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SVEA-96 Optima2
License Amendment Request

June 30, 2005

Agenda

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• Introduction	K. Nicely
• Overview of License Amendment Request (LAR)	K. Nicely
• Technical Items of Interest	D. Redden
• NRC Interactions	K. Nicely
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NOTE: Proprietary information will be discussed as part of each presentation topic. However, the proprietary information is not contained in this presentation since it is duplicative to the June 15, 2005, LAR.

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Introduction

Ken Nicely
Licensing Engineer

Purpose

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- Present an overview of the Exelon Generation Company, LLC (EGC) LAR supporting the introduction of Westinghouse SVEA-96 Optima2 fuel at Dresden Nuclear Power Station (DNPS) and Quad Cities Nuclear Power Station (QCNPS) and use of proprietary Westinghouse methodologies
- Highlight potential technical items of interest
  - Anticipated transient without scram (ATWS) methodology
  - Justification for using slip and void correlation at pressures that exceed 1450 psia
  - Operating Limit Minimum Critical Power Ratio (OLMCPR) conservative adder for legacy fuel
- Describe plans for the frequency and schedule for future NRC interactions, in light of the schedule for completing remaining task reports
- Demonstrate that the LAR is complete and acceptable for NRC review
- Solicit initial NRC feedback and review schedule

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Overview of LAR

Ken Nicely
Licensing Engineer

Overview of LAR
Objectives

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- Obtain NRC approval of Technical Specification (TS) changes needed to support the transition to SVEA-96 Optima2 fuel at DNPS and QCNPS
  - Remove “for GE analyzed cores” from Table 3.1.4-1, “Control Rod Scram Times”
  - Revise the description of a fuel assembly in TS Section 4.2.1 to include the unique watercross design for allowing non-boiling water in the assembly interior
  - Add references to seven Westinghouse topical reports in TS Section 5.6.5.b
    - Topical reports being added will be used to determine core operating limits for future fuel cycles containing SVEA-96 Optima2 fuel

Overview of LAR
Objectives (cont.)

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- Address NRC's comments regarding the lack of detailed information in the original LAR dated January 20, 2005
  - Comments documented in March 17, 2005, NRC letter to EGC
- Document methodology clarifications presented at April 14 and May 5, 2005, meetings between NRC, Westinghouse, and EGC

Overview of LAR
Components

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- Cover letter
- Attachment 1: Evaluation of proposed change
- Attachment 2: Markup of TS pages for DNPS
- Attachment 3: Markup of TS pages for QCNPS
- Attachment 4: Retyped TS pages for DNPS
- Attachment 5: Retyped TS pages for DNPS
- Attachment 6: Applicability of Westinghouse fuel and analytical methods
- Attachment 7: Evaluation of licensing basis events
- Attachment 8: Westinghouse application for withholding, affidavit, and non-proprietary versions of Attachments 6 and 7

Description of Components
Attachments 1 – 5

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- Attachments 1 – 5 are similar to the original LAR submittal (i.e., January 20, 2005) except for following changes
  - SVEA-96 Optima2 description updated in Section 4.2 of Attachment 1 to provide additional description of bundle
  - Topical report summaries expanded in Section 4.3 of Attachment 1 (Item 4 - March 17, 2005, NRC letter)
  - Safety evaluation limitations and conditions added to topical report summaries in Section 4.3 of Attachment 1

Description of Components
Attachment 6

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- Addresses issues related to first application of Westinghouse fuel and associated analytical methods to an EPU plant (Item 3 - March 17, 2005, NRC letter)
  - Demonstrates that Westinghouse proprietary methods and code systems will be applied within NRC approved applicability ranges, except for slip and void correlation
  - Justifies validity of uncertainties applied to thermal limits
  - Assessment database and uncertainty of models remain valid
    - Includes empirical data from Westinghouse's on-going qualification program (i.e., gamma scan and traversing in-core probe (TIP) measurements, critical experiments, and comparisons to higher order transport code)
    - References Westinghouse's response to RAI #11 of WCAP-15942-P to show relative ranking of DNPS and QCNPS in comparison to other Westinghouse fueled plants, for key parameters

