Materials Degradation Management

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MANAGING KNOWN DEGRADATION MECHANISMS

- Degradation poses technical and regulatory challenges
  - PWR vessel head penetration (VHP) nozzles
  - PWR reactor coolant pressure boundary (excluding VHP nozzles and SG tubes)
  - BWR internals and piping
  - Steam generator tubes
- Materials degradation will continue

REACTOR VESSEL HEAD PENETRATION NOZZLES

- Safety concerns
  - Structural integrity
  - Consequential damage due to boric acid
- Inspection issues
  - Susceptibility models
  - Plant specific relief requests
- Regulatory Position
  - NRC Order EA-03-009 for inspection of upper heads
  - Bulletin 2003-02 for inspection of lower heads
  - Considering Long Term Regulatory Position

OTHER PORTIONS OF RCPB

- Inspection issues
  - Have gathered information on current industry inspection practice
  - Have incorporated issues into Davis-Besse lessons learned action plan
- Regulatory issues
  - Currently evaluating alternatives

BWR INTERNALS AND PIPING

- Voluntary industry initiative has been effective at managing aging of BWR reactor vessel, vessel internals, and piping
- NRC continues to evaluate/monitor through review of operating experience and semiannual inspection summaries
- Future challenges exist
  - Crack growth in highly irradiated components
  - Impact of mitigation techniques on crack growth
  - Repair of highly irradiated components

STEAM GENERATOR TUBE INTEGRITY

- Staff and industry addressing steam generator tube integrity issues
- Currently working on incorporating industry initiative into regulatory framework

ADDRESSING STEAM GENERATOR TUBE INTEGRITY

- Rulemaking: 1994 to 1996
- Proposed Generic Letter: 1997 to 1998
- NEI 97-06: 1998 to present

ASSURANCE OF TUBE INTEGRITY

- Regulations (10 CFR Part 50, Technical Specifications)
- Industry programs (plant programs, industry guidance)
- NRC Review and Oversight

CURRENT TECHNICAL SPECIFICATIONS

- Do not reflect improvements for ensuring tube integrity
- Have some unnecessary prescriptive attributes

MODIFICATIONS TO TECHNICAL SPECIFICATIONS

- Objective – provide additional assurance that tube integrity will be maintained during operation
  - Structural integrity
  - Leakage integrity

MODIFICATIONS TO TECHNICAL SPECIFICATIONS (cont'd)

- Attributes
  - Largely performance based
  - Reflects performance of SGs with new materials
  - Flexible
- Public involvement

CRITICAL ELEMENTS

- Assessment of potential degradation mechanisms
- Inspection
- Integrity assessment
- Maintenance, plugging, and repair

CRITICAL ELEMENTS (cont'd)

- Leakage monitoring
- Secondary side integrity and foreign material exclusion
- Reports and self assessment
- Water chemistry

STEAM GENERATOR TUBE OVERVIEW

- Current framework – reasonable assurance of tube integrity
- Near term schedule for improving regulatory framework
- NRC continues to work on technical issues as they arise

MANAGING MATERIALS DEGRADATION

- Summary
  - Materials exposed to LWR environments will continue to degrade with time and operation
  - Well coordinated NRC program addressing issue
  - National and international technical communities are involved
  - Programs addressing currently identified degradation – technical and regulatory
  - Research program addressing
    - Potential new degradation mechanisms
    - Inspection and monitoring techniques
    - Mitigation and repair strategies
  - Staff and industry are keenly aware of need to aggressively handle degradation as it emerges