AmerGen

A PECO Energy/British Energy Company

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5928-00-20293
October 11, 2000

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

Dear Sir or Madam:

SUBJECT: THREE MILE ISLAND NUCLEAR STATION, UNIT 1 (TMI-1)
OPERATING LICENSE NO. DPR-50
DOCKET NO. 50-289
LICENSEE EVENT REPORT (LER) NO. 2000-004-00
"DISCOVERY OF A CONDITION OUTSIDE THE PLANT DESIGN BASIS FOR THE SMALL BREAK LOSS OF COOLANT ACCIDENT ANALYSIS OF RECORD FOR THE CORE FLOOD TANK (CFT) LINE BREAK CASE"

This letter transmits LER No. 2000-004-00, regarding the discovery of a condition which is outside the plant design basis for the CFT Line Break analysis. For a complete description of the evaluated condition, refer to the text of the report provided on Forms 366 and 366A.

This condition did not adversely affect the health and safety of the public. For additional information regarding this LER contact Mr. Gregory M. Gurican of the TMI-1 Regulatory Engineering Department at (717) 948-8753.

Sincerely,

R. E. Fraile
Plant Manager

REF/gmg

cc: TMI Senior Resident Inspector
Administrator, Region I
TMI-1 Senior Project Manager
File No. 00106

IE22

NRC FORM 366 (6-1998) U.S. NUCLEAR REGULATORY COMMISSION	APPROVED BY OMB NO. 3150-0104 EXPIRES 06/30/2001
LICENSEE EVENT REPORT (LER) (See reverse for required number of digits/characters for each block)	Estimated burden per response to comply with this mandatory information collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the 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 20503. If an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
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TITLE (4)

Discovery of a Condition Outside the Plant Design Basis for the Small Break Loss of Coolant Accident Analysis of Record for the Core Flood Tank Line Break Case

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
09	11	2000	2000	-- 004 --	00	10	11	2000	FACILITY NAME	DOCKET NUMBER

		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
OPERATING MODE (9)	N		20.2201(b)		20.2203(a)(2)(v)		50.73(a)(2)(i)		50.73(a)(2)(viii)
POWER LEVEL (10)	100		20.2203(a)(1)		20.2203(a)(3)(i)	x	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)		Specify in Abstract below or in NRC Form 366A
			20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Gregory M. Gurican, TMI Regulatory Engineer	(717) 948-8753

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

SUPPLEMENTAL REPORT EXPECTED (14)				EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
x	YES (If yes, complete EXPECTED SUBMISSION DATE).		NO		4	11	2001

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) **(16)**

On September 11, 2000, a condition potentially outside the design basis of the plant was discovered by AmerGen Energy Co. L.L.C. (AmerGen). Previously accepted analysis assumptions in the small break portion of the loss of coolant accident (LOCA) evaluation model (EM) related to the Core Flood Tank (CFT) line break were found to be non-conservative. This condition was reported by Framatome Technologies Inc. (FTI) in the Preliminary Safety Concern Report No. PSC 2-00. Preliminary analysis of the CFT line break with offsite power available yields an acceptable (peak clad temperature) PCT only when reduced analysis margin for operator action is assumed. However, the existing abnormal transient procedure ATP 1210-10 requires tripping of the reactor coolant pumps (RCPs) as an immediate manual action upon loss of sub-cooling margin (LSCM); therefore, the procedural guidance remains unaffected by the preliminary analysis. This event was reported to the NRC by one-hour notification pursuant to 10 CFR 50.72(b)(1)(ii)(B).

The root cause of this event, as determined by AmerGen, was the failure to consider that the CFT Line Break with offsite power available could be the most limiting event in the small break LOCA spectrum. Additionally, some analysis assumptions were not verified before application to the new EM. There were no adverse safety consequences from this event, and the event did not affect the health and safety of the public as the event is one of an error in analysis rather than an event related equipment failure, or an actual accident/operating transient.

I. Plant Operating Conditions Before The Event:

TMI-1 was operating at 100 percent power at the time of the event.

II. Status of Structures, Components, or Systems That Were Inoperable At The Start Of The Event And That Contributed To The Event:

None.

III. Event Description:

Preliminary Safety Concern (PSC) Report No. 2-00 initiated by Framatome Technologies Inc. (FTI) on July 28, 2000 identified that a potentially limiting break had not been considered in the small break loss of coolant accident (SBLOCA) analyses spectrum.