Description of Components
Attachment 7

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- Addresses the lack of detail and technical justification on Westinghouse analytical methods (Item 1 - March 17, 2005, NRC letter)
  - Tables 3 – 21 provide limitations/conditions and associated resolutions of NRC safety evaluations for the topical reports comprising the Westinghouse methodology
- Addresses the lack of detail and technical justification for mixed core applications (Item 2 - March 17, 2005, NRC letter)
  - Table 1 provides a summary of events that have been reviewed and categorized for evaluation or analysis
  - Table 2 provides the acceptance criteria for the analysis of events identified in Table 1
  - Five licensing basis events (including ATWS) provided as examples to illustrate:
    - Methodology for event categorization
    - Treatment of mixed cores

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Technical Items of Interest

Dan Redden
Project Manager

ATWS Evaluation

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- ATWS overpressure analysis performed each reload
- Equilibrium and mixed cores of SVEA-96 Optima2 fuel will be evaluated for the initial transition for long-term plant response
- Acceptance criteria
  - Peak cladding temperature < 2200°F
  - Peak containment pressure < containment design pressure
  - Peak reactor vessel pressure < 120% reactor vessel design pressure (ASME Limit C)
  - Offsite dose < 10 CFR 100 acceptance limits
  - Demonstrated equipment availability

ATWS Evaluation (cont.)

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- Methodology described in CENPD-300-P-A
- BISON used to analyze an ATWS event
- Extension of the slip and void correlation range has been justified
- Standby Liquid Control (SLC) system modeling
  - SLC performance specifications and parameters are unchanged from the current licensing basis EPU evaluation, except that the solution has been upgraded to enriched sodium pentaborate
    - Enriched sodium pentaborate incorporated irrespective of fuel product line to regain margin lost from EPU
  - SLC system model will be evaluated with BISON, and will include conservative inputs, including the pressure difference between the SLC pumps discharge relief valves and the reactor

ATWS Evaluation (cont.)

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- Boron mixing model
  - Transition to SVEA-96 Optima2 fuel does not affect the actual mixing of boron in the reactor and recirculation system
  - Current licensing basis assumptions will continue to be used
    - "Perfect" mixing model with 75% effectiveness factor
    - These assumptions will be incorporated into BISON
- BISON reactivity calculation
  - BISON is qualified to determine reactor power under transient conditions with a wide range of pressures, inlet enthalpies, and voids
  - BISON has the ability to determine reactor power with boron in the core
  - BISON predictions will be compared with POLCA7
  - 75% effectiveness factor will be reduced if BISON over-predicts the reactivity worth of the boron when compared to POLCA7

ATWS Evaluation (cont.)

- Sensitivity cases
  - Several base and sensitivity cases will be evaluated to ensure the reasonableness and conservatism of the containment response model
  - Base cases will include the QCNPS Unit 2 equilibrium core of SVEA-96 Optima2 fuel and will determine the limiting ATWS event and limiting time in core life
  - Sensitivity cases will be run on the limiting event and time in life using an equilibrium full core of GE14 and the mock transition core
  - Sensitivity case will be run assuming natural SLC solution
  - This will demonstrate that the effect on the fuel transition on containment parameters is small

ATWS Evaluation
Slip and Void Correlation

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- NRC safety evaluation for RPA 90-90-P-A requires justification if the slip and void correlation models will be used above 1450 psia
- Application range of the slip correlation in combination with the Solberg boiling model was extended by a comparison against the EPRI slip/boiling (i.e., void) correlation
- LAR describes an extension of the comparison of these models with higher pressures and higher steam qualities than originally used in the topical report
- Comparison indicates that the change of void fraction with pressure in the range of interest is almost the same for both methods
- Application of the slip and void correlation has been verified for the expanded pressure and steam quality ranges

OLMCPR Conservative Adder

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- NRC safety evaluation for CENPD-300-P-A requires licensee submittals to include justification for the OLMCPR adder for legacy fuel and reference the appropriate supporting documentation
- Results for QCNPS are documented in a Westinghouse task report
- LAR provides a summary of the analysis, which includes:
  - Developing the CPR correlation for the legacy fuel
  - Validating the CPR correlation for the legacy fuel, and performing a statistical analysis to determine the 95/95 lower tolerance limit
  - Applying the conservative multiplier (i.e., adder) to the OLMCPR calculation
- Methodology used is consistent with that used to support the transition to Westinghouse fuel for Hope Creek Generating Station (Reference PSE&G submittal dated March 27, 2000)

