



SETTING THE STANDARD

NRC Standards Forum 2017

ASME Summary Review of Standards Forum Activities - Report on 2016 Forum Action Items

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Topic: Methodology for Risk Informed Strategies

Task ID: 2010-11

Champions: Bob Budnitz (ANS) and Rick Grantom (ASME);

Current Status: PRA Standards for current and proposed nuclear power plants have been published and are used to support major risk informed applications. PRA Standards cover all nuclear power plant operating modes. Additional risk informed Standards/strategies to improve safety and efficiencies actively being pursued.

Standards Used: ASME/ANS PRA Standard Parts 1 - 10, Low Power/Shutdown PRA Standard, Level 2 PRA Standard, Non Light Water Reactor PRA Standard

Regulatory Use: RG 1.200, RG 1.174, RG 1.177, 10CFR50.65, 10CFR50.69, Reactor Oversight Program/Significance Determination Process (ROP/SDP), Low Power/Shutdown Risk Assessment

Future Recommendations: Support consensus and regulatory acceptance of proposed risk informed strategies/applications enabled by future Standards publications

Topic: High Strength Reinforced Rebar

Task ID: 2012-06

ASME Champion: Javeed Munshi (BPV III-2), Namho Lee (BPV III-2 WG Design)

Current Status: BPV III-2 is currently working on a code revision to allow the use of ASTM 615 Grades 75 and 80 and ASTM A706 Grade 80 reinforcement for containment structure construction. Currently out for approval by the SG. Once approved it will proceed to BPV III Standards Committee and ACI TAC.

Future Recommendations: TBD

Topic: Powder Metallurgy and Hot Isostatic Processing Methods

Task ID: 2013-*1 (see next slide 2015-06)

ASME Champion: Keith Hottle/Annemarie Appleton

Current Status: ASME Section II Part D, Mandatory Appendix 5 has been approved for the 2019 Edition to include HIP powder components as an additional processing option to wrought and cast. The revision includes the requisite controls that need to be in place in the ASME SA/SB specifications/ code case to ensure the quality and integrity of the HIP components. Based on the application of these controls, BPV II's default position will be to assign the previously established wrought allowable stress values to HIP components in the time independent range.

ASTM Specifications A988, A989, and B834 are currently being updated to include the requisite controls added to Mandatory Appendix 5.

Future Recommendations: Adopt the new versions of A988, A989, B834 as SA-988, SA-989, and SB-834. BPV II Task Group to remain in place to address new alloy families as necessary. Acquire data for HIP components in the time-dependent range.

Topic: Alloy Code Development for Powder Metallurgy

Task ID: 2015-06

Topic: Powder Metallurgy and Hot Isostatic Processing Methods

Task ID: 2013-*1

ASME Champion: Keith Hottle, Annemarie Appleton

Current Status: Same activity?

Future Recommendations: TBD

Topic: PWSCC Initiation Testing for Alloy 690 Weld Metals

Task ID: 2013-03

ASME Champion: Robin Dyle

Current Status: EPRI has work looking at Alloy 600 and 690 cracking issues. Currently an expert panel is developing crack growth rate models.

Future Recommendations: This information will be shared with Section XI for consideration inclusion in the Code.

Topic: Residual Stress (RS) Guidelines

Task ID: 2013-07

ASME Champion: SG-MFE TG chaired by Charles Kim

Current Status: 3 Related records for revisions to BPV III Subsections NB, NC, ND and NG:

- Record 12-1461 is a Code revision to differentiate between peening for distortion vs peening to introduce compressive residual stresses. Board approved in 8/2017, for inclusion in 2019 Edition.
- Record 14-764 will clarify existing Code words through a Code revision to require surface stress improvement after weld repairs to the wetted component/item surface. In-process.
- Record 17-13 will address commitments made during balloting of Record 12-1461.

Topic: Elimination of Dissimilar Metal Welds (DMWs)

Task ID: 2014-02

ASME Champion: BPV III SG MFE (Tentative)

Current Status: The project is currently under development at EPRI and will be presented to ASME when it is ready for action.

Future Recommendations: TBD

Topic: ASME Code Acceptance of HDPE

Task ID: 2014-03

ASME Champion: Tim Adams, Tom Musto, Matt Brandes, Phil Rush

Current Status:

- PE Pipe testing is done
- There is a Section XI effort on acceptable flaw size
- ASME Section III Appendix XXVI was published in 2015 to incorporate CC N-755-2 into a mandatory appendix.
- Additions to 2017 Edition of Appendix XXVI to include alternative materials, acceptance criteria and update the hydro test requirements.

Future Recommendations: Awaiting 50.55(a) on 2015 Code

Topic: Thick Section Component Welding

Task ID: 2014-06

ASME Champion: BPV III SG MFE (Tentative)

Current Status: The project is currently under development at EPRI and will be presented to ASME when it is ready for action.

Future Recommendations: TBD

Topic: Environmentally Assisted Fatigue – Long Term Collaboration/Testing

Task ID: 2015-03

ASME Champion: Keith Wright

Current Status: The EPRI roadmap & gap reports highlighted plant representative ‘component feature’ and loading tests as a priority. PVP2017-65995 outlines the collaboration ongoing. An EPRI ‘RFP’ was issued July 2017 and a number of organisations have responded or expressed interest. Awaiting EPRI selection.

Future Recommendations: Testing enables benchmarking of a variety of methods & quantification of margin.

