Palisades GSI-191 Closure Plan

September 28, 2016



Introduction of Entergy Team

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- Steve Mongeau Technical Lead
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Agenda

- Purpose of Meeting
- Background
- Strategy Summary
- RoverD Closure Key Process Steps
 - CASA Grande
 - Thermal hydraulics
 - Probabilistic risk assessment
 - Testing
 - Licensing actions
- Current LAR Submittal Schedule



Purpose of Meeting

- Present key elements of Palisades GSI-191 closure plan
- Summarize plant specific RoverD process steps
- Provide future communication plans
 - Discuss possible constraints that can impact current schedule
 - Pilot Plant Safety Evaluation
 - WCAP-17788 acceptance
 - Acceptance of Palisades' specific aluminum release equation
 - Current LAR submittal schedule



- Palisades
 - 2 Loop Combustion Engineering NSSS
 - NaTB Buffer



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2007	2008	2009	2010
Replaced original sump screens with increased surface area and 0.045" hole size	As-Built strainer failed flume test under prescribed debris and chemical loads	Replaced strainers installed in 2007 with same configuration but 0.095" hole size.	PNP provided responses to initial draft RAIs for GSI-191 closure



2011	2012	2013	2014 to Present
Continued work or RAIs and planning modifications	of insulation	PNP selected the risk-informed approach to GSI- 191 closure – SECY 12-0093 Option 2	PNP has been following the risk informed pilot plant and applying lessons learned



Strategy Summary

- Strainer will not pass with deterministic DBA loading
 - 30-day spray WCAP-16530-NP chemical quantity
 - Using current aluminum inventory arguments
 - Using WCAP-16530 corrosion rates
 - Max debris load break
 - Worst-case design basis break
 - Max unqualified coatings
- Strategy for Success:
 - Add plant-specific fidelity for chemical load AND
 - Ensure strainer performance for debris generation from the highest frequency breaks



Risk-Informed Paths





Key RoverD Process Steps

- CASA Grande
- Thermal hydraulics
- Probabilistic risk assessment
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RoverD Closure Option

















Conventional Debris Deterministic Test Range

- ECCS performance test for breaks <10-in diam keeps RoverD risk in Region III.
- Combined cal-sil and fiber limits keeps test loads consistent with plant ZOI
- Qualified coatings damage also bounded by RoverD ZOI size



Key RoverD Process Steps

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Thermal Hydraulics

- MAAP fidelity improvements
- Containment response library
 - Insights and margin assessment
- WCAP-17788 (In-Vessel)
 - In-fuel fiber blockage limits
 - Boric acid solubility
- FSAR Temperature Profile for Chemical Product Inventory



Key RoverD Process Steps

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Role of CAFTA/SAPHIRE PRA

- Quantifies baseline risk for perfect plant with no debris effects
- Quantify probability of plant damage states (pumps out of service, etc.)
- Quantify credit for operator action
- Trace additional contributors to ΔLERF



Key RoverD Process Steps

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Purpose of Testing

- Demonstrate <u>successful</u> strainer performance for <u>deterministic</u> debris loads that are consistent with <u>guidance</u>
- Some flexibility under RoverD to select conventional debris loads, but challenges remain with aluminum corrosion products



Deterministic Precipitate Load

Industry Practice

- 30-day FSAR temperature history
- 30-day spray operation
- Conservative pH condition
- Conservative material exposure
- No credit for solubility
- No credit for inhibition
- WCAP-16530 surrogate precipitate
- WCAP-16530 30-day precipitate quantity

Palisades' Application

- 30-day FSAR temperature history
- 30-day spray operation
- Conservative pH condition
- Conservative material exposure
- No credit for solubility
- No credit for inhibition
- WCAP-16530 surrogate precipitate
- *Plant-specific* 30-day precipitate quantity

Palisades Test Program Overview





OSU Program

Program Objective

- Develop Palisades' specific
 30-day Al release inventory
 - Empirical equation or point condition

Important Program Details

- Al release = Al precipitate generation
 - No credit for solubility
- Conducted under OSU QA program approved by Palisades.
- Program commercially dedicated by Alion and accepted by Palisades
- Al release is a function of Al corrosion

OSU Summary



 Potential reduction using Palisades' specific 30-day aluminum release inventory



OSU Program Design

- Evaluate baseline Al corrosion and release under representative conditions
 - Palisades chemistry (NaTB /H₃BO₃)
 - Temperature (130 25 °C)
 - Solution pH (7.2 8.2)
 - Velocity (0.01 to > 6 ft/s)
 - Duration (Hours up to 30 days)
- Evaluate changes from base line
 - Inhibition (Si, Ca, PO₄)
 - Margin Assessment Only
 - Miscellaneous ions (SO₄, Cl, Fl, Cu, Zn, Pb)
 - Galvanic and concurrent, non-galvanic corrosion (Cu, Zn, Pb, CS)
 - Thermal cycling



OSU Facilities

Glass Cell System



- Time: 0 48 hrs
- T(°C): 85, 55, 25
- Velocity: 0.01 >6 ft/s
- Electrochemical, weight loss and solution concentration

Shaker Table System



- Time: 0-30 days
- T(°C): 85, 55, 25
- Velocity: fixed
- Weight loss and solution concentration

OSU Facilities



Time: 0 – 24 hrs

T(°C): up to 130

concentration

Velocity: 0.01 – 0.3 ft/s

Weight loss and solution



corrosion chamber

Sample slots in corrosion chamber

OSU Testing Schedule

- Active testing in 2016
 - Remaining target aluminum release test
 - Thermal cycling
 - Integrated test

- NRC Visit Opportunities
 - View test facilities
 - Test set up
 - General test procedure

Test Number	Test Operating Parameters	Test Type	Proposed Date
5007	4.5 pH, 0.1 ft/s, 130C	High temperature spray zone	09/27/2016
5008	7.5 pH, 0.1 ft/s, variable temperature	Thermal cycling effects	10/11/2016
5009	7.5 pH, 0.1 ft/s, 100C	Aluminum baseline release	10/25/2016
5010	7.2 pH, 0.1 ft/s, 130C	Aluminum baseline release	11/03/2016
5011	7.2 pH, 0.1 ft/s, 100C	Aluminum baseline release	11/15/2016
5012	7.5 pH, 0.1 ft/s, variable temperature	Inclusion of all metals, FG & Cal- Sil	12/06/2016

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Licensing Actions

Licensing Background:

- Submittal on May 15, 2013
 - 6 Commitments
 - 3 completed
 - 3 remain open
- Submittal on December 18, 2013
 - Provided Schedule of Major Milestones
 - Due to Pilot Plant status, schedule is outdated



Licensing Actions

Path Forward:

- Proposed Presubmittal Meetings
 - Meeting #1 GSI-191 Closure Overview (Today)
 - Meeting #2 Chemical Corrosion Findings
 - Meeting #2a Site Visit and Preliminary Data Review (~November 2016)
 - Meeting #2b Review of Data Findings (~May 2017)
 - Meeting #3 Strainer Testing Methodology/Plan (~June 2017)
 - Meeting #4 LAR Content (~June 2018)
- Submit LAR
- Implement Modifications
- Submit GSI-191 Closure Document



Current LAR Submittal Schedule





Summary

- Palisades committed to GSI-191 closure
- Significant plant specific testing occurring
- Challenges remain
- Continued dialogue will be key to success



Questions/Discussion

