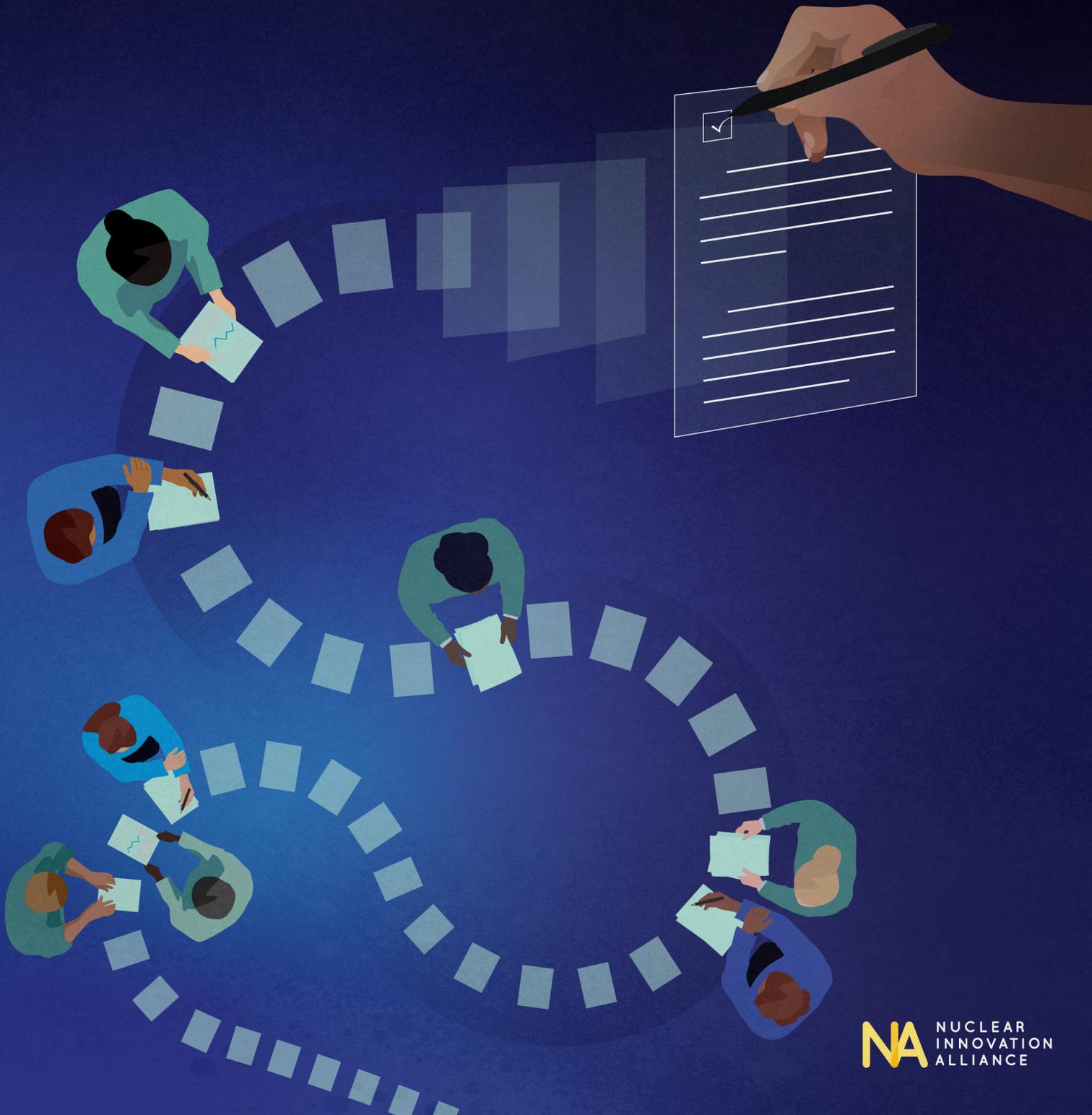
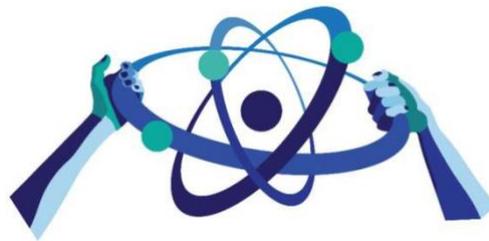


Improving the Effectiveness and Efficiency of the Advisory Committee on Reactor Safeguards

March 2023



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The contents of this report are based on interviews with over thirty-five individuals, including current and several former members of the ACRS, current and former ACRS staff, several former NRC Commissioners, former NRC Staff, and members of the ACRS stakeholder community.

Disclaimer:

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I. Executive Summary

The Nuclear Innovation Alliance’s (“NIA’s”) previous report, *Promoting Efficient NRC Advanced Reactor Licensing Reviews to Enable Rapid Decarbonization*,¹ suggested that “the Commission should systematically evaluate the [Advisory Committee on Reactor Safeguards] ACRS review process and how this can be appropriately aligned with the expectations that Congress set out for the Commission under [Nuclear Energy Innovation and Modernization Act (“NEIMA”)].”² In light of this suggestion, NIA undertook its own extensive review of the ACRS to determine how it should better align with Congressional expectations under NEIMA without diminishing the significant role the ACRS has in the review and resolution of key technical issues associated with nuclear power plant regulation. Based on this review, the authors produced four main recommendations accompanied by specific proposed solutions. These recommendations broadly align with ACRS’ own suggestions for the self-transformation presented to the Commission in 2019.³ A brief description of each overarching recommendation and the takeaways from that recommendation are described briefly below.

1. **The first overarching recommendation is to “Re-focus the Scope and Depth of ACRS Reviews.”**

In accordance with this recommendation, the ACRS should:

- focus on safety-significant matters and assist the NRC in meeting its statutory mandate to determine “that there is reasonable assurance”⁴ “that the utilization or production of special nuclear material will be in accord with the common defense and security and will provide adequate protection to the health and safety of the public.”⁵ (pg. 14)
- increase training, focus the scope of reviews, and use an action plan to further prioritize matters needing review. (pg. 15)
- consolidate duplicative Full Committee and Subcommittee meetings. (pg. 18)
- provide dates in the schedule for placeholder meetings. (pg. 18)

The Commission should:

- direct the ACRS to focus on novel and safety-significant issues in its reviews, and potentially refer specific matters to the ACRS with novel technical issues prior to review. (pg. 15)

¹ Alex Gilbert, *Promoting Efficient NRC Advanced Reactor Licensing Reviews to Enable Rapid Decarbonization*, Nuclear Innovation Alliance (2021), available at <https://nuclearinnovationalliance.org/licensingdurationsforclimatemitigation>.

² *Id.* at 18.

³ See e.g., Letter from Peter C. Riccardella, Chairman of NRC Advisory Committee on Reactor Safeguards to Kristine Svinicki, NRC Chairman (Oct. 17, 2019), available at <https://www.nrc.gov/docs/ML1929/ML19290F956.pdf> (hereinafter “ACRS Transformation Letter”); ACRS, *Commission Meeting with the Advisory Committee on Reactor Safeguard (ACRS)* (Dec. 6, 2019), available at <https://www.nrc.gov/reading-rm/doc-collections/commission/slides/2019/20191206/staff-20191206.pdf>.

⁴ AEA at § 185(b).

⁵ AEA at § 182(a).

- establish timelines and milestones for ACRS reviews. (pg. 16)
- have OGC available to assist the ACRS in understanding the agency's statutory mandate. (pg. 16)
- communicate topics of interest to the NRC Staff in advance of meetings. (pg. 17)
- establish a hard deadline for the NRC Staff to provide documents in advance of the meetings and allow the meeting date to slip if the NRC Staff fails to meet its deadline. (pg. 17)
- exercise greater discipline on itself to limit the demands it places on the Staff to what is essential to ensuring adequate protection. (pg. 17)

The NRC Staff should:

- improve its preparation for engagements with the ACRS to better optimize the review of topics. (pg. 16)
- review its own practices in engaging with the ACRS, identify best practices that lead to efficient and effective ACRS reviews, and promote those best practices. (pg. 16)
- provide the ACRS with documents sufficiently in advance of ACRS meetings to allow for a fulsome review. (pg. 20)
- communicate the portions of the review that have the greatest potential safety significance. (pg. 20)
- engender a culture where the NRC Staff can feel empowered to raise concerns that the Committee is raising issues that are not safety significant. (pg. 20)

Finally, Congress should:

- revise the ACRS' statutory mandate in the Atomic Energy Act to emphasize that the ACRS should review only novel and safety-significant issues, and remove the requirement that the ACRS review all construction permit and operating license and renewal applications. (pg. 16)

