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DUKE POWER

April 9, 1990

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

Subject: Catawba Nuclear Station
Docket No. 50-413
LER 413/90-02, Rev. 1

Gentlemen:

Attached is Licensee Event Report 413/90-02, Revision 1, concerning TECHNICAL SPECIFICATION VIOLATION FOR CONTAINMENT AIR RETURN FAN BREAKER OPEN DUE TO INAPPROPRIATE ACTION.

This event was considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

Tony B. Owen
Station Manager

keb\LER-NRC.TBO

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1/1

NRC Form 366
(5-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Catawba Nuclear Station, Unit 1	0 5 0 0 0 4 1 3	1 OF 2 2

TITLE (4) Technical Specification Violation For Containment Air Return Fan Breaker Open Due To Inappropriate Action

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)
									N/A	0 5 0 0 0
0 1	0 3	9 0	9 0	0 0 2	0 1	0 4	0 3	9 0		0 5 0 0 0

OPERATING MODE (9): 1

POWER LEVEL (10): 1 0 0

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)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
20.405(a)(1)(iii)	X 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)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
R.M. Glover, Compliance Manager	AREA CODE 8 0 3 8 3 1 - 3 2 3 6

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	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)

On January 3, 1990, at approximately 1030 hours, with Unit 1 in Mode 1, Power Operation, Containment Air Return Fan 1B (CARF-1B) failed to start during a quarterly test. It was subsequently found that breaker F01A in Motor Control Center (MCC) 1EMXN was open (not tripped). After the breaker was closed, the quarterly test was successfully performed, and CARF-1B was returned to operable status by 2020 hours. CARF-1B was last run on October 23, 1989. This incident is attributed to an inappropriate action, since it is apparent that this breaker was manually opened, sometime between October 23, 1989 and January 3, 1990. Several possible causes were investigated. It is speculated that an individual may have stepped on or handled breaker F01A while climbing up to the cable tray above MCC 1EMXN. Alternatively, the possibility that a wrong Unit/wrong train incident occurred was evaluated, as was the possible involvement of testing activities. Corrective actions included a Corporate Security Services investigation to attempt to determine the individual responsible, measures to ensure that the positions of similar breakers are periodically verified, procedure review, and training on this incident.

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Catawba Nuclear Station, Unit 1	0 5 0 0 0 4 1 3	9 0	0 0 2	0 1	0 2 OF 2 2

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

BACKGROUND

The Containment Air Return [EIIS:BK] Subsystem of the Containment Air Return and Hydrogen Skimmer [EIIS:BB] (VX) system is designed to ensure a rapid return of air from upper to lower Containment [EIIS:NH] after an initial large break LOCA blowdown. This subsystem consists of two independent, 100% capacity fans [EIIS:BLO] per Unit, designed to start nine minutes after the Containment high-high pressure (Sp) setpoint (3 psig) is reached. The Containment Air Return Fan Dampers [EIIS:DMP] (ARF-D-2 for Train A, ARF-D-4 for Train B) are designed to open 10 seconds after an Sp signal, to provide a flow path for the air return fans from upper to lower Containment.

Technical Specification 3.6.5.6 requires two operable VX Trains in Mode 1, Power Operation, Mode 2, Startup, Mode 3, Hot Standby, and Mode 4, Hot Shutdown. With one train of VX inoperable for greater than 72 hours, the Unit must be in at least Hot Standby within the next 6 hours, and in Mode 5, Cold Shutdown, within the following 30 hours. With both trains inoperable, Technical Specification 3.0.3 requires that action be initiated within one hour to place the Unit in a mode in which the Technical specification does not apply. The Unit is to reach Mode 3 within the next 6 hours, Mode 4 within the following 6 hours, and Mode 5 within the subsequent 24 hours.

Each Containment Air Return Fan (CARF) is interlocked with the Containment Pressure Control System (CPCS) such that if Containment pressure is below 0.250 psig, a contactor coil will deenergize, opening breaker [EIIS:BRK] contacts, preventing the CARF from starting. This interlock is provided to prevent the depressurization of Containment. The isolation contactors for this interlock are physically separated from the rest of the control circuit and are located in power lockout Motor Control Centers (MCCs) EMXM and EMXN. Each of these contactors has an associated breaker in series. In order to obtain a safety related seismic contactor, the breaker and contactor were purchased and used as a unit.

PT/1/A/4450/05A(B), Containment Air Return Fan 1A(B) and Hydrogen Skimmer Fan 1A(B) Performance Test, is performed quarterly by Performance. In Section 12.1, the CARF is automatically started in response to an Sp signal, with the discharge damper (ARF-D-2 or ARF-D-4) closed.

EVENT DESCRIPTION

On October 23, 1989, CARF-1B operated successfully during the performance of PT/1/A/4450/05B.

On January 3, 1990, at approximately 1030 hours, with Unit 1 in Mode 1, CARF-1B failed to start during the performance of PT/1/A/4450/05B. CARF-1B and Hydrogen Skimmer Fan (HSF) 1B were previously declared inoperable per Technical Specification 3.6.5.6 for the performance of PT/1/A/4450/05B, at approximately 0835 hours. A high priority work request, 7353 PRF, was initiated to

*U.S. GPO: 1988-520-589:00070

investigate/ repair CARF-1B. Instrumentation and Electrical (IAE) personnel found that breaker F01A, in MCC 1EMXN, located in the Unit 1 560 foot elevation Electrical Penetration Room, was in the OFF (not tripped) position. The breaker was completely in the OFF position, which would require a manual, not automatic trip, actuation. The breaker was closed to the ON position, PT/1/A/4450/05B was successfully performed, and CARF-1B and HSF-1B were declared operable by 2020 hours.

Corrective actions taken on January 3 and 4 included an inspection of this breaker, and a review with Design Engineering of breaker operation and possible causes of its opening. An extensive tagout review was performed by Operations on January 4, including searches for tagouts on any breakers on MCCs 1EMXM, 2EMXM, 1EMXN and 2EMXN. Maintenance Engineering Services (MES) personnel investigated the operation of the breaker, and concluded that the complete opening could not have been accomplished by a trip mechanism. No evidence was found that would indicate that a tagout error could have resulted in opening breaker F01A in MCC 1EMXN. On January 5, all power lockout breakers on MCCs 1EMXM, 2EMXM, 1EMXN, 2EMXN were locked closed as an interim measure. It was noted that the Nuclear Safety Related stickers were missing for MCCs 1EMXM, 1EMXN and 2EMXM. Security awareness in the area of MCC 1EMXN was heightened, due to the possibility of deliberate equipment tampering (sabotage). This possibility was discussed with the Senior Resident NRC Inspector, and it was determined that there was no basis for assuming this to be the cause.

On January 4, 1990, at approximately 1915 hours, with Unit 2 in Mode 1, Operations personnel noted that there was no power indication for Containment Floor and Equipment Sump Pump 2B1 during a control board review. Power indication had been present during the previous control board review, at 0700 hours, on January 4. An Operator investigated the problem, and found that the pump's breaker, F10B in MCC 2MXM, located in the Unit 2 577 foot elevation Electrical Penetration Room, was in the OFF (not tripped) position. This breaker was apparently opened sometime between 0700 hours and 1915 hours. The Operator subsequently closed the breaker. Subsequently, Security personnel performed area inspections and discovered collections of protective clothing and other materials in cable trays above both MCC 1EMXN and MCC 2MXM.

