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LaSalle County Station

Pre-Application Meeting
Extended Power Uprate

December 7, 2011

Introductions

Exelon Team

- Kenneth Ainger – Project Management Director, EPU
- Kevin Borton – Power Uprate Licensing Manager
- John Rommel – Power Uprate Engineering Director
- Harold Vinyard – LaSalle Engineering Director
- Tim Byam – Power Uprate Lead Licensing Engineer
- Vikram Shah – Power Uprate Senior Engineering Manager
- Terry Simpkin – LaSalle Regulatory Assurance Manager
- Faramarz Pournia – Power Uprate Project Manager
- Stevie Du Pont – Power Uprate Licensing Engineer

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Agenda and Meeting Purpose

- Introduce LaSalle EPU Staff
- Describe NEI Pre-Submittal Meeting Pilot
- Present LaSalle Extended Power Uprate Schedule and Approach
- Describe Key Aspects of Technical Evaluations and Obtain Feedback
  - Annulus Pressurization Loads
  - ECCS NPSH Analysis
- Discuss Potential Topics for Future Meetings

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NEI Pilot – Pre-submittal Meetings

- Purpose is to enhance License Amendment Request pre-submittal meetings
  - Reach a common understanding on the regulatory criteria and standards to be applied during the NRC review of the proposed changes
  - Identify potential application issues that can be addressed during the application conceptual phase that will reduce acceptance review time, requests for additional information, and application review time
- Process
  - Pilot Checklist is used to focus on applicable review criteria, codes, standards, justification required for use of a new analytical method, applicability of a precedent, or feasibility of a desired schedule in order to reach alignment with the NRC
  - NRC meeting notice and meeting summary will docket the expectations and outcomes of the alignment in order to greatly reduce the risk and uncertainty associated with future application acceptance and NRC review
- LaSalle specific checklist focus
  - Verify methodology and approach used for analyses of Annulus Pressurization Load
  - Verify current NRC expectations and approach regarding ECCS NPSH calculations

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Background

- LaSalle Original License
  - Unit 1 licensed 1982 / Unit 2 licensed 1983
  - Original Licensed Thermal Power (OLTP) of 3323 MWt per unit
- LaSalle Previous Uprates
  - Stretch Power Uprate of 5% in 2000 to 3489 MWt
  - MUR Uprate of 1.6% in 2010 to 3546 MWt
  - Current Licensed Thermal Power (CLTP) of 3546 MWt
- EPU
  - Projected Power Uprate level of 3988 MWt (increase ~12.5% of current licensed power or 120% of original licensed power)

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Schedule Overview

NRC Communication Schedule

- 2nd Pre-Submittal Meeting: Target February 2012
- 3rd Pre-Submittal Meeting: Target April 2012
- Final Pre-Submittal Meeting: Target June 2012

EPU Implementation Schedule

- Submit LAR: Target 3rd QTR 2012
- LAR Approval: Target 1st QTR 2014 (20 months)

- Unit 2 Implementation: 2nd QTR 2015 (Outage L2R15)
- Unit 1 Implementation: 1st QTR 2016 (Outage L1R16)

Steam Dryer Evaluation could impact above schedule

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EPU LAR Approach

- LAR will meet criteria in NRC RS-001, "Review Standard for Extended Power Uprates"
- Evaluations supporting the LAR were performed using Constant Pressure Power Uprate (CPPU) Licensing Topical Report (NEDC – 33004P-A) (commonly called CLTR)
  - Fuel related evaluations were performed to the guidance in NRC-approved NEDC-32424P-A (commonly called ELTR1)
  - Safety issues identified in ELTR1 that should be addressed in a plant-specific EPU license amendment request are addressed in the LaSalle Specific Power Uprate Safety Analysis Report (PUSAR) (NEDC-33603P)
  - For generically evaluated issues – the PUSAR references the NRC-approved generic evaluations in either ELTR1 or ELTR2 (NEDC-32523P-A)
- No Submittals Linked to Proposed EPU Submittal
- Incorporated Past RAIs

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EPU LAR Approach

Exelon's submittal will include

- Cover Letter and Amendment Request
- Attachments
  - Description/Evaluation of Proposed Changes including No Significant Hazards Consideration
  - Markup of Operating License and Technical Specifications
  - Markup of Technical Specifications Bases and Technical Requirements Manual (Information Only)
  - Power Uprate Safety Analysis Report (PUSAR) (non- proprietary, proprietary, and affidavit)
  - Regulatory Commitments
  - Supplemental Environmental Report
  - List of Modifications
  - EPU Startup Test Plan
  - Grid Stability Study
  - PRA Report
  - Flow Induced Vibration (FIV) Piping and Component Evaluation
  - Instrument Setpoint Calculations Affected by EPU
  - Steam Dryer Evaluation (High Cycle Fatigue Report) (non-proprietary, proprietary, and affidavit)

