NRC FORM 366 (4-95) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 04/30/98
ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20603.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

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Browns Ferry Unit 3	05000296	1 OF 4

TITLE (4)
Computer Modeling Indicates Sensors May Not Detect Pipe All Pipe Breaks

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 NAME	DOCKET NUMBER
									NA	05000
01	21	1998	1998	001	00	04	01	1998	NA	05000

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)			
POWER LEVEL (10)	072	20.2201(b)	20.2203(a)(2)(v)	50.73(a)(2)(i)	50.73(a)(2)(viii)
		20.2203(a)(1)	20.2203(a)(3)(i)	50.73(a)(2)(ii)	50.73(a)(2)(x)
		20.2203(a)(2)(i)	20.2203(a)(3)(ii)	50.73(a)(2)(iii)	73.71
		20.2203(a)(2)(ii)	20.2203(a)(4)	50.73(a)(2)(iv)	X OTHER
		20.2203(a)(2)(iii)	50.36(c)(1)	50.73(a)(2)(v)	Voluntary Report

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Steven W Austin, Licensing Engineer	(205) 729-2070

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 15 single-spaced typewritten lines) (16)

On January 21, 1998, at approximately 1900 hours, through computer modeling it was determined that temperature sensors for certain high energy line breaks may not detect all possible break locations. BFN's current analysis for Environmental Qualification (EQ) of Electrical Equipment is based on the MONSTER computer code. This code is no longer available. Therefore, TVA is utilizing an updated code, Generation of Thermal-Hydraulic Information for Containments (GOTHIC) in support of a license amendment for Power Uprate. Utilization of the GOTHIC code introduced differences in modeling and assumption methods. Due to the introduction of these factors, particularly the steam buoyancy aspect, the GOTHIC code predicted that a postulated critical crack in the Reactor Core Isolation Cooling (RCIC) steam line in the main steam valve vault (MSVV) may go undetected when the personnel door between the MSVV and the reactor building general area is open. However, it was further determined that the MONSTER code was properly utilized to establish the current EQ temperature parameters and there is conservatism built into the GOTHIC code. In light of these considerations, it could not be conclusively determined that the leak detection and isolation would not occur as modeled by the MONSTER code. TVA is providing this voluntary report to inform others under what circumstances existing computer models may provide different results.

I. PLANT CONDITIONS

At the time of discovery, Unit 2 was at 100 percent thermal power, Unit 3 was at approximately 72 percent thermal power, ascending from a scheduled power reduction. Unit 1 was shutdown and defueled.

II. DESCRIPTION OF EVENT

A. Event

On January 21, 1998, at approximately 1900 hours, during ongoing Environmental Qualification (EQ) analysis being performed in support of a Unit 2 and 3 License Amendment for Power Uprate, TVA's computer modeling indicated temperature sensors for certain high energy line breaks (HELBs) may not detect all possible break locations. This was the result of utilizing a different computer code to model the environment than the current model.

The current EQ analysis is based on the MONSTER computer code, an adaptation of the CONTEMPT model. The MONSTER software program is no longer available. Therefore, an updated code, the Generation of Thermal-Hydraulic Information for Containments (GOTHIC) is being used to evaluate changes in the EQ analysis to support a power uprate license amendment. One primary difference in the two computer codes is that the GOTHIC computer code includes the direct effects of the buoyancy of steam. This effect results in steam from a postulated steam line break being modeled to flow almost exclusively upward. The effect of this is generally higher than predicted temperatures above a steam line break and lower temperatures below the break for GOTHIC than the MONSTER code.

The difference in the two computer codes is most evident for the intermediate to small pipe breaks that are located in areas that contain openings into upper elevations. It was initially postulated by the GOTHIC code that a critical crack in the Reactor Core Isolation Cooling (RCIC) [BN] steam line, inside the main steam valve vault (MSVV) [NG], may go undetected when the personnel door into the reactor building general area is open; thus, allowing steam from a postulated break to flow into the upper elevations of the reactor building general area.

On January 21, 1998, TVA made an Emergency Notification System, one hour Non-Emergency telephone call to the NRC operations center, notifying them of an event that resulted in a nuclear power plant being in an unanalyzed condition that significantly compromised plant safety.

Further review has determined that the MONSTER computer code was correctly utilized in the current analysis. It was also found that there is conservatism built into the GOTHIC code which accounts for some of the difference between the two codes. In light of these considerations, it could not conclusively be determined that the leak detection and subsequent isolation would not occur as modeled by the GOTHIC code and the MONSTER analysis was determined to be acceptable. Accordingly, the unanalyzed condition significantly compromising safety did not exist. TVA subsequently withdrew the one-hour notification.

