Westinghouse Semi-Annual Fuel Performance Update Meeting (Slide Presentation of June 21-24, 2004)

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Westinghouse Semi-Annual
Fuel Performance Update Meeting
June 21-24, 2004
Monroeville, Pa
Preliminary Agenda

Monday June 21 1:00 – 4:00 **FCEP training**

Tuesday June 22 8:00- 6:00 **PWR Fuel Update**

7:30	Check-in and coffee, juice and pastries available	
8:00 – 8:15	INTRODUCTIONS AND WELCOME	
8:15 – 9:00	Fuel Performance Update (PWR)	Proprietary
9:00 – 10:00	Flawless Fuel Initiatives	Proprietary
10:00 – 10:15	---BREAK---	
10:15 – 10:45	General Fuel and Core Component (Westinghouse/CE) – Issues	Proprietary
10:45 – 11:15	CEAs/RCCAs Update	Proprietary
11:15 – 12:15	NRC Discussions with Westinghouse/customers	
12:15 – 12:45	---LUNCH---	
12:45 – 1:15	Materials Update (Advanced Alloy Development)	Proprietary
1:15 – 2:00	Latest Overall LTA Schedule	Proprietary
2:00 – 2:30	Fuel Development Program Update & Strategy	Proprietary
2:30 – 2:45	---BREAK---	
2:45 – 3:30	Nuclear Integration – Westinghouse/CE	Proprietary
3:30 – 4:00	BEACON™-COLSS	Proprietary
4:00 – 4:45	BWR Fuel Performance Update	Proprietary
4:45 – 5:30	Licensing Update	Proprietary
5:30 – 6:00	PWR Update	Proprietary

Wednesday June 23 8:00-4:30 **BWR Update**

7:30	Check-in and coffee, juice and pastries available	
8:00 – 8:15	INTRODUCTIONS AND WELCOME	
8:15 – 10:00	Power uprates	
10:00 – 10:15	---BREAK	
10:15 – 12:00	Licensing Initiatives	
12:00 – 1:00	---LUNCH---	
1:00 – 1:45	Columbia Manufacturing and Shipping	Proprietary
1:45 – 2:30	Current Industry Issues	Proprietary
2:30 – 2:45	---BREAK	
2:45 – 3:15	Reload Licensing Summary - what codes we use	Proprietary
3:15 – 4:00	Fuel Performance Update	Proprietary
4:00 – 4:30	BWR Update	Proprietary

Thursday June 24 8:00-3:45 **PWR Update meeting (continued)**

8:30	Coffee, juice and pastries available	
8:40 – 9:00	CHF Update	Proprietary
9:00 – 9:20	Training	Proprietary
9:20 – 10:30	Westinghouse/NRC Round-table Discussion	
10:30 – 10:45	---BREAK---	
10:45 – 11:45	WRAP-UP	
11:45 – 1:00	---LUNCH---	
1:00 – 1:30	**Meeting with TOSS (Training Center)**	Proprietary
1:30 – 3:30	**Tour Waltz Mill Training Facility**	
3:30 – 3:45	EXIT	

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NOTE: The attire for all four days is business casual.

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Optimized ZIRLO™

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June 22, 2004

Optimized ZIRLO

- ZIRLO - Excellent performance, low growth, low corrosion, licensed to 62000 MWD/MTU, FDI ~ 800 -900
  - –Extremely large experience base - over 2.5 million ZIRLO fuel rods are in operation or discharged

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Optimized ZIRLO

- ZIRLO with lower tin levels improves corrosion resistance while preserving the mechanical properties and margin for abnormal operating conditions
- Higher Burn-UP Capability (>70,000 vs. 62000 MWD/MTU)
- Higher Rod Internal Pressure Margin

Zirlo Chemistry

Standard and Optimized ZIRLO Chemistry:

Alloy	Sn%	Nb%	Fe%	Oxygen
ZIRLO	[			] a, b, c
Optimized ZIRLO	[			]

The tin level in ZIRLO is lowered to improve the corrosion resistance but still maintain the other excellent characteristics of ZIRLO. Similar to what was done for Zircaloy-4 in prior years.

