



ANS-8 Standards Process, Current Revisions, and Connections to Wider Standards Organizations – Panel Discussion

Doug Bowen, Oak Ridge National Laboratory
Larry Wetzel, BWX Technologies
John Miller, Sandia National Laboratory
Deb Hill, UK National Nuclear Lab

November 2, 2017
ANS Winter Meeting
Washington, DC



Agenda

Topic of Discussion	Presenter
Introduction and high-level organizational overview	Doug Bowen
Nuclear Criticality Safety Consensus Committee (NCSCC) discussion and overview	Larry Wetzel
ANS-8 Subcommittee discussion and overview	Doug Bowen
NCSD and standards interactions/history	John Miller
Working group interactions	Deb Hill
Discussion about how ANS-8 standards are viewed compared to other standards	Larry Wetzel
How to get involved	ALL



Introduction and high-level organizational overview

Doug Bowen

Introduction

- For many years, the domestic and international consensus standards for nuclear criticality safety (NCS) have provided guidance for those who conduct hands-on operations with fissionable materials
- These consensus standards have been crucial to reducing the number of criticality accidents in process facilities
- The last known process criticality accident inside the United States was in 1978 at the Idaho Chemical Processing Plant, and outside the United States at Tokai-mura, Japan, in 1999

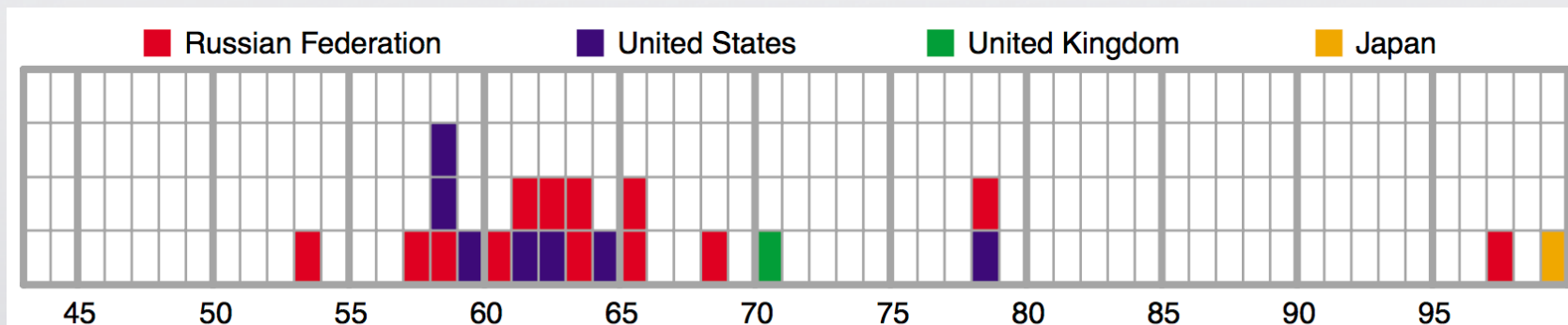


Figure 1. Chronology of process criticality accidents.

Figure from LA-13638 "A Review of Criticality Accidents"



Domestic NCS consensus standards

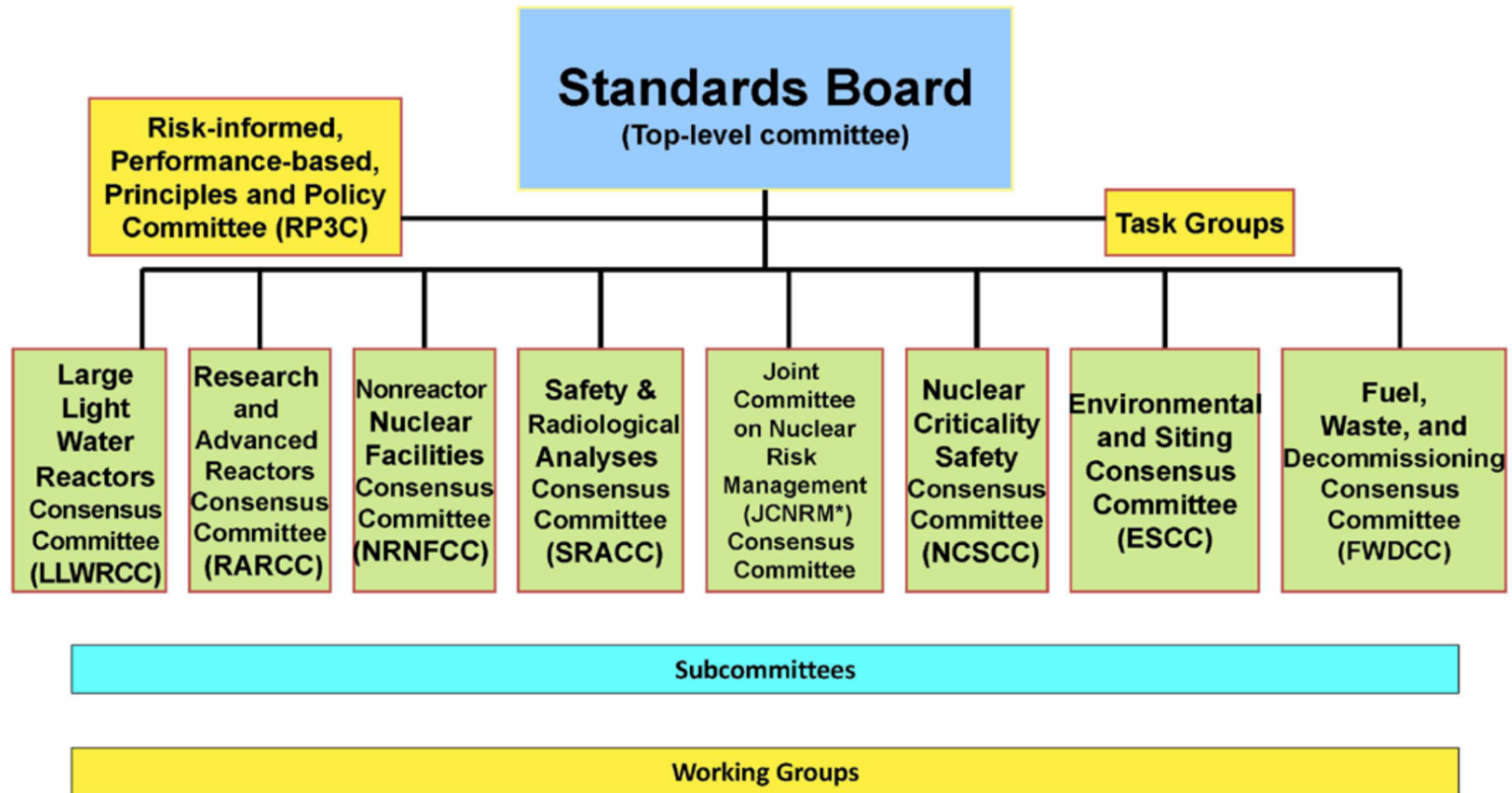
- The domestic consensus standards for NCS include the American Nuclear Society (ANS) series-8 standards (ANS-8)
 - The first NCS standard was initiated around 1960 and published as the first approved standard in 1964
 - This standard, ASA N6.1-1964, "Safety Standard for Operations with Fissionable Materials Outside Reactors," was the precursor to today's American National Standards Institute/American Nuclear Society (ANSI/ANS)-8.1-2014 standard for operations with fissionable material outside reactors
- Based on the NCS community's needs, the number of domestic standards has grown significantly to a total of 18 active standards and 1 standard under development
- These standards fall loosely into three main categories:
 - "administrative" or "program" standards
 - "application" standards
- Over the years, based on need, existing standards have been augmented, new standards have been generated, or due to lack of use, some standards have been withdrawn

