SUPPRESSION POOL TEMPERATURE TRANSIENT
FOLLOWING STATION BLACKOUT

Commonwealth Edison Company
LaSalle County Station
Project File Nr 35.2
System: Station Blackout

NSLD
Calc. No. 3C7-0390-001
Date May 23, 1990
Safety Related YES
Project No(s). 8726-17
Page No. 1

CALCULATION

REVISION SUMMARY SHEET

REVISION NO.	PREPARED BY/DATE	REVIEWED BY/DATE	APPROVED BY/DATE	REVISED PAGE NOS.
0	J. W. Ahrens 4-27-90	Tamer Umar 5-22-90	[illegible] 23 May 1990	N/A
	Robert J Petrison 4-27-90			
1	Jeffrey [illegible] 5-11-92	Thomas W [illegible] 5-11-92	Robert J Petrison 5-11-92	All

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Prepared by: [signature] Date: 5-11-92

Reviewed by: [signature] Date: 5-11-92

Approved by: [signature] Date: 5-11-92

SUPPRESSION POOL TEMPERATURE TRANSIENT FOLLOWING STATION BLACKOUT

Commonwealth Edison Company
LaSalle County Station
Project No. 8726-17
Project File No. 35.2
System Code: SBO
WIN 1218

EXCEPTIONS TO VERIFIED DATA

Information used in this calculation is assumed to be verified except as follows:

None

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I. INTRODUCTION

In order to demonstrate compliance with Title 10 of the Code of Federal Regulations, Part 50.63 requirements relative to Station Blackout, specific plant parameters have been examined for a station blackout scenario. The parameters of interest are directly related to the capability of the plant in maintaining core cooling and appropriate containment integrity. This report presents the expected response of suppression pool water temperature to a station blackout. Station blackout, defined as the total loss of AC power, both offsite and onsite (including any diesel generated power), would affect the suppression pool by eliminating any pool cooling via the RHR system for the duration of the blackout.

Two cases were analyzed to determine the suppression pool temperature for coping with a station blackout (SBO) event. The first case (Case 1) models RCIC operation during the SBO event. The second case (Case 2) assumes HPCS cooling mode instead of RCIC cooling. In these two cases, it was assumed that the primary system is cooled down by manual depressurization via the Automatic Depressurization System (ADS) in conjunction with automatic cycling of the safety/relief valves. For automatic opening and reseating of the safety/relief valves, low-low set point logic was utilized (Reference 2). In both cases, heat transfer to the suppression pool heat structures, namely the pool steel structures, was included. Also, both cases utilize a modified ANSI Standard (best estimate) power ratio following the scram as documented in Table 3 and Reference 6.

This revision was made to add recovery techniques to cool the reactor pressure vessel (RPV) and/or the suppression pool. Some conservatism was also removed.

II. SYSTEM DESCRIPTION

Figure 1 is a schematic of a BWR Mark II pressure suppression containment system. This containment system features a drywell (upper chamber) and a wetwell (lower chamber) which consists of a pool of water (suppression pool) and a wetwell air space. The two chambers are connected by a system of vent pipes (downcomers). These two units comprise a structurally integrated prestressed concrete pressure vessel lined with welded steel plate. A steel pressure head is provided for closure at the top of the drywell. The drywell and wetwell are separated by a reinforced concrete floor which serves to prevent steam flow between the two chambers except through downcomers provided for this purpose.

A number of safety-related systems are provided in a BWR plant to mitigate the consequences of postulated transients and accidents. Systems of interest to this analysis are shown in Figure 2. These systems are the RHR, the reactor core isolation cooling system (RCIC), high-pressure core spray (HPCS), and the S/RVs. A description of these systems can be found in the LSCS UFSAR [2].

During the hypothetical station blackout event, the reactor is isolated (main steam and feedwater isolation) and reactor pressure is relieved via steam flow through the S/RV system. The steam passes through the S/RV, the S/RV discharge line, and the S/RV quencher into the suppression pool. Since the quenchers are submerged (23 ft), steam flowing into the suppression pool is assumed completely condensed. The suppression pool water temperature will rise due to steam condensation until either 1) steam flow to the main condenser is restored and all S/RV flow to the pool is stopped or 2) one or more trains of the RHR system is started in the pool cooling mode. Both of these actions require some source of AC power.

III. METHOD OF ANALYSIS

The suppression pool temperature transients for the two cases considered in this analysis were calculated using the S&L computer code SUPTRAN [3]. SUPTRAN calculates mass within the suppression pool and Reactor Pressure Vessel (RPV) using a mass conservation equation for each volume. Suppression pool internal energy is calculated using the first law of thermodynamics for an open system with accounting of flow between the pool and RPV. Thermodynamic conditions within the RPV are calculated based on a rate equation for the RPV pressure.

Various flows modeled in the SUPTRAN code are depicted in Figure 2. Descriptions of the flows and flow models can be found elsewhere [3], [4]. The thermodynamic condition in the RPV is governed by the identified mass flows as well as by heat addition to RPV fluids from the nuclear fuel and from the RPV and reactor internals. The thermodynamic condition of the suppression pool is governed by the identified mass flows. Heat transfer to the suppression pool structures, namely steel components, was also included.

IV. MODELING ASSUMPTIONS

The transient analyses were performed using the S&L computer code SUPTRAN (See Appendix A). The evaluation made use of best estimate assumptions such as using a modified ANSI Standard decay heat curve (Reference 6) and 100% rated reactor power. SUPTRAN computer models for both the RCIC and HPCS cases were obtained directly from Reference 11. These computer models were modified to represent an operator controlled RPV cooldown in a conservative manner with respect to suppression pool temperature.

The acceptance criteria for suppression pool temperature is defined in Reference 1 in terms of a heat capacity temperature limit (HCTL) curve. This curve plots pool temperature versus RPV pressure. The operating procedures require the operator to control vessel pressure in order to stay below this curve (Reference 14).

The operator actions implemented in the models include:

- Operator initiated RPV cooldown at a rate of 100°F/hr following the initial vessel depressurization due to S/RV actuation after MSIV closure.

- Operator controlled S/RV actuation is used to control vessel pressure after 100°F/hr cooldown is terminated until the end of station blackout.

- At 4 hours 15 minutes, equipment is restored that allows the operator to cool down the RPV and/or suppression pool.

In both cases conservative modeling techniques were employed to maximize the energy input to the suppression pool. Although operator actions may call for termination of manual depressurization at specific reactor pressures to maintain sufficient operating margins, the analyses performed here allow manual depressurization to occur to lower reactor pressures to maximize pool heatup. The emphasis here is to produce bounding pool temperature transients.

Tables 1 and 2 summarize the event logic and plant specific data for the cases studied. Assumptions for each case analyzed are discussed below.

Case 1 (RCIC)

1) Although the normal opening pressure for the first two (lowest set point) S/RVs is 1091 psia, their low-low opening setpoints are 1021 and 1061 psia, respectively. The SUPTRAN program has no capability of resetting the setpoints. Therefore, not only subsequent S/RV openings for the first two valves were set to 1021 and 1061 psia, but also initial opening pressures for the first two S/RVs were set at the lower pressures (1021 and 1061 psia). Considering that the opening setpoints are lower and the differential pressures for reseating of the first two valves are larger (110 and 120 psid, Table 5.2-9 of Ref. 2), this assumption is conservative because the S/RVs will stay open longer and the discharge of steam to the suppression pool and the resulting temperature increase in the pool will be larger. For reseating the remaining valves, a differential pressure of 100 psid was used (Reference 9).

2) Heat transfer to the suppression pool structures is included (Reference 4).

3) 100% of the rated reactor power was used.

4) ANSI Standard (best estimate) decay heat curve (Reference 6) was used in conjunction with the GE design basis curve. See Table 4.

5) The initial suppression pool temperature assumed was 105 °F (Reference 19).

6) RCIC operation is assumed.

7) S/RV reseating differential pressures of 110, 120 and 100 psid were used for the 18 S/RVs, respectively (See Table 2).

8) Manual depressurization cooldown at 100°F/hr was imposed until vessel pressure reached 167 psia.

9) Following termination of manual depressurization cooldown , operator controlled S/RV actuation was implemented to control vessel pressure between 167 psia and 172 psia until the end of station blackout.

10) Modeling the operator controlled S/RV actuation was accomplished by specifying a 19th S/RV with a setpoint pressure of 172 psia and a reseat pressure of 167 psia. This valve is only activated following termination of manual depressurization.