ZIRLO AND OPTIMIZED ZIRLO PEAK OXIDE THICKNESS COMPARISON

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Status of Optimized ZIRLO LTA Programs

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ZIRLO Licensing History/Issues

- For region use
  - –OGC has determined Optimized ZIRLO is not in the rule making
  - – Westinghouse will file petition for rule making
    - –Expedited rule making may be pursued
- Topical approval will require exemption to 50.46 for region implementation of Optimized ZIRLO pending rule making (Need Approval in 2004)
- NRC has approved several exemptions for Optimized ZIRLO
  - –Millstone
  - –Byron
  - –Calvert Cliffs
  - –Catawba

Optimized ZIRLO

SUMMARY:

- ZIRLO - Excellent performance, low growth, low corrosion, licensed to 62,000 MWD/MTU, capable of 70000+ MWD/MTU depending on the fuel duty, and FDI ~ 800 - 900

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Alloy X LTA Plans

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What is the Need for a New Alloy

- Potential Driving Factors
  - Ultra high burn up designs - 75 GWD +
  - Higher uranium loadings
    - higher densities
    - different fuels
  - Uprates
  - New Regulatory Provisions
    - Long term storage
    - LOCA margin improvements
- **It takes many years to bring a new alloy to full licensing**
  - **We can not wait for a specific need to be identified before beginning development**

Alloy X is Needed for Very High Fuel Duties

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Alloy X Development Program

- Alloy development team formed with W experts from US and Sweden

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What Is Alloy X ?

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Alloy X Show Excellent Potential for Very Low Corrosion Rates

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Material Property Summary

- No surprises – properties are reasonable
- Tensile strengths are lower than ZIRLO but can be accounted for in design
- Corrosion results show significant potential improvement
- LOCA tests show within ZIRLO burst model
- Fabrication of tubing has been successful

Strong Technical Justification for LTA License Exemption

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- W core design indicated no significant concerns
- W licensing group has participated from initiation

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Risk Management

- *Corrosion performance*
  - Autoclave testing shows excellent performance
  - Past in-reactor experience with similar alloys

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  - More evolutionary from known alloys than revolutionary

Alloy X – Risk Management

- *Use limited number of assemblies and rods*

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Risk Management

- *Reactor Coolant contamination*
  - Corrosion rates will be monitored
  - Limited number of rods
- *Rod Fabrication*

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Alloy X – Licensing

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Alloy X – Core Design

- Typical Core Design

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Alloy X – Inspections

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For Alloy X LTA in Spring 05

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Alloy X LTAs
Short-term schedule

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Latest Overall LTA Schedule

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Latest Overall LTA Schedule

- LTAs Used for these reasons
- Demonstrate new materials, designs or design features
- Used to evaluate changes in operating conditions
- Used to obtain high burnup data

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Westinghouse High Burnup ZIRLO™ LTA Summary

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Other Test Programs

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ZIRLO™ Hotcell Exams

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Summary of LTA Programs

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Summary of LTA Programs (cont.)

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Summary of LTA Programs (cont.)

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Summary of LTA Programs (cont.)

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Summary of LTA Programs (cont.)

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Summary of LTA Programs (cont.)

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Westinghouse perspective on RES's RIS on RIA

- Proposed Limits are excessively restrictive
  - –Expansion due to contraction tests on ZIRLO show good ductility under rapid deformation even at high levels of corrosion
  - –CIP01 test performed well at energy levels well above those proposed in RIS
  - –Reducing energy to account for impact of 12 to 15 ms vs 30 ms pulse not justified

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Westinghouse perspective on RES's RIS on RIA (Cont'd)

- Westinghouse proposed 100 cal/g energy addition with approval of 3 D methods RIA methods
- Cabri water loop conversion will provide means to perform prototypical test under 10 ms pulse with
- Expansion due to contract (EDC) tests provide good cost effective means to test cladding under RIA like conditions. Materials are available at Studsvik hotcell to test if the test results are useful.

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Summary

- Obtaining data from various plants with different operating conditions and heats of material
- Data obtained is sufficient to obtain high burnup licensing
- RES proposed RIA limits are two conservative. Not justified by either performance data or accident consequence

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Next Generation Fuel Update

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17x17 NGF LTA Status

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Key Objectives of NGF Program

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17x17 NGF Fuel Assembly Overview

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17x17 NGF Schedule

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17x17 NGF Critical Heat Flux Testing

- Five test series completed

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Critical Heat Flux Testing

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Licensing for Region Implementation

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CE 16x16 Next Generation Fuel Update

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Agenda

- CE 16x16 NGF Design Expectations
- CE 16x16 NGF Design
- NGF LTAs
- General Program Schedule
- Licensing Plan

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CE 16x16 NGF Design Expectations

