NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/85

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
McGuire Nculear Station, Unit 1	0 5 0 0 0 3 6 9	1 OF 0 9

TITLE (4) Effect on Containment Environment of a Superheated Steam Blowdown following a Steamline Rupture.

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
0 1	1 2	8 4	8 4	— 0 0 8 —	0 0	0 4	0 6	8 4	McGuire Unit 2	0 5 0 0 0 3 7 0
										0 5 0 0 0

OPERATING MODE (9): 1

POWER LEVEL (10): 0 9 4

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check one or more of the following)* (11)

20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	X OTHER *(Specify in Abstract below and in Text, NRC Form 366A)*
20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	Information

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER	
	AREA CODE	
Phillip B. Nardoci, Licensing Engineer	7 0 4	3 7 3 - 7 4 3 2

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES *(If yes, complete EXPECTED SUBMISSION DATE)*	X NO				

ABSTRACT *(Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines)* (16)

During NRC review of the Catawba FSAR, it was noted that several model changes were made to the Westinghouse MARVEL code used to calculate the mass and energy release for postulated main steamline breaks. One of these changes, accounting for additional heat transfer to steam during tube bundle uncovery in the steam generator (i.e. superheated steam), could have significant impact on the containment temperature response for ice condenser containments. It was estimated that the peak temperature response of the containment lower compartment may exceed the previously calculated temperature profile, with an attendant potential impact on equipment environmental qualification.

Although not reportable as an LER pursuant to §50.73, this report is submitted for information only.

A limited best estimate analysis was performed of the effect on containment environment of a superheated steam blowdown following a postulated steamline rupture for McGuire Nuclear Station. The resulting peak containment temperature of 311°F is lower than the original FSAR peak containment temperature of 326°F, and therefore the environmental qualification of safety related equipment inside containment is not affected.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

During NRC (containment systems branch) review of the Catawba FSAR , it was noted that several model changes were made to the Westinghouse MARVEL code used to calculate the mass and energy release for postulated main steam line breaks (MSLB). One of these changes, accounting for additional heat transfer to steam during tube bundle uncovery in the steam generator (i.e. superheated steam), could have significant impact on the containment temperature response for Ice Condenser Containments. Based on the data from a sensitivity study performed by Westinghouse (Westinghouse Letter NS-EPR-2563 from E. Rahe, Jr. to J. Miller (NRC) dated February 17, 1982), it was estimated that the peak containment temperature response of the containment lower compartment may exceed the temperature profile previously calculated, with an attendant potential impact on equipment environmental qualification. Therefore, the NRC required (Ref. Catawba Safety Evaluation Report, February 1983, Page 6-9) that a refined main steamline break analysis be done, taking into account the change in the heat transfer model, to determine the adequacy of the temperature profile in the containment lower compartment. Note that this issue only applies to split ruptures. Double-ended ruptures are not impacted by tube uncovery due to entrainment in the blowdown and re-evaporation of the condensate in the containment.

Since McGuire is an Ice Condenser Containment Plant similar to Catawba, a best estimate evaluation was performed of the effect on containment environment of a superheated steam blowdown following a postulated steamline rupture for McGuire. For this study, a modified version of the LOFTRAN code was used to calculate the superheat steam blowdown. Briefly, in the revised model, the additional heat transfer occurring between the primary side and secondary side in the region of the uncovered tubes is added to the saturated steam enthalpy to obtain a total exit enthalpy including superheat. In effect, this model assumes that all heat transfer occurring across uncovered tubes results in superheated steam.

Table 1 is a listing of a representative mass/energy release for a 0.6 ft^2 split break starting at 102% power as calculated by the modified LOFTRAN. Mass and energy releases for superheat steam are provided. Figures 1 thru 4 present the transient results and include graphs of saturated steam temperatures and enthalpies for comparison purposes. The major differences in the assumptions used for this analysis as opposed to the FSAR are:

1. Nominal initial conditions on steam generator inventory

2. Maximum auxiliary feedwater flows

3. Best Estimate ANS Decay Heat

4. Best Estimate core characteristics with no strck rod

5. Nominal performance of safeguards systems

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LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

The containment results were calculated using a modified version of the LOTIC-III ice containment code which accounts for (1) convective heat transfer due to the superheat atmosphere in the containment, (2) best estimate Tagami condensation heat transfer, and heat transfer to ice condenser drain flow.