11) Primary system leakage of 61 gpm is assumed to be added to the drywell for the first 4 hours. This is based on a Technical Specification limit of 25 gpm total leakage (Reference 12) plus 18 gpm per recirculation pump as allowed by Reference 13. Reference 15 calculates 37.76 percent of the 61 gpm flashes as it enters the drywell. The flashed steam is assumed to go directly to the suppression pool. After 4 hours, credit is taken for the reduced RPV pressure and Reference 15 calculates 17.85 percent of 27.5 gpm is flashed to steam. This steam is assumed to go directly to the suppression pool. Reference 15 gives an enthalpy of the steam as 1205.6 BTU/lbm.

12) The Overall Cooldown method was selected as the SUPTRAN option for performing the manual depressurization [3].

13) It is assumed that at 4 hours 15 minutes into the transient, equipment is made available to cool the RPV at a rate of 100°F/hr.

Case 2 (HPCS)

1) Case 1 assumptions were used.

2) However, instead of RCIC operation, HPCS cooling mode was used.

3) HPCS flow rate data obtained from Reference 7 was used. This data was selected rather than the data given in Reference 10, since the modification described in Reference 7 would result in a reduction in the HPCS flow rate. The use of a lower HPCS flow rate is conservative.

4) Manual depressurization cooldown at 100°F/hr was imposed. Manual depressurization cooldown was not terminated on vessel pressure because there are no pump shutoff considerations. Consequently, the vessel was allowed to depressurize to essentially the wetwell atmospheric pressure.

5) At 4 hours 15 minutes into the transient, 2 RHR trains were started in the pool cooling mode to reduce the suppression pool temperature.

V. RESULTS AND CONCLUSIONS

The results of the suppression pool temperature analysis are shown in Figures 3 through 5, for Case 1 and Figures 9 through 11 for Case 2. In particular, Figures 3 and 9 represent graphs of suppression pool temperature and RPV pressure as a function of time for the RCIC and HPCS cases, respectively. Figures 4 and 10 represent graphs of suppression pool temperature as a function of RPV pressure for the RCIC and HPCS cases, respectively superimposed on the HCTL curve for comparison. Finally, Figures 5 and 11 represent graphs of RPV temperature and RPV water level as a function of time for the RCIC and HPCS cases, respectively.

In Case 1, the suppression pool temperature at 4 hours after the SBO begins is 213.1°F; it is 217.1°F at 4 hours 15 minutes. In Case 2, the suppression pool temperature at 4 hours after the SBO begins is 230.8°F. At 4 hours 15 minutes, it is 234.2°F. The difference between the 4-hour pool temperature resulting from HPCS operation versus RCIC operation is attributed to the additional mass and energy discharged to the pool through the S/RVs for HPCS. This occurs because HPCS is allowed to depressurize the RPV to lower pressures. Consequently, S/RV discharge occurs for longer periods of time.

Figures 4 and 10 indicate that utilizing conservative modeling which maximizes pool heatup, the vessel pressure and pool temperature are adequately controlled below the HCTL curve. Hence, the Heat Capacity Temperature Limit would not be reached during the four hour station blackout event.

The assumptions for Case 1 included S/RV cycling between 167 and 172 psia following manual depressurization termination. This small Δp was selected to maximize energy input to the pool. However, this would result in an inordinate number of S/RV actuation cycles which would not be realistic from an operations standpoint. In order to demonstrate the conservativeness of this assumption, a second RCIC case was run (Case 1A) which modified the valve set pressure to 200 psia such that operator controlled S/RV cycling occurs between 167 psia and 200 psia. The results of this alternate RCIC case are presented in Figures 6 through 8. The suppression pool temperature under these circumstances is 212.7°F at 4 hours and 215.8°F at 4 hours 15 minutes after the SBO begins. The alternate RCIC case results in only four operator controlled S/RV cycles following termination of manual depressurization and prior to four hours after the SBO begins.

An additional run was made using the information of Case 1, but without primary system leakage to the suppression pool. The results were used as input to Calculation No. ATD-0117, Rev. 0 "Evaluation of NPSH Requirements for HPCS, RHR and RCIC Pumps and Back Pressure Limitations of RCIC Turbine Following Station Blackout." The results are shown in Appendix A.

The lowest reactor water level occurs during RCIC operation and is approximately -130 inches. This level does not result in core uncovery since the top of the active fuel is -161 inches per Reference 17.

VI. REFERENCES

1) OEI Document 8390-4C Emergency Procedure Guidelines Appendix C, WS-5 Heat Capacity Limit Worksheet No. 2, December 27, 1989 (Draft).

2) LaSalle County Station UFSAR, Chapters 5 and 6, Revision 0, Commonwealth Edison Company, April 1988.

3) "SUPTRAN - A Computer Code to Calculate Suppression Pool Temperature Transients," (Users' Manual), S&L Computer Software Library, Program Number SUP09809813I, SUPTRAN, June 1990.

4) Field, R. M., "Suppression Pool Temperature Transient Studies," NSLD Calculation 3C7-0181-003, Revision 0, Approved May 14, 1981.

5) LaSalle County Station DAR, Chapter 6, "Suppression Pool Water Temperature Monitoring System," pg. 6.1-2, Rev. 9, June 1981.

6) "Revised Decay Heat Curve for Use in Station Blackout Calculation," letter from W. Naughton (CECo) to J. S. Abel (CECo), dated February 23, 1989.

7) Attachment 1 to "Conceptual Design Report for the Deletion of ECCS Minimum Flow Switches E12-N010, E21-N004, and E22-N006," WIN 0762, Rev. 0, La Salle County Station Units 1 and 2.

8) "Preprocessing and Postprocessing Program: PPP," S&L Software Library, Program No. PPP 09.8.099-1.31.

9) "Pressure Switches Data Sheet," No. PS223, Revision C, dated October 9, 1989, La Salle County Station Units 1&2, Commonwealth Edison Company.

10) La Salle County Station UFSAR, Figure 6.3-2, Commonwealth Edison Company, Revision 5, April 1989.

11) "Station Blackout-Suppression Pool Temperature," NSLD Calculation 3C7-1082-002, Revision 2, Approved November 13, 1989.

12) Commonwealth Edison Company, LaSalle County Station Unit 2 Technical Specifications, Appendix "A" to License No. 18, Section 3/4.4.3, "Reactor Coolant System Leakage."

13) "Station Blackout (SBO) Implementation: Request for Supplemental Submittal to NRC," Letter from Byron Lee, Jr. (NUMARC), January 4, 1990.

14) LaSalle Specific Operating Procedures:

   a. LPLGA-01, Revision 0, January 1987

   b. LPLGA-02, Revision 0, January 1987

   c. LPLGA-03 Revision 0, January 1987

   d. LPLGA-04, Revision 0, January 1987

   e. LPLGA-05, Revision 0, January 1987

15) "Drywell Temperature Transient Following Station Blackout," NSLD Calculation 3C7-0390-002, Revision 1, Approved May 11, 1992.

16) LaSalle County Station UFSAR, Table 4.4-1, Commonwealth Edison Company, Revision 4, April 1988.

17) Commonwealth Edison Company, LaSalle County Station Unit 2 Technical Specifications, Bases Figure B3/4 3-1, "Reactor Vessel Water Level," Amendment No. 33.

18) General Electric Drawing, "Reactor Core Isolation Coolant Systems', Drawing No. 761E205AA, Rev. 3, 3/7/77.

19) Commonwealth Edison Company, LaSalle County Station Unit 1 Technical Specifications, Section 3.6.2.1, "Suppression Chamber Limiting Condition for Operation," Amendment No. 67.