Organizational overview



American Nuclear Society

The ANS Standards Committee





Organizational overview

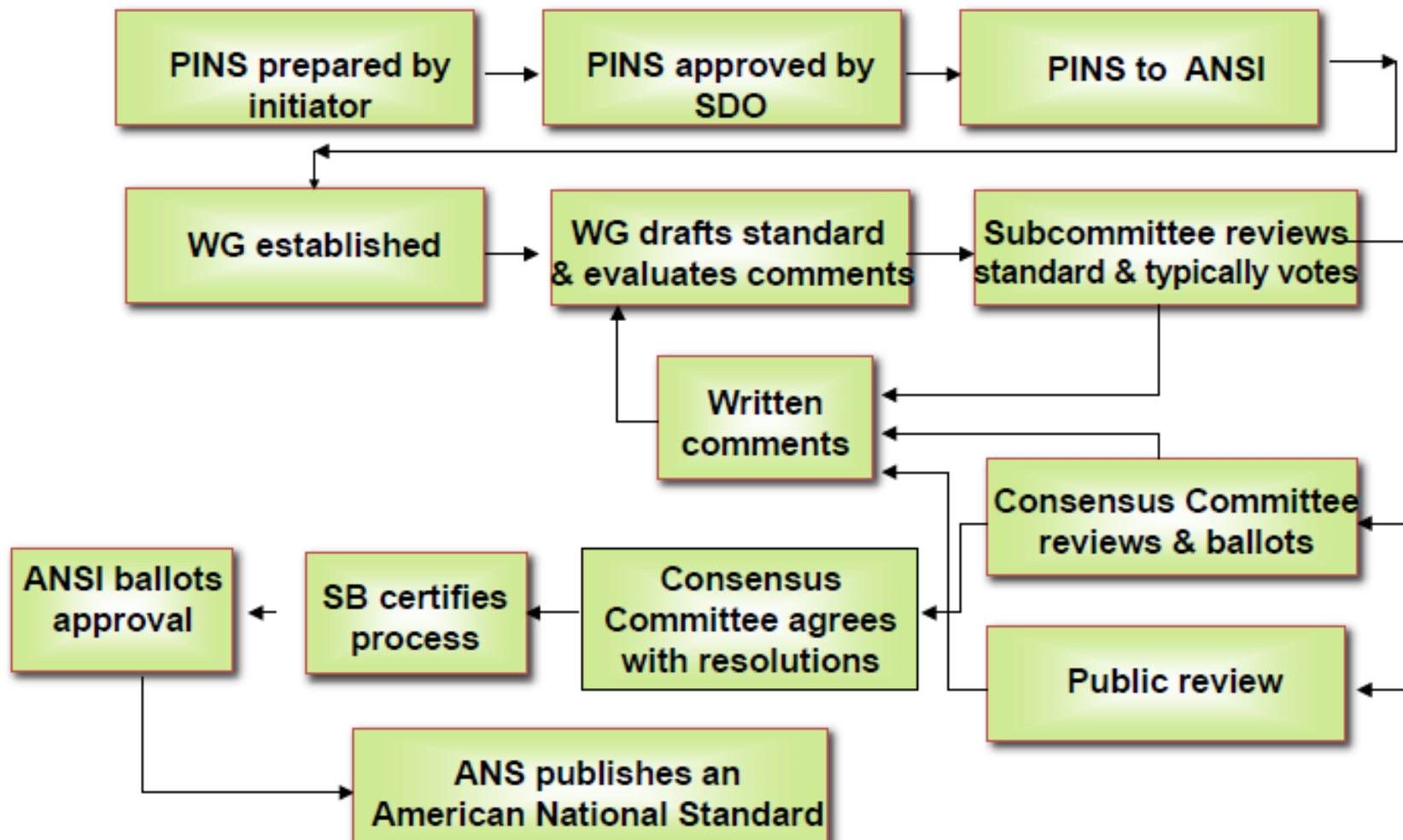
- These organizations work in concert to develop and maintain the ANSI/ANS standards
- The rules and procedures for developing and maintaining the standards, including roles and responsibilities for working group members, working group chairs, subcommittee chairs, consensus committee chairs, and so forth, are continuously updated to improve the process
- The ANS standards website provides reference information about the ANS standards process and describes how volunteers can find participation opportunities



Nuclear Criticality Safety Consensus Committee (NCSCC) discussion and overview

Larry Wetzel

Standards Development Process





Process at Consensus Committee and above

- CC ballot comments addressed by WG.
- Substantial agreement reached; consensus declared by CC Chair.
- ANS SB verifies that the rules and procedures (process) has been followed and certifies that a BOI has been satisfied before seeking ANSI approval.
- ANSI reviews SDO process and certifies as an American National Standard.
- Publication initiated by SDO once approved by ANSI.



