October 27, 2005

LICENSEE: PPL Susquehanna, LLC (PPL)

FACILITY: Susquehanna Steam Electric Station, Unit 1 (SSES 1)

SUBJECT: SUMMARY OF OCTOBER 12, 2005, CATEGORY 1 WORKING-LEVEL MEETING WITH PPL AND FRAMATOME ADVANCED NUCLEAR POWER (FANP) TO DISCUSS THE LICENSEE'S PROPOSED EXIGENT TECHNICAL SPECIFICATION REQUEST RELATED TO MINIMUM CRITICAL POWER RATIO SAFETY LIMIT (MCPRSL) AND CONTROL CELL FRICTION ISSUES AT SSES 1

On October 12, 2005, a public meeting was held between the U.S. Nuclear Regulatory Commission (NRC), and representatives of PPL and Framatome Advanced Nuclear Power (FANP) at NRC Headquarters, One White Flint North, 11555 Rockville Pike, Rockville, Maryland. The purpose of the meeting was to conduct a working-level discussion related to the schedule, approach, and strategy for the SSES 1 revised core design Cycle 14 (U1C14A) and Cycle 15 (U1C15) MCPRSL amendment request in light of the control rod friction issues experienced on SSES-1.

PPL presented an overview of the current SSES 1 operations relative to PPL's Control Cell Channel Management Action Plan by describing the evaluation, analysis, and the compensatory actions completed following the rod sequence exchange in June 2005 in which control rod friction conditions were observed. PPL explained their decision to initiate a mid-cycle outage and core redesign to address the control rod friction conditions in the core. They described their friction mitigation plan and strategy to definitively characterize the source of the friction and confirm the subsequent actions for reducing or eliminating the friction. PPL indicated that they plan to maintain the original SSES 1 core design parameters by (1) re-channeling the suspect fuel, (2) discharging and replacing the suspect fuel with previously discharged ATRIUM-10 fuel, and (3) shuffling the non-suspect fuel to affected locations. PPL stated that the most probable cause of the channel deformation in SSES 1 is due to shadow corrosion induced channel bow, and that additional inspections and analyses during the mid-cycle outage will be used to reach a definitive root cause. Finally, PPL provided the basis for the channel bow assumptions and calculations for both the original design and the redesigned U1C14A MCPRSL.

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rvg@nrc.gov

In addition, PPL provided an overview of their proposed U1C15 MCPRSL amendment request which is scheduled to be submitted in November 2005. PPL indicated that the U1C14A design will preserve the U1C15 beginning-of-life characteristics as much as practicable. The U1C15 design may require minor changes in order to minimize U1C14 effective control blade exposure on U1C15.

The business portion of the meeting concluded with the licensee requesting any feedback from the NRC staff's preliminary review of their application. The NRC staff informed PPL that a request for additional information would be generated in the near term and that the staff would be ready to support this review on an exigent basis.

A representative from Alleghany Electric Cooperative, Inc., Mr. Lance Hubbard, was in attendance. There were no other members of the public in attendance. Optional public meeting feedback forms (NRC Form 659) were available at the meeting, but none were completed.

Enclosure 1 is a list of the meeting attendees, and Enclosure 2 is a copy of the licensee's slides presented at the meeting.

Please direct any inquiries to Mr. Richard V. Guzman, Project Manager, at 301-415-1030.

/RA/

Richard V. Guzman, Project Manager, Section 1
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-387 and 50-388

Enclosures: 1. List of Attendees
2. Licensee's Handout

cc w/encls: See next page

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Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-387 and 50-388

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cc w/encls: See next page

DISTRIBUTION:

PUBLIC	PDI-1 Reading	RGuzman	OGC	ACRS	TMarsh/CHaney
CHolden	RLaufer	FAkstulewicz	THuang	PClifford	SWu
NMorgan	RTaylor	MSnell	MO'Brien	TMensah	CMiller, EDO, RI

ACCESSION NUMBER: ML052980239

OFFICE	PDI-1/PM	PDI-2/LA	PDI-1/SC
NAME	RGuzman	MO'Brien	RLaufer
DATE	10/25/05	10/27/05	10/27/05

OFFICIAL RECORD COPY

LIST OF ATTENDEES

REVIEW MEETING WITH PPL SUSQUEHANNA, LLC (PPL)

