

**From:** Michelle Honcharik  
**To:** Jerry Holm  
**Date:** 4/13/04 11:36AM  
**Subject:** Information for 1:30pm (EST) BAW 10241 call

Jerry,  
Please see attached.  
Michelle

PM: Michelle  
Honcharik

Proj. # 728

Framatome ANIP

### EXTENSION of the BHTP CHF CORRELATION RANGES

This is relating the review of BAW-10241(P) BHTP DNB Correlation Applied with LYNXT (TAC No. MB7033). Framatome requests to extend the applicable ranges beyond the approved ranges for local quality lower than -0.125 and pressure higher than 2425 psia.

A CHF correlation is an empirical function relating a set of independent parameters (such as pressure, mass flux, thermodynamic quality, and fuel geometry) to a set of experimentally measured critical heat flux values by means of a statistical regression analysis. The purpose of the statistical fit is to capture significant trends in the relationship between CHF and the various independent variables. In general, correlations derived in this manner do a very good job of predicting CHF as a function of the independent parameters within the range of the database. However, experience has shown that such correlations do not generally do a very good job when extended to conditions outside their database. There are several reasons for this behavior: 1) the correlation is a statistical fit to data, not a mathematical expression of the physical behavior of the system; 2) the functional form of the correlation is generally some type of polynomial, the coefficients of which are iterated on to produce a curve that most closely matches the measured data over the full range of the database; and 3) polynomial functions are extremely flexible, and can be made to fit almost any reasonable distribution of data, but they have a disconcerting tendency to sometimes go off in odd directions when applied outside their range of derivation.

The staff has reviewed available information provided by Framatome dated February 11, 2004 and has found further information needed to support the staff review is given as follows:

1. In order to justify even a relative minor extrapolation of a correlation beyond its database, it is necessary to examine the correlation's behavior very carefully in the extrapolated region, to be certain it maintains the expected trends. The plot in Figures 1 and 2 shows that the BHTP does exhibit the expected behavior, but the examples shown are for only two data points, both of which is at mass flux values near middle of the range of normal operation. Would the correlation show the same trends at very low mass flux? At very high mass flux? At low pressure and low mass flux? At high pressure and low mass flux?
2. Because the correlation is non-linear in the independent parameters, the example of one or two data points in the middle of the range, as presented in Figures 1 and 2, is not sufficient to demonstrate the general applicability of the correlation to this extended range. In order to show that the BHTP correlation appropriately captures the trend of thermodynamic quality versus critical heat flux, and that of the pressure versus critical heat flux, over the full operating range of mass flux and pressure, please provides a family of curves like those in Figures 1 and 2. These curves need to encompass the full range of mass flux and pressure starting at the lowest thermodynamic qualities tested. If the correlation is able to hold up through this extrapolation, then the additional curves should all look very much like the examples in Figures 1 and 2, and it will have successfully demonstrated the applicability of the correlation when extended beyond its database over the relatively small range of extrapolation considered.

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**Subject:** Information for 1:30pm (EST) BAW 10241 call  
**Creation Date:** 4/13/04 11:36AM  
**From:** Michelle Honcharik

**Created By:** MCH3@nrc.gov

<b>Recipients</b>	<b>Action</b>	<b>Date &amp; Time</b>
framatome-anp.com		
Jerald.Holm (Jerald Holm)		

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	Pending	framatome-anp.com

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BAW 10241_LQ&HP.wpd	6554	04/13/04 11:18AM
MESSAGE	553	04/13/04 11:36AM

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