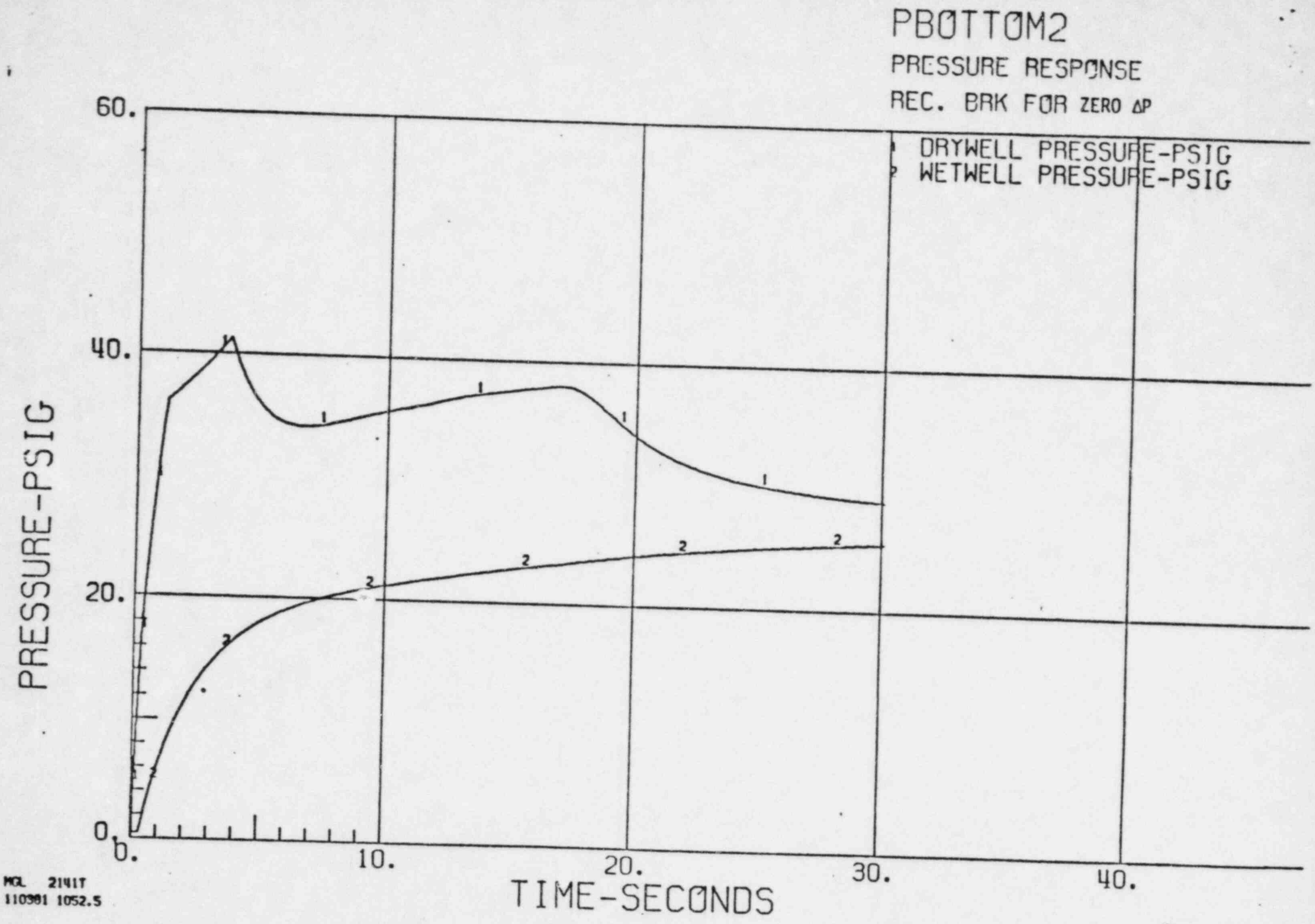
$$Down = Down_1 + (4 \times 10^{-5})\ (Down_1)^2$$

Where $UP_1$ = Upward load from single test

$Down_1$ = Downward load from single test.

REFERENCE

"Safety Evaluation Report, Mark I Containment Long-Term Program", NUREG 0661, Nuclear Regulatory Commission, July 1980.


