

## **NRR-PMDAPEm Resource**

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**From:** timothy.byam@exeloncorp.com  
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**To:** Mozafari, Brenda  
**Cc:** michael.reitmeyer@exeloncorp.com; patrick.simpson@exeloncorp.com  
**Subject:** Slide Deck for Exelon Pre-Submittal Meeting  
**Attachments:** Fuel Transition Meeting Presentation (Final).pptx

Brenda,

Attached are the slides for the upcoming Exelon/NRC Pre-Submittal meeting currently scheduled for August 27, 2013. These slides have been through our review process and are considered final. There is no proprietary information contained on the slides. Please let me know if you have any questions. Thank you,

Tim

**Timothy A Byam**  
Principal Regulatory Engineer  
Exelon Nuclear

4300 Winfield Rd.  
Warrenville, IL 60555  
Office: 630 657 2818 | Fax: 630 657 4327  
[timothy.byam@exeloncorp.com](mailto:timothy.byam@exeloncorp.com) [www.exeloncorp.com](http://www.exeloncorp.com)

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**Created By:** timothy.byam@exeloncorp.com

**Recipients:**

"michael.reitmeyer@exeloncorp.com" <michael.reitmeyer@exeloncorp.com>  
Tracking Status: None  
"patrick.simpson@exeloncorp.com" <patrick.simpson@exeloncorp.com>  
Tracking Status: None  
"Mozafari, Brenda" <Brenda.Mozafari@nrc.gov>  
Tracking Status: None

**Post Office:** cccmsxch13.energy.power.corp

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# Fuel Transition License Amendment Request Pre-Submittal Meeting

Exelon Generation Company, LLC  
Dresden and Quad Cities Stations  
August 27, 2013



# Meeting Agenda

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- Objectives
- Background
- Licensing Approach
- Schedule
- Technical Topics
- Summary
- Discussion

## Meeting Objectives

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- Describe the transition process from Westinghouse to AREVA fuel supply
- Communicate transition plan
- Address technical topics associated with the proposed transition
- Discuss licensing activities and schedule
- Obtain NRC input on the transition plan

## Background

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Dresden Nuclear Power Station (DNPS) and Quad Cities Nuclear Power Station (QCNPS)

- General Electric BWR/3 with a Mark I Containment
- Original Operating License
  - DNPS Unit 2 – 12/22/1969
  - DNPS Unit 3 – 01/12/1971
  - QCNPS Unit 1 – 10/01/1971
  - QCNPS Unit 2 – 03/31/1972
- Initial power level
  - DNPS Units 2 and 3 – 2527 MWt
  - QCNPS Units 1 and 2 – 2511 MWt
- Extended Power Uprate Approved
  - DNPS Units 2 and 3 – 2957 MWt
  - QCNPS Units 1 and 2 – 2957 MWt
- Renewed Operating License Expires
  - DNPS Unit 2 – 12/22/2029
  - DNPS Unit 3 – 01/12/2031
  - QCNPS Units 1 and 2 – 12/14/2032

## Background

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### Westinghouse Optima2 Fuel – Key Features

- 96 rods arranged in four 5x5-1 sub-bundles
- Sub-bundles separated by cruciform internal structure (water cross) in channel
- Eight 2/3-length and four 1/3-length part-length rods
- 8 spacers
- Sub-bundles supported at the bottom by stainless steel inlet piece with integrated debris filter

## Background

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### AREVA ATRIUM 10XM Fuel – Key Features

- 10x10 lattice – 91 fuel rod locations
- 3 X 3 Square internal water channel
- 12 part length rods
- 9 grid spacers
- Debris filter lower tie plate
- 178 kgU
- Extensive operating experience



## Background

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### DNPS and QCNPS Fuel Transition Project

- December 2012 – AREVA awarded contract for fuel beginning in 2016
- April through Present – AREVA has been collecting and evaluating plant data needed for fuel transition
- June 2013 – Began fuel transition LAR planning activities

## Licensing Approach

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- Exelon will be asking for NRC review of the inclusion of AREVA approved generic methodologies as applicable to support licensing analyses and associated DNPS and QCNPS TS changes in support of the transition to AREVA ATRIUM 10XM fuel
- Submittal of combined DNPS and QCNPS LAR planned for February 2015
- AREVA first fuel delivery planned for February 2016 for installation in scheduled refueling outage in March 2016 (Quad Cities Unit 2)
- Current licensing basis will be retained for events not impacted by the change in fuel design

## Licensing Approach

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Revise TS and COLR to incorporate AREVA fuel analysis methods and setpoint changes as necessary

- Proposed TS changes will be provided with LAR
  - TS 5.6.5, Core Operating Limits Report (COLR) changed to add AREVA analytical methods
- Individual COLRs will be revised as part of the reload process

## Licensing Approach

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- LAR will provide AREVA proprietary reports for Exelon
  - Mechanical Design Report
  - Fuel Rod Design Report
  - Thermal-Hydraulic Design Report
  - Fuel Cycle Design Report
  - Reload Safety Analysis Report
  - LOCA Break Spectrum Analysis Report
  - LOCA-ECCS Analysis MAPLHGR Limit Report
- LAR will provide listing of current BWR Approved Topical Reports for Dresden and Quad Cities that are still applicable

