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# Advanced Reactor Stakeholder Public Meeting

November 5, 2020

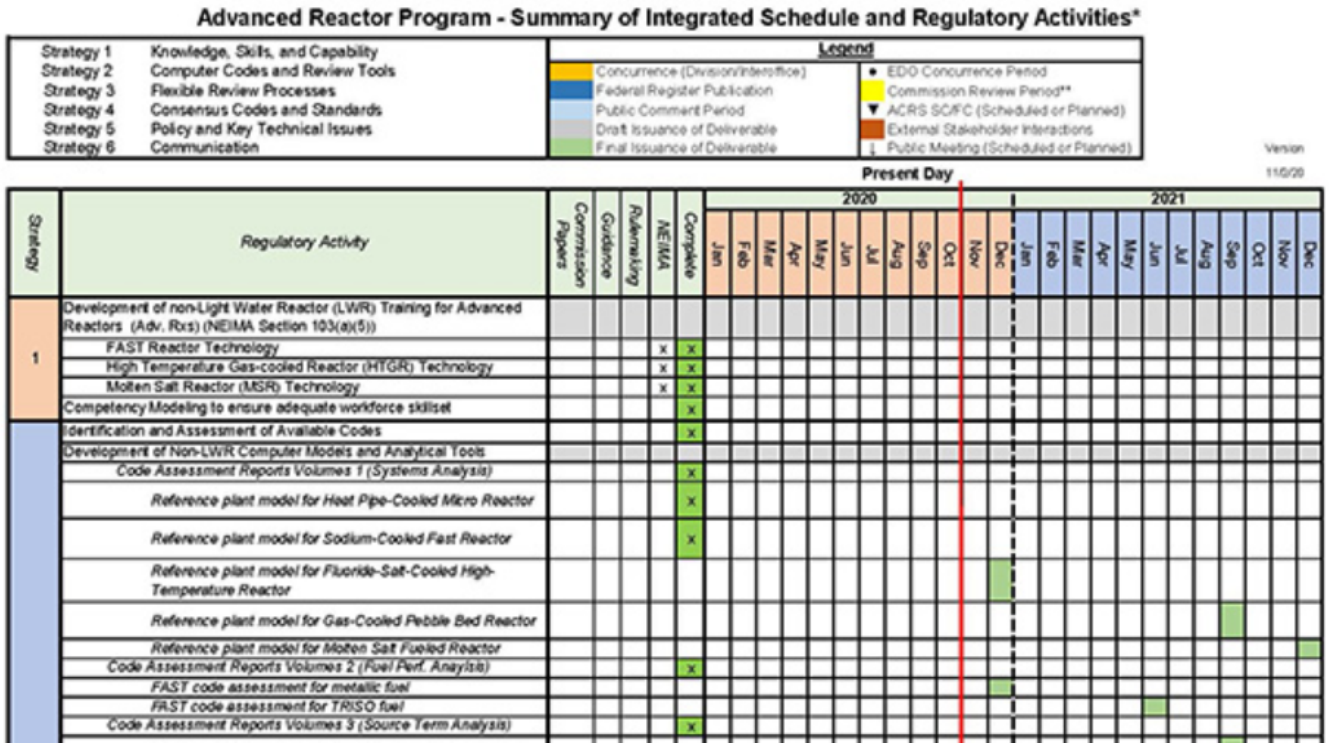
Microsoft Teams Meeting
Bridgeline: 301-576-2978
Conference ID: 841 066 007#

| Time | Agenda | Speaker |
|---|---|---|
| 10:00 - 10:20 am | Opening Remarks | NRC |
| 10:15 - 10:30 am | Promoting Pre-application Engagement | A. Muniz, NRC |
| 10:30 - 11:00 am | Advisory Committee on Reactor Safeguards (ACRS) Lessons-Learned on New Plant Reviews | M. Snodderly, NRC |
| 11:00 - 11:30 am | Discussion of SECY-20-0093, Policy and Licensing Considerations Related to Micro-Reactors | A. Cubbage, NRC |
| 11:30 am - 12:00 pm | NEIMA Section 103(e), Report to Congress on Completing the Part 53 Rulemaking and Enhancing NRC Expertise Related to Advanced Reactor Technologies | J. Hoellman, NRC |
| 12:00 – 1:00 pm | BREAK | All |
| 1:00 - 1:15 pm | Status of NRC Review of ASME Section III, Division 5, High Temperature Reactors | J. Hoellman, NRC |
| 1:15 - 1:30 pm | Considerations for Streamlining NRC Endorsement of ASME Section III, Division I | I. Tseng, NRC |
| 1:30 - 1:45 pm | Update on Price-Anderson Act Considerations for Advanced Reactors | W. Reckley, NRC |
| 1:45 – 2:00 pm | Concluding Remarks and Future Meeting Planning | NRC/All |

