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MURRAY R. EDELMAN
VICE PRESIDENT
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June 29, 1983

PY-CEI/NRR-0057 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
Confirmatory Issue No. 21
Suppression Pool Temperature
Limits

Dear Mr. Youngblood:

This letter and the attached revised report provide additional information in response to the Perry Nuclear Power Plant (PNPP) SER Confirmatory Issue No. 21 regarding suppression pool temperature limits. This revised submittal addresses the NRC staff's concerns and is intended to completely replace the previous letter and report submitted on January 31, 1983.

The attached revised report addresses the PNPP plant-specific information, analyses, and assumptions used in the analyses, to meet the requirements and criteria given in NUREG-0783. All analyses in the attached revised report were performed by General Electric.

The results can be summarized as follows:

a. The SRV discharge events of Paragraph 5.6 of NUREG-0783 were analyzed with the conservative assumptions given in Paragraph 5.7 of NUREG-0783.

b. The highest computed bulk pool temperature for the events mentioned in a. above is 181°F with SRV operation at steam discharge condition below 25 $lbm/ft^2/sec$. This means that the local pool temperature will remain below 200°F. NUREG-0783 criteria requires that the local pool temperature not exceed 210°F for such low mass flux conditions.

These analyses with NUREG-0783 assumptions are quite conservative. The actual maximum bulk pool temperature from such an event is expected to be substantially below 180°F using more realistic assumptions. Thus, the pool will be stable even beyond 220°F for such low mass flux rates with Perry's X quenchers designs.

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These analyses are being provided to close SER Confirmatory Issue No. 21 in relation to the NRC's Task Action Plan A-39. Therefore, the information contained in the attached revised report will not be incorporated into the PNPP FSAR.

We believe that this letter and the attached revised report should resolve this confirmatory issue in the next Supplementary Safety Evaluation Report.

Very truly yours,

Murray R. Edelman

Murray R. Edelman
Vice President
Nuclear Group

MRE:kh

cc: Jay Silberg, Esq.
John Stefano
Max Gildner

Attachment

PNPP NUREG-0783 SUPPRESSION

POOL TEMPERATURE ANALYSES

INTRODUCTION & SUMMARY

This report addresses the Mark III Perry Plant suppression pool temperature limits during safety relief valve discharge events based on the assumptions and transients described in NUREG-0783. No transient was found to exceed the acceptance criteria described in NUREG-0783 Section 5.1. The analytical model used for the pool temperature calculation is described in NRC approved NEDO-20533, "The GE Mark III Pressure Suppression Containment System Analytical Model." The model is used to analyze the thermodynamic response of a pressure suppression containment to various transients. It calculates a peak bulk temperature for the suppression pool. The local temperature can be computed by adding to the bulk temperature an increment determined by existing applicable plant data; in this case 14 degrees from Kuosheng test data.

The limit for this temperature, as stated in NUREG-0783, is 200°F for quencher mass flux greater than 94 lbm/ft^2 sec. For quencher mass flux less than 42 lbm/ft^2 sec., local temperature must be 20°F subcooled; considering the submergence depth of the quencher for this plant that value is 210°F. Local temperature limits in between these two values are linearly interpolated.

All assumptions for these analyses are in accordance with NUREG-0783, Section 5.7.1 and other major assumptions are listed in Table 1. The transients analyzed are those described in Section 5.7.2. They are of three main types; Stuck Open Relief Valves, Isolation/Scram, and Small Break Accidents. Details of these transients are in Table 2. The tabulated results for bulk temperatures are listed in Table 3. The highest bulk temperature calculated was 181°F for the isolation case. The

addition of local to bulk temperature of 14°F determined by Kuosheng test data gives a local temperature of 195°F which is within the criterion described earlier. Perry has the same GE's X-shaped quenchers used in Kuosheng. The analyses and results are summarized in the following tables:

Table 1	Major Assumptions and Initial Conditions
Table 2	SRV Transient Cases
Table 3	Peak Suppression Pool Bulk Temperatures

The Perry suppression pool temperature monitoring system meets the general design requirements of Section 5.8 of NUREG-0783.

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TABLE 1

ASSUMPTIONS AND INITIAL CONDITIONS

1. Initial conditions for Perry are those specified in the Perry FSAR with the exception that the water within the weir wall is not used as a heat sink.