REGARDING PROPOSED MINIMUM CRITICAL POWER RATIO

SAFETY LIMIT CHANGES AND CONTROL CELL FRICTION ISSUES

OCTOBER 12, 2005 - 9:00-12:00, O-8-B-4

NAME	ORGANIZATION*
1. R. Guzman	NRC/NRR/DLPM/PDI-1
2. F. Akstulewicz	NRC/NRR/DSSA/SRXB
3. T. Huang	NRC/NRR/DSSA/SRXB
4. P. Clifford	NRC/NRR/DSSA/SRXB
5. R. Taylor	NRC/NRR/DSSA/SRXB
6. S. Wu	NRC/NRR/DSSA/SRXB
7. N. Morgan	NRC/NRR/DLPM/PDI-1
8. M. Snell	NRC/RES/DSARE
9. R. Pagodin	PPL
10. R. Sgarro	PPL
11. A. Dyszel	PPL
12. C. Hoffman	PPL
13. J. Smith	PPL
14. M. Crowthers	PPL
15. J. Ingham	FANP
16. J. Holm	FANP
17. L. Hubbard	Alleghany Electric Cooporative, Inc.

*

NRC	U.S. Nuclear Regulatory Commission
NRR	Office of Nuclear Reactor Regulation
DLPM	Division of Licensing Project Management
PDI-1	Project Directorate I, Branch 1
FANP	Framatome Advanced Nuclear Power
DSSA	Division of Systems Safety and Analysis
SRXB	Reactor Systems Branch
RES	Office of Nuclear Regulatory Research
DSARE	Division of Systems Analysis and Regulatory Effectiveness

Enclosure 1

MEETING SLIDES

Enclosure 2

Susquehanna Steam Electric Station

Unit 1 Technical Specification MCPR Safety Limit Amendment Request

PPL Susquehanna, LLC
Nuclear Fuels & Analysis

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Agenda

NRC

- Introductions
- Objectives
- Staff Comments

PPL

- Overview of Current Operation
- Unit 1 Cycle 14A Amendment Request
- Overview of U1C15 MCPR SL Submittal
- Unit 2 Status

ALL

- Concluding Remarks

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Susquehanna Steam Electric Station (SSES)

Characteristics:

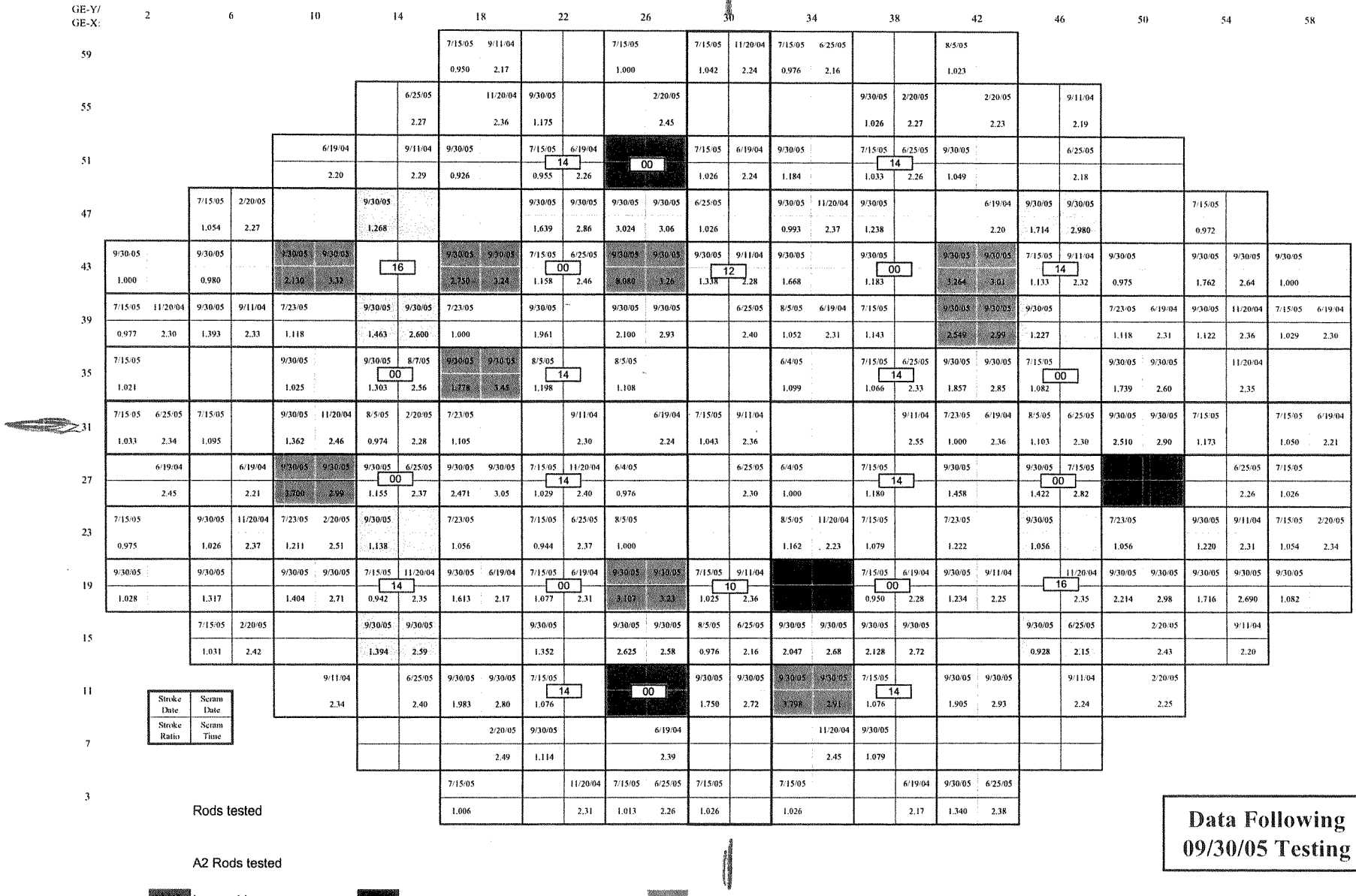
- "C" Lattice GE BWR 4
- 3489 MWth
- 764 Assemblies
- 185 Cruciform Blade Control Rods
- Full Core Atrium-10 (10 x 10) fuel

Overview of Current Operations
Unit 1 Cycle 14 Control Cell Interference

- Purpose of Channel Management Action Plan
  - Identify and trend the observance of control cell friction
  - Proactively declare control rods inoperable, should testing indicate that friction might result in the development of an actual inoperable condition, prior to the next scheduled test
  - Ensure a control rod's ability to perform its safety function, without risking damage to: the control blade, reactor internal components, or risk lifting the fuel during an earthquake

Overview of Current Operations
Unit 1 Cycle 14 Control Cell Interference

- PPL Channel Management Action Plan
  - Test method consistent with GE guidance SC05-06, "Updated Surveillance Program for Fuel Channel-Control Blade Interference Monitoring"
  - 101 Control Cells in Monitoring Program (as of 10/01/05)
    - 4 Inoperable Control Rods
    - 5 Declared Slow Control Rods (only 1 per TS 3.1.4)
    - 37 "Slow-to-Settle" Control Rods ($\geq$ 30 seconds to settle)
    - 49 Friction Control Rods (based on stroke ratio $\geq$ 1.25)


GE-Y/ GE-X:
2 6 10 14 18 22 26 30 34 38 42 46 50 54 58
59 55 51 47 43 39 35 31 27 23 19 15 11 7 3
Stroke Date
Scram Date
Stroke Ratio
Scram Time
Rods tested
A2 Rods tested
Inoperable
Inoperable October 2005
High Risk Cells
Data Following 09/30/05 Testing

Overview of Current Operations
Unit 1 Cycle 14 Control Cell Interference

- Operational Impact
  - 4 Inoperable Control Rods → Asymmetric Control Rod Patterns
    - FANP Analyzed MCPR SL → No Change Due to Control Rod Patterns
    - Remaining AOOs and Accidents Not Affected
  - No Additional Testing Prior to Outage
  - "Slow-to-Settle" Control Rods Targeted for Full In or Full Out
  - Control Rod Pattern Adjustments (With Non-Friction Rods) To Maintain Full Power