CONCLUSION

This incident is attributed to an inappropriate action, because it is apparent in each case that the breaker was manually opened. Several work activities, such as tagouts, cable movement and testing, as well as the possibility of sabotage, were considered as potential causes of Breaker F01A being opened. A definitive conclusion has not been reached. It is speculated that the breaker in both locations was stepped on or handled while climbing up to an overhead cable tray. In each case, the breaker is believed to have served as a climbing point to reach a tray containing what were concluded to be bedding materials.

While bedding material collections have been found in other cable trays, none of these has been found occupied or in use. If these trays were to be occupied, it would not present a seismic concern, according to Design Engineering. Although the presence of these materials in these cable trays was in violation of Station Directive 2.12.5, Control of Combustible Materials for Safety Related Areas, the materials were removed when discovered. Design Engineering has analyzed the cable tray fire scenario, and determined this not to be a problem due to train separation.

Consideration has also been given to the possibility that action was taken on the wrong Unit or wrong train during a work evolution. No evidence was found that would indicate this as the cause. Further, January 3 testing activities and the procedure controlling the performance test were evaluated; no reason for Breaker F01A being open could be found. The evidence indicated that the correct breaker was opened on that day. A review of work requests has been performed and no evidence has been found indicating an activity which could have opened the breaker.

Immediately following this incident, several corrective actions were implemented to prevent recurrence. A search of cable trays throughout the Auxiliary Building [EIIS:NF] was performed by K-Mac (vendor cleaning crews) personnel. When similar materials were found in cable trays, they were removed (as were the materials found above the breakers).

There is no Control Room indication of the status of the power lockout breakers for the CARFs. Station Problem Report (SPR) No. CNPR-04631 has been initiated by Maintenance Engineering Services (MES), proposing that Control Room indications/alarms be provided in case power lockout breakers are open or tripped. A planned corrective action is for Design Engineering to determine if there are any other safety-related circuits similar to this design, in which a breaker might be in the OFF position unknown to the Operators. Operations verified the positions of all essential 600V breakers needed for plant operation, in case of an accident, which either have no Control Room indication, or would not indicate being open, on January 6, and is continuing to do this on a weekly basis as an interim measure. The requirement to verify these breaker positions has been incorporated in permanent Station procedures. A planned corrective action will be to add labels, beside the power supply labels on the main control boards, which identify these components as having power lockout breakers. In addition, an SPR has been initiated by Operations to initiate an evaluation of the appropriate long term action for the CARF-1B power lockout breaker. An Operator Update has been issued describing the power lockout breakers, and this information has been sent to Training for inclusion in Operations lesson plans as necessary.

An extensive investigation was performed by Duke Power Company (DPC) Corporate Security Services (CSS) along with the Security Group at Catawba Nuclear Station (CNS) to determine the person(s) responsible for opening the two breakers. On January 8, CSS was notified to provide investigative assistance.

On January 9, CSS met with CNS Security, and conducted physical inspections of the areas with Operations. Since the two locations are accessible to almost anyone at CNS with unescorted access, the initial investigation concentrated on the collection of existing physical evidence. On January 9, most of the materials collected from the two locations were sent to Forensic Analytical Services and Testing, Inc. (FAST), in Bessemer City, North Carolina. An initial forensic inspection of these items did not reveal anything conclusive. On January 11, a forensic chemist from FAST inspected the two areas and obtained several finger and palm prints from both locations. On January 12, the Power Group, Human Resources Department, Nuclear Access Section, was contacted by CSS to determine whether the finger print cards for CNS employees could be released for comparison with the lifted prints. This comparison would initially involve those employees who possibly left prints while investigating the incidents, on January 3 and 4. CSS contacted Professional Investigators of Raleigh, North Carolina and requested a print examination. A print expert began examination of the prints on January 15. This examination revealed that, after excluding the prints that matched the employees known to have been in the two areas, three prints were available: two prints from the Unit 1 location, and one print from the Unit 2 location. CSS obtained a Personnel Access Portal (PAP) transaction report listing several hundred employees entering and exiting the PAP between 0700 hours and 1900 hours on January 4, to attempt to identify the individual responsible for opening breaker F10B in MCC 2MXM. On January 16, this list was forwarded to the Power Group by CSS. It was requested that print cards for each employee on the list be released for comparison with the three prints collected. The Power Group stated that the DPC Legal Department would have to approve the request before the cards could be released. Subsequently, the Legal Department stated that, based on an interpretation of the NRC regulation regarding finger print cards, that the print cards could not be released for investigative purposes.

On January 15, the print examiner inspected the two areas and made the determination that none of the three prints collected could have been made more than three weeks prior to being removed for examination by the forensic chemist, on January 11. The print examiner stated that he would be willing to offer expert testimony to that effect. This indicates that the three prints lifted were placed no earlier than December 21. However, it would not be possible, due to surface characteristics, to lift prints older than three weeks.

On January 17, CSS met with the Legal Department to discuss possible options in pursuing the investigation. Although the Legal Department would pursue the matter, it was understood by CSS that the eventual release of the employee finger print cards kept on file could not be considered as an available option. The use of polygraph examinations could also be eliminated as a possible option. A possible option would be to require employees to finger printed for comparison with the three prints. However, the selection process for deciding which employees would be finger printed would need Legal Department review and approval.

On January 20 and 21, dose cards for the 0700 hours to 1900 hours period on January 4 were examined by the finger print expert in Raleigh, North Carolina. None of the finger prints on these dose cards matched the three prints lifted from the MCCs.

On January 23, meetings were held with selected Supervisors whose employees were involved in work activities, in the area of Breaker F1CB in MCC 2MXM where a bedding material collection was found. These Supervisors in turn interviewed their employees to attempt to determine the responsible individual(s). These discussions did not identify the responsible individual(s).

A review of previous incidents reveals that this is the only case in which safety-related equipment was rendered inoperable as a result of inappropriate action during the course of activities which were not work-related. This is not a recurring event or problem.

CORRECTIVE ACTION

SUBSEQUENT

1) The CARF-1B circuitry was investigated under Work Request (W/R) 7353 PRF. The power lockout breaker for CARF-1B (breaker F01A in MCC 1EMXN) was found, under priority 2X W/R 7353 PRF, to be in the full open position. The breaker was not in the intermediate mechanical slot (trip) position, but was full open. The trip capability of this breaker was examined, and it was determined that a manual, not automatic, trip would be required to move the breaker completely to the OFF position. The breaker was closed under W/R 7353 PRF. This breaker must be closed to start CARF-1B. CARF-1B was started during the performance of PT/1/A/4450/05B, Containment Air Return Fan 1B and Hydrogen Skimmer Fan 1B Performance Test, which was successfully completed on 1/3/90.

2) Following the completion of the actions on the CARF 1B Test, the Security Force implemented "Heightened Awareness" in the area of the CARF Breaker.

3) Tie wraps initially and locks subsequently were placed on these power lockout breakers as an interim measure, until a permanent solution is reached. Subsequent discussion between Operations and Design Engineering revealed that the only breakers on MCCs 1EMXM, 2EMXM, 1EMXN and 2EMXN needing to remain locked were the power lockout breakers for the VX Containment Air Return Fans.

4) The power supply breaker for Containment Floor and Equipment Sump Pump 2B1 (Breaker F10B in MCC 2MXM) was found to be open by an Operator following a control board review, which was performed at 1915 hours on January 4, 1990. Since indication was present at the 0700 hours control board review, and not at the 1915 hours control board review, it is apparent that this breaker was opened sometime between 0700 hours and 1915 hours on 1/4/90. The breaker was closed by Operations, restoring its Control Room indication.

