

Nuclear Innovation Alliance Licensing Efficiency Workshop

Workshop Summary Report



Authors:

Patrick White, NIA

NIA Staff

Acknowledgements:

This report is the product of presentations, discussions, feedback, and iteration with advanced reactor developers, power companies, non-governmental organizations, and other stakeholders at the Nuclear Innovation Alliance (NIA)'s September 15, 2022 workshop on improving Advanced Reactor Licensing Efficiency. The Advanced Reactor Licensing Efficiency Workshop was held in accordance with Chatham House Rules which allows sharing of workshop discussions only without direct attribution of specific comments. This report summarizes the major insights from the Advanced Reactor Licensing Efficiency Workshop and is intended to facilitate follow-on discussions with policymakers and stakeholders who were unable to participate in the original workshop. The summary and recommendations presented in this report do not necessarily reflect the views of any specific workshop participant but instead are NIA's synthesis of the workshop presentations and insights.

Please contact Patrick White (pwhite@nuclearinnovationalliance.org) with questions, comments, and feedback.

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Executive Summary

Effective and efficient licensing of advanced nuclear reactors is critical to their successful development and deployment as a clean energy source. Ensuring efficient licensing is a multi-variable problem that requires alignment of numerous stakeholders and effective navigation of technical, regulatory, and legal processes and procedures. Stakeholders including the Nuclear Regulatory Commission (NRC), advanced reactor developers, reactor license applicants (e.g., utilities, municipalities, and other energy users), non-governmental organizations (NGOs) and think tanks, and members of the public all have important roles to play in the licensing process. Achieving stakeholder alignment on both technical and policy issues is critical to the timely, predictable, and efficient licensing of advanced nuclear reactors. Enhancing application submissions, applicant and regulator interactions, and communication about licensing processes facilitates an effective application review process and enables applicants and regulators to focus on the issues most significant to public health and safety.

The Nuclear Innovation Alliance (NIA) hosted a workshop on improving Advanced Reactor Licensing Efficiency on September 15, 2022 to foster stakeholder conversation on this important subject. The workshop was designed as a forum to exchange lessons learned and expand on ideas for making the licensing of advanced nuclear reactors more effective. NIA convened stakeholders from both industry and public interest groups to share general experience and insights from prior licensing activities, best practices for licensing engagement and activities, and emerging best practices for new reactor licensing. The overarching goal of the workshop was to enable participants to collaboratively identify potential roadblocks or challenges to effective advanced reactor licensing and focus on solutions to address them.

The Advanced Reactor Licensing Efficiency Workshop was held in accordance with Chatham House Rules which allows sharing of workshop insights only without direct attribution of specific comments. This report summarizes the major discussions from the Advanced Reactor Licensing Efficiency Workshop and is intended to facilitate follow-on discussions with policymakers and stakeholders who were unable to participate in the original workshop. The summary and recommendations presented in this report do not necessarily reflect the views of any specific workshop participant but instead are NIA's synthesis of the workshop presentations and discussions.

A recurring theme throughout workshop discussions was that both applicants and NRC need to prioritize effective and consistent communication at all levels of staff and management to help ensure effective licensing. Communication is key to an efficient licensing process because it enables applicants to develop and submit license applications that facilitate effective staff reviews, helps applicants and NRC staff reach timely resolution on question or issues that arise during review, and enables NRC management and Commission to help resolve policy questions and ensure staff accountability throughout licensing reviews. More effective communication between applicants and NRC at all levels combine to create a more efficient licensing process for all advanced reactor designs.

Recommendations on five major topic areas emerged from discussions during and after the Advanced Reactor Licensing Efficiency Workshop:

1. Achieving and maintaining alignment between applicant and NRC on the licensing review process and creating clear lines of communication
2. Preparing the application content and performing the safety review based on clear, definitive, and consistent expectations
3. Ensuring efficient use of staff resources is critical as the NRC receives an increasing number of advanced reactor license applications
4. Developing processes to identify and resolve challenges encountered during reviews
5. Ensuring uniform understanding and expectations on the role of specific NRC offices and committees in the licensing process

Detailed recommendations on each topic for applicants, NRC staff and management, and the NRC Commission are provided in this report. Specific detailed examples from the workshop and recommendations from participants are also highlighted as “focus areas” for each topic and help provide additional insights on best practices for efficient licensing.

This report is intended to facilitate on-going discussion with stakeholders including NRC staff and management, NRC Commission, advanced reactor developers, advanced reactor license applicants, NGOs, policymakers, and members of the public on how to make the licensing of advanced reactors more efficient and effective. Rapid deployment of advanced nuclear energy, renewable energy sources, and other low-carbon energy sources at scale is critical to meeting our clean energy needs, and efficient licensing of advanced nuclear energy is key to deployment.

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Workshop Background

The Nuclear Innovation Alliance (NIA) Advanced Reactor Licensing Efficiency workshop was a follow-on activity from the NIA's December 2021 report "[Promoting Efficient NRC Advanced Reactor Licensing Reviews to Enable Rapid Decarbonization](#)". This report provided recommendations for both advanced reactor license applicants and the NRC on how to improve the efficiency and effectiveness of advanced reactor licensing reviews. Efficient and effective licensing is defined as licensing processes that are:

- Mission-focused (fulfilling the NRC statutory mission to protect public health and safety, to Promote the common defense and security, and to protect the environment)
- Timely (e.g., providing licensing decisions on a timeline that facilitates commercial deployment)
- Cost-effective (avoiding excessive staff or applicant costs to resolve application questions)
- Efficient (making best use of staff and applicant time and personnel resources)
- Predictable (meeting established applicant expectations for duration, cost, and requirements for both one-time and repeatable licensing processes)
- Transparent (ensuring applicant and public understanding of regulatory processes and regulatory information)

The report and the subsequent engagement with various stakeholders highlighted the importance of opportunities for stakeholders to share general insights from prior licensing activities, best practices for licensing engagement and activities, and emerging best practices for new reactor licensing.

NIA's 2021 Licensing Efficiency Report Summary

The Nuclear Regulatory Commission (NRC) expects to review license application documents for up to a dozen advanced reactor designs in 2023 and continue pre-application engagement with an additional dozen companies. Efficient and effective regulation will be key to the successful commercialization of advanced reactors and NIA's December 2021 report focused on the identification of potential barriers to efficient licensing and provided recommendations on how to improve the efficiency of licensing reviews. The NIA report identified a programmatic goal to reduce application reviews to 18-24 months through a combination of process and operational improvements. The report identified four major categories of recommendations for applicants and the NRC:

- Rethinking pre-application engagement
- Restructuring safety review processes
- Providing for early Commission policy involvement
- Establishing effective communication during review

Detailed recommendations were provided for each of the major recommendation categories, with specific recommendations to both applicants and the NRC to improve the licensing process. A detailed summary of the December 2021 NIA report recommendations is provided in Appendix B.

Advanced Reactor Licensing Efficiency Workshop Motivation and Structure

The December 2021 NIA report served as the substantive basis for NIA engagement in 2022 with different stakeholders on efforts to improve the efficiency of advanced reactor licensing reviews. Discussions with NRC staff and management and advanced reactor developers, however, revealed

perception gaps on the effectiveness of existing licensing processes and expectations for how to effectively navigate different stages of the NRC licensing review process. Additionally, there were significant differences between the licensing experiences and strategies of advanced reactor developers. These gaps illustrated the need for a forum to exchange lessons learned and expand on stakeholder ideas for making the licensing of advanced nuclear reactors more effective. After discussions with stakeholders, NIA determined that a Chatham House Rules workshop would most effectively facilitate sharing lessons learned by enabling the open discussion of both positive and negative experiences with the licensing process.

NIA convened stakeholders from industry and public interest groups to share general insights from prior licensing activities, best practices for licensing engagement and activities, and emerging best practices for new reactor licensing. The goal of the workshop was to enable participants to collaboratively identify potential roadblocks or challenges to effective advanced reactor licensing and focus on solutions to address those barriers. The workshop was held at the Bethesda North Marriott Conference on September 15, 2022. A complete list of workshop participants is provided in Appendix A of this report.