# Advanced Reactor Integrated Schedule of Activities

## Advanced Reactor - Summary of Integrated Schedule and Regulatory Activities

### Summary of Integrated Schedule and Regulatory Activities (updated 11/02/2020)




https://www.nrc.gov/reactors/new-reactors/advanced.html

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# Draft White Paper - Preapplication Engagement to Optimize Application Reviews

**Adrian Muniz, Project Manager**
Advanced Reactor Licensing Branch

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# Purpose

- Provides information to advanced reactor developers on the benefits of robust preapplication engagement in order to optimize application reviews.
- Encourages pre-application interactions with advanced reactor developers to provide stability and predictability in the licensing process through early identification and resolution of technical and policy issues that would affect licensing.
- Proposes a set of pre-application activities that, if fully executed, will enable staff to offer more predictable and shorter schedules and other benefits during the review of an advanced reactor license application.

# Pre-Application Engagement

- NRC staff applied a graded approach to identify key safety and environmental licensing areas for pre-application engagement with advanced reactor developers
  - Topical Reports - definitive findings
  - White Papers, Audits and Meetings – feedback and staff awareness

# Benefits of Pre-Application Engagement

- Enhanced regulatory predictability
- Greater review efficiency
- More visibility for public on key topics
- Early engagement and interactions with ACRS and other agencies

# Benefits of Full Execution of White Paper Pre-Application Engagement

- Review schedule at least 6 months shorter than the generic schedules depending on the complexity of the design
- Acceptance review completed in two weeks, only addressing administrative aspects (e.g., proprietary review, making the application publicly available, and issuing notice of availability)
- Key Assumptions for shortened schedule
  - Timely Responses to Requests for Additional Information (RAIs)
  - No Substantive Changes to Application (unless driven by RAIs)
  - No Significant Design Changes (Pre-application vs Application)

# Stakeholders' Feedback

# Observations and Lessons Learned From ACRS Licensing Reviews

Mike Snodderly
Senior Staff Engineer
Advisory Committee on Reactor Safeguards
November 5, 2020

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# ACRS Lessons Learned

- The following comments are my own
- I do not speak for the Committee
- This presentation will summarize the Committee's letter, "Observations and Lessons Learned ACRS Licensing Reviews Relevant to Future Advanced Reactor Applications" October 2, 2020 (ML20267A655)

# References

- References are a comprehensive list of previous licensing reviews performed by the Committee
- Including letter reports on:
  - NuScale
  - past reviews of design certification and early site permit applications
  - new initiatives related to proposed non-light water reactor advanced reactor licensing
  - reviews of topical reports for advanced reactor designs

# Conclusions and Recommendations

- A cross-cutting approach should be adopted by the staff and ACRS for conducting effective safety reviews of future applications, focused by initial chapter-by-chapter reviews that identify open items and significant cross-cutting design issues

# Conclusions and Recommendations

- To avoid significant delays late in the review process, critical topical reports should be submitted and reviewed early, particularly methodology reports that underpin the design bases and accident analyses for advanced reactors

# Conclusions and Recommendations

- Staff should ensure that the completeness of proposed new reactor designs is sufficient to demonstrate that all structures, systems, and components (SSCs) important-to-safety are appropriately identified and to support requested exemptions and waivers from the General Design Criteria

# Conclusions and Recommendations

- The time period of transient and accident analyses should be continued to the extent necessary to ensure that applicants demonstrate an effective and reliable means to place the plant in a safe, stable condition, with no ongoing degradation

# Conclusions and Recommendations

- Complementary tools would provide a more effective licensing framework for advanced reactor design applications and their review:
  - critical deterministic safety examinations,
  - hazards analyses,
  - risk-informed methods,
  - demonstration testing, which could include a prototype

