framatome

Increased Burnup – LOCA EMs and Fuel Rupture Process

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Objectives

- Recall Framatome's High Burnup Licensing plan (Open)
- Discuss accounting for FFRD conditions in the LOCA EMs (Closed)
- Discuss Framatome's approach to determining fuel rod rupture for LOCA (Closed)
- Provide an opportunity for NRC feedback (Closed)

Agenda

Introduction and background (Open)

AFM Increased Burnup with FFRD (Closed)

LOCA Evaluation Models (Closed)

FFRD rupture analyses (Closed)

Summary and Next Steps (Closed)

Introduction and Background

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Introduction and Background

High Burnup topical pre-submittal meetings to date

Advanced Codes and Methods topical reports

Scope of future topical report submittals – Increased Burnup

Increased Burnup Topical Report Pre-Submittal Meetings

- Overall High Burnup Topical Report Pre-submittal……..12/18/2020
- FFRD - Use of GOTHIC for Fuel Particle Transport…….. 2/24/2021
- High Burnup Topical Report Content (Topics and Expected Sample Problems) and Radiological Dose……5/25/2021
- FFRD – Core Coolability and Criticality……9/15/2021
- Increased Burnup – LOCA EM and FFRD Rupture Analyses …..5/4/2022

Background – Advanced Codes and Methods

Neutronics	ARCADIA (ANP-10297P-A and S1P-A)
Thermal–Hydraulic	COBRA-FLX (ANP-10311P-A Revision 1)
CHF	GAIA CHF (ANP-10341P-A)
Non-LOCA	ARITA (ANP-10339P) and AREA (ANP-10338P-A)
SB LOCA	S-RELAP5 (EMF-2328P-A and S1P-A)
LB LOCA	S-RELAP5 (EMF-2103P-A Revision 3)
GALILEO in SB and LB LOCA	ANP-10349P
Fuel Performance Code	GALILEO (ANP-10323P-A Revision 1)
External Loads	ANP-10337PA and Supplement 1P
Fuel Design topical report	GAIA (ANP-10342P-A) with Q12 (ANP-10334P-A)
M5Framatome	BAW-10227P Revision 2
Liftoff	BAW-10243P-A (statistical holddown)
Cladding Collapse	BAW-10084P-A Revision 3 (CROV)
Bow Penalties	XN-75-32P-A

Scope of Future Submittal - Increased Burnup

Scope

- Umbrella report to address all issues outside of:
  - ANP-10323P-A (GALILEO) &
  - BAW-10227P Rev 2 (M5Framatome)

Range of Applicability

- Burnup – max
- Enrichment – max
- Advanced codes and methods – see previous slides for definition
- Fuel designs - Standard designs (HTP (W15x15, CE14x14, CE16x16) and GAIA 17x17)
- Plants (Westinghouse and Combustion Engineering)

Acronyms

AFM – Advanced Fuel Management

AREA – ARCADIA Rod Ejection Accident

CE – Combustion Engineering

CHF – Critical Heat Flux

CROV – Framatome's Creep Ovalization Analysis Code

EM – Evaluation Model

FFRD – Fuel Fragmentation, Relocation, and Dispersal

FPC – Fuel Performance Code

LBLOCA – Large Break Loss of Coolant Accident

LB - Large Break

LOCA – Loss of Coolant Accident

NRC – U.S. Nuclear Regulatory Commission

PWR – Pressurized Water Reactor

RCS – Reactor Coolant system

RLBLOCA – Realistic Large Break Loss of Coolant Accident

SB – Small Break

SBLOCA – Small Break Loss of Coolant Accident

SRP – Standard Review Plan

W - Westinghouse

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Thank You!