



UNITED STATES
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

December 6, 2000

LICENSEE: Virginia Electric and Power Company
FACILITY: North Anna Power Station, Units 1 and 2
SUBJECT: MEETING SUMMARY - DISCUSSION OF THE FUEL TRANSITION PROGRAM AT NORTH ANNA POWER STATION, UNITS 1 AND 2

On November 2, 2000, a meeting was held at NRC Headquarters in Rockville, MD, between the NRC, Virginia Electric and Power Company (VEPCO), Framatome Cogema Fuels (FCF), and Framatome Technology Incorporated (FTI). The purpose of this meeting was to discuss the plan to replace the Westinghouse fuel presently used at North Anna Power Station, Units 1 and 2, with Framatome fuel. VEPCO presented an overview of the fuel transition program, along with their proposed schedule to submit a March 2002 license amendment request to implement the Framatome fuel. Likewise, FCF and FTI conducted presentations on the pertinent design evaluations of this program. A copy of these presentations is enclosed (Enclosure 1). The NRC staff discussed the topical report review process and indicated they are reviewing topical reports on this same program for other plants.

VEPCO agreed to send Dominion Topical Report VEP-FRD-42, Rev. 1-A, "Reload Nuclear Design Methodology" to the staff for review to determine applicability to the Framatome fuel transition program. In addition, the staff and VEPCO decided to conduct future meetings to monitor the progress of this program.

The meeting attendance list is enclosed (Enclosure 2).


Stephen R. Monarque, Project Manager, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-338 and 50-339

Enclosures: As stated

cc w/encls: See next page

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ATTENDEES - MEETING OF NOVEMBER 2, 2000
DISCUSSION
OF THE FUEL TRANSITION PROGRAM AT NORTH ANNA POWER STATION

<u>NAME</u>	<u>ORGANIZATION</u>
G. E. Edison	NRC/DLPM/LPDII-1
Stephen R. Monarque	NRC/DLPM/LPDII-1
Gary Darden	Dominion Generation
Robert Margolis	Dominion Generation
Kurt Flaig	Dominion Generation
Paula Larouere	Dominion Generation
Thomas Shaub	Dominion Generation
John Biller	Framatome Technology Inc.
Dennis Gottuso	Framatome Cogema Fuels
Rick Williamson	Framatome Cogema Fuels
Kerry Basehore	Dominion Generation
Francis Akstulewicz	NRC/NRR/DSSA/SRXB
Chu-yu Liang	NRC/NRR/DSSA/SRXB
Tony Attard	NRC/NRR/DSSA/SRXB
Stewart Bailey	NRC/DLPM/LPD III-2
Ralph Caruso	NRC/NRR/DSSA/SRXB
Arthur Copsey	Framatome Cogema Fuels



*North Anna
Fuel Transition Program Meeting
NRC-One White Flint
November 2, 2000*



*Introductory Remarks
Meeting Objectives
Presentation Topics*

G. L. Darden - Dominion



➤ *Introductory Remarks*

➤ *Meeting Participants*

- K. L. Basehore-Manager, Nuclear Analysis & Fuel, Dominion
- G. L. Darden-Program Manager, Nuclear Safety, Dominion
- K. F. Flaig-Nuclear Safety Analysis, Dominion
- P. J. Larouere-Fuel Performance Analysis, Dominion
- R. S. Margolis-Nuclear Safety Analysis, Dominion
- E. T. Shaub-Nuclear Licensing, Dominion
- J. R. Biller-LOCA Analysis, Framatome Technologies, Inc.
- A. B. Copsey-Thermal/Hydraulics Analysis, FCF
- D. A. Gottuso-NAPS Project Manager, FCF
- R. D. Williamson-Mark-BW Product Mgr, FCF



➤ *Meeting Objectives*

- Discuss North Anna fuel transition program
- Describe Dominion/FCF responsibilities
- Obtain NRC Staff feedback on:
 - Program features
 - Licensing approach
 - Schedule

➤ *Presentation Topics*

- Overview of Transition Program
- Dominion & FCF Program Responsibilities
- Dominion & FCF Transition Experience
- Advanced Mark-BW Mechanical Fuel Design
- Design Evaluations of FCF Fuel & Mixed Core
- Transition Program Licensing
- Program Schedule
- Questions/Action Items