PBOTTOM2
PRESSURE RESPONSE
REC. BRK FOR ZERO ΔP
1 DRYWELL PRESSURE-PSIG
2 WETWELL PRESSURE-PSIG
60.
40.
20.
0.
PRESSURE-PSIG
0.
10.
20.
30.
40.
TIME-SECONDS
MCL 2141T
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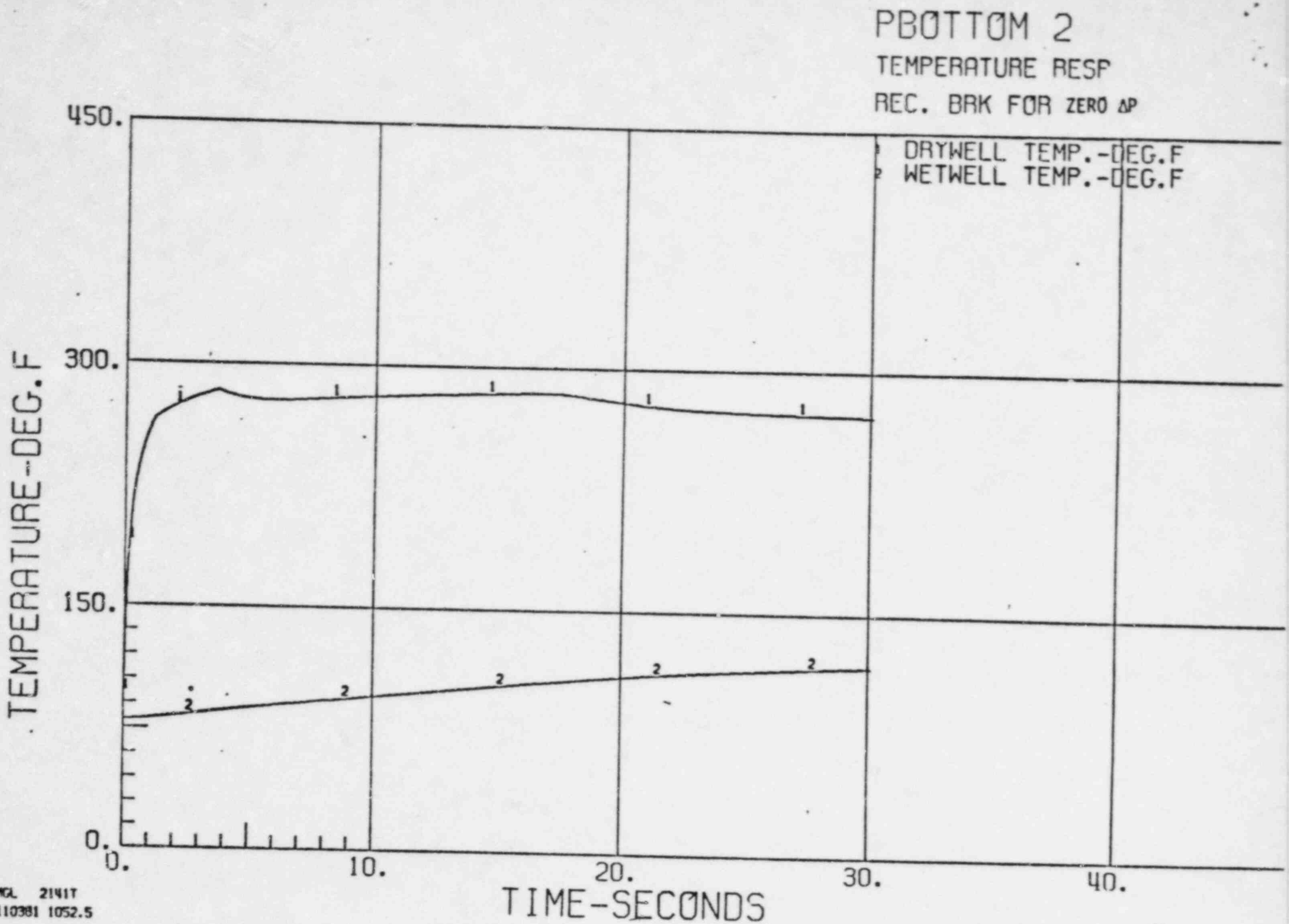


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