- Three (3) issues that we expect to resolve through implementation of a 16x16 NGF design:
  - Increase margin to Grid-To-Rod fretting failures
  - Increase thermal margin to accommodate further power uprates in the future
  - Increase margin to core crudding resulting from hot spots in the core

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CE 16x16 NGF Assembly

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NGF LTAs to be Implemented at Waterford 3 [Spring 2005] a, c

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General Program Schedule

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Licensing Plan

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CE Physics Methods and Code Integration with APA

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Overall Plan for Integrated Neutronics System

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Neutronics code integration – Strategy

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Neutronics code integration - Project Plan and Status

- Transition will require some changes to APA software

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Neutronics code integration - Project Plan and Status

- Transition will require some changes to APA software

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Neutronics code integration - New Methodology

- PARAGON

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Licensing - Strategy

- Obtained approval for PARAGON, ZrB2 for CE methods, and ZIRLO™ cladding in CE cores
- Provide required reload submittals well in advance

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- Perform reload under 10 CFR 50.59
  - –New methodology already accounted for in COLR references which will include PARAGON/PHOENIX-P and ANC

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Neutronics code integration - Licensing Issues

- Based on current information (e.g. results of benchmarking, implementation strategy, review of SERs) Westinghouse believes that

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Neutronics code integration - Summary

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BEACON™-COLSS Integration

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BEACON-COLSS Project

- Project started in 2002 to merge COLSS and BEACON™ core monitoring system
  - –Combine the best parts of BEACON & COLSS to develop a functional upgrade to COLSS
  - –Develop a BEACON-COLSS product line for CE plants
  - –Significant benefits to current COLSS plants
  - –Back fit potential to CE analog and W plant designs

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BEACON-COLSS Project

- COLSS is a licensed core monitoring system on CE digital plants
  - –Operating at 12 CE plants
  - –NRC Review and approval of COLSS uncertainty methods in 87
- BEACON is a licensed PWR core monitoring system with movable and fixed incore detectors (MIDs & FIDs)
  - –Operating at ~50 plants
  - –NRC review and approval of BEACON methods in 1994
  - –NRC approval of BEACON Addendums in 1999 and 2001

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Design Bases

- COLSS design bases
  - –Assist operations in maintaining LCOs
  - –Assist operations in maintaining core power below licensed limit
  - –Assist operator during normal operation
- BEACON-COLSS design bases

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Functional Design

- BEACON-COLSS Function Design Requirements

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BEACON-COLSS Overview

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Uncertainty Methodology

- COLSS licensed uncertainty methodology
  - –Compares COLSS synthesized results with "true" 3-D results

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Uncertainty Methodology

- BEACON licensed uncertainty methodology
  - –Compares BEACON 3-D results with "true" 3-D results

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Uncertainty Methodology

- BEACON-COLSS uncertainty methodology
  - –Merge COLSS and BEACON methods

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Licensing Submittal

- Submit licensing document as Addendum 3 to the BEACON Topical Report

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Status / Schedule

- New uncertainty methodology developed and test results generated for one plant
- Production version of analysis software being developed
- Development of BEACON licensing addendum in progress
- Uncertainty analysis being performed on second plant
- Formal licensing submittal in September

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BWR Control Rod Update

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Topics

- Design Evolution
- Experience
- Licensing History
- NRC Interactions

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Westinghouse Design Evolution

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Experience - US Deliveries Details

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CR-99 Deliveries

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Experience - Inspections

- All Westinghouse control rod designs are easily inspected
  - Simple visual inspection
  - Low cost inspection
  - No special tools needed
  - Inspection verifies the condition of the control rods
- Easily inspected control rod a clear advantage
  - Lower risk of costly future inspection programs

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Experience - Inspections

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Experience - Lessons Learned from Inspections

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Licensing History

- Westinghouse (Atom/ABB) Licensing History
  - –TR UR 85-225, CR 82 use in D-Lattice, approved 1986
  - –Supplement 1, CR 82 use in C-Lattice, approved 1988
  - –Supplement 2, CR 82 use in S-Lattice, approved 1989
  - –Supplement 3, CR 82 use of High Worth rods, submitted in 1988
- CR 82 is currently NRC licensed
  - –CR 82M-1is same as CR except for 316 ss vs 304 for CR 82
  - –Used via a 50.59 approached (Discussed with NRC previously)

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NRC Interactions

- Westinghouse BWR Control Rod Experience Update Meeting
  - Summer 2003

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Recent BWR Licensing initiatives