Overview of Transition Program

G. L. Darden - Dominion

➤ *Overview of Transition Program*

- Program management by Dominion/FCF team
- Scope is shared between Dominion & FCF
- Mark-BW design essentially same as LTAs in North Anna 1
 - No axial blankets/gadolinia for first core
- Minimize plant limit & condition changes
- Analyses use existing methods
 - Exception is LBLOCA updates submitted for review
 - Minimizes NRC review effort
- Dominion submits licensing amendment request - Mar 2002
- Key Objective is licensing of first core for Feb 2003 delivery



Dominion & FCF Program Responsibilities

G. L. Darden - Dominion

➤ *Dominion Program Responsibilities*

- Project management
- Provide design inputs
- Analysis of NSSS Non-LOCA events
- Core thermal/hydraulics statepoint and core safety limits
- Prepare and submit license amendment request
- Nuclear core design & core follow

➤ *FCF Program Responsibilities*

- Project management
- LBLOCA topical review support
- Fuel design analysis
 - Fuel rod thermal/mechanical
 - Fuel assembly mechanical
 - Faulted analysis
- LOCA application analysis
- Mixed core thermal/hydraulic analysis
- Fuel assembly fabrication



Dominion Transition Experience

G. L. Darden - Dominion



Dominion & FCF Transition Experience



➤ *Dominion Experience & Assessments Performed*

- W products: SPS Improved Fuel; NAPS Improved Fuel
 - Zirc grids, debris-resistant features, thimble plug removal
 - Performed T/H & LOCA, Non-LOCA transient analyses
 - Core analysis performed from initial introduction into core
- North Anna Mark-BW LTAs - FCF
 - Advanced features: M5 clad, mid-span mixing grids
 - Integrated FCF T/H & LOCA analysis w/existing analyses
 - Neutronic analyses confirmed similarity & margins vs W fuel
- Recent Safety Analyses
 - Surry core uprating
 - Increased SGTP & RCS flow decrease (LOCA & Non-LOCA)
 - High burnup Westinghouse rods in North Anna 2
 - Enrichment increases at Surry and North Anna
 - North Anna spent fuel pool criticality analyses



*Dominion & FCF
Transition Experience*



➤ *Dominion Experience & Assessments Performed*

- Approved methods for NSSS accident analyses (Non-LOCA)
- Approved methods for core physics & DNB analyses
- Fuel vendor performs rod thermal/mechanical analyses
- LOCA analyses performed for SPS & NAPS with W codes
- Key topical relevant to transition analyses
 - VEP-FRD-42-A, Reload Design Methodology
 - VEP-FRD-41-A, RETRAN NSSS Analyses
 - VEP-NE-1-A, Relaxed Power Distribution Control Methodology
 - VEP-FRD-19A, PDQ (Neutronics Code)