TABLE 1

LASALLE STATION EVENT LOGIC

Four Hour Station Blackout Evaluation

System or Event	Case 1	Case 2
Main Steam (Isolation)	t=3.5 sec*	t=3.5 sec*
Feedwater (Isolation)	t=0.0 sec	t=0.0 sec
Reactor Power	Scram t=0	Scram t=0
RHR in Pool Cooling	Not Used	Not Used**
RPV Cooling System	RCIC on @t=51 sec. Cyclic Operation on RPV Level	HPCS on @t=33 sec Cyclic Operation on RPV level

*Table 6.2-4 of Ref. 2
**Started at 4 hours 15 minutes

TABLE 2

LASALLE PLANT SPECIFIC DATA FOR STATION BLACKOUT SCENARIO

Reactor and Associated System Specifications

Reactor Core Power (100% rated = 3323 MW)	11,338. MBtu/hr
Reactor Volume	2.335×10^4 ft^3
Initial RPV Liquid Mass	6.090×10^5 lbm
Initial RPV Vapor Mass	2.361×10^4 lbm
Rated Turbine Flow (@100% full power)	4018. lbm/sec
Initial RPV Pressure	1040 psia
RPV Heat Structure Mass	3.055×10^6 lbm
RPV Heat Structure Specific Heat	0.111 Btu/lbm-°F
RPV Heat Structure Area	10,000 ft^2
RPV Heat Structure Heat Transfer Coefficient	1000 Btu/hr-ft^2-°F

RPV Liquid Level Control Specifications

RPV Cross-Sectional Area	334.8 ft^2
Initial Void Fraction Below Liquid Level	.1200
Liquid Level 2	-50.0"
Liquid Level 8	+55.5"
Initial Liquid Level	+40.5"

(References 11 & 16)

TABLE 2 (Cont'd)

LASALLE PLANT SPECIFIC DATA FOR STATION BLACKOUT SCENARIO

RCIC System Specifications (Reference 18)

Delay Time for Initial RCIC Flow: 30 second following Startup Signal

RPV Pressure (psia)	RCIC Pump Mass Flow Rate (gpm)	RCIC Pump Mass Flow Rate (lbm/s)*	RCIC Turbine Mass Flow Rate (lbm/hr)	RCIC Turbine Mass Flow Rate (lbm/s)
0.	0.	0.	0.	0.
164.	0.	0.	0.	0.
165.	600.	80.3	8250	2.3
1173.	600.	80.3	27,250	7.6
2000.	600.	80.3	27,250	7.6

*Using specific volume of 0.01664 ft^3/lbm at 200°F

HPCS System Specifications (Reference 4 and 11)

Delay Time for Initial HPCS Flow: 30 second following Startup Signal.

RPV Pressure (psia)	HPCS Pump mass Flow Rate (gpm)	(lbm/sec)
15.45	6796	940
2[illegible]5.45	6196	857
515.55	5070	701
815.45	3774	522
1145.45	1611	222
1175.45	1339	185

TABLE 2 (Cont'd)

LASALLE PLANT SPECIFIC DATA FOR STATION BLACKOUT SCENARIO

Suppression Pool and Associated System Specifications (Reference 4)

Initial Pool Water Mass	7.984×10^6 lbm
Initial Pool Temperature	105°F
Service Water Temperature	105°F
RHR-HX Effectiveness	0.372
RHR Mass Flow Rate-Pool Cooling (1 Train)	1036. lbm/sec
Pool Heat Structure Surface Area	46350. ft^2
Pool Heat Structure Mass	1,043,000 lbm
Overall Heat Transfer Coefficient	100. Btu/(hr-ft^2-°F)
Pool Structure Specific Heat	0.111 Btu/(lbm-°F)

TABLE 2 (Cont'd)

LASALLE PLANT SPECIFIC DATA FOR STATION BLACKOUT SCENARIO

S/RV System Specifications (Reference 4)

Number of Automatically Operating S/RV's	18
SRV Seat Area (1 Valve)*	13.61 in^2
SRV Loss Coefficient	1.0
SRV Reseat Differential Pressure***	1 valve at 120 psig 1 valve at 110 psig 16 valves at 100 psig
SRV Relief Setpoints	2 valves at 1091. psia** [illegible] valves at 1101. psia [illegible] valves at 1111. psia 4 valves at 1121. psia 4 valves at 1131. psia
Number of Operator Controlled S/RV's (RCIC Case)	1
Operator Controlled SRV Seat Area*	13.61 in^2
Operator Controlled SRV Loss Coefficient	1.0
Operator Controlled SRV Reseat Differential Pres.	5 psig
Operator Controlled SRV Relief Setpoint	172 psia

* 122.5% of ASME rated flow.
** 102' and 1061 psia for Low-Low Setpoint Logic
*** Per Reference 9, the reseat differential pressure varies between 50 and 100 psi.

TABLE 3

ANSI STANDARD POWER RATIO FOLLOWING SCRAM

Time after scram (sec)	Heat addition power ratio*/rated power
0.	1.0840
2.	0.5026
6.	0.6271
10.	0.5249
20.	0.2309
30.	0.1372
31.	0.1370
60.	0.0492
100.	0.0427
101.	0.0344
150.	0.0316
200.	0.0298
400.	0.0259
600.	0.0238
800.	0.0223
1000.	0.0209
1500.	0.0189
2000.	0.0184
4000.	0.0141
6000.	0.0124
8000.	0.0114
10000.	0.0106
15000	0.0094
20000.	0.0086

*This is a hybrid curve which uses GE data (see Table 3 of Reference 11) for conservatism for the first 100 seconds after scram. After 100 seconds, actual ANSI standard data was used (Reference 6).

TABLE 4

EVENT SEQUENCE FOR RCIC/HPCS CASES

Case 1 (RCIC)	Time (sec)
Start of Transient and MSIV closure, Scram, FW Isolation	0.0
MSIV closure complete	3.5
Initial S/RV operation on high reactor pressure	0-130
Reactor pressure cycling between 935 and 1021 psia using one S/RV	130 - 434
Manual depressurization to 167 psia	434 - 6487
RCIC in continuous operation	51 - 10942
Operator controlled S/RV cycling between 167 and 172 psia	6576 - 15300
Suppression pool temperature reaches 213.1°F	14400
Suppression pool temperature reaches 217.1°F and cooling of the RPV at 100°F/hr and suppression pool with RHR occurs	15300

TABLE 4 (Cont'd)

Case 2 (HPCS)	Time (sec)
Start of Transient and MSIV closure, Scram, FW Isolation	0.0
MSIV closure complete	3.5
Vessel level falls to level 2	21
S/RV operation on high reactor pressure	0-84
Reactor pressure cycling between 911 and 1021 psia using one SRV	84-1424
Manual depressurization to 24.1 psia	1424-12561
HPCS in cyclic operation between L2 and L8	1424-21600
Suppression pool temperature reaches 230.3°F	14400
Suppression pool temeprature reaches 234.2°F and 2 RHR trains start in pool cooling mode	15300