2. The second overarching recommendation is to “Improve ACRS Operations and Management.”

In accordance with that recommendation, the ACRS should:

- keep itself to approximately ten members. (pg. 21)
- diversify the background of ACRS members (drawing from former industry members, academics, and former national lab personnel or consultants). (pg. 22)
- relax experience requirements in certain areas of new state-of-the-art technology (e.g. artificial intelligence). (pg. 22)
- adhere to term limits. (pg. 22)
- not allow a single member to dominate the conversation for a particular subject area. (pg. 24)

The Commission should:

- implement the above suggestions for the ACRS to the extent that the ACRS cannot do so. (pg. 23)
- hire a consultant with expertise in organizational effectiveness to evaluate the manner in which ACRS members engage with the NRC Staff and licensees and suggest options for training and best practices on public and peer engagement. (pg. 25)
- incorporate components that screen for individuals who are independent yet collaborative and collegial when selecting ACRS members. (pg. 24)

The Executive Director for Operations in coordination with the ACRS should:

- not allow the ACRS to criticize, badger, or undermine individuals who are unable to answer ACRS questions on the spot. (pg. 24)
- request that ACRS members be able to set forth a brief explanation for why they are asking a question and tie it back to regulation (i.e., what is the member trying to understand and what is the safety concern). (pg. 24)

The ACRS Chairman should:

- ensure that debate among ACRS members is constructive, collegial, and within the ambit of its statutory purpose. (pg. 24)
- ensure that the views of individual ACRS members do not unduly chill or influence the views of the NRC Staff. (pg. 24)
- provide and maintain a safe space for respectful disagreement. (pg. 24)

3. The third overarching recommendation is “Reduce the Cost of ACRS Reviews.”

In accordance with that recommendation, Congress should:

- amend the Atomic Energy Act to provide that all costs associated with ACRS reviews, including the cost of ACRS time be excluded from the fee recovery requirement. (pg. 25)
- amend the Atomic Energy Act to provide that all NRC Staff time used to prepare for ACRS meetings should not be billed to licensees and should also be excluded from fee recovery. (pg. 25)

4. The fourth overarching recommendation is to “Adjust Management of the ACRS.”

In accordance with that recommendation, the Commission should:

- be more involved in the screening and selection of individual candidates who possess the knowledge, skills, and abilities necessary to address keys topics before the NRC. (pg. 26)
- be more involved in selecting or identifying the ACRS Chair and engage with the ACRS Chair on a regular basis. (pg. 26)
- provide the ACRS information on topics requiring ACRS review, particularly those that are novel or have significant safety implications. (pg. 26)

- discuss budgeting and prioritization with the ACRS. (pg. 27)
- set much of the agenda for the semi-annual meetings with the ACRS. (pg. 27)
- revamp the way that it interacts with the ACRS in meetings by eliminating meetings solely focused on repeating written material in paper filings. (pg. 27)
- ensure the ACRS Executive Director position is always filled by a seasoned executive who has technical credibility and sufficient weight and standing within the Commission to push back against the NRC Executive Director of Operations as well as the ACRS Chairman and members, and who has the experience needed to garner respect, as well as the savvy needed to deal with various disparate personalities. (pg. 27)
- perform a budget review of the ACRS staffing needs to ensure the Executive Director's organization is appropriately staffed to ensure it can meet the anticipated bow-wave of new reactor reviews. (pg. 27)

The authors' hope is that these recommendations (or some semblance thereof) will be implemented to position ACRS and NRC to successfully enable safe deployment of advanced nuclear energy.

II. Introduction

The Nuclear Innovation Alliance’s (“NIA’s”) previous report, *Promoting Efficient NRC Advanced Reactor Licensing Reviews to Enable Rapid Decarbonization*,⁶ suggested that “the Commission should systematically evaluate the [Advisory Committee on Reactor Safeguards] ACRS review process and how this can be appropriately aligned with the expectations that Congress set out for the Commission under [Nuclear Energy Innovation and Modernization Act (“NEIMA”)].”⁷ In light of this suggestion, NIA undertook its own extensive review of the ACRS to determine how it could better align with Congressional expectations under NEIMA without diminishing the significant role the ACRS has in the review and resolution of key technical issues associated with nuclear power plant regulation. The authors reviewed documentation relevant to the Committee, including statutory authority, requirements by NRC rule, and some ACRS meeting transcripts. The authors also interviewed over 35 individuals, including current and several former members of the ACRS, current and former ACRS staff, several former NRC Commissioners, former NRC Staff, and members of the ACRS stakeholder community. These interviews, which comprised over 100 hours of interview time, demonstrated a broad array of opinions regarding the ACRS, with several common themes described below.

Interviewees overwhelmingly indicated that the ACRS has the potential to be a valuable part of the NRC review process, but there was also uniform agreement that the ACRS and its processes need to be improved and modernized. A majority of interviewees indicated that the scope of ACRS reviews must be narrowed and focused on safety-related issues, the length of reviews must be reduced, and inefficiencies must be eliminated, particularly in light of the potential influx of a large number of advanced reactor reviews. Interviewees also indicated that the ACRS and the NRC Staff should work together to optimize the review process, control or reduce process costs for applicants, and maintain a positive working relationship between all stakeholders. In terms of ACRS membership, interviewees indicated that the ACRS should pursue greater diversity of members’ viewpoints and experience. Interviewees also suggested that the Commission should be more involved with and set priorities for ACRS reviews. Finally, interviewees suggested the Executive Director of the ACRS⁸ (a senior NRC Staff member who serves as the bridge between ACRS and the NRC Staff) is important to implementing some of the recommendations in this paper.

This paper provides a brief background of the ACRS and provides NIA’s recommendations to enhance the value of the ACRS based on NIA’s independent assessment of interviewee suggestions and NIA’s review of ACRS’ history. These recommendations can enable the ACRS and the NRC to implement numerous improvements to reduce the scope and length of ACRS reviews; increase focus on safety-relevant issues; gain greater efficiencies and optimize

⁶ Alex Gilbert, *Promoting Efficient NRC Advanced Reactor Licensing Reviews to Enable Rapid Decarbonization*, Nuclear Innovation Alliance (2021), available at <https://nuclearinnovationalliance.org/licensingdurationsforclimatemitigation>.

⁷ *Id.* at 18.

⁸ The Executive Director of ACRS coordinates technical, management, and administrative support of the statutory Advisory Committee on Reactor Safeguards (ACRS); provides overall program and management direction for ACRS administrative and technical support and associated resource management; and maintains liaison with the Commission, NRC staff, and others to provide for the conduct of ACRS in a manner responsive to the needs of the Commission.

interactions with the NRC Staff; reduce applicant, licensee, and NRC costs; optimize Committee membership and diversity; and improve Commission involvement in the Committee. These recommendations will enable the review of advanced reactors to focus on safety-related issues and to support the clean energy transition, improve energy security, and enable rapid decarbonization. These recommendations are also in line with ACRS' own suggestions for the ACRS transformation presented by the ACRS to the Commission in [October](#) and [December](#) 2019 to prioritize reviews on issues related to public health and safety, emphasizing risk significance and agency transformation priorities; stay abreast of staff transformation initiatives and continue to contribute to those initiatives; and improve operational efficiency.⁹

III. Background on the Advisory Committee on Reactor Safeguards

A. History

The Advisory Committee on Reactor Safeguards (“ACRS”) was first organized in June 1947 when the Atomic Energy Commission (“AEC”) established a blue-ribbon advisory group (the Reactor Safeguards Committee) “to evaluate the technical health and safety aspects of reactor hazards.”¹⁰ In 1950, the AEC created a second advisory group, the Industrial Committee on Reactor Location Problems, to “evaluate the scientific and environmental aspects of reactor locations.”¹¹ In 1953, these two committees were combined to form the ACRS. All of these developments occurred in the infancy of the nuclear industry: the first nuclear reactor produced electricity in 1951 and the first commercial reactor did not come online until 1957.

Improved safety was a consideration in the first revision of the Atomic Energy Act of 1954, leading to the development of the ACRS as a statutory committee authorized to provide oversight on safety and report directly to the Commission under the Price Anderson Act of 1957.¹² Price-Anderson mandated that the ACRS review each power reactor or test facility application and that the ACRS reports be made public.¹³ Prior to this statutory mandate, the AEC’s advisory committees existed on an ad hoc basis.

