

# SIEMENS

November 22, 1996  
HDC:96:064

Document Control Desk  
ATTN: Chief, Planning, Program and Management Support Branch  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

## 10 CFR 21 Evaluation and Notification for EXEM PWR LOCA Model

This letter is written notification of a reportable defect per 10 CFR Part 21 reported to the NRC Operations Center by facsimile on November 21, 1996.

In a telephone conversation on October 10, 1996, Siemens Power Corporation (SPC) and its current PWR utility customers were informed the NRC had rejected SPC's proposed 1991 changes made to the FCTF reflood heat transfer correlations in the TOODEE2 code in the approved 1986 EXEM PWR large break loss of coolant accident (LBLOCA) evaluation model. These changes were submitted to eliminate a non-physical trend in heat transfer coefficients as a function of reflood rate in the 1986 EXEM PWR LBLOCA evaluation model.

The NRC also determined, based on the information available to the staff, the non-physical trend in the 1986 EXEM PWR LBLOCA evaluation model constituted an unacceptable error. These NRC determinations were documented in a letter from R. C. Jones (USNRC) to H. D. Curet (SPC) dated October 11, 1996. As a result of these determinations, SPC performed a 10 CFR 21 evaluation in accordance with the SPC procedures. This letter documents the results of this Part 21 evaluation.

The SPC Part 21 evaluation concluded the defect in the FCTF heat transfer correlations in the 1986 EXEM PWR evaluation model to be a substantial safety defect. The basis for this conclusion rests on the fact that certain plants analyzed with interim corrections to the FCTF heat transfer correlations exceeded 10 CFR 50.46 limits.

9612030134 961122  
PDR PT21 EMVEXXN  
96 PDR

L-4-1PT21C  
X RD-8-2 Exxon

11  
2e19

## Siemens Power Corporation

Nuclear Division  
Engineering & Manufacturing

2101 Horn Rapids Road  
P.O. Box 130  
Richland, WA 99352-0130

Tel: (509) 375-8100  
Fax: (509) 375-8402

020039

The affected PWR utilities have been kept informed of this issue by the above-mentioned telephone conversation, a meeting conducted by the NRC held on Wednesday, October 16, 1996 in Rockville, Maryland regarding the impact of the defect on calculated 10 CFR 50.46 criteria, and direct communications between the utilities and SPC. Actions taken and to be taken to address the issue are provided in the Attachment.

Very truly yours,



H. Donald Curet, Manager  
Product Licensing

/smg

Attachment

cc: L. J. Callan (NRC)  
T. E. Collins (NRC)  
E. Y. Wang (NRC)  
L. J. Federico  
B. N. Femreite  
L. E. Hansen  
L. J. Maas  
J. H. Nordahl  
C. M. Powers  
R. S. Reynolds

REPORTABLE DEFECT(i.) *Name and address of the individual informing the Commission*

H. D. Curet, Manager, Product Licensing, Siemens Power Corporation, 2101 Horn Rapids Road, Richland, WA 99352

(ii.) *Identification of the facility, the activity, or the basic component supplied for such facility or such activity within the United States which fails to comply or contains a defect.*

Each SPC fueled PWR that was analyzed with the SPC 1986 EXEM PWR LBLOCA model which contained a non-physical reflood heat transfer trend in the TOODEE2 code may have operated based on a non-conservative LOCA analysis prediction.

(iii.) *Identification of the firm constructing the facility or supplying the basic component which fails to comply or contains a defect.*

Siemens Power Corporation, Richland, WA.

(iv.) *Nature of the defect or failure to comply and the safety hazard which is created or could be created by such a defect or failure to comply.*

SPC observed a non-physical trend in the approved 1986 EXEM PWR LBLOCA evaluation model heat transfer coefficients computed by the FCTF correlations in the reflood rate range of approximately 1 in/sec to 1.77 in/sec. In this range, as the reflood rate decreases, the calculated heat transfer coefficient can under certain conditions increase. Though non-physical, the trend was considered by SPC to be conservative compared to FCTF experimental data.

In 1991 SPC made changes to the FCTF reflood heat transfer correlations in the TOODEE2 code in the approved 1986 EXEM PWR LBLOCA evaluation model. These changes were made to eliminate a non-physical trend in heat transfer coefficients as a function of reflood rate in the 1986 EXEM PWR LBLOCA evaluation model. The NRC rejected those changes and also concluded, based on the information available to the staff, that the FCTF correlation model includes an unacceptable error not only because of the non-physical heat transfer trend but also because of non-conservative heat transfer model predictions.