The best estimate condensate heat transfer was incorporated by accounting for the large steam to air mass ratio existing in the ice containment lower compartment. Since ice condenser plants evacuate the air volume to the upper compartment early in the transient, a nearly pure steam environment exists in the lower compartment promoting condensate heat transfer to the heat sinks. A best estimate maximum Tagami stagnation heat transfer coefficient of 602 Btu/hr ft^2 °F was used (as compared to the FSAR value of 72 Btu/hr ft^2 °F).

The original LOTIC III model did not consider any additional heat transfer to the heat sinks above the saturation temperature. This superheat convection heat transfer will become important when the surface temperature gets close to the saturation temperature. To account for this additional heat transfer, an additional term was added to the wall heat transfer correlation. This term is $h_{conv}A\ (T_{bulk}-T_{sat})$ where h_{conv} varies from 2 BTU/hr-ft^2 °F to 1 BTU/hr-ft^2 °F.

Utilizing this better estimate heat transfer results in a more rapid rise in the heat sink temperatures. When the heat sinks reach the saturation temperature of the containment, heat transfer to the heat sinks is primarily by superheat convection which does not condense the vapor in the atmosphere. The retention of vapor lowers the net superheat in the atmosphere. Hence, heat removal by primarily superheat convection results in lower peak temperatures than would be predicted with the standard LOTIC-III heat transfer model.

In addition to the changes in the wall heat transfer model, heat removal by water draining from the ice condenser was also modeled. In the drain model, it was assumed that condensation occurs on the surface of the stream and that the stream is well mixed. This model does not allow for any evaporation of the drain water and therefore is not considered as a spray.

Figure 5 shows the lower compartment temperature using the modified LOTIC-III code with just lower compartment heat sinks (excluding the dead-ended heat sinks).

The peak containment temperature is 311°F which is applicable for the lower compartment and conservative for the dead-ended compartment.

In summary, the peak containment temperature reached in this best estimate analysis is comparable to the original FSAR peak containment temperature of 326°F, and therefore the environmental qualification of safety related equipment inside containment is not affected.

The incorporation of superheated steam generator blowdown into the main steamline break containment analysis results in higher calculated temperatures. However, inclusion of the ice condenser drains as a heat sink tends to offset this effect. Thus, the current FSAR Analysis adequately characterizes the containment response to postulated steamline breaks. Accordingly, the McGuire Nuclear Station steamline break analyses presented in the FSAR will not be revised.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

TABLE 1

McGuire .6 ft^2 Steamline Rupture- 102% Power
Best Estimate Blowdown With Superheated Steam- Auxiliary
Feedwater Flow Of 1687 gpm

TIME SEC	BREAK FLOW LB/SEC	ENTHALPY BTU/LB
0.	1277.	1190.
1.	1277.	1190.09
2.	1266.	1191.46
3.	1261.	1191.
4.	1251.	1191.
5.	1242.	1192.43
6.	1270.	1191.14
7.	1299.	1190.
8.	1326.	1189.
9.	1349.	1189.
10.	1326.	1189.
12.	1287.	1190.
15.	1222.	1192.
20.	1132.	1196.
30.	1010.	1199.
50.	794.1	1202.
100.	626.4	1204.
120.	593.4	1204.
140.	566.2	1204.
150.	550.1	1208.
155.	540.2	1209.
160.	530.1	1211.
165.	519.8	1213.
170.	509.1	1215.
175.	498.1	1216.
180.	486.7	1218.
190.	462.6	1222.
200.	441.3	1224.
210.	421.	1227.
220.	397.8	1230.
230.	371.7	1233.
250.	311.8	1241.
300.	161.9	1261.
350.	114.3	1266.
400.	109.2	1266.
450.	108.8	1264.
500.	108.7	1263.
550.	108.6	1261.
600.	108.6	1259.