5) On January 4, 1990 an inspection of the two areas involved (MCC 1EMXN and MCC 2MXM) was performed by Security. Collections of protective clothing and other materials, determined to have been used as bedding, were found in cable trays above both MCC 1EMXN and MCC 2MXM. The materials were removed.

6) On January 4, 1990, tagouts (R&Rs) were searched for any breakers on MCCs 1EMXM, 2EMXM, 1EMXN and 2EMXN, and none were found which could have opened breaker F01A on MCC 1EMXN by mistake. There is no work activity in which breaker F01A on MCC 1EMXN is opened. R&Rs were searched for CARF-1B, as well as any R&Rs on the VX System for the period in question. R&Rs were searched for preplanned tagouts on this breaker, and none were found. Subsequently, Unit 2 tagouts on VX were searched for the period in question. None of these searches revealed a situation in which this breaker was opened.

7) An Operator Update entitled "Power Lockouts" was initiated on January 18, 1990. This update described the power lockout breaker. It stated that if one of these breakers is inadvertently opened, power is interrupted to the component, but Control Room indication remains. It also stated that a periodic verification of the positions of these breakers would be added to PT/1(2)/A/4350/03, Electrical Power Source Alignment Verification. An Operator Update entitled "Verification Prior to Action" was initiated on February 5, 1990. This update emphasized the importance that the correct unit, train, motor control center, and breaker compartment have been verified before repositioning a breaker. The mispositioned power lockout breaker for CARF-1B was referenced.

8) Operations submitted a Station Problem Report (SPR) to initiate an evaluation of the appropriate long term action for the CARF 1B breaker on 1EMXN.

9) Operations evaluated other applications where 2 breakers in series were used and as a result procedures PT/1(2)/A/4350/03, Electrical Power Source Alignment Verification, were revised to include the following weekly checks of these breakers being in the closed position:

PT/1/A/4350/03 F04C in 1EMXG Cont. Rm. Area PFT-1 Moist. Sep. Htr.
F02D in 1EMXG Cont. Rm. Area Chiller Comp A Oil Pump Mtr.
F08B in 2EMXH Stat. Rn. Hdr Disch to RL Syst Vlv 1RN-843B
F07C in 1EMXK Elec. Hydrogen Rec. Pwr. Sup. Pnl. 1A
F01A in 1EMXM Pwr L/O for CARF-1A
F01B in 1EMXM Pwr L/O for 1NI-173A
F01D in 1EMXM Pwr L/O for 1NI-121A
F01E in 1EMXM Pwr L/O for 1NI-162A
F01A in 1EMXN Pwr L/O for CARF-1B
F01B in 1EMXN Pwr L/O for 1NI-178B
F01D in 1EMXN Pwr L/O for 1NI-152B
F01E in 1EMXN Pwr L/O for 1NI 183B
F01A in 1EMXZ Pwr L/O for 1NI-100B
F01B in 1EMXZ Pwr L/O for 1NI-147B
F07C in 1EMXL Elec Hydrogen Rec Pwr Sup Pnl 1B
F01D in SDSD RC Sup to Aux. Feed. Isol. Vlv. 1CA-174
F02C in SDSD RC Sup to Aux. Feed. Isol. Vlv. 1CA-175

PT/2/A/4350/03 F08B in 2EMXH Stat Hdr Disch to RL Sys Vlv 1RN-843B
F04C in 2EMXH Cont. Rm. Area PFT-2 Moist. Sep. Htr.
F07D in 2EMXH Cont. Rm. Area Chiller Comp. B Oil Pump Mtr
F07C in 2EMXK Elec. Hyd. Rec. Pwr. Sup. Pnl. 2A
F01A in 2EMXM Pwr. L/O For CARF-2A
F01B in 2EMXM Pwr. L/O for 2NI-173A
F01D in 2EMXM Pwr. L/O for 2NI-121A
F01E in 2EMXM Pwr. L/O for 2NI-162A
F01A in 2EMXN Pwr. L/O for CARF-2B
F01B in 2EMXN Pwr. L/O for 2NI-178B
F01D in 2EMXN Pwr. L/O for 2NI-152B
F01E in 2EMXN Pwr. L/O for 2NI-183B
F07C in 2EMXL Elec. Hyd. Rec. Pwr. Sys. Pnl. 2B
F01C in 1EMXZ Pwr. L/O for 2NI-100B
F01D in 1EMXZ Pwr. L/O for 2NI-147B
F03C in SDSD RC Sup. to Aux. Feed. Isol. Vlv. 2CA-174
F04B in SDSD RC Sup. to Aux. Feed. Isol. Vlv. 2CA-175

The above breakers were added as Enclosure 13.7. If power lockout breakers are deleted, these procedure requirements will be deleted.

10) Security implemented "Random Controls" to vary their surveillance times in an attempt to identify the individual(s) involved.

11) Between January 4 and January 6, 1990, K-Mac personnel performed an inspection in other areas of the Auxiliary Building, and discovered bedding materials in 14 locations (additional collections have been found, and removed since this inspection).

12) The K-Mac organization was revised to increase Supervisor involvement with their work crews. This reorganization reduces the number of employees per supervisor, which will result in closer tracking of employees during shifts. The supervision within other groups onsite was evaluated as well for necessary improvements.

13) Nuclear Safety Related stickers were placed on 1EMXM, 1EMXN, and 2EMXM. These stickers are required per CNS-1390-01-00-0095, Procedure for Tagging Electrical Nuclear Safety-Related Equipment. Maintenance personnel will be responsible for ensuring these stickers are in place in the future.

14) On January 23, meetings were held with selected Supervisors whose employees were involved in work activities in the area of Breaker F10B in MCC 2MXM where a bedding material collection was found. These Supervisors subsequently interviewed their employees to attempt to identify the responsible individual(s).

15) An extensive investigation involving CSS, CNS Security, Forensic Analytical Services and Testing, Inc. and Professional Investigators of Raleigh, N.C. was performed to attempt to determine the responsible individual(s).

16) Design Engineering (DE) evaluated the potential for this event at Oconee and McGuire. DE notified both stations.

17) A review was performed by Design Engineering of a possible cause of the breaker (F01A on MCC 1EMXN) opening through the trip (intermediate mechanical slot) position (i.e., tripping to the full open position). An overcurrent condition would trip the breaker to the intermediate position.

18) An evaluation of test procedures was conducted at the time of the event to determine if those procedures could have inadvertently left the CARF-1B Breaker open. No discrepancies were found.

PLANNED

1) Labels will be added, next to the power supply label for affected components, which identify power lockout breakers. Each label is to be approximately 1 1/2 in. by 1/2 in. These labels are being added under OMP 1-6, Control Panel Information Changes. A total of 20 labels will be added on Control Panels MC-4 and MC-11, Units 1 and 2 Components affected are VX CARF 1(2) A, VX CARF 1(2) B, 1(2)NI-173A, 1(2)NI-121A, 1(2)162A, 1(2)NI-178B, 1(2)NI-152B, 1(2)NI-183B, 1(2)NI-100B, and 1(2)NI-147B. A program for labeling maintenance will be established within the maintenance group.

2) A study is being performed to determine if there are other safety-related circuits, similar to the VX design, where a breaker can be in the OFF position such that Control Room indication would be compromised. The scope of this study will include QA-1, 600V breakers. An evaluation will be performed to determine if further measures are needed in addition to those already taken. There is the possibility that the power lockout breakers will be eliminated. The purpose of this review is to provide a permanent solution to the problem of important breakers being in the OFF position, such that Control Room indication is compromised.

3) K-Mac has begun a periodic (monthly) inspection of cable trays. Station Management will review the results of these inspections for necessary actions. In addition, Security is performing random cable tray inspections.