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III. ANALYSIS OF THE EVENT

The environmental parameters in the reactor building were determined utilizing the computer programs discussed. In these environmental evaluations, the mass energy released from a HELB is released in a given compartment where the HELB is located. The computer program determines the environmental parameters in the break compartment and in compartments surrounding the break. The program also determines the temperature of the temperature sensors used to detect a HELB.

The current analysis which was performed using the MONSTER code concluded that the current break detection system would detect the full spectrum of break sizes. This program produced the environmental temperature profiles presently used for the EQ of electrical equipment.

In modeling a large HELB, a break that results in significant mixing in the break compartment and compartments surrounding the break, the HELB is consistently modeled by both the MONSTER and GOTHIC computer codes.

In modeling of a small break (low mass energy release) by GOTHIC code, the break does not produce significant mixing and turbulence. Because of the modeling of buoyancy, the GOTHIC code predicts that the steam released will rise to the top of the compartment forming a layer of steam on the ceiling. If a flow path in the top of the compartment is present, the GOTHIC code predicts that the layer of steam will flow through the openings.

In this configuration, the GOTHIC code would predict a lower temperature than the MONSTER code for temperature sensors located in the lower elevations. There are conservative assumptions in the Gothic model (e.g. no credit for deflection of steam due to obstructions, heatsink modeling, etc.) that also contribute to the difference in the two codes.

TVA evaluated the differences in the predicted environments from the GOTHIC code compared to the current predicted environments based on the MONSTER code. The MONSTER code was found to be applied correctly and the current analysis is considered reasonable and accurate. In all but one case, the environments predicted by GOTHIC were consistent with MONSTER code, such that required HELB isolations would occur.

The one case with differences is a small break (i.e. critical crack) of a RCIC steam line in the MSVV. The MONSTER analysis predicts that this break would be detected and isolated by temperature sensors located in the torus room one elevation below the MSVV. The personnel access door between the MSVV and the reactor building general area must be modeled as closed for these sensors to detect and isolate the break. Because of the conservative assumptions in the GOTHIC model, and that the MONSTER model was properly used, it could not be concluded that the current analysis is invalid. The results are primarily due to the differences in the computer codes rather than an actual response.

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

Although the current analysis is adequate, TVA performed an evaluation to determine the plant response due to the RCIC steam line break in the MSVV assuming all of the GOTHIC codes assumptions were valid.

Based on current piping design, a critical crack is postulated at a 90 degree elbow located between the terminal end pipe support and the RCIC steam line outboard containment isolation valve [ISV].

The temperature switches used to detect the critical crack are located in close proximity of two large penetrations in the floor of the MSVV near the ceiling of the torus room located one elevation below the MSVV. The GOTHIC results show that if the personnel passage door from the MSVV to the reactor building general area is closed, steam fills the MSVV from the top to the bottom, forcing initially air and finally steam out through the penetrations collecting on the ceiling of torus room near the temperature sensors. The required isolation will occur as designed.

However, it is postulated by the GOTHIC code that with the door open, steam from a critical crack will gather at the top of the MSVV and eventually flow out the door opening and into the reactor building general area, and may not be detected by the torus room temperature sensors. If undetected for approximately 2 hours, this would lead of a reactor building temperatures above current limits.

Alternate means of detection will alert personnel of an steam line break in the MSVV. A main control room alarm will actuate at 160 degrees F due to high MSVV area temperatures. After approximately 100 seconds, automatic isolation of the reactor water cleanup [CE] system, and closure of the Main Steam Isolation Valves [SB] [ISV] (MSIV) will occur. Closure of the MSIVs would be followed by an automatic reactor scram. The main control room personnel enter the appropriate Emergency Operating Instructions, Alarm Response procedures, and Abnormal Operating Instructions. Personnel dispatched to area would identify the source of the leak and the containment isolation valves would be closed from the main control room.

Based on the multiple indications available to the operator ample time to detect and isolate the leak is available before the temperature limits are exceeded.

Therefore, even if the break occurs and the plant responds as the GOTHIC model predicts, the required isolations would be initiated without exceeding the EQ profiles of the electrical equipment in reactor building. Therefore the safety of the plant and its personnel, and the health of the public were not impacted by the event described in this report.

TVA is providing this voluntary report to inform others under what circumstances existing computer models may provide different results.