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FIGURE 1

McGuire .6 ft^2 Steamline Rupture- 102% Power
Best Estimate Blowdown With Superheated Steam-Auxiliary
Feedwater Flow Of 1687 gpm

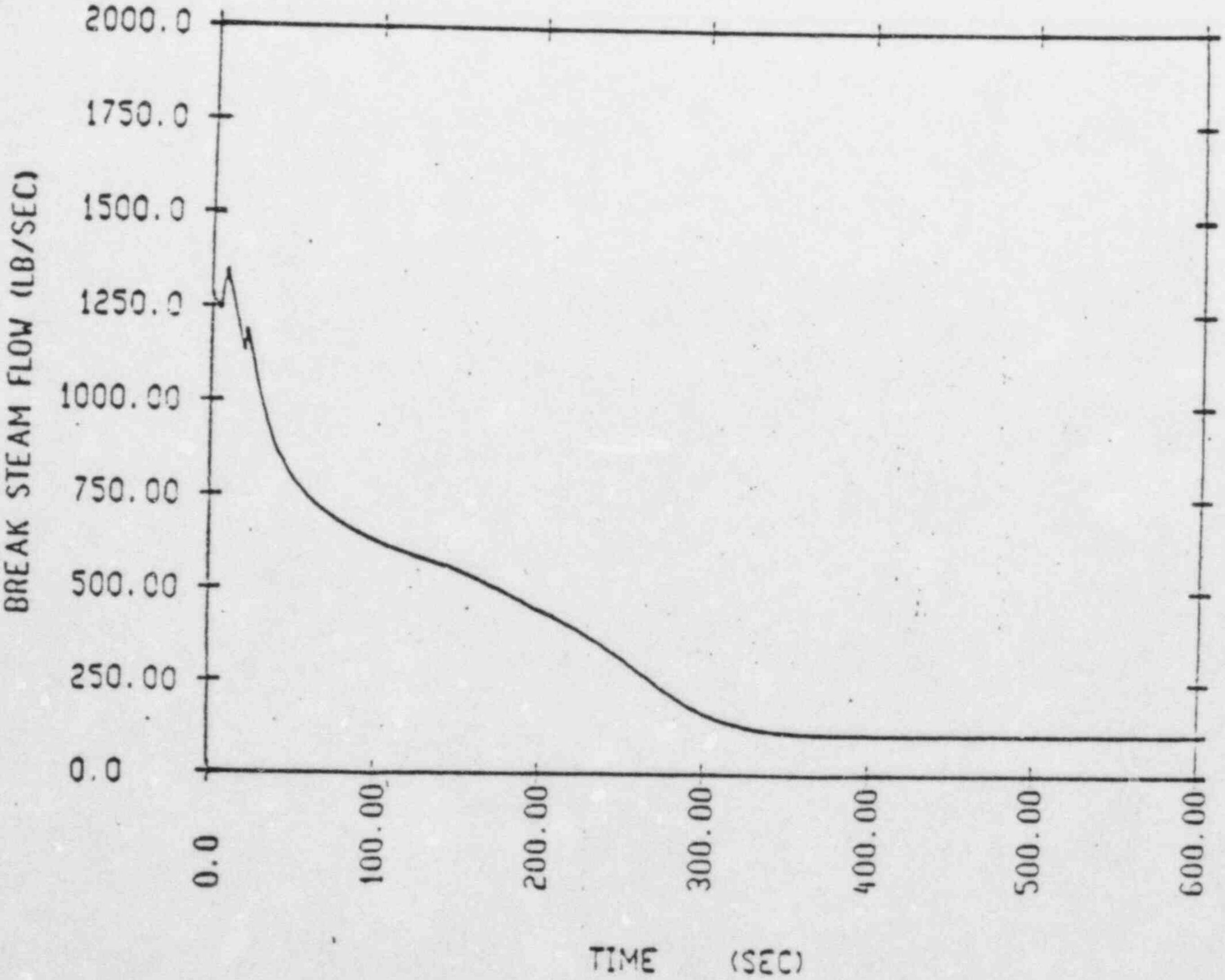

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FIGURE 2

McGuire .6 ft2 Steamline Rupture- 102% Power
Best Estimate Blowdown With Superheated Steam- Auxiliary
Feedwater Flow Of 1687 gpm

