GSI-191 Issue Resolution

Pre-submittal Meeting

September 20, 2017

Introductions / Opening Remarks

ATTENDEES

Larry Nicholson – Director Licensing & Regulatory Affairs

Dan Forter – Senior Director of Projects

Jarrett Mack – NextEra Licensing

Paul Leonard – ENERCON

Tom McCarthy – ENERCON

The foundation for everything we do are the Values and Core Principles of our Nuclear Excellence Model

Nuclear Excellence Model

Vision	We are a team that delivers consistent excellent performance
Mission	We will produce energy in a safe, reliable, cost effective way, while caring for our employees, communities and the environment
Values	Conduct all activities to demonstrate a deep respect for Nuclear Safety Live the Safety Guiding Principles Be a Self-Improving Culture & Learning Organization Maximize the time spent on Prevention and Detection to minimize / eliminate Correction activities Foster a work environment where we are the employer of choice
Core Principles	Operationally Focused Passion for Excellence Engaged Leaders Standardized Processes Responsive to Stakeholders Effective Workforce Planning Engaged Employees Effective Long-Range Planning Strong Teamwork Strong Ownership & Accountability Effective Supervisors Worklife Balance
Strategic Focus Areas	Operational Excellence  Organizational Effectiveness  Generation Reliability  Effective Business & Financial Performance 

NEXTera ENERGY NUCLEAR FLEET

Agenda

- Introductions / Opening Remarks
- Purpose and Desired Outcome
- General Approach for Fleet
- St. Lucie Unit 1 and Unit 2 Resolution Approach
- Turkey Point Unit 3 Resolution Approach
- Turkey Point Unit 4 Resolution Approach
- Point Beach Unit 1 and Unit 2 Resolution Approach
- Seabrook Resolution Approach
- NEI 04-07 Section 6 – Alternate Evaluation Methodology
- Conclusion
- Next Steps

Purpose and Desired Outcome

Purpose

- Present the resolution approaches being taken for each PWR plant in the fleet
- Gain feedback from the NRC staff as to additional information for the submittals that would facilitate their review

Desired Outcome

- NextEra/FPL and NRC have mutual understanding of the general content to be contained in the submittals to support closure
- Alignment on path forward and timing on plant submittals

General Approach for Fleet

- **All Plants In NextEra/FPL Fleet Utilizing Option 2a from SECY-12-0093**
  - In-vessel debris loading utilizing methodology from WCAP-17788 (under NRC review)
- **Content of Submittals Aligned With NRC Guidance**
  - Revised Content Guide (November 2007)
  - NRC Staff Review Guidance for Head Loss, Coating, and Chemical Effects (March 2008)
- **Stand-Alone Submittals**
  - Submittals do not refer to previous submittals
  - Previous RAIs will not be specifically addressed (by calling them out) but will have sufficient information in the submittal to support their closure, if still applicable
  - Submittals provide reasonable assurance that the necessary attributes have been satisfied to demonstrate the capability of each plant to mitigate the very low probability event from impacting the health and safety of onsite personnel and the public.

St. Lucie Unit 1 and Unit 2 Resolution Approach

- **Overall Approach Is Fully Deterministic**
  - All aspects of the Revised Content Guide and Staff Review Guidance were addressed with fully deterministic approaches and methodologies previously accepted by the NRC, except for in-vessel fiber loading (WCAP-17788 – under NRC review)
  - PSL1 now has 7,244 ft^2 strainer (GE), PSL2 has 5,607 ft^2 strainer (PCI)
  - Debris generation considered DEGBs at all ISI Class 1 welds inside first isolation valve from 0.5” to 42” diameter
  - Strainers fully submerged during recirculation
  - Unit specific head loss and penetration (bypass) testing was performed, with a portion of one head loss tested observed by NRC staff at the test lab
    - Debris quantities above calculated transport quantities used for testing to provide operational margin
  - Strainer head loss and NPSH determination demonstrate that operating margin is available
  - Coatings generation and transport aligned with NRC expectations
  - Ex-vessel downstream effects demonstrated no blockage or wear concerns
  - Chemical effects conservatively determined chemical precipitates based on aluminum quantities used for initial licensing and hydrogen generation analysis. Completed walkdowns determined significantly lower aluminum quantities
  - Fuel rod debris loading (LOCADM) acceptance criteria is met for all break sizes
  - In-vessel debris loading analysis per WCAP-17788 demonstrated quantities below the current limits for AREVA fuel (U2 transitioning)