Technical Evaluations

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Task Report Number	Task Report Name	Task Report Scope	Ready for NRC Audit
023	Fast Transients Model	Inputs and other non-cycle specific configuration information used for cycle specific fast transient evaluations (See also TSD 039)	08/26/05
032	Fuel Assembly Design Package	Non-cycle specific Optima2 bundle configuration information and mechanical compatibility evaluation	09/08/05
037	Radiation Source Term	Source term information for radiological consequences evaluations	08/26/05
039	Mock Transition Loading Pattern Design and Licensing Evaluation	Cycle specific evaluations of mock transition loading pattern (fast transients, slow transients, stability)	08/26/05
008	Reload Licensing Basis Methodology - QCNPS	QCNPS Unit 2 specific determination of the disposition of accident and transients (bounding versus cycle-specific evaluations)	08/26/05
009	Reference Optima2 D&Q Loading Pattern Evaluation (Equilibrium)	Equilibrium loading pattern model used for bounding analyses	08/26/05
010	Safety Analysis Core Models	Non-equilibrium loading pattern model used for bounding analyses and Task 039	08/26/05
012	Thermal Hydraulic Compatibility	Verification of Optima2 thermal hydraulic compatibility in mixed core and full core	08/26/05
013	Nuclear Benchmark	Evaluation of historical fuel cycles (GE14 and Atrium 9) evaluated with Westinghouse POLCA	08/26/05
015	CPR Correlation for Powerplex	Westinghouse input to Exelon for developing Optima2 CPR correlations for Powerplex	08/26/05
016	Thermal Hydraulic Model Inputs to Powerplex/Microburn	Westinghouse input to Exelon for developing Optima2 thermal hydraulics inputs for Powerplex	08/26/05
020	CPR Correlation for Design	CPR correlation for GE14 and Atrium 9 fuel within POLCA code	08/26/05
034	Heat Balance	NSSS statepoint determination: pressures, flows, enthalpies, steam and water qualities, etc. for input to Westinghouse safety analysis	08/26/05
026	ATWS (Overpressure)	Part 1 of ATWS evaluation: transient up to the point of boron injection, verification of peak RCS pressure	08/26/05
027	Containment Loads	Evaluation of the effects of full core and mixed core on containment and suppression pool accident response (except ATWS)	08/26/05
024	Station Blackout, Appendix R, Decay Heat	Evaluation of the effects of full core and mixed core on Station Blackout and Appendix R; includes long-term decay heat profile	09/27/05
026	ATWS (Containment Response)	Part 2 of ATWS evaluation: transient through reactor shutdown, boron mixing, containment and suppression pool response	10/14/05
025	Spent Fuel Pool Report	Several spent fuel and new fuel vault evaluations, including criticality, decay heat removal, and seismic compatibility	10/27/05
028	Reactor Seismic Loads	Evaluation of the effects of full core and mixed core on seismic response of NSSS	10/28/05
029	Reactor Internals Pressure Difference	Evaluation of the effects of full core and mixed core on reactor pressure internals difference	11/15/05
021	LOCA	Loss-of-coolant accident analysis PCT evaluations	11/21/05

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NRC Interactions

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Licensing Engineer

Licensing Activities

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- SVEA-96 Optima2 LAR submittal
  - Submitted June 15, 2005
  - Request NRC approval by March 15, 2006
- SLMCPR LAR submittal (contingency)
  - Plan to submit November 15, 2005
  - Request NRC approval by March 15, 2006
- QCNPS Unit 2 refueling outage
  - Scheduled start date late March 2006
  - Startup for Cycle 19 scheduled for mid April 2006
- RAI response goal < 4 weeks
- Weekly status calls with Project Manager and Frank Akstulewicz
  - Review status of NRC technical review and RAIs
  - Discuss status of cycle-specific evaluations that may require license amendments (e.g., SLMCPR)
- NRC audits of application of Westinghouse's proprietary methodologies

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Closing Remarks

Kevin Donovan
Director – Nuclear Fuels

Closing Remarks

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- Revised LAR is comprehensive and the comments contained in the NRC's March 17, 2005, letter have been addressed
- EGC and Westinghouse are committed to supporting the NRC's review
  - Routine communications with NRC Project Manager and technical staff
  - Timely RAI responses
  - NRC audit of application of the proprietary methodologies