Following subsequent investigation, on September 11, 2000 AmerGen was formally notified by FTI of two separate non-conservatisms in the SBLOCA analyses that contributed to this event:

- The core flood tank (CFT) line break with offsite power available was more limiting than the CFT line break with loss of offsite power event, but this had not been identified in the analysis; and,

- The RCP flow degradation sub-model under two-phase fluid conditions is not conservative.

This event was reported by immediate notification to the NRC per 10CFR50.72(b)(1)(ii)(B).

FTI performed several preliminary analyses of this event for TMI-1 and provided the following results:

- Analyzing a CFT line break at 2772 MWt with offsite power available, with RCPs tripped at two minutes after LSCM and using the more conservative two-phase pump degradation sub-model produced PCTs in excess of 2200 degrees F.

- Analyzing a CFT line break at 2568 MWt (the TMI-1 licensed power level) with offsite power available, with RCPs tripped at two minutes after LSCM, and using the more conservative two-phase pump degradation sub-model produced PCTs still in excess of 2200 degrees F.

- Analyzing a CFT line break at 2568 MWt with offsite power available, with tripping the RCPs at one-minute after indication of LSCM, and using the more conservative two-phase pump degradation sub-model, the predicted PCT did not exceed 750 degrees F.

In view of this information, TMI-1's SBLOCA analysis must credit an earlier RCP trip following LSCM.

IV. Assessment of Safety Consequences & Implications of the Event:

There were no direct adverse effects from this condition. Information on the potential reduction in analytical margin related to tripping of the RCPs following indication of LSCM was promptly briefed to control room personnel.

The effect of this event on nuclear safety and safe plant operations is minimal because:

- The emergency operating procedure (EOP) requirement is to trip the RCPs immediately on indication of LSCM. TMI-1 has had 15 years of operator training experience with a variety of LOCA scenarios which indicates that the RCPs have consistently been tripped within one-minute of recognition of the LSCM condition.

- The length of piping under consideration for the CFT line break is relatively small. For each of the 2 CFT lines, this portion of the piping extends from the reactor vessel to the first check valve, which is just outside the primary shield wall.

- A more realistic scenario than that of 10 CFR 50, Appendix K, would not involve the failure of high and low pressure injection, and thus would provide sufficient ECCS flow such that the core would remain covered.

The implications of the event (i.e., using the SBLOCA analysis of record for the CFT line break, with offsite power available, the RCPs tripped at two-minutes following LSCM, and application of the 10 CFR 50 Appendix K required single-failure assumption) are that the upper portion of the fuel would be uncovered resulting in excessive clad temperatures. The Reactor Coolant System would ultimately be vulnerable to fission product release, but the containment barrier would not be challenged. The guidance, training, and management expectation in this scenario is that, even with the ECCS failures, the operators would trip the RCPs immediately. Preliminary FTI analysis of this case credit tripping the RCPs at one minute after LSCM and result in PCTs of less than 750 degrees F.

V. Previous Events & Extent of Condition:

A. Several related events are similar in that these are cases where the plant was outside of its design basis, or may not have been bounded by the original analysis. However, these previous instances are not considered to reflect a programmatic failure of the current engineering analysis process. This conclusion was reached on the basis of the small number of similar events identified and the fact that most of these design analyses were performed many years ago. It is recognized that improvements made in the state of the art of accident modeling, in conjunction with a larger bank of industry experience, have improved the ability to identify new challenges to design bases.

- During development of the Davis-Besse LBLOCA RELAP5 input model by Framatome Technologies Inc. (FTI), an RCP modeling question led to the discovery that all previous EM analyses may not have used the appropriate RCP type in the LBLOCA analyses. In FTI's Preliminary Report of Safety Concerns, PSC No. 1-99, addressed this event.

- FTI discovered that input data assumed that mixing-vane grids were used in the hot channel for the heatup portion of the LOCA analyses. None of the fuel types in the TMI-1 Cycle 12 core included mixing-vane grids. Preliminary evaluation by FTI indicated that the peak clad temperatures (PCT) would increase when input data assumes that standard grids are used in the LOCA analyses. The FTI re-analysis showed that the maximum PCT will be higher than previously predicted but was still below the 10 CFR 50.46 limit and thus there is no adverse affect on operability. This condition was not reportable under the requirements of 10 CFR 50.72 or 10 CFR 50.73, however 10 CFR 50.46 required a 30 day report be made to the NRC since the calculated change in PCT was significant, i.e., >50 degrees F.