Turkey Point Unit 3 Resolution Approach

- **Overall Approach Is Fully Deterministic**
  - All aspects of the Revised Content Guide and Staff Review Guidance were addressed with fully deterministic approaches and methodologies previously accepted by the NRC, except for in-vessel fiber loading (WCAP-17788 – under NRC review)
  - PTN3 now has 4,699 ft^2 strainer (GE)
  - Debris generation considered DEGBs at all ISI Class 1 welds inside first isolation valve from 0.5” to 31” diameter
  - Strainers fully submerged during recirculation
  - Using PSL1 head loss testing to bound PTN3 head loss
  - Using Diablo Canyon penetration (bypass) testing to bound PTN3 penetration
  - Strainer head loss and NPSH determination demonstrate that operating margin is available
  - Coatings generation and transport aligned with NRC expectations
  - Ex-vessel downstream effects demonstrated no blockage or wear concerns
  - Chemical effects conservatively determined chemical precipitates based on aluminum quantities post-EPU
  - Fuel rod debris loading (LOCADM) acceptance criteria is met for all break sizes
  - In-vessel debris loading analysis per WCAP-17788 demonstrated quantities below the current limits for Westinghouse fuel

Turkey Point Unit 4 Resolution Approach

- **Overall Approach Utilizes Fully Deterministic and Section 6 Approach**
  - All aspects of the Revised Content Guide and Staff Review Guidance were addressed with fully deterministic approaches and methodologies previously accepted by the NRC, except for strainer head loss and in-vessel fiber loading (WCAP-17788 – under NRC review)
  - Strainer head loss resolution utilizes NEI 04-07 Section 6 Alternate Evaluation Methodology for breaks larger than 23”
  - PTN4 now has 3,600 ft^2 strainer (PCI)
  - Debris generation considered DEGBs and partial breaks at all ISI Class 1 welds inside first isolation valve from 0.5” to 31” diameter. Partial breaks (hemispherical ZOI) taken at 45^o intervals around circumference of pipe
  - Strainers fully submerged during recirculation
  - Unit specific head loss and penetration (bypass) testing was performed
    - -- Deterministic head loss criteria met for all breaks up to 23”
  - Point Beach head loss testing used to bound all PTN4 breaks >23” up to 31”
  - Deterministic penetration criteria met for all breaks up to 31”
  - Strainer head loss and NPSH determination demonstrate that operating margin is available for both Region I and Region II breaks
    - -- Region II breaks use pre-event air partial pressure for determination of NPSH available. Containment accident pressure was not utilized.

Turkey Point Unit 4 Resolution Approach (continued)

- Coatings generation and transport aligned with NRC expectations
- Ex-vessel downstream effects demonstrated no blockage or wear concerns
- Chemical effects conservatively determined chemical precipitates based on aluminum quantities post-EPU
- Fuel rod debris loading (LOCADM) acceptance criteria is met for all break sizes
- In-vessel debris loading analysis per WCAP-17788 demonstrated quantities below the current limits for Westinghouse fuel

- **The Turkey Point Unit 3 and Unit 4 Resolution Contained In Combined Submittal**

