

## 2017 NRC Standards Forum - Detailed Summary

### NRC Standards Forum Overview, Tom Boyce, NRC (ML17272A065)

- The objectives of the Standards Forum are to 1) identify codes and standards that need to be developed that are not currently being developed in a timely manner by SDOs, 2) facilitate “Collations-of-the-Willing” with relevant stakeholders to facilitate and accelerate the development and implementation of roadmaps to address identified needs for new or revised standards, and 3) receive feedback from stakeholders.
- NRC encourages participants to sign up for coalitions to develop standards and codes.
- NRC will try and facilitate any exchanges of information by hosting meetings, phone calls, conferences, etc.
- There are two lists of topics that are going to be discussed during the forum. 1) “EPRI Topics List,” which includes topics presented at the 2016 Standards Forum by EPRI and topics that will be presented this year. There is also the opportunity to add additional topics to this list that are not EPRI-developed. 2) “Current Topics List,” which tracks the topics that originated during the previous NESCC meetings. These lists will be merged and maintained by the NRC after the Forum.
- NRC has made improvements on SDO Participation in MD 6.5, primarily through SDO coordinators that develop list of prioritized SDO activities per NRC mission, and who coordinate activities of NRC participants in SDO.
- A Standards Steering Committee was established to prioritize the standards-related activities important to the NRC. The Committee ensures that there is an aligned NRC position across SDOs for similar topics and approves the priority list developed by coordinators.
- Jim Kinsey, INL: How does NRC apply its resources to standards, particularly with fees?  
Answer: Tom Boyce: Most development of standards is not fee based, unless it is tied to a specific licensing action. Resources for standards would be part of the larger NRC efforts to review various applications, in this case for non-LWRs.
- Farshid Shahrokhi, Areva: Could you elaborate a little bit on the endorsement process since that is when the standards become valuable to the vendors?  
Answer: Tom Boyce: In general, endorsements are through either the Code of Federal Regulations (CFR) or Regulatory Guides (RGs), based on regulatory need. The NRC sometimes endorses standards in NUREGs, particularly standard review plans.
- Prasad Kadambi, ANS: How does the Standards Steering Committee handle joint SDO activities such as ANS/ANSI standards?  
Answer: We’ve established a separate coordinator for the Joint Committee on Nuclear Risk Management (JCNRM) involving ANS and ASME.
- Martin Van Staden, X-Energy: What triggers NRC to start looking at a code or standard, e.g., ASME III, Division 5?  
Answer: In general, the staff strives to be ready to review applications before they are submitted, so staff may elect to look at standards that they believe are applicable to anticipated applications, in time to support the applications. The NRC becomes aware of anticipated applications by interactions with the potential applicants. The NRC could wait

until the application, but it would be better to have NRC staff on the committee before then. The NRC balances the standards work with any near term agency needs and available resources.

### **Summary Review of Standard Forum Activities - Report on 2016 Forum Action Items (ML17272A063)**

#### IEEE, Tom Koshy (ML17272A064)

- IEEE323 - the current endorsed version is from 1974 in RG 1.89. IEEE revised the standard in 2016 with license renewal and subsequent license renewal (SLR) in mind to be able to update the RG. Also lessons from Fukushima are included in the revision.
- IEEE 344 - IEEE committed to look at high frequency seismic activity and work collectively with IEC to bring in a wider acceptance internationally. Hopefully the resulting standards can be considered for endorsement by the NRC.
- The other 2 standards have not gained traction in the regulatory side but are still under development (see slide)
- EPRI is working on advanced battery evaluation.
- Small modular reactor (SMR) optimization is under subcommittee review. If interest is determined, a white paper would be first, then a guidance document, then a draft standard, then a final standard.
- HTGR - no current IEEE standards but topic is under consideration.

#### ANS, George Flanagan (ML17272A062)

- ANS 53.1 – This modular HGTR standard was reaffirmed in 2016 without any changes.
- ANS 54.1 - revision of a 1989 standard on General Safety Design Criteria for a Liquid Metal Reactor Nuclear Power Plant. Standard was withdrawn due to lack of interest but now is under revision. Working with DOE and NRC to make sure it aligns with DG 1.330 regarding advanced reactor design criteria.
- Standard on categorization and classification of systems components and structures for new reactor power plants is under development. Also working with DOE as part of modernization licensing effort.
- There is a collaborative effort on reactor coolant radiological source terms for normal operation between ANS and EPRI. Effort will include up-to-date information on operating power plants, which will be incorporated into ANS 18.1 for another revision in the next couple years.
- ANS is looking to work with EPRI on a standard for an emergency planning zone (EPZ), but has not started working on a standard at this time.