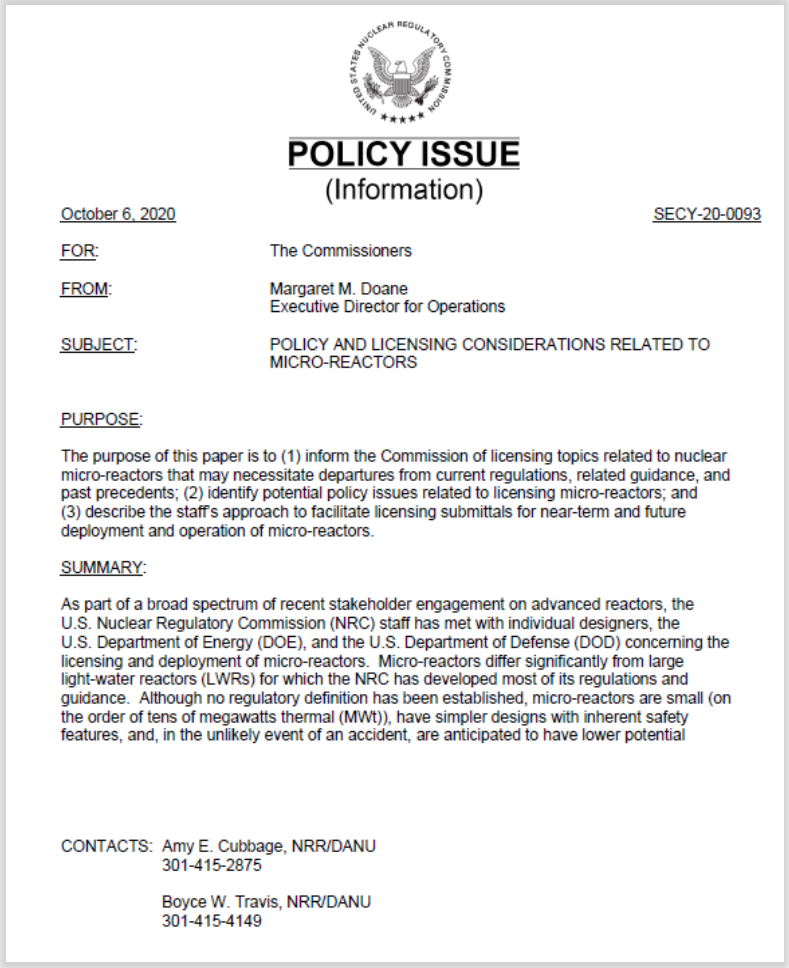
# Policy and Licensing Considerations Related to Micro-Reactors

Amy Cubbage, Senior Project Manager

Division of Advanced Reactors and Non-Power Production and Utilization Facilities (DANU), NRR

# SECY-20-0093

https://www.nrc.gov/docs/ML2012/ML20129J985.pdf



**POLICY ISSUE**
(Information)

October 6, 2020 SECY-20-0093

FOR: The Commissioners

FROM: Margaret M. Doane
Executive Director for Operations

SUBJECT: POLICY AND LICENSING CONSIDERATIONS RELATED TO MICRO-REACTORS

PURPOSE:

The purpose of this paper is to (1) inform the Commission of licensing topics related to nuclear micro-reactors that may necessitate departures from current regulations, related guidance, and past precedents; (2) identify potential policy issues related to licensing micro-reactors; and (3) describe the staff's approach to facilitate licensing submittals for near-term and future deployment and operation of micro-reactors.

SUMMARY:

As part of a broad spectrum of recent stakeholder engagement on advanced reactors, the U.S. Nuclear Regulatory Commission (NRC) staff has met with individual designers, the U.S. Department of Energy (DOE), and the U.S. Department of Defense (DOD) concerning the licensing and deployment of micro-reactors. Micro-reactors differ significantly from large light-water reactors (LWRs) for which the NRC has developed most of its regulations and guidance. Although no regulatory definition has been established, micro-reactors are small (on the order of tens of megawatts thermal (MWt)), have simpler designs with inherent safety features, and, in the unlikely event of an accident, are anticipated to have lower potential

CONTACTS: Amy E. Cubbage, NRR/DANU
301-415-2875

Boyce W. Travis, NRR/DANU
301-415-4149

The purpose:

(1) inform the Commission of licensing topics related to nuclear micro-reactors that may necessitate departures from current regulations, related guidance, and past precedents;
(2) identify potential policy issues related to licensing micro-reactors; and
(3) describe the staff's approach to facilitate licensing submittals for near-term and future deployment and operation of micro-reactors.