*FCF Transition Experience and
Advanced Mark-BW Mechanical Fuel Design*

R. D. Williamson – FCF Product Manager



*FCF Successful
Transition Experience*



➤ *LTA Experience*

- McGuire
- Trojan
- North Anna

Resident Fuel Design

- W OFA
- W Standard
- W Vantage 5H

➤ *Batch Experience*

- McGuire
- Catawba
- Trojan
- Sequoyah

- W OFA
- W OFA
- W Standard
- W Vantage 5H



*Dominion & FCF
Transition Experience*



➤ *FCF Experience & Assessments Performed*

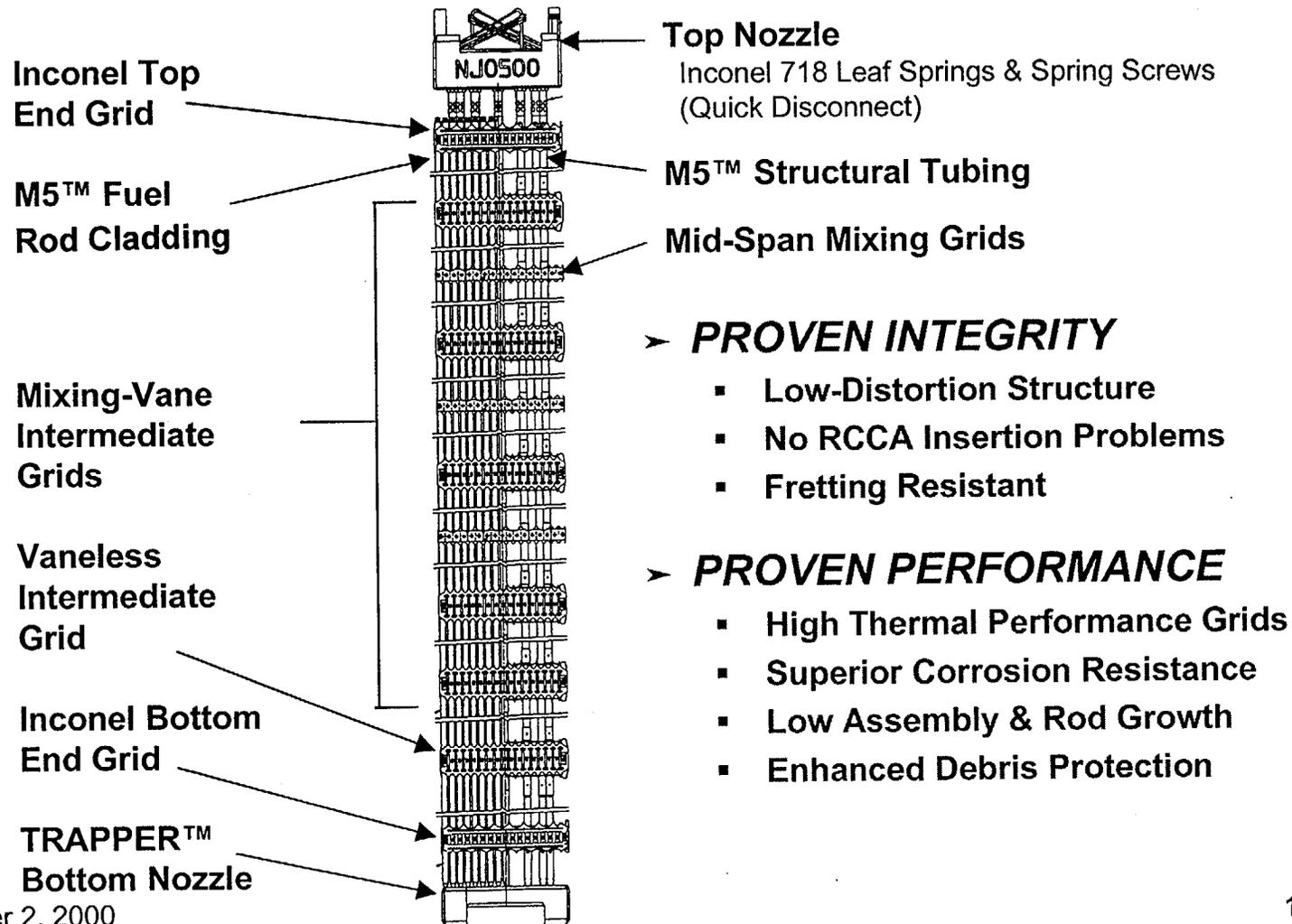
- Approved methods for full fuel thermal, mechanical, structural and faulted analysis
- Key topical relevant to transition analyses
 - BAW-10156P-A, Rev. 1, LYNXT Thermal/Hydraulics Code
 - BAW-10162P-A, TACO3 Fuel Performance Code
 - BAW-10159P-A, BWCMV CHF Correlation (W Fuel)
 - BAW-10227P-A, M5 Cladding & Structural Material
 - BAW-10199P-A, BWU CHF Correlation (Mark-BW Fuel)
 - BAW-10133P-A, Add. 1&2, Assembly Faulted Analysis
 - BAW-10164P-A, Rev. 3, RELAP5 Code
 - BAW-10168P-A, Rev. 3, RSG LOCA Evaluation Model
 - BAW-10220P-A, Sequoyah Transition Analysis



Mark-BW - Experience



-
- *Licensed and proven in eight W plants*
 - *Proven transition performance -- No problems*
 - *Superior CHF margin relative to resident fuel design*
 - *Keyed, floating grids reduce fuel assembly distortion*
 - *No RCCA insertion problem*
 - *TRAPPER™ bottom nozzle provides enhanced debris protection*
 - *Superior fuel integrity*





*Advanced Mark-BW LTA
Program at North Anna*



-
- *Four Advanced Mark-BW Lead Test Assemblies inserted into North Anna Unit 1 -- June 1997*
 - NRC approval provided on May 9, 1997
 - *LTAs currently in their 3rd cycle of operation*
 - 46 GWd/mtU fuel assembly burnup after 2 cycles
 - 52 GWd/mtU estimated fuel assembly burnup after 3 cycles
 - *Post-Irradiation Examinations performed at end of each cycle*
 - *LTAs are performing as predicted*