#### NEI, Steven Kraft (no presentation)

- Actions NEI has taken related to SDOs:
  - Steve Kraft is now a member of ASME Board of Standards
  - Russ Bell is on ANS Standards Board

- Steve is operating reactors, Russ is advanced reactors
- NEI has identified a list of standards that they have interest in. They will share that with the NRC.
- NEI does not believe IEEE 497 should be worked on, but there is NEI representation on the committee.

ASME, Ryan Crane and Allyson Byk (ML17272A061)

- The Standards Forum has improved the communication between ASME and NRC, along with twice a year calls between NRC staff and ASME staff on Sections III and XI.
- NRC priorities help drive ASME priorities, too.
- ASME reviewed the status of all the topics that they agreed to consider at the 2016 Forum. See Enclosure 5 and the ASME presentation for details.
- Division 5 is ready to be considered for incorporation into 10 CFR 50.55(a).
- Jim Kinsey, INL and George Flanagan, ORNL: Division 5 is ready to be endorsed by the NRC. Can we do rulemaking to incorporate it into 10 CFR 50.55(a)?  
Answer: Tom Boyce: Perhaps. Consider whether, if Division 5 is endorsed in 10 CFR 50.55(a) and the code is changed again, that would present a problem because of the difficulty and length of time it takes to do a rulemaking. It also may be best if the code is endorsed through a regulatory guide from the standpoint of flexibility of design.
- ASME has good interaction with EPRI on many of the code development activities. This is fostered by strong representation of EPRI staff on ASME code committees and EPRI often submits papers to the ASME conferences, resulting in a review by ASME of the work.

Advanced Nuclear Technology (ANT) Research and SDO Impact, David Scott, EPRI (ML17272A060)

- Nuclear Power is the largest sector within EPRI; projects include a variety of topics, including the ANT Group.
- The ANT group provides and facilitates a common approach across the entire global fleet, advances technologies and techniques that help increase safety, reliability, durability, and also quality of new nuclear construction, and reduces the risk and the uncertainty in deploying these new nuclear power plants around the world.
- Focused on advanced non-light water reactor designs (ANLWRs) in the recent past.
- Publication process at EPRI: there is an annual process to determine the cost to the public for the publications. The project and program managers may recommend that a report be made available to the public at no cost. Ultimately, the decision is with the EPRI Directors. Within ANT, there is a commitment that if a document has a direct effect on an SDO or a standard or a Code, then we make the recommendation, and we pursue that report being made free to the public.
- EPRI Responded to questions from the 2016 NRC Standards Forum:
  1. The three technical focus areas, is this for nuclear or for ANT?

- Engineering, Procurement, and Construction (EPC), Materials and Components (M&C) and Modern Technology Application (MTA) are specific to ANT.
2. ACI 318 (and consequently, 349) interest in high-strength reinforcing steel.
    - EPRI Phase 1 (published 10/3/2015, Product ID 30020075440), and Phase 2 (published 11/2016, Product ID ending in 7535). EPRI intends, as of now, to complete Phase 3 of that project, since there is certainly interest by both ACI 318 and then, consequently, ACI 349.
  3. The driver to influence ACI 301 relative to ACI 207 when dealing with mass concrete.
    - It is advisable to endorse and call out specifications and standards that are written in mandatory language. ACI 207 does not write that guide in mandatory language whereas ACI 301 does.
  4. What is the status of alloy code development in Section II and Section III?
    - EPRI is working on the ASME Code development for the alloy development, including powder metallurgy/hot isostatic processes (PM/HIP); these are not duplicate projects but are component specific.
  5. What is EPRI's interest in connecting with relevant IEEE committees on advanced batteries (commentator noted IEEE standards on Valve Regulated Lead Acid [VRLA] batteries)?
    - EPRI is interested and has someone on the IEEE committee.
- Slides list the active EPC, M&C and MTA projects; ones applicable to SDOs are in bold.
  - Question: Where does the concept come from for the proposed projects in the future? Is this driven by the utility side, that they say here's a need? Or how do these get to be identified and then worked into a project?  
 Answer: David Scott: EPRI goes through a prioritization process, incorporating what they think the industry needs, perhaps based on engagement with universities. The information is then vetted through EPRI advisors, traditionally consisting of utility members, and funding participants, to determine how to move forward.
  - Question: Is there a methodology in place at all where the SDOs would indicate that they need information in order to develop a standard? And that would feed into your program to provide that data?  
 Answer: David Scott: Not any more so than just general correspondence that we would have with those SDO organizations. For example, EPRI staff attend Code Week for ASME but EPRI doesn't usually ask representatives from those Code Committees what it is that they need. For the most part, it's just through EPRI leadership, through ideas that come from potential principal investigators, and then also a prioritization process that we have with the utility members as well.
  - The Advanced Reactor Strategic Program:
    - EPRI is developing an Owner Operator's Guide, which is like a utility requirements document (URD) that first identifies what the different options are for a potential owner as it relates to advanced reactor designs, and then what the different requirements would be as it relates to making sure that those are constructed in a