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U1C14 Quarter Core Bundle Average Exposures (In GWd/MTU On 09/30/05)

GEY \ GEX	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59
30	45.4	42.8	14.6	43.7	16.1	36.6	17.2	37.3	16.7	35.8	15.2	35.5	13.3	29.8	44.0
28	42.8	31.5	31.2	16.0	37.2	17.1	37.4	16.5	36.2	16.7	35.3	15.8	27.8	43.8	43.7
26	14.6	31.1	16.2	36.7	16.5	37.1	43.7	35.3	16.1	36.4	16.3	36.9	14.5	28.6	43.2
24	43.7	15.7	36.4	16.5	36.8	16.2	35.9	16.3	36.9	16.5	36.1	15.9	27.0	11.2	42.7
22	15.8	36.8	16.2	36.8	16.6	35.3	16.0	33.7	16.3	42.9	16.3	36.0	14.3	28.2	44.2
20	36.3	16.8	36.9	16.3	35.7	16.8	37.4	16.7	35.4	17.0	36.4	15.7	32.1	31.5	43.3
18	16.7	37.1	44.0	36.3	16.2	37.5	17.1	36.9	16.9	36.3	16.2	35.0	26.1	44.7	42.5
16	37.2	16.2	35.1	16.3	33.8	17.0	37.1	17.3	37.0	16.3	14.6	25.7	46.1	35.8	
14	16.7	36.0	15.9	36.8	16.4	35.8	17.2	36.9	15.9	32.9	31.8	43.8	42.8		
12	36.8	16.8	36.4	16.6	42.9	17.2	36.5	16.2	32.8	12.4	45.0	41.4	42.1		
10	16.0	35.5	16.4	36.3	16.5	36.5	16.3	14.5	31.6	45.3	41.6				
8	36.0	15.9	36.8	16.0	36.4	15.8	35.1	25.7	44.1	43.6					
6	13.4	27.8	14.5	27.1	14.4	32.1	26.2	45.4	43.1	41.8					
4	29.7	44.6	28.8	11.3	28.3	31.4	45.1	35.7							
2	44.4	43.5	42.3	43.7	41.8	43.7	42.4								

Cycle Exposure 13,153 MWD/MTU

Overview of Current Operations
Unit 1 Cycle 14 Control Cell Interference

- Root Cause Investigation
  - Initiated following the unsuccessful sequence exchange in late June 2005
  - Reviewed applicable aspects of the Control Rod Drive System and other potential control cell interference mechanisms that could realistically cause the "slow-to-settle" control rod conditions observed
  - Interim Root Cause – Likely Channel Deformation
  - Most Probable Cause of Deformation – Shadow Corrosion Induced Channel Bow
  - Additional Inspections and analysis will be used to reach the definitive root cause

Overview of Current Operations
Unit 1 Cycle 14 Control Cell Interference

- Corrective Actions
  - Thermal Limit Penalties implemented following 06/03/05 testing
  - Compensatory Actions for MCPR and LHGR
    - Developed to bound the amount of bow that would be necessary to result in a "Slow-to-Settle" Control Rod condition
    - Remains Applicable With Current Configuration
  - Mid-cycle Outage
    - Revised Core Design is provided later as part of U1C14A

Decision to Take a Mid-Cycle Outage

- PPL Operational Decision Making Model
  - The Channel Management Action Plan enabled PPL to safely manage the operation of the plant
  - Data was evaluated through the testing on 09/30/05
  - Cell Friction Monitoring Plan data confirmed that friction was slowly increasing, and could be predictably trended, within the affected cells
  - A proactive decision was made to initiate a mid-cycle outage and core redesign to address the trend, prior to reaching Technical Specification limits

Mid-Cycle Outage Strategy

- Purpose: More definitively characterize the source of friction and confirm subsequent actions to reduce or eliminate the friction by rechanneling and reinsertion.
- Outage Investigational Methods
  - Friction Testing Prior to In-Vessel Activities
  - In-Vessel Visual Inspection of most affected cells
  - Channel bow measurements

U1C14A Core Redesign Characteristics

- Mitigates (and possibly eliminates) control cell friction for successful operation to the Spring 2006 refueling outage
- Maintains Unit 1 Cycle 14 reactivity and depletion characteristics - minimizes impacts on MCPRSL and changes to U1C15 fuel and core design.
- Develops a fuel/core design that meets all licensing requirements, maintains fuel integrity, and will not unnecessarily limit plant operation