Toolkit for ANS Standards Development and Maintenance

- [ANS Standards Committee Procedures Manual for Consensus Committees](#)
- [Policy Manual for the ANS Standards Committee](#)
- [Standards Committee Rules and Procedures](#)
- [Standards Development Checklist](#)
- [ANS Standards Development Process Overview](#)
- [Standards Development Flow Chart](#)
- [Review of Draft Approval Process for Working Group Chairs](#)
- [Policy for Specifying Requirements, Recommendations, and Permission in a Standard](#)
- [ANS Glossary of Definitions](#)
- [Template for an ANS Standard](#)
- [Recent Problem Areas Identified During Recent Ballots of New Standards](#)
- [Approaches to Staffing Working Groups](#)

<http://www.ans.org/standards/resources/>



ANS-8 Subcommittee discussion and overview

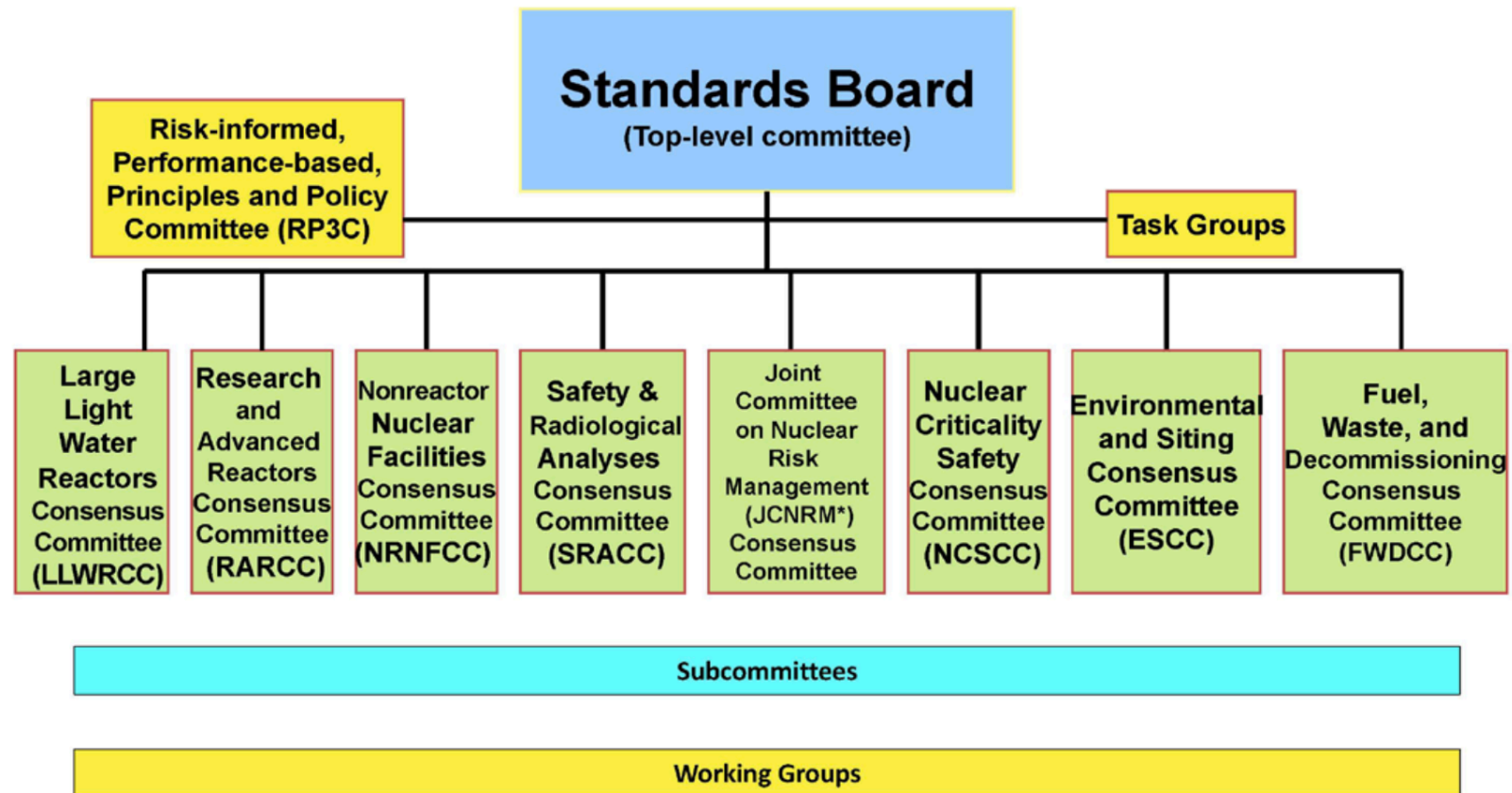
Doug Bowen

Organizational overview



American Nuclear Society

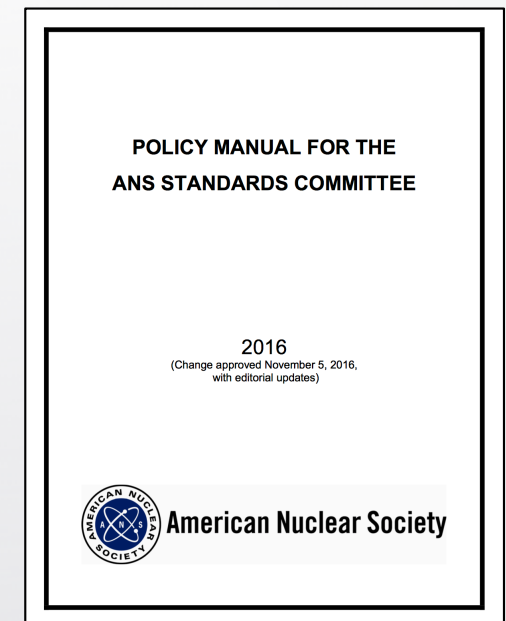
The ANS Standards Committee



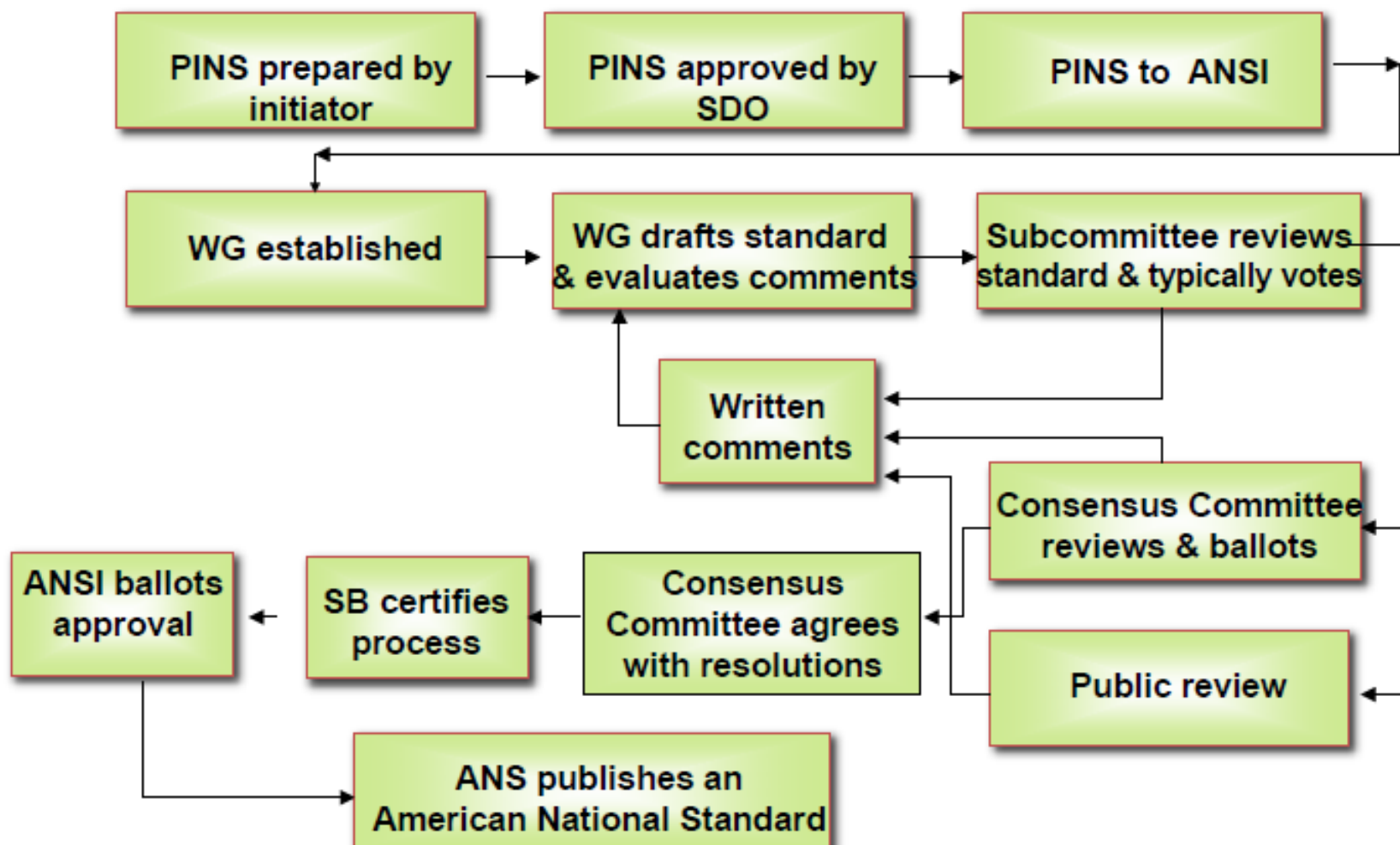


Process in the ANS-8 Subcommittee and Working Groups

- Members of working groups should be selected for their recognized expertise in the scope of the assigned standard
- Members of subcommittees are selected for their experience and competence in the scope of the committee and for their ability and willingness to participate in committee activities, and for their ability to provide credible technical comments on proposed standards.



Standards Development Process





ANS-8 Standards

ANS-8 Subcommittee

ANSI/ANS-8.1-2014 – NCS in Operations with Fissionable Materials Outside Reactors

ANSI/ANS-8.3-1997 (R2012) – Criticality Accident Alarm System