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Annulus Pressurization Loads Analysis

Vikram Shah

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Annulus Pressurization (AP) Loads Analysis

Purpose

- Verify methodology and approach used for analyses of Annulus Pressurization Load
  - Perform the EPU break mass and energy release (M&E) and pressurization calculations for the annulus pressurization using the GEH TRACG computer code
  - TRACG based M&E release methodology for the AP loads will address GEH corrective action of the Safety Communication SC09-01

Methodology

- Current CLTP Methodology
  - NEDO-24548, Annulus Pressurization Load Adequacy Evaluation
  - Computer Code: RELAP4/ MOD 3

- EPU Methodology
  - NEDE-32176P, Revision 4, TRACG Model Description
  - NEDE-32177P, Revision 3, TRACG Qualification
  - NEDE-33083P-A, TRACG Application for ESBWR, October 2005
  - NEDE-33440P, Revision 2, TRACG ESBWR Safety Analysis – Additional Information, March 2010
  - Computer Code: TRACG V.04
- Same computer code was used in the Grand Gulf EPU Submittal to address AP loads

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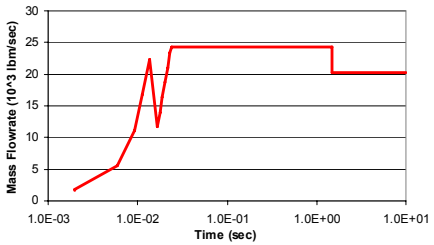
Annulus Pressurization (AP) Loads Analysis Overview

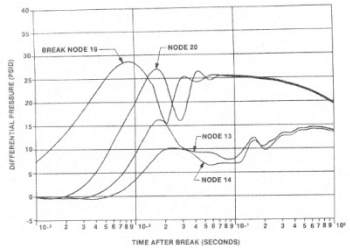
Pipe Whip
Jet Reaction
Jet Impingement

High Energy line break analysis



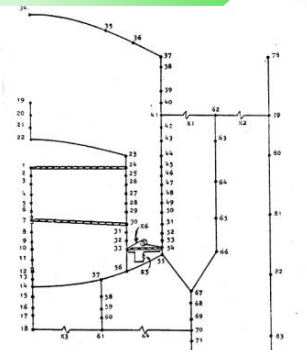
Mass / energy release vs. time

Sub-compartment analysis



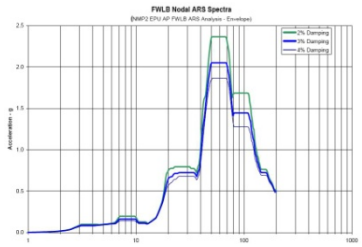
Annulus pressure vs. time

Integrated dynamic analysis



Displacements, accelerations, forces, stresses, moments and response spectra

Structures & attached piping analysis



Piping and component loads, stress, fatigue, and accelerations

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Annulus Pressurization Loads Analysis Methods Comparison

Evaluation	CLTP Method	EPU Method	Comparison / Comments
Mass and Energy Release	Generic NEDO-24548	TRACG 04	Note 1
Annulus Pressurization Loads	RELAP4/MOD 3	TRACG 04	Note 2
Jet Loads	ANSI 176 (draft)	ANSI/ANS 58.2-1988	Same method, Old standard superseded.
Pipe Whip Restraint	PDA	PDA	Same
Dynamic Structural Analysis	SAP4G07	SAP4G07	Same

- Note 1 - The TRACG 04 allows the calculation of mass and energy (M&E) release rates to include the physical attributes of the piping system for both rated and off-rated conditions. TRACG eliminates unphysical and artificially imposed jumps in mass and energy. Providing estimates of M&E at off-rated and rated conditions addresses the concerns identified in GEH Safety Communication SC 09-01, Annulus Pressurization Loads Evaluation, dated June 8, 2009

- Note 2 - The use of the TRACG 04 vessel component together with a fine mesh model (336 nodes) of the LaSalle annulus provides a more detailed annulus pressurization response than the analysis of record, which uses a coarse node (35 node) RELAP 4/MOD 3 model.

