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ECCS Suction Strainer Reliability

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Presented to:
CSNI Task Group on Sump Clogging
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Agenda

- Background
- Discuss current status of PWRs
- Discuss re-evaluation of BWRs
- Discuss NRC activity related to this CSNI task

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Background

- US NRC Bulletin 96-03 requested BWR to implement appropriate procedural measures and plant modifications to minimize the potential for clogging of emergency core cooling system (ECCS) suppression pool suction strainers by debris generated during a loss-of-coolant accident (LOCA)

- US NRC GL 2004-02 requested PWR licensees perform detailed mechanistic evaluations of ECCS and containment spray system (CSS) functions and make modifications, as needed, to ensure system function.

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Background

- The GL 04-02 was supplemented by Information Notice 2005-26 to inform PWR licensees about Chemical Effects research results
- The NRC required PWR licensees to:
  - Performed plant specific evaluations and physical head loss tests
  - Chemical Effects required to be evaluated
  - Downstream Effects required to be evaluated
    - Ex-vessel
    - In-vessel

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Status of PWRs

- There are 69 PWRs in the US
- Each licensee has made major efforts to resolve the issues in the Generic Letter.
  - All PWR licensees increased strainer sizes by 1 to 2 orders of magnitude
  - Many PWR licensees replaced pipe insulation.
  - Approximately 10% of PWRs licensees replaced chemical buffer with STB from TSP to reduce chemical effects
- Some issues remain un-resolved such as Downstream in-vessel effects and test protocols to reduce ZOIs for pipe insulation.

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Status of PWRs

- Some plants with large quantities of fibrous insulation have not yet been able to demonstrate satisfactory strainer performance
- Attempts to credit test and evaluation refinements have not generally succeeded
  - Debris generation/zone of influence (ZOI) reductions
  - Debris settling credit
- Industry planning new efforts to credit settling and ZOI reductions – staff will continue to evaluate
- Staff has accepted testing that credits reduced debris erosion

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Status of PWRs

- NRC staff is evaluating other options such as use risk-informed acceptance criteria and proposed rule on transition break size (10CFR Part 50.46a)

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Status of BWRs

- There are 35 BWRs in the US
- ECCS suction strainers were enlarged in the 1990s
- In 2008 NRC staff requested the BWR owners group to consider lessons learned from PWRs
- 12 technical issues were identified as having been evaluated significantly different between what the BWRs did for Bulletin 96-03 and what the PWRs are doing for GL 04-02

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Status of BWRs

- The 12 issues are:
  - Downstream Effects-Systems and Components
  - Downstream Effects-Fuel
  - Debris Head-loss Correlation
  - Chemical Effects
  - Assessment of Coatings
  - Latent Debris
  - ZOI Adjustment for Air Jet Testing
  - ZOI for Protective Coatings
  - Debris Transport-Erosion
  - Debris Characteristics
  - Near Field Effects and Scaling
  - Spherical ZOI

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Status of BWRs

- BWROG combined these into 4 Technical sub-teams
  - Debris Source Term
  - Strainer Head loss
  - Downstream Effects-components
  - Downstream Effects-Fuel
- The owners group has met several time with staff to review individual issues and resolution approach.
- This will be a multi-year effort by BWROG

Current NRC Knowledge Base Activity

- NRC staff published NUREG/CR-7011 in May 2010 "Evaluation of Treatment of Effects of Debris in Coolant on ECCS and CSS Performance in Pressurized Water Reactors and Boiling Water Reactors"
- Regulatory Guide 1.82 draft revision 4 has been prepared and has gone through the public comment period. This revision incorporates lessons learned from resolution of GL 04-02. ECD June 2011.
- Update of NUREG/CR-6808 "Knowledge Base for the Effect of Debris on Pressurized Water Reactor Emergency Core Cooling Sump Performance" dated February 2003 is in process. ECD December 2011.

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ECCS Strainer Performance

- What Questions Do You Have