Fuel Design Comparison



	V5H Resident Fuel	North Anna Mark-BW LTAs	North Anna Reloads
Top Nozzle	RTN w/ Lock Tubes	Quick Disconnect	Same as LTA
Guide Thimbles	ZIRLO™	M5™	Same as LTA
Fuel Rods	ZIRLO™	M5™	Same as LTA
End Grids	Inconel	Inconel	Same as LTA
Intermediate Grids	ZIRLO™	Zr-4	Same as LTA Zr-4 or M5™
Mid Span Mixing Grids	None	Quantity = 3 Zr-4	Same as LTA Zr-4 or M5™
Bottom Nozzle	Debris Resistant w/ P-Grid	TRAPPER™ Fine Mesh	TRAPPER™ Coarse Mesh



*Key Design Evaluations of FCF Fuel:
Transition LOCA Evaluation*

J. R. Biller - FTI



Dominion

LOCA

Analysis & Licensing Experience



-
- *Prior Experience*
 - The McGuire and Catawba Units
 - The Trojan Unit
 - Recently, the Sequoyah Units
 - *Have Experience with the North Anna Units*
 - LTA work -- actual LBLOCA analysis
 - *North Anna LOCA activities will follow same path as Sequoyah*



LOCA Transition Components



➤ *Two Major Components:*

- North Anna plant-specific analysis tasks
 - RELAP5 revised EM being used
 - LBLOCA & SBLOCA
- Approval of LOCA EM revisions currently under Staff review
 - Improved LBLOCA methods - all computations performed in a single code (fully coupled system analysis in RELAP5)
 - Submitted materials and North Anna needs discussed with NRC Staff in October 20, 2000 meeting



LOCA Licensing Needs



-
- *Large Break LOCA*
 - Fuel Temperature Uncertainty
 - FTI Letter FTI-00-551, February 29, 2000
 - RELAP5 code topical report revision: BAW-10164P, Rev. 4
 - Expected approval date: before 12/31/00
 - Removal of REFLOD3B Code
 - RELAP5 code topical report revision: BAW-10164P, Rev. 5
 - RSG LOCA evaluation model: BAW-10168P, Rev. 4
 - Requested approval date: 12/31/01
 - *Small Break LOCA*
 - Top/Side Breaks
 - Topical restriction per BAW-10168P-A, Rev. 3
 - To be addressed in North Anna licensing submittal



LOCA Analysis Plan



-
- *LOCA Analysis Plan – same general approach as for Sequoyah*
 - Plant model input development
 - Plant model refinement and testing
 - Perform plant sensitivity studies
 - time-in-life
 - minimum/maximum ECCS flow
 - break spectrum
 - reactor vessel upflow/downflow
 - LOCA limit calculations- K_z/F_Q (or kw/ft)
 - Mixed Core Assessment
 - Hydraulic evaluation of ΔP between FCF & W fuel assemblies
 - Determine need for mixed core study & quantification of ΔPCT
 - SBLOCA Analysis



*Key Design Evaluations of FCF Fuel:
Mixed Core Thermal/Hydraulic Analysis*

A. B. Copsey - FCF



FCF
CHF Correlations



-
- *BAW-10159 (BWCMV) - Developed from W, NFI data*
 - Licensed for W 15x15 and 17x17 STD and OFA, plus VANTAGE 5H and Mark-BW
 - *BAW-10189 (BWCMV-A) extended to Mark-BW through extensive testing, producing 20% improvement in DNBR*
 - *BAW-10199 (BWU) correlation increasing range of application and reducing uncertainty*
 - Addendum to extend BWU to MSMGs will be submitted before 12/31/00



LYNXT Code History



-
- *Based on COBRAIV-I (developed by ERDA and NRC)*
 - *Modified by FCF*
 - *Benchmarked to experiments, FCF codes (LYNX1, LYNX2) and industry codes (COBRA3C)*
 - *Approved LYNXT topicals*
 - *BAW-10156P-A, March 1986*
 - *BAW-10156P-A, Rev. 1, August 1993*
 - *Used to successfully license 15x15 (FCF) and 17x17 (Westinghouse) reload cores*

