U.S. DEPARTMENT OF ENERGY | Office of Nuclear Energy

Endorsement of ASME Section III Division 5 Rules for Construction of High Temperature Nuclear Reactors: Update on Industrial Perspective

NRC Public Stakeholders Meeting
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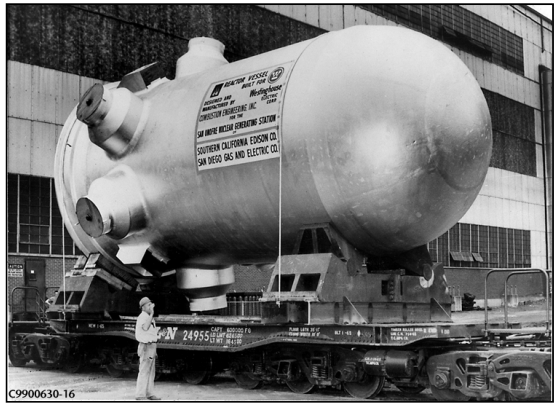
ASME Section III Treats Metallic Materials for Low & High Temperatures Differently

- **Allowable stresses for LWR & low-temperature advanced reactor components are not time dependent**
  - **< 700°F (371°C) for ferritic steel and < 800°F (427°C) for austenitic matls**



PWR RPV

Monju SFR IHX

- **At higher temps, materials behave inelastically. Allowable stresses are explicit functions of time & temperature**
  - **Must consider time-dependent phenomena such as creep, creep-fatigue, relaxation, etc.**
  - **ASME Sec III Division 5 provides rules for construction of high temperature reactor components**

ASME Sec III Div 5 Contains Construction & Design Rules for High-Temperature Reactors

- Includes gas, liquid metal & molten salt-cooled reactors
- First Issued in Nov 2011, revised in 2013, 2015 & 2017
- Covers high-temperature metallic components explicitly
- Includes rules for graphite & ceramic composites for core supports & internals for first time in any international design code
- Covers low temperature metallic components, largely by reference to other portions of Sec III

Discussions Regarding Endorsement of ASME Section III Division 5 Began in 2015

- **Following multiple DOE-NRC Non-LWR Advanced Reactor Workshops and ASME meetings since 2015, ASME Task Groups have been formed to define potential pathways and schedules for NRC endorsement of Div 5**
  - **Metallic structures & components**
  - **Non-metallic support structures**
- **DOE-NE supports ASME task groups & related technical basis development to reduce technical risk and support private sector deployment of new advanced reactors**
- **NRC/NRO is actively participating in task groups, but has requested industrial input regarding value/prioritization**

DOE Contacted Three Industry Technical Working Groups Regarding Div 5

- **TWGs are focused on high temperature gas cooled, fast, and molten salt cooled reactors (HTGRs, FRs & MSRs)**
- **Input requested on value of endorsement of Div 5 for design of advanced reactors and reduction of their anticipated risk for licensing and deployment**
- **Support for endorsement of Div 5 has been received from all TWGs**
  - **– Positive verbal feedback provided by Chairs of all TWGs with expectations of supporting letters soon**
  - **– Supporting letter from HTGR TWG sent to Chair of ASME Section III, copies to NRC/NRO, 11/13/17**

ASME Will Summarize and Reinforce Industrial Support Requests to NRC/NRO

- **When all industry requests have been received by ASME, the Chairs of Section III and the Board of Nuclear Codes and Standards will send joint request to NRC/NRO underscoring the value of and need for endorsement of Division 5**
- **Existing ASME Task Groups will continue to work towards pathways and schedules for endorsement**
- **DOE-NE will support R&D activities agreed upon with ASME Committees and BNCS to provide continued technical basis development to optimize the existing Division 5 (2017 edition)**

High Priority ASME Code Actions Are Endorsed by BNCS and Supported by DOE R&D Activities

Topics	2019 Edition	Beyond 2019
New simplified analysis methods (EPP) that replace current methods based on linear analysis (and can be used at higher temperatures) for all Class A materials	X	
Adequacy of the definition of S values used for the design of Class B components, which is based on extrapolated properties at 100,000 hours, in light of application to 500,000 hours design	X	
Construction rules for "compact" heat exchanges		X
Incorporation of new materials such as Alloy 617 and Alloy 709 (austenitic stainless)	A617	A709
Pursuit of "all temperature code"		X
Complete the extension of Class A materials for 500,000 hr-design	304H, 316H	Grade 91, 2¼Cr-1Mo, Alloy 800H
Develop design by analysis rules for Class B components (including compact HX)		X
Add non-irradiated and irradiated graphite material properties		X
Develop rules for cladded components for molten salt reactor applications		X

Industry Is Expressing that Endorsement of ASME Sec III Div 5 Is Valuable

- **Requests for input on Div 5 endorsement from broad range of advanced reactor vendors and suppliers is evoking positive responses**
- **ASME Section III and BNCS are also very supportive of Div 5 endorsement**
- **DOE-NE is supporting and coordinating industry and ASME support for endorsement with active R&D activities to optimize the Division 5**
- **Endorsement of Div 5 is anticipated to reduce technical risk and support private sector deployment of new advanced reactors**