NRC Review and Endorsement of ASME BPVC Section III, Division 5

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NRC Implementation Action Plan (IAP) Strategy 4: Facilitate industry code & standards development needed to support the non-LWR lifecycle, including fuels & materials

ASME BPVC, Section III establishes rules for material, design, fabrication, examination, testing, overpressure, and quality assurance of nuclear components.

ASME BPVC, Section III, Division 1 establishes rules for components where material strength and deformation is time-independent.
  - ASME BPVC Section III, Division 1 is incorporated by reference in 10 CFR 50.55a
  - Maximum temperature is 425°C (800°F)
  - Does not address graphite and ceramic-composite components

ASME BPVC, Section III, Division 5 extends the rules for nuclear components to operate within the creep-regime (time-dependent).
Review Expectations

• NRC will create a draft RG by April 2021 (public milestone). Staff will solicit public comments on the draft RG and will subsequently issue a final RG.

• The HBB (Class A) rules will be reviewed with the assumption that components have safety-significant functions similar to Division 1, Class 1 (NB) components. HCB (Class B) rules will be reviewed with the assumption that the components will have similar functions to Division 1, Class 2 (NC) components.

• Categorization of SSCs is not within the scope of this activity.

• NRC review will emphasize the “Reasonable Assurance of Adequate Protection” standard.

• NRC reviewers consist of materials, mechanical, and inspection staff from NRR, RII, and RES
Contractor Expert Recommendations

• In October 2018, the NRC core team sent the ASME BPVC Section III, Division 5 standard and the technical background documents to the Pacific Northwest National Laboratory (PNNL), Oak Ridge National Laboratory (ORNL), and NUMARK for a peer review on the technical adequacy of Section III, Division 5.

• In December 2019, PNNL, ORNL, and NUMARK provided draft reports to the NRC detailing their technical findings.

• In January 2020, the NRC initiated efforts to review the PNNL, ORNL, and NUMARK reports and to begin drafting the Regulatory Guide (RG) and RG technical basis document (NUREG).
Status of Contractor Reports

- **PNNL** – PNNL Final Report available at ADAMS Accession No. ML20269A145
- **ORNL** – ORNL Final Report available at ADAMS Accession No. ML20269A125
- **NUMARK/EMC²** – All technical input received. Final reports expected early November 2020.
- **ANL** – Final input expected mid-November 2020.

ANL Expert Assistance

• The NRC staff recognizes that Argonne National Laboratory (ANL) has foremost expertise on this standard, including that ANL staff chair ASME BPVC Section III, Division 5 subgroups and working groups.
  • The NRC expects that the review team, the public, and ACRS will have questions and concerns regarding the adequacy and use of ASME BPVC Section III, Division 5.
• Obtain on-call technical expertise from ANL related to NRC’s endorsement of ASME BPVC Section III, Division 5.
  • Technical assistance to facilitate the staff’s efforts in drafting a RG and the NUREG
  • Providing the review team with the technical basis and historical perspective on ASME BPVC Section III, Division 5.
INL Expert Assistance

• The NRC staff recognizes that Idaho National Laboratory (INL) has foremost expertise on the graphite portions of this standard.
  • The NRC expects that the review team, the public, and ACRS will have questions regarding the graphite rules in Section III, Division 5.

• Obtain on-call technical expertise from INL related to NRC’s endorsement of ASME BPVC Section III, Division 5.
  • Technical assistance to facilitate the staff’s efforts in drafting a RG and the NUREG
  • Providing the review team with the technical basis and historical perspective on ASME BPVC Section III, Division 5.
Current Status – Next Steps

• NRC staff are receiving the final contractor reports. The contractor reports will be published and available to the public. These reports provide a recommendation on the technical adequacy of ASME Section III, Division 5.

• The NRC staff is drafting the NUREG (technical analysis) and RG (the vehicle for endorsement and conditions).

• The ASME Code Committees have developed both background reports and gap analyses for the metallic and non-metallic portions of ASME Section III, Division 5. These reports have been published or will be published soon. The NRC has started interactions with the ASME Code committees regarding the NRC contractor comments.

• At the current time, we have not found any issues that would be show stoppers; however, there is still a significant amount of work to be completed and public interactions to be had.
Backup - Contractor Assignments

• Task C, Elevated Temperature Metallic Components
  • PNNL
    • Design, Fabrication, Examination, Testing (HBB; HCB; HGB-3000, -4000, -5000, -6000),
    • Rules for Strain, Deformation, and Fatigue Limits (Mandatory Appendix HGB-I)
    • Rules for Construction of Core Support Structures Without Explicit Consideration of Creep and Stress-Rupture (Mandatory Appendix HGB-II)
    • Rules for Buckling and Instability (Mandatory Appendix HGB-III)
    • Rules for Time-Temperature Limits (Mandatory Appendix HGB-IV)
  • ORNL
    • Materials (HBB; HCB; & HGB-2000)
    • Tables and Figures (Mandatory Appendix HBB-I)
    • Guidelines for Restricted Material Specifications (Non-Mandatory Appendix HBB-U)
Backup - Contractor Assignments

• Task C, Elevated Temperature Metallic Components (continued)
  • NUMARK/EMC²
    • Rules for use of SA-533 Type B (Mandatory Appendix HBB-II)
    • Rules for Strain, Deformation, and Fatigue Limits (Nonmandatory Appendix HBB-T)
    • Rules for Stress Range Reduction Factors (Mandatory Appendix HCB-I)
    • Rules for Allowable Stress Values for Class B Components (Mandatory Appendix HCB-II)
    • Rules for Time-Temperature Limits (Mandatory Appendix HCB-III)

• Task D, Graphite
  • NRC Staff (General Requirements)
  • NUMARK/EMC² (Technical Requirements)

• Task E, Code Cases N-861 and N-862
  • NUMARK/EMC² (All aspects)