ENCLOSURE 2

MFN 09-345

Draft Technology Update Presentation

Non-Proprietary Information

IMPORTANT NOTICE

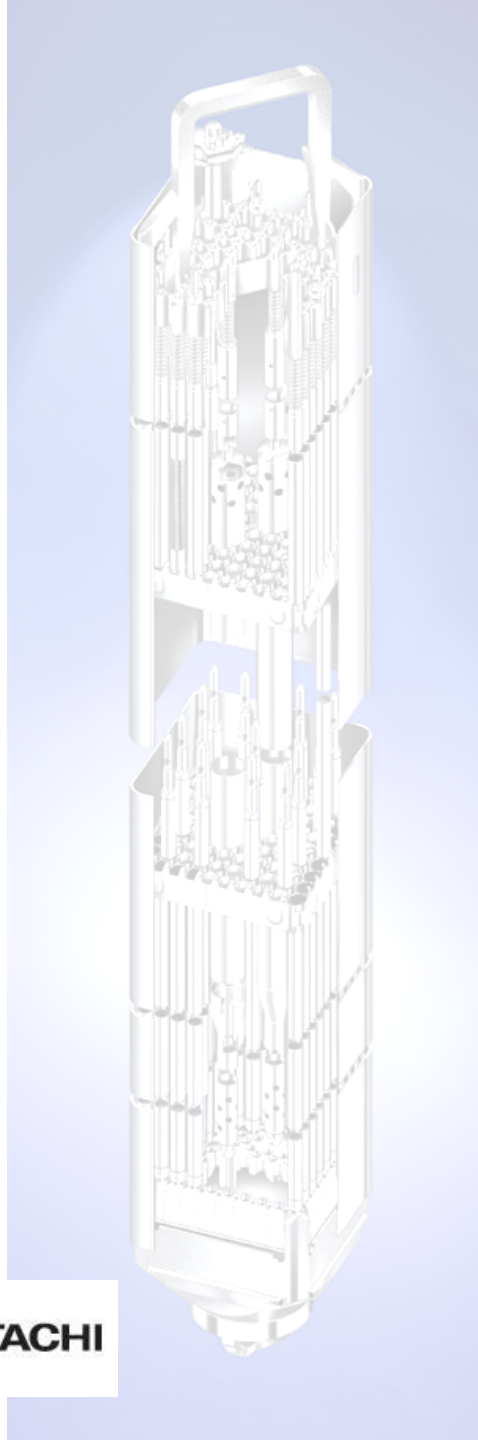
Enclosure 2 is a non-proprietary version of the Draft Technology Update Presentation from Enclosure 1, which has the proprietary information removed. Portions that have been removed are indicated by open and closed double brackets as shown here [[ ]].

2009 Technology Update

LANCER/AETNA Status

Brian Moore

April 20, 2009



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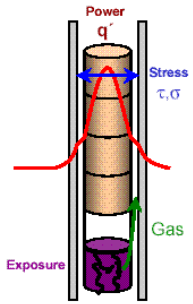
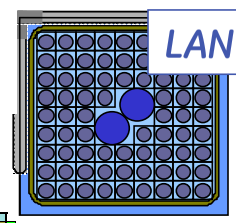
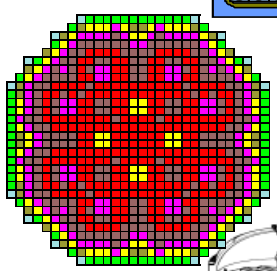
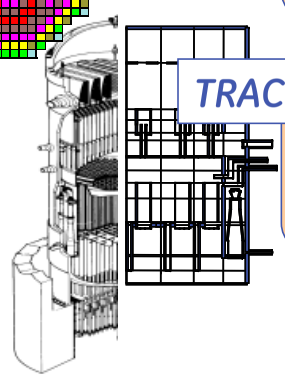
HITACHI

New Methods Code Suite









PRIME

Fuel rod thermal-mechanical
Mechanical behavior of fuel rod.

(Replaces GSTRM)

LANCER

2-D Lattice Physics
Nuclear Behavior of Fuel Rods Within Bundle.