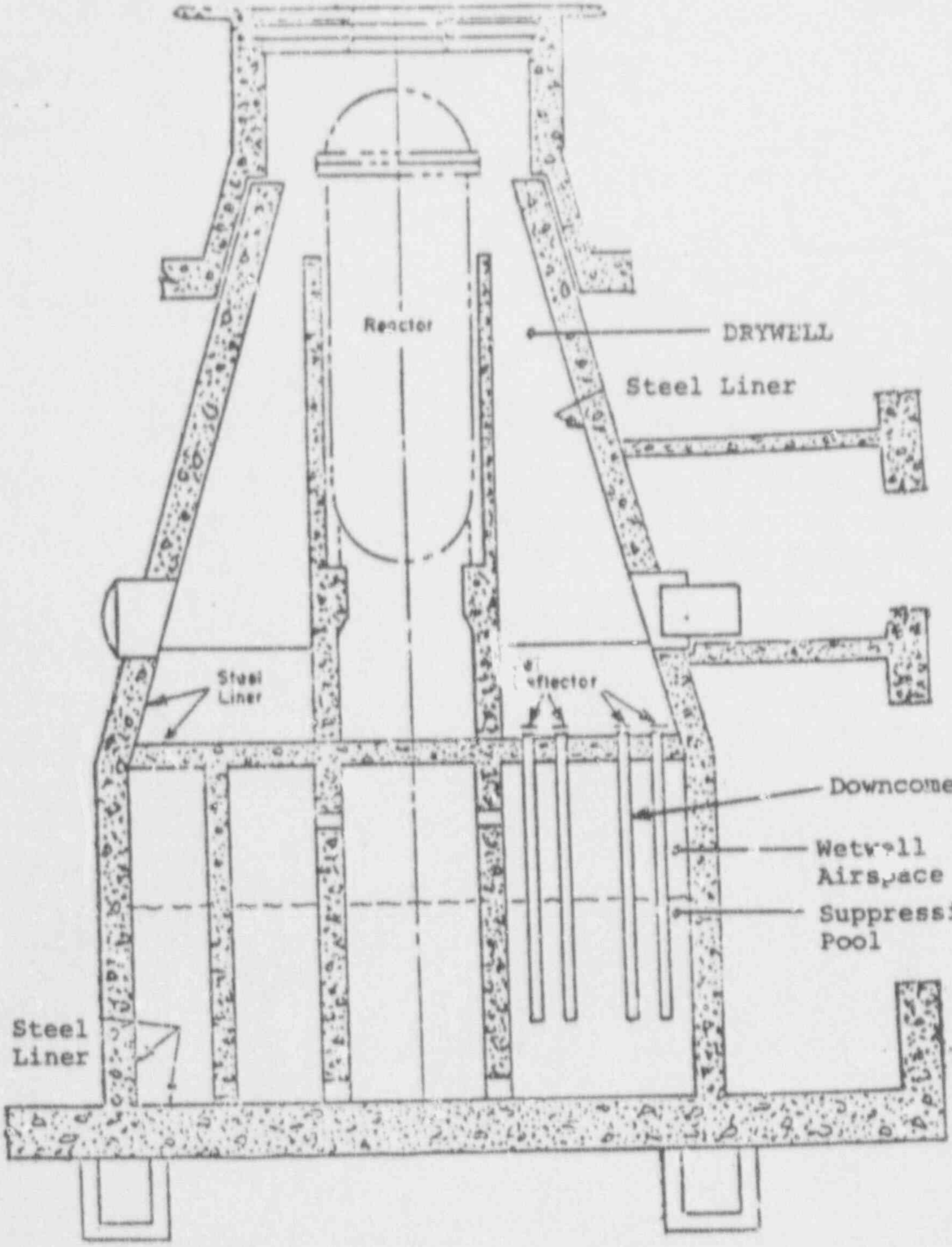

Figure 1: BWR Mark II Pressure Suppression Containment System

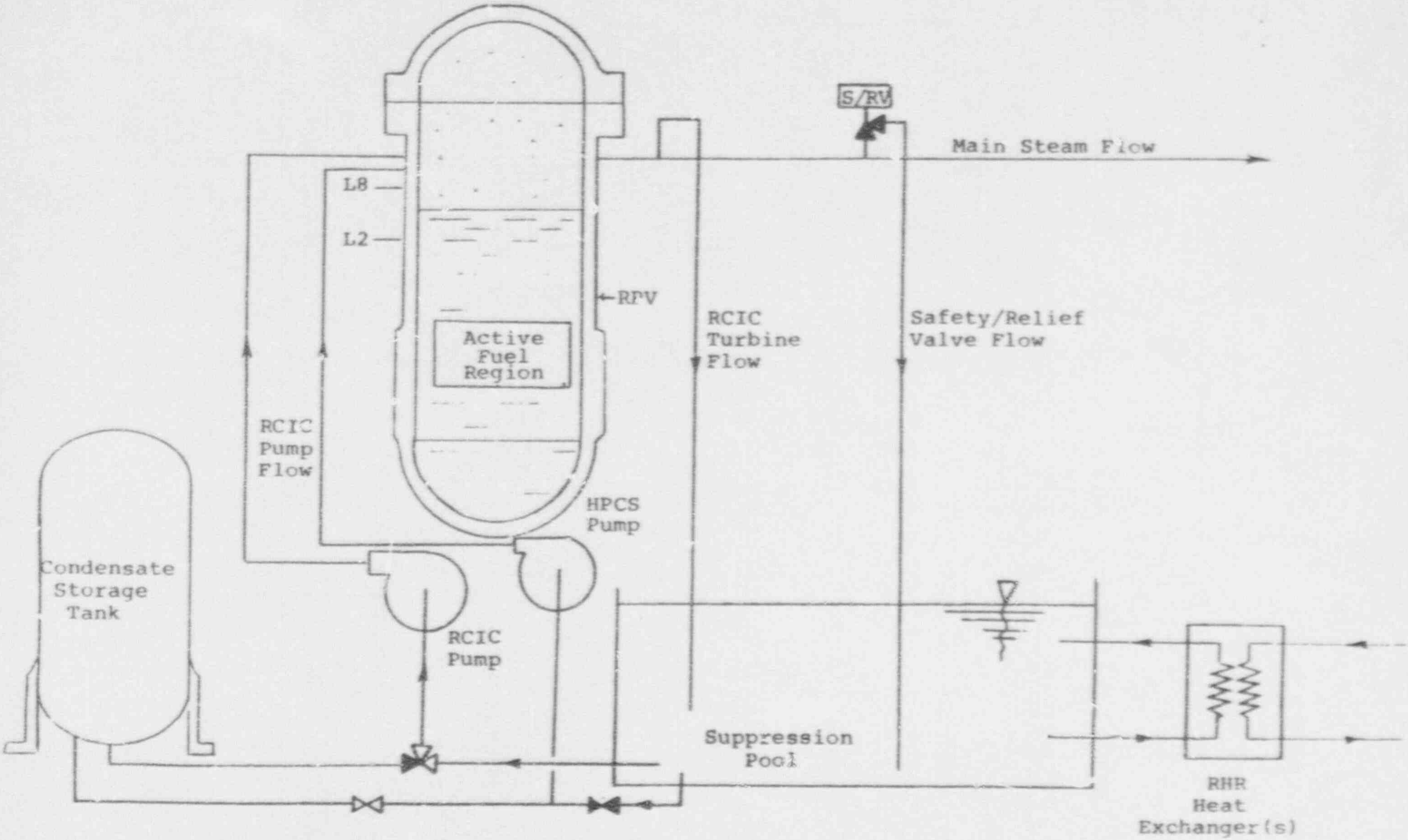

FIGURE 2: General Schematic of a BWR RPV and Pressure Suppression Pool

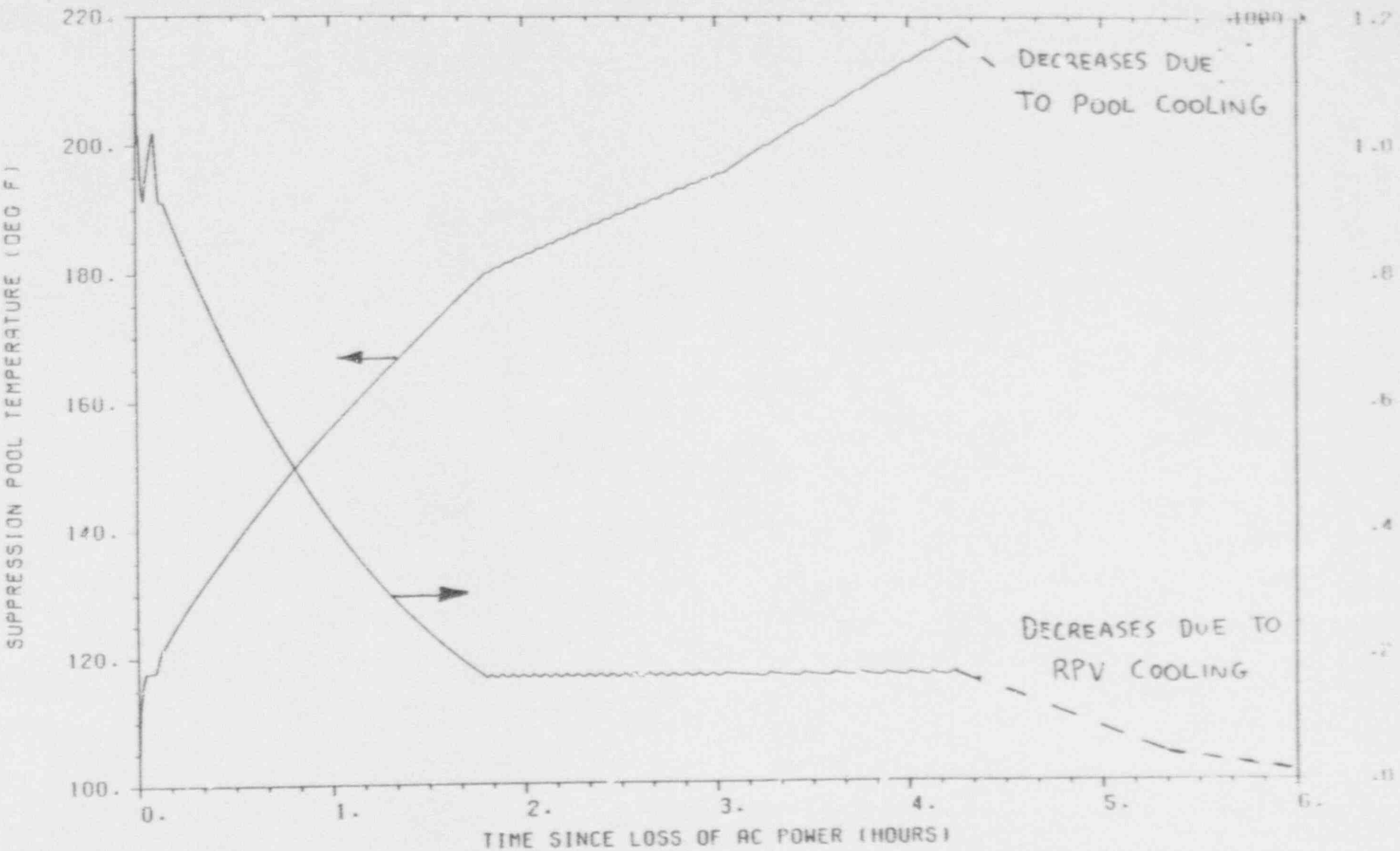

FIGURE 3: CASE 1 - SBO WITH RCIC COOLING (MAX POOL TEMP CASE)