Point Beach Unit 1 and Unit 2 Resolution Approach

- **Overall Approach Utilizes Fully Deterministic and Section 6 Approach**
  - All aspects of the Revised Content Guide and Staff Review Guidance were addressed with fully deterministic approaches and methodologies previously accepted by the NRC, except for strainer head loss and in-vessel fiber loading (WCAP-17788 – under NRC review)
  - Strainer head loss resolution utilizes NEI 04-07 Section 6 Alternate Evaluation Methodology for breaks larger than 17”
  - PBN1 and PBN2 now have 1904.6 ft^2 strainers (PCI) for each of the separate and independent trains
  - Debris generation considered DEGBs and partial breaks at all ISI Class 1 welds inside first isolation valve from 0.5” to 31” diameter. Partial breaks (hemispherical ZOI) taken at 45^o intervals around circumference of pipe
  - Strainers fully submerged during recirculation
  - Bounding (PBN1 and PBN2) head loss testing was performed assuming a single strainer train in service
    - Deterministic head loss criteria met for all breaks up to 17”
    - To bound all breaks >17” up to 31”, assumption made that both strainer trains in service
  - Bounding (PBN1 and PBN2) penetration (bypass) testing was performed assuming both strainer trains in service
    - Deterministic penetration criteria met for all breaks up to 31”

Point Beach Unit 1 and Unit 2 Resolution Approach (continued)

- Strainer head loss and NPSH determination demonstrate that operating margin is available for both Region I and Region II breaks
  - Region II breaks use cooldown of sump water and conservatively determined chemical precipitation temperatures for determination of NPSH available. Containment accident pressure was not utilized.
- Coatings generation and transport aligned with NRC expectations
- Ex-vessel downstream effects demonstrated no blockage or wear concerns
- Chemical effects conservatively determined chemical precipitates based on aluminum quantities
- Fuel rod debris loading (LOCADM) acceptance criteria is met for all break sizes
- In-vessel debris loading analysis per WCAP-17788 demonstrated quantities below the current limits for Westinghouse fuel in upper plenum injection plant
- Submittal will include commitments to complete pending modifications that formed the basis for the completed deterministic analyses

Seabrook Resolution Approach

- **Overall Approach Utilizes Fully Deterministic and Section 6 Approach**
  - All aspects of the Revised Content Guide and Staff Review Guidance were addressed with fully deterministic approaches and methodologies previously accepted by the NRC, except for debris transport, strainer head loss, and in-vessel debris loading
  - SBK now has 2,412 ft^2 strainers (GE) for each of the separate and independent trains
  - Debris generation considered DEGBs and partial breaks at all ISI Class 1 welds inside first isolation valve from 0.5" to 31" diameter. Partial breaks (hemispherical ZOI) taken at 45^o intervals around circumference of pipe
  - Strainers fully submerged during recirculation
  - Debris transport for Region 2 breaks (>17") credited some fines holdup at the debris interceptors based on the testing previously performed
    - In line with the Alternate Evaluation Methodology of NEI 04-07 Section 6
  - Strainer head loss and in-vessel fiber loading resolution utilizes NEI 04-07 Section 6 Alternate Evaluation Methodology for breaks larger than 17"
  - Head loss testing was performed assuming a single strainer train in service
    - Testing performed was GE/CDI sector testing (2 strainer disks)
    - Debris quantities at time of test do not bound current values however submittal provides justification for acceptance of the difference

Seabrook Resolution Approach (continued)

- PSL1 penetration (bypass) testing used to bound SBK penetration
  - -- Deterministic penetration criteria met for all breaks up to 17”
  - -- To bound all breaks >17” up to 31”, assumption made that both strainer trains in service
- Strainer head loss and NPSH determination demonstrate that operating margin is available for both Region I and Region II breaks
  - -- Region II breaks use pre-event air partial pressure for determination of NPSH available. Containment accident pressure was not utilized.
- Coatings generation and transport aligned with NRC expectations
- Ex-vessel downstream effects demonstrated no blockage or wear concerns
- Chemical effects conservatively determined chemical precipitates based on aluminum quantities
- Fuel rod debris loading (LOCADM) acceptance criteria is met for all break sizes
- In-vessel debris loading analysis per WCAP-17788 (under NRC review) demonstrated quantities below the current limits for Westinghouse fuel
- Submittal will include commitment to modify the refueling cavity drain system to ensure the water that could collect there would be available for the containment sump pool