specific manner. Then, EPRI will engage regulators and DOE. The document will be free to the public in the first quarter of 2018

- Early integration of safety analysis in the design process project to feed into ANS 30.1. Intending to develop a guidance document on PRA for advanced reactors
- Developing a gap analysis in Gen IV materials in terms of what are currently in existence and utilized and accepted by Code within the advanced light water reactors, and in some cases, small modular reactor space. Assess to see what changes are needed for the advanced reactor designs, both in the sense of the materials and the components which are going to be using these materials, particularly considering the different environments and the different types of degradation which may occur. Available end of 2017.

- Question: Is EPRI using a structured decision making process, or integrated decision-making or analysis?

Answer: Mr. Scott: EPRI is trying to make a push on integrating and communicating and breaking down the silos within the different sectors in that sense.

Comment: George Flanagan, ORNL: EPRI and DOE are needed to supplement the basis of information that SDOs use to develop standards.

#### **National Nuclear Energy Strategy - Delivering the Nuclear Promise, Stephen Kraft, NEI (ML17272A059)**

- NEI does not write or sponsor standards; they write guidance documents that sometimes get turned into standards.
- National Nuclear Energy Strategy: Maintaining operational focus, increasing value and improving efficiency.

#### **Wrap up of Operating Reactor topics; Identification of Codes/Standards/Topics that Need “Coalitions,” Tom Boyce, NRC**

- NRC noted which topics on EPRI Topics List (ML17276B281) are primed for a successful Coalition.
- Discussion on EPZ coalition: Carl Mazzola (ORNL), Chair of the ANS Consensus Committee is the appropriate ANS point of contact. There is still a need for basic data and studies before moving forward with a standard.  
Russ Bell, NEI: NEI has taken the lead in working with the NRC on the technical basis for the rulemaking.  
Tom Boyce: NRC will make sure that the ANS standard and rulemaking are coordinated.
- Tom Boyce asked for any additional topics to what EPRI added to the list.
- Carol Moyer, NRC: ANSI is gathering stakeholders to help coordinate and accelerate standards in Additive Manufacturing. If participants are interested in joining the ANSI Collaborative, they should contact Ms. Moyer or Ms. Mehta.
- Current Topics List (ML17276B282): Highlighted items are in need of updates.
- Mr. Kadambi: There is an ANS standard right now being written on aging management and life extension of DOE facilities.

- Mr. Crane, ASME: Please keep the NQA Committee, on the list, especially with the work going on in the DOE. We can re-visit at next Forum.
- Russ Bell, NEI: On the topic of possible conversion of gas accumulation guidance, it was not well-received within NEI. Recommend closing topic.

**Update on NRC non-LWRs work, Amy Cabbage, NRC (ML17272A075)**

- There continues to be significant interest in non-LWRs; dozens of companies are working on designs. Designs under consideration in the U.S. are largely aligned with three technology types: high temperature gas cooled reactors, molten salt reactors and sodium cooled fast reactors or more broadly liquid metal fast reactors which encompasses other reactors such as leg cooled reactors. Industry has formed three advanced reactor technology working groups (TWGs).
- In response, NRC has been proactively planning for non-LWRs. We've issued a final Vision and Strategy document in December of 2016 which established a strategic goal for the NRC to assure readiness to effectively and efficiently review and regulate non LWRs by no later than 2025 to align with DOE's goal of having at least two non LWR designs reviewed and ready for construction by the early 2030s.
- The Vision and Strategy identifies three strategic objectives: enhancing our technical readiness, optimizing regulatory readiness and optimizing communications.
- The Implementation Action Plans (IAPs) has six strategies, number 4 being "Industry Codes and Standards."
- NRC has started formal pre-application interactions with one applicant, Olko, Inc., for a small sodium cooled fast reactor design. NRC is currently reviewing their Quality Assurance Program. NRC anticipates additional submittals later this fall.
- Through the cost share programs and GAIN vouchers, DOE is providing significant support to non-LWR developers.
- NRC hosts stakeholder meetings every six weeks. The NRC is putting out all documents as preliminary drafts for stakeholder interaction, discussion, and comment. (see <https://www.nrc.gov/reactors/new-reactors/advanced.html>)