4) Operator training will be conducted on the possible causes of this incident, to further emphasize the importance of verifying that the correct breaker has been identified.

5) The investigation to determine the individual(s) involved will continue with Legal Department assistance.

6) Station Management will review the need to protect certain breakers from damage or inadvertent opening and to provide for necessary protection.

7) Operator training will be conducted on power lockout breakers.

SAFETY ANALYSIS

The Containment Air Return Fans (CARF) are designed to automatically start at 10 minutes into a postulated LOCA to provide forced air return into lower Containment. This forced air return limits Containment peak pressure in the event of a postulated LOCA. The two CARFs discharge air from upper to lower Containment through two discharge dampers, 1ARD-D-2 for CARF-1A, and 1ARF-D-4 for CARF-1B. The discharge dampers are automatically opened when two permissives are received: Containment pressure = 0.25 psig, and differential pressure across the divider barrier < 0.5 psid. The discharge dampers open prior to CARF autostart to provide a path for natural convection air return from upper to lower Containment.

The latest date that breaker 1EMXN-F01A was known to be closed is October 23, 1989. Therefore, the potential time frame for inoperability of CARF-1B was October 23, 1989, through January 3, 1990. Since the breaker was open, autostart and operation of the fan would not have occurred in a postulated LOCA during this incident. It is likely that, during troubleshooting by Operations, the breaker would have been found to be open. The closing of the breaker would have made CARF-1B operable. However, since the Main Control Board indicating light for CARF-1B remained illuminated even with the breaker open, the possibility that Operations would have ascertained the breaker position and manually started CARF-1B will be conservatively ignored.

CARF-1A was operable throughout this incident and able to perform its design function, with the following exceptions:

1) Train A Solid State Protection System (SSPS) testing was conducted from 0930 hours to 1130 hours on November 16, 1989. This testing defeated the autostart capability of CARF-1A, in addition to the automatic opening capability of ARF-D-2.

2) Train A Containment Pressure Control System (CPCS) testing was conducted from 0800 hours to 0925 hours on November 17, 1989, and from 0915 hours to 1057 hours on December 15, 1989. This testing defeated the autostart and manual start capability of CARF-1A as well as the automatic and manual opening capability of ARF-D-2 during performance of the test.

3) Train A Containment Air Return System testing was conducted from 0838 hours to 1207 hours on December 11, 1989. This testing involved opening the feeder breaker to ARF-D-2, thereby defeating its capability to open, either manually or automatically.

4) Train A Diesel Generator (D/G) testing was conducted from 0820 hours to 1235 hours on January 2, 1990. During this testing, the design Nuclear Service Water (RN) System flow balance is altered slightly by throttling valve 1RN236, D/G Cooling Water Heat Exchanger 1A Outlet Throttle Valve. Also during this testing, 1FD22, D/G Engine Fuel Oil Day Tank 1A Fill Valve, was in a closed position. Therefore, D/G 1A was declared inoperable during this period of time.

During SSPS testing, conservative estimates yield 45 minutes as the required time to return Train A SSPS to an operable state, at which time the autostart capability of CARF-1A and the automatic opening capability of ARF-D-2 would be functional. This time estimate includes operator notification of testing personnel and termination of the test procedure. Additionally, during the period of SSPS testing, the manual start capability of CARF-1A was intact and fully functional. The High Energy Line Break Emergency Procedures require the operators to ensure operation of the CARFs, and this would occur at approximately 15 minutes into a postulated LOCA.

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

During CPCS testing, conservative estimates yield 20 minutes as the required time to return Train A CPCS to an operable state, at which time the autostart capability of CARF-1A and the automatic opening capability of ARF-D-2 would be functional. This time estimate includes operator notification of test personnel and termination of the test procedure. Additionally, during the section of the procedure in which ARF-D-2 would not manually open, Train B damper, ARF-D-4, would have opened to allow natural convection air flow from upper to lower containment until CARF-1A was started and ARF-D-2 was opened to provide forced air circulation. The CARF-1B power lockout breaker, 1EMXN-F01A, does not supply power to either Air Return Fan discharge dampers.

During Train A Containment Air Return System testing, conservative estimates yield 50 minutes as the required time to return ARF-D-4 to an operable state by closing the feeder breaker. This time estimate includes operator notification and test termination.

During Train A D/G testing, little or no impact would be realized for the functional operability of the D/G. 1RN236 is in a throttled position for flow testing, but is not throttled sufficiently to render the D/G incapable of functioning. In fact, during this test the D/G is operating and fully loaded to provide a heat load. During this test, an Operator is present in the D/G room to respond to any problem that may arise. Upon notification, the Operator would immediately return 1RN236 to its initial position to ensure technical operability of the D/G. The D/G engine fuel oil day tank has the design capability to provide fuel oil for at least 1 full hour of operation without makeup. During the 1FD22 valve test, an Operator would be able to open 1FD23, D/G Eng Fuel Oil Day Tank 1A Fill Bypass Valve.

In the tests cited above, the D/G testing would have no effect on the ability of CARF-1A to operate and fulfil its design funtion. CPCS testing would have affected CARF-1A operability for 20 minutes, SSPS testing would have affected CARF-1A operability for 45 minutes, and Containment Air Return System testing would have affected CARF-1A operability for 50 minutes. Therefore, the enveloping time frame for any analysis of the effects of CARF inoperability is considered to be 50 minutes.

On January 30, 1987, it was discovered that the curbs had not been installed around the Containment Air Return Fan pits, in which, during a postulated LOCA with containment spray actuation, the pits would have been flooded with collected spray, rendering the fans inoperable (LER # 413/87-005-01). To analyze the effects of this incident, Westinghouse performed a Containment peak pressure analysis using the LOTIC1 computer model. Using the actual flowrates of the Residual Heat Removal [EIIS:BP] (ND) System, Component Cooling [EIIS:CC] (KC) System, Containment Spray [EIIS:BE] (NS) System, and Nuclear Service Water [EIIS:BI] (RN) System as inputs to the computer model, along with the actual ice condenser ice weight and RN System inlet temperature, it was determined that containment peak pressure would not have exceeded the design pressure in a postulated LOCA.

To analyze the effects of the present incident, the projected heat transfer performance through both the ND/KC/RN and NS/RN heat transfer paths was compared to the conditions during the 1987 incident, using actual flowrates, UA factors for the heat exchangers, and RN System inlet temperature. It has been determined that the performance in a postulated LOCA during this incident would have been greater than the corresponding performance during the missing curb incident. The most significant factor in this analysis was the RN inlet temperature. In the missing curb analysis, the RN inlet temperature was assumed to be 85 degrees F. In the evaluation of this incident, a maximum RN System inlet temperature of 65 degrees F was conservatively assumed. Surveillance data shows that the actual RN inlet temperature varied between 47 and 65 degrees F during the period of inoperability of CARF-1B, and was approximately 47 degrees F during the 50 minute assumed inoperability of CARF-1A during Containment Air Return System testing, which is the longest time period of the cited testing activities. Standby Nuclear Service Water Pond (SNSWP) temperature follows lake temperatures. Surveillance data indicates that 6NSWP temperature was actually one to two degrees F lower than lake temperature. SNSWP temperature would not have varied significantly during post-LOCA response, including the 50 minutes assumed period of inoperability. As an additional factor of conservatism, it may be pointed out that the Ice Condenser ice weight in the 1987 missing curb incident was assumed to be 2.75E+6 (lbm). During this incident, the actual ice condenser ice weight was 2.79E+6 (lbm). Also, the 1987 missing curb incident safety analysis assumed no CARFs operating for the duration of the transient. In a postulated LOCA during this incident, at least one train of the CARFs would begin to operate well before Ice Condenser meltout would occur (containment peak pressure occurs after Ice Condenser meltout). The containment peak pressure analysis for the missing curb incident in 1987 is deemed to be applicable to this incident. Therefore, it is concluded that containment peak pressure would have been well within its design limit in the event of a postulated LOCA during this incident.

