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Capacity Assessment

For Statistics, Research, Evaluation, and Other Analysis

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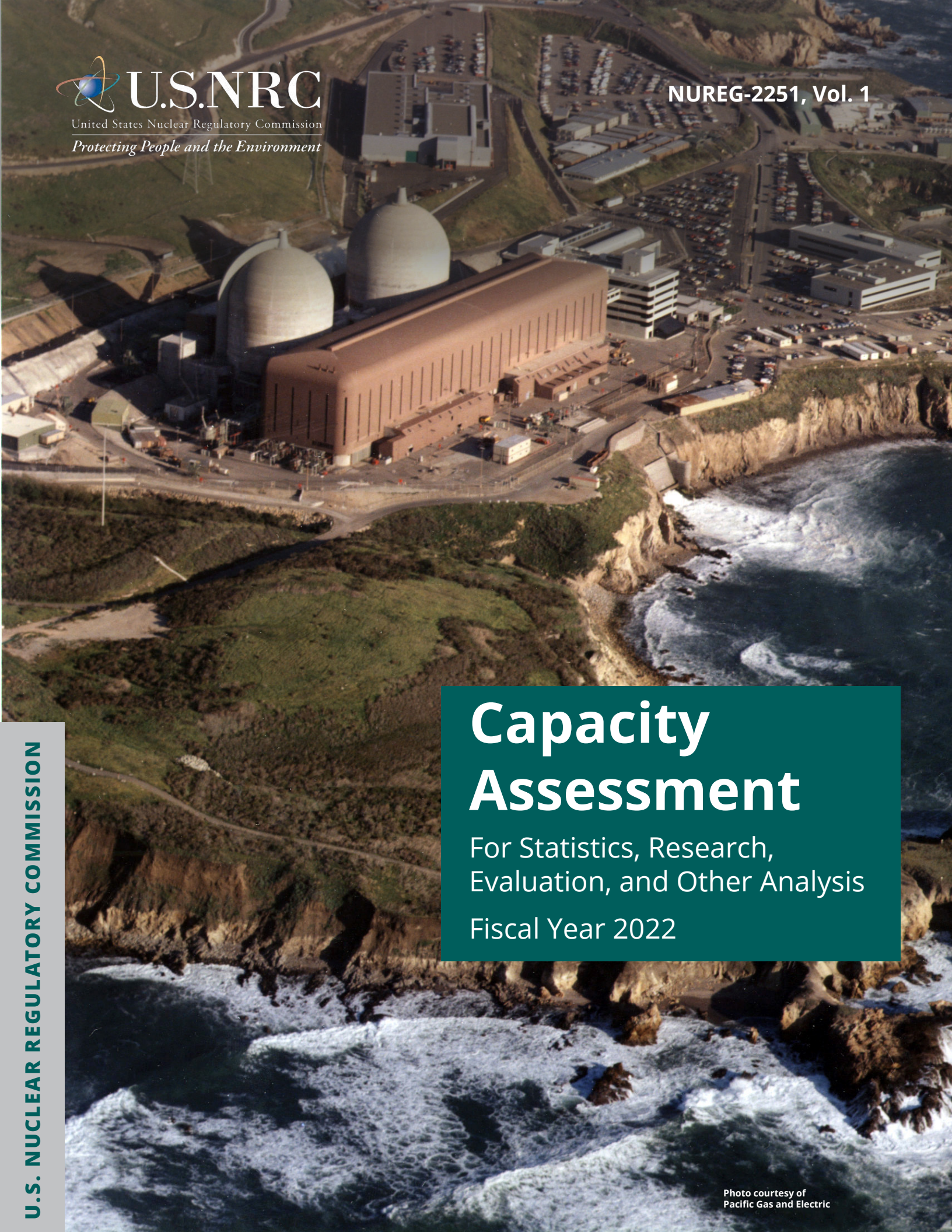

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ABSTRACT

The U.S. Nuclear Regulatory Commission (NRC or the agency) is an independent agency established by the Energy Reorganization Act of 1974, which began operations in 1975 as a successor to the Atomic Energy Commission. The NRC is required by the Foundations for Evidence-Based Policymaking Act of 2018 to generate a capacity assessment, which is an accounting of NRC's capacity to carry out the evidence-building activities needed to meet its functions (i.e., the NRC's mission is to license and regulate the Nation's civilian use of radioactive materials, to provide reasonable assurance of adequate protection of public health and safety, and to promote the common defense and security and to protect the environment) and its capacity to disseminate and use evidence. This capacity assessment uses a structured approach for assessing and building the agency's capacity (e.g., staffing, funding, infrastructure, and processes) to carry out evidence-building activities (e.g., analysis, research, and evaluation) necessary to support agency functions. This approach identifies areas where new or different investments could strengthen or improve the agency's ability to meet its mission and strategic goals. The capacity assessment identified 27 findings and associated mitigating strategies that represent opportunities to enhance the NRC's capacity.


CAPACITY
BUILDING

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EXECUTIVE SUMMARY

The NRC's capacity assessment uses a structured approach for assessing and building the agency's capacity (i.e., staff, funding, infrastructure, and processes) to carry out evidence-building activities (e.g., analysis, research, statistics, and evaluation) necessary to support agency functions. This approach identifies areas where new or different investments could strengthen or improve the agency's ability to meet its mission and strategic goals.

The NRC's capacity assessment focuses on the evidence-building activities used to support the key agency functions of licensing, oversight, research, rulemaking, financial management, and evaluation. For simplicity, this capacity assessment sometimes refers to NRC functions, and the evidence-building activities that support those functions, interchangeably. Future annual updates may expand to other key agency functions. The evidence-building activities applicable to the six NRC key agency functions are assessed against the attributes of coverage, quality, independence, methods, and effectiveness.[1] The capacity assessment includes a review of budget information, workload and workforce data, competency model assessment results, and data collected during a series of focus groups used to survey staff and management. Additional interviews were held with staff and management to further refine the findings and mitigating strategies. Staff input was essential in developing the capacity assessment, and this document empowers staff by building upon their shared ideas to enhance NRC's evidence-building capacity.

The NRC has identified 27 findings within this capacity assessment that are intended to enhance the NRC's ability to perform evidence-building to support key agency functions. The following seven findings are considered to be a priority for the agency and are expected to have the largest influence on the agency's capacity for evidence-building. These findings are summarized below. Sections 5.1–5.7 discuss the findings and mitigating strategies in further detail.

- The NRC's Strategic Workforce Planning (SWP) process results indicate that there are key evidence-building positions with expected staffing gaps across each agency function analyzed in this capacity assessment including licensing, oversight, research, rulemaking, and financial management. In addition, there are key evidence-building positions that are potentially susceptible to high attrition. The specific positions within each functional area are discussed further in Sections 5.1–5.5.
- Knowledge management tools are not utilized to their fullest extent to ensure successful capture and transfer of knowledge to staff. Survey results for each of the key agency functions show that approximately half of surveyed staff and

[1] Office of Management and Budget (OMB) Memorandum M-20-12, "Phase 4 Implementation of the Foundations for Evidence-Based Policymaking Act of 2018: Program Evaluation Standards and Practices," dated March 10, 2020, discusses the details of many of these attributes.

management usually use knowledge management resources and processes (internal wiki site, videos, publications, etc.) to capture best practices. Knowledge management is important for all staff at different points in their career, however there is particular urgency because approximately 26 percent of the NRC's workforce is currently eligible to retire and approximately 44 percent will be eligible to retire within the next 5 years. In addition, a number of positions identified in this assessment could potentially be negatively impacted by high attrition over the next 5 years (Section 5.7.1).

- The NRC competency modeling program requires refinement in order to provide insights into agencywide skill gaps. The NRC's use of competency model assessments has the potential to be a powerful tool for identifying agencywide skill gaps that, if addressed, would strengthen the NRC workforce. However, the competency model assessment data from fiscal years (FY) 2020 and 2021 are not sufficient to identify critical agencywide skill gaps. An analysis of the FY 2020 and FY 2021 competency model assessment results has enabled a better understanding of the ways to improve this tool. Potential improvements identified include (1) increasing participation rates for both staff and managers, (2) establishing a core set of skills for competency models with the same position across offices (e.g., project managers, engineers), (3) adding competency models for staff without a model currently assigned, (4) refining the existing models to verify that staff are assessed only for competencies that apply to them, (5) ensuring a more consistent approach for establishing target ratings, and (6) addressing limitations to the current tool to improve reports and the ability to produce individual development plans directly from the system (Section 5.7.3).
- The NRC needs a sufficient knowledge base to effectively employ artificial intelligence (AI) within NRC's processes and to regulate the use of AI externally. AI tools can be a powerful and beneficial asset to the NRC. To maximize the usefulness of AI tools, the NRC needs to have (1) sufficient staff knowledge and familiarity with them, (2) access to the latest programs, software, and libraries, and (3) high-quality datasets. The NRC is exploring the potential ways that applicants and licensees can use AI and digital twins.[2] However, the NRC staff currently has limited technical capacity to review and regulate technologies relying on AI. Technical knowledge and skills should be enhanced to improve readiness in the future. The staff needs to be familiar with a range of potential technologies, have adequate training support in place, and have a data science and AI knowledge base available. The NRC needs to develop a way to track its progress toward achieving technical and regulatory readiness to review such applications to ensure sufficient licensing and oversight capacity (Section 5.7.6).

