AEP/FANP/NRC Meeting

November 6, 2003

Agenda

- Introduction
- Fuel Design Description
- Analyses and Methodology Changes
- Technical Specification Changes
- Schedule
- NRC Feedback

Introduction

- Fuel Vendor Transition D. C. Cook Units 1 & 2
- Focus Today on D. C. Cook Unit 1
- Discussion of Content and Schedule for Future Submittals

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Introduction (continued)

- Objectives
  - –Describe Fuel and Methodology to be used for D. C. Cook Unit 1
  - –Reach an Understanding on NRC Submittals Required
  - –Provide Information on Submittal Schedule and Requested Review Dates

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Fuel Design Description

- Experience
  - –10 Batches Exxon/ANF/Siemens Fuel (with B&W, now Framatome ANP) Previously Used in the Cook Units
  - –Framatome ANP has Supplied Other Ice Condensers: Catawba, McGuire, Sequoyah

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Fuel Design Description

- Assembly Description
- 15x15 HTP Assembly with M5™
- Operating Experience

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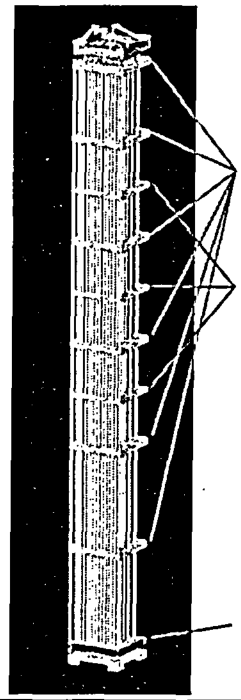
15x15 HTP Fuel Assembly

- Top Nozzle
  - Alloy 718 Leaf Springs
  - Removable Quick Disconnect
- M5™ Fuel Rod Cladding
  - M5™ End Plugs
- Zirc-4 Guide Tubes
- FUELGUARD™ Bottom Nozzle



- Six Zirc-4 HTP Grids
- Three Zirc-4 IFM Grids
- Lower Alloy 718 HMP Grid

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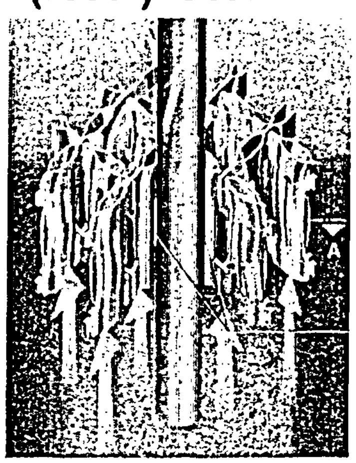
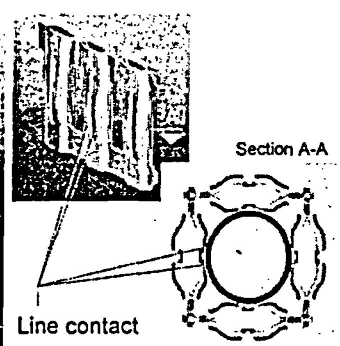
High Thermal Performance (HTP) Grid

®

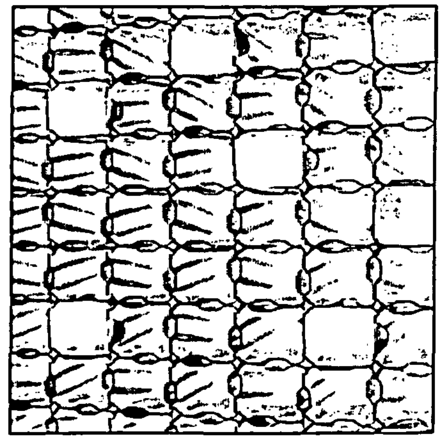




- *"Line Contact" Rod Support System*
- *Robust Construction*
- *Low Flow Resistance*
- *Curved Flow Channels for Flow Mixing*

