Overview and Status of Industry Analysis Activities

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Status of Industry Analysis Activities

- Results presented here are work in progress – future results and other input could change our current thinking and approach
- Focus for BWR vessels is related to the temperature where the leak test has to be performed
- Focus for PWR vessels is heat-up and cool-down curves consistent with actual plant operation
- Other Level A and B transients have been assessed to determine the limiting condition

Goals for Alternative Approach

- Easy to understand and implement
- Will not require changes to the current Code fracture mechanics equations
- Will not require a change in the assumed reference flaw size
- Maintains easy to use Code computational procedures
- Consistent with risk informed margins that have been used in other industrial applications

Other Benefits for Developing a Risk-Informed Appendix G

- Fewer reportable events due to exceeding pressure temperature (P/T) limit curves
- Increased LTOP pressure set-points with reduced likelihood of inadvertent LTOP events leads to fewer challenges and increased safety
- Reduced temperature and reduced time to perform BWR leak test

Plant Selection Criteria

- Basis was not only for the vessels with the highest irradiated RT_{NDT} values, but also others with lower irradiated RT_{NDT} values, since method needs to be applicable to any plant wanting to implement the risk informed approach
- Vessels with limiting plates, forgings, and welds also were selected to provide a broad spectrum of materials that can encompass the entire fleet

PWR Vessels

- Beaver Valley 1 (plate)
- Kewaunee (forging, circ weld)
- Palisades (axial welds)
- Salem 2 (intermediate irradiated RT_{NDT} for axial welds and plates)
- Seabrook (low irradiated RT_{NDT} for plates and axial welds)
- Indian Point 3 (plate)
- Calvert Cliffs 1 (axial weld)
- Oconee 1(welds)

BWR Vessels

- Browns Ferry 1 (welds)
- Brunswick 2 (forging/plate)
- Millstone 1 (axial welds – even though it is not operating)
- Nine Mile Point 1 (plate)
- Others with highest irradiated RT_{NDT} values at 32 EFPY being considered

Next Presentations

- BWR transients and conditions
- Reiteration of objectives and how risk informed results will be translated into a simple deterministic method similar to what is currently being used
- Preliminary results for both BWRs and PWRs
- Further details on PWR results and relationship to actual plant operation

BWR Input for Risk Informed Approach

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Background

- Objectives of BWR inputs for Appendix G risk-informed work:
  - Define the input data for FAVOR runs to cover all boiling water reactors (BWRs) In terms of transients and accumulated fluence
  - Add to compiled data for BWRs and materials to define conditions that will be used in PFM analyses
- Integrate relevant P-T curve and irradiated RT_{NDT} inputs from work performed for BWRs over the past 5 or 6 years

Materials and Fluence Data

- Materials data were initially compiled in support of the BWR Vessel and Internals Project (BWRVIP) Integrated Surveillance Program (ISP)
- Identified portions of the data associated with 16 plants were added or updated
- New and/or updated data changes:
  - Changes were generally minor in nature and did not significantly the original data
  - Resulting data are considered to be a very good overall summary that represents the entire BWR operating fleet

Transient Data

- Design Basis event service classifications
- ASME Code event service classifications
- Design basis transient flow, pressure and temperature definitions
  - Beltline region (recirculation outlet nozzle)
- The design basis number of events assumed for 40 years
- The number of events accumulated to-date
- The number of events projected to 60 years of operation

Conclusions

- Maximum heat-up rate for a BWR pressure test is $\leq$ 25 ^{0}F/Hr
- Pressure Test temperatures that exceed 212 ^{0}F can lead to industrial safety and operational concerns
- 100 ^{0}F/Hr cool-down bounds all service level A & B transients relative to brittle fracture concerns

Detailed Approach Summary and Status of Results

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