2. Suppression pool temperature at the normal power operation Technical Specification limit (95°F).

3. Feedwater pumps are operating and trip on an automatic signal.

4. In the event of a loss of off-site power in conjunction with the loss of any one emergency bus, Perry's design will assure that the available RHR loop can be switched from the pool cooling mode to the reactor shutdown cooling mode.

5. 10 minute operator action to initiate RHR pool cooling mode.

6. A switchover time of 16 minutes is allowed to switch from the pool cooling mode to the shutdown cooling mode.

7. When both RHR loops are operating and shutdown cooling is available, one RHR loop is left aligned in the pool cooling mode while the other is diverted to shutdown cooling.

8. Drywell coolers are assumed to be inoperable. Therefore, drywell pressure may exceed the high drywell pressure trip set point (~2 psig). Consequently, under appropriate initial conditions, the RHR will automatically switch out of the pool cooling mode and line up in the low pressure coolant injection (LPCI) mode. The RHR system will have to be manually switched back into the pool cooling mode. Ten minutes are

TABLE 1 (Continued)

allowed for this action. Each case is considered individually to see if this is applicable. For the small break cases which scram on high drywell pressure, this is assumed to occur at scram.

9. There is no specified pool temperature at which the HPCS is terminated.

10. Because Perry is capable of utilizing normal shutdown cooling through the recirculation and RHR loops or the two alternate shutdown modes, there is no single failure either in system design or power source that will result in the loss of one RHR heat exchanger loop and the RHR shutdown cooling mode.

NOTE: The assumptions in Section 5.7.1, of NUREG-0783, were all used in this report.

TABLE 2

DESCRIPTION OF SRV TRANSIENTS

CASE 1A - STUCK OPEN SRV DURING POWER WITH 1 RHR LOOP AVAILABLE.

- Event initiated by SORV occurring when pool temperature is at TS 1 (95°F).

- Operator initiates RHR in pool cooling mode.

- RHR operating 10 minutes later.

- At pool temperature of 110°F operator manually scrams reactor.

  NOTE: Perry's operating procedures will not specify the maximum number of attempts the operator will be allowed to use to reclose a stuck-open SRV. However, Perry's operating procedures will require the operator to scram, when the suppression pool reaches the Technical Specification pool temperature limit for reactor scram or if a SORV can't be shut within two minutes.

- The main condenser is available for approximately 20 seconds as a heat sink and can be reinstated at 1200 seconds at 30% steamline flow if vessel pressure is above 125 psia.

- At pool temperature of 120°F, 3 additional SRV's are available to further depressurize the vessel at a cool down rate of 100°F/hr., if necessary.

- When vessel pressure reaches the RHR shutdown cooling permissive pressure of 134.7 psia, operator starts change over from RHR pool cooling mode to vessel shutdown cooling mode. This action is assumed to take 16 minutes. There is no RHR on during this time. Vessel pressure is maintained with SRV's if necessary.

TABLE 2 (Continued)

- Transient ends shortly after shutdown cooling starts as decay heat is being removed by this method and no more energy is being added to the pool.

CASE 1B - SORV WITH MSIV CLOSURE WITH 2 RHR LOOPS AVAILABLE.

- Similar to Case 1A with these exceptions; 1) spurious MSIV closure disallows use of main condenser as heat sink and 2) given MSIV closure as second failure, no RHR's are assumed to fail.

CASE 2A - SRV DISCHARGE FOLLOWING ISOLATION/SCRAM WITH 1 RHR LOOP AVAILABLE.

- Event is initiated by scram.

- MSIV closes 3.5 seconds after scram.

- RHR in pool cooling mode 10 minutes after scram.

- At pool temperature of 120°F, 3 additional SRV's are manually actuated to depressurize the vessel at a cooldown rate of 100°F/hr. or higher if necessary to keep pool temperatures within design limits.

- When vessel pressure reaches the RHR shutdown cooling permissive pressure of 134.7 psia, operator starts changeover of RHR loop to vessel shutdown cooling mode.

- During the assumed 16 minutes changeover time, vessel pressure is maintained by manual SRV control.

- At onset of shutdown cooling mode, pool no longer receives energy from vessel and transient is over.

TABLE 2 (Continued)

CASE 3A - SRV DISCHARGE FOLLOWING SMALL BREAK ACCIDENT - 1 RHR AVAILABLE.