[2] A digital twin is a virtual representation that serves as the real-time digital counterpart of a physical object or process.

- Caps on corporate costs in annual budget justifications, pursuant to the Nuclear Energy Innovation and Modernization Act (NEIMA) have caused the NRC to reduce or postpone critical investments and services including modernization of information technology systems which affect the NRC's capacity for performing evidence-building analysis. Continued postponements of critical investments and services will negatively impact the NRC's capacity to perform evidence-building activities to support the agency mission. The NRC identified major efficiencies and areas for cost savings within corporate support just prior to, and within the initial implementation of NEIMA, and has prioritized spending that is integral to the success of the agency's mission. Continued reductions to meet the corporate support cap are not sustainable, are already negatively impacting the agency, and will have an even greater impact as the corporate support cap declines in future years (Section 5.7.11).
- The NRC anticipates challenges associated with the Resident Inspector Program regarding recruitment and retention and would benefit from a data-driven approach for monitoring and assessing the program's health. The NRC senior leadership have reported challenges in attracting and retaining high-quality senior resident inspectors and resident inspectors to staff the Resident Inspector Program. The program needs to offer sufficient incentives to ensure that resident inspector vacancies can be promptly filled (Section 5.2).
- The NRC would benefit from institutionalizing program evaluation into agency activities similar to the implementation of enterprise risk management and performance management. Because evaluation is a scientific discipline, "credible evaluations must be managed by qualified evaluators with relevant education, skills, and experience for the methods undertaken."[3] Hiring an individual or external firm qualified in designing and performing program evaluations would enhance the effectiveness and efficiency of the NRC's programs, policies, operations, and organizations to ensure measurable results. The program evaluator would serve as an agencywide resource for designing evaluations consistent with the standards in the NRC's "Evidence-Building and Evaluation Policy Statement" and the Foundations for Evidence-Based Policymaking Act of 2018 (Evidence Act) (Section 5.6).[4]

[3] OMB Memorandum M-20-12, "Phase 4 Implementation of the Foundations for Evidence-Based Policymaking Act of 2018: Program Evaluation Standards and Practices," dated March 10, 2020, page 4.

[4] "Evidence-Building and Evaluation Policy Statement," June 3, 2021 (available in the *Federal Register* at 86 FR 29683).

1. INTRODUCTION

The NRC recognizes the importance and value of public communication and involvement as a cornerstone of strong, fair, and transparent regulation of the nuclear industry. The public is kept informed of the NRC's regulatory activities through a variety of meetings open to the public, including Commission meetings, advisory committee meetings, hearings, and staff meetings. The NRC develops regulations, regulatory guidance, and various forms of externally directed communications. The agency strives to make its work publicly available through a variety of platforms, such as its public website and social media platforms including Facebook, Twitter, and YouTube.

The NRC's capacity assessment provides a unique insight into the challenges, needs, and opportunities to improve the agency's capacity. This capacity assessment is the first of its kind for the agency and includes findings that were identified through the assessment process discussed below, as well as findings that have been previously identified and are currently being mitigated. Moving forward, annual updates to this initial capacity assessment will continue to document findings that may impact the agency's capacity. Previously identified findings and associated mitigating strategies included in the capacity assessment are monitored through agency strategic planning meetings with senior leadership and through the NRC's Enterprise Risk Management process, if appropriate.[5] The NRC will continue to use these processes to ensure agency coordination and progress. In addition, the findings included in this capacity assessment are in many cases, complex in nature and cannot be solved with stopgap solutions. Implementation of the mitigating strategies may require strategic approaches to gain additional information and data over the next 4 years to ensure meaningful change and improvement.

Readers should keep in mind that this document reflects the NRC's Evaluation Officer's assessment, under the direction of the Executive Director for Operations, of the agency's capacity at the time it was written.[6] Importantly, capacity is not fixed; it is the agency's goal to have the appropriate capacity to build and use evidence in service of meeting its mission.

2. PURPOSE

The NRC's capacity assessment is intended to assess, build, and maintain the capacity to conduct evidence-building activities by (1) establishing baselines that enable measurable results over time for key agency functions, (2) identifying opportunities to enhance technical expertise for evidence-building, (3) increasing knowledge of evidence-building methodologies, practices, and standards, and (4) improving the agency's processes and

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5 Management Directive (MD) 4.4, "Enterprise Risk Management and Internal Control" dated December 14, 2017 is available at https://www.nrc.gov/reading-rm/doc-collections/management-directives/index.html.

6 Key Evidence Act positions are listed on the NRC's website at https://www.nrc.gov/about-nrc/plans-performance/evidence-building-and-evaluation.html.

ability to make evidence-based decisions. This initial capacity assessment is a starting point and will require a continuous effort to achieve its full potential of strategically identifying agency challenges that could impact the agency mission and strategic goals. The NRC reviews and updates the capacity assessment annually to identify new findings, update past findings, and ensure that progress is made toward mitigating strategies.

3. APPROACH

This initial capacity assessment begins to set baselines for evidence-building activities within key agency functions. By focusing on key agency functions, the capacity assessment produces discernible results and avoids overgeneralization of the different types of evidence-building activities performed across key agency functions. The key agency functions selected for this initial capacity assessment are licensing, oversight, research, rulemaking, financial management, and evaluation. These key agency functions make up the bulk of the NRC's analysis, research, statistics, and evaluation activities. While the key agency function of evaluation is not a new concept, the Evidence Act has elevated the importance of evaluation of programs, policies, operations, and organizations to improve effectiveness and efficiency.

"The Evidence Act requires each agency to produce a capacity assessment for research, evaluation, statistics, and other analysis [evidence-building activities]....".[7] While statistics is included in the NRC's capacity assessment, the NRC is not a statistical agency.[8] Therefore, the use of statistics is typically prescriptive in nature and inherent in much of the technical analysis performed to support the key agency functions. These evidence-building activities are required to be assessed against the attributes of coverage, quality, methods, effectiveness, and independence. Findings and insights resulting from the capacity assessment will also support the NRC's ability to conduct evidence-building activities associated with the priority questions included in the NRC's Evidence-Building Plan.[9]

3.1 Coverage

The attribute of coverage focuses on the distribution of evidence-building activities, workforce gaps and surpluses, and skill gaps in the workforce as follows.

Distribution of evidence-building activities—Each key agency function may use different types of evidence-building activities to support decisionmaking. However, considering that the NRC is a regulatory agency, technical analysis is the most prominent type of evidence-building activity performed. The budgeted resources for each key agency function are

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7 OMB Memorandum M-21-27, "Evidence-Based Policymaking: Learning Agendas and Annual Evaluation Plans," dated June 30, 2021, page 15.

8 Consistent with Title III of the Evidence Act, a Federal *statistical* agency is an agency or organizational unit of the Executive Branch whose activities are predominantly the collection, compilation, processing, or analysis of information for statistical purposes, as designated by OMB. 44 U.S.C. § 3561(11).

9 https://www.nrc.gov/about-nrc/plans-performance/evidence-building-and-evaluation/learning-agenda.html

segmented by business line to better show how evidence-building activities are distributed across the NRC.[10] Workload indicators for activities that are comprised of evidence-building activities (e.g., number of licensing actions and inspections completed which are supported by analysis) are used for comparison to the budgeted resources.[11]

Workforce gaps and surpluses—The NRC's workforce is critical to performing evidence-building activities necessary to carry out its mission. The NRC's Strategic Workforce Planning (SWP) process is used to strategically recruit and retain the workforce needed for the expected workload over a duration of 5 years. The gaps and surpluses identified by the SWP process are analyzed to provide a full understanding of potential workforce challenges for each key agency function, assuming no hiring and the estimated workload occurs. Potential workforce challenges are then strategically mitigated to ensure adequate workforce coverage and mitigating strategies are discussed in the relevant sections.[12]

Skill gaps—The NRC's competency models are used to identify skill gaps across the workforce specific to evidence-building including analysis, research, evaluation, and statistics. Competency models and assessments improve workforce agility by (1) providing a means of comparing an employee's current skillset to the skills needed now and, in the future, and (2) helping to ensure a workforce with the necessary skills to be successful in a dynamic environment with the identification of training, mentoring and rotations to address skill gaps.

3.2 Quality, Methods, Independence, and Effectiveness

The attributes of quality, methods, independence, and effectiveness are used to assess how the NRC performs evidence-building activities, as discussed below:

Quality refers to the measure of an evidence-building activity in comparison to established standards such as rigor, relevance and utility, transparency, collaboration, independence and objectivity, and ethics.[13]

Methods refers to the extent to which appropriate methodologies and standards are applied, and if agency guidance, or procedures are followed.