To correct the unacceptable error, SPC implemented two specific, interim modifications to the FCTF reflood heat transfer correlations in the TOODEE2 code in the 1986 EXEM PWR LBLOCA evaluation model to eliminate the non-physical trend in the two following ways:

Interim Option 1. The reflood heat transfer coefficients were restricted to increase linearly between the values calculated by the FCTF reflood heat transfer correlations for reflood rates of 1 in/sec and 1.77 in/sec.

Interim Option 2. The reflood heat transfer coefficients calculated over the entire reflood range were not allowed to exceed the heat transfer coefficient value at the reflood rate of 1.77 in/sec.

LBLOCA analyses with Interim Options 1. and 2. were or are being performed for SPC fueled plants.

- (v.) *The date on which the information of such defect or failure to comply was obtained.*

October 10, 1996 was when the NRC informed SPC of the determination of an unacceptable error in the 1986 EXEM LBLOCA evaluation model (i.e., TOODEE2 code). LBLOCA analyses on October 12-13, 1996, with the interim options implemented in TOODEE2 determined that 10 CFR 50.46 criteria could have been exceeded for certain plants.

- (vi.) *In the case of a basic component which fails to comply, the number and the location of all such components in use at, supplied for, or being supplied for one or more facilities or activities subject to the regulations in this part.*

Each SPC fueled PWR, which can have reflood rates of less than 1.77 in/sec before the occurrence of PCT and are analyzed with the SPC 1986 EXEM PWR LBLOCA model, as modified with Interim Options 1. and 2. to eliminate the non-physical reflood heat transfer trend, may be predicted to exceed 10 CFR 50.46 criteria. (See Table 1).

- (vii.) *The corrective action which has been, is being, or will be taken; the name of the individual or organization responsible for the action; and the length of time that has been or will be taken to complete the action.*

SPC has evaluated six SPC fueled PWRs (See Table 1); four with Interim Option 1. and two with Interim Option 2. With the exception of Kewaunee, all have provided the NRC with 50.46 notifications of the impact of the evaluations. If required, plants took compensatory action to remain within 50.46 criteria.

TU Electric evaluated Comanche Peak Units 1 and 2 and has provided or will provide the NRC with 50.46 notifications.

SPC is currently developing a modification to the TOODEE2 code which eliminates the previously observed non-physical reflood heat transfer trend. A topical report to the NRC describing and justifying this modification is scheduled for submittal to the NRC by December 16, 1996.

Once NRC approval of the topical report is received, LBLOCA analyses with the new model will have to be performed for SPC fueled PWRs to establish analysis of record PCTs for each impacted plant.

- (viii.) *Any advice related to the defect or failure to comply about the facility, activity, or basic component that has been, is being, or will be given to purchasers or licensees.*

All current SPC fueled licensees have been and are maintained fully informed of the defect and actions being taken to correct the defect. All such licensees will be advised that once the NRC approves a modification to TOODEE2 to correct the defect, they should assess if notification of the NRC under 10 CFR 50.73 requirements is necessary.

SPC supplied a final reload to AEP's D. C. Cook Unit 2 in 1988. This reload was analyzed with the 1986 EXEM PWR LBLOCA evaluation model containing the non-physical trend. AEP will be made aware of this defect and advised that once the NRC approves a modification to TOODEE2 to correct the defect, AEP should assess if notification of the NRC under 10 CFR 50.73 requirements is necessary.

Table 1

Summary of SPC Interim Evaluations

<u>Plant</u>	<u>Disposition</u>
Harris	Analyzed with Interim Option 2. and determined to meet 50.46 criteria without compensatory action.
Palisades	Analyzed with Interim Option 2. and determined to meet 50.46 criteria without compensatory action.
St. Lucie 1	Analyzed with Interim Option 1. and determined to meet 50.46 criteria without compensatory action.
Millstone 2	Analyzed with Interim Option 1. and determined to meet 50.46 criteria without compensatory action.
Robinson	Analyzed with Interim Option 1. and determined to require compensatory action to meet 50.46 criteria.
Kewaunee	Analyzed with Interim Option 1. and determined to require compensatory action to meet 50.46 criteria.

## Note:

Interim Option 1. The reflood heat transfer coefficients were restricted to increase linearly between the values calculated by the FCTF reflood heat transfer correlations for reflood rates of 1 in/sec and 1.77 in/sec. With the 1986 model reflood rates greater than 1.77 in/sec, heat transfer coefficients are not to exceed the heat transfer coefficient value at the reflood rate of 1.77 in/sec.

Interim Option 2. The reflood heat transfer coefficients calculated over the entire reflood range were not allowed to exceed the heat transfer coefficient value at the reflood rate of 1.77 in/sec.