With respect to the offsite dose analysis, containment leakage is a function of containment pressure. It has been concluded that the design pressure for containment would not have been exceeded in the event of a postulated LOCA during this incident. Therefore, the assumed Technical Specification leakage rate of 0.2% per day is valid for this incident. Because the effectiveness of the NS System depends upon a well-mixed containment atmosphere, the iodine removal capabilitiy of the spray is less efficient without Containment Air Return System forced air flow. However, no credit for iodine removal was assumed in the design basis LOCA analysis. Standard Review Plan 6.5.4 requires that Containment Air Return System forced flow be available in order to take credit for iodine stripping by the ice condenser. Iodine removal by the ice condenser was assumed in the design basis LOCA analysis. During the 1987 missing curb incident, the offsite dose consequences were evaluated assuming no iodine removal by the ice beds. The results indicated that offsite doses were within the limits of 10CFR100 limits. This previous analysis is considered

bounding for the present incident, as the 1987 incident involved no CARFs operating during the entire course of the event, while this incident involved no CARFs for only a 50 minute duration (most conservative testing activity). Therefore, it is concluded that no offsite dose consequences beyond the design basis would have occurred in the event of a LOCA during this incident.

With respect to hydrogen control, at least one Train of Hydrogen Skimmer Fans and associated components was available during this incident. The Hydrogen Skimmer Fans take suction from the dead-ended compartments of lower containment. No hydrogen accumulation problems would have occurred due to this air movement. Also, the Hydrogen Recombiners were available to decrease the containment hydrogen concentration if a postulated LOCA had occurred during this incident. The absence of the CARFs for a maximum time period of 50 minutes would not cause stratification or abnormal distribution of the hydrogen in containment due to the natural convection air flow present in a LOCA. EPRI study "Hydrogen Mixing and Distribution in Containment Atmospheres", EPRI NP-2669, states that the jet effect due to a LOCA and natural convection is quite effective at mixing the lower containment volume. The report states that "the concentration differences between measuring locations was less than one volume percent within 20 minutes after stopping the hydrogen jet for all cases".

The impact of delayed air return actuation on Lower Containment temperature and, hence, equipment qualification concerns, can be determined by examining the Main Steamline Break analysis in Chapter 6 of the FSAR. Prior to normal air return fan actuation and operation at 600 seconds, the Lower Containment temperature has peaked at 326 degrees F and is trending downward. Also, mass and energy releases for this accident reveal that both the mass flowrate and associated enthalpy are decreasing prior to 600 seconds. In the worst case, failure of the CARF to operate would result in the temperature at 600 seconds (320 degrees F) being protracted through the time of air return fan start, which is assumed to be 50 minutes after the accident. As a result, equipment and instrumentation located in Lower Containment would possibly be exposed to elevated temperatures for a longer period than predicted in the FSAR. The consequences of this situation have been examined; sufficient margin exists in the qualification profiles of the components to accommodate the extended duration of high temperatures. Therefore, a delay in air return fan actuation would not adversely affect equipment and instrumentation located in Lower Containment.

In conclusion, one train of CARFs was operable during this incident except for the five periods of time in which testing was conducted. During these time periods, four testing activities required greater than the 10 minute autostart time delay to return the system to operable, the most conservative bounding value being 50 minutes. A comparison of this incident (which involved no CARFs for a maximum time of 50 minutes) with the 1987 missing curb incident (which involved no CARFs for the duration of the transient) shows that the inoperability of both CARFs for 50 minutes would have no significant impact on containment pressure, offsite dose consequences, equipment qualification concerns, or hydrogen control.

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A Design Engineering safety analysis was performed using both the conservative FSAR conditions, and Westinghouse analysis using more realistic boundary conditions. The post-LOCA Containment response, pressure and temperature versus time, under FSAR conditions is shown on Figures 1 and 2. Important points concerning these figures are as follows:

- rapid pressurization following pipe rupture
- sprays actuate immediately at 3 psig
- VX fans actuate at 10 minutes
- switch safety injection and sprays to sump recirculation mode
- align RHR containment sprays at 50 minutes
- ice meltout at 4191 seconds
- peak pressure, 14.0 psig, at 7308 seconds
- peak temperature bounded by steam line break

The post steam-line break Containment response, temperature versus time, is shown on Figure 3. Important points concerning this figure are as follows:

- peak temperature occurs prior to 10 minutes VX fan actuation
- mass and energy release decreasing at 10 minutes-all feedwater isolated
- peak pressure is bounded by LOCA

The Westinghouse analysis assumed more realistic boundary conditions, and assumed that the VX fans were unavailable. The results of this analysis (see Figures 4 and 5) show that the peak Containment pressure still occurs after ice meltout and less than the design temperature:

- ice meltout at approximately 150 minutes
- peak pressure at 213 minutes

There is no negative input on Containment pressure response. The Containment temperature response is bounded by the steam line break.

It is conservatively estimated that it would have taken, under accident conditions, 85 minutes to diagnose and close the open power lockout breaker for CARF-1B. This Design Engineering safety analysis concluded that there would be no impact on post-LOCA Containment response if the VX fan delay increased from 10 minutes to either 50 or 85 minutes, using the Westinghouse analysis.

With respect to equipment qualification, the Design analysis concluded that there would be no unacceptable impact on any equipment if the VX fan delay increased form 10 minutes to 50 to 85 minutes. Since the VX fans cool Lower Containment post-accident, a delay in the rate that Lower Containment cools down would result. The current Lower Containment temperature for equipment

qualification (EQ) evaluation is that resulting from the steam line break (short term) and LOCA (long term). With a VX fan delay of 50 or 85 minutes, the EQ temperature profile can be conservatively estimated as (see Figure 6):

Time	Temperature
0-10 min.	Current Profile (SLB)
10-50 min.	320 degrees F (SLB)
50-85 min.	230 degrees F (LOCA)
> 85 min.	Current Profile (LOCA)

The equipment in Lower Containment was evaluated based on this temperature profile.

The health and safety of the public were not affected during this incident.

