

**framato**me

**Chapter 15 Non-LOCA  
Methodology for PWRs: Bias i  
Critical Heat Flux Correlation  
Design Limit for HTP Fuel**

**Pre-Submittal Meeting**

**J. Adams and Morris Byram**

**August 2021**



# Objectives

- Supplement the EMF-2310 Topical Report
- Provide an HTP-fuel-specific design limit for Biasi
  - No design limit will be provided for Modified Barnett
  - Current users of Modified Barnett will transition to Biasi

# Agenda

Overview	Morris Byram
Range of Application	John Adams
CHF Correlation Design Limit Description	John Adams
Topical Report Content	John Adams
Next Steps	Morris Byram

# Overview

- Biasi correlation published in *Energia Nucleare* in 1967
- Framatome first used the Biasi correlation and associated design limit in 1995
- NRC approved Biasi for steam line break in 1999
- In 2018, Framatome wrote a CR identifying non-conservatism with the Biasi design limit published in the 1967 paper relative to HTP fuel
  - A similar issue was identified for the Modified Barnett correlation
- To support operability assessments, Framatome developed a design limit for Biasi that is applicable to HTP fuel at MSLB conditions for all impacted customers
- Some customers are operating in a degraded condition awaiting NRC approval of the revised design limit
- NRC previously reviewed Biasi calculations during a virtual inspection in Feb 2021
- Framatome is submitting this approach to the NRC as a supplement to EMF-2310

# Range of Plant Application

- Limited to current applications of EMF-2310 for CE-217 plants with HTP/HMP fuel
  - Includes only Calvert Cliffs 1 and 2, Millstone 2, and St. Lucie 1 and 2
- New applications will not use Biasi

# Range of Applicability

- The original range of applicability was based on the test data available in literature
- The revised range of applicability is based on the HTP CHF test database
- Application of Biasi will continue to be limited to post-scrum MSLB transients

# CHF Correlation Design Limit Description

- Predictions using COBRA-FLX local conditions with a code-to-code penalty were compared to the entire Framatome HTP CHF database in the application range. Includes data used for:
  - Extended HTP correlation (EMF-92-153)
  - ACH-2 correlation (ANP-10269)
  - ORFEO-NMGRID (ANP-10341)
  - ORFEO-HMP (pending)
- Results inspected for:
  - Trends
  - Non-normal distribution and unequal variances
  - Systematic and test campaign bias (includes axial shape and subchannel type subregions)
- Design limit calculated to bound 95% of data with 95% confidence

# Topical Report Content

- Outline of Supplement
  - Introduction
  - Summary and Range of Applicability
  - Regulatory Requirements
  - CHF Testing and Experimental Data
  - Subchannel Code
  - Correlation Definition
  - Correlation Assessment and Statistical Analysis
  - Quality Assurance Program
  - Comparison to NUREG/KM-0013

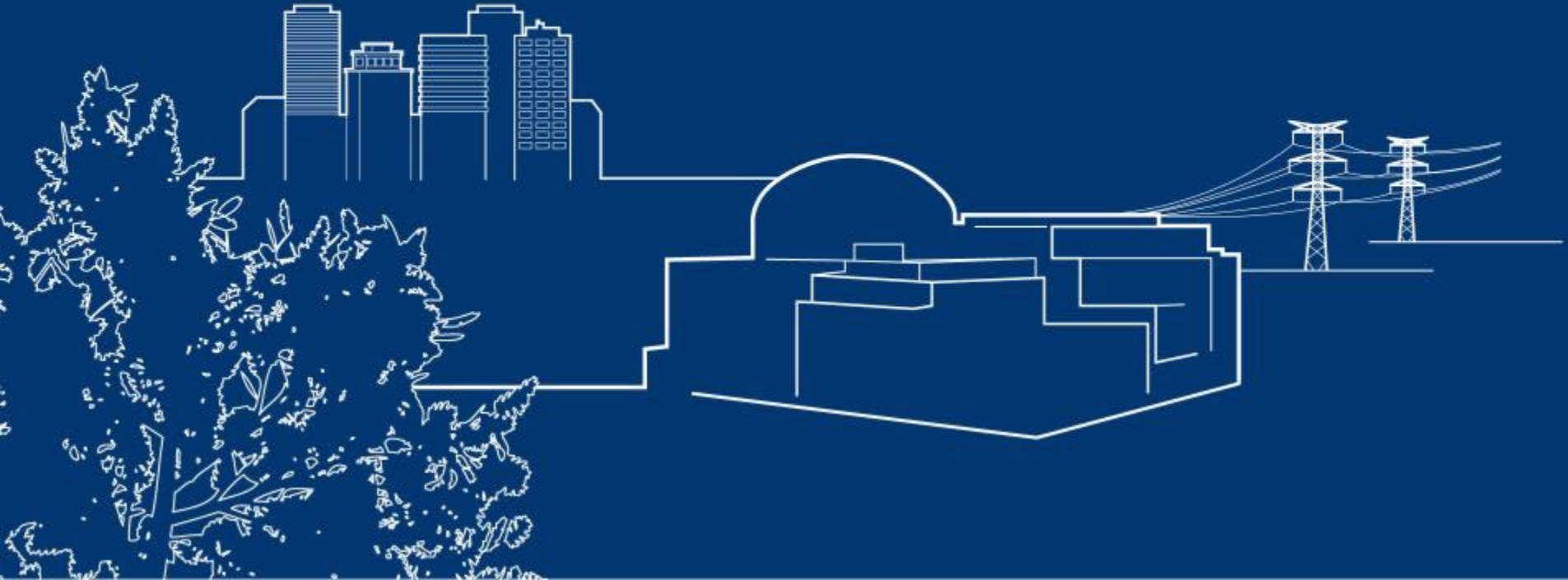


# Next Steps

- Expedited review requested (6 months)
  - Framatome has made no changes to design limit since Feb 2021 inspection
  - NRC had no findings related to the technical content of the Biasi design limit calculations
- Submittal planned for Feb 2022
- Approval requested by Aug 2022

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