Unit 1 Cycle 14A Redesign Characteristics

- Friction Mitigation Techniques
  - Re-Channel Suspect Fuel (up to, as necessary)
    - (16) 80-mil Channels
    - (60) 100-mil Channels
  - Discharge Suspect Fuel and Replace With Previously Discharged ATRIUM-10 Fuel (Pre-Characterized)
  - Shuffle Non-Suspect Fuel to Affected Locations

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Unit 1 Cycle 14A Redesign Characteristics

- Current Core Redesign Parameters
  - Full Core ATRIUM-10 Fuel
    - U1C14 Inventory + Re-insert Fuel
    - 76 Re-Channeled Assemblies
    - 40 Non-Susceptible U1C13 Assemblies Shuffled
    - 56 Re-insert U1C12 Assemblies (Pre-Characterized)

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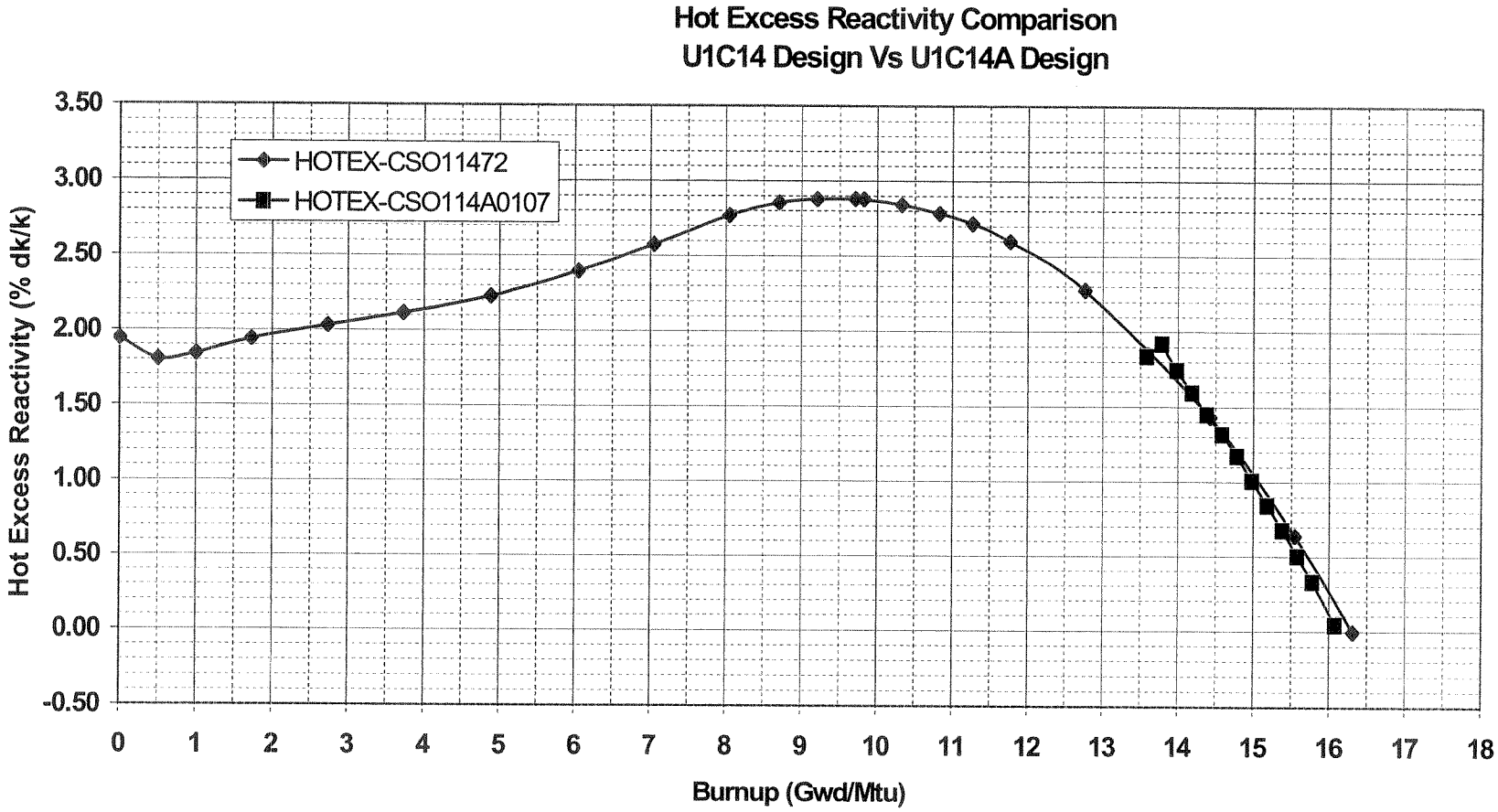
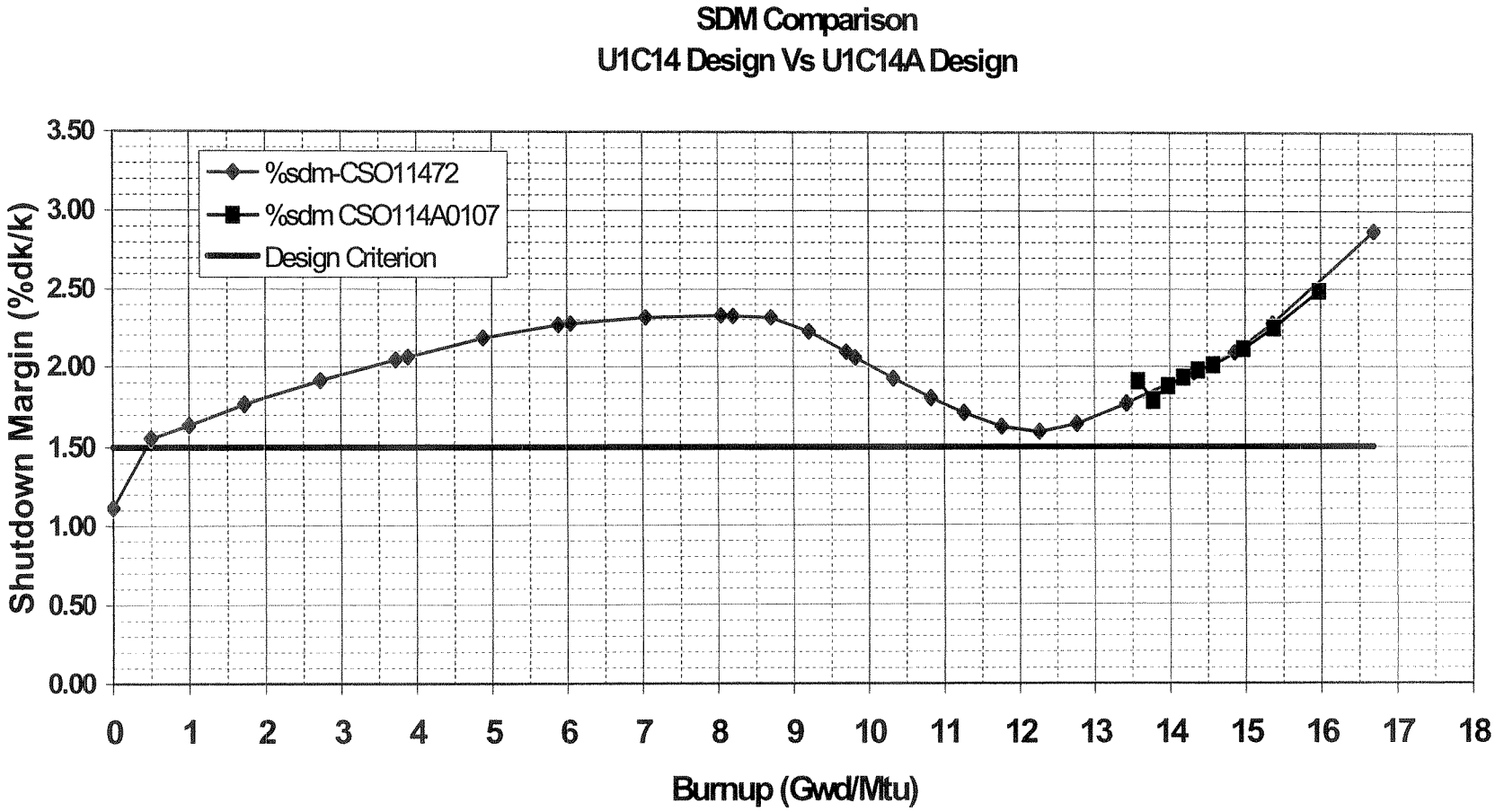
U1C14A CORE REDESIGN RESULTS

