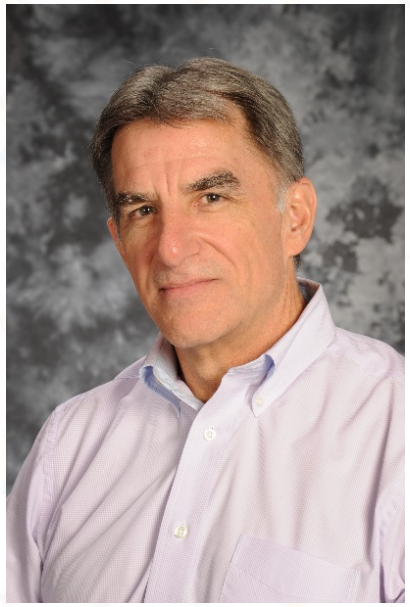
Regulatory Considerations when Developing a Deployment Path

Jim Kinsey

GAIN

GAIN Gateway for Accelerated Innovation in Nuclear



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Mr. Kinsey has over 40 years of experience in the nuclear industry, including significant commercial experience in licensing, regulatory affairs, system engineering and major project management. He has managed numerous industry licensing and regulatory affairs projects, including the licensing of GE-Hitachi's ESBWR advanced reactor design, and the development of successful recovery and re-start programs for commercial nuclear plants previously placed on the NRC's "Watch List". He also has considerable experience in supporting "day-to-day" commercial nuclear facility operation, including engineering management of safety systems, plant power uprate projects, outage management, and as a primary utility interface with both federal and state regulators.

At the Idaho National Laboratory, he is responsible for licensing strategy development and implementation in direct support of industry's near-term deployment of advanced nuclear technologies. In this role, he has led the development of a series of DOE/industry proposals resulting in key Commission policy changes and related updates to NRC's regulatory guidance, including acceptance of performance-based functional containment approaches, and the use of a risk-informed and performance-based approach for plant event identification and assessment.

Mr. Kinsey holds a Bachelor of Science degree in Nuclear Engineering from the University of Cincinnati and is a Licensed Professional Mechanical Engineer. He has also previously received a Senior Reactor Operator Certification for Boiling Water Reactors.

3 Major “Eras” of Regulatory Framework Development

CORRECTING for Operational Experience *1980 - TODAY*

DEVELOPING the Independent Regulator *1975 -1979*

SEARCHING for the Regulator’s Role *1954 - 1975*

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Summary of 3 Watershed Eras – Emerging Regulatory Role

1) Searching for the Regulator's Role
   - Atomic Energy Commission (AEC) is in the challenging position of being both nuclear industry promoter and regulator
   - Increased period of public activism
   - Safety reviews focused on power control and containment design, based on smaller demonstration reactor experience
   - Challenges included quality issues in numerous areas (design, hardware, construction, operations)

2) Developing the Independent Regulator
   - New agency establishing rules and guidance to implement its Independent Regulator role
   - In parallel, industry pushing Nuclear Regulatory Commission (NRC) for prescriptive requirements – "tell us what you want"
   - Creates an inappropriate paradigm of "if it's licensed, it's safe"

3) Correcting for Operational Experience
   - Design weaknesses
   - Various plant events highlighted the importance of operating practices, material selections, personnel training, etc.
   - Industry ramped up efforts to assess and improve in these areas
   - In parallel, NRC expanded the light water reactor (LWR)-centric regulatory framework and its oversight of day-to-day plant performance

Regulatory Framework "Patchwork"

- These watershed periods, and more recent updates, have resulted in what some refer to as a "patchwork" of regulatory requirements and implementing guidance that have been "added-on" or modified as time moves on

- The Regulatory Framework includes four major elements, and we covered 1, 2, & 4 today:
  1. Commission policy
  2. Regulations and associated regulatory guidance
  3. Technology-specific licensing technical requirements for implementing those rules
  4. Processes used by NRC to review license applications and assess plant operations

