Duke Energy Presentation – Brunswick MELLLA+ Methods Applicability,
Pre-Application Meeting,
August 20, 2013

Brunswick MELLLA+ Methods Applicability

Pre-Application Meeting

August 20, 2013

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Brunswick MELLLA+ Methods Applicability

- Duke Participants
  - Roger Thomas
  - Jeff Boaz
  - Bill Murray
  - Charles Stroupe (Presenter)
- GEH Participants
  - Jens Andersen
  - Kent Halac
  - JD Kvaall
  - Jim Harrison
  - Bruce Hagemeier

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Agenda

- Schedule
- Introduction and Objectives
- Fuel and plant licensing analysis strategy
- GEH Methods Applicability to AREVA fuel
- AREVA Methods Applicability to MELLLA+: Approach
- Summary

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Schedule

- MELLLA+ LAR submittal (both Units) — Fall 2014
  - B1C19 sample problem with ATRIUM™ 10XM
- B1C21 cycle specific application results to NRC — Fall 2015
  - First planned MELLLA+ cycle
- MELLLA+ requested approval (both Units) — Spring 2016
- MELLLA+ implementation
  - During B1C21 refueling outage — Spring 2016

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Introduction and Objectives

- Provide details on GEH methods applicability
  - GEH ability to model ATWS with AREVA fuel
- AREVA methods applicability to MELLLA+: Approach

Introduction and Objectives
Background

- On January 8, 2013 Duke energy presented a pre-application meeting with the NRC. (ML13007A373)
  - Benefits of MELLLA+
  - Approach to fuel and licensing analysis strategies
  - Thermal hydraulic stability solution (AREVA's Enhanced Option III)
  - Containment Accident Pressure (CAP)
  - Anticipated Transient Without SCRAM analysis
  - MELLLA+ impacts
- Several follow up pre-application meetings were proposed. For today's meeting, methods applicability will be discussed.
  - The NRC requested "The licensee should justify the use and applicability of the GEH generic MELLLA+ LTR to the AREVA approaches and the use of AREVA fuel assemblies." (ML13016A014)

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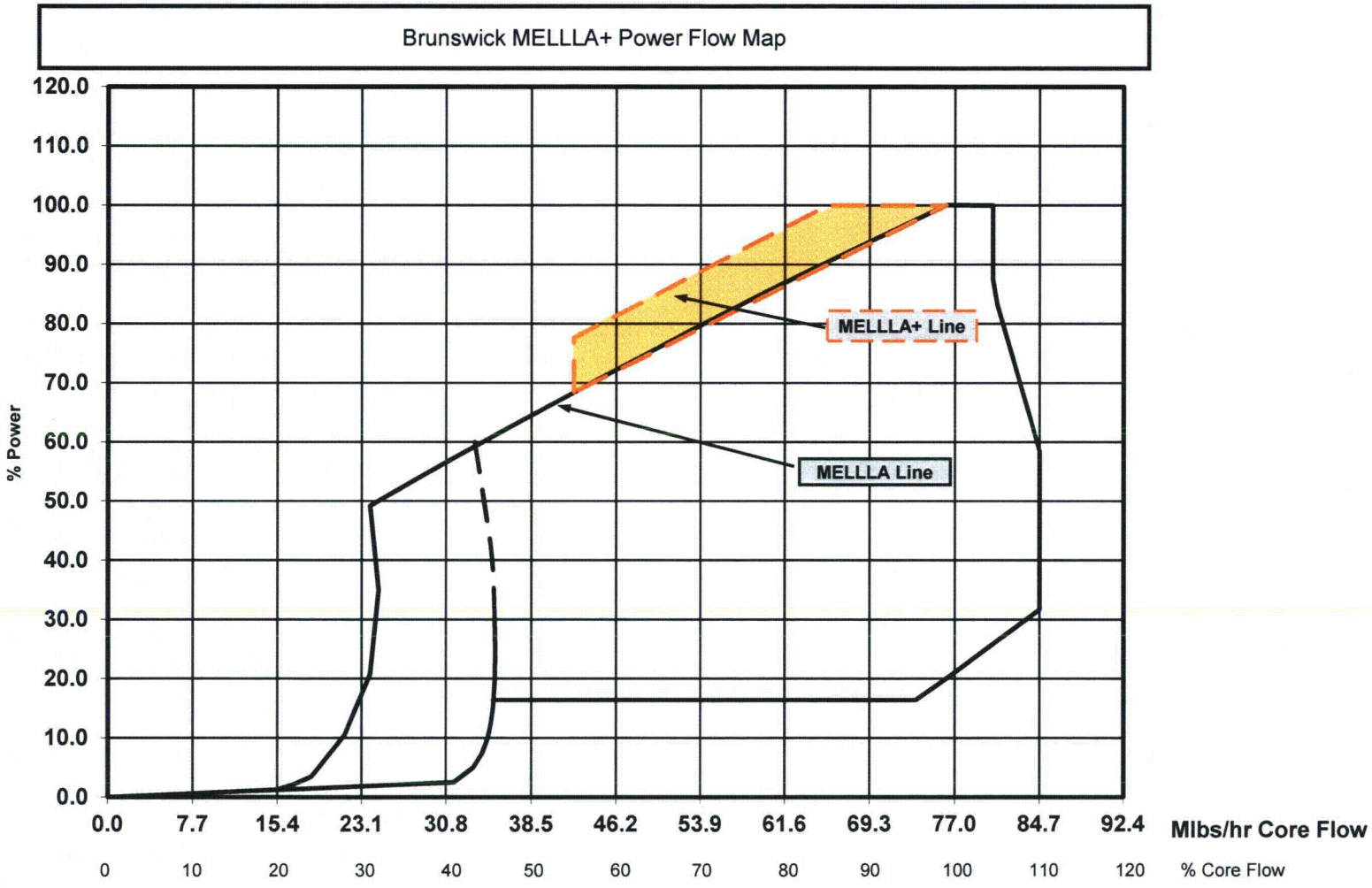
Introduction and Objectives
MELLLA+ overview