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10 NRC business lines include Operating Reactors, New Reactors, Nuclear Materials Users, Decommissioning and Low-Level Waste, Fuel Facilities, Spent Fuel Storage and Transportation, and Corporate Support (which includes Financial Management).

11 The budgeted resources are shown at the Product Line level, rather than for individual evidence-building activities.

12 "Enhanced Strategic Workforce Planning Pilot Lessons-Learned Report, Appendix B, Enhanced Strategic Workforce Planning Process," June 11, 2018, ADAMS Accession No. ML18162A073.

13 The NRC's "Evidence-Building and Evaluation Policy Statement" and Management Directive 3.17, "NRC Information Quality Program," discuss standards for the attribute of quality.

Independence refers to the extent to which evidence-building activities are free from bias and inappropriate influence.

Effectiveness refers to the degree to which an activity is successful in achieving a desired result.[14] Effectiveness should produce clear and concise results, ensure that internal and external stakeholders needs are met, and create information useful to the agency's decisionmaking.

These attributes were assessed using quantitative and qualitative data obtained by engaging with internal stakeholders (e.g., staff, management, and senior leadership) through a variety of methods to support data triangulation including focus group discussions, surveys, and followup interviews. The NRC's senior leadership was asked to select knowledgeable staff to represent the key agency functions and participate in focus groups and surveys. A total of 218 staff members and managers participated in 12 focus groups.

Surveys were administered during the focus groups to discuss the survey questions and offer the opportunity to ask clarifying questions. This unique approach produced credible results because participants had a clear and common understanding of each survey question before responding. The 20-question survey contained several multiple-choice questions to address the attributes of quality, methods, independence, and effectiveness. The survey questions focused on the extent to which staff have capacity to perform evidence-building activities to support their NRC function. The survey also contained an open-ended question for qualitative feedback. Average scores were calculated for each attribute (i.e., quality, methods, independence, and effectiveness) for each key agency function.

The survey results were compared to a maturity model to indicate the maturity of each key agency function. The maturity model was developed by benchmarking against other agencies' models and using the guidance provided by the Office of Management and Budget (OMB) that define the standards and practices. The survey results establish a baseline for each of the evidence-building attributes (quality, methods, effectiveness, and independence).

Survey results mapped to the maturity model	
Average Score	Rating
3–4	High Capacity
2–3	Medium Capacity
1.5–2	Low Capacity
1–1.5	Marginal Capacity

[14] This is defined in the NRC Strategic Plan 2022-2026, which is available in ADAMS at Accession No. ML22067A170.

4. AGENCY ENVIRONMENTAL SCAN

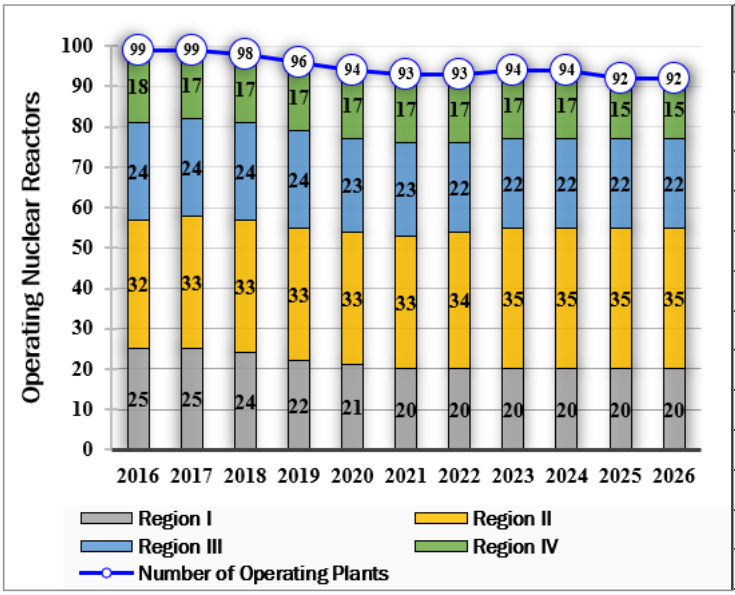
An environmental scan was conducted to forecast the environment that may affect the NRC's capacity over the next 5 years. The agency environmental scan is based on information known as of March 2022, and provides information on internal and external drivers that may influence the NRC's workload and workforce. Many internal and external factors may influence the environment in which the NRC will operate through FY 2026. These factors include industry operating experience, national priorities, climate change impacts, the security and threat environment, legislation, Federal court litigation, market trends, new technologies, public health emergencies, and resource availability. The agency environmental scan considered these factors when identifying potential impacts that could affect the NRC's capacity to conduct analysis, evaluation, research, and statistical activities in support of the agency mission.

4.1 Reactor Safety Program

4.1.1 Operating Reactors Business Line

The United States currently has 93 operating commercial nuclear power reactors (operating reactors). Seven operating reactors ceased operations and shut down from FY 2016 through FY 2021 (Figure 1). The decrease has been mainly in the northeastern United States, the geographic region overseen by the NRC's Region I Office. The total number of operating reactors is expected to be relatively flat over the next five years. The number of shutdown nuclear power reactors was offset in FY 2017 with the addition of Watts Bar Nuclear Plant, Unit 2, and future offsets are expected to occur in FY 2022 and FY 2023 with the addition of Vogtle Electric Generating Plant, Units 3 and 4, respectively. Oversight and licensing activities, including inspections, operator licensing, event evaluation, allegations, and enforcement, should be relatively constant over the next few years.

Once construction on Vogtle Units 3 and 4 is complete, the workload for the NRC's Construction Inspection Program will decrease through FY 2023. Vendor inspections are expected to continue at a steady pace through FY 2026, with focus shifting from vendors supporting Vogtle Unit 3 and 4 construction to vendors supplying operating reactors and advanced reactor applicants.



Reactor Name	Fiscal Year	Status
Fort Calhoun	2017	Shutdown
Watts Bar Unit 2	2017	Operation
Oyster Creek	2018	Shutdown
Pilgrim	2019	Shutdown
Three Mile Island Unit 1	2019	Shutdown
Indian Point Unit 2	2020	Shutdown
Duane Arnold	2020	Shutdown
Indian Point Unit 3	2021	Shutdown
Vogtle Unit 3	2022	Operation
Palisades	2022	Shutdown
Vogtle Unit 4	2023	Operation
Diablo Canyon Unit 1	2025	Shutdown
Diablo Canyon Unit 2	2025	Shutdown

Figure 1 - Number of Operating U.S. Commercial Nuclear Power Reactors (Actual from FY 2016–FY 2021 and Projected from FY 2022–FY 2026)

Operating reactor licensees are adopting new technologies to improve safety and to operate more economically. These technologies include (1) expanded use of digital (versus analog) and wireless technologies, (2) accident tolerant fuel (ATF), and (3) additive manufacturing technology (e.g., three-dimensional printing).[15] The NRC must ensure that it has the technical skills to develop appropriate regulatory frameworks for these technologies, as well as adequate resources to perform associated licensing and oversight activities as more licensees adopt the technologies. In addition, the NRC must assess the likelihood of future similar technology adoptions and take appropriate action to effectively regulate such technologies.

The NRC and the nuclear power industry continue to evolve into new areas, especially business-driven and information-driven innovation. In addition to more traditional improvements for areas such as ATF, higher enriched fuels, higher burnup fuels, and digital instrumentation and controls, the NRC must prepare for new areas of innovation such as additive manufacturing, flexible plant operation, digital twins, and other information-driven applications of AI.

The nuclear power industry is a maturing industry (e.g., many personnel have extensive experience and facilities have systems with technology enhancements) and has developed efficient operation and maintenance practices for the existing technology. However, additional operation and maintenance costs can occur as equipment ages. Parts may become more expensive or difficult to find, necessitating full replacement and potential design changes. The NRC has made changes to its programs for the oversight of a maturing

[15] ATFs are a set of new technologies that have the potential to enhance safety at U.S. nuclear power plants by offering better performance during normal operation, transient conditions, and accident scenarios.

industry and has seen an increase in emergent issues concerning aging management. Specifically, the NRC continues to enhance its inspection procedures, risk-informs sample selections, shares and utilizes operating experience, and has methods for conducting program adjustments, if needed.

Over a plant's life, safety is ensured through maintenance and the plant's unique licensing basis. The two primary risk metrics used in analyzing internal events for operating reactors are core damage frequency and large early release frequency. In general, both have been trending downward because of improvements in operational practices (e.g., improved maintenance) and plant modifications, such as improved reactor coolant pump seals. On the other hand, the calculated risk from external hazards (e.g., seismic, flooding) has increased for many plants as licensees and the NRC have gained an improved understanding of these hazards. Furthermore, the effects of aging on components that have not been replaced (e.g., reactor coolant system piping) could affect future plant risk and need to be further understood. Improved risk profiles of the plants and better operation may lead to reduced oversight and licensing activities. However, there may be increased need for inspection and licensing activities to verify the acceptability of the licensee's probabilistic risk assessment models and for maintaining the NRC's Standardized Plant Analysis Risk models.