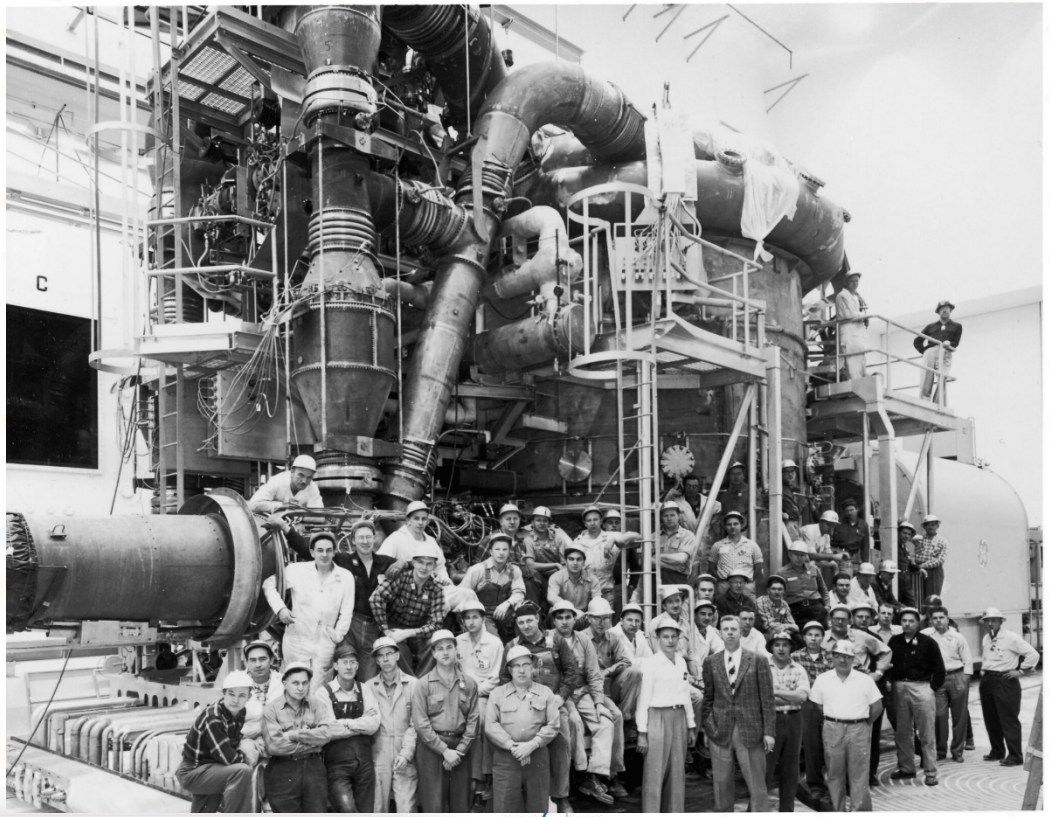
- Item 3 is generally outside the scope of this technology-inclusive webinar
  - This category of includes establishing the technical basis and associated requirements for topics such as; fission product transport in sodium and molten salts, performance limits for TRISO particle fuel, design limits for advanced materials
  - Multiple efforts underway among reactor developers, DOE (including its national laboratory and university partners), NRC research

Three Fundamental Safety Functions

- All commercial reactor facilities must establish an underlying and foundational safety basis (or "Safety Case")

- The Safety Case establishes how the operation of the reactor design addresses the following three universally recognized fundamental safety functions when responding to a broad range of expected off-normal events and postulated accidents:
  - Control of reactivity (power control)
  - Reactor heat removal
  - Containment of radionuclides

- The regulatory requirements, guidance, and precedents associated with the existing regulatory framework "patchwork" generally all have some connection and/or underlying basis that ties back to one of these three fundamental functions