Topic: Demonstration of Self- Consolidating Concrete (SCC) and SCC Structural Members

Task ID: 2015-04

ASME Champion: Javeed Munshi (BPV III-2)

Current Status: TBD

Future Recommendations: TBD

Topic: Additive Manufacturing of Net Shape Powder Metallurgy Cans for Valves

Task ID: 2015-05

ASME Champion: George B. Rawls Jr.

Current Status: ASME has formed a new BPTCS/BNCS Special Committee on Use of Additive Manufacturing for Pressure Retaining Equipment. Its first meeting was in August. The standards to be considered first are:

- AWS D20.1, Standard for Fabrication of Metal Components using Additive Manufacturing
- ASTM F3184-16 Standard Specification for Additive Manufacturing Stainless Steel Alloy (UNS S31603) with Powder Bed Fusion

Future Recommendations: Work will continue.

Topic: Mass Concrete Modeling & Temperature Control

Task ID: 2015-10

ASME Champion: Javeed Munshi (BPV III-2) , Joshua Zhang (BPV III-2)

Current Status:

- Research on NPP Basemat Modeling (Structural modeling of NI basemat mass concrete) considering the primary loads (static load, seismic load), and secondary loads (thermal / temperature load during operation etc.) has been conducted by SNERDI, it related more to structural design-analysis rather than material design and applications.
- A related research paper has published in ICONE-25 Proceedings entitled "NUCLEAR ISLAND BASEMAT MODELING FOR GENERATION III NUCLEAR POWER PLANT DESIGN IN CHINA", Paper NO.: ICONE-25 Paper 66346.

Future Recommendations: TBD

Topic: Advanced Manufacturing Program

Task ID: 2016-06

ASME Champion: Ralph Hill and George Rawls

Current Status:

- BPTCS/BNCS Special Committee on Use of Additive Manufacturing for Pressure Equipment was appointed and approved to proceed with the following charter at the June 7, 2014 BPTCS Meeting.

To develop a technical baseline to support development of a proposed BPTCS standard or guideline addressing the pressure integrity governing the construction of pressure retaining equipment by additive manufacturing processes. Construction, as used in this Charter, is limited to materials, design, fabrication, examination, inspection, and testing.

- First meeting of the Committee was held during Boiler Code Week in Minneapolis, MN on Wednesday, August 9, 2017.

Key Point from First Meeting:

- Gap Analysis Compared to ASME Standards/America Makes

The America Makes effort will be used by the committee as a resource to support their effort to develop requirements for AM. AM committee will monitor the development to close the technology gaps identified in the America Makes Standardization Roadmap and apply the information, where appropriate, for the ASME pressure equipment standard.

Topic: Advanced Manufacturing Program (Continued)

Task ID: 2016-06

Path Forward for Materials:

Current work performed under Record 17-601 to include hot isostatically pressed powder into Section II, App. 5 is being reviewed - AM Committee will develop a white paper on what changes/expansions are needed to Section II, App. 5 for controls to powder bed fusion AM materials. Material grade 316 will be used as a test case

- **Control of Fabrication for AM Processes**

AWS is developing Standard D20.1/D20.1M:201X Specification for Fabrication of Metal Components using Additive Manufacturing - expects approval of the standard in 2019. AWS D20.1 draft is a thorough document in terms of process control and material control. The current plan is to apply AWS D20.1 for control of fabrication similar to the approach Section IX currently uses. The committee will compare essential variables in AWS D20.1 for laser fusion and electron beam AM processes currently being used.

- **Design of AM Components**

A combination of analysis and testing will be required to address AM pressure equipment. The design by analysis rules in Section VIII Div. 2 are the most appropriate requirements to evaluate the complex shapes for additive manufacturing. The committee will prepare a white paper for design requirements for AM using Section VII, Div. 2, Part 5 as a basis for the analysis section and Section VIII Div. 1, UG-101 and Section X, App. 8 for qualification by testing.

Topic: Design Standards for High Temperature Reactors (includes Liquid Metal Reactors)

Task ID: None

ASME Champion: Sam Sham

Current Status:

- Division 5 rules cover Class A and Class B metallic pressure boundary components and supports, Class SM metallic core support structures, and Class SN nonmetallic core components for high temperature gas-cooled reactors, liquid metal reactors (sodium, lead or lead/bismuth) and molten salt reactors (with liquid or solid fuel).
- Code actions to optimize Division 5 rules
 - Various actions are being taken to extend qualified lifetimes of Class A materials to support 60-year design life.
 - New Class A material, Alloy 617, is being added to Division 5 to expand design envelopes.
 - Elastic, perfectly plastic methods are being developed to modernize and simplify Division 5 design analyses.
 - Inelastic analysis methods are being developed for incorporation into Division 5 Appendix HBB-Z.
 - Design rules for integrally clad components with weld overlay on Class A materials are being developed to support molten salt reactor applications.
 - Graphite irradiation data are being incorporated into Division 5 to support use of graphite design rules.
 - Ceramic composite design rules are being incorporated into Division 5.

Future Recommendations: Incorporate Section III, Division 5 in 10 CFR 50.55A

Topic: ASME Code Case N-860 Examination Requirements and Acceptance Standards for Spent Nuclear Fuel Storage and Transportation

Task ID: Record 16-364 and proposed Code Case N-860

ASME Champion: Kenn Hunter

Current Status:

- Work under development by the Task Group on ISI of Spent Nuclear Fuel Storage and Transportation Containment Systems (BPV XI)
- EPRI guidance has been considered
- Inspection flowchart to support the code case has been through several comment cycles and expected to be approved by the end of this year.

Future Recommendations: Draft code case will be finalized upon approval of inspection flowchart.

Questions?