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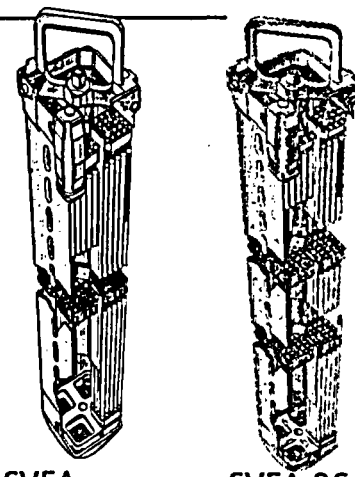
10x10 SVEA Design Evolution

- SVEA-96 [ ] a, c
- SVEA-96+ [ ] a, c



SVEA-96/96+ SVEA-96 Optima2

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Support Introduction SVEA-96 Optima2 Fuel into the U.S.

Report No	Title	Submittal Date	Approval Date
WCAP-16078	ECCS Evaluation Model Code Sensitivity for SVEA-96 Optima2	[ ] a,c	

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- Responses to three Sets of RAI's Submitted

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Support Introduction SVEA-96 Optima2 Fuel into the U.S.

Report No	Title	Submittal Date	Approval Date
WCAP-16081	10x10 SVEA-96 Optima2 Critical Power Correlation	[ ]	a,c

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- Responses to two Sets of RAI's Submitted

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Improvements to Licensing Analysis Methodology

Report No	Title	Submittal Date	Approval Date
WCAP-15836	Fuel Rod Design Methods for Boiling Water Reactors – Supplement 1	[ ]	a,c

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- Responses to two Sets of RAI's Submitted

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Improvements to Licensing Analysis Methodology

Report No	Title	Submittal Date	Approval Date
WCAP-15942	Fuel Assembly Mechanical jDesign Methodology for Boiling Water Reactors – Supplement 1	[	] a,c

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Improvements to Licensing Analysis Methodology

Report No	Title	Submittal Date	Approval Date
WCAP-00000	Three-Dimensional Core Simulator-Based System Analysis Code, POLCA-T: Application to Stability Evaluations and Control Rod Drop Accident	[	] a,c

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Improvements to Licensing Analysis Methodology

What is POLCA-T?

- POLCA-T is an computer code system which will replace existing codes for nuclear, T/H, and transient 3D BWR analyses. a,c

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Improvements to Licensing Analysis Methodology

- POLCA-T could also potentially replace the following functions currently performed in Europe a,c

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Improvements to Licensing Analysis Methodology

One code system for steady-state and dynamic analyses:

- No interfaces, no transformation/condensation/normalization required.
- A single data base
- Powerful models and a modern, well structured code
- Reduced maintenance
- Improved QC

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Improvements to Licensing Analysis Methodology

POLCA-T Status

- Release 1.0.0 February 2003 for production application to stability calculations in Europe.

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Improvements to Licensing Analysis Methodology

- POLCA-T Status – Used for European Engineering Studies
- Powerful tool for studying special events, particularly when asymmetries and/or local effects are important.

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Improvements to Licensing Analysis Methodology

Typical POLCA-T Verification and validation

- Analytical solutions:

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Improvements to Licensing Analysis Methodology

Typical POLCA-T Verification and validation efforts

- Separate effects:

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Improvements to Licensing Analysis Methodology

Typical POLCA-T Verification and validation efforts

- Integral tests, Stability:

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Improvements to Licensing Analysis Methodology

Typical POLCA-T Verification and validation efforts

- Integral tests, Transients: a,c

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Improvements to Licensing Analysis Methodology

POLCA-T Plans for the near future a,c

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US BWR Columbia Manufacturing and Shipping Update

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Topics

- Fabrication Split and Schedule
- Shipping/Transport
- Facilities Changes
- Licensing Activities

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Major Component Sources for US BWR Fabrication

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Current Manufacturing Schedule

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Shipping/Transport

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Facilities Changes

- Chemical/Rod Area
  - Minor floor plan changes to accommodate new/additional equipment
- Mechanical Area
  - Optimize PWR and BWR Product Flow
  - PWR Skeleton Build Area
  - Add additional Rod Staging area
  - Add BWR final assembly area
  - Consolidate forest

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Facilities Changes

- Status
  - Space for BWR Equipment Has Been Cleared
    - Tool Room moved
    - Manual and automated skeleton equipment moved
    - RCCA equipment moved

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PLANNED BWR PRODUCT FLOW

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Licensing Activities

- Columbia Facility
  - Finalize Layout Plan – Complete
  - Complete Integrated Safety Assessment – Jan-05
    - No NRC License Submittal Needed
- Shipping Containers