ANSI/ANS-8.5-1996 (R2012) – Use of Borosilicate-Glass Raschig Rings as a Neutron Absorber in Solutions of Fissile Material

ANSI/ANS-8.6-1983 (R2017) – Safety in Conducting Subcritical Neutron-Multiplication Measurements In Situ

ANSI/ANS-8.7-2012 – NCS in the Storage of Fissile Materials

ANSI/ANS-8.10-2015 – Criteria for NCS Controls in Operations with Shielding and Confinement

ANSI/ANS-8.12-1997 (R2016) – Use of Soluable Neutron Absorbers in Nuclear Facilities Outside Reactors

ANSI/ANS-8.14-2004 (R2016) – Use of Soluable Neutron Absorbers in Nuclear Facilities Outside Reactors

ANSI/ANS-8.15-2014 – Nuclear Criticality Control of Special Actinide Elements

ANSI/ANS-8.17-2004 (R2014) – NCS Criteria for the Handling, Storage, and Transportation of LWR Fuel Outside Reactors

ANSI/ANS-8.19-2014 – Administrative Practices for NCS

ANSI/ANS-8.20-1991 (R2015) – NCS Training

ANSI/ANS-8.21-1995 (R2011) – Use of Fixed Neutron Absorbers in Nuclear Facilities Outside Reactors

ANSI/ANS-8.22-1997 (R2016) – NCS Based on Limiting and Controlling Moderators

ANSI/ANS-8.23-2007 (R2012) – Nuclear Criticality Accident Emergency Planning and Response

ANSI/ANS-8.24-2007 (R2012) – Validation of Neutron Transport Methods for NCS Calculations

ANSI/ANS-8.26-2007 (R2016) – NCS Engineer Training and Qualification Program

ANSI/ANS-8.27-2015 – Burnup Credit for Light Water Reactor Fuel

ANSI/ANS-8.28 (Proposed) – Administrative Practices for the Use of Non-Destructive Assay Measurements for NCS

“Administrative” or “Program” Standards

ANS-8 Subcommittee

ANSI/ANS-8.1-2014 – NCS in Operations with Fissionable Materials Outside Reactors