Fuel and plant licensing analysis strategy
Duke

- All topical areas of the MELLLA+ LTR will be addressed in the LAR
- Duke Energy will address:
  - SAR Integration of GEH and AREVA input
  - APRM and Enhanced Option III setpoints and implementation
  - Risk evaluation, procedure updates, operator training
  - Plant changes to mitigate ATWS (SLC B-10 enrichment increase)
  - Selected non-fuel impacts

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Fuel and plant licensing analysis strategy GEH

- GEH MELLLA+ LTR process (NEDC-33006P-A) with GEH methodologies and analyses will address:
  - Non-fuel impacts
  - Long term ATWS and ATWS instability explicitly modeling ATRIUM™ 10XM fuel

Fuel and plant licensing analysis strategy AREVA

- AREVA methodologies and analyses will address:
  - Fuel, core design, COLR fuel limits, LOCA, DBA
  - ATWS and ASME overpressure
  - Enhanced Option III (EO-III) stability solution

GEH Methods Applicability to AREVA fuel

- GEH will present information on methods applicability
  - ATRIUM™ 10 Fuel Experience
  - ATRIUM™ 10XM Fuel for ATWS Methods
  - Uncertainty Identification/Management Process
  - ATRIUM™ 10XM Modeling Approach
  - Methods Application
    - Core Modeling
    - ATWS Analysis
    - Applicable Interim Methods LTR and MELLLA+ LTR Limitations and Conditions

- GEH proprietary presentation will be given at this point in the presenation

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Agenda (Recap)

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AREVA Methods Applicability to MELLLA+: Approach

- An AREVA methods applicability report has been generated that addresses: Thermal-Hydraulics, Core Neutronics, Transient Analysis, LOCA and Stability.
  - Report will be submitted for information with the LAR
- Methods applicability report shows
  - There are no SER restrictions on AREVA methodology that are impacted by MELLLA+ operation
  - MELLLA+ core and assembly conditions for Brunswick are equivalent to core and assembly conditions of other plants for which the methodology was benchmarked
  - Bundle operating conditions in the MELLLA+ regime are within the envelope of hydraulic test data used for model qualification and operating experience
- The AREVA methodology is applicable for MELLLA+ conditions at Brunswick

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Summary

- GEH methods are applicable to ATRIUM™ 10XM fuel in the MELLLA+ condition
  - ATRIUM™ 10XM explicitly modeled
  - Uncertainties in modeling ATRIUM™ 10XM fuel with GEH methods addressed
- AREVA methods applicability to MELLLA+
  - Methods applicability report will be submitted with LAR

Brunswick MELLLA+ Fuels Methods Applicability

Questions?

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Selected Acronyms

AL – Analytical Limit

AP – Annulus Pressurization

APRM – Average Power Range Monitor

ATWS – Anticipated Transient Without Scram

AV – Allowable Value

BSP – Backup Stability Protection

CAP – Containment Accident Pressure

CIER – Channel Instability Exclusion Region

COLR – Core Operating Limits Report

DBA – Design Basis Accidents

ECCS – Emergency Core Cooling System

EO-III – Enhanced Option III

EPU – Extended Power Uprate

FWHOOS – Feedwater Heater Out Of Service

FWT – Feedwater Temperature

GEH – General Electric Hitachi

HCTL – Heat Capacity Temperature Limit

HSBW – Hot Shutdown Boron Weight

LAR – License Amendment Request

LOCA – Loss of Coolant Analysis

LTR – License Topical Report

MELLLA – Maximum Extended Load Line Limit Analysis

MELLLA+ – Maximum Extended Load Line Limit Analysis Plus

NC – Natural Circulation

NPSH – Net Positive Suction Head

NTSP – Nominal Trip Setpoint

PRNM – Power Range Neutron Monitor

SAR – Safety Analysis Report

SBO – Station Black Out

SLC – Standby Liquid Control

SLO – Single Loop Operation

SPT – Stability Protection Trip

STP – Simulated Thermal Power

TLO – Two Loop Operation

2RPT – Two Recirculation Pump Trip