With the enactment of the Energy Reorganization Act of 1974, the licensing functions of the AEC were transferred intact to the NRC. Since then, the ACRS has continued in the same advisory role to the NRC, with its responsibilities changing with the needs of the Commission. The ACRS consists of up to fifteen technical experts (as of this publication, the ACRS has ten members, with the NRC currently seeking to fill vacant positions¹⁴) who serve on a part-time

⁹ See e.g., Letter from Peter C. Riccardella, Chairman of NRC Advisory Committee on Reactor Safeguards to Kristine Svinicki, NRC Chairman (Oct. 17, 2019), available at <https://www.nrc.gov/docs/ML1929/ML19290F956.pdf> (hereinafter “ACRS Transformation Letter”); ACRS, *Commission Meeting with the Advisory Committee on Reactor Safeguard (ACRS)* (Dec. 6, 2019), available at <https://www.nrc.gov/reading-rm/doc-collections/commission/slides/2019/20191206/staff-20191206.pdf>.

¹⁰ See NRC, *ACRS History*, available at <https://www.nrc.gov/about-nrc/regulatory/advisory/acrs/history.html>.

¹¹ *Id.*

¹² P. Samantha, *NRC Regulatory History of Non-Light Water Reactors (1950-2019)*, at 2-2 (June 2019).

¹³ See *infra* at 5.

¹⁴ See NRC Notice, *Seeks Qualified Candidates for Appointment to the Advisory Committee on Reactor Safeguards* <https://www.federalregister.gov/documents/2022/05/20/2022-10841/seeks-qualified-candidates-for-appointment-to-the-advisory-committee-on-reactor-safeguards>.

basis¹⁵ and meet as a Full Committee approximately ten times a year. They deliberate as a collective body, and the Full Committee provides advice to the Commission in the form of letters, reports, white papers, and memoranda – all of which may contain recommendations for the Commission’s consideration.

In addition to the Full Committee, as of this writing, the ACRS has the following subcommittees:

- Planning and Procedures Subcommittee (which meets each month the Full Committee meets)
- Digital Instrumentation and Controls (“I&C”)
- Metallurgy and Reactor Fuels
- Accident Analysis
- Regulatory Rulemaking, Policies, and Practices
- Plant Operations and Fire Protection
- Radiation Protection and Nuclear Materials
- Probabilistic Risk Assessment (“PRA”)
- Fuels, Materials, and Structures
- Future Plant Designs
- Design Centered Licensing
- Application/Design-Specific Subcommittees
 - SHINE
 - Kairos
 - NuScale
 - BWRX-300

There are approximately 10 Full Committee and 50 Subcommittee meetings every year.¹⁶

Today, the ACRS has four primary purposes:

1. to review and report on safety studies and reactor facility license and license renewal applications;
2. to advise the Commission on the hazards of proposed and existing production and utilization facilities and the adequacy of proposed safety standards;
3. to initiate reviews of specific generic matters or nuclear facility safety-related items; and
4. to provide advice in the areas of health physics and radiation protection.¹⁷

¹⁵ The ACRS is subject the Federal Advisory Committee Act (“FACA”) and is composed of Special Government Employees who are not fulltime Federal government employees.

¹⁶ *ACRS Charter*, available at <https://www.nrc.gov/docs/ML2033/ML20337A117.pdf>.

¹⁷ NRC, *Advisory Committee on Reactor Safeguards*, available at <https://www.nrc.gov/about-nrc/regulatory/advisory/acrs.html>.

The ACRS performs these functions through its meetings, publications (primarily through the use of letter reports¹⁸), and interactions with NRC Staff, Commissioners, licensees, applicants, and external stakeholders.

The cost of the review activities of the ACRS is subsumed into the overall Part 171 fee structure that the utilities and others pay in their yearly general license fees. Thus, the ACRS itself is not off the fee base. However, the NRC Staff cost associated with preparing for and attending ACRS meetings is a cost charged directly to applicants for a specific license review under Part 170.

B. Authorizing Statute

As noted previously, the ACRS is statutorily mandated. Section 29 of the Atomic Energy Act of 1954 mandates that:

There is hereby established an Advisory Committee on Reactor Safeguards consisting of a maximum of fifteen members appointed by the Commission for terms of four years each. The Committee shall review safety studies and facility license applications referred to it and shall make reports thereon, shall advise the Commission with regard to the hazards of proposed or existing reactor facilities and the adequacy of proposed reactor safety standards, and shall perform such other duties as the Commission may request. One member shall be designated by the Committee as its Chairman. The members of the Committee shall receive a per diem compensation for each day spent in meetings or conferences, or other work of the Committee, and all members shall receive their necessary traveling or other expenses while engaged in the work of the Committee. . .¹⁹

The ACRS' broad scope of optional and required reviews is also set forth in the Act:

The Advisory Committee on Reactor Safeguards shall review each application under section 103 or section 104b. for a construction permit or an operating license for a facility, any application under section 104c. for a construction permit or an operating license for a testing facility, any application under section 104a. or c. specifically referred to it by the Commission, and any application for an amendment to a construction permit or an amendment to an operating license under section 103 or 104a., b., or c. specifically referred to it by the Commission, and shall submit a report thereon which shall be made part of the record of the application and available to the public except to the extent that security classification prevents disclosure.²⁰

¹⁸ NRC, *Advisory Committee on Reactor Safeguards (ACRS) Letter Reports*, available at <https://www.nrc.gov/reading-rm/doc-collections/acrs/letters/index.html>.

¹⁹ See Atomic Energy Act of 1954, as Amended, available at <https://www.nrc.gov/docs/ML1327/ML13274A489.pdf#page=23>.

²⁰ Atomic Energy Act of 1954, as Amended, available at <https://www.nrc.gov/docs/ML1327/ML13274A489.pdf#page=23> Page 150.

The ACRS is further governed by NRC regulations, particularly those set forth in 10 CFR Part 7, the ACRS Charter²¹ (required under the Federal Advisory Committee Act to specify the Committee’s mission or charge, specific duties, and general operational characteristics), and the ACRS Bylaws²² (describing the procedures to be used by the ACRS in performing its duties, and the responsibilities of the members).

IV. Recommendation 1: Re-focus the Scope and Depth of ACRS Reviews.

A. Problem Statement

There is no doubt that the ACRS works hard to provide the Commission with an independent analysis of the matters under its purview. However, many interviewees indicated that changes in the NRC and its scope of work over the decades along with a static statutory mandate has increased ACRS engagement in matters where the ACRS provides less overall value. Therefore, the ACRS needs modernization.

When the ACRS was first created in 1947 and statutorily mandated in 1957, the AEC was tasked with licensing the United States’ first commercial nuclear power reactors. The AEC was a new Federal agency, responsible for both promoting and regulating nuclear power, and its Staff had limited experience with evaluating nuclear technology. The first reactors often included a variety of different reactor technologies (e.g., pressurized water reactors, boiling water reactors, and sodium fast reactors), and there were significant differences between subsequent reactors of the same type based on rapid advances in the state of the art and siting-based modifications. In light of the circumstances, the ACRS provided significant value reviewing each application for a construction permit and operating license for new nuclear power plants and providing an independent analysis of each design and site—separate and apart from the Staff of the AEC. This made sense, given the state of industry and AEC Staff knowledge at the time: virtually everything was novel; without appreciable experience, there was little or no understanding of what was considered safety significant; and therefore a broad range of topics warranted review from independent experts. The ACRS’ statutory framework reflects this reality. With the lack of experience at the Atomic Energy Commission and subsequently the NRC in deploying and regulating light water nuclear reactors, the ACRS played a useful role in raising fundamental issues related to reactor design, operation, and siting to support the licensing of these first reactors.

The industry and the NRC have changed drastically over the course of sixty-five years since this statutory framework was first established. The industry has since gained tremendous experience licensing and safely operating light water reactors, with over 100 reactors licensed, most reactors in an extended period of operation under a new license, and some reactors pursuing Subsequent License Renewal (SLR) or entering their second period of extended operation. The NRC Staff, likewise, has significant experience and technical knowledge of light water reactors that did not exist when the ACRS was first created. At this point, numerous members of the NRC Staff and the industry have decades of experience operating, maintaining, or regulating light water reactors, and this level of knowledge and familiarity with these designs is functionally equivalent

²¹ *ACRS Charter*, available at <https://www.nrc.gov/docs/ML2033/ML20337A117.pdf>.

²² *ACRS Bylaws*, available at <https://www.nrc.gov/docs/ML2121/ML21217A060.pdf>.

(or may exceed) the experience of some members of the ACRS. For this reason, it is timely to consider a different role for the ACRS as it no longer serves the same role as its predecessor did in the 1950s-60s during the dawn of the nuclear age.