ANSI/ANS-8.3-1997 (R2012)
– Criticality Accident Alarm System

ANSI/ANS-8.5-1996 (R2012)
– Use of Borosilicate-Glass Raschig Rings as a Neutron Absorber in Solutions of Fissile Material

ANSI/ANS-8.6-1983 (R2017)
– Safety in Conducting Subcritical Neutron-Multiplication Measurements In Situ

ANSI/ANS-8.7-2012 – NCS in the Storage of Fissile Materials

ANSI/ANS-8.10-2015 – Criteria for NCS Controls in Operations with Shielding and Confinement

ANSI/ANS-8.12-1997 (R2016)
– Use of Soluable Neutron Absorbers in Nuclear Facilities Outside Reactors

ANSI/ANS-8.14-2004 (R2016)
– Use of Soluable Neutron Absorbers in Nuclear Facilities Outside Reactors

ANSI/ANS-8.15-2014 – Nuclear Criticality Control of Special Actinide Elements

ANSI/ANS-8.17-2004 (R2014)
– NCS Criteria for the Handling, Storage, and Transportation of LWR Fuel Outside Reactors

ANSI/ANS-8.19-2014 – Administrative Practices for NCS

ANSI/ANS-8.20-1991 (R2015)
– NCS Training

ANSI/ANS-8.21-1995 (R2011)
– Use of Fixed Neutron Absorbers in Nuclear Facilities Outside Reactors

ANSI/ANS-8.22-1997 (R2016)
– NCS Based on Limiting and Controlling Moderators

ANSI/ANS-8.23-2007 (R2012)
– Nuclear Criticality Accident Emergency Planning and Response

ANSI/ANS-8.24-2007 (R2012) – Validation of Neutron Transport Methods for NCS Calculations

ANSI/ANS-8.26-2007 (R2016) – NCS Engineer Training and Qualification Program

ANSI/ANS-8.27-2015 – Burnup Credit for Light Water Reactor Fuel

ANSI/ANS-8.28 (Proposed) – Administrative Practices for the Use of Non-Destructive Assay Measurements for NCS

“Application” Standards

ANS-8 Subcommittee

ANSI/ANS-8.1-2014 – NCS in Operations with Fissionable Materials Outside Reactors

ANSI/ANS-8.3-1997 (R2012) – Criticality Accident Alarm System

ANSI/ANS-8.5-1996 (R2012) – Use of Borosilicate-Glass Raschig Rings as a Neutron Absorber in Solutions of Fissile Material

ANSI/ANS-8.6-1983 (R2017) – Safety in Conducting Subcritical Neutron-Multiplication Measurements In Situ

ANSI/ANS-8.7-2012 – NCS in the Storage of Fissile Materials

ANSI/ANS-8.10-2015 – Criteria for NCS Controls in Operations with Shielding and Confinement

ANSI/ANS-8.12-1997 (R2016) – Use of Soluble Neutron Absorbers in Nuclear Facilities Outside Reactors

ANSI/ANS-8.14-2004 (R2016) – Use of Soluble Neutron Absorbers in Nuclear Facilities Outside Reactors

ANSI/ANS-8.15-2014 – Nuclear Criticality Control of Special Actinide Elements

ANSI/ANS-8.17-2004 (R2014) – NCS Criteria for the Handling, Storage, and Transportation of LWR Fuel Outside Reactors

ANSI/ANS-8.19-2014 – Administrative Practices for NCS

ANSI/ANS-8.20-1991 (R2015) – NCS Training

ANSI/ANS-8.21-1995 (R2011) – Use of Fixed Neutron Absorbers in Nuclear Facilities Outside Reactors

ANSI/ANS-8.22-1997 (R2016) – NCS Based on Limiting and Controlling Moderators

ANSI/ANS-8.23-2007 (R2012) – Nuclear Criticality Accident Emergency Planning and Response

ANSI/ANS-8.24-2007 (R2012) – Validation of Neutron Transport Methods for NCS Calculations

ANSI/ANS-8.26-2007 (R2016) – NCS Engineer Training and Qualification Program

ANSI/ANS-8.27-2015 – Burnup Credit for Light Water Reactor Fuel

ANSI/ANS-8.28 (Proposed) – Administrative Practices for the Use of Non-Destructive Assay Measurements for NCS

Status Summary of ANS-8 Standards – Revisions In Progress

ANS-8 Subcommittee

ANSI/ANS-8.1-2014 – NCS in Operations with Fissionable Materials Outside Reactors

ANSI/ANS-8.3-1997 (R2012) – Criticality Accident Alarm System

ANSI/ANS-8.5-1996 (R2012) – Use of Borosilicate-Glass Raschig Rings as a Neutron Absorber in Solutions of Fissile Material

ANSI/ANS-8.6-1983 (R2017) – Safety in Conducting Subcritical Neutron-Multiplication Measurements In Situ

ANSI/ANS-8.7-2012 – NCS in the Storage of Fissile Materials

ANSI/ANS-8.10-2015 – Criteria for NCS Controls in Operations with Shielding and Confinement

ANSI/ANS-8.12-1997 (R2016) – Use of Soluble Neutron Absorbers in Nuclear Facilities Outside Reactors

ANSI/ANS-8.14-2004 (R2016) – Use of Soluble Neutron Absorbers in Nuclear Facilities Outside Reactors

ANSI/ANS-8.15-2014 – Nuclear Criticality Control of Special Actinide Elements

ANSI/ANS-8.17-2004 (R2014) – NCS Criteria for the Handling, Storage, and Transportation of LWR Fuel Outside Reactors

ANSI/ANS-8.19-2014 – Administrative Practices for NCS

ANSI/ANS-8.20-1991 (R2015) – NCS Training

ANSI/ANS-8.21-1995 (R2011) – Use of Fixed Neutron Absorbers in Nuclear Facilities Outside Reactors

ANSI/ANS-8.22-1997 (R2016) – NCS Based on Limiting and Controlling Moderators

ANSI/ANS-8.23-2007 (R2012) – Nuclear Criticality Accident Emergency Planning and Response

ANSI/ANS-8.24-2007 (R2012) – Validation of Neutron Transport Methods for NCS Calculations

ANSI/ANS-8.26-2007 (R2016) – NCS Engineer Training and Qualification Program

ANSI/ANS-8.27-2015 – Burnup Credit for Light Water Reactor Fuel

ANSI/ANS-8.28 (Proposed) – Administrative Practices for the Use of Non-Destructive Assay Measurements for NCS



NCSD and standards interactions/history

John Miller

A Perspective on the Interaction between the NCSD and ANSI/ANS-8 Standards

NCSD Topical Meeting 2017

John Miller
Dr. Bowen
Dr. Busch
Larry Wetzel, P.E.