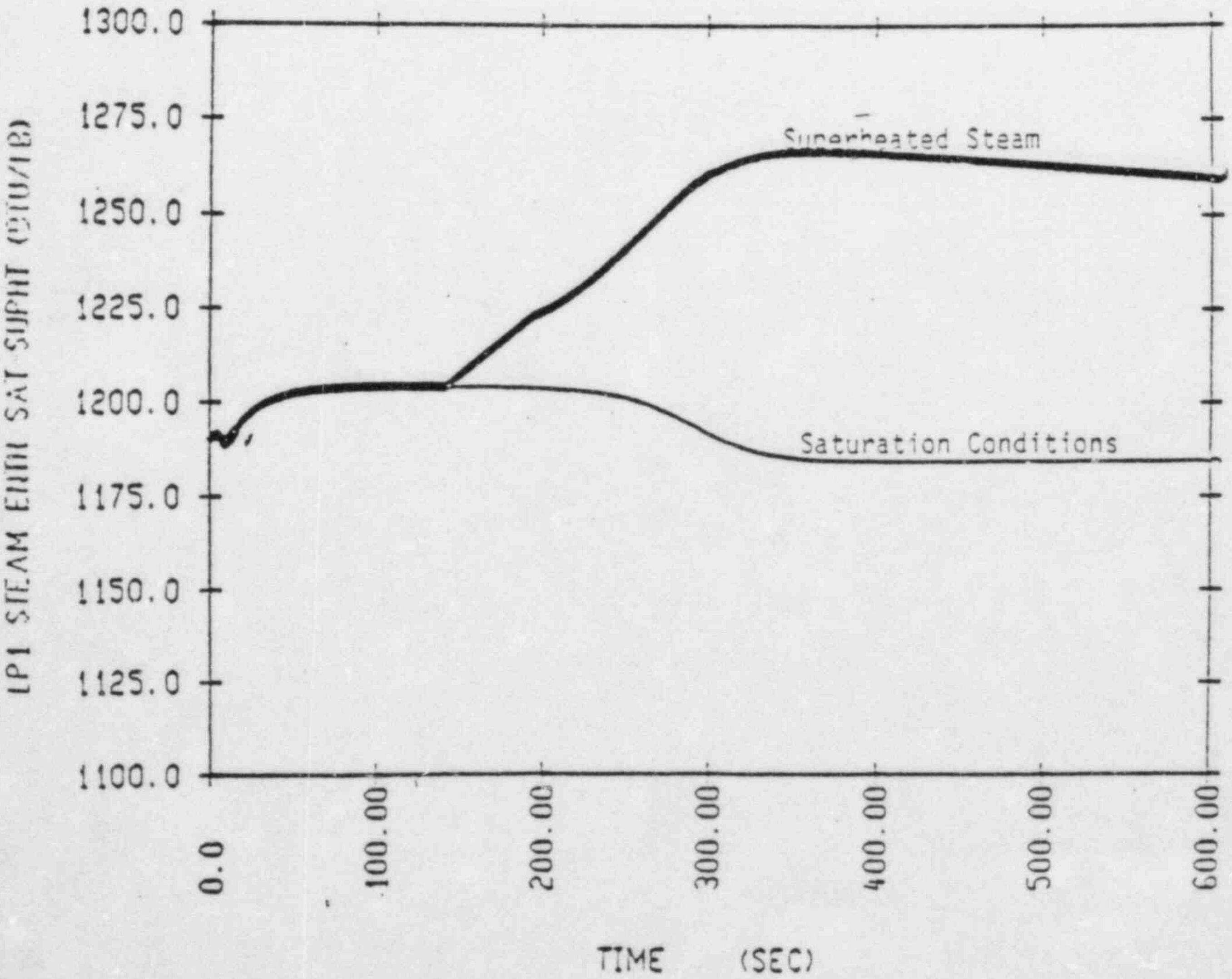

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FIGURE 3

McGuire .6 ft^2 Steamline Rupture- 102% Power
Best Estimate Blowdown With Superheated Steam- Auxiliary
Feedwater Flow Of 1687 gpm