(Replaces TGBLA)

AETNA

3-D Core Simulation
Nuclear + Thermal-Hydraulic Behavior of Bundles in Core

(Replaces PANAC)

TRACG

Coupled Core and BOP Simulation
Best Estimate Analysis of Operational Transients

(Replaces ODYN, TASC, SAFER, CORCL)

LANCER02 Status

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AETNA02 Status

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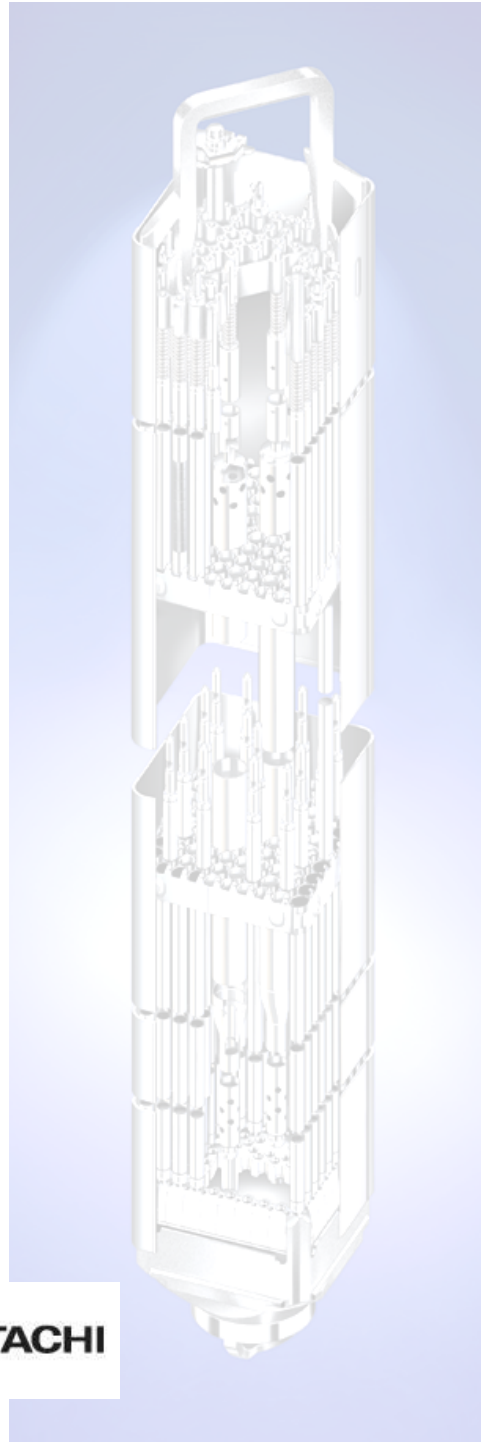
2009 Technology Update

COBRAG
Subchannel Code for BWR Fuel

Jens Andersen
June 4-5, 2009



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COBRAG

- Best estimate engineering computer code for analysis of BWR fuel bundle thermal hydraulics
  - Steady state multi-fluid model
  - Subchannel model

- Application:
  - Void fraction
  - Pressure drop
  - Critical power

- COBRAG models summarized at 2008 Technology update meeting
  - Detailed description contained in NEDE-32199

- Status

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COBRAG
Comparison to Void Fraction Data

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COBRAG

Comparison to Void Fraction Data

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COBRAG

Comparison to Void Fraction Data

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COBRAG

Comparison to Void Fraction Data

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COBRAG
Status and Schedule

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2009 Technology Update

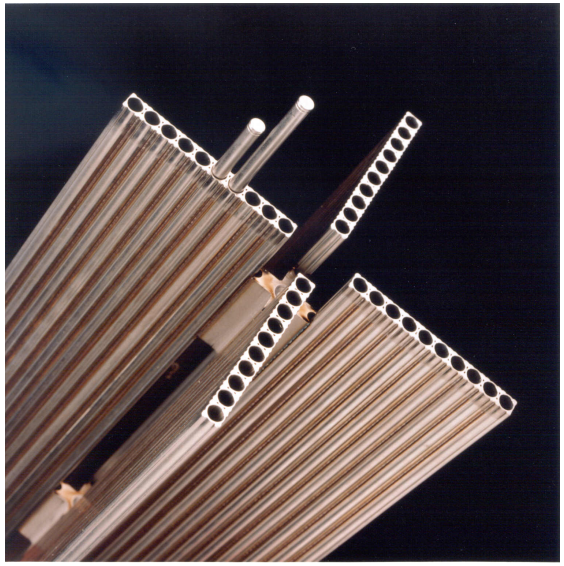
Marathon Control Rod Performance

Scott Nelson

June 4-5, 2009

GE Hitachi
Nuclear Energy

Marathon Control Rod Performance



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Marathon Surveillance Program Requirements

- The Marathon control rod SER, NEDE-31758P-A, contains a surveillance program.
- Requires visual inspections of irradiated Marathon control rods.
- The status of the surveillance program was last updated in April 2009 via MFN 09-266.
- The previous update, MFN 08-355, was submitted to NRC in April 2008.

Marathon Surveillance Program Status

- MFN 09-266 contains new inspection results for nine high depletion Marathon control rods.

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Marathon Surveillance Program Status

- Additional indication-free inspection results support the conclusion in previous evaluations.

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Marathon Surveillance Program Status

- MFN 09-266 contains a listing of planned visual inspections.