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Current Industry issues

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Current BWR Industry Issues

- BWR Channel Bow
- BWR Debris Fretting
- BWR Coolant Chemistry
- BWR Secondary Failure Mitigation
- BWR Stability: Plant-Specific Detect and Suppress (Option 3) Solution
- NRC Perspective

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BWR Channel Bow

- Historical Emphasis on
  - Interference with plant components – particularly control rods
  - Channel Reuse – no longer practiced
  - Degredation of CPR performance
    - Oskarshamn 2 dryout in 1988
    - Now CPR Performance treated explicitly (R-factor modification and/or treated in SLMCPR evaluation)
  - Reactivity Loss
    - Implicitly accommodated by following critical $k_{effective}$ based on core follow

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BWR Channel Bow

- Recent reimergence of Interference problems – our impression
  - Primarily BWR/6 with some occurrence in C-lattice BWR/4 plants
  - Associated with BWR Shadow corrosion
    - High energy cycles – control blades inserted next to fresh assemblies
    - Increased hydriding on control blade side causes substantial bowing

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BWR Channel Development

- Major emphasis on channel material and process development a,c

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BWR Channel Bow – Symmetric Lattice

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PWR assembly growth

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BWR Channel Bow – Zirlo Potential

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BWR Channel Bow – Shadow Corrosion

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BWR Channel Bow – SVEA Channel Hot Cell Exam

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BWR Channel Bow – Summary

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Debris Fretting - Summary

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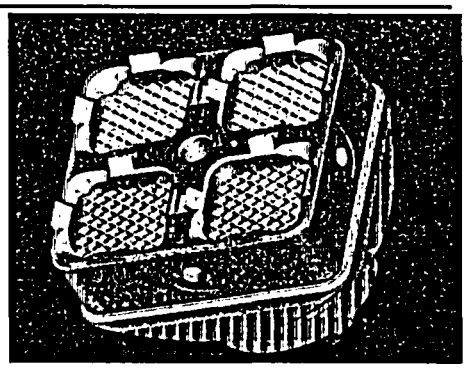
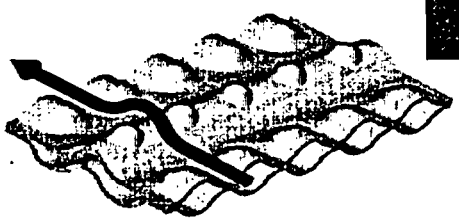
TripleWave Debris Filter

- Milestones
  - All testing finished
  - LFA inserted 2001
  - Inspection 2002
  - Reloads in 2003





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TripleWave Debris Filter - Efficiency

a,c

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Debris Fretting – Spacer Development

a,c

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Debris Fretting – Spacer Concept

a,c

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Debris Fretting – Spacer Concept

a,c

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Debris Fretting – Oxide Protection

- Recognized that an oxide layer provides wear/fretting protection

a,c

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Debris Fretting – Cladding Corrosion

a,c

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BWR Secondary Failure Mitigation

a,c

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BWR Stability: Option 3 – PS-DIVOM

- Recent events illustrate need for Detect and Suppress (DSS)

[ ] a, c

- Application of NEDO-32465
  - Protects SLMCPR
  - Plant-specific (PS) DIVOM since Generic DIVOM can be inadequate
  - BWROG, GNF-GE, AREVA and Westinghouse jointly developed Guideline Procedure to assure uniform methodology
  - Application process to be established by each vendor

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BWR Stability: Option 3 – PS-DIVOM

- Westinghouse will use codes currently used for reload licensing stability and hot channel transient CPR calculations:
  - RAMONA initialized by POLCA to predict oscillations
    - CENPD-294-P-A and CENPD-295-P-A
  - BISON-slave to predict normalized CPR changes (ΔCPR/ICPR)
    - RPA-90-90-P-A
  - First application in QC2 - Cycle 19

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BWR Water Chemistry

- Enhanced Spacer Shadow Corrosion
  - FE/(ZN+NI) ratio
- Accelerated Corrosion – Enhanced Nodular Corrosion
  - Condenser Leak: Specific Chemistry cause not established
- Crud Induced Failures
  - High concentrations of Zn and Cu
- Chemical Incursion during first cycle
  - Alloy content, high duty after event

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BWR Water Chemistry - Lessons

- Careful control – avoid chemical incursions
- Eliminate Cu. Control Zn, Fe, Ni
- As much fuel surveillance as possible
  - Data to support understanding
- Try to understand – phenomenological models
- Focus on corrosion resistant cladding
- Encourage as much cross cooperation as possible
  - Vendors, utilities, EPRI, European Experiences, etc.