# Topics addressed in SECY Paper

- Security requirements
- Emergency preparedness
- Staffing, training, and qualification requirements
- Autonomous and remote operations
- Regulatory oversight
- Aircraft impact assessment
- Annual fee structure
- Manufacturing licenses and transportation
- Population-related siting considerations
- Environmental considerations

# Micro-Reactors

- Micro-reactors differ significantly from large light-water reactors (LWRs)
  - much smaller (tens of megawatts thermal or less)
  - simpler designs
  - inherent safety features
  - anticipated to have lower potential consequences
- Stationary and mobile concepts
  - SECY-20-0093 focuses on stationary micro-reactors
  - NRC is engaged with department of defense on mobile concepts
- SECY-20-0093 addresses commercial power reactors licensed under Section 103 of the Atomic Energy Act

# Overall Strategy for Licensing

- Near-term approaches
  - Exemptions, as appropriate
  - Guidance development
- Longer-term approach
  - Rulemaking

# Security Requirements

- Exemptions or alternative approaches can be considered under existing requirements
  - Similar review standards as nonpower utilization facilities could be considered
- Physical security rulemaking underway could provide alternatives to current physical security requirements
- Staff will evaluate physical security holistically within the Part 53 rulemaking

# Emergency Preparedness (EP)

- Proposed EP rule (10 CFR 50.160) would provide optional path for micro-reactors
- Potential exemptions beyond the alternatives available in the proposed rule could be evaluated on a case-by-case basis
- Staff is evaluating graded approaches to EP within Part 53 rulemaking

# Staffing, Training, and Qualification

- NUREG-1791 “Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)”
  - Guidance can be used to evaluate exemption requests
  - Predicated on human factors engineering program
- Alternative basis may be needed for micro-reactors
- Depending on the different licensing scenarios identified, policy issues may arise
- Will be evaluated within Part 53 rulemaking

# Autonomous and Remote Operations

- Staff has initiated development of a method for scaling the scope and depth of HFE reviews for non-LWR technologies such as micro-reactors (BNL contract)
  - Consider risk insights
  - Remote/autonomous operations
- Ongoing BNL work and stakeholder engagement will help frame this issue
- Staff evaluating the need for future Commission engagement on this topic.

# Regulatory Oversight

- Staff is developing an oversight program including micro reactors
  - leveraging lessons learned from development of construction inspection procedures for SHINE
  - focusing on areas with greatest impact on safety and overall risk
  - addressing factory fabrication and shorter construction timelines
  - Considering nonpower reactor inspection experience

# Aircraft Impact Assessment

- Considerations for micro-reactors:
  - Anticipated lower consequences
  - Smaller footprint of facility
  - Potential for underground location
- Can provide basis for meeting underlying purpose of the rule
  - Non-LWR differences were contemplated in statements of consideration
- Issue will be addressed in Part 53 in the longer-term

# Annual Fee Structure

- Rulemaking to 10 CFR Part 171 is envisioned
  - Considering variable annual fees similar to those for light-water small modular reactors
  - Additional consideration for micro-reactors
- Working group has been formed to develop options
- Additional stakeholder outreach planned
- NEI plans to submit white paper

# Manufacturing Licenses

- No near-term applicants identified
- If applications planned, then staff will assess need for guidance
- Some licensing scenarios such as transporting fueled reactors, could pose policy issues
- Manufacturing license provisions will be evaluated in the Part 53 rulemaking.

# Population-Related Siting Considerations

- Current guidance in Regulatory Guide 4.7 is not scalable
- Staff developed SECY-20-0045,"Population-Related Siting Considerations for Advanced Reactors"
  - Provided options to the Commission
  - Proposed revision to guidance
  - Considered micro-reactor attributes

# Environmental Considerations

- COL-ISG-29 “Environmental Considerations Associated with Micro-reactors,” was finalized in October (ML20252A076)
- Generic Environmental Impact Statement (GEIS) is underway
  - SRM-SECY-20-0020 directed rulemaking
- In longer-term, staff is also considering rulemaking to evaluate use of environmental assessment rather than environmental impact statement

# Next Steps

- Stakeholder engagement on specific topics, for example:
  - Staffing, training, and qualification requirements
  - Autonomous and remote operations
  - Annual Fee structure
- Continue to consider micro-reactors attributes in technology-inclusive guidance development and rulemaking
- Address design-specific issues, as needed

# Questions?

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# Nuclear Energy Innovation and Modernization Act (NEIMA) Section 103(e)