The workshop was centered around three session topics that were identified as cross-cutting for all advanced reactor licensing activities:

- Session Topic 1: Enhancing communication and project management
- Session Topic 2: Effectively utilizing regulatory engagement plans and optimizing pre-application interactions
- Session Topic 3: Ensuring effective and efficient safety evaluation reviews

Each session consisted of speakers providing opening remarks on their experiences and views on the specific topic followed by an NIA-moderated discussion among participants on the topic. The workshop also featured opening remarks from NRC Commissioner Jeff Baran and a closing roundtable discussion on lessons learned. NRC staff and management did not participate in this workshop with the understanding that a summary report would be developed to facilitate public discussion on the workshop discussions and findings.

Workshop Findings

The discussions with participants throughout the workshop focused on advanced reactor licensing under the existing licensing frameworks – 10 CFR Part 50 and 10 CFR Part 52. Participants acknowledged that while the on-going 10 CFR Part 53 rulemaking process could have significant gains for advanced reactor licensing efficiency if a usable rule is promulgated, it is not likely that advanced reactors deployed commercially this decade will use the 10 CFR Part 53 regulatory framework. The limited expected near-term usage of 10 CFR Part 53 is due, in part, to the substantial time associated with the Part 53 rulemaking process (final rule not expected until at least 2025) and the expected uncertainties and delays associated with the usage of a novel regulatory framework.

There was a consensus among workshop participants that there are no legislative or regulatory impediments to the efficient licensing of advanced reactors by the NRC. Participants did not identify any specific regulatory requirements that limit the licensing of advanced reactors and believed that there are sufficient regulatory pathways and processes to enable the licensing of advanced reactors by the NRC. The existing licensing rules contain provisions that enable regulatory flexibility (e.g., 10 CFR 50.12 “Specific Exemption”) and allow applicants and regulators to adapt or modify existing regulatory requirements on a case-by-case basis. The main challenge for advanced reactor licensing is ensuring the efficient, effective, and consistent use of the existing regulatory exemption processes by applicants, NRC staff and management, and the Commission. It was noted that the on-going Part 53 rulemaking seeks to reduce or eliminate the need for regulatory exemptions for advanced reactor licensing by implementing a technology-inclusive, risk-informed, performance-based regulatory framework.

The effectiveness and efficiency of advanced reactor licensing reviews are tied to ensuring the availability of the right information at the right time for the right decision makers. Many previous delays encountered during reactor licensing activities were associated with inadequate licensing resources, licensing information, or project management discipline (both by applicants and NRC) that resulted in unnecessarily protracted regulatory reviews or decisions that lacked full context of the regulatory issue at hand. Workshop participants identified several important priorities for both applicants and the NRC:

- Applicants need to imagine themselves in the position of NRC technical reviewers to provide appropriate materials and information that facilitate efficient safety determinations
- NRC technical reviewers need to stay focused on the regulatory basis for decision making and evaluation of applications and minimize extraneous reviews
- NRC and applicant project managers need to stay engaged to identify emergent issues and ensure review and deliverable accountability for both applicants and reviewers
- NRC and applicant senior management should be prepared to resolve questions arising during the review and identify which issues require escalation for timely resolution
- The Commission needs to be prepared to make timely decisions on critical licensing issues

These priorities help ensure the effective and efficient licensing of advanced reactors using the existing Part 50 and Part 52 regulatory pathways by creating greater alignment around regulatory processes, requirements, and application and review expectations.

A major takeaway from the workshop is that both applicants and NRC need to prioritize effective and consistent communication at all levels of staff and management to help ensure effective licensing. Communication is key to an efficient licensing process because it enables applicants to develop license applications that facilitate staff reviews, NRC staff to reach timely resolution on question or issues that arise during review, and NRC management and Commission to help resolve policy questions and ensure staff accountability on review processes. More effective communication at all levels combine to create a more efficient licensing process for all advanced reactors designs.

Recommendations on five major topic areas emerged from discussions during and after the Advanced Reactor Licensing Efficiency Workshop:

1. Achieving and maintaining alignment between applicant and NRC on the licensing review process and creating clear lines of communication
2. Preparing the application content and performing the safety review based on clear, definitive, and consistent expectations
3. Ensuring efficient use of staff resources is critical as the NRC receives an increasing number of advanced reactor license applications
4. Developing processes to identify and resolve challenges encountered during reviews
5. Ensuring uniform understanding and expectations on the role of specific NRC offices and committees in the licensing process

Additional discussion of these topics (including recommendations for applicants, NRC staff, NRC management, and Commission) are provided below. Table 1 provides recommendations across all five topics.

Table 1. Summary Workshop Recommendations

Recommendations for Applicants
<ol style="list-style-type: none"> 1. Applicants should seek to proactively develop lines of communication at all levels as early as practicable and maintain these lines of communication throughout the review process 2. Applicants should focus on providing information that enables the NRC staff review and prepare applications that reduce barriers to the reviewer reaching a safety determination 3. Applicants must prioritize meeting licensing submittal deadlines to help reduce burden on NRC staff resources and enable effective staff resource planning 4. Applicants should work to proactively share concerns about the licensing process at increasing levels of NRC management and not skip to senior management or the Commission
Recommendations for NRC Staff and Management
<ol style="list-style-type: none"> 1. NRC staff and management should improve internal communication to ensure alignment on technical and policy positions within a specific license application review and predictability across different license application reviews 2. NRC staff should focus on providing clear feedback and information requests to applicants, and ensuring internal agency alignment on technical and policy issues 3. NRC management must keep NRC staff accountable for the depth, breadth, scope, and regulatory basis for technical reviews 4. NRC staff and management should regularly update applicants on both major and minor challenges or questions as they emerge during the licensing review and not wait until a review is completed
Recommendations for the Commission
<ol style="list-style-type: none"> 1. The Commission should clarify the role of Office of General Counsel (OGC) in licensing reviews so that applicants and staff understand the roles, responsibilities, and scope 2. The Commission should clarify the role of Advisory Committee on Reactor Safeguards (ACRS) to applicants and staff so they can maximize Committee effectiveness in licensing

In addition to the summary recommendations in Table 1, specific detailed examples from the workshop and recommendations from participants are also highlighted as “focus areas” under each major topic to provide additional insights for stakeholders. Table 2 provides the topics for each workshop focus area.

Table 2. Focus Area Topics and Recommendations

Recommendation topics for NRC Staff and Management
<ol style="list-style-type: none"> 1. Regulatory engagement plans and specific milestones 2. Applicant licensing audits by NRC staff 3. Importance of effective NRC project managers 4. Escalation and resolution of regulatory questions and issues 5. Alignment on expectations for ACRS reviews

Topic Area 1: Achieving and maintaining alignment between applicant and NRC on the licensing review process and creating clear lines of communication

Participants during the workshop repeatedly stated that consistent communication about the expectations for the licensing process is critical to effective, efficient, and timely licensing. These expectations included how to engage with the regulator most effectively during the licensing process, the content and level of detail expected for licensing documents and supporting material, and process and procedural expectations for the application review. These expectations should be mutually established during the pre-application process and be focused on licensing process outcomes. Early alignment enables the timely resolution of long-lead regulatory issues, facilitates better planning by both applicants and the NRC for staff and project management resource allocation, and can establish effective communication pathways critical to resolving technical, policy, or administrative issues encountered during the licensing review process.

Applicant Recommendation 1: Developing lines of communication with NRC staff and management

Workshop participants emphasized that the NRC licensing process is an applicant-driven process, so it is important that applicants take a strong lead in establishing expectations and pathways for communication with the NRC. Alignment between applicants and the NRC is critical at all levels of staff and management – from the NRC staff technical reviewers through the Commission.

Applicants should seek to proactively develop lines of communication at all levels as early as practicable and maintain these lines of communication throughout the review process.

These lines of communication can facilitate peer-to-peer resolution of questions encountered during the pre-application and application review processes and reduce barriers to the timely resolution of issues. Lines of communication at multiple levels also help ensure alignment between multiple levels of staff and management for both the applicant and NRC. If information or decisions are slowly or incompletely communicated between staff and management levels in either organization, consistent and redundant communication at multiple levels can help identify and resolve intraorganizational information or decision making gaps. Additionally, applicants should have a clear understanding of the role of each level of NRC management (e.g., Project Manager, Branch Chief, Division Director, Office Director) to ensure that information, questions, and concerns are appropriately directed within the organization.