- Event is initiated by small break in steamline.
- Scram occurs on high drywell pressure.
- Rapid vessel depressurization.
- Rest of the transient as described in Case 2A.

CASE 3B - SRV DISCHARGE FOLLOWING SMALL BREAK ACCIDENT - 2 RHR AVAILABLE LOSS OF SHUTDOWN COOLING MODE.

- Similar to Case 3A with this exception; both RHR loops are in the pool cooling mode 10 minutes after scram and stay in that mode throughout the transient.

TABLE 3

PEAK SUPPRESSION POOL BULK TEMPERATURE
PERRY NUREG ANALYSIS

EVENT	TEMPERATURE
1a. SORV at Power + 1 RHR and Condenser	15[illegible]°F
1b. SORV with MSIV Closure + 2 RHR	158°F
2a. Isolation/SCRAM + 1 RHR	181°F
3a. SBA + 1 RHR	176°F
3b. SBA + 2 RHR; Shutdown Cooling Mode Failure	151°F

Note

- Cases 1a, 1b, 2a Vessel Normal Cooldown Rate.
- Cases 3a and 3b, Vessel Rapid Cooldown Rate.

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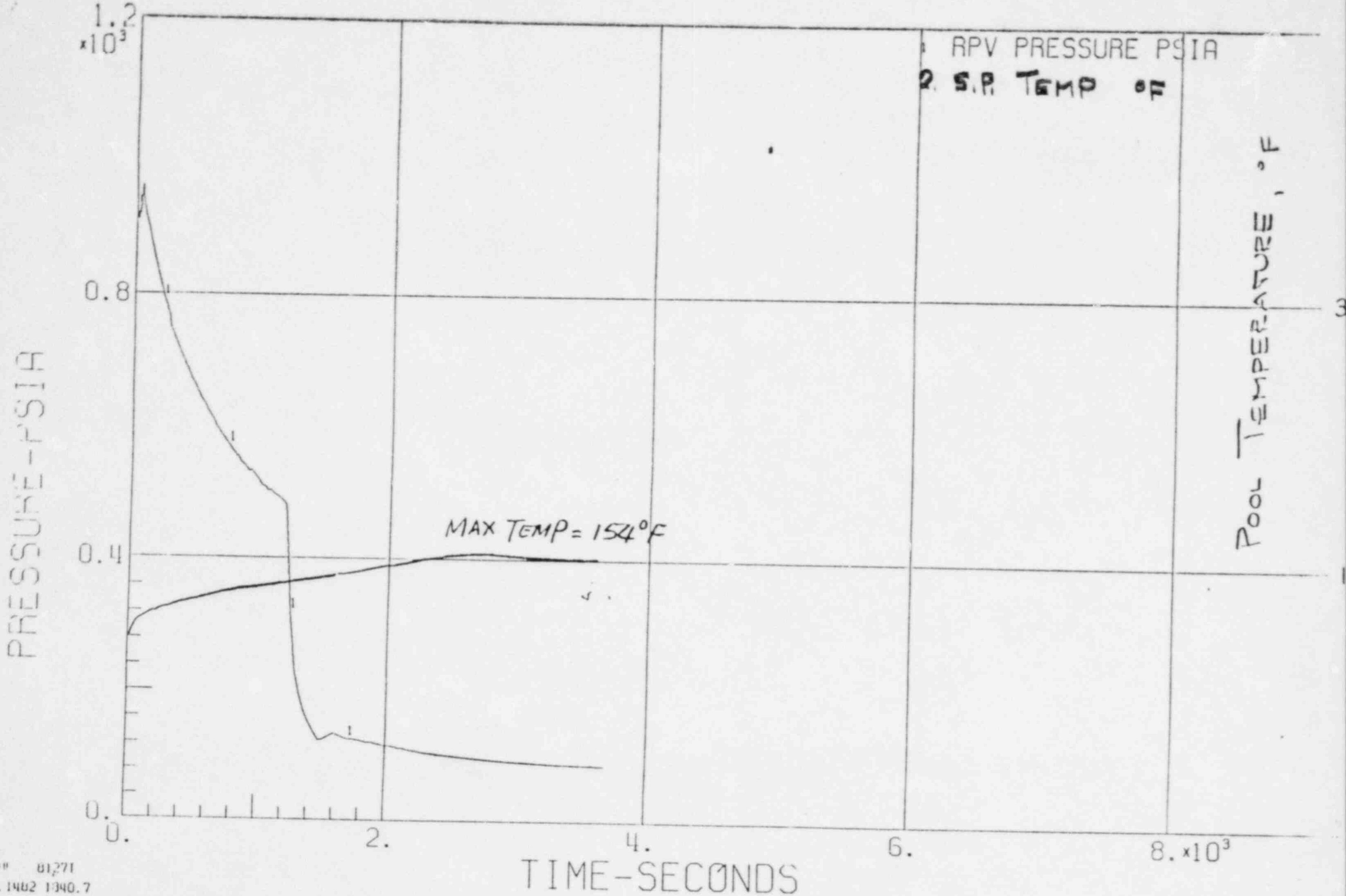
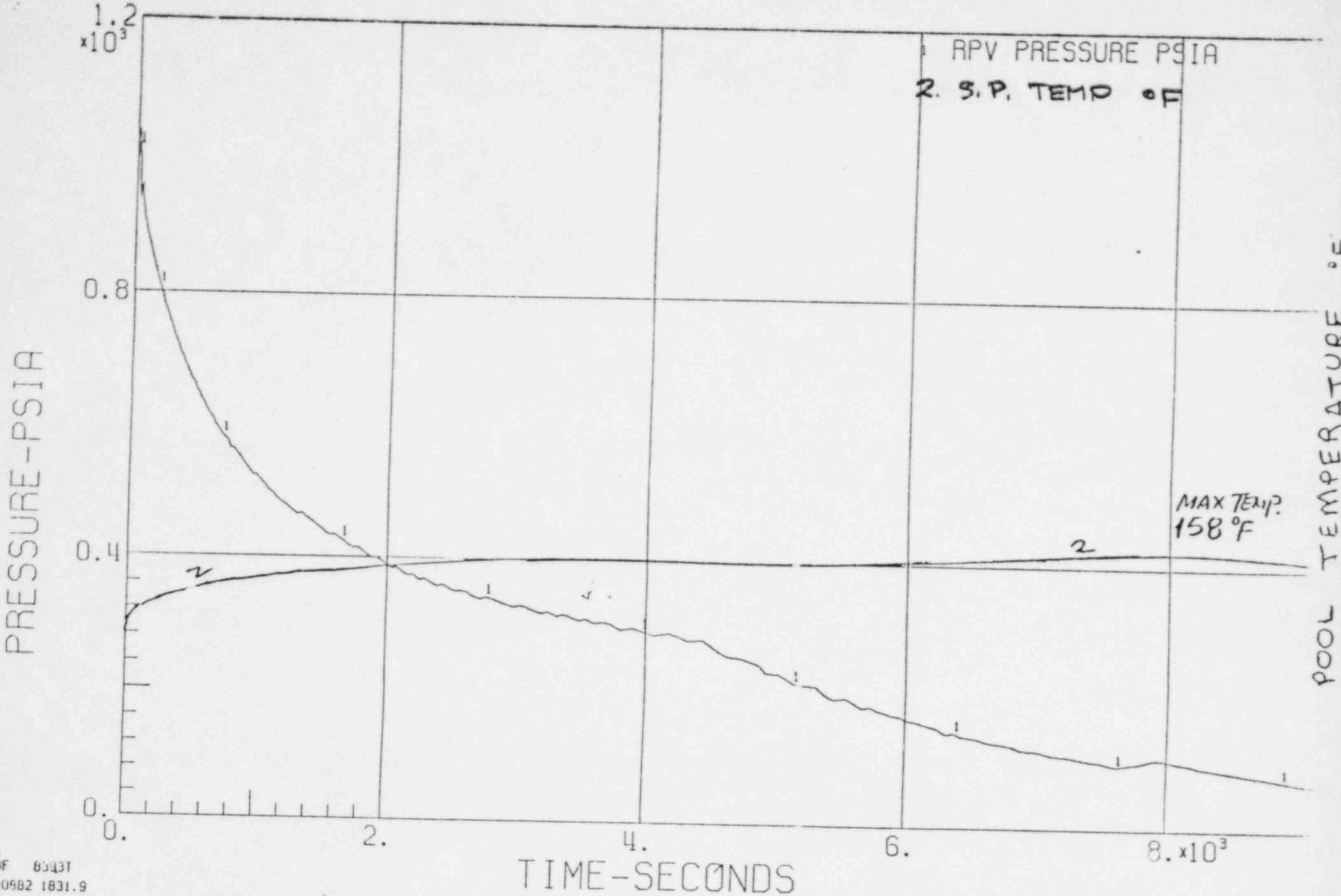
CASE 1A