**NRC Staff involvement with codes and standards development related to non-LWRs, Shivani Mehta, NRC (ML17272A074)**

The Primary SDOs that NRC works with are:

- ASME
  - Section III, Division 5 – High Temperature Materials
- ANS
  - Risk-informed Principles and Policy Committee
  - Research and Advanced Reactor Consensus Committee
  - Standards Development

- ASME/ANS
  - JCNRM Working Group on non-LWR PRA

**DOE Perspectives, Jim Kinsey, INL (ML17272A073)**

- DOE supports the industry's development of codes & standards primarily through: Focused research providing the technical bases for new or modified codes & standards, committee participation by subject matter experts.
- ASME Section III, Division 5 covers High Temperature Design, incl. ceramic and graphite composite components. Current DOE work is to support optimization of the codes in Division 5.
- DOE believes that ASME Section III, Division 5 needs to be updated and endorsed. A lack of NRC endorsement of ASME construction rules for advanced non-LWRs represents a significant regulatory risk that delays development & deployment and discourages commercial interest.
- Andrew Yeshnik, NRC: Task Group on endorsement produced gap letters that highlighted holes in the ASME code rules in Division 5 that NRC said would prevent us from endorsing the standard. And so the question has gone back to ASME at this point of how close are we on closing those gaps which would prevent us from endorsing it?
- Andrew Yeshnik, NRC: Time extension for Alloy 617 is being worked on to allow for 40 years rather than 20 years. The work on the graphite and composite core components is continuing and are hoping to produce the first rules on quality assurance for those. There are general infrastructure problems with the code, e.g., what does ASME stamping look like for high temperature components that need to be resolved.
- Mark Holbrook, INL: At an internal DOE meeting on Materials Program Review, there was indication at that time that they were working on a developing a road map to assist with closing the loop on those particular items.

**DOE/ASME Gap analysis, Michael Muhlheim, ORNL (ML17272A072)**

- DOE initiated a scoping study to understand the process, scope, and gaps of developing voluntary consensus standards for an SFR. Report to be published in September 2017.
  1. Obtain a list of all standards cited in RGs
    - Standards include consensus standards and industry standards
  2. From this list, select a few standards for an in-depth review to assess their potential application for non-LWR technologies.
    - Down select the number of standards for review to endorsed standards.
    - Assess the standards applicability to a sodium fast reactor (SFR) (i.e., technology specific or technology neutral).
    - Categorize the level of effort required to develop or revise the standard for applicability to an SFR.
  3. Describe the process for developing, approving, and endorsing a consensus standard.
    - Discuss and estimate the timelines for modifying a standard through the standards committees.
    - Discuss the process of citing or endorsing a standard by the NRC.

- ORNL presentation details the standards that were examined.
  - There are 19 current standards that need significant changes and 12 new standards were identified. These need to be prioritized. (see Enclosure 4)
  - Complete the gap assessment and provide detailed assessments and inputs to the revision of existing consensus standards and the development of new standards
  - Designs can proceed without approved standards.
- Question: How are these standards to be prioritized:  
 Mike Muhlheim: Determine if the standards are cross-cutting, if there's data to support the updates or development, also consider resources at the SDOs.  
 George Flanagan: Also, involve the technology working groups and work with R&D organizations.

**Risk-Informed Performance Based Discussions, William Reckley, NRC (ML17272A070)**

- NRC described the definition of risk-informed and performance based (RIPB) (see presentation).
- SDOs face challenges in RIP approaches: 1) how the SDO can develop a more risk informed performance based standard from both the simple design requirements and marry those up with potential flexibility on the performance based side. 2) Performance based approach tends to put more responsibility on the operator.
- These challenges may not be present for the ANLWR community. A risk informed, performance based approach could be used as kind of strategy in getting through the first of a kind ANLWR and then moving on to additional deployment strategies.