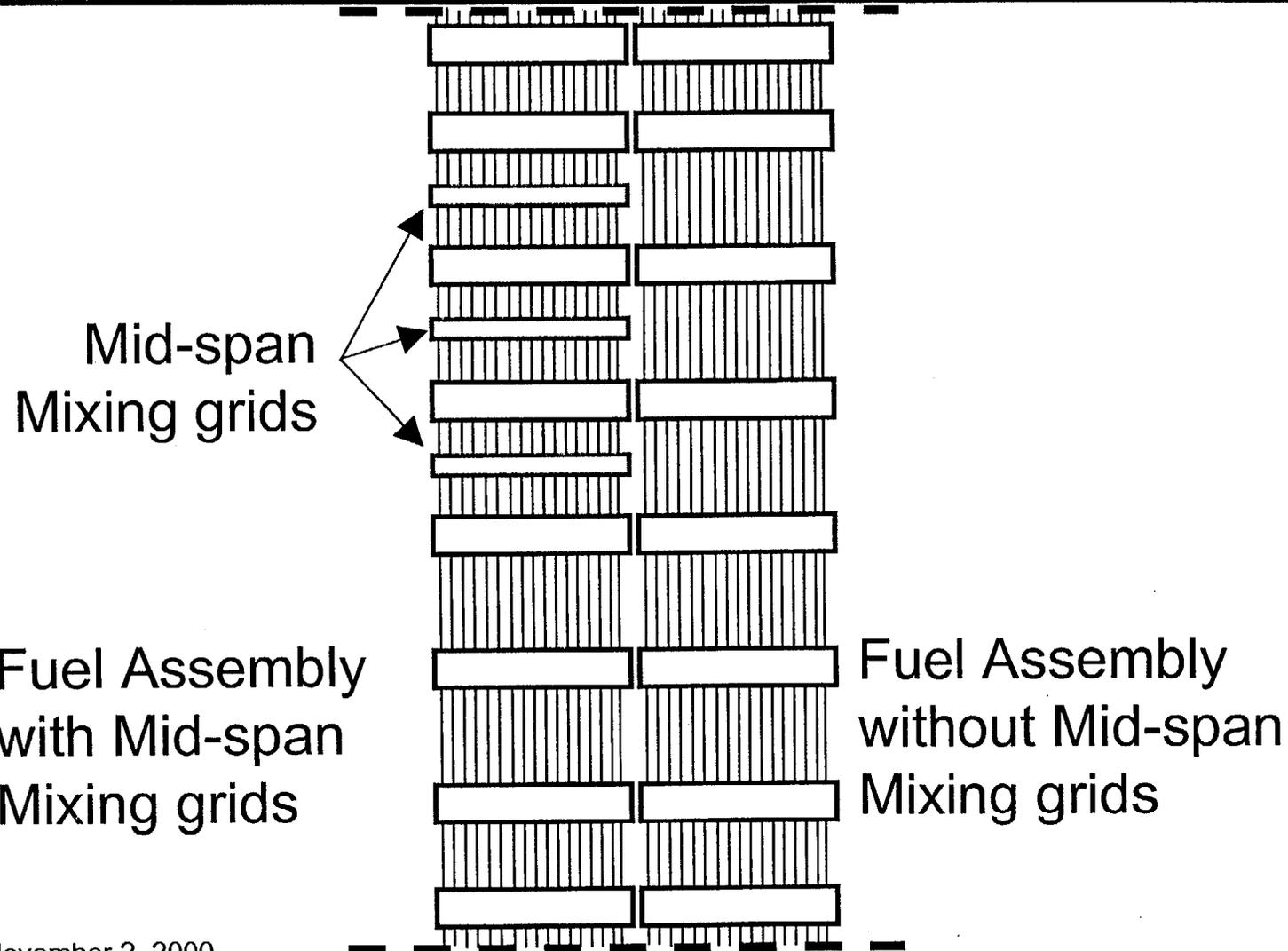


LYNX**T** Benchmarks/Isothermal Test Comparisons



-
- *Comparison to LYNX1 (BAW-10129P-A, July 1985) and LYNX2 (BAW-10130P-A, July 1985)*
 - *Comparison to COBRA3C*
 - *Comparison to VIPRE (EPRI) and FLICA III-F (Framatome) codes*
 - *Comparison to isothermal and heated tests*
 - *Interbundle Diversion Crossflow (IBDCF) tests (results in BAW-10156P-A and BAW-10156P-A, Rev. 1)*
 - *Marignan tests from CEA's Hermes facility*

Marignan Test Configuration





Mixed Core Analysis



-
- *LYNXT is used with appropriate CHF correlations*
 - *LYNXT model includes detail required to model crossflow*
 - *Mixed core configurations evaluated:*
 - one assembly
 - four assemblies (4 Mark-BW LTA)
 - 1/3 core
 - 2/3 core
 - N-1 assemblies (re-insert of resident fuel)