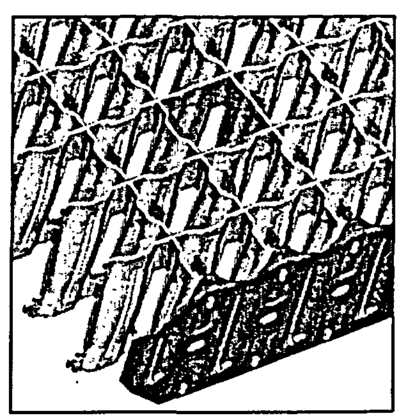
Intermediate Flow Mixer (IFM)

- Contact Features of HTP Grid
- Low Resistance for Compatibility with Non-IFM Cores
- Angled Flow Channels for Enhanced Mixing at Mid Spans



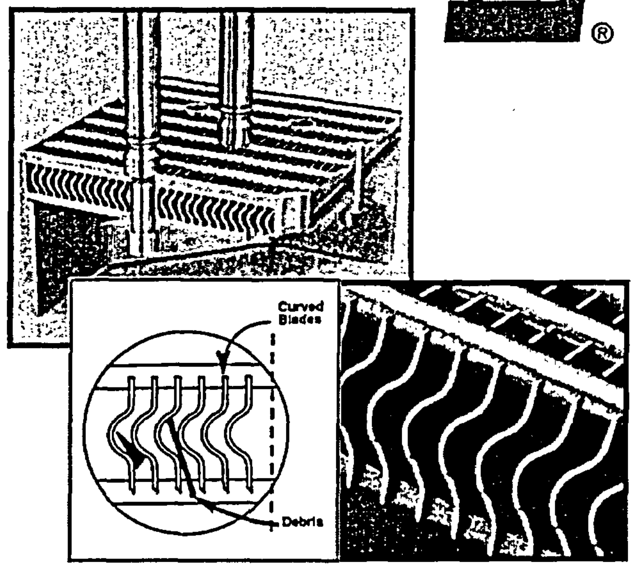
High Mechanical Performance (HMP) Grid

- Design Based on HTP Grid
- "Line Contact" Fuel Rod Support
- Alloy 718 for Increased Robustness
- Straight Flow Channels



FUELGUARD™ Bottom Nozzle

- Curved Blade Design
  - No Direct Line of Sight
  - Precludes Debris, Even Straight Wires
  - Low Pressure Drop
  - Filtering Efficiency >90%
  - No Debris Failures in FUELGUARD™ PWR Assemblies
  - Reduction of Inlet Turbulence



M5™ - An Advanced Zirconium Alloy for PWR Fuel Assemblies

- Alloy M5™ developed for high burnup applications
- M5™ evolved from an extensive 15 year development program that evaluated 20 potential advanced alloys
- A Ternary Alloy
  - Niobium, Oxygen, Zirconium

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M5™ - An Advanced Zirconium Alloy for PWR Fuel Assemblies

- M5™ has been tested and proven in a wide range of PWR operating environments
  - Over 349,000 fuel rods in 35 PWR reactors
  - 30 reloads with M5™ fuel rods in 17 reactors
  - 36 all M5™ fuel assemblies in 9 reactors
  - 71,000 MWd/tU burnup achieved
- M5™ has been tested and proven in severe conditions in irradiated loops
  - High lithium, temperature, heat flux, etc.

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HTP Assembly with M5™ Cladding

- Lead HTP Assembly to Use M5 Cladding
  - Calvert Cliffs
  - 14x14 CE Assembly
- Lead 15x15 HTP Assembly to Use M5 Cladding
  - Crystal River (B&W Plant)
  - D. C. Cook Unit 1 (Westinghouse Plant)

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Precedents for HTP Fuel Use

- Design Variants for 14x14, 15x15, 16x16, 17x17, and 18x18 Arrays in Framatome ANP, Siemens/ KWU, CE, and Westinghouse Plants
- Since 1989, Nearly 4,500 HTP Fuel Assemblies Delivered Worldwide
- Maximum Fuel Assembly Burnup of 57 GWd/MTU
- No Fretting Failures at HTP Spacer Positions
- No Manufacturing Defect in Fuel Made Since 1995

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Operating Experience of HTP *(08/2003)*