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Marathon Post-Irradiation Examination

- As shown in MFN 09-266, five highly-irradiated, D lattice Marathon control rods have shown crack indications.
- One of these control rods from Plant A was taken to hot cell for a Post-Irradiation Examination (PIE).
- The results of the PIE are contained in GEH report 0000-0095-4020-R1, contained within MFN 09-266.

Marathon Post-Irradiation Examination

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Marathon Post-Irradiation Examination

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Marathon Post-Irradiation Examination

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Marathon Post-Irradiation Examination

- **Results**
  - **The measured pressure within the tubes is well below predicted values, indicating significant conservatism in the pressurization methodology.**

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Marathon Post-Irradiation Examination Conclusions

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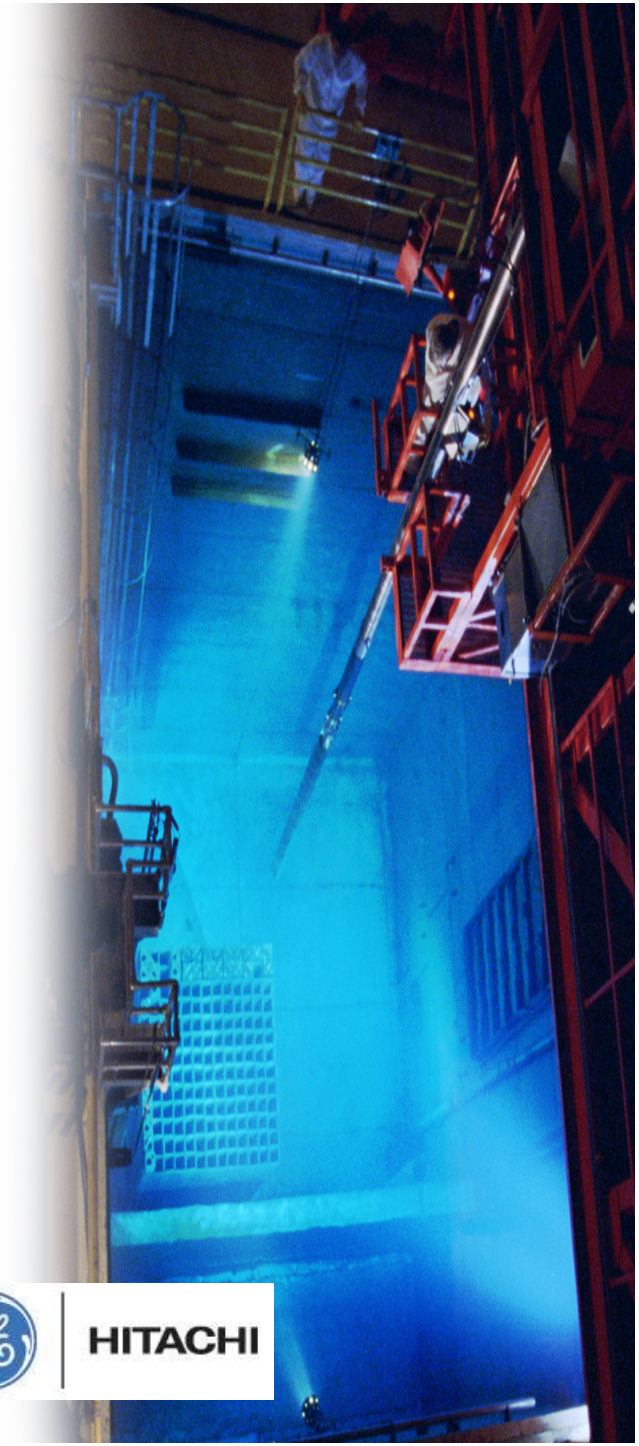
2009 Technology Update

GNF Channel Performance

Paul Cantonwine
June 4-5 2009



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Summary: 2008 NRC Technology Update

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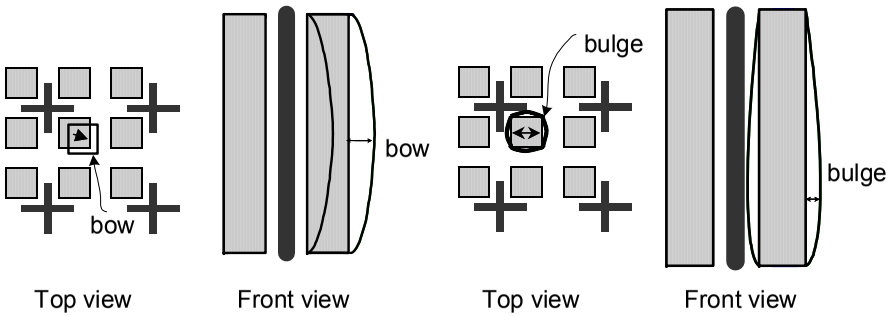
Outline