Numerous interviewees indicated challenges arising from this evolution. For one, the ACRS is still required to provide an outside assessment of every application for a construction permit or operating license, irrespective of standardization or design maturity, including some license renewals for facilities that have operated safely for many decades.²³ Some interviewees were concerned that, as more advanced and new reactors pursue licensing while, in parallel, existing reactors pursue subsequent license renewal, the requirement of the ACRS to review every application could quickly fill the ACRS calendar, making it more difficult for advanced and new reactors to obtain a slot on the meeting schedule and delaying completion of mandated licensing reviews. Other interviewees thought that the statutory requirements would continue to drive the ACRS to focus too heavily on areas with little or no added benefit, including repetitive reviews of light water reactor technologies or advanced reactor technologies that have already undergone NRC and ACRS review (i.e., nth of a kind reactors).

Finally, a number of interviewees noted that some individual ACRS members have pursued questioning on matters of personal and professional curiosity that were not intrinsic to a safety concern and that consumed precious time that could have been better spent on matters of potential safety significance. Given the fact that NRC, applicant, and licensee resources are finite, and the NRC is a fee-based agency, ACRS leadership and members should exercise discipline and avoid lines of inquiry that are not germane to the safety decision so as to avoid burdening the NRC Staff, licensee or applicant with unnecessary costs and delays. More importantly, there is a public interest in the NRC and the ACRS using their time to focus on significant safety issues.

On the other hand, several interviewees indicated that the ACRS is at its best when reviewing novel regulatory issues and that the ACRS has served a beneficial role in helping the NRC Staff resolve these issues. One example is the ACRS review of reduced emergency planning zones commensurate with reduced risk from advanced reactors, which provided additional support for the NRC's Staff determination. It is NIA's understanding that the ACRS also worked closely with the NRC Staff to develop the agency's current risk-informed regulations²⁴ to the benefit of the NRC Staff. Some interviewees also indicated that the ACRS can be valuable to the Commission in reinforcing expectations to modernize and evolve regulatory perspectives. NIA also understands that the ACRS has authored useful generic papers regarding advanced reactor technology, including a short paper on the technology of pebble bed reactors and the challenges associated with the deployment of this technology. These papers can enable technical knowledge management and knowledge transfer to NRC Staff.

²³ We understand that the ACRS has stated that they need to review every topical report written by advanced reactor applicants; however, we do not agree that such review is required particularly to the extent that Topical Reports are building on known technology or methods.

²⁴ See "Risk-informed regulation" definition on the NRC website, <https://www.nrc.gov/reading-rm/basic-ref/glossary/risk-informed-regulation.html>.

These observations are generally consistent with the ACRS' own analysis of Commissioner input on where ACRS engagement is most effective, as set forth in the ACRS Transformation Letter.²⁵ In that ACRS Transformation Letter, the ACRS stated that its engagement is most effective in:

- “Risk-Informed Decision Making – Several commissioners opined that the most important role the ACRS can play is to continue its firm support of and advice regarding risk-informed decision making.”²⁶
- “Digital I&C – This was identified as an important topic, and one commissioner stated that NRC and the nuclear industry are far behind where they should be on this topic.”²⁷
- “Research Reviews – Research reviews were identified by several commissioners as an important area for continued ACRS involvement.”²⁸
- “New Technologies and Reactor Types –ACRS is a highly competent group of dedicated experts from outside the agency, encompassing a broad range of disciplines, who dig deeply into the matters subject to the Committee’s review. The ACRS members’ independent technical assessments assist the NRC staff in making high-quality regulatory evaluations.”²⁹

In sum, interviewees generally agreed that the ACRS should optimize the use of its finite resources by focusing on safety-significant³⁰ issues, commensurate with risk, and novel technologies. However, some interviewees disagree that ACRS engagement has been effective in digital I&C and instead believe the ACRS has contributed to the failure of the agency and industry to make progress on digital I&C deployment.³¹ In addition, some interviewees suggested that the ACRS could reduce the length of reviews and remove inefficiencies with a few relatively modest modifications as elaborated below.

²⁵ See *supra* at n.4.

²⁶ ACRS Transformation Letter at 3.

²⁷ ACRS Transformation Letter at 3. ²⁸ ACRS Transformation Letter at 3.

²⁸ ACRS Transformation Letter at 3.

²⁹ ACRS Transformation Letter at 3.

³⁰ See NRC definition of “safety-significant” <https://www.nrc.gov/reading-rm/basic-ref/glossary/safety-significant.html>. While the definition of safety significant is broad, it is worth noting that some technologies undergoing licensing by the NRC have been around for decades and, as such, are not novel per se; they just have not been used in commercial applications. For example, air-cooled condensers are widely used in industrial applications but not in nuclear power generation, and they have no safety function. Unless there is a nexus to safety, the ACRS should not invest significant time reviewing these components.

³¹ Based on these interviews, the ACRS does not possess a state-of-the-art understanding of the status of digital I&C in nuclear, energy and process industries. In Section IV.B.1.a, NIA recommends steps that should be taken to improve ACRS's awareness of state-of-the-art approaches.

The following sets forth proposed solutions to address these issues.

B. Proposed Solutions

There are several ways to implement greater ACRS focus on safety-significant issues and novel technologies or novel approaches to regulatory issues. The following sections explore implementation pathways for various stakeholders including the ACRS itself, the Commission, the NRC Staff, and Congress. Ideally, all stakeholders would pursue improvements in concert with one another.

1. Solution 1. Focus ACRS review on safety-significant issues and novel technology or approaches to regulatory issues.

a. The ACRS

Recent ACRS Chairmen have been moving to streamline the level of activities that are reviewed by the Committee, as discussed further in subsequent sections. While this is positive, further changes would improve the operational effectiveness of the ACRS. As an initial matter, the ACRS could improve training for new members on the requirements of the Atomic Energy Act. NIA understands from some interviews that ACRS training is focused on requirements relating to managing their time, avoiding conflicts of interest and other administrative matters, but that no formal training is conducted on the roles and responsibilities of ACRS members in serving the Commission. Since the ACRS exists specifically to assist the Commission to meet the requirements of the Act, the members should receive appropriate training on how the ACRS helps the Commission perform its duties. At a minimum, ACRS members should receive training on the requirement that licensees demonstrate a reasonable assurance of adequate protection and what that means. The ACRS should also implement training on the NRC's regulations and how they are implemented, including the rulemaking and licensing review process so that ACRS members better understand how the Agency operates as a whole. As part of that training, ACRS members should have an opportunity to tour operating nuclear power plants and non-power reactors to gain a better practical understanding of how these facilities are operated, consistent with the ACRS-EDO MOU³², which already contemplates the possibility that the ACRS might visit licensee facilities.³³ A greater understanding of these topics should help the ACRS focus on the safety-significant issues where it is most needed and avoid areas which do not add value in helping the Commission meet its mission under the Act or involve areas outside of the legal or regulatory mandate of the ACRS. Because of its broad benefits, training costs should not be borne by applicants or licensees.

Interviewees that served on the ACRS also indicated that the ACRS Chairman and subcommittee chairs could more proactively reign in members who pursue time-consuming questions with no safety significance. Indeed, the "Chairman of the Committee is empowered to conduct the

³² See *ACRS-EDO Memorandum of Understanding* (2018 Revision), released in response to a FOIA request and available at ML19018A064 (hereinafter ACRS-EDO MOU).

³³ Interviewees also suggested that the ACRS could benefit from informal briefings from the NRC Staff on technical issues or new technologies, a topic that we address in more detail in Solution 2.

meeting in a manner that, in his/her judgment, will facilitate the orderly conduct of business.”³⁴ The ACRS already screens out issues of low safety significance, like “requests for power uprates less than 7 percent, requests for plants to operate in the expanded power to flow domain, and some license renewal applications,”³⁵ and the ACRS has also established criteria for in-depth reviews.³⁶ The ACRS is attempting to move to a new reactor design certification application review process that focuses on key, risk-significant issues that are cross-cutting over the application.³⁷ The ACRS in the past has also used an action plan, NUREG-0286, to focus its review on key issues. The ACRS could formalize a screening or prioritization process, perhaps by updating NUREG-0286³⁸ every year, and applying it to all ACRS reviews to eliminate previously reviewed or repetitive issues, or those of low safety significance. For example, the ACRS could screen out reviews in cases with no offsite consequences that would impact public health and safety, nth of a kind reactor reviews, or in cases such as uprates with no new issues of potential safety significance.

b. The Commission

The Commission should direct the ACRS to focus on novel and safety-significant issues in its required reviews, either informally through a change in the ACRS Charter, or the NRC rules applying to the ACRS. As it stands, the ACRS does not perform an in-depth review of every aspect of every license application: such a review would be impracticable, if not impossible. It would be logical for the Commission to direct the ACRS to focus specifically on those matters most likely to impact the Commission’s required finding “that there is reasonable assurance”³⁹ “that the utilization or production of special nuclear material will be in accord with the common defense and security and will provide adequate protection to the health and safety of the public.”⁴⁰

Re-reviewing technology or methods⁴¹ that have already been reviewed by the ACRS during previous licensing reviews or focusing on matters of little or no safety significance ultimately does not assist the Commission in making the findings that it is required to make under the Atomic Energy Act, and the Commission should ask the ACRS to focus on new matters that are relevant to the findings required by law. The Commission can also specifically refer anticipated

³⁴ 84 Fed. Reg. 27662.