Region	Plant Type	Fuel Type	First Inserted	In Operation: Assemblies	In Operation: Fuel Rods	Total: Assemblies	Total: Fuel Rods	Maximum FA Burnup (MWd/kgU)
European Market	KWU	15x15	2001	4	820	4	820	37
	KWU	16x16	2001	7	1,652	8	1,888	24
	KWU	16x16	2000	4	944	4	944	42
	KWU	16x16	2003	32	7,552	32	7,552	6
	KWU	16x16	1989	0	0	4	944	46
	KWU	16x16	2000	24	5,664	24	5,664	45
	KWU	18x18	1992	1	300	44	13,200	54
	KWU	18x18	1992	14	4,200	28	8,400	53
	FANP	17x17	1994	0	0	40	10,560	48
	FANP	17x17	1993	157	41,448	392	103,488	56
	FANP	17x17	1994	157	41,448	392	103,488	57
	FANP	17x17	1994	124	32,736	328	86,592	50
	FANP	17x17	1993	132	34,848	368	97,152	49
	FANP	17x17	1994	157	41,448	360	95,040	51
	ACE	14x14	2002	8	1,432	8	1,432	7
	ACE	14x14	1994	120	21,480	309	55,311	51
	W	17x17	2000	36	9,504	36	9,504	40
	PPP	17x17	2000	160	42,240	160	42,240	42
	W	17x17	2003	44	11,616	44	11,616	1
	FANP	17x17	2002	24	6,336	24	6,336	11
	Totals			1,205	305,888	2,609	682,171	57
US & Far East Market	CE	14x14	1988	0	0	2	352	46
	CE	14x14	2003	4	704	4	704	4
	CE	14x14	2001	93	16,368	93	16,368	24
	W	14x14	1995	81	14,499	136	24,344	53
	CE	14x14	2002	80	14,080	80	14,080	12
	CE	15x15	1988	204	43,616	480	103,232	52
	W	15x15	1991	157	32,028	477	97,308	57
	W	17x17	1994	155	40,920	351	92,664	54
	CE	14x14	2001	148	25,760	148	25,760	26
	B&W	15x15	2003	85	17,680	85	17,680	0
	MHI	17x17	2000	16	4,224	16	4,224	23
	Totals			1,023	209,879	1,872	396,716	57
Global Totals				2,228	515,547	4,481	1,058,887	57

Analyses and Methodology Changes – Transition Core

- Minimize Changes to Current Plant Licensing Bases
- Evaluate the Introduction of HTP Fuel Design per the Requirements of 10 CFR 50.59
  - *Similar to Approach Used for any Plant Change*
  - Similar to Approach Used for Each Reload Core Design (except scope)
- Identify Plant Safety Analyses Potentially Affected
- Assess Impact of Fuel Design Change on Plant Safety Analyses and Repeat Analyses as Required

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Analyses and Methodology Changes (continued)

- Review all Event Analyses Identified in FSAR (Disposition of Events)
- Analyses are Dispositioned as:
  - Not Impacted by the Change in Fuel Design
  - Bounded by the Consequences of Another Event
  - Potentially Limiting – Analyze using Framatome ANP Methodology
- Potentially Limiting Events are Analyzed Using NRC Approved Methodology

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Analyses and Methodology Changes (continued)

- Results from Disposition of Events Define the Required Transition Cycle Safety Analyses for each Area
  - Thermal Hydraulic Analyses
  - Anticipated Operation Occurrence (AOO) Transient Analyses
  - Accident Analyses
  - Special Analyses

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Analyses to be Submitted for Review and Approval

- Add EMF-2103PA (Realistic LBLOCA) to List of Approved Methodology
- RLBLOCA Analysis
  - Nodalization
  - Input Parameters
  - Results
  - North Anna Lessons Learned

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Analyses to be Submitted for Review and Approval (cont.)