*Exceptional
service
in the
national
interest*



Sandia National Laboratories is a multi-mission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC., a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

Outline

- Intent
- Historical BKG of ANSI/ANS-8 series
- Consensus Process Overview
- NCSD History and Involvement
- Current Interactions and Benefits

Intent

- **Illuminate** the reasons behind the **culture** of standards involvement by the NCSD community.
- Highlight activities that support/build this culture
- Request from ANS Prof. Div. Committee (PDC)
 - *“increase support to Standards development”*
 - NCSD’s ***“Healthy level of involvement...”***
 - NCSD requested to **share best practices**

ANSI/ANS-8 series BKG

- 60+ years of guides and standards
- 1955 recognized that guidance was necessary as the Nuc. industry was expanding/maturing.
- 1955- Committee selected to prepare a draft “guide”
 - 1956: Issued classified report
 - 1957: TID-7016 published - unclassified version
 - 1961: TID-7016, Rev. 1
 - 1978: TID-7016, Rev. 2
 - 1996: LA-12808: “*in spirit*” Rev. 3 of TID-7016

ANSI/ANS-8 series BKG (1960-70)

- 1958-1962: Cluster criticality accidents
- 1st NCS Standard: N6.1-1964
 - Parent of ANSI/ANS-8.1
 - Prepared in 1958 – **adopted in 1964**
- By 1972:
 - 4 NCS related standards
 - 6 more being explored.
 - 8.1, 8.3, 8.5, 8.6, 8.7, 8.10 and parts of 8.19, 8.23, and 8.24 trace beginnings to the mid/late 1960s.
 - Some have been subsumed/withdrawn

Roy Reider [LA-4671 (1971)]

*Any history of safety usually recognizes the enormous influence that accidents have on the safety standards and procedures employed thereafter... These incidents should be of only historic interest now because the techniques employed then would not even be considered today. However, there are **powerful lessons to be learned from the early history of criticality safety** as well as the early history of criticality accidents.*

LA-13638 (2000)

In the U.S., technical guidance and administrative good practices were codified in a series of documents entitled Nuclear Safety Guide, beginning with the 1957 edition. Many of these same people then became involved in the development of American National Standards and then international standards. Similar actions developed in parallel in other countries, both those that had experienced criticality accidents and those that had managed to work with fissile materials without accidents. The marked decrease in the accident rate by the late 1960s was probably due to a combination of adherence to these newly codified regulations and guidance and upper management attention to this new hazard.

ANSI/ANS Consensus Process

- Intended to verify the principles of **openness and due process** have been followed
- that a **consensus of all interested stakeholder** groups has been reached.
- USA --- ANSI is the only accreditor of NCS related voluntary consensus standards of which the ANS is the developing organization.

ANSI Developments

- 1969 Adopted ANSI name
- 1970, a public review process was formalized and **ANSI BSR** created
 - Board of Standards Review (BSR) **implemented procedures**
 - Ensure standards met Institute guidelines
 - **Enhanced the credibility** of ANSI standards

ANSI/ANS Consensus Process

- Structure for ANS-8 series

NCSCC  **ANS-8**  **19 WGs**

- NCSCC – Responsible for preparation and maintenance of NCS related voluntary consensus standards
- Subcommittee ANS-8 – aims “to establish standards providing guidance in the prevention of nuclear chain reactions... for handling, storing, transporting, processing, and treating fissionable nuclides.”

ANS-8 Working Groups

- 19 working groups (18 issued; 1 development)
 - ~128 individuals, ~56 on multiple WGs
- Positions to facilitate involvement
 - Members, Observers/Liaisons, Reviewers, & Associate members
 - **Associate: increasingly becoming a preferred avenue for young/new members.**
 - Learn consensus process
 - Learn history/intent of a specific WGs recommendations/requirements

ANS-8 Working Groups cont.

- Approved standards can be adopted by nuclear facilities, regulators, etc.
- Working groups and the standards process
 - Provide “**neutral ground**” for regulators and licensees, NRC and DOE, to work together to establish good NCS practices.
 - Attempts to **balance** variable perspectives
 - Looking to ensure “**consistency** of use”

NCSD Involvement

- **1967:** ANS authorized formation of technical group for NCS
- **1969:** NCSD formally a division of ANS
 - Timing = Synergy between NCSD and ANSI/ANS-8
- NCSD supporter/instigator for some ANS-8 standards and NCS guides
- NCSD fosters the culture of standards use/development
 - ~750 members, ~17% participate on standards

NCSD support

- Tend to be recognized as separate activities
 - Several Generations have passed
 - Imbedded into the NCS culture
- Need to reinforce/acknowledge the relationship
 - Work with YMG and students to provide opportunities to be involved with both
 - Provide avenue for involvement, networking, ultimately knowledge transfer

NCSD support

- 1 Session/meeting dedicated to SubC-**ANS-8**
 - All WGs provide status
- Special sessions/tutorials
 - new and significantly revised standards
- NCSCC sponsored poster/panel session (~4 yr)
- Several WG meetings per ANS meeting
 - 2017 Summer meeting: 6 of 13
- Reporting on WG activities: NCSD Newsletter, Collaborate, Listserv
- NCSD Education Committee

- Part of the NCSD Culture
 - Intertwining has provided a strong group of volunteers willing to work on standards.
- Healthy perspective towards standards involvement within the NCS community
 - Viewed as an avenue that helps build a company's/individual's professional reputation
 - Part of professional development/ qualifications
 - Avenue for shaping and preparing future standards, and subsequently future regulations.