## Report to Congress on Completing the Part 53 Rulemaking and Enhancing NRC Expertise Related to Advanced Reactor Technologies

# NEIMA Section 103(e)(1) – due July 2021

(e) REPORT TO COMPLETE A RULEMAKING TO ESTABLISH A TECHNOLOGY-INCLUSIVE REGULATORY FRAMEWORK FOR OPTIONAL USE BY COMMERCIAL ADVANCED NUCLEAR REACTOR TECHNOLOGIES IN NEW REACTOR LICENSE APPLICATIONS AND TO ENHANCE COMMISSION EXPERTISE RELATING TO ADVANCED NUCLEAR REACTOR TECHNOLOGIES.—

(1) REPORT REQUIRED.—Not later than 30 months after the date of enactment of this Act, the Commission shall submit to the appropriate congressional committees a report (referred to in this subsection as the "report") for—

(A) completing a rulemaking to establish a technology-inclusive regulatory framework for optional use by applicants in licensing commercial advanced nuclear reactor technologies in new reactor license applications; and

(B) ensuring that the Commission has adequate expertise, modeling, and simulation capabilities, or access to those capabilities, to support the evaluation of commercial advanced reactor license applications, including the qualification of advanced nuclear reactor fuel.

# Required Evaluations

(4) REQUIRED EVALUATIONS.—Consistent with the role of the Commission in protecting public health and safety and common defense and security, the report shall evaluate—

(A) the ability of the Commission to complete a rule-making to establish a technology-inclusive regulatory framework for licensing commercial advanced nuclear reactor technologies by December 31, 2027;

# Required Evaluations (cont)

(B) the extent to which additional legislation, or Commission action or modification of policy, is needed to implement any part of the new regulatory framework;

(C) the need for additional Commission expertise, modeling, and simulation capabilities, or access to those capabilities, to support the evaluation of licensing applications for commercial advanced nuclear reactors and research and test reactors, including applications that use alternative coolants or alternative fuels, operate at or near atmospheric pressure, and use passive safety strategies; and

(D) the budgets and timeframes for acquiring or accessing the necessary expertise to support the evaluation of license applications for commercial advanced nuclear reactors and research and test reactors.

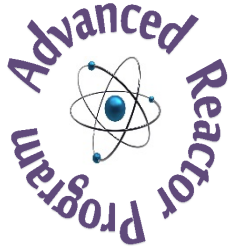
# Stakeholder Input

(2) COORDINATION AND STAKEHOLDER INPUT.—In developing the report, the Commission shall seek input from the Secretary, the nuclear energy industry, a diverse set of technology developers, and other public stakeholders.

(3) COST AND SCHEDULE ESTIMATE.—The report shall include proposed cost estimates, budgets, and timeframes for developing and implementing a technology-inclusive regulatory framework for licensing commercial advanced nuclear reactor technologies, including completion of a rulemaking.

# Next Steps

- Draft the Report required by NEIMA Section 103(e)
- Continue to have extensive stakeholder interactions on Part 53 rulemaking at dedicated public meetings
- Continue to engage with ACRS
- Reengage stakeholders at future Periodic Stakeholders Meeting



Advanced Reactor Stakeholder Public Meeting

# Break

*Meeting will resume at 1pm*

Microsoft Teams Meeting
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# NRC Review and Endorsement of ASME BPVC Section III, Division 5

# Background – ASME BPVC

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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

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- 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

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- 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

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- **PNNL** – PNNL Final Report available at ADAMS Accession No. ML20269A145

- **ORNL** – ORNL Final Report available at ADAMS Accession No. ML20269A125

- **NUMARK/EMC²** – All technical comments have been resolved. Final reports expected early November 2020.

- **ANL** – Final input expected mid-November 2020.