NRC Recommendation 1: Developing internal lines of communication to ensure consistency and predictability

Several workshop participants shared concerns that they had observed communication gaps within the NRC both between NRC staff working on different license applications and between different levels of NRC staff and management. These communication gaps led to inconsistency and unpredictability during licensing reviews as decisions or policy questions could change significantly if stakeholders were missing technical information, context, or if they were absent from the decision-making process entirely. There

was also some observed inconsistency during licensing reviews as changes to NRC staff and management could result in changing requirements on an individual review or inconsistent interpretation of regulatory requirements or guidance on different reviews. Resolution of these internal vertical and horizontal communication gaps is critical to more aligned and effective reviews.

NRC staff should improve internal communication to ensure staff and management alignment on technical and policy positions within a specific license application review and predictability across different license application reviews

This improved communication can help ensure consistency of reviews, enable earlier and more effective management and Commission involvement in policy issues that will require additional resources to resolve, and help increase predictability for applicants. Reducing the delays associated with both applicant and staff re-work, as well as reducing the schedule risks associated with resolving questions related to conflicting regulatory interpretations, can have a significant positive impact on the licensing efficiency of advanced reactors.

Focus Area 1: Regulatory engagement plans and specific milestones

A key lesson learned shared by workshop participants was the importance of application-specific regulatory engagement plans (REPs) and specific project milestones. REPs can help make the licensing review process more efficient by creating better alignment between applicants and the NRC in terms of application review scope, schedule, and expected resource needs. REPs are created and maintained by applicants but usually incorporate NRC feedback to promote alignment on regulatory processes.

The NRC utilizes five-year budget plans, so decisions about hiring, training, and retention are most effective when incorporated well in advance of the staff and management resource needs. Major changes to NRC resource requirements with less than two years notice can have significant impacts on the ability of NRC management to ensure that the right resources are available to support timely reviews. Applicants must communicate their licensing review needs to the NRC with as much advanced notice as possible and prioritize meeting deadlines in the REP.

Workshop participants suggested that an effective REP focuses on gaining alignment between applicants and the NRC on four key questions:

1. Regulatory compliance goals: what does the ideal outcome look like for licensing and how do project specific requirements or approvals differ from the existing regulatory requirements?
2. Technical resolution: how will an applicant provide the technical case that will demonstrate compliance with the license application's regulatory requirements? What are the key technical questions to address with the NRC staff, management, and Commission?
3. Technical needs and testing requirements: what activities does the applicant plan to complete to support resolution of technical questions and reach consensus with NRC? What are the tools, methods, and assessments that will require approval or buy-in from NRC staff?
4. Execution strategy: how will an applicant reach alignment with NRC on the regulatory and technical compliance topics? What information, interactions, or discussions are needed and how can alignment be confirmed across NRC staff, management, Commission, and NRC offices and

committees such as the Office of General Counsel and Advisory Committee on Reactor Safeguards?

Workshop participants agreed that starting with existing NRC and industry guidance on REPs is an effective way for an applicant to develop their own REP. Creating a licensing risk matrix and identifying policy issues requiring resolution can be critical to planning effective pre-application activities as part of the REP development process. Participants emphasized creating a clear scope for pre-application engagement activities as part of the REP that can help reduce or eliminate risks associated with the licensing process.

An effective and credible REP can also act as a justification for NRC staff prioritization of staff resources towards an applicant's license application review if there are NRC resource limitations when supporting multiple simultaneous license application reviews. An REP that includes commercial information related to project execution timelines can help establish and increase credibility for the applicant. It is also important that the REPs help NRC staff prioritize staff resources and effort towards the most important topics in the licensing review. Workshop participants noted that it is much more effective to clearly indicate what topics are most important to the review and not force NRC staff to guess on prioritization. A clear and deliberate prioritization of issues within an REP also helps the NRC staff prioritize their time and effort during the review in consultation with NRC management.

The REP should also include the applicant's planned and targeted use of topical reports, technical reports, and white papers so that NRC management has an accurate expectation of what technical and training resources will be needed to efficiently review these submissions. The NRC will need to assess what resources may be informally provided by the applicant (e.g., meetings and white papers intended to increase staff familiarity with a specific technology) and what resources will need to be developed internally or outsourced to external contractors to build the NRC staff's technical expertise. Workshop participants highlighted that applicant-provided technology-specific training can provide useful background information to a wide range of NRC staff and management, and are designed to both create a uniform knowledge baseline for all NRC staff reviewers and establish and strengthen communication between applicants and NRC at various levels of staff and management. Plans for expected staff engagement activities should be included in the REP to facilitate NRC resource planning and allocation.

Workshop participants also suggested that pre-meeting briefing documents and post-meeting reports could help ensure appropriate staff preparation and increase alignment with applicants. Workshop participants reported that informal pre-meeting briefing documents were used effectively to minimize time spent in meetings on general design review questions and instead focus on the discussion and review of specific technical questions. These documents optimized use of NRC staff time during meetings and enabled focus on key regulatory questions. Post-meeting reports or letters were also helpful to document informal feedback during pre-application reviews and enable prompt resolution of any misunderstandings between NRC staff and applicants. These reports are non-binding (and should never be viewed as a formal regulatory finding), but are another tool to help promote effective communication. The use of these two additional tools should also be included in the REP to help NRC staff and management prepare for applications.

Workshop participants also emphasized the importance of including licensing or review milestones as both part of the REP and all subsequent regulatory planning activities between an applicant and the NRC. Milestones can help focus both applicant and NRC management on dates, actions, or measurable licensing or review activities that track with the completion of the regulatory review. These milestones (such as the completion of chapters of a draft safety evaluation report) can help serve as the basis for review status discussions between applicants and NRC management or for allocating additional NRC staff and management resources as a review progresses. Failure to hit early milestones can be a warning sign that resource allocation or strategy may need to be revised if an applicant expects to complete the licensing review on the initial licensing timeline. A milestone-based REP can help increase accountability among all stakeholders in an effective review process.

Finally, there are opportunities to continue using the REP following completion of the pre-application period. An effective REP helps outline an applicant's strategy for regulatory engagement, the expected pathway to resolution of technical and policy issues, and their expectations for NRC staff and management interactions. NRC staff review of topical reports, technical reports, and white papers will likely be completed in parallel with first-of-a-kind license applications, so continued tracking of regulatory engagement could be extremely valuable. While REPs are normally used to help frame preapplication engagement, the NRC should consider the continued use of an REP or other alignment document during the licensing process (especially during first-of-a-kind license applications) to help ensure on-going coordination between applicants, NRC staff, and NRC management.

Applicants should prioritize the development of detailed REPs that provide insights on licensing strategy, submissions, and plans for reducing both technical and policy licensing risk throughout the pre-application and application review process. Applicants should work with the NRC to ensure that the REP has achievable, measurable milestones and that both applicants and the NRC will be held accountable to milestones if there are deviations from the schedule. Regular communication between the applicant and NRC about the REP should be prioritized by all stakeholders and the REP or other alignment documents should be updated by applicants in consultation with the NRC (i.e., treated as a living document) if plans or resource availability require changes to the licensing strategy.

Topic Area 2: Preparing the application content and performing the safety review based on clear, definitive, and consistent expectations.

One recurring concern cited by workshop participants is issues with expectations for licensing reviews. Participants expressed frustration that they found limited or inconsistent guidance for potential applicants on NRC expectations for application content, depth and scope of regulatory reviews, and the most effective ways to engage with NRC staff and management to provide supplementary licensing information. Participants expressed confidence that they could satisfy NRC expectations for submitted license application materials if the expectations were clearly documented and consistently applied, but they were concerned that differences between applicant understanding and NRC expectations could result in significant delays and reworks during the application process. It is critical to have consistent communication on the expectations for the review and what questions will be addressed. NRC and applicants should work collaboratively to establish review expectations during the pre-application process to reduce, mitigate, or prevent application preparation and review inefficiencies.

Applicant Recommendation 2: Preparing applications that enable efficient NRC staff review

Efficient review of applications by the NRC staff requires, above all else, that the NRC staff have adequate information from the applicant to make a safety determination. Workshop participants acknowledged that incomplete or poorly developed applications (or supporting materials) would significantly limit the NRC staff's ability to complete reviews on schedule with a minimum number of requests for additional information (RAIs). A focus on "high quality applications" has been previously cited among success criteria for new reactor licensing and remains important to success for advanced reactors.

Applicants should focus on providing information that enables the NRC staff review and prepare applications that reduce barriers to the reviewer reaching a safety determination.