Conclusion

- Due to the application of the ANS-8 standards in today's regulatory environment it is important that the NCSD continues supporting the culture of standards involvement.
- Improvement in reaching younger members
 - Issues with expectations on speed of progress
 - Associate members



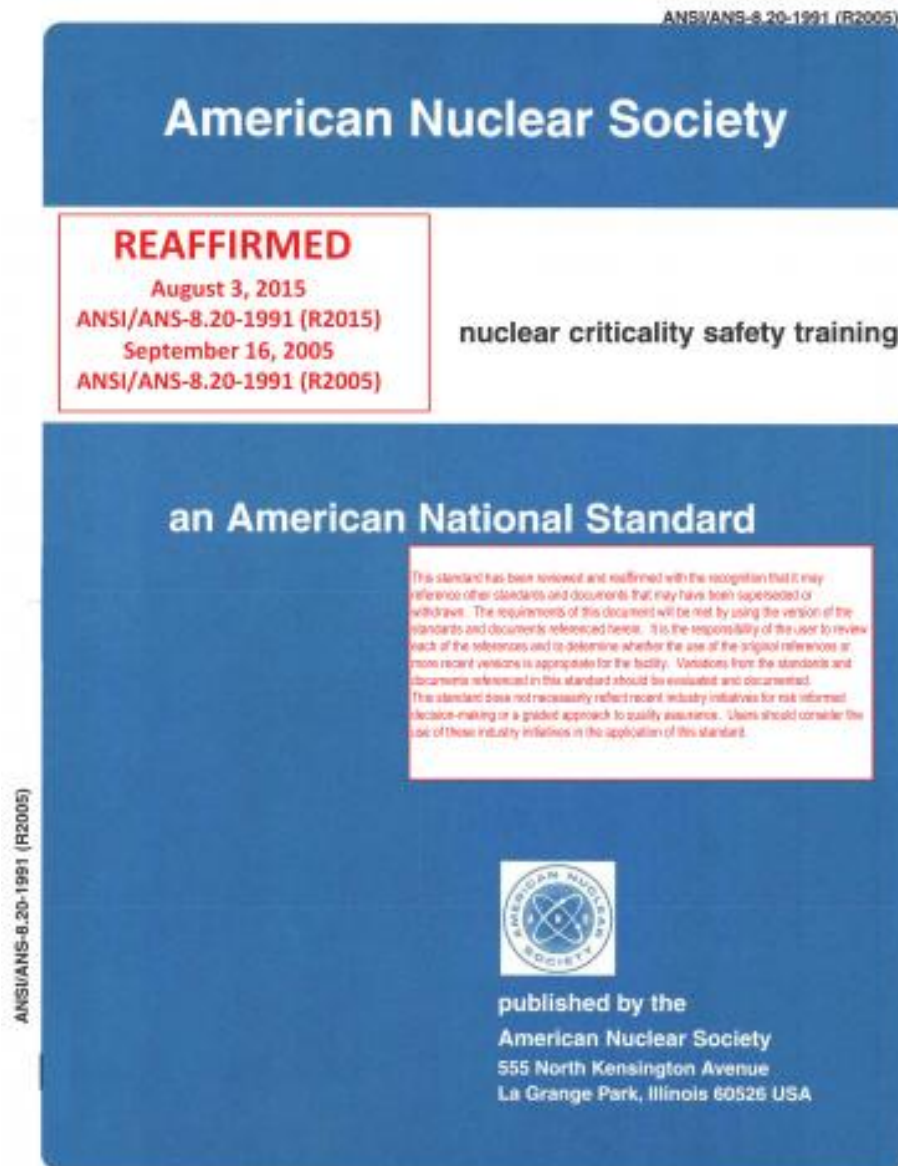
Working group interactions

Deb Hill

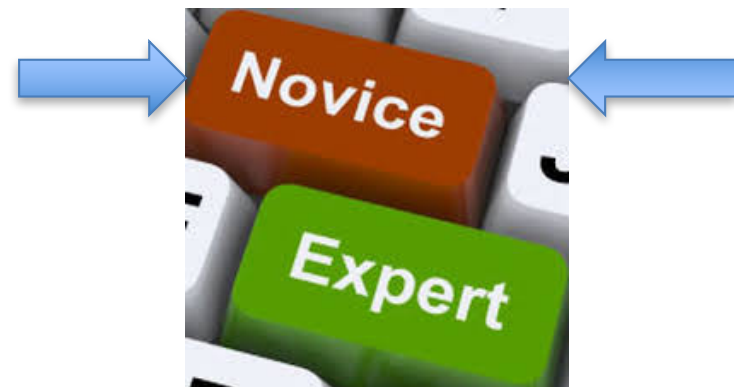
Workings and Interfaces Between WG Members from a WG Chair Perspective

Presented By : Deborah Hill

My Background ...



- WG Member of ANS-8.20 since ~ 2005 {Also Recent WG Member of ANS-8.22}
- WG Co-Chair since 2015 {With Dr. Ronald Knief}



What is a Working Group (WG) ... ?



Writing Committee for Standard {ANS Guidance is ~ 12 Full Members}

- Creates the Standard
- Makes Decision about Maintenance
- Responds to Requests for Clarification / Interpretation

Responsibilities of a WG Chair ...



Forms Group



Guides Schedule



Chairs Meetings



! DELEGATE !

Delegates Tasks



**Ensures
Consensus**



**Positive
Experience !**

- Onus on WG Members to Be Good Team Members –
e.g. Respond in Requested Timescales, Proactively Offer Support

What is Consensus Decision Making ... ?

- **“Consensus decision-making** is a decision-making process that not only seeks the agreement of most participants, but also to resolve or mitigate the objections of the minority to achieve the most agreeable decision. **Consensus** is usually defined as meaning both general agreement, and the process of getting to such agreement.”
Wikipedia
- It doesn't need to be everyone's first choice
- Consensus decision making is the most widely used method but Councils will also use voting to break an impasse.



Key Responsibility of Both ...

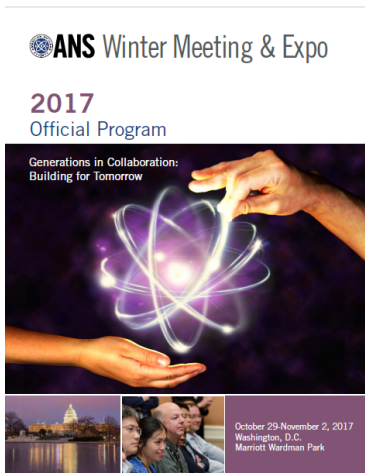


Understand the Importance of the Standards in Regulatory Space ...

Get it **Right**
First Time

- Unambiguous
- Easy to Follow for All
- Nothing More (or Less)
Than What's Required
{*Shall / Should / May*}

Typical Writing Process ...