- Hot Excess Reactivity-MB2



U1C14A CORE REDESIGN RESULTS

- Shutdown Margin - MB2



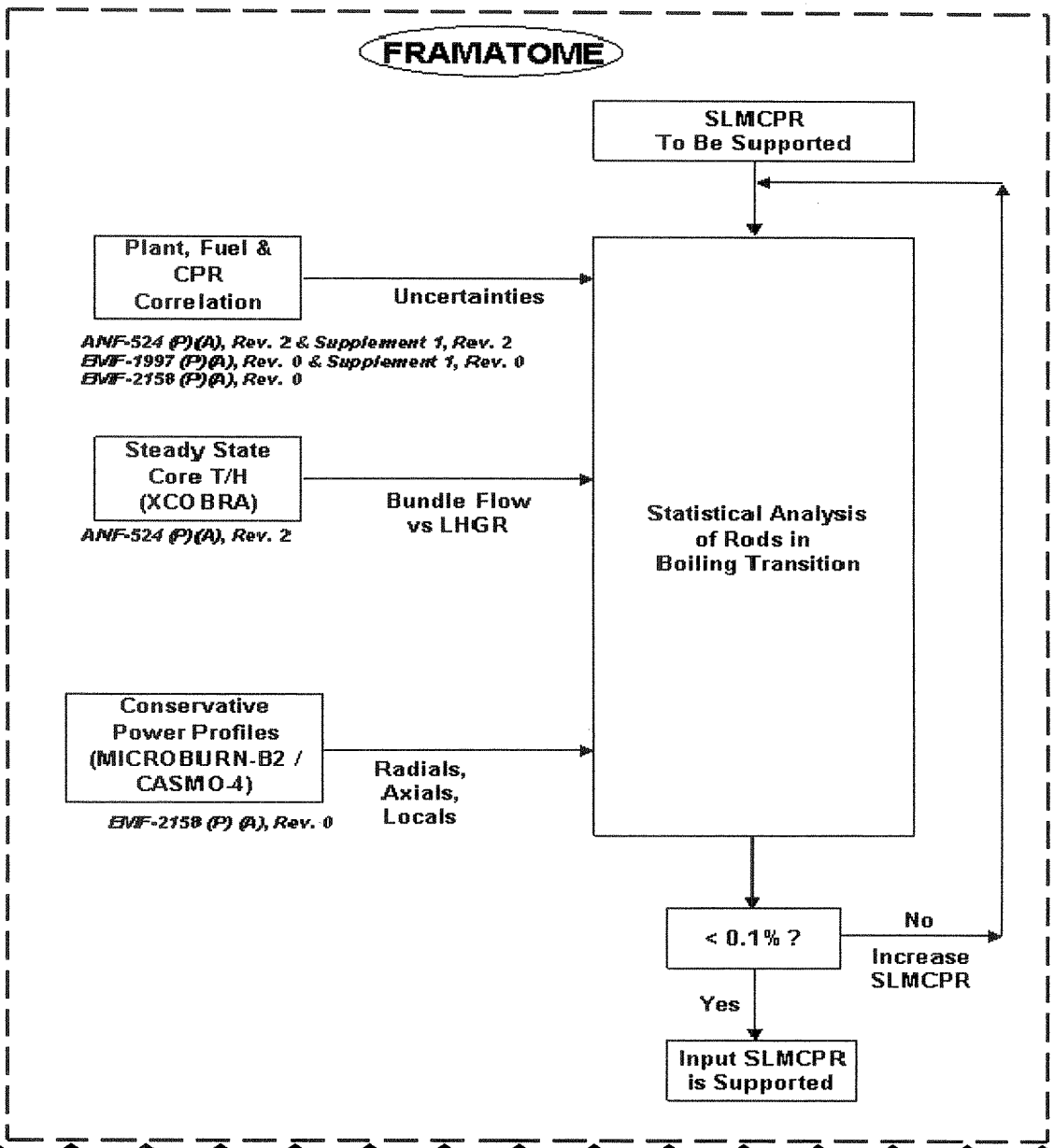
U1C14A Core Redesign Results

- The final redesigned core:
  - Meets the redesign objectives of:
    - Mitigating the effects of control cell friction
    - Maintaining the reactivity characteristics of the original core design
    - Maintaining fuel integrity, and not unnecessarily limiting plant operations
    - Meets all licensing requirements, using the NRC approved methods.