## Licensing Approach

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- Representative QCNPS Unit 2 Cycle Analysis Report will be provided to the NRC in support of their review of the LAR
  - This representative Cycle Analysis Report is intended to support the LAR review for DNPS Units 2 and 3 and QCNPS Units 1 and 2
- Purpose of representative analyses is to demonstrate the applicability of AREVA methodology to Dresden and Quad Cities at current operating conditions
- The basis for ensuring that the analyses provided will be representative for both plants is that the plants are the same in many aspects (power, flow, size, etc.)
- Approach supports the applicability of the LAR review for DNPS Units 2 and 3 and QCNPS Units 1 and 2

## Fuel Transition LAR Schedule

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### Fuel Transition

- Submittal: February 2015
- Need Date: March 2016
- QCNPS Unit 2 implementation: March 2016
- DNPS Unit 3 implementation: November 2016
- QCNPS Unit 1 implementation: March 2017
- DNPS Unit 2 implementation: November 2017

## Fuel Transition LAR Schedule

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### Concurrent Reviews

- Criticality Safety Analysis (CSA) LAR
  - Fuel Transition LAR does not depend on NRC approval of a CSA LAR
  - CSA LAR does not depend on NRC approval of Fuel Transition LAR
  - LAR will address CSA for DNPS Units 2 and 3 only (submittal scheduled for March 2014); QCNPS Units 1 and 2 criticality changes will be completed under 10 CFR 50.59 based on DNPS amendment
- AST
  - If accident dose increases by more than 10% as a result of fuel transition, AST analysis will require revision and results will be included in the fuel transition LAR

## AREVA Technical Topics

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### AREVA Critical Power Evaluator (ACE)

- Issue: Potentially Non-conservative ACE critical power correlation
  - Approved LTR uses an integrated peaking factor based on the local fuel rod peaking factors that could lead to non-conservative CPR predictions
- Solution: Submit Either Generic USNRC Approved or Exelon specific application of ACE supplement
  - Supplement will be part of COLR reference list
  - Generic ACE supplement currently under USNRC review
  - If generic supplement is not approved in time for LAR submittal, Exelon specific ACE supplement will be provided (same technical content as generic supplement)



## AREVA Technical Topics

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### Thermal Conductivity Degradation (TCD)

- Issue: Evolving NRC Criteria regarding TCD
  - Halden ultra-high-burnup experiment indicated steady degradation in the thermal conductivity of uranium fuel pellets with increasing exposure. Irradiation damage and the progressive buildup of fission products in the fuel pellets result in reduced thermal conductivity of the pellets.
  - NRC expressed concern that some vendors might still be using codes for safety analyses that do not account for this phenomenon and therefore may produce non-conservative results.
- Solution: Submit Exelon specific analysis of Core
  - AREVA uses RODEX4 for all thermal-mechanical analyses (which contains models for TCD).
  - AREVA uses RODEX2 for transient and LOCA analyses.
    - AREVA analyses for Exelon will address NRC concerns.
    - Method for addressing TCD in analyses using RODEX2 will be described in LAR materials.

# AREVA Technical Topics

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## AREVA LOCA Methods

- Issue: Changes to NRC Approved Method
  - Current method is EMF-2361(P)(A) Revision 0, EXEM BWR-2000 ECCS Evaluation Model, May 2001.
  - An improved radiation view factor calculation approach has been implemented in the HUXY code.
  - AREVA committed to utilize a modified analysis approach for all future break spectrum analyses. AREVA developed the modified approach to address an NRC concern.
- Solution: Submit Exelon specific analysis
  - DNPS and QCNPS specific analyses will use modified LOCA methods as required per AREVA commitment to NRC

## AREVA Technical Topics

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### Reactivity Insertion Accident

- Issue: Control Rod Drop Accident revised acceptance criteria
  - NRC has proposed the following changes:
    - More restrictive coolability criteria (currently 280 cal/g)
    - More restrictive fuel failure criteria (currently 170 cal/g)
    - More severe fission-product inventory for total radiological source term
- Solution: Respond with Industry
  - AREVA will meet the more restrictive coolability criteria (230 cal/g)
  - Do not anticipate that this issue will affect the Exelon fuel transition LAR.
  - Current timetable for completion of NRC criteria would not occur until after submission of Exelon Fuel Transition LAR

## AREVA Technical Topics

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### Channel Bow Considerations

- Issue: Channel bow model implementation
  - NRC has expressed concern about applying channel bow model outside range of applicability
    - Applies to both SLMCPR and fuel rod power history analyses
- Solution: Submit Exelon specific application
  - Submittal will describe actions should the channel bow fundamental parameters fall outside the current database supporting the model

## AREVA Technical Topics

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### Safety Limit MCPR Considerations

- Issue: Application of SLMCPR methodology to co-resident
  - OPTIMA2 fuel design quadrant flow split creates an additional flow uncertainty.
- Solution: Submit Exelon specific application to account for quadrant flow split
  - Include the additional quadrant flow split uncertainty in the calculation of the perturbed flow used in the SAFLIM3D MCPR calculation.

## Summary

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- Exelon transitioning to AREVA ATRIUM 10XM fuel
- Established transition process followed by industry will be used
- NRC-approved methodologies will be used for the transition analyses
- Exelon will be asking for NRC review of the inclusion of AREVA approved generic methodologies as applicable to support licensing analyses and associated DNPS and QCNPS TS changes in support of the transition to AREVA ATRIUM 10XM fuel
- One license amendment request will address both DNPS and QCNPS
- Representative QCNPS Unit 2 Cycle Analysis Report will be provided to the NRC in support of their review of the DNPS and QCNPS LAR
- Exelon and AREVA are identifying and addressing technical issues to support the NRC's review

## DISCUSSION