- NRC Information Notices: IN 97-15: "Reporting of Errors and Changes in LBLOCA Evaluation Models of Fuel Vendors and Compliance with 10 CFR 50.46(a)(3)." Changes and errors in Siemens Power Corporation (SPC, formerly Exxon Nuclear) and General Electric (GE) LBLOCA analysis models led to a series of 30-day reports and 10 CFR 50.72 reports as required by 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors." This reinforced the importance of the Licensee's role in ECCS analysis development and acceptance.

B. With regard to the extent of condition for this event, AmerGen is still investigating the potential impacts on other SBLOCA analyses, to determine if credit for tripping the RCPs within two minutes following the LSCM was assumed and the ramifications related to changing from two-minutes to one-minute in specific analyses, if affected. The preliminary FTI analyses performed with a one-minute RCP trip result in lower PCTs than that predicted for the two-minute trip interval for other LOCA events. (See Long Term Corrective Actions below.)

VI. Identification of Root Cause

The root cause of this event, as determined by AmerGen, was the failure to consider that the CFT Line Break with offsite power available could be the most limiting event in the SBLOCA spectrum. This event was not identified at an earlier opportunity because FTI's single failure evaluation assumptions and delayed RCP trip sensitivity studies were not well documented for the SBLOCA spectrum.

DISCUSSION

As a member of the B&W Owners' Group (BWOG), TMI-1 uses the services of FTI for its accident analysis modeling work. FTI has an approved 10 CFR 50 Appendix B program to ensure the quality of its work, and AmerGen (through the BWOG) conducted QA audits of the program and specific work products.

In the early 1980's, while attempting to resolve the issues surrounding NUREG 0737 Action Item II.K.3.5, the CFT line break case with offsite power available was not identified as a limiting event. This led to a subsequent assumption that there was no benefit to refining the RCP degradation sub-model for 2-phase flow. These decisions were made by FTI as part of the analysis work.

VII. Corrective Actions:

Immediate & Short Term Actions:

"Night Orders" were written to reinforce the expectations and existing procedural guidance pertaining to immediate shutdown of the RCPs on indication of LSCM. **This action has been completed.**

Long Term Corrective Actions:

1. FTI will perform analyses and will issue a report for resolution of PSC 2-00. This report will verify the preliminary results. It will also document the results of additional analyses to verify that the current SBLOCA spectrum results are still valid and applicable to TMI-1. **The target date for completion of this action is December 20, 2000.**

2. The licensee will evaluate methods of improving ECCS margin and will notify the NRC, in a supplement to this report, of the planned approach to obtain the desired improvement. **The target date for submittal of the supplemental LER is April 11, 2001.**

The Energy Industry Identification System (EIIS), System Identification (SI) and Component Function Identification (CFI) Codes are included in brackets, [SI/CFI] where applicable, as required by 10 CFR 50.73 (b)(2)(ii)(F).

ABBREVIATIONS AND ACRONYMS

10 CFR	Title 10 of the Code of Federal Regulations
ATP	Abnormal Transient Procedure
B&W	Babcock and Wilcox
BWOG	B&W Owner's Group
CAP	Corrective Action Process (or Program)
CFT	Core Flood Tank
CRAFT2	An FTI Evaluation Model (computer code)
ECCS	Emergency Core Cooling Systems
EM	Evaluation Model
EOP	Emergency Operating Procedure
FTI	Framatome Technologies Inc.
HPI	High Pressure Injection
IN	NRC Information Notice
LBLOCA	Large Break Loss of Coolant Accident
LER	Licensee Event Report
LPI	Low Pressure Injection
LOCA	Loss of Coolant Accident
LSCM	Loss of Sub-Cooling Margin
MWt	Megawatts Thermal (t)
NRC	Nuclear Regulatory Commission
PCT	Peak Clad Temperature(s)
PSC	Preliminary Safety Concern
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
RELAP5	An Evaluation Model (Computer Code)
SBLOCA	Small Break LOCA
SG	Steam Generator
TMI-1	Three Mile Island Unit 1
UFSAR	Updated Final Safety Analysis Report