Transition Program Licensing

G. L. Darden - Dominion



Transition Program Licensing



-
- *Requires interaction with NRC staff for the following:*
 - *FCF topical report revisions*
 - Submitted (one pending submittal by 12/31/00)
 - *Minor revisions to extend Dominion topical reports to FCF fuel (implement via GL 83-11 program)*
 - Address fuel type restriction in reload topical SER
 - Reference use of FCF thermal/hydraulics code
 - *Dominion transition licensing report & license amendment request*
 - Describes FCF fuel & design evaluations performed
 - Proposed Technical Specification changes (minimal)



Transition Program Licensing



➤ *Content of North Anna License Amendment Request*

- Mark-BW fuel design description
- Fuel mechanical analyses
- Large & small break LOCA analysis
- Thermal/Hydraulic & statistical DNBR analysis
- Mixed core thermal/hydraulic analysis
- NSSS event analyses & evaluations
- Technical Specifications changes
 - Fuel design features (TS 5.3.1)
 - Core Operating Limits Report references (TS 6.9.1.7e)

➤ *License Amendment approval requested by Jan 2003*



Application of Dominion Reload Methods to FCF Fuel



-
- *Dominion topicals having issues to address for use with FCF fuel:*
 - VEP-FRD-42, Rev, 1-A, Reload Nuclear Design Methodology
 - Defines reload core design & safety analysis methodology
 - NRC SER (7/29/86) approval granted with this language:

“We have reviewed the Reload Nuclear Design Methodology described in VEP-FRD-42, Revision 1 and find it acceptable for referencing by Virginia Power in licensing Westinghouse supplied reloads of Westinghouse supplied reactors.”

- Revise (addendum) to document methodology qualification for FCF fuel
- VEP-NE-1-A, Relaxed Power Distribution Control Methodology
 - Methodology for allowable power distributions & operating limits
 - References use of COBRA-IIIC code for DNB analysis
 - Revise (addendum) to reference FCF LYNXT thermal/hydraulics code



*Application of Dominion
Reload Methods to FCF Fuel*



-
- *Implement proposed changes under provisions of Dominion's Generic Letter 83-11 Supplement 1 program*
 - Rely upon prior approval of Dominion analyses for FCF LTA's currently in North Anna 1 (SER for Unit 1 & 2 use issued 5/9/97)
 - LTA analyses with Dominion tools demonstrated neutronic equivalence of FCF & Westinghouse assemblies
 - LTA benchmark analyses & subsequent comparison to measured incore data constitute documentation for analysis of FCF fuel with Dominion tools
 - Dominion analysis procedure changes (as needed) to ensure FCF fuel is evaluated per approved FCF topical reports
 - Documentation available for review & audit per requirements of GL 83-11 and VPAP-0313 (internal procedure)
 - Transition licensing submittal will summarize approach taken



*Application of Dominion
Reload Methods to FCF Fuel*



➤ *Unique considerations not present in “typical” Generic
Letter 83-11 application*

- Approach does not involve application of a new method
- Dominion approved methodology in place as listed in current NAPS TS 6.9.1.7e, References
- Only the object of analysis (fuel) is changing
- Effort essentially consists of demonstrating the capability to analyze FCF fuel



Transition Program Licensing



-
- *FCF Topicals Required for First Core*
 - Letter FTI-00-551 [fuel temperature uncertainty]
 - Approval requested by 12/31/2000
 - BAW-10164P, Rev. 4 & 5 [RELAP5 topical report revisions]
 - Approvals requested by 12/31/2000 & 12/31/2001 respectively
 - BAW-10168P, Rev. 4 [RSG LOCA EM revision]
 - Approval requested by 12/31/2001
 - BAW-10199P, Appendix F [BWU CHF Correlation extension]
 - Approval requested by 9/30/2001
 - *Dominion Licensing Submittals Required for First Core*
 - Approval of pending changes for increased fuel enrichment & elimination of seismic impact on RCCA insertion
 - Transition licensing report submitted with amendment request



Transition Program Schedule

G. L. Darden - Dominion

➤ *Key Schedule Milestones*

- NRC program presentation meeting - Nov 2000
- **NRC approval of FCF LBLOCA fuel temperature uncertainty revisions – Dec 2000**
- Complete Design & Engineering Effort – Dec 2001
- **NRC approval of FCF LBLOCA EM revisions – Dec 2001**
- **Submit License Amendment Request – Mar 2002**
- Post-submittal meeting with NRC -- May 2002
- **NRC Licensing Request Approval – Jan 2003**
- Delivery of First FCF Reload Batch - Feb 2003



Summary
Questions
Action Items

G. L. Darden - Dominion

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