81271
1.1482 1340.7

PERRY NUREG
RPV PRES RESPONSE

CASE 1B



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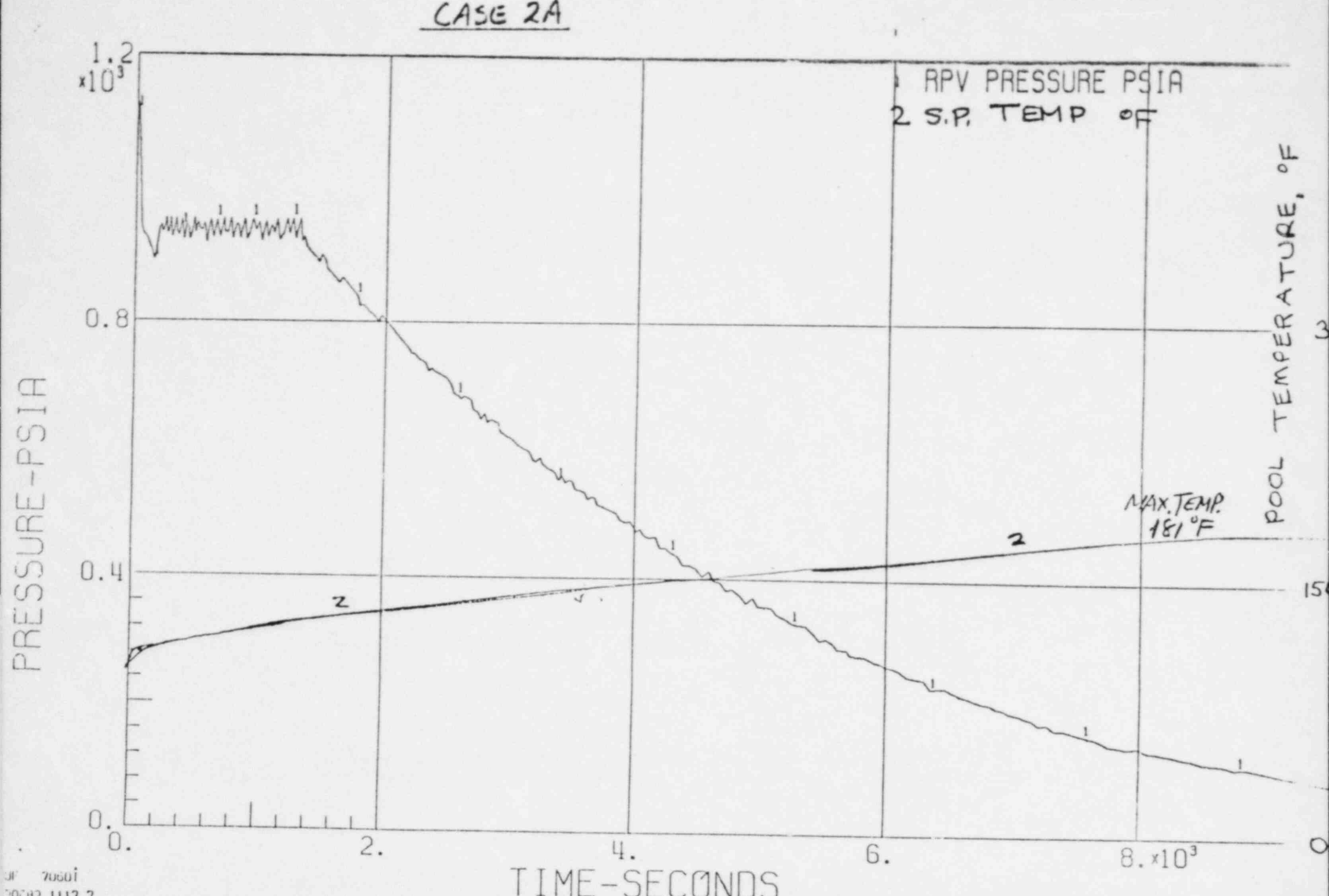
PERRY NUREG
RPV PRES RESPONSE