# ANL Expert Assistance

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- 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

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- The NRC staff recognizes that Idaho National Lab (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

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- 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

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- **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

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- **Task C, Elevated Temperature Metallic Components** (continued)
  - NUMARK/EMC$^2$
    - 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/EMC$^2$ (Technical Requirements)
- **Task E, Code Cases N-861 and N-862**
  - NUMARK/EMC$^2$ (All aspects)

# CONSIDERATIONS FOR STREAMLINING NRC ENDORSEMENT OF ASME SECTION III, DIVISION I

IAN TSENG
NRC

STAKEHOLDER MEETING
11/5/2020

The NRC is exploring ways to streamline our endorsement of ASME Section III, Division 1 to reduce regulatory burden, and to increase latitude and flexibility to new reactor applicants

# CURRENT PRACTICE

- Incorporation by Reference (IBR) of ASME Boiler and Pressure Vessel Code Section III, Division 1, "Rules for Construction of Nuclear Facility Components"
- Use of ASME Section III, Division 1 is mandated for Class 1, 2, and 3 components
- Endorsement is currently updated by rulemaking every two years

# EMBARK VENTURE STUDIOS

A diverse team brainstormed ideas and held three public meetings and one staff townhall to discuss:

- Improving clarity of 10 CFR 50.55a
- Improving process efficiency for the use of the ASME Codes and Code Cases
- Increasing flexibility to licensees in implementing their IST and ISI programs

There were differing views coming out of the EVS project as to:

- Whether Section III, Division 1 needs to be retained in the regulations
- What the periodicity for endorsement should be

# STREAMLINING CONSIDERATIONS

- Options to increase regulatory flexibility
- Assessment of the right method and periodicity of endorsement
- Once we're ready to talk about this we'll engage with stakeholders further

# EXPRESSED STAKEHOLDER FEEDBACK

ASME sent the NRC a letter that expressed clear preference for:

- Endorsement of Section III, Division 1 not to exceed a "two year cycle" to support their stakeholders
- Use of whatever endorsement methodology best achieves this objective

UNMUTE

# STAKEHOLDERS:
# WE WANT TO HEAR YOUR THOUGHTS!

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# Price-Anderson Act and Financial Protection

# Price-Anderson & Advanced Reactors

- Financial protection as potential policy issue
  - See SECY-10-0034, "Potential Policy, Licensing, and Key Technical Issues for Small Modular Nuclear Reactor Designs," and SECY-11-0178, "Insurance and Liability Regulatory Requirements for Small Modular Reactor Facilities"
- Periodic Report to Congress
  - The Commission and the Secretary shall submit to the Congress by December 31, 2021, detailed reports concerning the need for continuation or modification of the provisions of this section, taking into account the condition of the nuclear industry, availability of private insurance, and the state of knowledge concerning nuclear safety at that time, among other relevant factors, and shall include recommendations as to the repeal or modification of any of the provisions of this section.

# Recent Activities

- Financial protection requirements discussed during several periodic stakeholder meetings, with significant focus during meeting on November 2, 2017 (see meeting summary ADAMS Acc. No. ML17319A210)
- Issue left as no actions planned by stakeholders and NRC staff to prepare Commission paper for report to Congress and engage stakeholders during its development
- Staff and contractor have been preparing report to Congress and related Commission paper with plans to complete in 2021

# Financial Protection Summary

- Regulatory Requirements:
  - Less than 10 Mwt[1] (see 10 CFR 140.11(1)-(3))
    - $2.5M for 1-10Mwt
  - Greater than 100 Mwe (see 10 CFR 140.11(4))
    - Primary (maximum amount from private sources)
    - Secondary (with provisions for multiunit 100-300Mwe)
  - 10 Mwt–100MWe[1] (see 10 CFR 140.12)
    - x = $(\$185 * Kwt) * Population\ Factor$
    - Not to exceed $74M

1: "..the Commission may establish a lesser amount on the basis of criteria set forth in writing, which it may revise from time to time, taking into consideration such factors as the following: (A) the cost and terms of private insurance, (B) the type, size, and location of the licensed activity and other factors pertaining to the hazard, and (C) the nature and purpose of the licensed activity." Price-Anderson also requires that the NRC "agree to indemnify and hold harmless the licensee and other persons indemnified, as their interest may appear, from public liability arising from nuclear incidents which is in excess of the level of financial protection required of the licensee." (up to $500M)

# Path Forward

- Considering implications of advanced reactors on Price-Anderson
  - Commission Policy is that advanced reactors will provide the same degree of protection as current reactors, with expectations of enhanced margins of safety
  - No immediate actions are called for to address the possibility that reduced risks posed by advanced reactors might warrant changes to the current insurance and liability requirements established by the Price-Anderson Act.

# Future Meeting Planning and Open Discussion

| 2020-21 Tentative Schedule for Periodic Stakeholder Meetings |
| --- |
| November 18, 2020<br>(Part 53) |
| December 10, 2020<br>(TICAP/ARCAP) |
| January 21, 2021<br>(Periodic) |




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