FIGURE 1

CONTAINMENT PRESSURE VS. TIME

CATAWBA FSAR

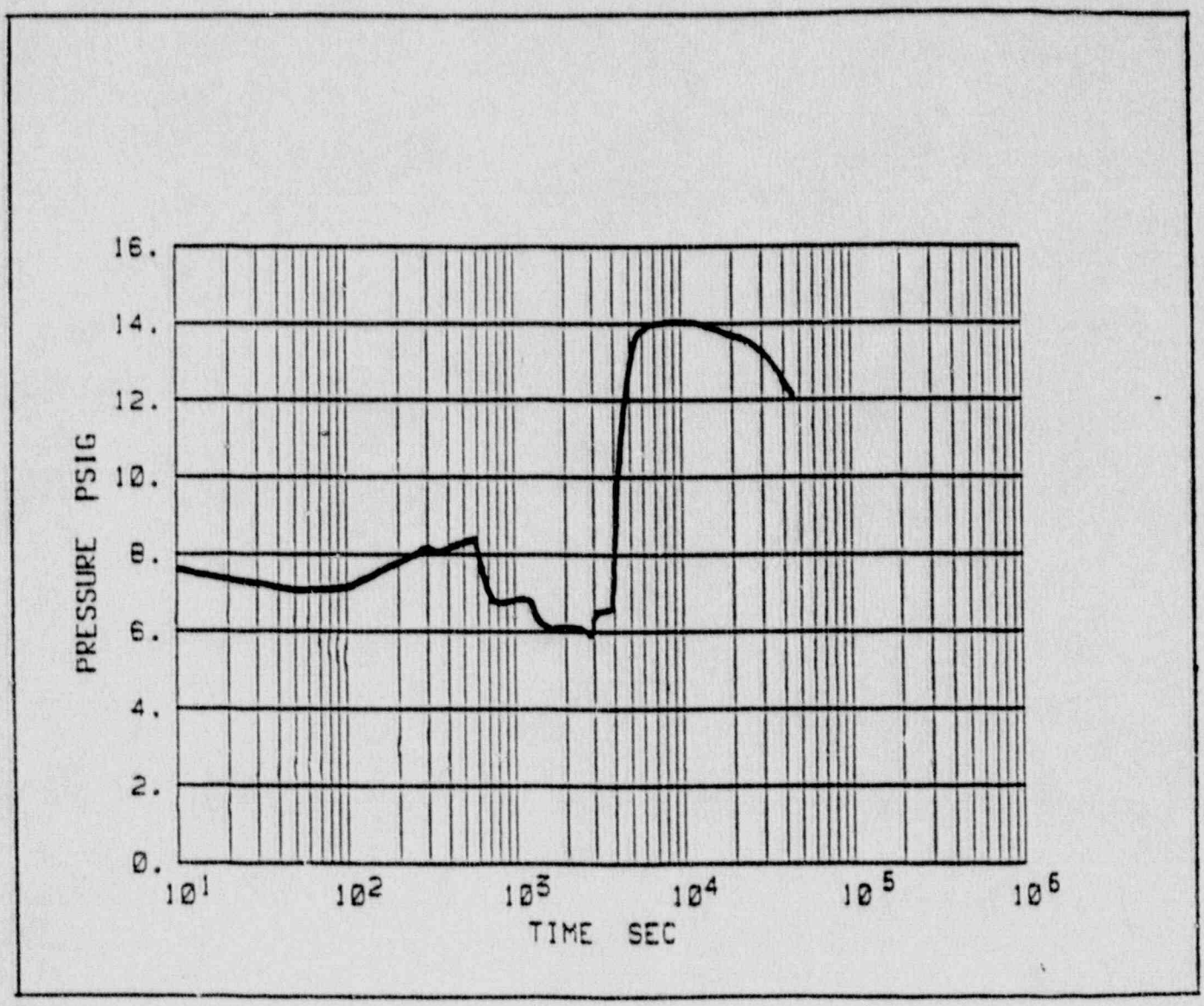

FIGURE 2

CATAWBA FSAR

LOWER COMPARTMENT TEMPERATURE VS. TIME

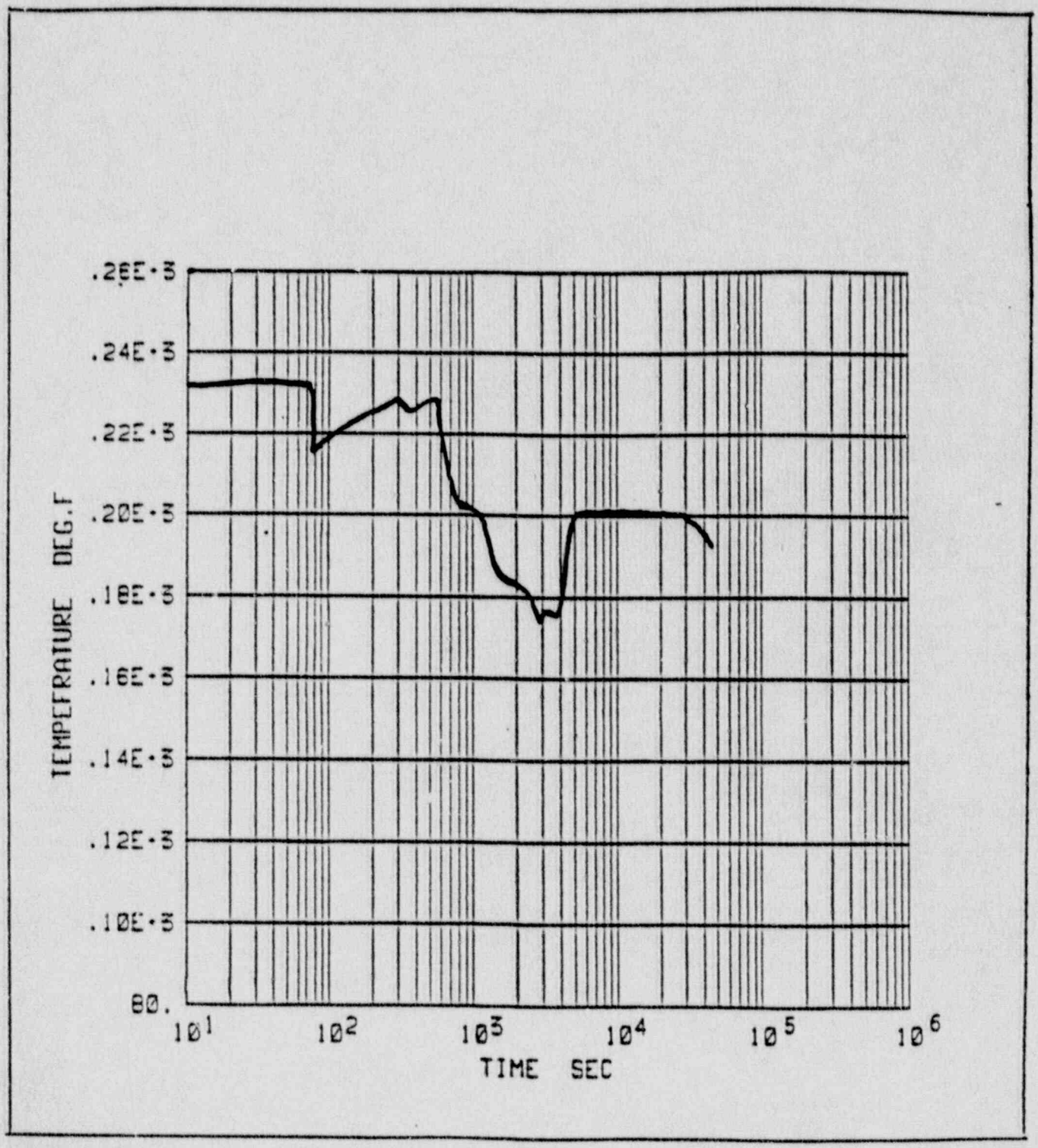

FIGURE 3

CATAWBA FSAR - STEAM LINE BREAK

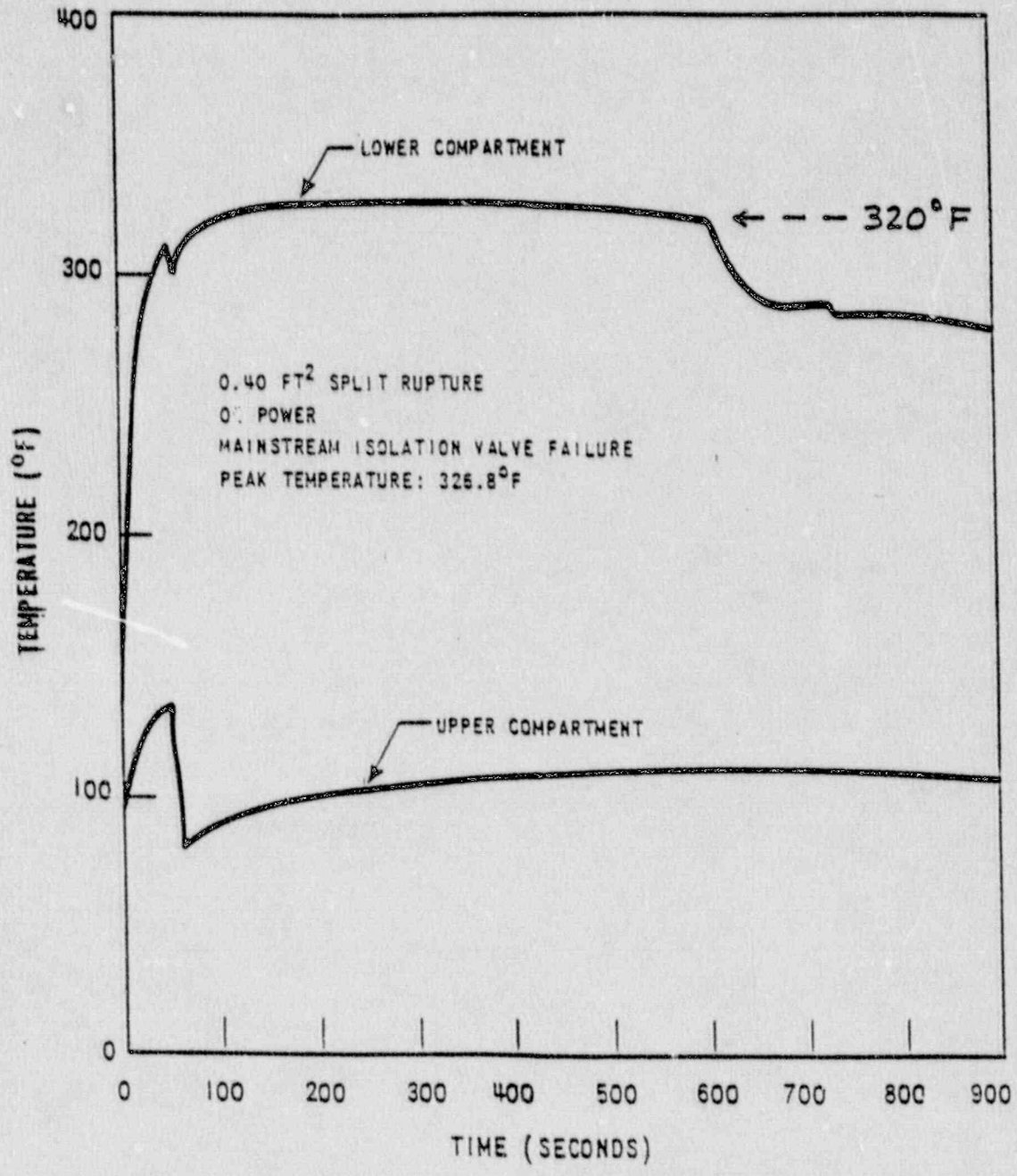