Navigating the Patchwork – Safety Case First, Then Licensing

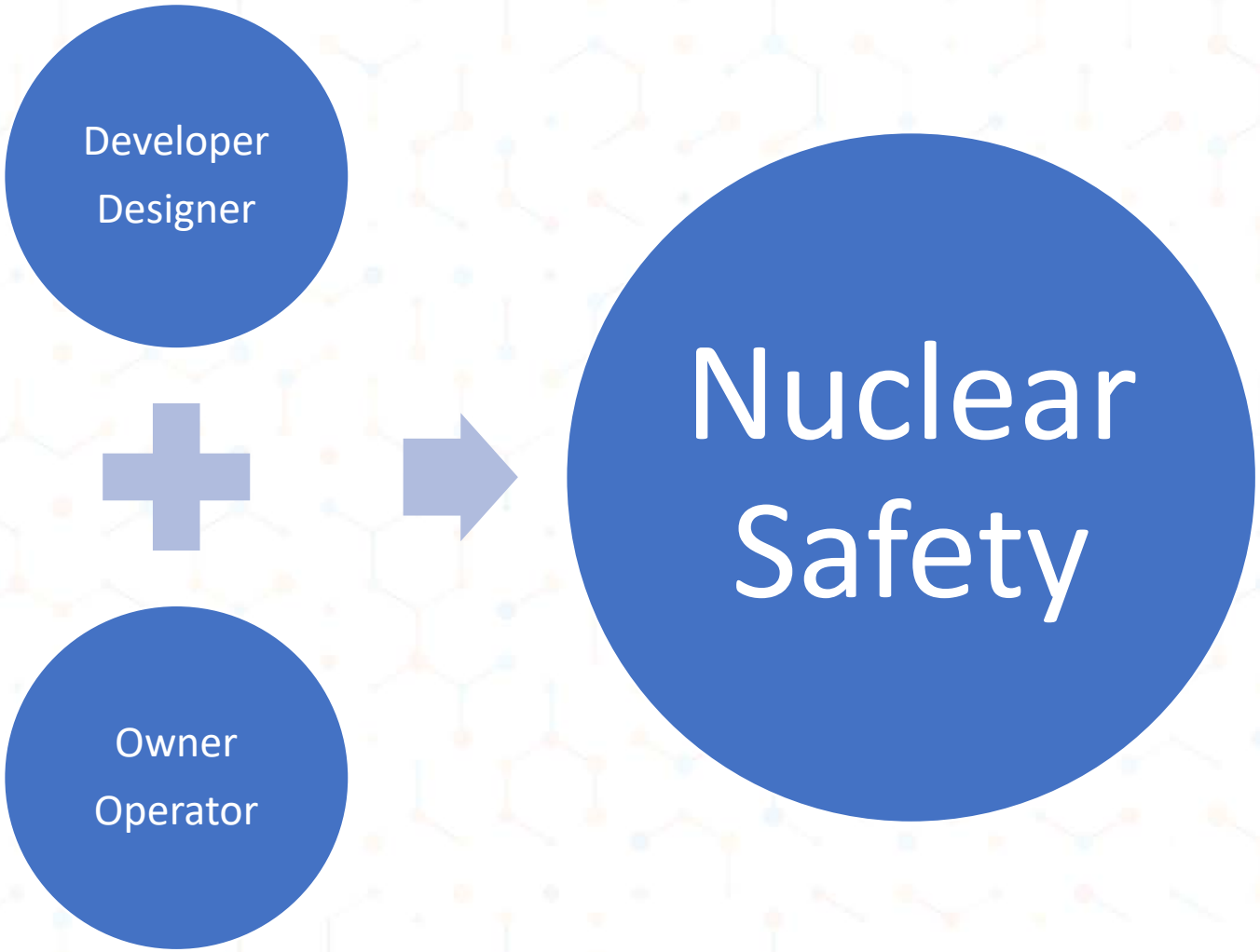
- History has highlighted that a primary focus on establishing a robust safety case for a reactor facility is the most effective approach to efficient licensing. The basic sequence:
  - Design the plant to provide robust safety while meeting owner/operator needs
  - Assess and prove that the safety case addresses NRC requirements with margin
  - Communicate this proof in a license application
  - Get licensed by NRC
  - Operate and maintain the facility inside the bounds of the safety case and associated licensing basis, maintaining safety and regulatory margins

- In concept, fulfilling the regulatory requirements (which are minimum expectations) and a successful license application review should be straightforward, if the design is robust.