NEI 04-07 Section 6 – Alternate Evaluation Methodology

- **Break Size**
  - For plants where this approach is utilized, the smallest break that meets all traditional deterministic criteria is larger than the Debris Generation Break Size (DGBS) called out in Section 6 (Region I)
    - 17” for PBN and SBK, 23” for PTN4
    - Though not being specifically credited, the risk associated with these break sizes is Very Small per RG 1.174
- **Mitigation Approaches for Region II Break Sizes**
  - For PTN4, credit is being taken for pre-event air partial pressure to ensure acceptable NPSH margin is maintained
  - For PBN, credit is being taken for having two trains in service during the most limiting sump recirculation conditions to ensure acceptable NPSH margin is maintained
    - RHR pumps are only pumps that take direct suction from strainers
    - Provides for debris to be divided between the two independent strainers
  - For SBK, credit is being taken for having two complete trains of ECCS and CBS in service to ensure acceptable NPSH margin is maintained and flow split is considered for in-vessel debris loading
  - Credit for strainer backwash may be taken for those plants where it can be accomplished (PBN and PTN4)
  - Credit for pump or train swap to place non-debris laden strainer in service may be taken (PBN and SBK)

NEI 04-07 Section 6 – Alternate Evaluation Methodology

- **Mitigation Approaches for Region II Break Sizes** (continued)
  - Credit for other water sources or cross-ties from unaffected Unit may be taken (PTN and SBK)
  - Credit for non-safety related equipment may be taken
    - Containment coolers (SBK)
    - FLEX equipment (SBK)
  - Procedure changes and training will occur after NRC agreement with specific approach

Conclusions

- **Significant effort has been taken by all plants to provide reasonable assurance that in the unlikely event that a LOCA did occur, the plant would be able to protect the health and safety of on-site personnel and the public**
- **As stated in SRM-SECY-12-0093, the plants have demonstrated adequate defense-in-depth as a result of:**
  - Installed vastly enlarged advanced strainers
  - Compensatory measures already taken
  - Low probability of challenging pipe breaks
- **The approaches outlined demonstrate mitigative capability and adequate defense-in-depth without the need for further and extensive efforts except for those few committed items**
- **Significant conservatisms exist in the treatment of potential LOCA scenarios and the debris generated from them**
  - The assumption that RCS piping will instantaneously fail and fully separate is in contrast to the mechanistic evaluations that were performed which allowed plants to credit Leak-Before-Break (GDC-4)
  - The quantity and size of debris generated from a LOCA has been very conservatively established

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Conclusions

- **Significant conservatisms exist in the treatment of potential LOCA scenarios and the debris generated from them** (continued)
  - The transport of debris to the sump strainers has been very conservatively estimated without reasonable credit being taken for debris holdup in containment and agglomeration of debris enabling much of the debris to settle in lower turbulence regions of the containment sump pool
  - The formation of chemical precipitates has been very conservatively established without credit for the specific types of precipitate that would be expected to form, and the timing and quantity of precipitate formation that would be expected based on sump pool concentrations
  - The approach taken for determination of the quantity of fine fiber debris that would pass through the strainer and transport to the reactor vessel is very conservative since testing is only performed with fiber
    - Fiber and particulates will agglomerate in the sump pool limiting the quantity of “fines” that will pass through the strainer

Next Steps

- **Following this meeting, NextEra/FPL will incorporate any necessary learnings in the submittals**
  - If necessary, plant specific discussions will be held to ensure the appropriate content is provided to the NRC
- **The submittals will be sent to the NRC for their review**
  - The current timeline anticipates this will occur within approximately the next month
- **It is anticipated that following the NRC review, closeout letters can be issued to each plant**
- **It is also understood that the closeout letters will address all aspects except for the specific debris loading determined for in-vessel effects as provided by WCAP-17788 which is currently under NRC review**