FRAMATOME ANP

An AREVA and Siemens company

FRAMATOME ANP, Inc.

June 20, 2003
NRC:03:039

Document Control Desk
ATTN: Chief, Planning, Program and Management Support Branch
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Request for Review of a Revision to EMF-2209(P)(A) Revision 1

Ref.: 1. EMF-2209(P)(A) Revision 1, *SPCB Critical Power Correlation*, Siemens Power Corporation, July 2000.

Framatome ANP requests the NRC's review and approval for referencing in licensing actions the attached revisions to the SPCB CHF correlation (see Reference 1). This revision describes a reduction in the conservatism included in the SPCB correlation for designs where a uranium blanket is used at the top of the fuel. We request that the NRC approve this revision by August 31, 2003 to support certain fuel reloads.

Framatome ANP will incorporate these changes into EMF-2209(P)(A) Revision 2 following NRC acceptance.

Framatome ANP considers some of the information contained in the enclosed revision to be proprietary. As required by 10 CFR 2.790(b), an affidavit is enclosed to support the withholding of the information from public disclosure. Five copies of the proprietary and non-proprietary versions of the attachment are enclosed.

Very truly yours,

Gerald Holm for

James F. Mallay, Director
Regulatory Affairs

Attachments

cc:

D. G. Holland (w/attachments)
J. S. Wermiel
Project 728

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AFFIDAVIT

STATE OF WASHINGTON)
) ss.
COUNTY OF BENTON)

1. My name is Jerald S. Holm. I am Manager, Product Licensing, for Framatome ANP ("FANP"), and as such I am authorized to execute this Affidavit.

2. I am familiar with the criteria applied by FANP to determine whether certain FANP information is proprietary. I am familiar with the policies established by FANP to ensure the proper application of these criteria.

3. I am familiar with the FANP information in letter number NRC:03:039 dated June 20, 2003, and referred to herein as "Document." Information contained in this Document has been classified by FANP as proprietary in accordance with the policies established by FANP for the control and protection of proprietary and confidential information.

4. This Document contain information of a proprietary and confidential nature and is of the type customarily held in confidence by FANP and not made available to the public. Based on my experience, I am aware that other companies regard information of the kind contained in this Document as proprietary and confidential.

5. This Document has been made available to the U.S. Nuclear Regulatory Commission in confidence with the request that the information contained in this Document be withheld from public disclosure.

6. The following criteria are customarily applied by FANP to determine whether information should be classified as proprietary:

(a) The information reveals details of FANP's research and development plans and programs or their results.

(b) Use of the information by a competitor would permit the competitor to significantly reduce its expenditures, in time or resources, to design, produce, or market a similar product or service.

(c) The information includes test data or analytical techniques concerning a process, methodology, or component, the application of which results in a competitive advantage for FANP.

(d) The information reveals certain distinguishing aspects of a process, methodology, or component, the exclusive use of which provides a competitive advantage for FANP in product optimization or marketability.

(e) The information is vital to a competitive advantage held by FANP, would be helpful to competitors to FANP, and would likely cause substantial harm to the competitive position of FANP.

7. In accordance with FANP's policies governing the protection and control of information, proprietary information contained in this Document have been made available, on a limited basis, to others outside FANP only as required and under suitable agreement providing for nondisclosure and limited use of the information.

8. FANP policy requires that proprietary information be kept in a secured file or area and distributed on a need-to-know basis.

9. The foregoing statements are true and correct to the best of my knowledge, information, and belief.

____

SUBSCRIBED before me this 20th

day of June, 2003.

Susan K. McCoy

Susan K. McCoy
NOTARY PUBLIC, STATE OF WASHINGTON
MY COMMISSION EXPIRES: 1/10/04

SUSAN K. McCOY
COMMISSION EXPIRES
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An investigation of the SPCB critical power correlation has determined that the correlation is overly conservative for nuclear designs with top natural uranium blankets. This conservatism arises from the fact that the test data used for deriving the correlation do not model the effect of the natural uranium at the top of the fuel rods. The top natural blanket significantly lowers the reactivity at the end of the rod and, consequently, the heat flux in the reactor is often nearly an order of magnitude lower at the end of the rod than the heat flux in the test assemblies. The non-uniform axial correction factor derived from the experimental data produces an overly conservative estimate of the local critical heat flux for the very low heat flux in the natural uranium top portion of the fuel rod.

To illustrate the impact of reducing the heat flux in the top node, two axial power distributions are presented in Figure 1. The test axial corresponds to the downskew axial shape used in the CHF tests. A second axial (blanket effect) is constructed from the test axial by reducing the power in the top node (location 0.98) and at the end of the heated length to simulate the natural blanket.

Figure 1 Test Axial and Modification

Analyzing these two axial power distributions with SPCB shows that reducing the power in the blanket region results in about a 0.04 reduction in the critical power ratio. The plane indicating boiling transition shifts from 8 feet to the end of the heated length, and the corresponding critical heat flux at the end of the heated length decreases from about 0.13 to 0.0003 MBtu/hr-ft^2. In reality, the critical heat flux should not decrease at all for this situation; it should remain at approximately 0.13 MBtu/hr-ft^2.

The investigation of this issue revealed that the Tong Factor, as defined by equation 2.14 in Reference 1, takes on values in the natural blankets that are often more than 100 times as great as the largest values observed for the axial shapes used in the correlation database. The excessively large Tong Factor results in a calculated critical power for the top node which is overly conservative.

The reduced axial power peaking in the top blanket also introduces a step change in the omega function as defined by equation 2.15 in Reference 1. This is because the local computed values may drop significantly below the minimum value imposed on the function. The value of omega has an inverse relation to memory length. The effective memory length may be increased by 3 or more feet for a 6 inch change in the evaluation elevation. The value of the memory length should not increase by more than the 6 inch difference in the evaluation locations. The basis for selecting a minimum value of the omega function was to assure that no memory length should be more than about 10 feet. An improved definition for the omega function may be derived by observing values of omega that bound the correlation database but allow variation of the minimum due to the mass velocity as illustrated in Figure 2.

The proposed modifications to eliminate the excessive conservatism in the SPCB calculation of the critical heat flux in the top natural uranium blanket are:

c) Limit the maximum value of Tong Factor as given by equation 2.14 in Reference 1 to no more than a prescribed value.

d) Limit the minimum value of the omega function as given by equation 2.15 to be no less than a mass velocity dependent function.

These modifications would be implemented in the documentation by modifying the footnote on page 2-8 of Reference 1 with respect to the Omega Function and adding a footnote on page 2-8 with respect to the base value of Tong Factor. The amended footnote for the omega function would state:

Ω is taken as the [

]

The added footnote for the maximum value of the Tong Factor would state:

The maximum value of F_{Base} is [ ]

These modified footnotes have no effect on the statistics of the SPCB database evaluation of Reference 1.

A Revision 2 to the document EMF-2209 will be issued following the NRC issuance of a safety evaluation for the proposed change.

References:

2. EMF-2209 (P)(A) Revision 1, *SPCB Critical Power Correlation*, Siemens Power Corporation, July 2000.

Figure 2 Omega Function and Bound for SPCB Database