Participants observed from both personal experience and discussions with NRC staff that application materials may not be developed with the NRC staff in mind as the primary audience. These application materials may not readily provide information to NRC staff that match the processes and guidance that NRC staff use to complete licensing reviews and thus can inadvertently slow the licensing process. Submitting high quality applications and supporting materials that provide information tailored to the NRC staff's review processes and requirements can reduce regulatory iteration cycles and enable more efficient reviews by staff.

NRC Recommendation 2: Providing clear feedback to applicants and ensuring internal agency alignment

A commonly repeated frustration with NRC licensing reviews is that NRC staff will appear to repeatedly ask applicants open-ended questions and require submissions of additional information until an applicant submits specific details or a solution NRC staff were expecting. This process, colloquially referred to as "bring me a rock", is tied to a common misperception by many stakeholders that NRC staff

can ask questions of applicants but cannot provide direction to an applicant on the specific design, methods, or programs that should be used to satisfy a regulatory requirement. While it would be inappropriate for the NRC staff and management to act as *de facto* consultants for applicants (i.e., solving technical problems for applicants rather than acting as independent reviewers of their work), additional guidance from NRC management and the Commission during staff engagement with applicants on technical and policy questions could help provide greater clarity for applicants.

NRC management must emphasize that clear requests for information that address specific questions and deficiencies in an application or identifying specific concerns with review topics do not interfere with the NRC's commitment to and statutory requirement for regulatory independence. A mismatch in expectations during reviews reflects the importance of clear communication between NRC staff, management and applicants on regulatory requirements, technical questions, and policy issues.

NRC staff should focus on providing clear feedback and information requests to applicants, and ensuring internal agency alignment on technical and policy issues.

Clear and documented feedback to applicants is critical to both ensuring alignment on the regulatory review process and creating a record of discussion and decisions that can be used to ensure review continuity if there are personnel changes during the licensing review by either NRC staff or applicants. These regulatory records do not need to have regulatory finality but should be treated by applicants and staff as an indication of progress made in discussions around key licensing topics and leveraged to the maximum extent possible. NRC staff and management should also seek to ensure internal alignment on technical and policy issues. Several workshop participants indicated that they observed disconnects between NRC staff and middle or senior management during pre-application interactions or licensing reviews. These disconnects could lead to abrupt changes to technical or policy decisions if NRC senior management overrode decisions that had been previously negotiated with lower-level management and staff. It is important that NRC staff and management seek internal alignment, especially on technical and policy issues, to help ensure a more predictable and efficient licensing process.

Focus Area 2: Applicant licensing audits by NRC staff

Licensing reviews with the NRC have historically focused on NRC staff review of applicant documents formally submitted as part of the official technical basis for a license application. This process, while ensuring transparency, has two distinct challenges: (1) the time associated with requesting, obtaining, and reviewing supporting applicant documents through requests for additional information (RAIs) and (2) the willingness and ability of applicants to submit large amounts of materials to the NRC staff as part of the docketed licensing basis to support licensing reviews. Workshop participants highlighted the opportunity to increase the use of licensing "audits" by applicants and NRC staff to enable staff to reach safety determinations more efficiently on license applications.

Licensing audits are agreements between an applicant and the NRC to allow NRC staff access to review a selection of an applicant's internal documents without submitting those documents as part of the docketed licensing basis or record for the plant. An audit consists of two major documents: an audit plan and a record of audit findings. The audit plan is the agreement between an applicant and NRC that

describes the purpose and scope of the audit (both in terms of content and duration) and the conditions or findings needed to close or complete the audit. The record of audit findings is a formal licensing document that is prepared after the close of the audit that documents NRC findings and can be used to support other licensing activities or portions of the licensing review.

Audit plans and internal processes for audits already exist for NRC staff and management. Audits have been utilized effectively by the NRC to support the licensing of digital instrumentation and control systems at the current operating reactor fleet. The audit processes have enabled NRC staff to access technical documents related to a licensing decision that would otherwise not be submitted by an applicant as part of a license application but help inform NRC staff findings and help answer questions related to a specific safety determination. Audits can be effective for specific issues, especially if they are complex technical issues with large amounts of supporting information that would not normally be docketed with the application. Audits, however, can also be ineffective for simple issues due to the cost and time associated with setting up and executing an audit plan.

Workshop participants shared differing experiences related to the use of audits to support licensing reviews. Several participants had effectively used audits to enable NRC to efficiently answer specific technical or methodological questions on their license application that would normally be outside the scope of a standard review but that helped the NRC staff efficiently reach a safety determination. They credited the audit process, in part, with reducing the time required to complete reviews by limiting the number of time-consuming document request iterations. Other participants, however, stated that they found that NRC audits could be time and resource intensive and did not demonstrate a clear benefit to the applicant. These participants shared that they struggled to reach agreement with NRC staff and management on the conditions to close the audit and that the audits continued without clear rational until individual NRC staff members were satisfied.

Discussions with participants during the workshop revealed two key factors that affected whether an audit was considered successful by an applicant. The first key factor was the design of the audit plan and initial discussions with NRC staff. Participants suggested there is an “art” to writing audit plans that provide sufficient flexibility to NRC staff to support their review while still creating specific conditions that enable the closure of the audit. Overly broad audit plans are challenging because they can be extremely hard to close. Participants emphasized that it’s important for applicants and the NRC to have clear understanding and agreement on purpose of an audit, and that this purpose is both reflected in the audit plan and revisited as part of regular communication between applicants and the NRC. While the NRC staff are responsible for writing the audit plan, effective communication and negotiation between NRC staff and applicants during the audit plan development process is critical to creating the conditions for success for an effective audit.

The second key factor is NRC management oversight of the audit and maintaining NRC staff accountability for audit activities. Participants felt that “unintended mischief” can occur during audits if the audit plan is overly broad or if the audit is not carefully managed. The NRC management overseeing an audit can make a significant difference in the success or failure of an NRC audit process by helping to coordinate between the applicant and NRC staff on the scope of the audit and holding NRC staff accountable for their review activities. The goal of the audit should be to both meet the purpose of the

audit plan and provide evidence as part of the official licensing record that a proper review has been conducted by NRC staff on documents that have not been submitted as part of the docketed record.

Audits can be an effective tool to support licensing reviews if they are scoped and conducted in a proper and good faith manner by both applicants and NRC. Communication and accountability are critical to ensuring alignment between all stakeholders. Audits should not be used to replace formal docketed document submissions but should be viewed as another regulatory tool that can be used to support staff reviews and safety finding determinations.

Applicants and NRC should explore the use of audits to support licensing reviews for specific, complex technical issues. Applicants and NRC should document best practices for audits and update NRC guidance on the preparation of regulatory audit plans, audit management, and documentation of audit findings. Lessons learned from using licensing audits should be incorporated into guidance documents.

Topic Area 3: Ensuring efficient use of staff resources as the NRC receives an increasing number of advanced reactor license applications

Advanced reactor developers are expected to increase their engagement with the NRC in the next several years as applicants seek to construct and operate demonstration and test reactors by the end of the decade. This increase in regulatory engagement could significantly increase NRC staff workload as they engage with a large number of advanced reactor developers licensing a wide array of reactor technologies. There is also significant uncertainty, however, in the exact timing, number, and scope of these licensing reviews. These uncertainties can make it challenging for the NRC to ensure that appropriate staff and management resources are available to engage with applicants and efficiently review applications – especially when budget and staffing plans are made years in advance. Consistent communication between applicants and NRC staff and management on planned licensing submittal and review activities is critical for resource planning. Both applicants and the NRC should be proactive in resource planning discussions to ensure that the right resources are available at the right time to support effective and efficient regulatory engagements and reviews, and work to ensure that NRC staff resources are properly used.

Applicant Recommendation 3: Meeting licensing deadlines and milestones

Pre-application interaction and licensing reviews by NRC staff require a significant degree of internal NRC planning and coordination. The alignment of a core review team, availability of internal and external technical experts, availability of project managers and NRC management, and coordination with other offices and committees such as Office of General Counsel or Advisory Committee on Reactor Safeguards requires substantial schedule discipline. Applicants submit (and regularly revise) regulatory engagement plans and license review schedules that help NRC plan resources and schedules to support licensing activities, but these plans are not always met by applicants for a variety of reasons.