4.1.2 License Renewal and Subsequent License Renewal

The NRC has established a timely power reactor license renewal process and clear requirements that are needed to ensure safe operation for an extended period. The decision to continue operations beyond 40 years to 60 years is strictly an economic decision to be made by power reactor owners. The NRC anticipates license renewal work will continue through FY 2026. Future applications are expected to be submitted for one nuclear power plant per year in FY 2022 through FY 2024.[16]

Subsequent license renewal work is expected to increase through FY 2026 based on the letters of intent that the NRC has received and Duke Energy's public announcement that it intends to seek subsequent license renewal for its entire fleet.[17] Potential consideration for "life beyond 80" would also drive the need for increased understanding of aging management for critical components.

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16 Stated in the NRC's 2022 Congressional Budget Justification (CBJ). This is available in ADAMS at Accession No. ML21181A336.

17 Duke Energy's public announcement is available at: https://news.duke-energy.com/releases/duke-energy-seeks-subsequent-license-renewal-for-oconee-nuclear-station

4.2 New Reactors Business Line

4.2.1 Light-Water Reactors

Light-water small modular reactors (SMRs) have the potential to enhance safety and security as well as offer greater scalability and siting flexibility for locations unable to accommodate more traditional large light-water reactors (LWRs). The NRC anticipates receiving several new applications for combined licenses, design certifications, and standard design approvals for SMRs before FY 2026. This would result in a projected increase of SMR licensing activities over the next 5 years.[18] The NRC is reviewing current designs by NuScale, General Electric Hitachi, and Holtec, and these companies are seeking to change the way reactors are designed, built, and operated. As such, the licensing of these new SMRs must also evolve. Licensing work associated with three LWR designs is anticipated through FY 2026.

4.2.2 Advanced Reactors

Technological innovation is changing the way advanced reactor designs are being developed. Advanced non-LWRs will use heat pipes, gas, liquid metal, or molten salt as a coolant and are expected to enhance the margins of safety by using simplified, inherent, passive, or other means to accomplish their safety and security functions. Some will have a fast neutron spectrum, some will operate at or near atmospheric pressure, and some will be much smaller than current generation reactors.

The Energy Policy Act of 2005 prompted a wave of design certification and combined license applications to the NRC for large LWRs. For various reasons, including economic factors, power generators are less likely to pursue LWRs and are expressing interest in non-LWR designs. The NRC continues to make significant progress in its activities to support licensing of non-LWRs, such as modernizing the agency's regulatory infrastructure to support licensing as required by Section 103 of the NEIMA.

In addition, Congress has provided significant funding to the U.S. Department of Energy (DOE) to encourage investment in the design and development of commercial non-LWRs. DOE's Advanced Reactor Demonstration Program is funding two non-LWR designs with the objective of commercial operation by calendar year 2027. The demonstration program is also funding other designs with the objective of commercial operation in the 2030s.[19]

At the end of FY 2021, the NRC continued to discuss future applications with about a dozen non-LWR designers. The NRC is reviewing one combined license application and one

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[18] As discussed in Appendix B to the "Regulatory Analysis for the Proposed Rule: Emergency Preparedness for Small Modular Reactors and Other New Technologies," the best estimate of the number of SMRs and non-LWRs is nine. This is available in ADAMS at Accession No. ML18134A0777.

[19] Additional information is available at https://www.energy.gov/ne/advanced-reactor-demonstration-program.

construction permit application for new non-LWRs and anticipates that several additional applications will be submitted through FY 2026.[20]

4.2.3 Medical Radioisotope Facilities

In support of the national initiative to establish a domestic supply of molybdenum-99 (^{99}Mo), the NRC is prepared to review license applications for medical radioisotope facilities. Potential and current applicants have proposed a variety of technologies to produce ^{99}Mo, including accelerator-driven subcritical operating assemblies, nonpower reactors, hot cell structures, and target fabrication facilities. In most cases, these facilities will feature multiple technologies located at a single site to prepare or manufacture targets, irradiate targets, and process targets for ^{99}Mo extraction. Given this diversity in technology, the licensing process for these facilities could vary based on the chosen production method. The NRC anticipates an increase in licensing and oversight for two operating license applications and two construction permit applications.

4.3 Nuclear Materials and Waste Safety Programs

4.3.1 Decommissioning and Low-Level Waste Business Line

The increasing number of power reactors entering decommissioning will continue, with three power reactors expected to enter decommissioning by the end of FY 2026. An increasing trend is expected to continue for power reactors attempting to transfer their spent fuel to dry cask storage (i.e., transition to independent spent fuel storage installations (ISFSIs)) within 3 to 5 years of final shutdown. Increased effort is expected for licensing reviews, such as license transfers to decommissioning entities, and reviews to support final site release, including license termination plans and final status survey reports. Inspections to support oversight of decommissioning activities (e.g., confirmatory surveys) are also expected to increase. Overall, the increase in power reactors entering immediate decommissioning will result in an increase in decommissioning inspections, ISFSI inspections, and licensing actions (i.e., technical and environmental reviews). Low-level waste disposal occurs at commercially operated low-level waste disposal facilities that must be licensed by either the NRC or Agreement States (for more information on Agreement States see Section 4.3.5). The four existing low-level waste disposal facilities in the United States accept various types of low-level waste; all are located in Agreement States. However, the NRC does review requests submitted by NRC licensees in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 20.2002, "Method for obtaining approval of proposed disposal procedures," for the disposal of low-level waste at commercial disposal facilities. Given the increased interest in decommissioning of power reactors, the number of 10 CFR 20.2002 reviews may increase over the next five years.

[20] Additional information on these submittals is available at https://www.nrc.gov/reactors/new-reactors/col/aurora-oklo.html and in ADAMS at Accession No. ML21272A376.

4.3.2 Spent Fuel Storage and Transportation Business Line

The increasing number of power reactors entering decommissioning will cause an increase in the number of storage and transportation licensing and certification requests. Design changes for transportation packages for uranium hexafluoride and for packages that can accommodate both new fresh fuel and spent fuel for advanced reactors are expected to increase through FY 2026. Fuel vendors will also be seeking approval for transportation of ATF designs with enrichments above 5 percent. Widespread implementation of ATF and higher enriched designs would require increased licensing activity for transportation packages. Work on new fresh fuel and spent fuel transportation packages is expected to increase for advanced reactor fuel designs through FY 2026.

As of this writing, the NRC has approved a consolidated interim storage facility (CISF) license for Interim Storage Partners and is currently reviewing one additional CISF application, for which a final licensing decision is anticipated in FY 2022. Increased interest is expected in commercial (i.e., nongovernment) shipment of spent nuclear fuel to one or both of these sites, resulting in an anticipated increase in technical reviews for security transportation plans, approval of security routes before transport of spent fuel, and coordination of oversight of shipping campaign activities to CISFs. For shipments to CISFs, the NRC oversight activities would increase at sites where spent fuel is moved from storage to transportation configurations and at receipt of shipments at one or both CISFs. The NRC staff is completing a regulatory review report of its readiness to support a potential increase in commercial shipments of spent nuclear fuel to the CISFs when they may begin operations. The staff review determined that the regulatory framework is complete and sufficient for commercial shipments and provided specific recommendations for updating and consolidating inspection procedures for greater efficiency for commercial shipments between licensed sites. A slight increase in licensing actions is anticipated to support new transportation package designs and oversight, as well as coordination of shipping campaign activities to interim storage facilities. Associated regulatory guidance documents will likely be needed to accommodate the number of designs and amendments.

4.3.3 Fuel Facilities Business Line

A potential increase is expected in licensing activities related to new fuel fabrication and enrichment facilities to support the production of fuel for advanced reactors that would operate with higher enrichments and different forms of fuels (e.g., higher enrichments and tri-structural isotropic fuel for pebble-bed, molten salt, or advanced gas-cooled reactors). The licensing and oversight functions for existing fuel facilities are expected to plateau through FY 2026.

Several fuel vendors, in coordination with the DOE, have announced plans to develop and seek approval for various ATF fuel designs. The NRC's role with ATF is to review the new fuel technologies and their associated enrichment, fabrication, transportation, and storage aspects to ensure that they maintain public health and safety when used by NRC licensees.

Facility changes and license amendments will be needed to accommodate the enrichment and fabrication of fuel with enrichments above 5 percent. ATF research activities are expected to remain stable through FY 2026 to support the development of agency technical review capabilities.

4.3.4 Emerging Technologies

The NRC has seen an increase in medical applications of radioisotopes and advances in medical technologies for use in diagnosis, therapy, and medical research. The NRC anticipates an increase in the number of emerging technologies licensed by the NRC and Agreement States. The number of reviews and new or revised guidance related to emerging medical technology and radiopharmaceuticals is expected to increase through FY 2026 based on information from the Advisory Committee on the Medical Uses of Isotopes, as well as interactions with professional societies involved with emerging medical technologies, the manufacturers of emerging medical technologies and radiopharmaceuticals, the U.S. Food and Drug Administration, and the Agreement States. The staff also developed a rulemaking plan to restructure the regulations for emerging medical technologies. If approved, the rulemaking would require a multiyear staff effort that would result in an increased workload for rulemaking and medical health physics staff. The increase in workload in this area is consistent with the health physicist gap in the NRC workforce identified in Section 5.2.