³⁵ ACRS Transformation Letter at 3.

³⁶ ACRS Transformation Letter at 3. (“The following criteria will be used to set priorities for our in-depth reviews: - Does the issue affect public health and safety? - Does the issue relate to one of the four agency transformation initiatives (i.e., risk-informed decision making; 10 CFR 50.59 flexibility; licensing of non-[light water reactors (“LWRs”)]; or digital I&C safety design principles)? - Does the issue involve new methods or technologies, or is it a routine matter that we have reviewed numerous times before, and for which the staff processes are mature and technically advanced? - Is the activity directed by the Commission? - Other criteria that future staff transformation activities may identify.”)

³⁷ *Id.*

³⁸ We heard in our interviews that prior members of the ACRS found this NUREG to be helpful.

³⁹ AEA at § 185(b).

⁴⁰ AEA at § 182(a).

⁴¹ The ACRS should be directed to consider prior reviews as final. In other words, if they have previously reviewed a safety methodology in a Topical Report, they should not re-open those topics in an application. If that cannot be done, then the ACRS should not be reviewing the Topical Report in the first place.

matters (including novel technical issues) to the ACRS for review before they arise in an application. Such matters could be flagged by NRC Staff as they encounter novel technical issues during pre-application engagement with developers and applicants.

In addition to narrowing the scope of ACRS reviews, the Commission could also establish timelines and milestones for ACRS reviews, similar to those found in 10 CFR Part 2 for adjudicatory proceedings.

Finally, the Commission should require the ACRS to have its own assigned counsel from the NRC's Office of General Counsel at the table for Full Committee meetings, similar to the role that the NRC General Counsel plays at the meetings of the Commission itself. This Counsel would be able to provide guidance on legal and regulatory interpretation and could assist the ACRS Chairman in ensuring that the ACRS is focused on matters within its statutory and Commission-instructed mandate to provide reasonable assurance of adequate protection. Several interviewees indicated that ACRS members have, from time to time, made legal or regulatory interpretations on matters for which they lack this expertise or where such interpretation is outside their scope. Having a legal counsel at the table could help to avoid situations where the ACRS is opining on areas outside of their expertise or legal mandate. The Commission has been well served by having OGC represented at the table during its Commission meetings, and ACRS could similarly benefit.

c. The NRC Staff

The NRC Staff should improve its preparation for engagements with the ACRS to better optimize the review of topics. For example, the NRC Staff should proactively identify novel aspects of design prior to ACRS review for specific consideration. The NRC Staff should also identify and rank systems in proposed designs based on the potential to impact safety. The NRC Staff should review its own practices in engaging with the ACRS, identify best practices that lead to efficient and effective ACRS reviews, and promote those best practices.

d. Congress

Finally, Congress should revise the ACRS' statutory mandate in the Atomic Energy Act to emphasize that the ACRS should review only novel and safety-significant issues at the direction of the Commission and remove the requirement that the ACRS review all construction permit and operating license and renewal applications. By focusing on novel elements of an application, the ACRS' unique capabilities could be better leveraged. This could include, for example, novel designs (e.g., NuScale's original passive⁴² LWR design application), novel issues (a significant modification in a design or the use of that design), novel technologies (e.g., reactors with molten salt coolants), first-of-a-kind reactors or facilities, novel regulatory

⁴² NuScale's recent Standard Design Approval application presents an opportunity for the ACRS to demonstrate a streamlined approach. The ACRS should limit its review to those aspects of the design that are new or that have the potential to be of such significance they undo the agency's prior reasonable assurance finding.

activities (e.g., the first subsequent license renewal⁴³) or applications with unique site-specific aging issues (e.g., alkali-silica reactions at Seabrook).

There is likewise no need for the ACRS to conduct reviews of the applications for the siting of every new reactor at the construction permit phase, or for license applications that have had large portions previously reviewed and approved (e.g., siting of standardized reactor designs at existing nuclear power plant sites). Nor should the ACRS focus heavily on reviewing the aspects of reactor technologies that are well known and well understood, even if they are being incorporated into a new reactor design. (e.g., light-water reactors, radiation protections, atmospheric transport). Revising the ACRS' statutory mandate to eliminate the requirement to perform duplicative reviews of routine matters makes sense and would enable the ACRS to focus on the safety issues where it can have the most impact.⁴⁴

2. Solution 2. Reduce the length of and improve timing of ACRS reviews, eliminate repeat reviews, and reduce time spent on NRC Staff preparation.

Interviewee opinions varied on the length and timing of ACRS reviews. Some interviewees stated that the NRC Staff would frequently issue documents after the agreed-upon deadline, compressing the time for ACRS members to review them and formulate a collective opinion on their adequacy. The ACRS-EDO Memorandum of Understanding requires the NRC Staff to provide documents to the ACRS four weeks in advance of meetings,⁴⁵ but the NRC Staff frequently does not meet that deadline. Other interviewees indicated that the ACRS meeting schedule drove delays due to limited schedule openings and the need to set the overall review schedule months in advance. If the NRC Staff were to miss a meeting, it could cause a cascading delay since the busy ACRS calendar might result in a meeting delay of several months.

The authors also heard scheduling complaints about the prevalence of repetitive Full and Subcommittee reviews. The Subcommittee is supposed to be “comprised of three to six members with the relevant expertise”⁴⁶ including the “ACRS members who are most cognizant of the technical details of issues” under review.⁴⁷ These topics are then put up again for “later consideration by the full membership during Full Committee meetings.”⁴⁸ In practice, however, many Subcommittee meetings include the majority of the Committee. According to ACRS meeting transcripts, of seven of the Subcommittee meetings in August 2022, September 2022, and October 2022, two had nine members in attendance, four had eight members in attendance,

⁴³ In any event, SLRs should only be focused on longstanding challenging issues that could potentially be exacerbated by further aging. Additionally, if ACRS activities remain the same, someone that volunteers to be the first SLR should have reduced or waived fees to participate in this activity.

⁴⁴ Further, while we are not suggesting the elimination of the ACRS, we would note that every one of NRC's peer nuclear regulators effectively reviews new reactor designs without having the additional equivalent of the ACRS.

⁴⁵ See ACRS-EDO MOU.

⁴⁶ See Federal Advisory Committee Act (“FACA”) Database Entry – Advisory Committee on Reactor Safeguards, available at <https://www.facadatabase.gov/FACA/apex/FACAPublicCommittee?id=a10t0000001gzx0AAA> (hereinafter FACA Database Entry - ACRS).

⁴⁷ ACRS-EDO MOU.

⁴⁸ See FACA Database Entry – ACRS.

and one had seven members in attendance.⁴⁹ In comparison, the October 2022 Full Committee meeting had eight members in attendance. It seems completely unnecessary for the ACRS to pull NRC Staff members and licensees into Subcommittee meetings in addition to Full Committee meetings when the level of attendance is the same at both meetings, particularly when there is no procedural benefit as the ACRS “Subcommittee meetings are conducted under the same FACA procedures as the Full Committee meetings.”⁵⁰

In addition to scheduling issues, some interviewees observed that the ACRS members sometimes asked questions on issues resolved months prior during the NRC Staff review, unnecessarily bringing up issues that the parties believed were already resolved. Many interviewees also indicated that, in their opinions, the NRC Staff has, at times, spent an inordinate amount of time and effort preparing for ACRS meetings, resulting in significant costs and potentially more delays. One interviewee stated that the majority of the time, the NRC Staff tends to defer to ACRS determinations rather than stand their ground on their own analysis in their Safety Evaluation Reports (SERs). This in turn extends the review period, duplicates efforts, and ties up valuable NRC Staff resources in addition to increasing costs as the NRC Staff modifies their Safety Evaluation. Having this interaction occur at the end of NRC Staff review is viewed as an unnecessary delay in the overall process.

Regardless of the ultimate cause, interviewees clearly agreed that the NRC Staff and ACRS could improve coordination to reduce the possibility for applicant costs and delays. Below are some suggestions of improvements that could be implemented by the NRC Staff and ACRS. The Commission could also require the NRC Staff and ACRS to implement these suggestions.

a. The ACRS

First, as described above, the ACRS should eliminate duplicative Subcommittee and Full Committee meetings. Where the same number of members attend each, and the same procedures apply, there is no reason for both sets of meetings to occur. In these cases, the ACRS should consolidate its review into only a Full Committee meeting (with the depth of a Subcommittee meeting). Alternatively, the Subcommittee could perform a fulsome review and only refer key items up to the full committee, with the Full Committee adopting the remainder of the Subcommittee review. These suggestions, in addition to modifying the ACRS’ scope of review to focus on novel matters of potential safety significance, would enable the ACRS to free up meeting slots on its schedule in order to implement the next suggestion (see Section 2.b).