- It should be noted that fulfilling regulatory requirements and obtaining an operating license do not make a reactor safe. Further, the operating phase can introduce challenges to the safety case, such as:
  - Unforeseen material degradations
  - Unexpected plant configurations or operating practices
  - Inadequate corrective action or maintenance programs

NRC License Applications & Responsibilities

- Adequate design for nuclear safety is the responsibility of the developer/designer, with implementation and oversight by the owner/operator
- The owner is responsible for the safety of the reactor, and protection of the public and environment, in addition to requirements provided by the regulator



Key Points for Successful Pre-application Engagement

- Pre-application interactions and the Regulatory Engagement Plan (REP) concept REP documents the agreement between Applicant and the NRC staff regarding:
  - Licensing approach
  - Resolution of issues
  - Schedule expectations
- Provides opportunities for segmenting parts of the review so that NRC staff feedback and open issue closure can be accomplished in a “staged” approach
  - Use of topical reports
  - Meetings & audits
- And, as discussed in Webinar # 1, it’s noted that NRC’s role is to review and confirm the applicant’s safety assessment and conclusions
  - It’s not NRC’s role to “tell us up-front what will pass,” although accepted approaches and related acceptance criteria are provided in most key areas

Attributes of Effective NRC Engagement

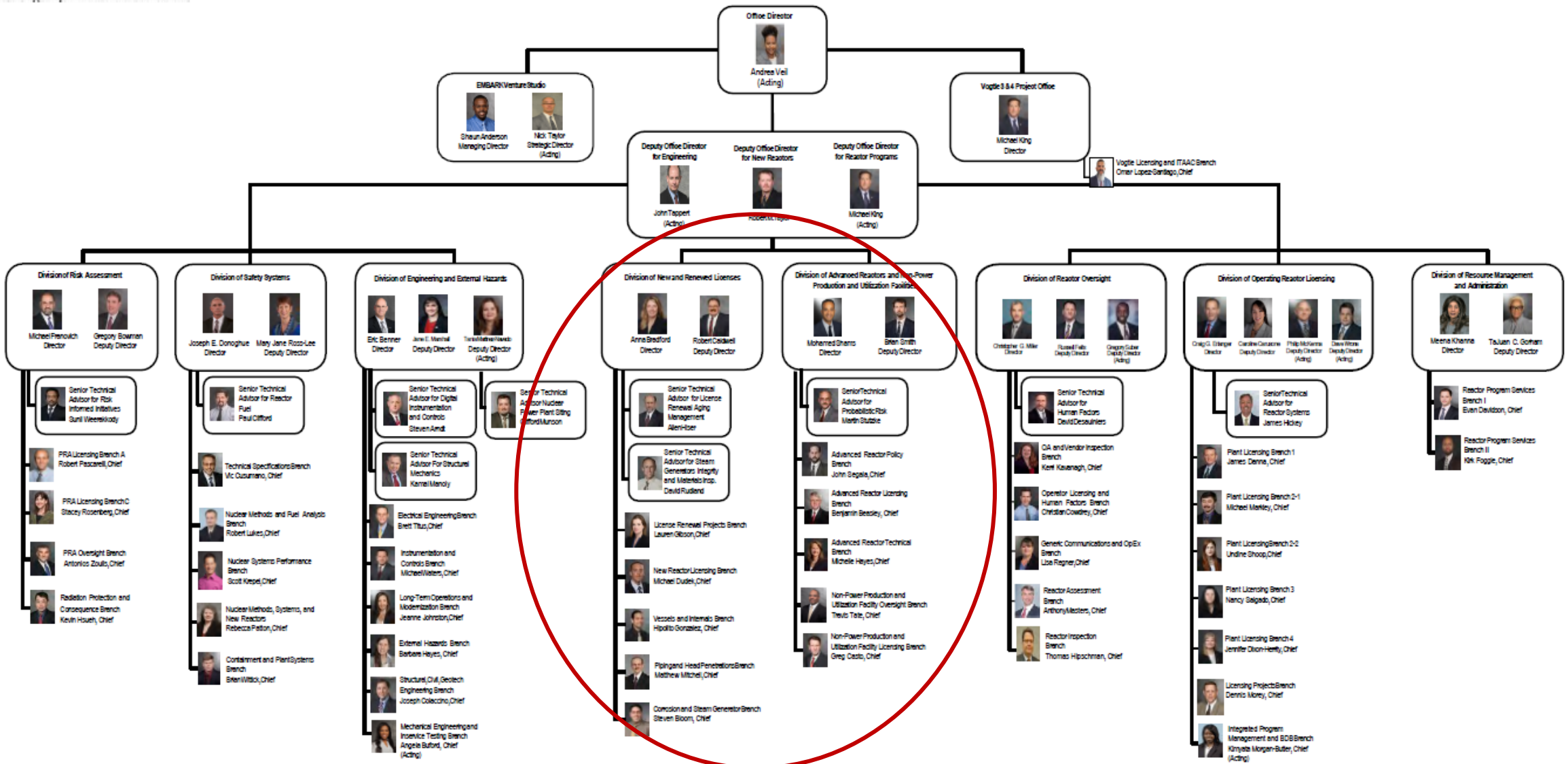
- Regulatory Engagement Plan concept: “everyone understands what’s coming”
  - Assists NRC in establishing the necessary resources for a timely review
- Develop and provide complete and accurate information
  - Clearly establish and describe the robust safety case for the design
  - Understand the review criteria and guidance that NRC will implement
  - Pre-Application Readiness Assessment (6 months prior to application submittal)
- Establish and maintain effective communications – defined points-of-contact