4.3.5 Agreement States

Section 274b of the Atomic Energy Act authorizes the NRC to enter into agreements with individual States, in which the State assumes the NRC's authority to license and regulate certain radioactive materials and activities within its borders. In the past few years, several States have inquired about becoming an Agreement State, which would affect the number of licensees under NRC jurisdiction and thus the budget needed for direct licensing and inspection activities. The NRC staff received letters of intent from Connecticut on December 10, 2020, and from Indiana on June 11, 2021.[21] Given the number of materials licenses in these States, there would be a moderate reduction in materials licensing and inspection workload in Region I and Region III if Connecticut and Indiana, respectively, become Agreement States.[22] Connecticut represents approximately 5 percent of NRC materials licensees, and Indiana accounts for approximately 9 percent of these licensees; specific resource changes would depend on the types of licensees and the associated licensing and inspection resources. These changes would not take effect until the agreement is in place. For Connecticut, the current projected date is January 1, 2025, so the

[21] Connecticut's letter of intent is available at https://scp.nrc.gov/Connecticut.html and Indiana's letter of intent is available at https://scp.nrc.gov/Indiana.html.

[22] If Michigan—another State that has previously expressed interest—were to become an Agreement State, there would be a significant workload reduction in materials licensing and inspection for NRC's Region III Office, given the many materials licensees in Michigan.

impacts would occur in FY 2025. For Indiana, the current projected date is January 1, 2026, so the impacts would occur in FY 2026.

For each additional Agreement State, there would be a modest workload increase for the NRC's Agreement State support for Integrated Materials Performance Evaluation Program reviews and a larger span of work for the Regional State Agreement Officers.

4.4 Information Technology and Information Management

The NRC continues to build a flexible, agile, and innovative information technology and information management environment that can support the rapid development of new technologies and changes in the nuclear industry. Technological advances continue to change the way the NRC works, communicates, and interacts. The NRC has ongoing efforts to strategically plan, modernize, and integrate information technology systems and applications throughout the agency and to increase internal capacity to gather, define, evaluate, analyze, link, and present data to support decisionmaking.

The NRC has an increased demand for application development and data visualization activities, and in turn, this increases support requirements related to the underlying information technology platforms and end-user services. The NRC will need additional resources and expertise from data scientists, data analysts, data engineers, and AI specialists that are currently limited within the agency.

The NRC is focused on modernizing information technology through FY 2026 to help the agency gain efficiency, improve proficiency, improve its security posture, standardize its system implementation approach, reduce costs, and improve enterprise systems' performance. Consistent with the OMB's Cloud Smart policy, the NRC will continue to use shared services and cloud options where appropriate when planning new mission or support applications or consolidating existing applications.

4.5 Cross-Business-Line Functions

4.5.1 Rulemaking

The NRC's rulemaking program supports the agency's mission by performing regulatory analyses to develop regulations. The NRC initiates a new rule or a change to an existing rule when necessary to protect public health and safety. Additionally, any member of the public may petition the NRC to develop, change, or rescind a rule. The Commission directs the NRC staff to begin work on a new rulemaking activity through approval of a staff rulemaking plan. Rulemaking activities may include development of the regulatory basis, proposed rule, final rule, direct final rule, and advanced notice of proposed rulemakings.

The NRC anticipates a slight increase in rulemaking activities for FY 2022 and FY 2023 for the following business lines: Operating Reactors (e.g., License Renewal Generic Environmental Impact Statement and Transforming the NRC's Environmental Review

Process); New Reactors (e.g., Risk-Informed, Technology Inclusive Regulatory Framework for Advanced Reactors (10 CFR Part 53) and Advanced Nuclear Reactor Generic Environmental Impact Statement); and Nuclear Materials Users (e.g., Decommissioning Financial Assurance for Sealed and Unsealed Radioactive Material, Training and Experience Requirements for Unsealed Byproduct Materials).

4.5.2 Research

The NRC continues to perform research to provide technical advice, tools, and information for meeting the agency's mission, including resolving safety and security issues, making regulatory decisions, and promulgating regulations and guidance. Research will continue in support of agency priorities, as discussed in the environmental scan, including support of the University Nuclear Leadership Program and preparation for industry-driven innovation. Activities will be performed through FY 2026 to prepare for and support licensing and oversight of the operating fleet, licensing renewal and decommissioning, advanced fuels, digital instrumentation, and controls, SMRs, and advanced reactors. Research activities will also support other areas of industry-driven innovation, such as those involving additive manufacturing, flexible plant operation, digital twinning, other areas of AI and machine learning, and the Nuclear Energy Innovation Capabilities Act of 2017.

5. ASSESSMENT OF KEY AGENCY FUNCTIONS

The evidence-building activities associated with the key agency functions are analysis, research, statistics, and evaluation. As previously discussed in Section 3.0, the capacity assessment includes an in-depth assessment of key agency functions and the associated evidence-building activities. Section 5.1 through Section 5.6 document the capacity assessment findings and mitigating strategies for each key agency function. Finally, Section 5.7 outlines the crosscutting issues that were identified across multiple key agency functions.

5.1 Licensing

The NRC issues licenses (or certificates, in the case of spent fuel storage casks and nuclear materials transportation packages) to possess and use nuclear materials and operate nuclear facilities. Upon receipt of an application, the NRC performs analyses to determine whether the proposed activity can be conducted safely and securely in conformance with applicable regulations. Through the licensing process, the NRC authorizes an applicant to conduct the following activities:

- Construct and operate commercial reactors and fuel cycle facilities, including decommissioning and license termination.
- Possess, use, process, export, and import nuclear materials and waste and handle certain aspects of their transportation.
- Site, design, construct, operate, and close waste disposal sites.

5.1.1 Coverage

5.1.1.1 Distribution of Evidence-Building Activities and Program Resources

Trends in resources and work were examined to determine any challenges to the NRC's capacity to perform analysis in support of licensing. Figure 2 shows the trend in resources for reactor licensing along with the number of licensing actions completed. It should be noted that resources apply to the entire licensing program rather than the subset of evidence-building analysis to support licensing. Most of the NRC's licensing budget is associated with the Nuclear Reactor Safety Program, which includes the Operating Reactors and New Reactors business lines. Resources for the Nuclear Reactor Safety Program have decreased from about $126 million in FY 2018 to $108 million in FY 2021. The NRC reactor licensing actions have decreased by about 14 percent from FY 2018 to FY 2021 (from 1,389 licensing actions to 1,200 licensing actions); similarly, total licensing resources for the Nuclear Reactor Safety Program have fallen by 14 percent from FY 2018 to FY 2021.

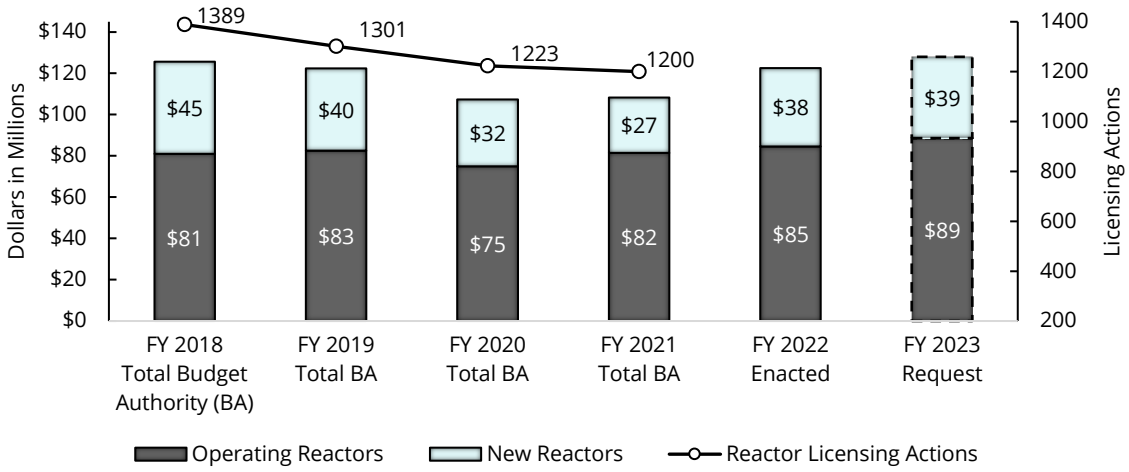


Figure 2 - Nuclear Reactor Safety Program Licensing Resources and Actions[23]

The Nuclear Materials and Waste Safety Program, which is made up of the Spent Fuel Storage and Transportation, Nuclear Materials Users, Decommissioning and Low-Level Waste, and Fuel Facilities Business Lines, has seen a slight decline in resources from about $47 million in FY 2018 to about $41 million in FY 2021 (Figure 3). Total licensing resources for the Nuclear Materials and Waste Safety Program have fallen by 14 percent from FY 2018 to FY 2021; NRC Materials Program licensing actions have decreased by about 20 percent over this time (from 1,681 licensing actions to 1,352 licensing actions).