- Add EMF-2310PA (Non-LOCA) to List of Approved Methodology
- Loss of Flow Analysis
  - Nodalization
  - Input Parameters
  - Results

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Approved Topical Reports for Application to D.C. Cook Unit 1

- XN-NF-82-06(P)(A) Revision 1 and Supplements 2, 4 and 5, "Qualification of Exxon Nuclear Fuel for Extended Burnup," Exxon Nuclear Company, October 1986
- XN-75-32(A) Supplements 1, 2, 3, and 4, "Computational Procedure for Evaluating Rod Bow," Exxon Nuclear Company, October 1983

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Approved Topical Reports for Application to D.C. Cook Unit 1

- XN-NF-85-92(P)(A), "Exxon Nuclear Uranium Dioxide/Gadolinia Irradiation Examination and Thermal Conductivity Results," Exxon Nuclear Company, November 1986
- ANF-88-133(P)(A) and Supplement 1, "Qualification of Advanced Nuclear Fuels' PWR Design Methodology for Rod Burnups of 62 GWd/MTU," Advanced Nuclear Fuels Corporation, December 1991

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Approved Topical Reports for Application to D.C. Cook Unit 1

- EMF-92-116(P)(A), "Generic Mechanical Design Criteria for PWR Fuel Design," Siemens Power Corporation, February 1999
- EMF-96-029(P)(A) Volumes 1 and 2, "Reactor Analysis System for PWRs Volume 1 - Methodology Description, Volume 2 - Benchmarking Results," Siemens Power Corporation, January 1997

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Approved Topical Reports for Application to D.C. Cook Unit 1

- EMF-92-081(P)(A) Revision 1, "Statistical Setpoint/Transient Methodology for Westinghouse Type Reactors," Siemens Power Corporation, February 2000
- EMF-92-153(P)(A) and Supplement 1, "HTP: Departure from Nucleate Boiling Correlation for High Thermal Performance Fuel," Siemens Power Corporation, March 1994

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Approved Topical Reports for Application to D.C. Cook Unit 1

- EMF-2328(P)(A) Revision 0, "PWR Small Break LOCA Evaluation Model, S-RELAP5 Based," Framatome ANP, March 2001
- EMF-2103(P)(A) Revision 0, "Realistic Large Break LOCA Methodology for Pressurized Water Reactors," Framatome ANP, April 2003
- ANF-88-054(P)(A), "PDC-3 Advanced Nuclear Fuels Corporation Power Distribution Control for Pressurized Water Reactors and Application of PDC-3 to H. B. Robinson Unit 2," Advanced Nuclear Fuels Corporation, October 1990

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Topical Reports Under Review Needed for D. C. Cook Unit 1

AEP®

- EMF-2310P Revision 1, "SRP Chapter 15 Non-LOCA Methodology for Pressurized Water Reactors"
  - Revise Boron Dilution Event Analysis Methodology
  - Submitted on 8/12/2003
  - NRC Approval Anticipated Early 2004

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Topical Reports Under Review Needed for D. C. Cook Unit 1

AEP®

- BAW-10240P Revision 0, "Incorporation of M5™ Properties in Framatome ANP Approved Methods"
  - Modify Previously Approved Methods to Reflect M5 Material
  - Submitted on 10/1/2002
  - NRC Approval Anticipated December 2003

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Technical Specification Changes Anticipated

- Section 3.2.6 – Allowable Power Level (APL) - Change to Reflect Framatome ANP PDC-3 Methodology
- Section 5.3.1 – Fuel Assembly Design - Add reference to M5 cladding and accompanying exemption
- Section 5.6.2 – Fuel Storage Criticality New Fuel - Change to Reflect Use of Framatome ANP Fuel
- Section 6.9.1.9.2 – Core Operating Limits Report - Change to Add Framatome ANP Topical Reports to COLR List
- No Changes to Limits Anticipated

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Schedule

- M5 Exemption Submittal - ? 2004
- LAR Submittal for All TS Changes - April 2004
  - Based on current approval schedule for Topicals
- Loss of Flow Analysis Report - June 2004
- RLBLOCA Analysis Report - August 2004
- LAR Approval - January 2005
- Startup of D. C. Cook Unit 1 - April 25, 2005

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Parallel Licensing Actions

- ITS Conversion
- License Renewal
- Fall 2004 Outage Related Changes
  - SI Setpoint Change
  - Containment Penetrations

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Objectives

- Describe Fuel and Methodology to be used for D. C. Cook Unit 1
- Reach an Understanding on NRC Submittals Required
- Provide Information on Submittal Schedule and Requested Review Dates

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NRC Feedback

- Presentation Addressed:
  - –Fuel Design Description
  - –Analyses and Methodology Changes
  - –Technical Specification Changes
  - –Schedule

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