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FIGURE 4

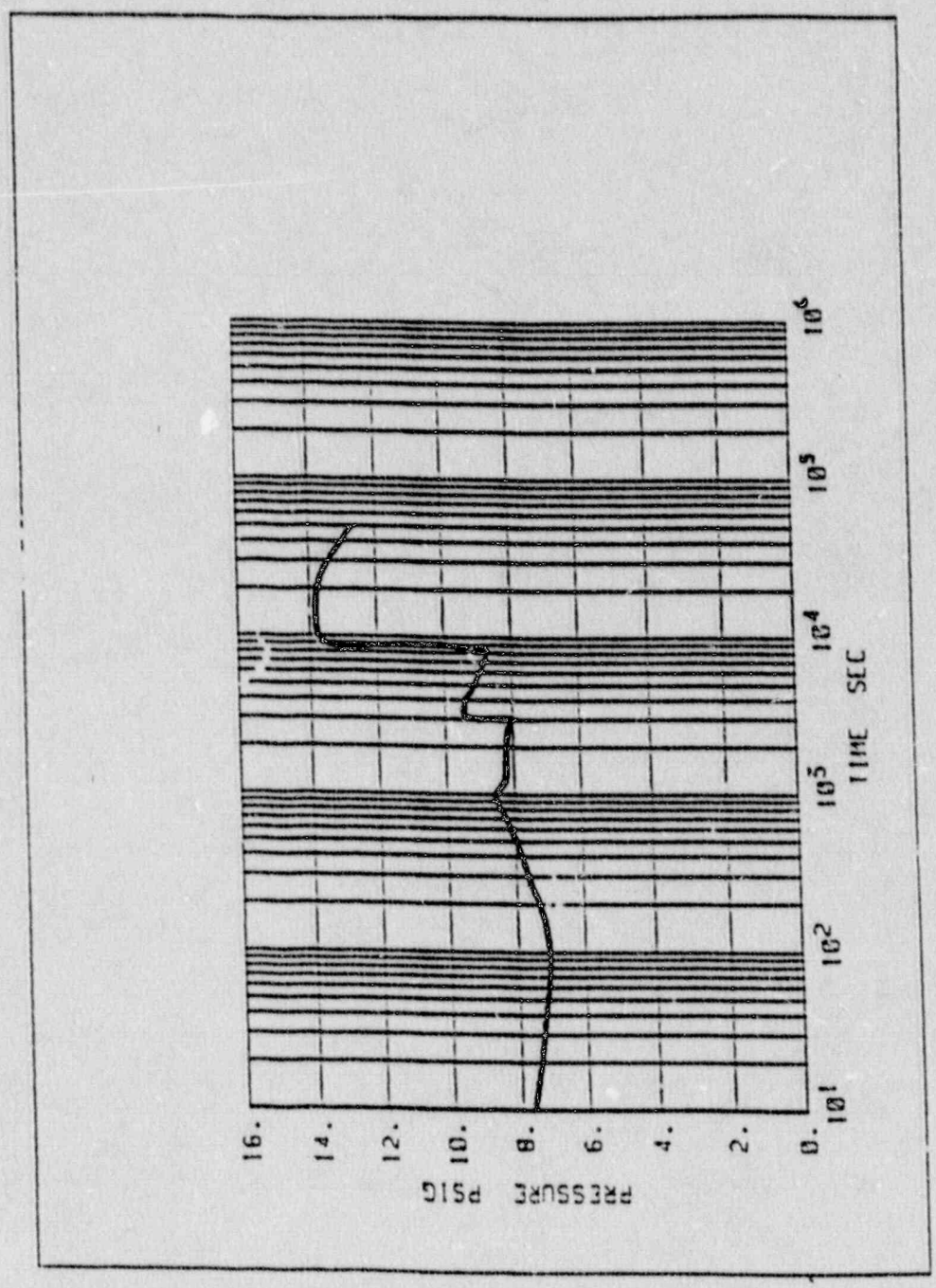

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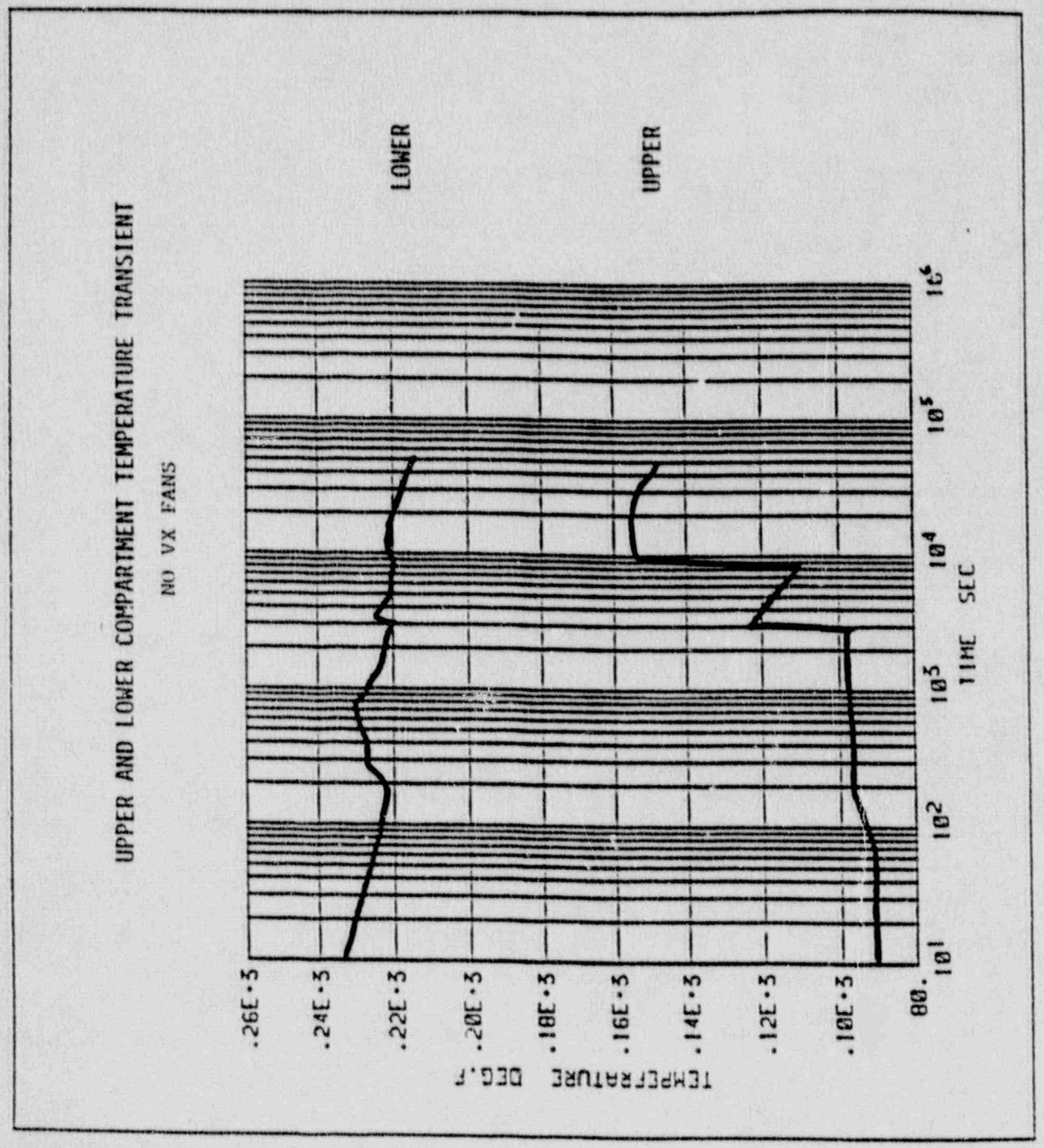
FIGURE 5


UPPER AND LOWER COMPARTMENT TEMPERATURE TRANSIENT
NO VX FANS
LOWER
UPPER