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PWR Core Technologies (PCT) Training Update

NRC/Westinghouse Meeting
Waltz Mill, PA
June 24, 2004

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Agenda

- PCT Internal Training Initiatives
  - Motivation
  - Ongoing Programs
- Current Internal/External Course Offerings
  - Course Catalog and Customized Courses

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Training Initiatives in PCT -- Why

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Current PCT Qualification Matrix (sample)

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Training Initiatives in PCT -- TAC

- The Training Advisory Committee (TAC) was constituted in PCT to oversee all training to ensure consistency and effectiveness of training.
- TAC will enforce the use of the Systematic Approach to Training (SAT) for all training products developed by PCT.
- TAC will review upcoming training (internal seminars, for example) to ensure it is provided effectively and consistently.
- TAC is sponsoring initiatives for developing new training products for qualifying and re-qualifying designers.

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Systematic Approach to Training

1. Analysis
   Job analysis, Job task analysis, training needs assessment
2. Design
   Learning objectives, performance testing, measures
3. Development
   Learning activities, Training method, training material
4. Implementation
   Instructors, subject matter experts, exemptions, feedback, records
5. Evaluation
   Analyze/trend feedback, effectiveness, self assessment, refine

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Training Initiatives in PCT – Qual Cards

- First training initiative is to develop qualification tracking cards, "qual cards," for all disciplines in PCT, including Nuclear Design, T/H Designer, Fuel Rod Designer, Licensing, and Software.
- "Qual cards" track competencies achieved by trainees and individual competencies are signed off by qualified designers upon completion of activities by trainees.
- US Navy and many US utilities use "qual cards" for qualification tracking.
- Pilot program underway to develop Job Task Analysis (JTA) for Nuclear Designers, to be followed by other disciplines. JTAs list Know ledges required by trainees and Activities they must perform to be qualified. In following examples, "K" indicates a Knowledge and "A" an Activity.

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Job Task Analysis (example)

Job Task Analysis – Design Initialization for Core Designer (New Hire)

Process:

Design Initialization	Complete formal preparation to begin the reload design process by collecting and reviewing information sources, as defined by the Engineering Procedures and as appropriate on a customer-specific basis. Note that other disciplines will have separate requirements for design initialization.

Job Tasks:

Task	Task Description
1	Complete External Design Initialization
2	Complete Internal Design Initialization

Knowledge/Abilities:

Sub-task	Sub-task Description	Knowledge and Abilities
1.1	Review Engineering Procedures for Design Initialization, EP-301, PCT Department Design Initialization Procedures in METCOM Sections 1.7.1, 1.7.3 and 1.7.4, and BHACON initialization procedures in Engineering Services Manual Section 1.10.3.	Ability to access Engineering Procedures on W intranet. Ability to access METCOM and the ESM through the on-line manuals viewer
1.2	Review Reload Energy Requirements document as returned and completed by customer.	Ability to access current standard RSER format Ability to compare RSER to cycle CATD from Fuel Projects
1.3	Review Design Interface Document as returned and completed by customer (if used on a particular design).	Ability to access current customer-specific DID. Ability to compare DID to cycle CATD.

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Core Designer – PWR Core Reload (example)

1. Core Reload Basics
2. Design Initialization
3. Loading Pattern Development
4. **Reload Safety Evaluation**
5. Nuclear Design Report
6. Core Follow

4. RELOAD SAFETY EVALUATION

QUAL 1: Reload Safety Analysis Checklist (RSAC) Plan Development

K1.1.1 - Understand the impact of end of cycle EOC burnup selections.
K1.1.2 - Understand design documents including the following:
- Reload Safety and Licensing Checklist (RSLC)
- Reload Schedule and Energy Requirements (RSER)
- Final safety Analysis Report (FSAR)
- Technical Specifications
- Design Interface Document (DID)
- Limits Transmittals.

A1.1.1 - Review applicable design parameters, assumptions, requirements, constraints, and previous cycle plan and results.
A1.1.2 - Confirm customer documentation is in place.

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Core Designer – Qualification Card (example)

QUAL 1:	Design Initialization	Perform engineering job performance requirements associated with External Design Initializations.