[23] This figure, and subsequent resource figures in this capacity assessment, include NRC staff resources (including management) and contractor costs. The graphs depict resource information which reflects the total budget authority (BA) and includes authorized prior-year carryover. It is important to note that licensing actions vary in their complexity, and different years may see more complex licensing actions (e.g., those that require more review hours).

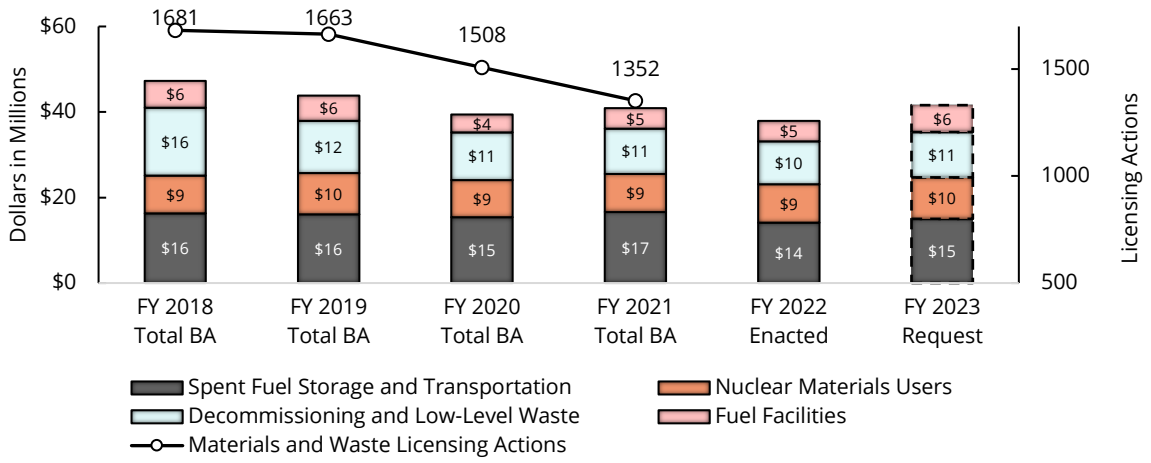


Figure 3 - Nuclear Materials and Waste Safety Program Licensing Resources and Actions

Licensing resources overall have fallen by 14 percent from about $173 million in FY 2018 to about $149 million in FY 2021. Similarly, NRC licensing actions had a corresponding decrease from about 3,100 to about 2,600 from FY 2018 to FY 2021, which is approximately a 17-percent reduction in licensing actions. Some of the increases in work for FY 2021 are due to the development of a regulatory infrastructure for advanced nuclear reactor technologies, as well as increases in subsequent license renewal applications and ATF topical reports. The decline in licensing actions is likely due to the six power plants that have entered decommissioning since 2018, as well as potential impacts from the COVID-19 pandemic.[24] For the Nuclear Materials Users Business Line, which accounts for most of the licensing actions in the Nuclear Materials and Waste Safety Program, the decline in licensing actions is primarily due to a decrease in the number of materials licenses under NRC jurisdiction (e.g., Vermont became an NRC Agreement State at the end of FY 2019).

5.1.1.2 Workforce Gaps and Surpluses

The NRC has about 600 staff members who perform licensing activities related to operating reactors, new reactors, fuel cycle facilities, decommissioning, transportation and storage, nuclear materials licensing, and medical radioisotope facilities. The majority of these staff members are responsible for performing evidence-building analysis to support licensing. The SWP data illustrates that with projected attrition, by FY 2026, the NRC will be short by about 200 licensing staff whose positions will need to be filled. Expected attrition from retirements (171 staff) and net workload increases (31 staff) account for this gap, consistent with the discussion in the environmental scan. The largest future workforce gap is for project managers; while this is not typically an evidence-building position, it is included in this discussion because it is critical in supporting the evidence-building activities for licensing. Among the evidence-building positions that support licensing, the largest

[24] As discussed during a September 30, 2021, Commission meeting, licensees may have deferred lower priority licensing actions because of the COVID-19 pandemic. The meeting transcript is available in ADAMS at Accession No. ML21288A219.

gaps exist for nuclear engineers, reactor engineers, risk analysts, materials engineers, and mechanical engineers (Figure 4).

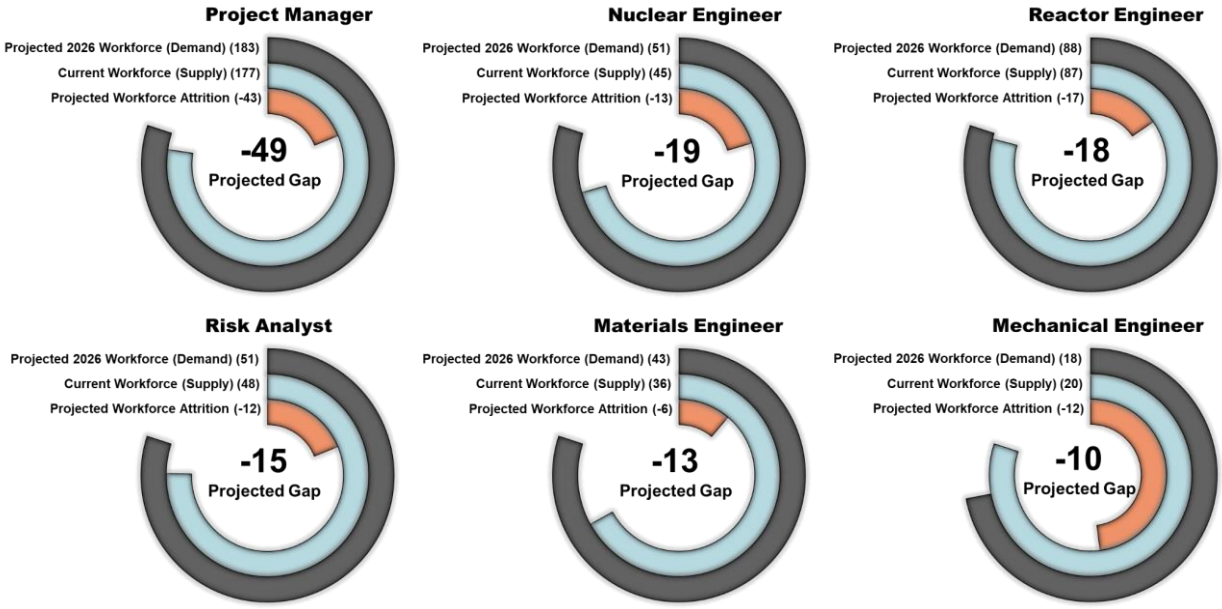


Figure 4 - Licensing Positions with the Largest Projected Gaps between FY 2021–2026

The largest future gap in licensing staff is project managers (-49 staff). This is followed by expected future gaps in the following evidence-building disciplines: nuclear engineering (-19 staff), reactor engineering (-18 staff), risk analyst (-15 staff), materials engineering (-13 staff), and mechanical engineering (-10 staff). The main factor in these staffing gaps is attrition. While increases are expected in the workload for advanced reactors and other areas as discussed in the environmental scan, these increases appear to be modest in comparison to the number of staff who are expected to be lost due to attrition. The NRC needs staff skilled in advanced reactor designs, operations, systems, and phenomena. This also includes staff skilled in the use of computer codes to model advanced reactor safety and operations. The need for computer codes and the supporting data and models is further discussed in Section 5.3.

The SWP data were also analyzed to identify specific positions that may be particularly susceptible to attrition. To that end, positions with at least 40-percent total attrition projected over the 5-year period from FY 2021 through FY 2026 were also identified. Within the licensing function, chemical engineers, electronics and electrical engineers, emergency preparedness specialists, hydrogeologists, mechanical engineers, program managers for security, security specialists, and structural engineers are projected to face significant

attrition. Therefore, these positions also warrant additional attention to ensure that the NRC's capacity to perform analysis for licensing is not negatively impacted.[25]

The NRC has prepared strategies to address the future gaps in licensing employees. These strategies include cross-training current staff, placing Nuclear Regulator Apprenticeship Network (NRAN) graduates, offering job rotation opportunities and internal promotions, reassigning staff from other areas of the NRC, and posting vacancy announcements.

5.1.2 Quality, Methods, Independence, and Effectiveness

5.1.2.1 Focus Groups, Surveys, and Interviews

The NRC held three focus groups for licensing with 65 staff who completed the survey. The participants included 6 Senior Executive Service (SES) managers, 12 Branch Chiefs, and 47 staff covering the range of licensing programs. When aggregating the survey results from licensing staff, Figure 5 shows that most participants provided positive responses ("usually" or "always"), which reflects well on the NRC's capacity for performing analysis to support licensing.