The ACRS should modify its schedule to include informal “placeholder” meetings. (Of note, the authors would not recommend these meetings unless all ACRS costs (both direct costs and those associated with all Staff preparation time) were moved off-fee, as recommended later in this

⁴⁹ According to ACRS meeting transcripts, the August 16 meeting on Plant Operations and Fire Protection and the October 18 meeting on Part 53 each had 9 members in attendance. The September 23 meetings on Digital Instrumentation & Control and Regulatory Policies & Practices, the October 17 meeting on Kairos, and the October 20 meeting on Accident Analysis: Thermal-Hydraulics each had 8 members in attendance. The October 4 meeting on Metallurgy and Reactor Fuel had 7 members in attendance. *See generally*, 2022 ACRS Meeting Schedule and Related Documents, available at <https://www.nrc.gov/reading-rm/doc-collections/acrs/agenda/2022/index.html>.

⁵⁰ *See* FACA Database Entry – ACRS.

report). These meetings would serve two purposes. During the “placeholder” meetings, the NRC Staff could give a series of short, one-hour updates on developing topics and in-progress reviews (with a focus on novel matters of potential safety significance). This would give the ACRS an established and scheduled advanced opportunity to gain familiarity with topics and ask early questions or give early feedback, instead of leaving ACRS reviews until near the end of an NRC Staff review when it is most likely to cause delays.⁵¹ However these meetings should not be commensurate with an in-depth review. Placeholder meetings could also serve as a timeslot for makeup meetings if another meeting were to be delayed, since rescheduling a placeholder meeting would not impact any specific review schedules. Of note, while not entirely the same, the implementation of placeholder meetings is consistent with the ACRS-EDO MOU which contemplates that the ACRS will “convene informal meetings with the staff for the purpose of preparation for subcommittee and Full Committee meetings, or to receive updates on various technical matters that would facilitate the planning of the ACRS meetings.”⁵² It is also consistent with the ACRS Transformation Letter, which contemplates that the ACRS “will arrange for periodic updates” on NRC transformation initiatives.⁵³ Nor would this be the first placeholder meeting on the ACRS schedule, as the ACRS has previously held such meetings, including an open dialogue with the NRC Staff on placeholders from 10 CFR Part 50 and Part 52 reviews.⁵⁴

Interviewees indicated that ACRS meetings proceed more smoothly when the NRC Staff and the ACRS communicate about topics of interest prior to the meeting. This allows the NRC Staff to focus its preparation efforts, to ensure that the proper Staff members are in attendance, and to prepare responses to questions. While the ACRS and NRC Staff already coordinate in advance on meeting topics,⁵⁵ the authors recommend that the ACRS issue a written notice to the NRC Staff, more than one week in advance of the ACRS meeting, with more detailed topics of special interest that the NRC Staff should be prepared to actively discuss. An example topic of interest from recent meetings might be: “The use of Quantitative Health Objectives (“QHOs”) in Part 53, including the basis, justification, and need for including QHOs in the rule.” The authors also recommend that the ACRS and the NRC Staff agree as a general matter that some questions may be best addressed in writing after a meeting is complete. Interviewees voiced competing

⁵¹ One example of the benefit of early engagement and familiarization is the NRC Staff’s recent engagement with the ACRS on licensing fusion systems under the NRC’s Part 30 framework. The ACRS criticized the NRC Staff’s recommended approach and submitted a letter to the Commission advocating for a different framework. However, it is apparent that the ACRS did not review the public record to familiarize itself with material presented at NRC public meetings over the two-year period that led to the NRC Staff’s development of the proposed framework. Early informal engagement from the NRC Staff setting forth that history would have allowed ACRS members an opportunity to better familiarize themselves with the NRC Staff’s proposed framework and to develop a clearer understanding of the basis of the NRC Staff’s present analysis. The introduction of scheduled meetings specifically left open for early engagement on developing topics would provide the NRC Staff with a necessary forum going forward to better address potential misunderstandings early on.

⁵² See ACRS-EDO MOU.

⁵³ ACRS Transformation Letter at 4.

⁵⁴ As an example, on September 20, 2019, the ACRS called a meeting with the NRC Staff to discuss lessons learned from Part 50 and Part 52 reviews.

⁵⁵ “The Program Office technical contact and the ACRS staff contact should work together to prepare the meeting agenda.” ACRS-EDO MOU.

opinions as to whether it is acceptable for the NRC Staff to provide supplemental responses to the ACRS after a meeting (although it is explicitly allowed in the ACRS-EDO MOU⁵⁶) and having a more robust formal policy in place to allow supplementary responses might temper NRC Staff tendencies to have all the answers up front and over-prepare for ACRS meetings with numerous dry runs. However, licensees should not be required to provide supplemental answers after ACRS meetings.

Providing discussion topics in advance of a meeting would require the NRC Staff to meet its deadlines and provide documents well in advance of the meeting date. The ACRS should establish a hard deadline for the NRC Staff to provide documents in advance of the meetings and allow the meeting date to slip if the NRC Staff fails to meet its deadline. If the NRC Staff is failing to meet deadlines and provide documents well in advance of meetings, allowing the meetings to slip will provide a public record of those issues for the Commission's further consideration.

Finally, multiple interviewees indicated that the ACRS places unreasonable demands on the NRC Staff to be prepared to respond to questions on topics that are not safety-significant, is insufficiently respectful of the NRC Staff's time, and sometimes even treats the NRC Staff disrespectfully. In response, the NRC Staff go to extraordinary lengths to prepare for ACRS meetings. The ACRS should recognize that NRC Staff time is a valuable resource. The ACRS should exercise greater discipline on itself to limit the demands it places on the Staff to what is essential to ensuring adequate protection.

b. The NRC Staff

Interviewees indicated that the NRC Staff frequently fails to provide the ACRS with documents sufficiently in advance of ACRS meetings to allow for a fulsome review. The NRC Staff should exercise better time management and provide the ACRS with documents for review at least four weeks in advance of ACRS meetings, as a hard deadline., consistent with the ACRS-EDO Memorandum of Understanding. The NRC Staff should also communicate the portions of the review that have the greatest potential safety significance. Having sufficient time for the review should allow the ACRS to provide topics of discussion in advance of meetings and should allow the NRC Staff to narrowly tailor its preparation for those meetings. The NRC should engender a culture where the NRC Staff can feel empowered to raise with the ACRS that the Committee is raising issues that are not safety significant.

V. Recommendation 2: Improve ACRS Operations and Management.

A. Problem Statement

The ACRS generally has a collegial atmosphere, and many interviewees focused on the importance of recruiting highly qualified and technically balanced members for the ACRS. As a general matter, most interviewees believe that the current membership of the ACRS is well

⁵⁶ "ACRS subcommittee members may ask for additional information about the documents under review that were not supplied prior to the meetings. The Program Office technical contact and other program office staff supporting the ACRS meeting should endeavor to provide the additional information, if it is reasonably available after the subcommittee meeting, to the ACRS staff contact." ACRS-EDO MOU.

informed and conscientious. However, interviewees agreed that there could be improvements in the diversity of viewpoints on the ACRS, and some cautioned against increasing the membership of the ACRS.

The ACRS has generally improved in maintaining respectful and collegial relations with the NRC Staff and licensees over the last twenty years. However, there are two exceptions to this progress. Certain ACRS members hold such strong views on their technical topics of interest that the NRC Staff is overly deferential when addressing those specific topics, knowing that any relevant regulatory initiatives will be subject to vigorous challenge from the ACRS. Certain ACRS members have recently engaged in unprofessional behavior like reading newspapers during review meetings.

B. Proposed Solutions

1. Solution 1. Keep the number of ACRS members manageable, hire the best possible members, and ensure a diversity of viewpoints.

a. The ACRS and the Commission

Both the ACRS and the Commission share the burden when it comes to hiring the best possible members for the ACRS and optimizing its numbers. As a result, the suggestions here are directed at both organizations. While the Commission could engage in rulemaking to place greater specificity on how the ACRS performs hiring and staffing, the Commission is more likely to implement these suggestions on an informal basis as is the ACRS. However, the authors strongly recommend that the Commission consider these recommendations, particularly as to term limits and the diversity of viewpoints, and push for implementation even if it is informal.