NAME:	
SAP ID NO.:	

References:

Regulatory/Industry	
Corporate/ Departmental	
EP-301	Design Initialization
METCOM 1.7.1	Design Initialization
METCOM 1.7.3	Reload Core Design Initialization
METCOM 1.7.4	Reload Initialization Meeting
ESM 1.10.3	Completed BEACON Model Input Data Checklist
EP-301-3	Complete the necessary portions of the Reload Initialization Questionnaire (RIQ)
Applicable Document(s)	

Prerequisites:

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Core Designer – Qualification Card (example)

QUAL 1:	Design Initialization	Perform engineering job performance requirements associated with External Design Initializations.

Performance Steps:

Step	Description	Method	Evaluator Initial/Date
1	Review applicable references. Demonstrate satisfactory knowledge level through discussion or practical exercise.	☐ Review/Discuss ☐ Perform ☐ Observe ☐ Simulate ☐ Demonstration	_____ /_____
2	Demonstrate capability to organize and conduct meetings with the customer and resolve all issues associated with energy requirements, design interface documents, Reload Safety & Licensing Checklist (RS&LC) and the BEACON Model checklist	☐ Review/Discuss ☐ Perform ☐ Observe ☐ Simulate ☐ Demonstration	_____ /_____
3	Using the process described in METCOM 1.7.3, "Reload Core Design Initialization", demonstrate capability to support issuing meeting minutes from the energy setting meeting.	☐ Review/Discuss ☐ Perform ☐ Observe ☐ Simulate ☐ Demonstration	_____ /_____
	Using the process described in EP-301, "Design Initialization", demonstrate the capability to complete the necessary portions of the RIQ		

COMPLETED BY:_____ DATE:_____
(TRAINEE)

EVALUATED BY:_____ DATE:_____
(SUPERVISOR)

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PCT Training Initiatives – External Training

- PCT supports external training for designers through local universities.

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- PCT supports professional licensure for engineers who seek it

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Training Courses

- Training Catalog Lists Standard Courses Offered
  - Courses scheduled based on demand
  - Advertise courses once tentative dates established
  - Require minimum number of students to justify course offerings
- Development of New Courses
  - Customer specific training requests
    - Course curriculum developed with utility
    - Plant specific focus
    - Westinghouse site or Utility site
  - New Technology or Industry Need
    - Examples: BOB Training or SOER training

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Training Courses - External

2004 NUCLEAR FUEL TRAINING COURSE SCHEDULE

	Course Number	Course Title	Dates Offered
Advanced Technology Courses	AFM100	Advanced Fuel Management	Scheduled upon request
	• AFM110	Module 1: Code Review and Model Preparation (2 days)	
	• AFM120	Module 2: Fuel Cycling Evaluation and Economics (2 1/2 days)	
	• AFM130	Module 3. Fuel Management Analysis (3 1/2 days)	
	• AFM140	Module 4 Loading Pattern "Tool Box" (4 days)	
	SOI100*	Implications of Design and Economic Decisions on Safety Analyses and Operational Issues (5 days)	Scheduled upon request
	MET100	Advanced Applications Methodology (5 days)	Scheduled upon request
Nuclear Design	ND200*	Nuclear Design Technology and Methods (15 days)	June 7-25, 2004
	• ND210	Module 1. Nuclear Design Code Systems and Models (5 days)	June 7-11, 2004
			Feb. 9-12 in Windsor
	• ND220	Module 2: Fuel Management (2 1/2 days)	June 14-16, 2004
	• ND230	Module 3. Nuclear Design Safety Evaluation Process (4 days)	June 16-22, 2004
	• ND240	Module 4 Plant Operations Calculations (3 1/2 days)	June 22-25, 2004
	ND300*	Operations Core Analysis Package (OCAP) (4 days)	Jan 6-9, 2004

* Courses may help in meeting requirements of INPO SOER 03-2.

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PCT Training Courses - External