Results from the focus group surveys include the following:

- As shown in Figure 5, the NRC has an overall maturity score of 3.1 out of 4 for licensing analysis. According to the NRC's maturity model, the agency's licensing function has an overall "High Capacity" rating for performing analysis.

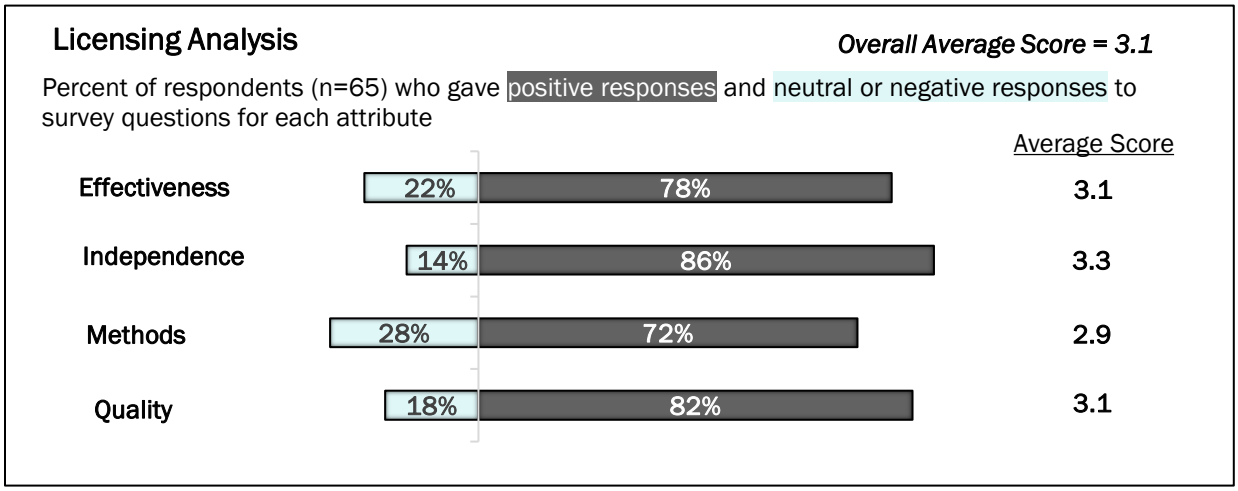


Figure 5 - Licensing Analysis Survey Responses

- Review of quantitative survey responses shows that the methods attribute has the most potential for improvement with the lowest average score of 2.9 (rating of Medium Capacity). A review of the responses to the survey questions on methods

[25] According to the SWP, the positions identified with high future attrition show that the NRC has a limited number of chemical engineers and hydrogeologists performing licensing work.

shows that the lowest response score was on the use of knowledge management resources and processes. These responses indicate the potential need to seek creative and innovative ways to promote increased use of knowledge management resources and processes.

- Discussions were held with staff members who perform analyses to support licensing activities. These discussions were aimed at sharing the results of the survey responses, discussing the suggested improvements, and identifying any other missed opportunities for enhancing the NRC's evidence-building activities. These discussions indicate that, to maximize the use of knowledge management, more staff time should be allocated to performing knowledge management activities and knowledge management should receive a higher priority. Additionally, discussions revealed that full advantage should be taken of senior-level staff experience.
- Review of qualitative survey responses provided several additional potential opportunities for improvement of the NRC's licensing program. However, none of these additional opportunities were significant enough to warrant its own finding and mitigating strategy as part of this capacity assessment.

5.1.3 Findings and Mitigating Strategies

Below are the findings and associated mitigating strategies to improve the NRC's capacity for performing analysis to support licensing. Other findings and associated mitigating strategies that impact licensing as well as other NRC functions are discussed in Section 5.7 on Crosscutting Items.

Finding: The SWP results indicate that the largest expected staffing gaps are in the following licensing positions: project managers, risk analysts, and engineers (i.e., reactor, nuclear, mechanical, and materials). This information was verified by confirming that these positions have been identified as future staffing gaps by the licensing business lines and that strategies have been developed to fill these positions.

- **Mitigating Strategy:** Where appropriate, the NRC should collaborate across organizations and develop an agencywide strategy to hire for positions susceptible to high attrition. The NRC should proactively use various recruiting, retention, and knowledge management resources to identify ways to ensure that qualified staff can perform NRC licensing functions.

Finding: Licensing actions vary in their complexity (e.g., some licensing actions will take more review hours than others because of the specifics of the action requested). For this reason, it is difficult to ascertain whether NRC licensing actions of a similar scope are becoming more or less efficient while maintaining the agency's internal expectations of high-quality technical analyses performed by the NRC staff.

- **Mitigating Strategy:** As discussed in Priority Question 4 of the NRC's Evidence-Building Plan, "To what extent are licensing actions performed by the NRC becoming more or less resource intensive over time and have there been any changes in work product quality," the NRC intends to perform an evaluation of the licensing program. The evaluation will (1) determine if similar licensing actions have become more or less resource intensive over time, (2) identify resource variances between similar licensing actions, (3) identify the factors contributing to the increase, decrease, and variance of resources for each type of licensing action, and (4) determine if there were any changes to the quality of the work products. The NRC will engage internal and external stakeholders to conduct this assessment.

5.2 Oversight

The NRC's oversight function is designed to verify that U.S. licensees of nuclear power plants, research and test reactors, fuel cycle facilities, and materials users are operating in accordance with NRC rules, regulations, and license requirements. Inspectors follow guidance in the NRC's inspection manuals, which contain objectives and procedures to use for each type of inspection for each type of nuclear facility. Analysis is used to identify samples for inspection and then to interpret the results of inspections. Analysis is also used to observe and gain insights from operating experience data from the entire fleet of licensed facilities. The Reactor Oversight Process (ROP) is the NRC's program to inspect, measure, and assess the safety and security performance of operating commercial nuclear power plants and to respond to any decline in their performance. The ROP focuses inspections on areas of greatest risks, increases regulatory attention to nuclear power plants if performance declines, uses objective measurements of performance, gives the public timely and understandable assessments of plant performance, and responds to violations in a predictable and consistent manner that corresponds to the safety significance of the problem. The staff has developed a variety of dashboards and data tools to support its analysis, and various efforts are underway to increase the use of operating experience and Reactor Program System data to improve oversight analysis. There are parallel efforts in the Nuclear Materials and Waste Safety Program to leverage the use of licensing and inspection data within the NRC's Web-Based Licensing system and other agency databases to develop dashboards to improve technical and financial decisionmaking.

5.2.1 Coverage

5.2.1.1 Distribution of Evidence-Building Activities and Program Resources

Trends in resources and work were examined to determine any challenges to the NRC's capacity to perform analysis in support of oversight. The NRC's oversight budget stayed relatively flat from about $151 million in FY 2018 to $152 million in FY 2021. Oversight of operating reactors accounts for about 75 percent of the budget and has increased slightly

over the past 4 years. Oversight of new reactors has decreased from 9 percent of the total oversight budget in FY 2018 to 7 percent in FY 2021.

Figure 6 shows the total number of reactor safety inspections completed by fiscal year, which includes inspections of operating reactors, research and test reactors, and new reactors. New reactor inspections are included in FY 2020 and FY 2021 but were not included in FY 2018 and FY 2019 because they were tracked using different metrics. Operating reactor inspections made up about 98 percent of the total inspections completed in FY 2018 and FY 2019, and about 88 percent of reactor safety inspections completed in FY 2020 and FY 2021. Research and test reactor inspections accounted for about 2 percent of all reactor safety inspections over the 4 years shown. New reactor inspections made up about 10 percent of the total in FY 2020 and FY 2021.

Operating power reactor inspections decreased from 2,404 inspections in FY 2018 to 2,267 in FY 2019 primarily because of the consolidation of several inspection procedures (IPs) into a single procedure whereas before they counted as separate completions. Operating reactor inspections saw a smaller decline to 2,257 in FY 2020; some could not be completed because of the required onsite components of the IP, the timing of the activities to be inspected, and actions taken by the NRC to protect the health and safety of both NRC and licensee staff, which restricted both onsite time and inspector travel, due to the ongoing COVID-19 pandemic. Operating reactor inspections saw a larger decrease in FY 2021 to 1,917.