Unit 1 Cycle 14 MCPR SL Basis

- Channel Bow Assumptions for U1C14 (Original Design) MCPR SL
  - Unit 1 Cycle 14 Designed to Mitigate Fluence Induced Channel Bow
  - Shadow Corrosion Channel Bow Not Previously Observed at Susquehanna
  - MCPR Safety Limit Assumed Channel Bow Consistent with Framatome-ANP Database
  - MCPR Safety Limit Performed Consistent with ANF-524(P)(A), "ANF Critical Power Methodology for Boiling Water Reactors."

Unit 1 Cycle 14A MCPR SL Submittal



Unit 1 Cycle 14A MCPR SL Submittal

- Channel Bow Assumptions
  - U1C14 (Original Design) MCPR SL
    - Assumed Bow Consistent with FANP Database
      - 53 mils For Exposed Fuel Assemblies
    - Core Designed to Mitigate Fluence Induced Channel Bow
  - U1C14A (Redesign) MCPR SL
    - Assumed Bow Twice the FANP Database
      - 107 mils For Exposed Fuel Assemblies
    - Channel Bow Measurements Will Be Performed To Confirm Assumption

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Unit 1 Cycle 14A MCPR SL Submittal

- Core MCPR SL Results
  - U1C14 MCPR SL
    - 1.08 Two Loop and 1.10 Single Loop
  - U1C14A MCPR SL (Nominal Bow)
    - Existing MCPR SL Is Not Impacted by Core Loading Pattern Change Alone

Proposed MCPR Safety Limit	Two Loop % Pins in BT	Single Loop % Pins in BT
1.08	0.0767	N/A
1.10	N/A	0.0458

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Unit 1 Cycle 14A MCPR SL Submittal

- MCPR SL Results (continued)
  - U1C14A MCPR SL (2x Nominal Bow)
    - 1.09 Two Loop and 1.10 Single Loop

Proposed MCPR Safety Limit	Two Loop % Pins in BT	Single Loop % Pins in BT
1.08	0.1397	N/A
1.09	0.0892	N/A
1.10	0.0547	0.0886
1.11	N/A	0.0618

Unit 1 Cycle 14A MCPR SL Submittal

- Summary
  - Mid-Cycle Redesign (U1C14A) results in similar characteristics to the original U1C14 design
  - Analyses Performed Using NRC Approved Methods
  - Meets Applicable Licensing Requirements
  - 2x Nominal Bow Assumed For U1C14A MCPR SL

Overview of U1C15 MCPR SL Submittal

- U1C14A impacts on U1C15 design
  - U1C14A design preserves U1C15 BOC characteristics as much as practicable.
  - U1C15 design may require minor changes in order to minimize U1C14 Effective Control Blade Exposure (ECBE) on U1C15
  - Dependent upon inspection results, rechanneling may be necessary to minimize friction recurrence.

Overview of U1C15 MCPR SL Submittal

- Channel Bow Assumptions for U1C15 Licensing
  - 2 times nominal bow
  - Use of SPCB correlation, instead of ANFB-10
- U1C15 MCPR SL Submittal ~ 11/30/2005

SSES Unit 2 Current Status

- Unit 2 is not currently showing signs of control cell friction
- Similarities to Unit 1
  - Core Loading Philosophy
  - Channel Design and Material Composition
  - Hot Excess Reactivity and Control History
- Anticipated Performance
  - Unit 2 will likely follow a similar friction trend to that observed in Unit 1
  - This trend will likely develop by the first quarter of 2006

Susquehanna Steam Electric Station, Units 1 and 2

cc:

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Susquehanna Steam Electric Station, Units 1 and 2

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