2004 NUCLEAR FUEL TRAINING COURSE SCHEDULE (continued)

	Course Number	Course Title	Dates Offered
Thermal-Hydraulic Design	TH200*	Thermal-Hydraulic Design Methods (5 days)	Aug 9-13, 2004
Fuel Rod Design	FR200*	Fuel Rod Design (3 days)	June 15-17, 2004
Nuclear Fuel Design	INT100	Introduction to Nuclear Fuel Design (3 days)	Scheduled upon request
Coolant Activity Analysis	CA200*	Coolant Activity Analysis (4 days in Columbia, SC)	April 26-29, 2004
Quality Assurance	QA100	Product and Software Design Control Process (1 day)	Scheduled upon request
Reactivity Management	REA200*	Reactivity Management During Refueling Operations (2 days)	Scheduled upon request
	REA300*	Reactivity Management During Plant Operations (5 days)	Scheduled upon request
Spent Fuel Management	SF100	Dry Spent Fuel Management (2 days)	Scheduled upon request
Reactor Engineering	ENG100*	Reactor Site Engineer Course (5 days)	Scheduled upon request
Software Engineering	SE100	Basic HP-UX Turnkey System Administration (2 days)	Scheduled upon request
	SE200	Overview of HP-UX Workstation and User Environment (2 days)	
	SE300	Software Engineering Methodology Course (2 days)	
	SE400	Fundamentals of Shell Programing (3 days)	
Station Nuclear Engineering	SNE594	Station Nuclear Engineer Applications	July 12-30, 2004

* Courses may help in meeting requirements of INPO SOER 03-2.

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PCT Training Courses - External

2004 NUCLEAR FUEL TRAINING COURSE SCHEDULE (continued)

	Course Number	Course Title	Dates Offered
Core Design Training Center	NDTC1000*	Nuclear Core Design Training Center	
	NDTC1010	Fuel Management Scoping (5 days)	Scheduled upon request
	NDTC1020	Loading Pattern Scoping (5 days)	Scheduled upon request
	NDTC1030	Cross-Section Development (5 days)	Scheduled upon request
	NDTC1040	Preliminary Model Generation (5 days)	Scheduled upon request
	NDTC1050	Final Loading Pattern Search (15 days)	Scheduled upon request
	NDTC1060	Nuclear Design Safety Evaluation Models (15 days)	April 12-30, 2004
	NDTC1070	Nuclear Design Safety Evaluation Calculations (35 days)	May 3 – June 21, 2004
	NDTC1080	Nuclear Design Calculations (20 days)	June 22 – July 20, 2004
	NDTC1090	Core Follow Calculations (5 days)	Scheduled upon request
	THDTC1000**	Thermal-Hydraulic Design Training Center	Scheduled upon request
	THDTC1010	Hydraulics (5 days)	
	THDTC1020	Core Components Design (5 days)	
	THDTC1030	Operating Limits (15 days)	
	THDTC1040	Safety Analyses (15 days)	
	FRDTC1010**	Fuel Rod Design Training Center	Scheduled upon request
	FRDTC1010	Rod Internal Pressure (5 days)	
	FRDTC1020	Stress/Strain/Fatigue (9 days)	
	FRDTC1030	Corrosion (4 days)	
	FRDTC1040	Rod Growth (2 days)	
	FRDTC1050	Fuel Temperatures (10 days)	
Core Monitoring and Surveillance	BCN100*	BEACON System (up to 10 days)	Scheduled upon request
	BCN200	BEACON Model Generation (up to 11 days)	Scheduled upon request
	MUN100	Measurement Uncertainty Training (1 day)	Scheduled upon request
	BCN300*	BEACON Special Topics	Scheduled upon request
	TRK200*	TracWorks System (2 days)	Scheduled upon request

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PCT Training Courses - External

2004 NUCLEAR FUEL TRAINING COURSE SCHEDULE (continued)

	Course Number	Course Title	Dates Offered
Overview Courses	ND100	Nuclear Design Overview (5 days)	Scheduled upon request
	TH100	Thermal-Hydraulic Design Overview (2 days)	Scheduled upon request
	FR100	Fuel Rod Design Overview (1 day)	Scheduled upon request
	CA100	Introduction to Coolant Activity Analysis (1 day at Columbia)	Scheduled upon request
	DI100	Reload Design Interface Process (3 days)	Scheduled upon request
	NFC100*	Nuclear Fuel Cycle (4 days)	Scheduled upon request
	RSE100*	Reload Safety Evaluation Process (4 days)	Scheduled upon request

*Courses may help in meeting requirements of INPO SOER 03-2.

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Transient Analysis Training Courses - External

- Non-LOCA Overview Training
  - 3-Day Course (up to 2 weeks if hands-on Code Instruction is requested)
  - Overview of Westinghouse Transient Analysis Methods & Codes
  - Overview of each non-LOCA accident with discussions on:
    - Acceptance criteria
    - Cases analyzed
    - Key parameters
    - Protection
    - Analysis assumptions
    - Results (Including transient plots and a sequence of events)

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Transient Analysis Training Courses - External

- Non-LOCA Overview Training
  - Performed for plant personnel from:

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