TEMPERATURE DEG.F
.26E-3
.24E-3
.22E-3
.20E-3
.18E-3
.16E-3
.14E-3
.12E-3
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80.
10¹
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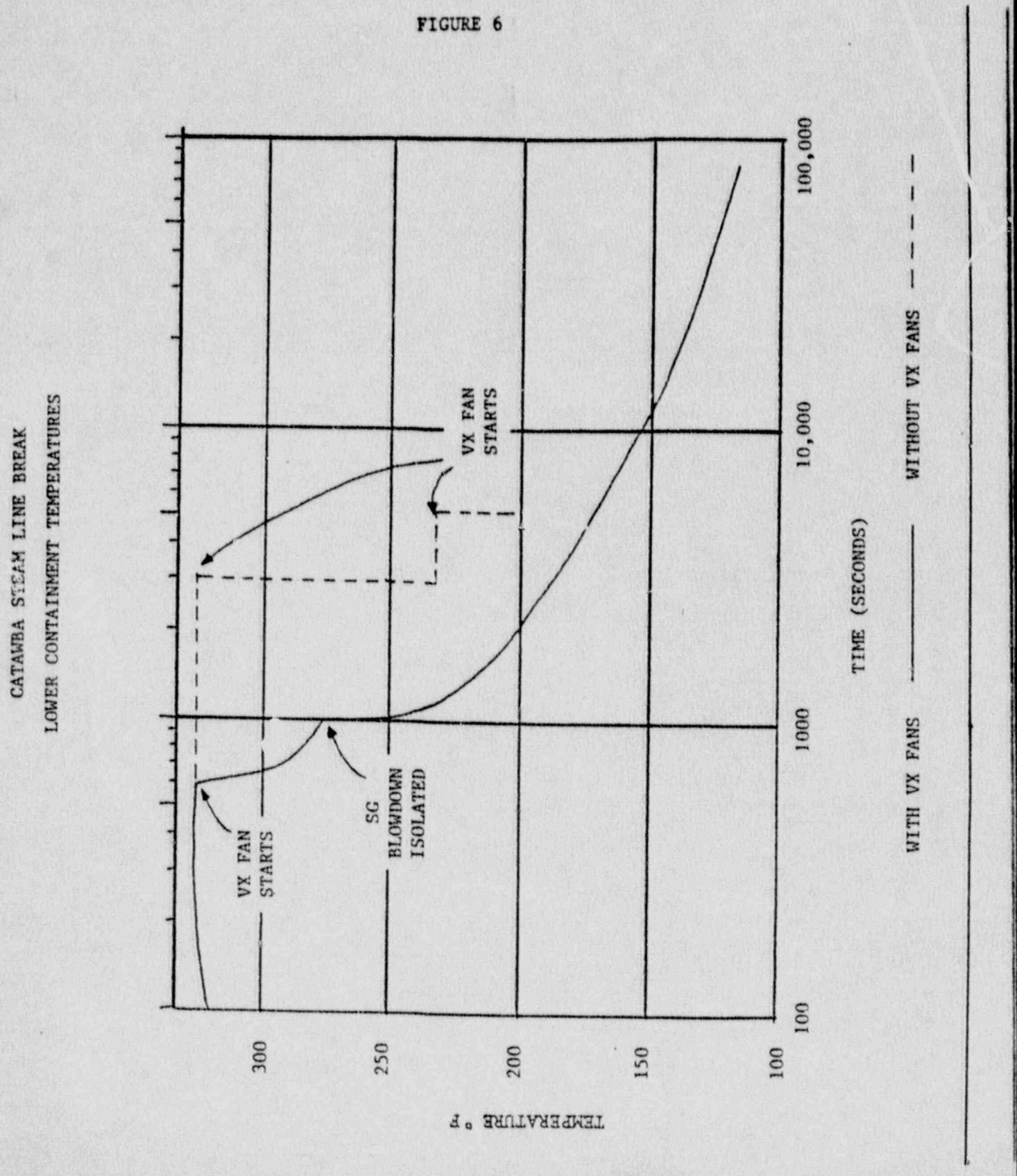
FIGURE 6



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