Applicants must prioritize meeting licensing submittal deadlines to help reduce burden on NRC staff resources and enable effective staff resource planning.

Meeting licensing submittal deadlines agreed to by applicants and the NRC is critical to ensuring availability of staff resources to support licensing reviews. Applicants must prioritize deadlines for submittals or provide as much notice as possible to NRC staff that deadlines may be missed. Transparency and communication between the applicant and NRC staff is critical to ensuring that appropriate NRC resources are available to support reviews. If applicants repeatedly fail to meet deadlines, NRC management may need to deprioritize allocation of NRC staff resources from an underperforming applicant's reviews to support other applicant reviews that have met previously set deadlines and schedules.

NRC Recommendation 3: Increasing accountability for NRC staff technical reviews

While many NRC technical reviews are efficiently completed without significant challenges, a significant number of workshop participants provided examples of previous NRC licensing reviews that required

significant time and resources to complete. A common thread across a number of these experiences was challenges with individual NRC staff technical reviewers who were unable to complete the review in a timely manner or reach a safety determination. While licensing review completeness and accuracy is paramount, the basis for the reviewer's line of inquiry and the reviewer's inability to close out the review was unclear to applicants.

NRC management must keep NRC staff accountable for the depth, breadth, scope, and regulatory basis for technical reviews.

NRC staff independence on technical reviews and a "questioning attitude" is core to both the NRC's effectiveness as an independent safety regulator and ensuring a positive safety culture, but this emphasis should not limit staff accountability for the basis and outcome of staff technical reviews. Several workshop participants suggested that NRC management is often hesitant to question staff technical reviews because of concern that questions could be interpreted as impeding staff reviews. NRC management must work to resolve this perception and enable robust technical discussion with staff technical reviewers to ensure that there is a clear regulatory rationale for the depth, breadth, and scope of reviews. This accountability, whether spurred by management discussions or applicant concerns, can take multiple forms including peer reviews from other NRC staff or discussions with other NRC technical experts and management. Maintaining accountability for technical review depth, breadth, scope, and regulatory basis increases regulatory review consistency, predictability, and efficiency.

Focus Area 3: Importance of effective NRC project managers

Workshop participants agreed (across multiple discussion topics) that one of the most important, yet least recognized, factors in the licensing review outcomes is the NRC project manager. The NRC project managers are the NRC staff responsible for overseeing a specific license application review. The NRC project manager is responsible for a wide range of activities including engaging with applicants on all application submittals and review processes, managing activities by NRC staff technical reviewers, coordinating NRC resource availability and allocation for reviews, ensuring vertical communication alignment with NRC management, and working to ensure overall review quality and execution. An effective NRC project manager can deftly manage these internal and external challenges and help keep licensing reviews on track. An inexperienced, inadequately trained, or insufficiently supported NRC project manager may struggle with one or more of their activities and contribute to unnecessary review delays, technical or policy conflicts, or ineffective use of limited NRC resources on activities that do not contribute to effective project completion and support overall NRC goals. Ensuring that NRC project managers have the skills, tools, resources, training, and experience to successfully manage licensing reviews is critical to the efficient and effective completion of licensing reviews.

Participants shared that they have worked with NRC project managers with varying levels of quality and experience. The main challenge faced by applicants is the inconsistency in the NRC project manager quality. It is hard to plan for NRC staff and management engagement when it is unclear if there will be effective internal alignment between NRC staff and senior management. Misalignment between NRC staff and management on expectations or decisions related to a license review can lead to unexpected policy and technical changes during the licensing process, resulting in significant licensing delays and

additional costs. Several participants described how the NRC project manager can also help to control the scope and closure of licensing activities including the use of audits to support NRC staff technical reviews and help facilitate effective interactions between NRC staff and ACRS. The NRC project manager affects nearly every stage of the licensing review process, so their management capabilities and effectiveness have an outsized impact on the outcomes of the licensing review.

Discussions with workshop participants (including former NRC staff) suggest that there are opportunities for improving the tools, resources, and training available to NRC project managers. Anecdotally, project management at the NRC is not viewed as a dedicated professional role but as an activity that NRC staff (normally NRC staff trained as scientists or engineers) are expected to complete as part of their duties as a project manager. This perception of project management as an activity and not a professional project manager role differs from other industries or regulators where project management is treated as a specific technical and professional skill set. This gap may explain the anecdotal discussions that NRC project managers do not receive the same tools, resources, and training as project managers in other fields and industries.

Use of standardized professional trainings (such as [Project Management Institute](#) trainings and a [Project Management Professional](#) certification) and project management tools in a comprehensive and complete manner could help increase the quality and uniformity of NRC project manager's skills and knowledge. Additional formalized access to resources for NRC project managers on technical or policy topics (such as streamlined access to NRC technical subject matter experts) could provide NRC project managers the information that they need to help manage the breadth, scope, depth, and basis for NRC staff technical reviews. Finally, creating opportunities for peer support; mentoring; sharing of lessons learned between individual licensing reviews, branches, and offices; and knowledge transfer could help facilitate the treatment of project management as a specialized professional discipline and not just another task expected of talented NRC technical staff. These recommendations and creation of a more comprehensive NRC project manager training and operational program could be undertaken by external organizations with a demonstrated track record in developing effective project management programs in technical organizations.

NRC should ensure licensing reviews are managed by consistently high-quality NRC project managers and that NRC project managers have the skills, tools, resources, training, and experience to successfully manage licensing reviews. NRC should prioritize the training and organizational management of NRC project managers as essential technical and professional positions on licensing reviews similar to subject matter experts on technical topics. NRC should assess the current training and support programs for project managers and provide additional tools, resources, peer learning, and training to increase the overall quality and consistency of NRC project managers.

Topic Area 4: Developing processes to identify and resolve challenges encountered during reviews

All licensing application reviews will encounter some challenges despite the applicant and NRC best efforts at effective pre-application engagement, submission of high-quality applications, and alignment on regulatory reviews. These challenges may be minor or major, but the ability for the applicant and the NRC to identify, address, and resolve these challenges in a timely manner is essential to an effective and efficient licensing process. Consistent, effective communication between stakeholders throughout the entire licensing process should be used to identify problems (and possible resolution pathways or solutions) as early as possible during pre-application and review. Both the NRC and applicants should be actively and constructively engaged in challenge identification and resolution.

Both the NRC and applicants should be open to providing and receiving feedback about the licensing review process. The ability to provide constructive feedback during the licensing review process is critical to creating alignment between stakeholders. The ability to receive feedback openly and assess how to effectively incorporate feedback or reach resolution on disagreements is equally important to effective licensing. Applicants must work to understand NRC staff's position and basis for regulatory decisions while NRC must be open to seeking an understanding of applicants' concerns about licensing processes without immediately pushing back or retreating to established agency positions.

Applicant Recommendation 4: Applicants should appropriately escalate licensing concerns

Applicant identification of challenges with the licensing review process can occur at a variety of applicant staff or management levels: technical questions may be raised by the NRC at the staff level, regulatory interpretations may be needed at the management level, and policy questions could be resolved at the NRC senior management or Commission levels. One concern cited by some workshop participants was that there can be a tendency for applicants to inadvertently (or intentionally) escalate issues to higher levels of NRC management without first addressing issues at a peer-to-peer level. This escalation can be perceived as a strategy to break decision deadlocks, expedite decision making, or bypass management who are unable or unwilling to make decisions. This escalation, however, can also reduce the ability for NRC management to manage applicant licensing activities actively and effectively.

Applicants should work to proactively share concerns about the licensing process at increasing levels of NRC management and not skip to senior management or the Commission.

Both applicants and the NRC have processes for escalation and resolution of concerns and questions that may arise during the licensing process, and it is important to respect those processes to the greatest extent possible. While the "applicant prerogative" to highlight staff-level issues during drop-in meetings with Commission can result in a rapid prioritization of topics by NRC staff, it can weaken trust and communication at all levels between an applicant and the NRC. Applicants should escalate concerns about the licensing process if they feel that topics are not being appropriately resolved, but working through issues at progressively increasing levels can ideally enable resolution closest to the problem and

allow stakeholders closest to the situation both to resolve the specific problem and address any underlying questions related to requirements, process, or expectation.