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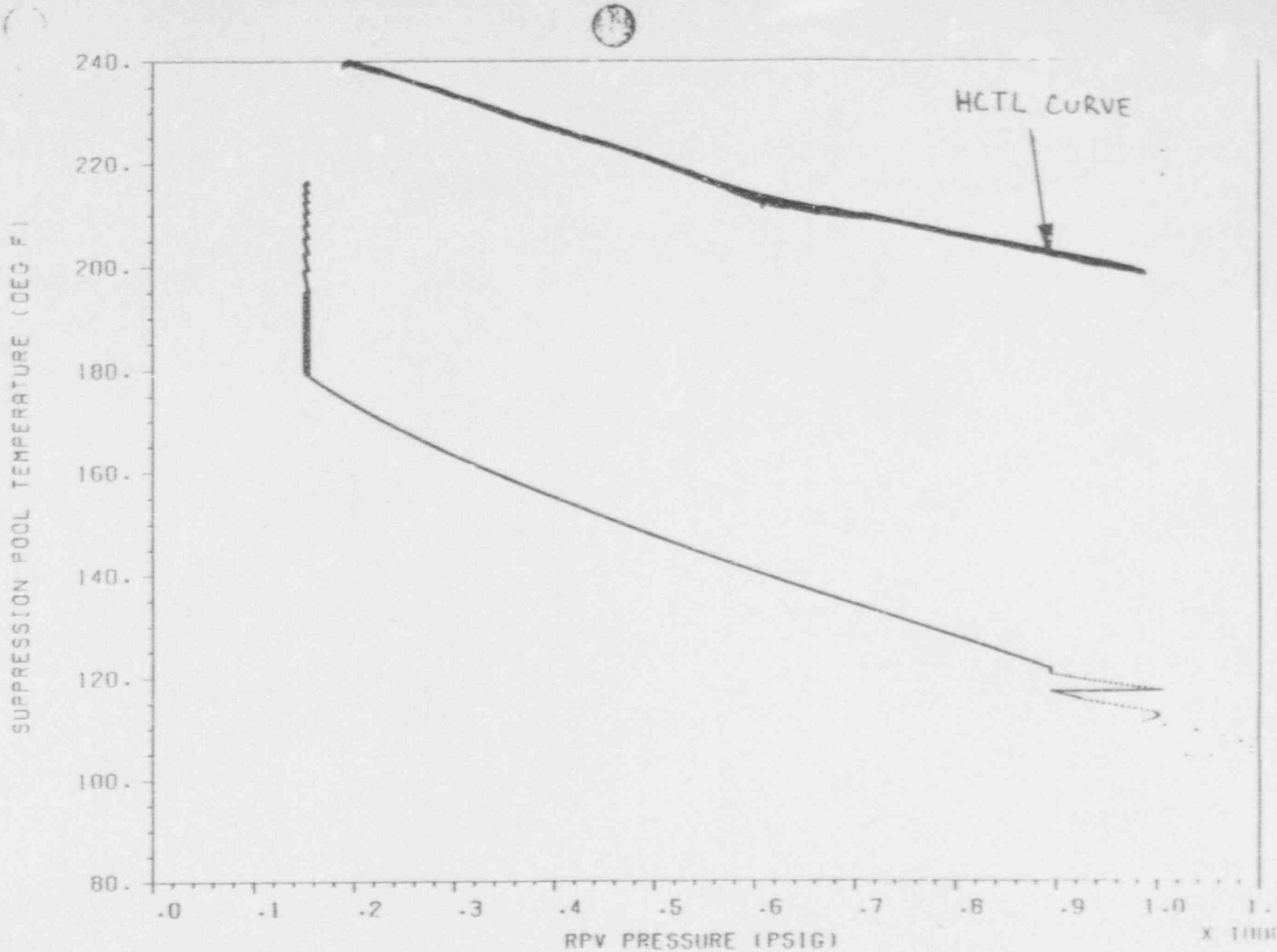

FIGURE 4: CASE1 - SBO WITH RCIC COOLING (MAX POOL TEMP CASE)

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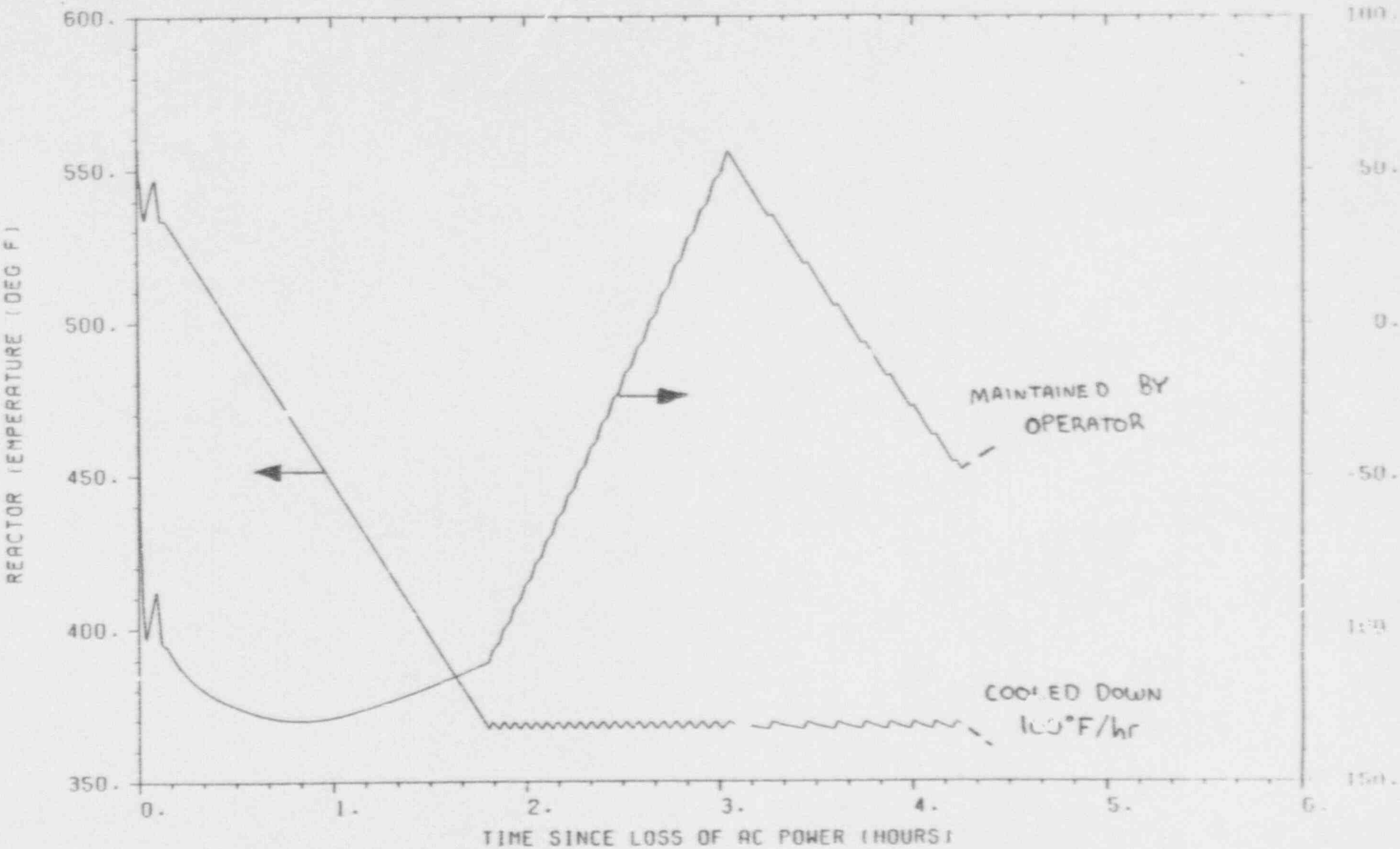