The expected outcome is improved license review efficiency, which translates to lower costs and shorter review schedules

NRC-NRR Organization and Primary Interface Areas

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Office of Nuclear ReactorRegulation



NRC Guidance – Areas of Initial Consideration

Technical / Environmental	Generic Communications	Guidance for Staff
• NUREGs • Regulatory Guides • Interim Staff Guidance (ISG)	• Bulletins • Generic Letters • Information Notices • Regulatory Information Summaries (RIS)	• Standard Review Plan (SRP) LWRs • Management Directives • Office Instructions

Examples of Advanced Reactor Regulatory Guidance

NRC Regulatory Guide 1.232: *"GUIDANCE FOR DEVELOPING PRINCIPAL DESIGN CRITERIA FOR NON-LIGHT-WATER REACTORS"*

- License applicants must address the General Design Criteria (GDC) (Appendix A to 10 CFR 50)
- The regulation reflects that the LWR-based GDC "*are also considered to be generally applicable to other types of nuclear power units and are intended to provide guidance in establishing the principal design criteria for such other units*."
- The DOE and NRC established a joint initiative to address this key area of regulatory uncertainty for non-LWRs
  - Multiple DOE workshops with industry while formulating proposed adaptations and interpretations for non-LWR content and approach
  - Addressing the 3 Fundamental Safety Functions within the context of the criteria was a key area of focus
  - Multiple NRC public meetings with stakeholders while developing its response to the DOE-proposed content
- NRC issued Regulatory Guide 1.232 as one acceptable approach for adapting the GDCs to non-LWRs

Draft Regulatory Guide: *"Performance-Based Emergency Preparedness for Small Modular Reactors, Non-Light-Water Reactors, and Non-Power Production or Utilization Facilities"*