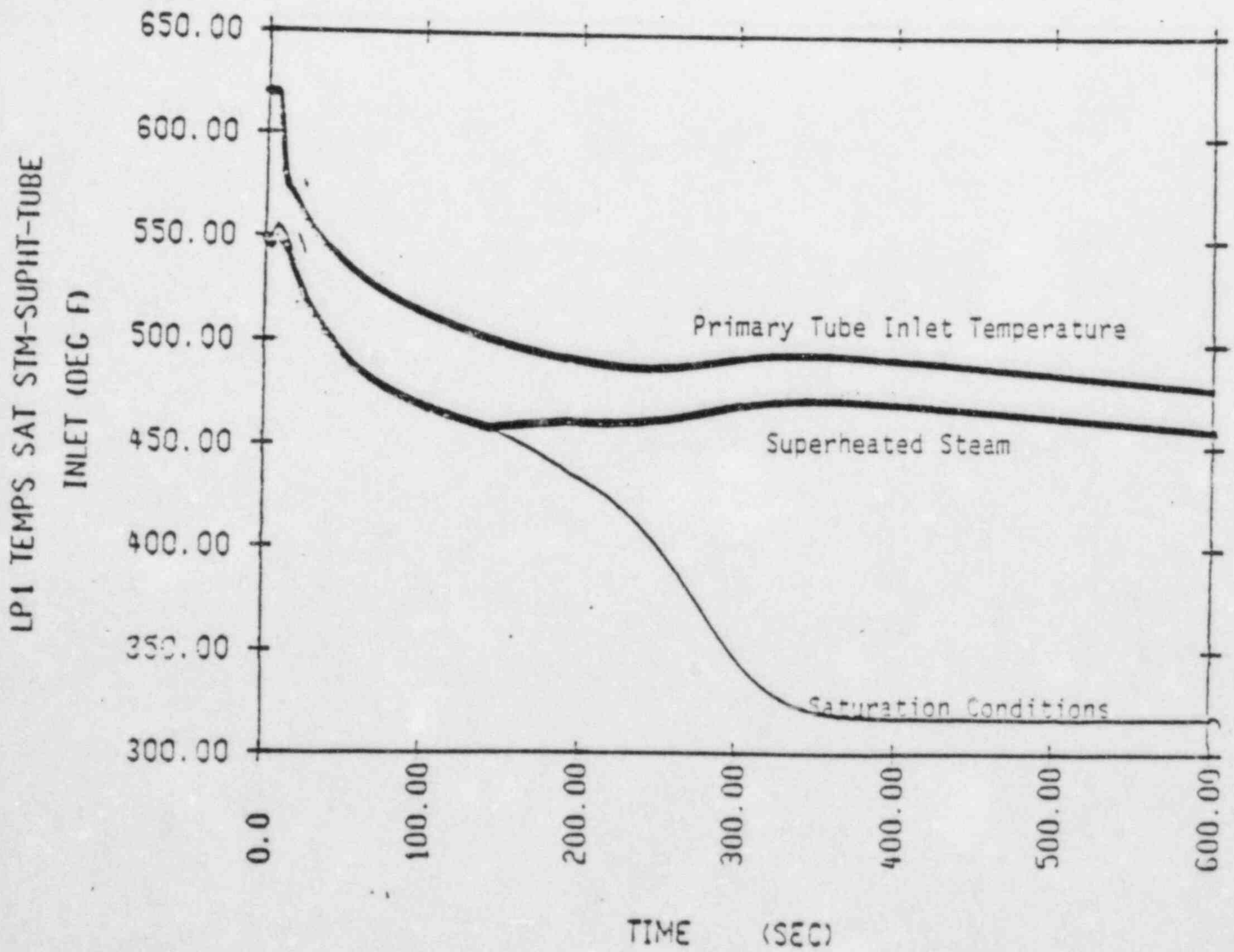

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FIGURE 4

McGuire .6 ft² Steamline Rupture- 102% Power
Best Estimate Blowdown With Superheated Steam- Auxiliary
Feedwater Flow Of 1687 gpm