FIGURE 5: CASE1 - SBO WITH RCIC COOLING (MAX POOL TEMP CASE)

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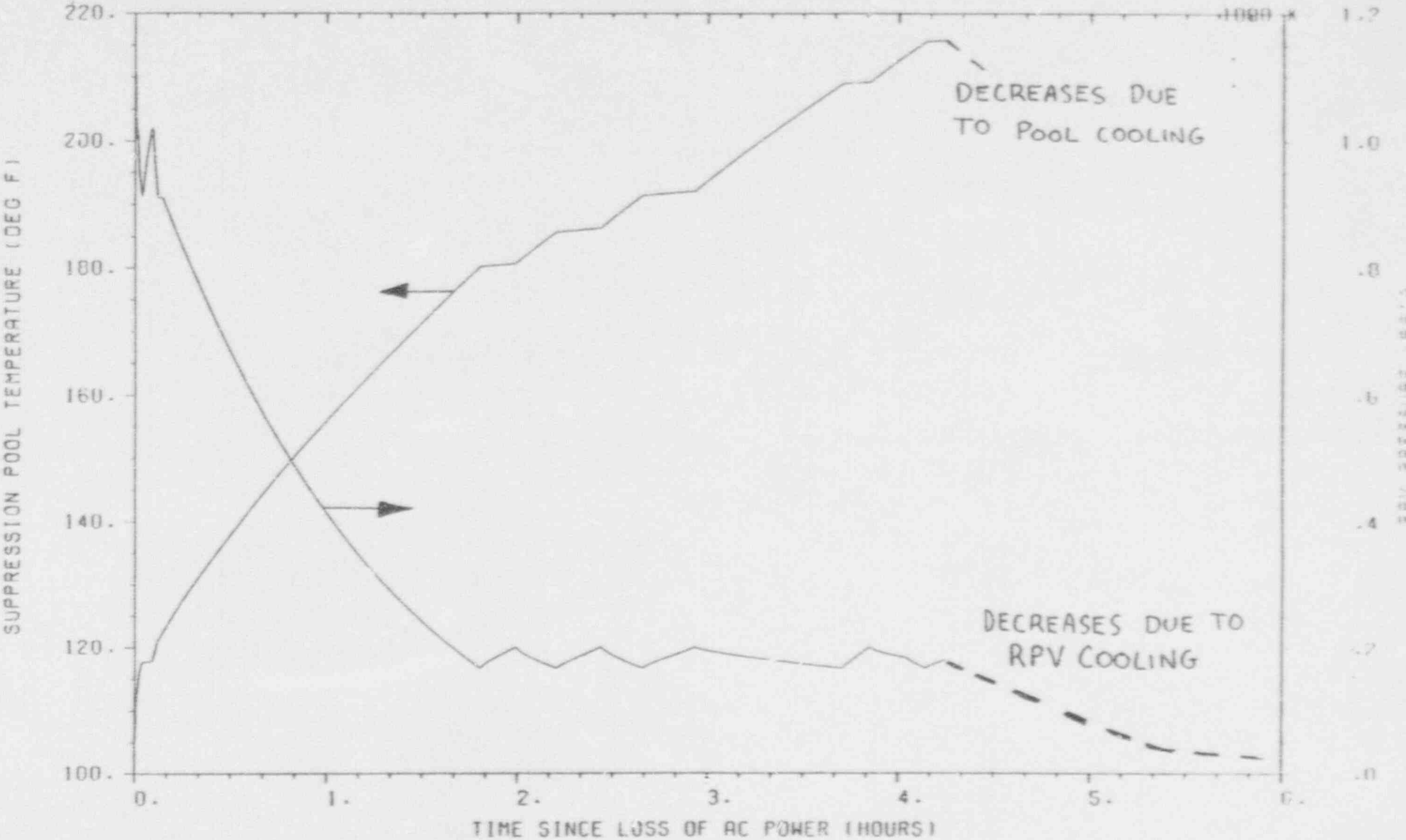

FIGURE 6: CASE 1A - SBO WITH RCIC COOLING (OPERATOR CASE)

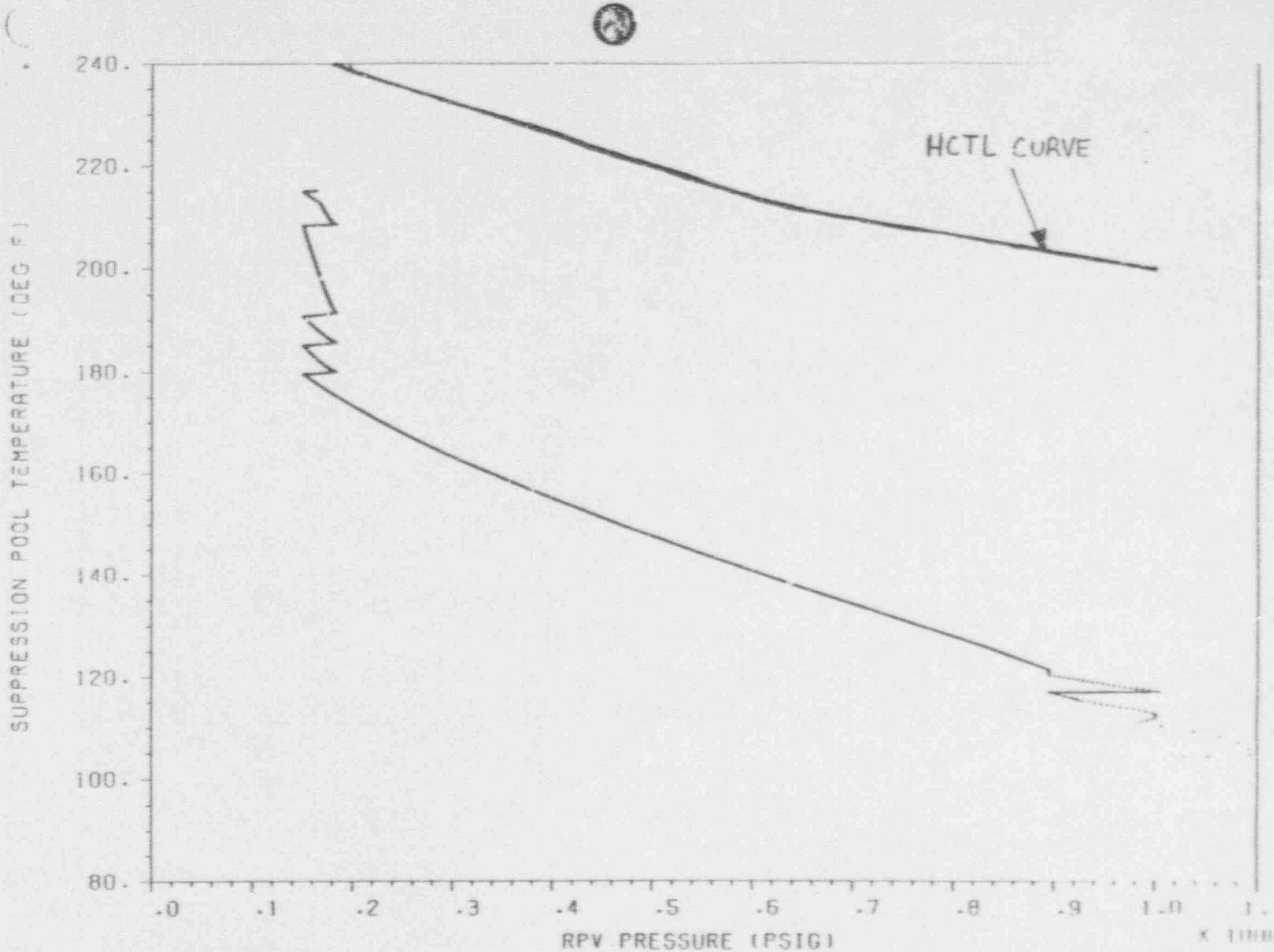

FIGURE 7: CASE1 - SBO WITH RCIC COOLING (OPERATOR CASE)