NRC Recommendation 4: Regular updates with applicants on regulatory issues

One concern highlighted by workshop participants was that they often felt blindsided by last-minute questions, concerns, and feedback on application materials provided by NRC staff and management. Participants described incidents where there was a misalignment and misunderstanding of the status of a licensing review: they were under impression that a review was progressing satisfactorily towards completion only to receive significant negative feedback from NRC staff and management late in the process, often after the original scheduled completion date for the review. This type of delayed feedback (often given all at once) limited the applicant's ability to effectively and efficiently respond to questions, resolve preliminary questions before they developed into significant issues, and provide timely responses necessary to keep the licensing review on schedule.

NRC staff and management should regularly update applicants on both major and minor challenges or questions as they emerge during the licensing review and not wait until a review is completed.

Early discussion of regulatory issues with applicants can be challenging due to a hesitancy for NRC staff to discuss work-in-progress, especially before complete review and concurrence have been obtained from other NRC staff and management. Consistent, regular, and open communication between stakeholders, however, is key to timely identification and resolution of issues. Routine internal NRC communication can be useful to highlight "precursor" questions and concerns for NRC management and enable development of plans to effectively communicate these issues with applicants. A combination of regularly scheduled drop-in meetings, staff-level calls, and public meetings should be used to help ensure alignment on issues (and resolution pathways) between applicants and the NRC.

Focus Area 4: Escalation and resolution of regulatory questions and issues

Workshop participants noted the timely and final resolution of technical and policy questions with NRC staff and management can have a significant effect on the successful completion of a licensing review. Protracted resolution of a key technical or policy question can have significant impacts on an applicant's design and licensing strategy, and changes to the finality of a decision can require costly rework by both the applicant and NRC staff to resolve. Participants noted four major challenges faced by applicants when engaging with NRC staff on technical and policy issues:

1. NRC staff discomfort or unwillingness to make preliminary technical or policy decisions during the preapplication process
2. Lack of alignment between NRC staff and management on technical or policy questions
3. Lack of formal processes to appeal or request formal review of NRC technical or policy questions
4. Protracted or delayed identification, discussion, and resolution of technical and policy questions

These challenges largely relate to communication and process issues between an applicant and NRC staff and between different levels of NRC staff and management. Gaps in communication between an applicant and NRC staff can result in different expectations related to the resolution of technical or

policy questions, the level of finality in different decisions, and the basis for decisions. Gaps in communication between different levels of NRC staff and management can result in inconsistency between applicant-specific interpretations of regulatory requirements and changes to applicant-specific decisions as NRC management seeks to satisfy stakeholders including applicants, NRC staff, other NRC offices and committees (including OGC and ACRS), and the public. The combined effect of these communication and process gaps is a challenging path for applicants to navigate as they seek a predictable and consistent set of licensing requirements.

Discussions with workshop participants suggest that a combination of communication and process changes could help improve the resolution of regulatory questions and issues that arise during licensing reviews. Many of the communication issues highlighted in this report (e.g., improved communication between applicants and the NRC, improved internal communication within the NRC) would help facilitate more efficient and timely identification and resolution of technical and policy questions. One remaining set of gaps, however, is how to effectively address uncertainties related to the regulatory finality of preliminary decisions, and the ability for applicants to escalate questions where they believe that the NRC staff has made an incorrect decision or a decision inconsistent with regulatory precedent.

Development of additional regulatory guidance for NRC staff on preliminary decisions and expedited procedures for applicants to escalate or appeal technical and policy questions could enable the more effective and efficient resolution of regulatory issues encountered during reviews.

The NRC could develop new regulatory guidance that provides NRC staff and NRC project managers information on the type of feedback and the level of regulatory finality that is appropriate to provide to applicants during pre-application interactions. Workshop participants acknowledged that the NRC cannot be expected to resolve all technical and policy issues during pre-application, but indications of NRC staff and management positions on questions that cannot be formally resolved can help provide applicants critical guidance on the finalization of the application materials. Publication of this type of regulatory guidance would help align expectations between applicants and NRC staff and management on expected outcomes for pre-application engagements and could help increase consistency and predictability related to pre-application engagement across different licensing reviews.

Development of expedited procedures for applicants to escalate or appeal technical and policy questions would provide both applicants and NRC staff and management a clear understanding of the decision-making criteria and process for key technical and policy questions. The NRC staff and management have existing internal processes for appeal or adjudication of differing professional opinions. These processes could be leveraged or adapted to create clear processes for the appeal or escalation of questions. A more transparent, expedited process would help promote consistency among applicants and provide applicants with a more predictable method to obtaining regulatory interpretations on issues critical to their licensing applications.

The NRC should develop regulatory guidance for NRC staff on providing preliminary decisions on policy and technical questions during the pre-application and application review process. The NRC should also explore creation of expedited review procedures for applicants to obtain consistent regulatory interpretations and to efficiently escalate or appeal technical and policy decision to NRC management.

Topic Area 5: Ensuring uniform understanding and expectations on the role of specific NRC offices and organizations in the licensing process

Interactions between an applicant and NRC technical staff are important to effective and efficient licensing, but workshop participants highlighted the importance of interactions with other organizations at the NRC. Specifically, participants highlighted how interactions with Office of General Counsel (OGC) and the Advisory Committee on Reactor Safeguards (ACRS) can have a significant impact on the licensing review process. Specifically, the interpretation of regulatory requirements by both OGC and ACRS can significantly affect on-going discussions between an applicant and NRC staff on license applications.

The role of both OGC and ACRS is important, but it is often unclear to applicants the exact role and responsibilities of these organizations. Their authority, their relationship to the Commission, and the timing and finality of their decisions relative to staff opinion were unclear to some workshop participants and sometimes deviated from historical understanding of their roles. Both OGC and ACRS fulfill important functions within NRC, but it is the lack of transparency and understanding of their role and responsibilities within the licensing review process that can impact licensing efficiency and effectiveness. Consistent communication from NRC management and the Commission on the role and responsibilities of specific NRC offices and committees throughout the licensing review process is critical to successful alignment. While the Commission will determine their appropriate roles, it is important that all stakeholders (including applicants, NRC staff and management, and members of the public) clearly understand the organizational scope and expectations of these NRC entities.

Commission Recommendation 1: Clarify the role and responsibilities of the Office of General Counsel

Timely, predictable, and clear interpretation of regulatory requirements is critical to effective and efficient licensing. Applicants rely on these interpretations to develop the licensing basis for their applications and to create application submission materials that will support NRC staff reviews. NRC staff use regulatory interpretations to support their decision-making as they work through regulatory requirements and guidance to make safety determinations applications. Changing regulatory interpretations can be expected as the NRC incorporates both lessons learned and changing legal requirements, but sudden changes to regulatory interpretations by OGC or staff over-reliance on OGC reviews during the licensing review process can negatively impact the effectiveness and predictability of the licensing review process.

The Commission should clarify the role of Office of General Counsel (OGC) in licensing reviews so that applicants and staff understand the roles, responsibilities, scope, and best practices for engagement.

Workshop participants noted that NRC staff would often defer to OGC interpretations of regulatory requirements, even if these requirements were inconsistent with previous OGC or NRC interpretations or understanding. Participants also shared experiences where NRC staff appeared to make regulatory decisions that were overly conservative to avoid conflicts with OGC despite regulatory precedent for less

conservative interpretations. The NRC Commission should clarify the role of OGC so that applicants, NRC staff, and management understand how to interact with OGC effectively and predictably.

Commission Recommendation 2: Clarify the role and responsibilities of the Advisory Committee on Reactor Safeguards

The ACRS has historically had an important role in the licensing review process by providing additional independent expert review on application questions related to reactor safety. The ACRS has evolved over time based on interactions with applicants and NRC, the specific reactor safety questions under review by the Commission, and the technical expertise of ACRS members. Workshop participants noted, however, that they felt the current scope and responsibilities of ACRS is unclear with some ACRS reviews and inquiries drifting into issues historically reviewed solely by NRC staff. Inconsistent understanding between applicants, NRC staff, and ACRS on roles and responsibilities can lead to delays as stakeholders seek to resolve multiple sets of sometimes conflicting input and requests.