First, based on interviews, including suggestions from a former ACRS Chairman, the authors suggest that the ACRS keep itself to approximately ten members. Some interviewees indicated that having fifteen ACRS members was too many, and it hindered both collegiality and efficiency of the ACRS. As one interviewee phrased it, it takes more time to write a letter with fifteen different opinions as input. In addition, one former ACRS Chairman felt that having nine or fewer members was the most effective approach to fostering collaboration.

That former ACRS Chairman also suggested that the ACRS should be composed, with equal representation, of former industry members, academics, and former national lab personnel or consultants. Indeed, multiple interviewees with experience serving on the ACRS found that it was helpful to have participation from individuals with utility experience, and most interviewees thought that a diversity of work history and educational backgrounds would benefit the ACRS. This is consistent with the ACRS' own Membership Balance Plan which emphasizes the importance of diverse points of view.⁵⁷ That said, it would help to have more individuals with experience running nuclear power plants in the United States.

⁵⁷ See ACRS, *Membership Balance Plan* at 3 (Dec. 2020), available at: https://gsa-geo.my.salesforce.com/sfc/p/#t0000000Gyj0/a/t0000001F3Xu/eFQkKnXVMnaf6p.zZ1Jnw8LZkrKsl7KgUKlGAR_jGus

In addition, while the current ACRS has a variety of backgrounds, current ACRS members are required to have decades of experience in their narrow fields of technical expertise. This can limit the diversity of viewpoints within the ACRS, particularly for new and innovative technologies. The Commission should consider redefining these experience requirements in the interest of balancing technical expertise with applied experience in nuclear power generation and knowledge of integrated plant operations. Additionally, a limited number of ACRS members should be recruited from the industry to provide front-line engineering and operations experience in areas of cutting-edge technology that are subject to rapid development and change and for which technical expertise may become quickly outdated (for example, recent advancements in fusion technology, digital instrumentation and controls, computing advances, and advanced reactor designs). Numerous interviewees opined that it does not benefit the ACRS to rely on decades-old experience in these areas of rapid development as the prior experience may not be fully relevant to state-of-the-art practices. Moreover, if the ACRS is going to effectively drive transformation and modernization of the NRC and its regulatory regimes, it must include members who break with outdated views and practices held over from large light-water reactor designs and operations. The ACRS should also recruit experts from outside the nuclear industry to provide perspective on rapidly developing areas of technology like digital instrumentation and control, automation in lieu of human operation, and artificial intelligence.

Further, in order to improve the ACRS' performance, there should be greater adherence to term limits on ACRS members. Moreover, term limits should be only two, or in rare circumstances three, consecutive four-year terms (i.e., eight years on the Committee with twelve years in only rare circumstances). Such a limit would be only slightly more limiting than the ACRS Membership Balance Plan, which already states that "absent unusual circumstances, [members] do not serve more than three, four year terms," and "members are reappointed in excess of this period only if there is a compelling continuing need for their expertise."⁵⁸ Indeed, the ACRS could simply revise the Membership Balance Plan to state that "absent unusual circumstances, [members] do not serve more than *two*, four year terms," with an allowance to extend that period in compelling circumstances. If the Commission is unable or unwilling to implement a term limit for ACRS members, whether informally or by rule, Congress could modify the Act to implement such a limit.

From a practical perspective, interviewees made the additional following suggestions for optimizing ACRS membership. While the ACRS may be undertaking some of these actions, the Committee (or to the extent necessary, the Commission) should continue to expand these actions to help the ACRS be more effective:

- enhance efforts to maintain an ongoing bench of individuals who indicate an interest in serving on the ACRS so that the selection process time can be reduced;

⁵⁸ ACRS, *Membership Balance Plan* at 3 (Dec. 2020), available at https://gsa-geo.my.salesforce.com/sfc/p/#t0000000Gyj0/a/t0000001F3Xu/eFQkKnXVMnaf6p.zZ1Jnw8LZkrKsl7KgUKlGAR_jGus. Of the current members, two members are serving their fourth term, and two other members are serving their third term. As such, 36% of the current members of the ACRS are serving on their third or greater term.

- engage with the Institute of Nuclear Power Operations (INPO)⁵⁹ to identify potential former Chief Nuclear Officer or senior nuclear executives who could serve on the ACRS;
- advertise through organizations like ANS, ASME, or IEEE, in order to improve awareness of open positions on the ACRS;
- recruit members with specific knowledge of upcoming issues (i.e., molten salt, fusion, and individuals with reactor design experience, etc.);
- use consultants to supplement the expertise of the ACRS in new and unique areas where the ACRS may not have sufficient expertise;
- use rotational assignees from Department of Energy National Laboratories, the U.S. Navy, or NASA; and
- have ACRS support staff include rotations of NRC Staff from the offices of Nuclear Material Safety and Safeguards or Nuclear Reactor Regulations or NRC Regional Field offices.

As already noted, according to interviews and the Membership Balance Plan, the ACRS may already have taken some of these steps, like maintaining a pool of applicants, using consultants, publishing solicitations in trade and professional society publications, and recruiting members in specific areas of expertise. However, interviewees indicated that it is still worth pursuing these steps to the maximum extent possible. The ACRS should also do what it can to improve the work-life balance of members in order to make the position more appealing to more applicants, for example, by following meeting schedules and not extending meetings well into the evening hours. Curtailing the field of ACRS reviews to those that add the most value (as recommended above) would also alleviate these burdens and improve time demands for members.

As a final note regarding the diversity of views, the majority of current members (six out of ten as of this publication) have a background at or ties to the Massachusetts Institute of Technology. The ACRS should obtain greater diversity by recruiting members from other universities, as there are a number of high caliber nuclear institutions that could serve as potential sources of new members.

2. Solution 2: Maintain a collegial atmosphere within the ACRS, improve relations with the NRC Staff, applicants and licensees.

a. The ACRS and the Commission

While former NRC Staff and licensees told numerous “war stories” about unprofessional and aggressive verbal behavior by some ACRS members—although a small number over the past 20+ years—the authors also received meaningful feedback that ACRS has generally improved in maintaining respectful and collegial relations with the NRC Staff and licensees over the last ten years.⁶⁰

⁵⁹ INPO is an independent organization that was established in 1979 in response to the Three Mile Island accident. INPO has provided additional oversight to nuclear power plant facilities, as well as self-directed industry initiatives to improve operation, maintenance, and analysis of nuclear plants since the ACRS was formed.

⁶⁰ The authors heard repeated comments that in the past, some ACRS members, particularly those with an academic background, treated their ACRS role akin to the role they would play challenging PhD candidates during a

While the authors' research and discussions demonstrate that the demeanor of ACRS meetings has substantially improved since the late 1990s, interviewees shared several recent examples where ACRS members have engaged in unprofessional behavior such as reading newspapers during meetings, or disrespectful behavior toward their colleagues, applicants, or NRC staff.

In light of these comments, the authors would suggest that the Commission hire a consultant with expertise in organizational effectiveness to evaluate the manner in which ACRS members engage with the NRC Staff and licensees and suggest options for training and best practices on public and peer engagement. Further, it seems apparent that the evaluative process for selecting ACRS members should also incorporate components that screen for individuals who are independent yet collaborative and professional.

Finally, the ACRS should avoid circumstances where it defers solely to the expertise of one member. Instead, the ACRS should develop its opinions as a whole, and should be empowered by the ACRS Chair to push back when one member's entrenched views dominate a meeting.

b. The Executive Director for Operations (“EDO”) in Coordination with the ACRS

As discussed previously, the EDO and the ACRS have a Memorandum of Understanding intended to establish a process to facilitate effective planning and engagement between the NRC Staff and the ACRS and the ACRS staff. The following matters should be addressed in that MOU and enforced:

- There should be a shared understanding between the ACRS and the EDO that NRC Staff preparations do not need to be at the level of a dissertation defense and that it is acceptable that the NRC Staff provide subsequent responses when they do not have an immediate answer to an ACRS member. The ACRS should not be permitted to criticize, badger, or undermine individuals who are unable to answer ACRS questions on the spot.
- There should be a shared understanding between the EDO and the ACRS that ACRS members should be able to set forth a brief explanation for why they are asking a question and tie it back to regulation (i.e., what is the member trying to understand and what is the safety concern). ACRS members should not ask questions only to “find” the presenter's “level of ignorance” or to pursue matters of personal interest unrelated to the objectives of the Commission or the ACRS regulatory mission. The ACRS Chairman should ensure that debate among ACRS members is constructive, collegial, and within the ambit of its statutory purpose.
- There should be a shared understanding between the EDO and the Chairman of the ACRS on how to ensure that the views of individual ACRS members do not unduly chill or influence the views of the NRC Staff. Rather, the EDO and the ACRS Chair should provide and maintain a safe space for respectful disagreement.

dissertation defense, seeking to test the full range of knowledge of the individual (NRC Staff or licensee) before them. This would help to explain the reticence that some NRC Staff have in meeting with the ACRS and the resultant excessive and expensive (for the licensee) preparations for presentations before the Committee.