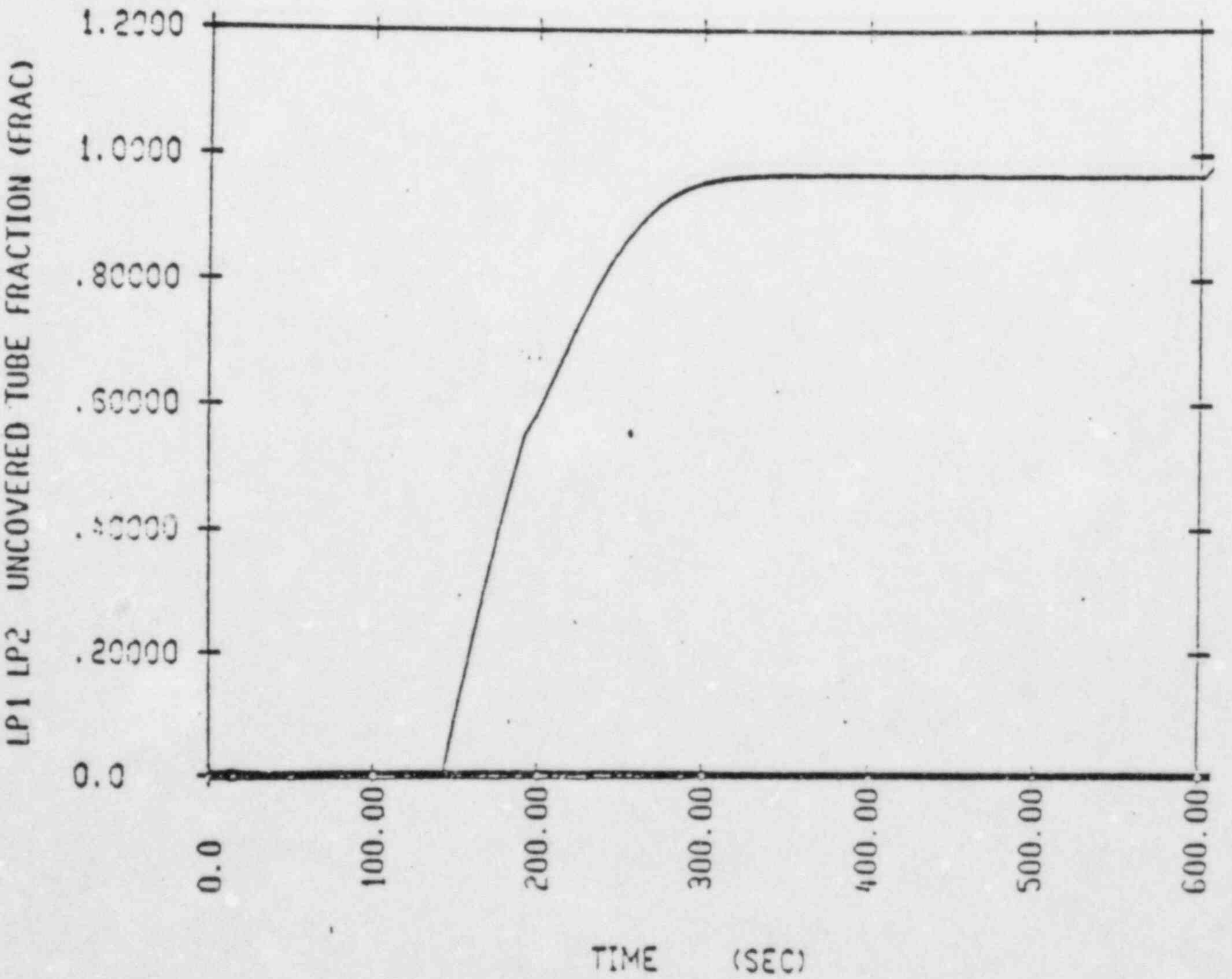

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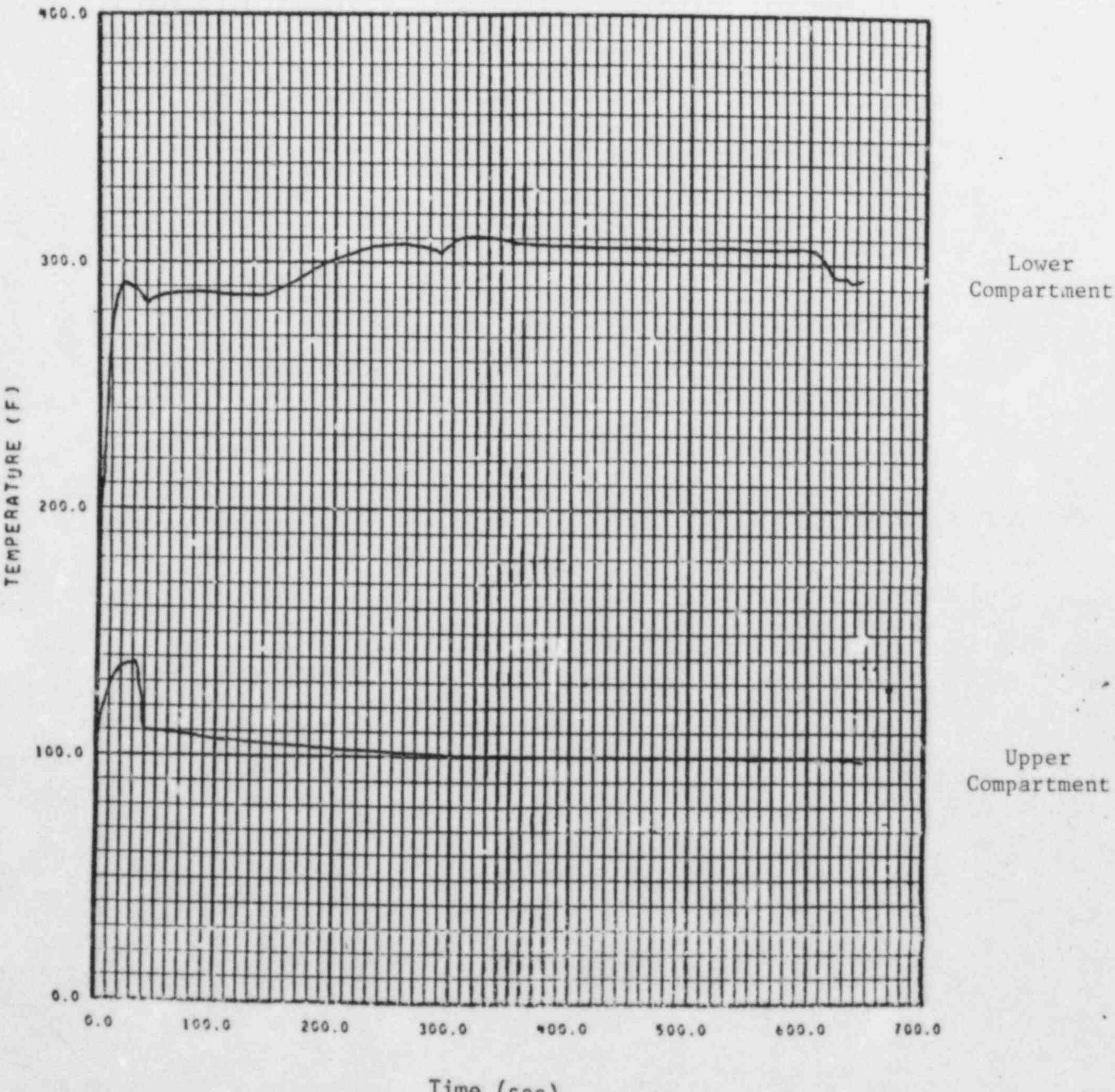
Figure 5
McGuire .6 ft^2 MSLB - 102% Power
Best Estimate Blowdown with Superheated Steam



Compartment Temperature

DUKE POWER COMPANY
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HAL B. TUCKER
VICE PRESIDENT
NUCLEAR PRODUCTION

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April 6, 1984

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Subject: McGuire Nuclear Station, Units 1 and 2
Docket Nos. 50-369 and 50-370
LER 369/84-08

Gentlemen:

Please find attached for your information Licensee Event Report 369/84-08 concerning the effect on containment environment of a superheated steam blowdown following a postulated main steamline break (MSLB) for McGuire Nuclear Station, Units 1 and 2. This concern was initially identified during NRC review of the Catawba FSAR. Although not reportable as an LER pursuant to 10 CFR 50.73, this report is being submitted for information only.

Very truly yours,

Hal B. Tucker

Hal. B. Tucker

PBN:glb

Attachment

cc: Mr. James P. O'Reilly, Regional Administrator
U. S. Nuclear Regulatory Commission
Region II
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30303

Records Center
Institute of Nuclear Power Operations
1100 Circle 75 Parkway, Suire 1500
Atlanta, Georgia 30339

Mr. W. T. Orders
NRC Resident Inspector
McGuire Nuclear Station

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