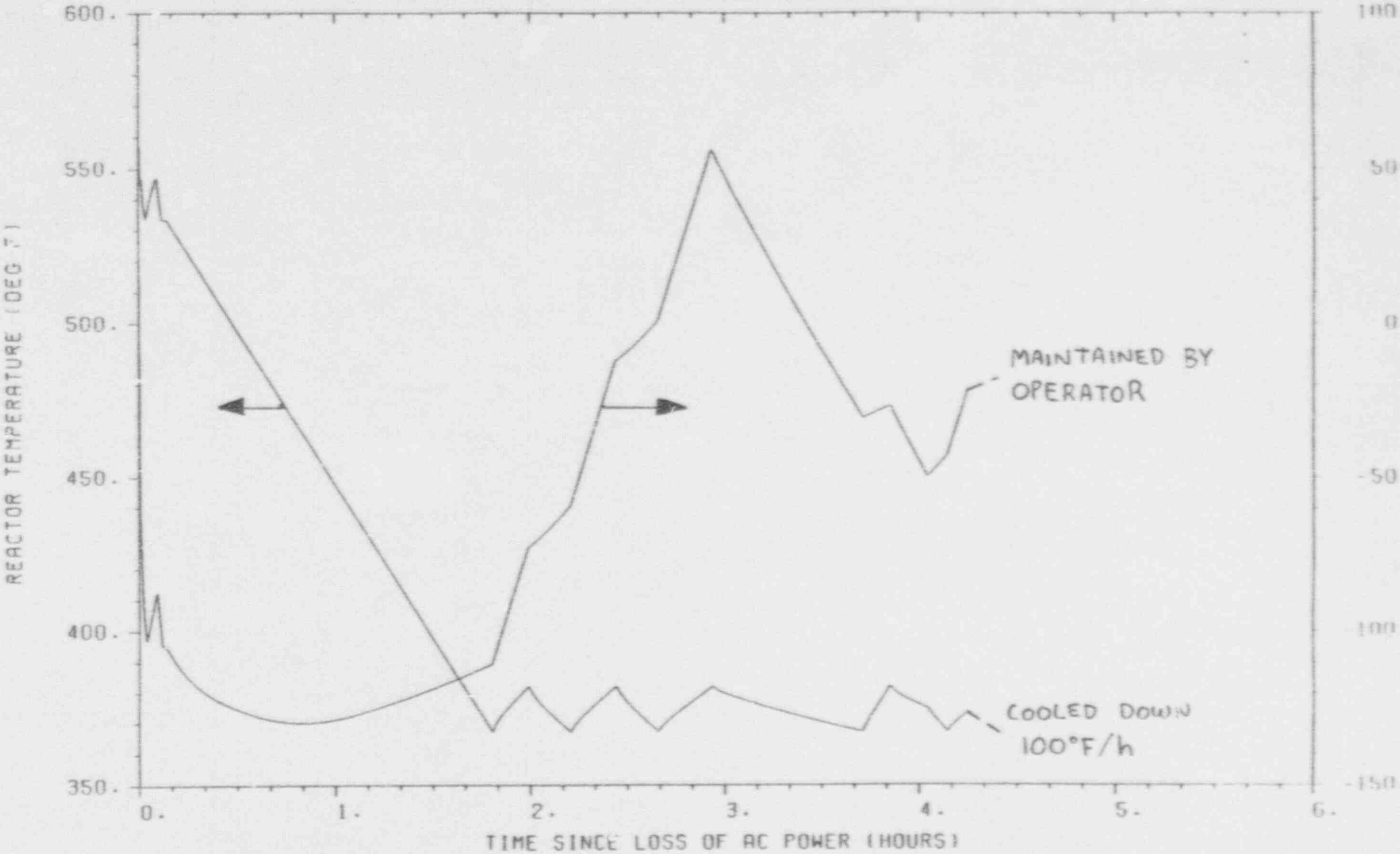

FIGURE 8: CASE1 - SBO WITH RCIC COOLING (OPERATOR CASE)

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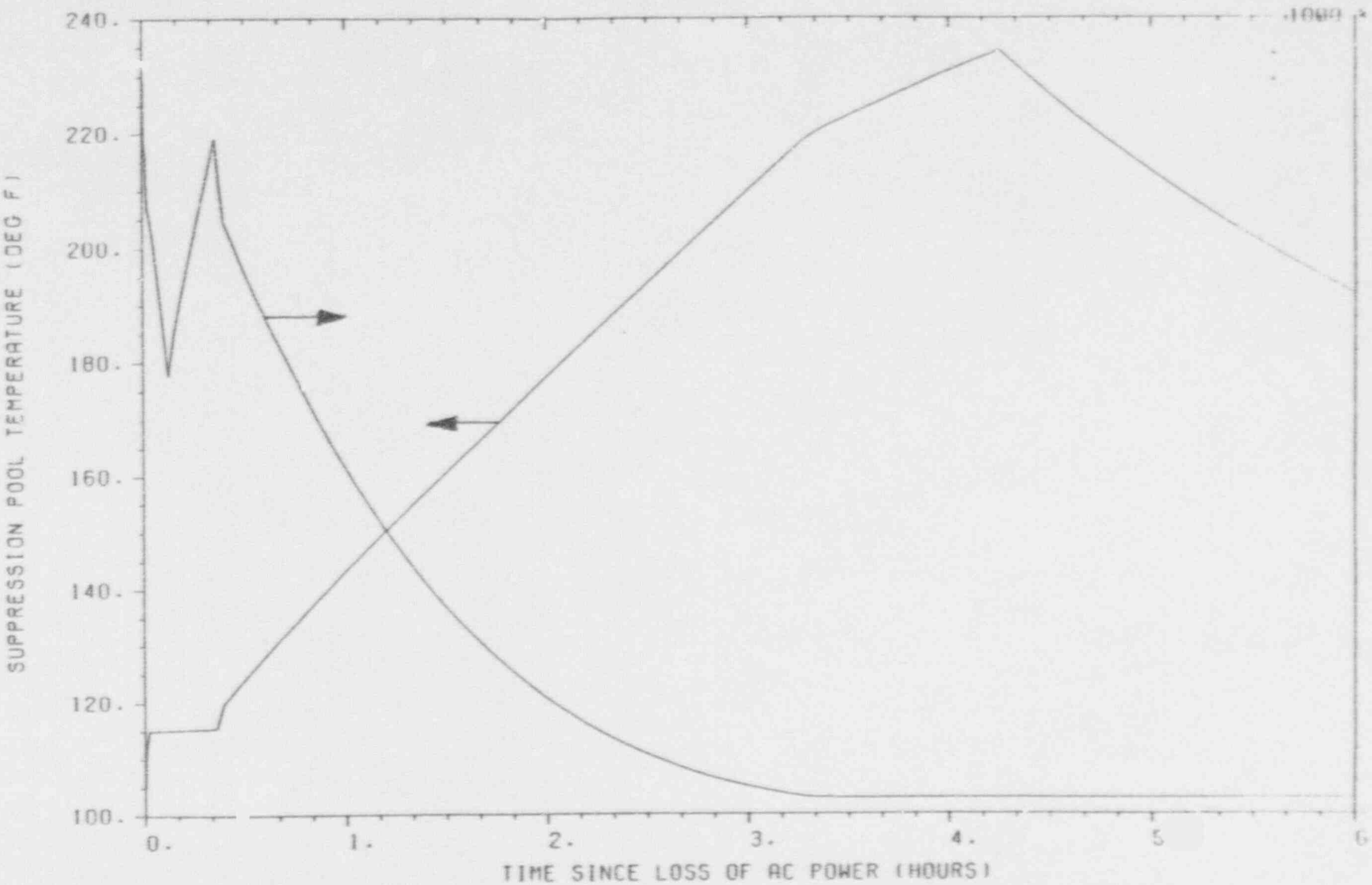