- Provides insight into key considerations related to the expected content of the pending emergency planning rule change
- Reflects insights and considerations from the completed Clinch River application review

License vs. Licensing Basis

Operating License (5-10 pages)

- Provides authority to load fuel and operate the facility at its licensed power level
- License conditions
  - Technical Specifications
  - Environmental Protection Plan
  - Other Conditions

Licensing Basis

- Broad set of information that NRC used to assess the application and issue the license
  - Final Safety Analysis Report
  - Material "Incorporated by Reference"
  - Commitments: Other Promises Made in Writing to NRC

What's Planned for the Next Webinars in this Series?

Webinar #3: Identifying and Managing Regulatory Risk on the Paths to Successful Deployment

- Available NRC licensing pathways ("one-step," "two-step") and key areas of regulatory consideration within each pathway
- Available methods for protecting information within the licensing process
- Identifying and assessing regulatory and project risk when establishing the licensing pathway for a deployment project

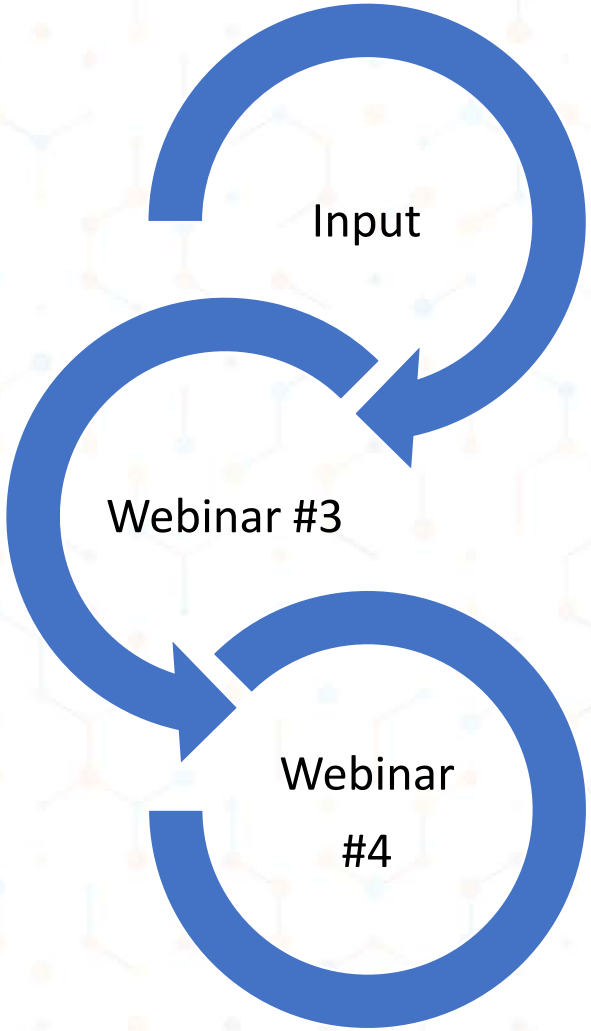
Webinar #4: Establishing New Routes to our Regulatory Future

- Regulatory changes and enhancements going forward
- Insights and inputs from industry

What More Can We Say?

We'd appreciate input from today's attendees regarding this webinar series and planned topics, so that we can adjust accordingly.

Send input to: GAINEvents@INL.gov



Additional Information: Summary of NRC-DOE MOU for GAIN

- In addition to this webinar series, GAIN can provide insights and support in addressing a range of industry stakeholder questions and challenges associated with advanced technology licensing.

- A DOE-NRC Memo of Understanding (MOU) was established in conjunction with GAIN.
  - MOU Purpose: Assist industry stakeholders as they work to Understand and navigate the regulatory process
  - DOE is the lead for implementation, coordinated via GAIN
  - NRC is responsible for assisting DOE in providing stakeholders with accurate current information

- Stakeholders can review FAQs and request information or ask questions about the NRC's regulatory requirements and activities

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