Meetings

Discuss and Refine

{Reach Consensus Prior to Submission to SC}

Feeds Calendars Comments Ballots Action Items Discussions

All Documents						Actions
Name	State	Submitter	Group	Date		
ANS-8 Forum Agenda - Nov. 2, 2017	Final	Bowen, Douglas	SubC - ANS-8	2017-10-27		
2016 Annual Activity Report - Final.pdf	Final	Murdoch, Kathryn	Standards Com...	2017-10-27		
Schedule of Standards Meetings During 2017 ANS...	Final	Schroeder, Pat	Standards Com...	2017-10-19		
ANS-8 Minutes for Approval - June 2017	Final	Murdoch, Kathryn	SubC - ANS-8	2017-10-19		



Agenda *{Often with Provided Information}*

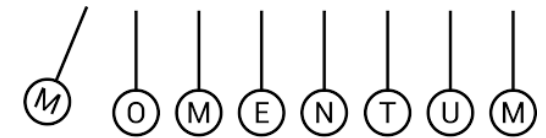
Important WG Participant Skills ...



**Understand Subject
Area**



Patience



Resilience



Attention to Detail
{Also Able to Step Back}



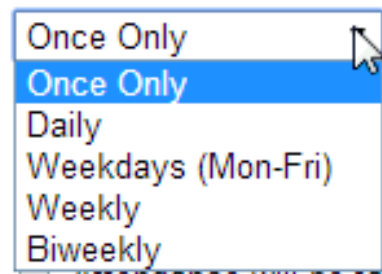
Respect
*{Don't Overdominate /
Consider Others Views}*



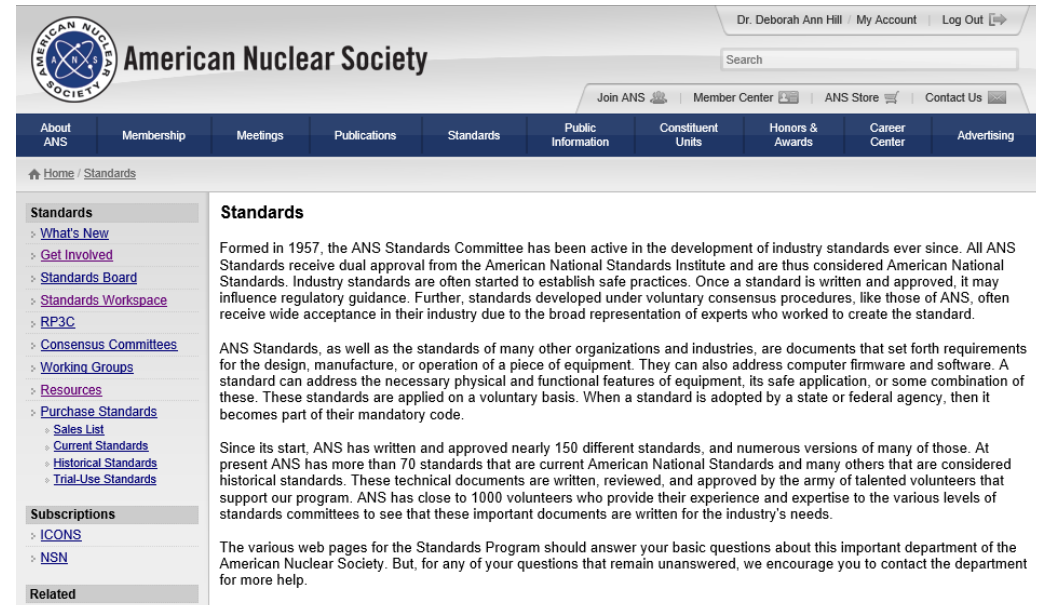
Proactive

Personal Lessons Learnt ... {aka "Where Has Deb Got It Wrong ?"}

* Meeting Frequency:



Keep Momentum
{Not 6 Monthly Meetings}



Understand Processes / Resources
{Suggestions:

- 1 = Coaching / Mentoring for New Chairs
- 2 = Straight-Forward Workflow Process
- 3 = More Streamlined YouTube Training}

Why Should YOU Get Involved ... ?



Important
for Industry



Networking

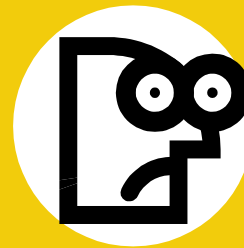
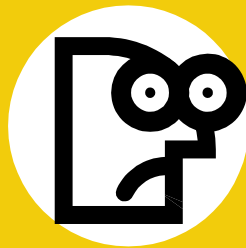


Influence the
Content

*Just Learning
Opportunities*

Learn from Others

No Contribution is Too Small or Too Inexperienced !



It's QUESTION TIME!!



Discussion about how ANS-8 standards are viewed compared to other standards

Larry Wetzel



ANS-8 Compared to Other Standards

- Many of the reactor focus standards were developed in a prescriptive approach.
- ANS-8 is focused on preventing a criticality accident.
 - ANS-8 is what to do, not how to do it.
- SB is pushing Risk Informed Performance Based (RIPB) standards.
 - ANS-8 is Risk Informed. Criticality is will kill people.
 - ANS-8 is Performance Based.



Risk Informed Performance Based

- A **prescriptive** requirement specifies particular features, actions, or programmatic elements to be included in the design or process, as the means for achieving a desired objective.
- **Performance-based** requirement relies upon measurable (or calculable) outcomes (i.e., performance results) to be met, but provides more flexibility to the licensee as to the means of meeting those outcomes.



Risk Informed Performance Based

1. Focus attention on the most important activities,
2. Establish objective criteria for evaluating performance,
3. Develop measurable or calculable parameters for monitoring system and licensee performance,
4. Provide flexibility to determine how to meet the established performance criteria in a way that will encourage and reward improved outcomes, and
5. Focus on the results as the primary basis for safety decision-making.



How to get involved

Doug, Larry, John & Deb



How to make contact

- Three levels of involvement
 - Observer
 - Associate Member
 - Member
- Fill out a Standards Volunteer Form
<http://www.ans.org/standards/involved/>
- Talk to the WG Chair



You will be added to the Standards Workspace which allows WG chairs to add you as a working group member

Are there any
questions?