FIGURE 9: CASE 2 - SBO WITH HPCS COOLING

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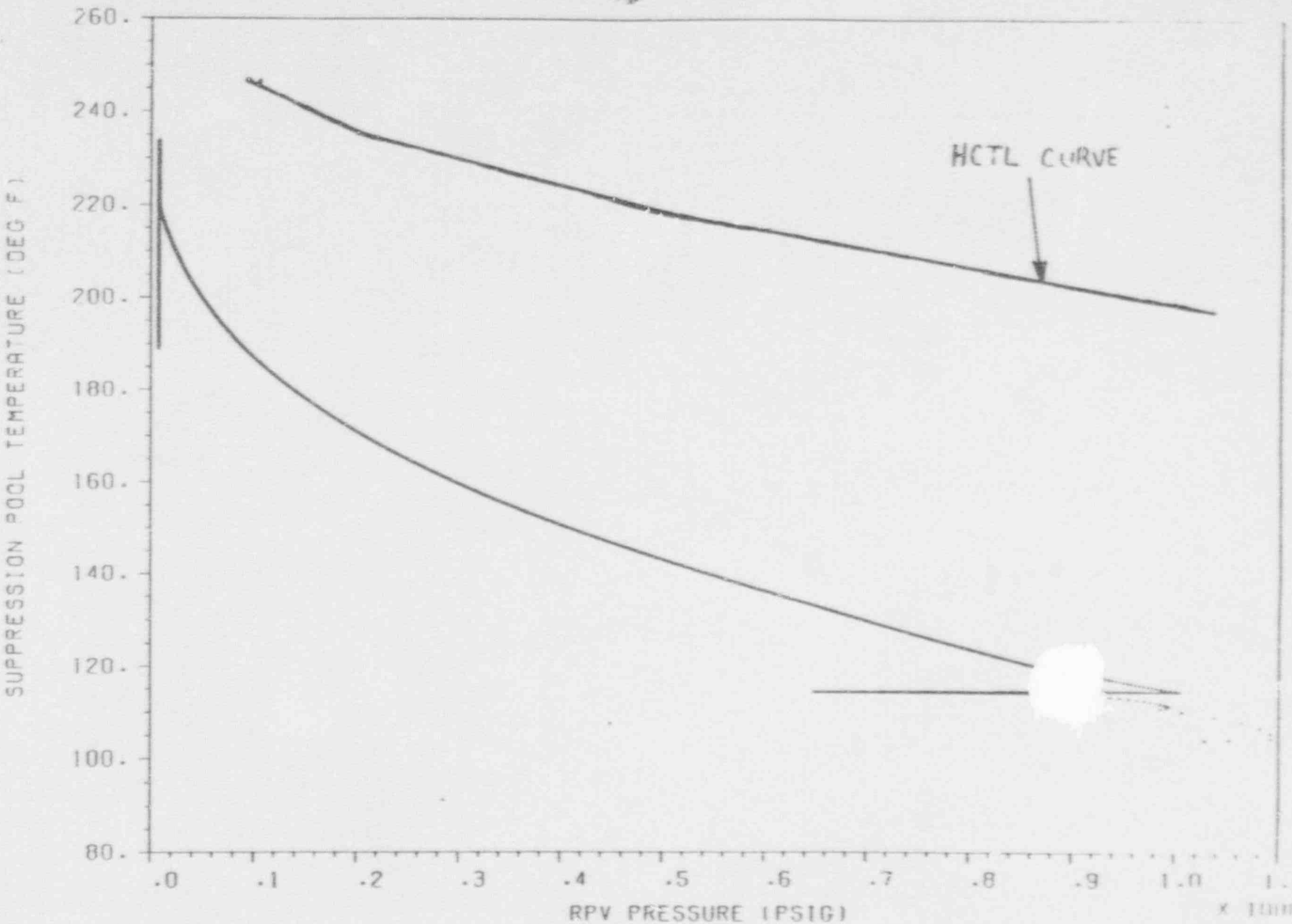

FIGURE 10: CASE2 - SBO WITH HPCS COOLING

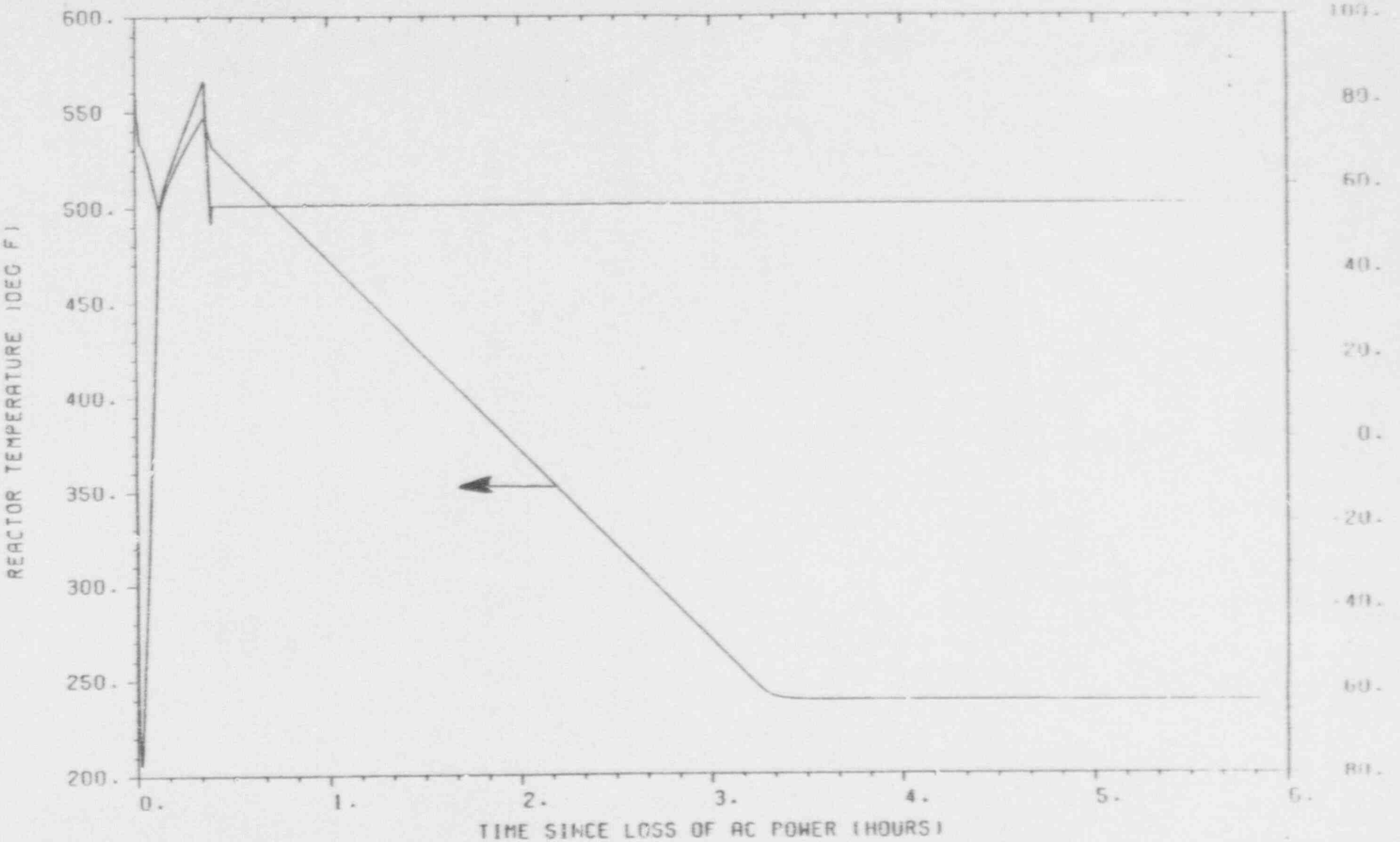

FIGURE 11: CASE2 - SBO WITH HPCS COOLING

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REVIEW METHOD SHEET

This calculation has been reviewed by me according to the method(s) checked below.

1. Computer Aided Calculations

a		Review to determine that the computer program(s) has been validated and documented, is [illegible] problem being analyzed, and that the calculation contains all necessary [illegible] reconstruction at a later date.
b	✓	Review [illegible] that the input data as specified for program execution is consist[illegible] input, correctly defines the problem for the computer algorithm [illegible] accurate to produce results within any numerical limitations of the program.
c	✓	Review [illegible] that the results obtained from the program are correct and within stated [illegible] and limitations of the program and are consistent with the input.
d		Review validation documentation for temporary changes to listed, or developmental, or unique single application programs, to assure that methods used adequately validate the program for the intended application.
e		Review code input only, since the computer program has sufficient history of use at Sargent & Lundy in similar calculations.
f		Review arithmetic necessary to prepare code input data.
g		Other:

2 Hand Prepared Design Calculations

a		Detailed review of the original calculations.
b		Review by an alternate, simplified, or approximate method of calculation.
c		Review of a representative sample of repetitive calculations.
d		Review of the calculation against a similar calculation previously performed.

3. Revisions

a		Editorial changes only.
b		Elimination of unapproved input data without altering calculated results.
c	✓	Other: This revision was made to add recovery techniques to cool the RPV and/or the suppression pool. Some conservatism was also removed.

4. Other

Reviewer	Thomas W. Kujawski Thomas W Kujawski	Date	5-11-92

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- APPENDIX A -

COMPUTER OUTPUT