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Annulus Pressurization (AP) Loads Analysis

Summary

- The application of TRACG for both the mass and energy release analysis and the annulus pressurization analysis is appropriate to provide a response frequency used in all downstream load analyses
- SC 09-01 will be addressed by analyzing the pipe breaks considered in the LaSalle design and licensing basis at various rated and off-rated operating conditions with bounding conditions being used in the downstream analysis
- Confirm NRC agreement that the above approach to calculation of AP Loads is acceptable

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ECCS NPSH Analysis

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ECCS NPSH Analysis

Purpose:

Verify methodology and Exelon's approach to perform NPSH analysis for a non-CAP credit plant is in accordance with NRC's expectations, and draft regulatory guidance

Methodology

- SECY 11-0014, Use of Containment Accident Pressure in Analyzing Emergency Core Cooling System and Containment Heat Removal System Pump Performance in Postulated Accidents
  - Event-specific analyses determine containment response
    - Suppression Pool Temperature
  - Event-specific $NPSH_a$ determined for each applicable event/pump
  - $NPSH_a$ compared to $NPSH_{reff}$ for each applicable pump
  - Time in Maximum Erosion Zone

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ECCS NPSH Analysis

Key Assumptions

- No Containment Accident Pressure
- Deterministic analysis with conservative inputs for DBA-LOCA, ASDC and Small Break LOCA.
- Nominal inputs for non-design basis events (SBO, Appendix R, ATWS) analyses
- Vendor supplied NPSHr 3% curves
- 21% uncertainty for $NPSHr_{eff}$ for DBA-LOCA, ASDC and Small Break LOCA events
- 0% uncertainty for non-design basis events (ATWS, SBO, Appendix R)
- Assumes minimum Suppression Pool Inventory (level) for all events
- All events are evaluated at 102% of EPU power

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ECCS NPSH Analysis

Preliminary Results

Event	Pump	NPSHa (Feet)	$NPSHr_{eff}$ (Feet)	Margin (Feet)
DBA-LOCA	RHR	18.8	16.9	1.9
DBA-LOCA	HPCS	19.7	6.1	13.6
DBA-LOCA	LPCS	19.0	2.4	16.6
ASDC	RHR	17.8	16.9	0.9
ASDC	HPCS	17.5	6.1	11.4
ASDC	LPCS	18.0	2.4	15.6
SBO	RHR	19.2	14.0	5.2
SBO	RCIC	Analysis in Progress		
SBO	HPCS	18.9	5.0	13.9
ATWS	RHR	32.4	14.0	18.4
App R	RHR	25.9	14.0	11.9
App R	HPCS	25.7	5.0	20.7
App R	LPCS	26.1	2.0	24.1

$NPSHr_{eff}$ values consistent with draft guidance ($NPSHr_{eff}$ = NPSHr3% + uncertainties) including 21% uncertainty for Design Basis Events and 0% uncertainty for non-Design Basis Events

No modifications are required to achieve the above results

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ECCS NPSH Analysis

Summary

- Exelon's approach to perform NPSH analysis is in accordance with NRC expectations and draft guidance
  - Demonstrates that adequate positive margin exist for ECCS/RCIC pumps
  - Demonstrates that ECCS/RCIC pumps will perform their safety functions
- Confirm NRC agreement that the above approach to determine ECCS NPSH is acceptable

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Future EPU Meeting Topics and Schedule

- Follow-up EPU Meetings
  - Proposed Topics
    - Steam Dryer Strategy and FIV Analysis
    - Impact and Changes to Human Factors
    - Impact on Primary Containment internal pressure (P_a)
    - Ultimate Heat Sink Analysis
    - Setpoint Calculations
    - Alternate Source Term Analysis
- Next meeting target February 2012

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Meeting Summary

- Pilot Alignment and Outcome
  - Discussion
  - Checklist Mark-up
- Critique

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Acronym List

- ASDC – Alternate Shut Down Cooling
- ATWS – Anticipated Transient Without Scram
- CAP – Containment Accident Pressure
- CLTP – Current Licensed Thermal Power
- DBA – Design Basis Accident
- ECCS – Emergency Core Cooling System
- EPU – Extended Power Uprate
- ESBWR – Economic Simplified Boiling Water Reactor
- FIV – Flow Induced Vibration
- GEH – General Electric – Hitachi
- HPCS – High Pressure Core Spray
- LAR – License Amendment Request
- LOCA – Loss of Coolant Accident
- LPCS – Low Pressure Core Spray
- LTR – Licensing Topical Report
- MUR – Measurement Uncertainty Recapture power uprates
- MWt – Mega Watts thermal
- NEI – Nuclear Energy Institute
- NPSH – Net Positive Suction Head
- NPSHa – Net Positive Suction Head available
- NPSHr – Net Positive Suction Head required
- $NPSHr_{eff}$ – Effective Net Positive Suction Head required
- PRA – Probabilistic Risk Assessment
- PUR – Power Uprate
- RAI – Request for Additional Information
- RHR – Residual Heat Removal
- SBO – Station Black Out
- SC – GEH Safety Communication
- SECY – Commission Papers (Written issues papers the NRC staff submits to the Commission to inform them about policy, rulemaking, and adjudicatory matters)

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