**ANS Initiatives for Risk-informed Performance-based Standards, Prasad Kadambi, ANS (ML17272A071)**

- Provided overview of ANS Performance-based Principles and Policy Committee (RP3C) Committee.
- Committee aims to implement principles and policies but does not develop standards.
- Pilot Projects Supporting Guidance Development: ANS 30.2 and 3.14. The guidance can be expected to be completed by the next Standards Forum.
- Committee wants to find out to what extent other SDOs are doing in the risk-informed performance based area.

**Fast Reactor Working Group (FRWG) NRC Standards Forum, Caroline Cochran, Oklo (ML17272A068)**

- Overview of TWG on Fast Reactors (FRs).
- TWG identified standards that are of interest to the technology for updates or development (see presentation).
- The ORNL Gap analysis is helpful to this community; suggest prioritizing this standards work by the easiest ones first to give TWG and industry embers some experience in standards development.



### **High Temperature Gas Cooled Reactors Codes and Standards, Farshid Shahrokhi, Areva (ML17272A067)**

- Overview of TWG on High Temperature Gas Cooled Reactors (HTGR).
- TWG intends to use current standards for their designs.
- TWG did not identify any standards to be updated or developed.

### **Molten Salt Reactor Standards Review, Nick Smith, Southern Co (ML17272A069)**

- Overview of TWG on High Temperature Gas Cooled Reactors (HTGR).
- TWG identified standards that would need to be updated from current standards (see presentation).
- Question: Farshid Shahrokhi, Areva: Is there a necessarily a need for standards when developing a design? Standards require a subject matter experts and financial resources that are not readily available.  
Amy Cabbage, NRO: There are no requirements to have a full suite of codes and standards that would support all the potential designs. However, if there are areas where stakeholders agree that there is a need, many people can use it and there is enough information to develop a standard in time for standard to be helpful, a standard should be worked on.

### **Wrap up of Advanced Reactor topics; Identification of codes/standards/topics that need “coalitions” George Flanagan, ANS (ML17272A066)**

- Overview of the ANS Standards Committee structure and specifically, Research and Advanced Reactors Consensus Committee (RARCC).
- ANSI/ANS-53.1-2011 (R2016), “Nuclear Safety Design Process for Modular Helium-Cooled Reactor Plants,” needs to be endorsed by the NRC.
- ANS-20.2, “Nuclear Safety Design Criteria and Functional Performance Requirements for Liquid-Fuel Molten-Salt Reactor Nuclear Power Plants” is a new standard under development. ANS would like NRC to endorse this standard in RG that cover the SFR DCs and HGTR DCs are a part of so that all three technologies are supported.
- ANS-30.1, “Integrating Risk and Performance Objectives into New Reactor Nuclear Safety Designs” is a new standard under development. Technology neutral standard to be used in the conceptual design phases to integrate risk-informed performance based PRAs.
- ANS-30.1, “Integrating Risk and Performance Objectives into New Reactor Nuclear Safety Designs” is a new standard under development. There is a white paper is a joint project between DOE and Southern Company that can be used as a basis for a standard that will use risk-informed processes.
- ANS proposing a “Coalition of the Willing” to develop a strategic vision for advanced reactors standards development.
  - A full day workshop to include all SDOs that are relevant to ALWRs, TWGs, EPRI, NEI, NRC and DOE.
  - To focus research at EPRI and DOE.
  - TWGs can learn where the SDOs are focusing efforts.
  - Details not established

- Comments:
  - David Scott, EPRI: Advanced Reactor TAG (EPRI) may be a good opportunity to have this meeting.
  - SDOs in attendance, TWG on MSRs, NRC and DOE expressed interest.
  - Raj Iyengar, NRC: It may be best to work on the issues one at a time. Be cautious on waiting for standards' development since standards can take a while to be developed. There are other activities that are ongoing. For example, NRC/RES is working on a holding a technical meeting to discuss materials for MSRs between NRC and EPRI.

**General Comments:**

Rita Baranwal, DOE GAIN (Gateway for Accelerated Innovation in Nuclear): DOE has proposed to issue an industry-focused funding opportunity announcement (FOA) which has not been issued yet. The information will be available on the DOE website ([www.gain.inl.gov](http://www.gain.inl.gov))

Amy Cubbage, NRC: To an extent we can look at international standards; some other countries are ahead of the US in the non-ALWRs. It may be helpful to look at international harmonization.  
Ryan Crane, ASME: ASME engages international entities in the multi-national design evaluation program (MDEP) activities.