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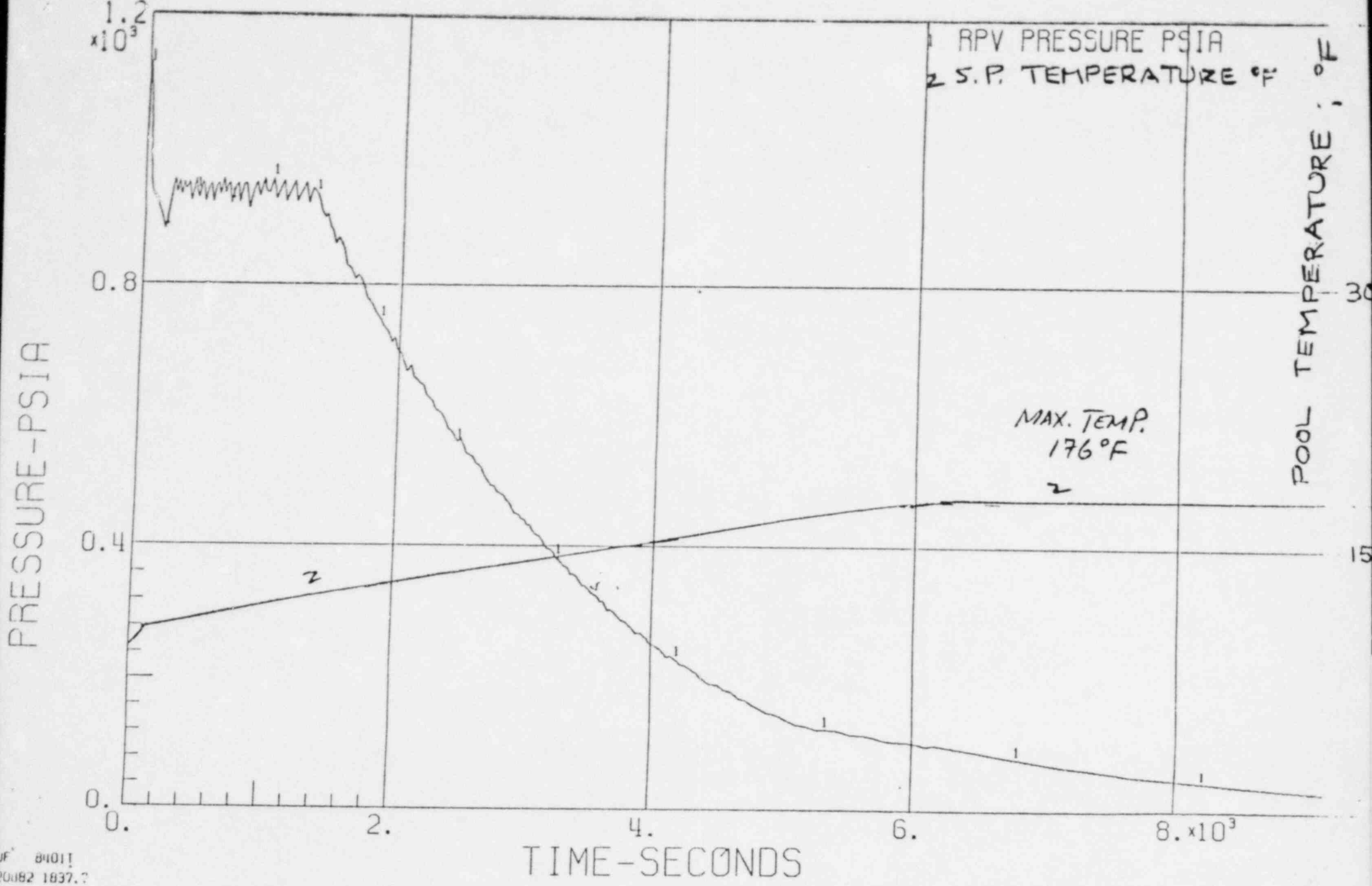
PERRY NUREG
RPV PRES RESPONSE