VI. Recommendation 3: Reduce the Cost of ACRS Reviews.

A. Problem Statement

Many interviewees, including several former ACRS members, stated a belief that the ACRS performs an important function by providing an independent review of the NRC Staff's work products. Some licensees and applicants, however, saw this as a problem as the licensee or applicant is responsible for paying for two reviews: one by the NRC Staff and a confirmatory review by the ACRS that covers the same content as the NRC Staff analysis. Further, it was observed that many NRC reviewers have become fairly adept at anticipating questions the ACRS might ask, and these issues are often already reflected in the ACRS presentation; yet the ACRS feels obligated to ask more questions. This issue is further compounded by what many saw as a tendency by the NRC Staff to excessively overprepare for ACRS meetings (sometimes with multiple dry runs per meeting), at least partially in response to the ACRS' sometimes unreasonable demands. The authors also heard complaints that ACRS members are sometimes unprepared for meetings and will go over or discuss information already spelled out in detail in the NRC Staff review documents. That said, as described above, the authors heard competing complaints from former ACRS members about the NRC Staff consistently providing documents behind schedule with minimal time for review prior to the meetings. The ACRS members should have the documents in sufficient time to prepare for scheduled meetings, but the ACRS Chairman also needs to hold individual members accountable for being fully prepared to avoid wasteful review of materials covered in work-product and background materials provided in advance by NRC Staff to the ACRS.

Recommendation 1 already addressed inefficiencies associated with NRC Staff and ACRS interactions, but the costs associated with ACRS reviews require independent recommendations.

B. Proposed Solution

1. Solution: Reallocate costs associated with ACRS reviews.

a. Congress

Congress should consider amending the Atomic Energy Act to provide that all costs associated with ACRS reviews, including the cost of ACRS time (which we understand is approximately \$5-5.5 million⁶¹), be excluded from the fee recovery requirement. In addition, NRC Staff time used to prepare for ACRS meetings should not be billed to licensees and should also be excluded from fee recovery. This would help resolve some of the applicant and licensee concerns relating to the overall ACRS review process. It is of course still imperative that ACRS and NRC Staff make these reviews as efficient as possible in accordance with the other recommendations in this paper, as the public has an interest in fiscal responsibility as well as timely deployment of climate solutions.

⁶¹ See FACA Database Entry – ACRS.

VII. Recommendation 4: Adjust Management of the ACRS.

A. Problem Statement

Over the last several decades, Commissions have shown varying levels of interest in selecting the ACRS members and the Executive Director of the ACRS. Based on the authors interviews and observations, the ACRS and the Commission would benefit from more involved Commission attention to the evaluation and selection of ACRS members and the Executive Director of the ACRS. This would engage the Commission more deeply in the work product of the ACRS and enhance ACRS understanding of the value it provides to the Commission. Many interviewees commented on the oversight and management structure of the ACRS. Some interviewees opined that the Commissioners should exercise greater oversight of the ACRS. For example, some interviewees indicated that the Commission, as a whole, could better focus the topics of ACRS review, while other interviewees raised concerns about the undue influence and coercion of a prior NRC Chairman attempting to direct ACRS views without input from the rest of the Commission. Ultimately, the Commission, as a whole, should take a greater interest, and have more involvement, in the matters put before the ACRS. Of note, some interviewees indicated that they thought Commission meetings with the ACRS were merely a “dog and pony show” without sufficient material substance and depth.

Several interviewees indicated that the Executive Director of the ACRS staff is a critical role for the success of the institution as a bridge between the ACRS and the NRC Staff. The Executive Director should keep the ACRS informed of NRC Staff reactions and priorities and the “pulse” of the agency and industry. The authors also heard that the Executive Director is key in establishing a good ACRS staff.

A. Proposed Solutions

1. Solution 1: Increase Commission engagement with the ACRS.

a. The Commission

The authors suggest that the Commission increase its engagement with the ACRS including by being more proactive, directional, and cognizant of ACRS priorities to ensure review activities are appropriately focused. As an initial matter, the Commissioners need to take ACRS membership, the Chairmanship and the executive leadership of the ACRS staff more seriously. They should be more involved in the screening and selection of individual candidates who possess the knowledge, skills and abilities (KSAs) necessary to address key topics before the NRC. The Commission’s involvement should start earlier in the process of ACRS member selection rather than waiting until an up-or-down vote on the NRC Staff recommendation. Also, the Commissioners should vote on each individual ACRS nominee individually rather than a slate of nominees. The Commission should also be more involved in selecting or identifying the Chair and should engage with the Chair on a regular basis. An ACRS Chair should have the ability to facilitate engagement with all stakeholders and impose discipline while reducing conflicts among individual ACRS members. The Chair should also be a strong leader capable of effective decision-making.

The Commission as a whole should also provide the ACRS information on topics requiring ACRS review, particularly those that are novel or have significant safety implications. If the ACRS were to utilize an action plan, like NUREG-0286 as suggested previously, the Commission should review, amend, and approve that document, while providing recommended areas for the ACRS to review, including areas to not review. Given the bow wave of licensing activities that the Commission will see from subsequent license renewals and potential new reactor orders, having a candid discussion about budgeting and prioritization is vital for both the Commission and the ACRS.

Also, the Commission should set much of the agenda for the semi-annual meetings with the ACRS, instead of allowing the ACRS to set the agenda. The Commission should also revamp the way that it interacts with the ACRS in meetings. As noted above, interviewees said that meetings between the ACRS and the Commission tend to be superficial and often consist of repeating talking points already provided in written materials. If that is the case, meetings could be eliminated in favor of paper filings.

2. Solution 2: Ensure the effectiveness of the ACRS staff.

a. The Commission

The Executive Director of the ACRS should be a firm, effective, and a credible leader. This individual must be able to interact with the NRC Staff, the ACRS staff, the Committee, and the EDO in an independent way to ensure the effectiveness of the ACRS. The position should always be given to a seasoned executive who has technical credibility and sufficient weight and standing within the Commission to push back against the NRC Executive Director of Operations as well as the ACRS Chairman and members, and who has the experience needed to garner respect, as well as the savvy needed to deal with various disparate personalities. The NRC should avoid using this position as a stepping-stone in the agency to “fast track” high potential managers in the NRC, to train SES executives, or to “park” SES executives who can or cannot be deployed elsewhere, potentially causing frequent changes in leadership.

The Commission should increase the budget of the ACRS supporting staff, as the ACRS staff is critical to the effective operation of the ACRS. The Commission should consider a budget review of the staffing needs to ensure the Executive Director’s organization is appropriately staffed to meet the anticipated bow-wave of new reactor reviews. A larger budget would allow the Executive Director to recruit additional members for the ACRS staff and accommodate performance of new reactor reviews at a faster pace, in a high-quality manner.

VIII. Conclusion

This report has laid out NIA’s recommendations for improving the effectiveness and efficiency of the ACRS to evolve from its original purpose (as envisioned in 1954 when commercial operating experience was scarce and uncertainty was high) and better align with the expectations Congress set out for the NRC under NEIMA. The authors’ hope is that these recommendations (or some semblance thereof) will be implemented to position the ACRS and the NRC to successfully enable safe deployment of advanced nuclear energy to fight climate change and

increase energy security. These recommendations are also in line with the ACRS' own suggestions for self-transformation presented to the Commission in 2019.⁶²

The ACRS has the potential to play a valuable role in the NRC's licensing review process, but its purpose, processes and practices need to be improved, economized, and modernized. These recommendations can enable the ACRS and the NRC to implement numerous improvements to reduce the scope and length of ACRS reviews, increase focus on safety-relevant issues, gain greater efficiencies, optimize interactions with the NRC Staff, reduce licensee costs, enhance Committee membership and diversity, and improve the ACRS's utility through more proactive Commission investment in its composition and activities. The ACRS and the NRC Staff should work together to optimize the review process, control or reduce process costs for applicants and taxpayers, and cultivate more positive working relationships with each other and all stakeholders.

⁶² See e.g., Letter from Peter C. Riccardella, Chairman of NRC Advisory Committee on Reactor Safeguards to Kristine Svinicki, NRC Chairman (Oct. 17, 2019), available at <https://www.nrc.gov/docs/ML1929/ML19290F956.pdf> (hereinafter "ACRS Transformation Letter"); ACRS, *Commission Meeting with the Advisory Committee on Reactor Safeguard (ACRS)* (Dec. 6, 2019), available at <https://www.nrc.gov/reading-rm/doc-collections/commission/slides/2019/20191206/staff-20191206.pdf>.