The Commission should clarify the role of Advisory Committee on Reactor Safeguards (ACRS) to applicants and staff so they can maximize Committee effectiveness in licensing

Greater clarity on the desired role for ACRS in new reactor licensing reviews can help set more consistent expectations for applicants and NRC staff, focus ACRS resources on issues and questions that are most important to licensing, and help increase the predictability and transparency of the licensing process. Workshop participants had mixed views on the value of ACRS as a statutory organization, but these opinions seemed largely tied to historical incidents related to unprofessional ACRS conduct or lines of questioning by ACRS members that seemed more focused on personal or professional interest rather than relevance to safety. Changes to the ACRS membership and professional standards appear to have resolved some specific issues related to inappropriate conduct but some participants felt that ACRS could benefit from further changes. Commission clarification of the ACRS role and responsibilities can help ensure that ACRS plays an effective role in the reactor licensing process.

Focus area 5: Alignment on expectations for ACRS reviews

The ACRS was created nearly seven decades ago to provide independent technical review of reactor applications by a group of highly qualified external experts. The ACRS initially served an important role for the Atomic Energy Commission (AEC) due to the limited experience of the AEC safety review staff and the dual mission of the AEC to promote and regulate nuclear energy. Early AEC staff reviews were completed by dedicated staff that had limited technical experience, largely attributed to the nascent nature of nuclear technology. ACRS expert reviews on technical topics helped supplement AEC staff experience and helped identify technical questions or issues that were overlooked by AEC staff reviews. While the AEC maintained internal divisions between promotional and regulatory activities, the ACRS served as an important check as an independent expert panel focused solely on reactor safety. The role and activities of ACRS have evolved in parallel with the experience and mission of the AEC and then NRC.

Several workshop participants questioned the current role of ACRS and what contributions ACRS makes to the licensing process. The NRC is no longer a promotional-regulatory dual mandate organization, and

the NRC technical staff is significantly more experienced than the AEC technical staff. Some participants were concerned that the ARCS review focus has shifted over time to performing primary technical reviews of applications instead of providing higher-level expert advice to the Commission on licensing matters. There were also questions about the role of ACRS, NRC staff, and applicants during ACRS reviews. Interactions between these groups during ACRS meetings made it unclear if the ACRS's primary role is reviewing NRC staff evaluations of a license application, reviewing applicant license applications, or a hybrid review function. There were suggestions from some workshop participants that the goal of ACRS should be to hold staff accountable for their review and provide independent advice to the Commission but that this goal is not being met by current ACRS activities.

The workshop participants did not have a consensus view on the function or role of ACRS but were aligned that it is critical to have clarity on the role of ACRS in reactor licensing reviews and on the expectations between ACRS, NRC staff, and applicants during ACRS reviews. Effective and efficient licensing is underpinned by consistent and predictable regulatory processes. Increasing the consistency and predictability of ACRS reviews by clarifying the expectations of process, outcomes, and interactions is important to increasing the efficiency of ACRS reviews as part of the licensing process. The ACRS ultimately provides recommendations to the Commission on licensing activities, so the Commission is responsible for clarifying the desired role and expectations for ACRS.

The Commission should clarify the role of ACRS in licensing reviews in terms of expectations for their reviews, the interactions with NRC staff and applicants, and the scope of their reviews and recommendations. The Commission should take a more active oversight role on ACRS activities to ensure that the Committee is effectively and efficiently performing its statutory mission and providing valuable recommendations to the Commission on reactor licensing activities.

Conclusion

Effective and efficient NRC licensing ultimately depends on people. The NIA Advanced Reactor Licensing Efficiency Workshop highlighted how effective communication, stakeholder alignment, and collaborative problem solving are keys to efficient licensing of advanced reactors.

Both applicants and the NRC have a role to play in improving advanced reactor licensing. Applicants must focus on submitting high-quality documents that provide NRC staff the information they need to efficiently reach safety determinations. The NRC must continue to prioritize effective project management and development of effective regulatory processes that ensure that regulatory discussions and reviews are appropriate in scope, breadth, and depth. The timely and efficient licensing of advanced reactors requires support from all stakeholders.

The 2022 Advanced Reactor Licensing Efficiency Workshop and this report are starting points for engagement with all stakeholders including prospective applicants, NRC staff and management, Commission, policymakers, external industry and public interest groups, and members of the public. Ensuring effective, efficient, and transparent regulatory processes is critical to building public trust in the NRC as an independent safety regulator and enabling the deployment of advanced nuclear energy as a climate solution.

Appendix A. Advanced Reactor Licensing Efficiency Workshop Participants

Name	Affiliation/Organization
Amir Afzali	American Nuclear Society
Frank Akstulewicz	Terrestrial USA
Thomas Braudt	X-energy
Stephen Burns	Third Way/former NRC Commissioner
Chris Carson	USNC
Travis Chapman	X-energy
Carrie Fosaaen	NuScale
Rani Franovich	Breakthrough Institute
Judi Greenwald	Nuclear Innovation Alliance
Don Gregoire	Energy Northwest
Maris Hanson	FLiBe Energy
Peter Hastings	Kairos
Scott Head	CFPP/UAMPS
Natalie Houghtalen	ClearPath
Victor Ibarra Jr	Nuclear Innovation Alliance
Ross Moore	Oklo
Josh Parker	BWXT
Everett "Chip" Perkins, Jr.	Abilene Christian University/Certrec
Zachary Rad	USNC
Robin Rickman	Terrestrial USA
Amy Roma	Hogan Lovells
Jackie Siebens	Oklo
Ryan Sprengel	TerraPower
Robbie Stewart	Boston Atomics
George Wadkins	GE Hitachi Nuclear Energy
Patrick White	Nuclear Innovation Alliance
George Wilson	TerraPower

Appendix B. Summary of December 2021 NIA report “Promoting Efficient NRC Advanced Reactor Licensing Reviews to Enable Rapid Decarbonization”

The December 2021 NIA report [“Promoting Efficient NRC Advanced Reactor Licensing Reviews to Enable Rapid Decarbonization”](#) provided recommendations for both advanced reactor license applicants and the NRC on how to improve the efficiency and effectiveness of advanced reactor licensing reviews. Four major categories of recommendations were identified for applicants and the NRC:

- Rethinking pre-application engagement
- Restructuring safety review processes
- Providing for early Commission policy involvement
- Establishing effective communication during review

This appendix provides a summary of the detailed recommendations for each of the major recommendation categories.

The first recommendation category was “rethinking pre-application engagement”. The NRC encourages “earliest possible” preapplication activities for advanced reactor applicants to help establish alignment on expectations and plans between potential applicants and the NRC. Conversations with stakeholders, however, suggested that the value of pre-application process with the NRC is unclear for many advanced reactor developers. Perceptions of a high-cost, long-duration, low-value pre-application process for applicants was driven by a variety of factors including:

- Lack of discrete benefits from pre-application during actual licensing review
- Process outcomes shaped by NRC personnel, not safety
- Lack of robust discussion on key technical issues

NIA developed detailed recommendations to address the challenges associated with pre-application engagement that are summarized in Table B.1.

Table B.1. Detailed Recommendations for “Rethinking Pre-application Engagement”

NRC Recommendations	Applicant Recommendations
<ul style="list-style-type: none"> • Assess opportunities for license review schedule reductions from pre-application activities 	<ul style="list-style-type: none"> • Develop regulatory engagement plans for issues to resolve during pre-application
<ul style="list-style-type: none"> • Document pre-application agreements on technical issues to support application reviews 	<ul style="list-style-type: none"> • Clearly communicate goals, strategy, and realistic timelines associated with preapplication engagement
<ul style="list-style-type: none"> • Provide actionable feedback and two-way communication on key technical questions 	<ul style="list-style-type: none"> • Collaborate with NRC staff to determine reasonable scope for pre-application
<ul style="list-style-type: none"> • Provide applicants with summaries of pre-application interaction and conclusions on technical issues 	<ul style="list-style-type: none"> • Characterize effective pre-application interactions to help guide NRC staff

The recommendations in Table B.1 are intended to produce a more effective pre-application process that helps both to reduce the total duration of licensing by focusing discussion on key issues and to increase the predictability of the licensing process.

The second recommendation category was “restructuring safety review processes”. Safety review processes for all commercial power reactors could be shortened by identifying opportunities to conduct certain licensing review processes in parallel and eliminating iterations if not needed. For example, medical isotope or research and test reactors (Class 104b licenses) can receive a construction permit (CP) and operating license (OL) in a total of 36-48 months while a Class 103 power reactor is expected to take a total of 72-96 months for review and approval of their CP and OL. NIA believes that the licensing safety review process could be shortened to reflect a simplified safety case for some advanced reactors and that a restructured safety review process could reduce total duration and variability of licensing reviews.