CASE 3A



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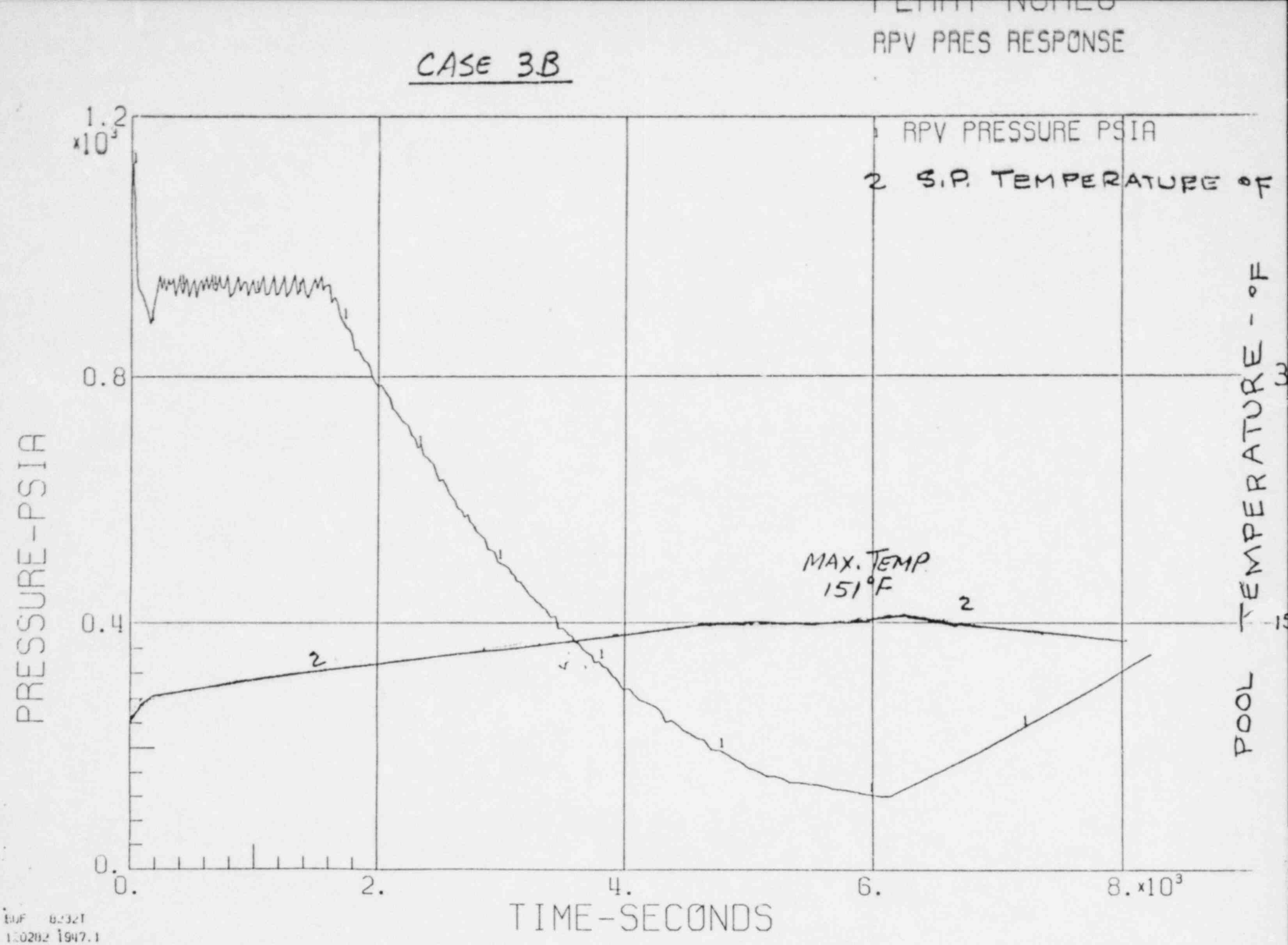
CASE 3B



RPV PRES RESPONSE
1 RPV PRESSURE PSIA
2 S.P. TEMPERATURE °F
MAX. TEMP
151°F
PRESSURE-PSIA
POOL TEMPERATURE - °F
TIME-SECONDS
1.2
$\times 10^3$
0.8
0.4
0.
0.
2.
4.
6.
8. $\times 10^3$