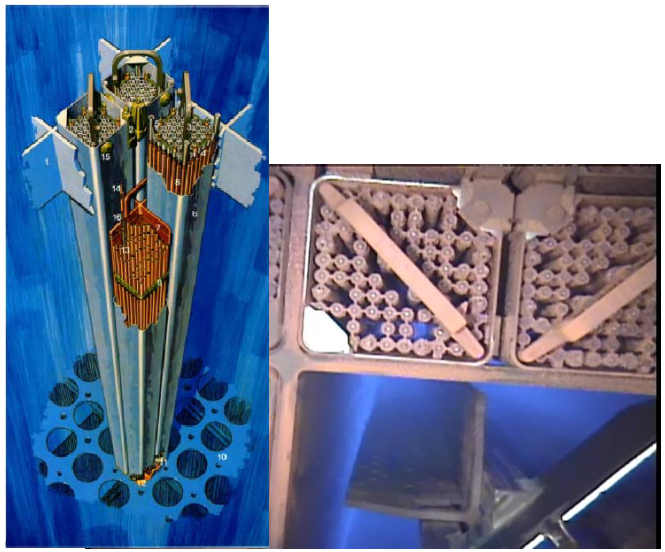
- Background
- GNF's Cell Friction Methodology
  - A Channel Distortion Management Tool
- Interference at LaSalle 1 (Mixed Core)
  - Scram Performance at Low Pressure
- Update of Safety Communication (SC08-05)
- Emerging Issues in D-Lattice Plants
- Transition from Zircaloy-2 to Zircaloy-4 Channels
- Development of Distortion Resistant Channels

Channel Distortion Mechanisms

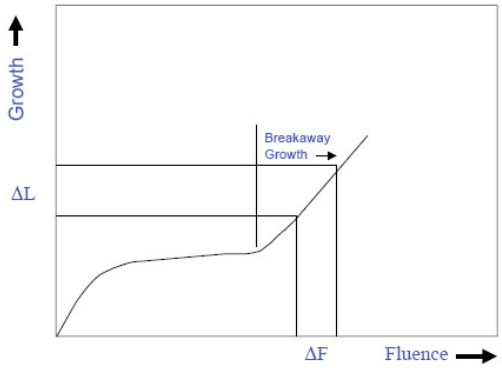


$$Bow \propto \Delta L$$

$$Bulge \propto \Delta P$$

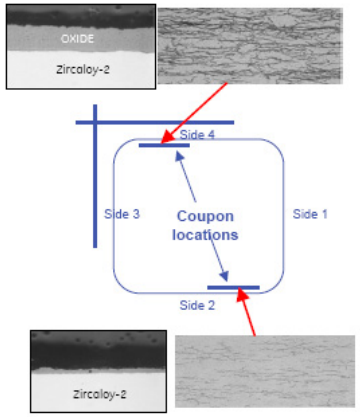


Fluence Gradient Bow



$$\Delta L \propto \Delta F$$

Shadow Bow



$$\Delta L \propto \Delta H$$

GNF Channel Performance: GNF Only Designs

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Cell Friction Methodology

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Interference Observations in Mixed Vendor Cores - LaSalle 1

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Recalibrated CFM Model Used Successfully at LaSalle 2

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Cell	Average Friction Rate Control Rod Inserted N/day	Average Friction Rate Control Rod Inserted lbf/day		Average Friction Rate Control Rod Withdrawn N/day	Average Friction Rate Control Rod Withdrawn lbf/day
2-39	-2.03	-0.46		5.09	1.14
2-27	-2.23	-0.50		1.41	0.32
10-51	-2.74	-0.62		6.29	1.41
14-55	-1.48	-0.33		13.26	2.98
22-3	-3.83	-0.86		0.00	0.00
46-55	-0.09	-0.02		4.77	1.07
50-11	-5.41	-1.22			
58-35	-3.21	-0.72		4.72	1.06
58-27					
34-59				10.74	2.41
02-19				1.34	0.30
54-47				6.81	1.53
58-43				1.73	0.39

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Observed that friction decreases when blade inserted into a cell with interference

Inserting blade induces stress in channel that is relieved by irradiation creep; therefore force between channel and blade decreases – decreasing friction

The Problem: Identified in January 2008

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Use Scram Time Testing as a Metric for Low-Pressure Scram Performance

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The Result

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Emerging Issue in D-Lattice Plants

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Transition to Zircaloy-4

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Visuals of Zr-4 Channels

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GNF Continues to Develop Distortion-Resistant Channel Materials

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Visuals of NSF Channels at Perry

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Visuals of NSF Channels at Hatch

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Summary: 2009 NRC Technology Update

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