NIA developed detailed recommendations to address restructuring safety review processes that are summarized in Table B.2.

Table B.2. Detailed Recommendations for “Restructuring Safety Review Processes”

NRC Recommendations	Applicant Recommendations
<ul style="list-style-type: none"> • Assess opportunities to streamline the licensing process and utilize non-power reactor licensing schedules 	<ul style="list-style-type: none"> • Prepare high-quality applications and avoid premature application submittals
<ul style="list-style-type: none"> • Simplify engagement with ACRS to reduce lengthy iteration cycles 	<ul style="list-style-type: none"> • Allocate sufficient resources for timely and complete responses to RAIs
<ul style="list-style-type: none"> • Focus requests for additional information (RAIs) based on safety-significant portions of designs 	<ul style="list-style-type: none"> • Control or eliminate application amendments or changes during review that can disrupt NRC staff reviews
<ul style="list-style-type: none"> • Provide additional regulatory guidance on “high-quality” applications 	

The recommendations in Table B.2 are intended to accelerate the licensing review process by reducing barriers to efficient NRC staff review and eliminating procedural review stages that may not be required for some advanced reactor designs with sufficiently simple and robust safety cases.

The third recommendation category was “providing for early Commission policy involvement”. Licensing of advanced reactors may require the timely and predictable resolution of novel policy issues. Figure B.1. illustrates novel policy issues that may need to be addressed to support advanced reactor licensing.



Figure B.1. Example policy issues requiring resolution for advanced reactor licensing reviews

Technical decisions on policy issues may be required at multiple levels within the NRC, and reaching alignment may require lengthy reviews and approval cycles. NRC participants in technical policy issues may include:

- Commission
- Advisory Committee on Reactor Safeguards (ACRS)
- Executive Director for Operations (EDO)
- Office Director
- Division Director
- Branch Chief
- Project Manager
- Technical Expert
- Staff Reviewer

Clear processes for early resolution of policy issues can help reduce the risk of delays late in the review process. NIA developed detailed recommendations to help provide for early Commission policy involvement that are summarized in Table B.3.

Table B.3. Detailed Recommendations for “Providing for Early Commission Policy Involvement”

NRC Recommendations	Applicant Recommendations
<ul style="list-style-type: none"> • Prioritize early escalation of policy issues to NRC middle and senior management for resolution 	<ul style="list-style-type: none"> • Prepare for early engagement with NRC staff on potential policy issues requiring management resolution
<ul style="list-style-type: none"> • Identify early and prioritize Commission involvement on policy issues requiring Commission decisions 	<ul style="list-style-type: none"> • Incorporate policy issues and technical issues into pre-application and regulatory engagement planning with NRC
<ul style="list-style-type: none"> • Ensure NRC management is actively engaged in licensing reviews to help provide accountability in the process 	<ul style="list-style-type: none"> • Prioritize management escalation of policy issues to most effectively utilize agency resources for the review

The recommendations in Table B.3 are intended to reduce the risk of policy issues becoming bottlenecks during the licensing process and can help increase the predictability of NRC reviews.

The fourth recommendation category was “establishing effective communication during reviews”. Communication between applicants and regulators has a significant effect on licensing process outcomes. Figure B.2 highlights different important stakeholders involved during a licensing review.

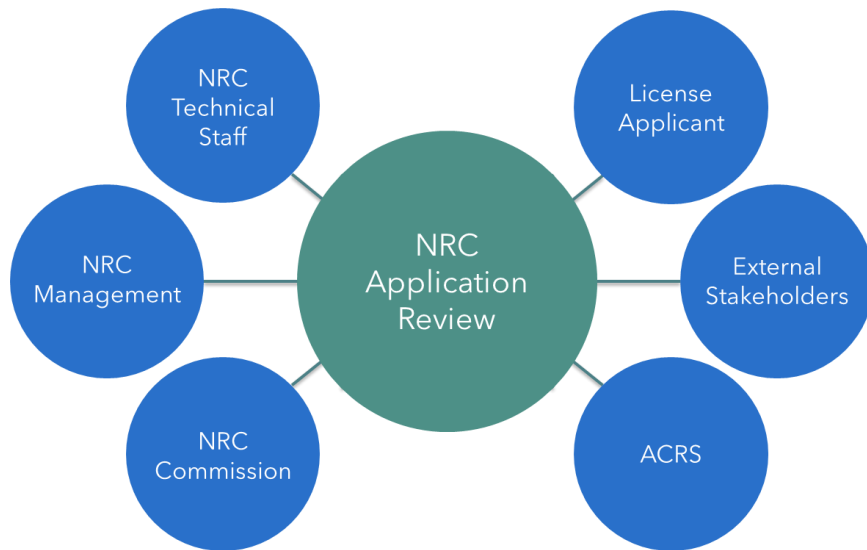


Figure B.2. Example of different stakeholders involved during licensing review process

Effective communication between stakeholders is critical at all stages of the licensing process. Figure B.3 provides examples of topic areas for both applicants and NRC staff where effective communication during different licensing stages could help facilitate a more effective and efficient review. A renewed focus by applicants and NRC staff on effective communication could provide significant benefits to existing licensing processes.

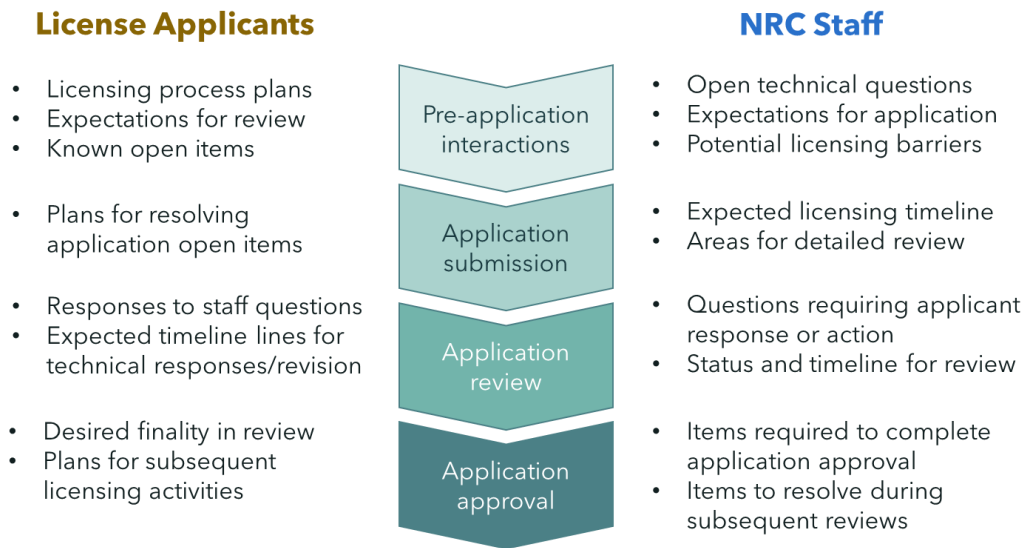


Figure B.3. Example applicant and NRC communication topic areas during different stages of the licensing review process

NIA developed detailed recommendations to address establishing effective communication that are summarized in Table B.4.

Table B.4. Detailed Recommendations for “Establishing Effective Communication”

NRC Recommendations	Applicant Recommendations
<ul style="list-style-type: none"> Establish clear lines of communication at each level of applicant/staff engagement 	<ul style="list-style-type: none"> Establish clear lines of communication at each level of applicant/staff engagement
<ul style="list-style-type: none"> Evaluate effectiveness of review activities including RAIs, SER development, and ACRS reviews 	<ul style="list-style-type: none"> Evaluate effectiveness of applicant staff engagement activities including RAI responses, NRC audits, and ACRS reviews
<ul style="list-style-type: none"> Review use and processes for RAIs to reduce long-duration RAI iteration cycles with applicants 	<ul style="list-style-type: none"> Provide realistic engagement schedules to help NRC staff manage resources
<ul style="list-style-type: none"> Improved project management and training for NRC staff 	<ul style="list-style-type: none"> Ensure timely, accurate, and complete responses to NRC staff inquiries

The recommendations in Table B.4 are intended to increase the effectiveness and predictability of NRC reviews by enabling greater alignment between applicants and the NRC in terms of process, requirements, and licensing goals.