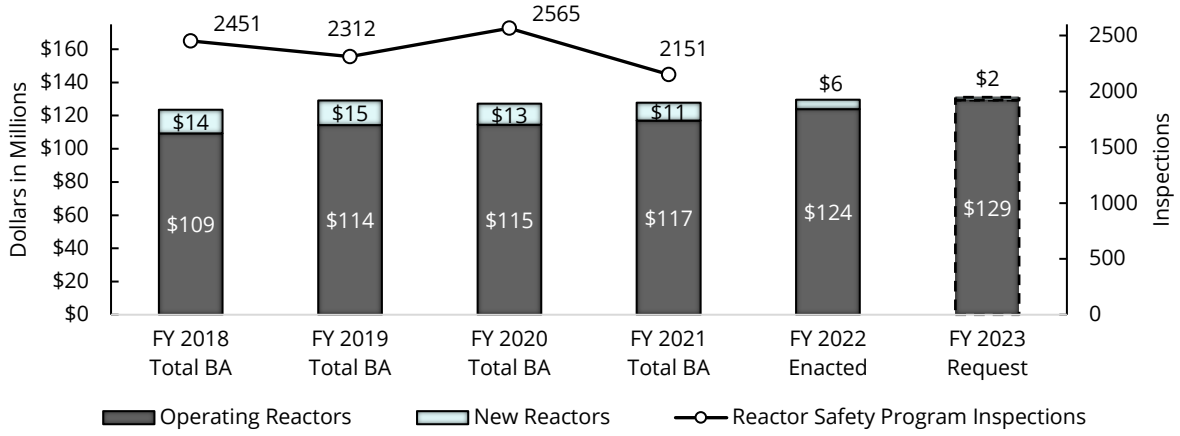


Figure 6 - Nuclear Reactor Safety Program Oversight Resources and Inspections

Approximately 16 percent of the oversight budget over the past few years has covered the Nuclear Materials and Waste Safety Program (Figure 7), including the Spent Fuel Storage and Transportation, Nuclear Materials Users, Decommissioning and Low-Level Waste, and Fuel Facilities Business Lines. The proportion of funding across these components has been relatively consistent over this time period. Nuclear Materials Users inspections experienced a noteworthy decrease (from 761 to 373) in FY 2020 because of fewer nuclear

materials user inspections due to the COVID-19 pandemic. However, nuclear materials user inspections increased in FY 2021 from 373 to 588. Similar to reactor inspections, some fuel facility inspections decreased because of consolidation of IPs.

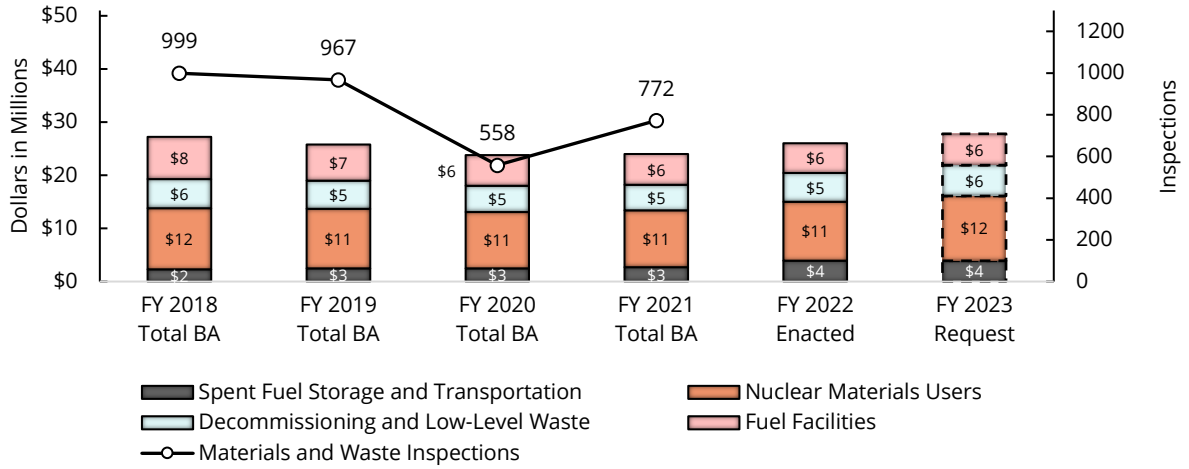


Figure 7 - Nuclear Materials and Waste Safety Program Oversight Resources and Inspections

5.2.1.2 Workforce Gaps and Surpluses

The NRC's 2021 SWP input indicates that there are over 600 NRC oversight staff in core positions. The majority of these staff members are responsible for performing evidence-building analysis to support oversight. By the year 2026, the SWP estimates that the agency will have a gap of approximately 150 oversight staff, considering attrition and workforce demand changes if no actions are taken to fill these positions. Among the inspector positions, in which staff perform the analysis evidence-building activity as an essential component of their work, the categories with the largest projected gaps are shown in Figure 8: project engineer RIDP (Resident Inspector Development Program) (-26 staff), resident inspector (-18 staff), health physicist materials inspector and license reviewer (-13 staff), and reactor inspector (-11 staff).

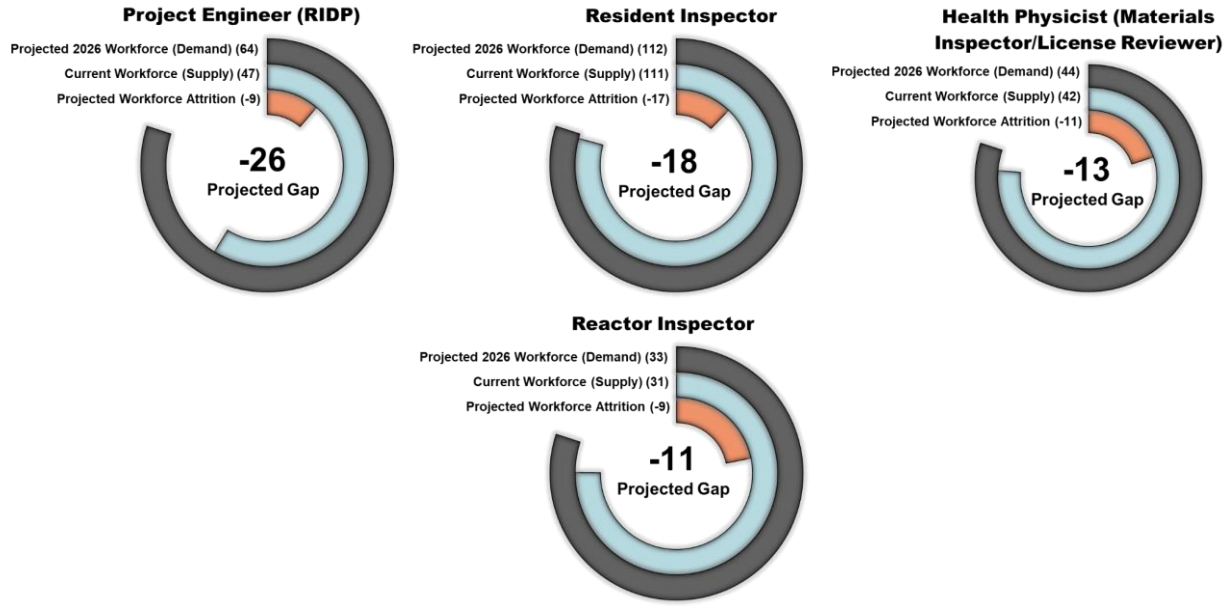


Figure 8 - Oversight Inspector Positions with the Largest Projected Gaps

The project engineer RIDP position serves as the primary pipeline for developing resident inspectors, though there are other sources. There is a projected need to increase by 17 staff; however, this increase reflects that this position is currently understaffed, rather than that the workload is actually increasing. Workload for the resident inspector position is flat; the gap of 18 staff exists almost entirely because of expected attrition losses. Likewise, the health physicist materials inspector/license reviewer and reactor inspector positions have a very small workload increase and thus the gaps are largely to address attrition.

The SWP data were also analyzed to identify specific positions that may be particularly susceptible to attrition. To that end, the staff identified positions with at least 40-percent total attrition projected over the 5-year period from FY 2021 through FY 2026. Within the oversight function, the health physicist (ISFSI inspector) and reactor inspector (fire protection) positions are projected to face significant attrition. Therefore, these positions also warrant additional attention to ensure that the NRC's oversight analysis capacity is not negatively impacted.

The NRC has prepared strategies to address the future gaps of oversight employees. These strategies include posting vacancy announcements, cross-training current staff, placing NRAN graduates, offering job rotation opportunities and internal promotions, and reassigning staff from other areas of the agency. NRC offices have also developed a workforce strategy to address the health physics workforce gap across the agency which is an important position responsible for conducting evidence-building activities such as analysis and research. The NRC staff has identified that this workforce gap also affects Agreement States. The staff is exploring opportunities to leverage existing programs such as scholarship and fellowship grants programs and university champions to build a

pipeline of potential health physics professionals primarily for the NRC but secondarily for the broader radiation protection industry to support States. Additional strategies include developing staff through cross-training within the agency and partnering with States to create cross-jurisdictional training opportunities and building relationships within the NRC and with States and other Federal agencies to strengthen communities of practice. For the FY 2023 Evidence-Building Plan, the NRC staff intends to answer the priority question, "How can the NRC better leverage research conducted through NRC-sponsored University Research and Development Grants?" One aspect of answering this priority question is to explore whether changes to the grant program are warranted to better target specific fields to support development of a talent pipeline.

The NRC's Region III office has responsibility for oversight of nuclear materials users in the midwestern United States. In June 2021, Indiana officially indicated its intent to become an Agreement State, and Michigan is considering this as well but has not yet submitted an official letter of intent. Indiana's transition will reduce workload for Region III's materials license reviewers and materials inspectors (from about 900 to 700 materials users). The transition will be even more significant if Michigan becomes an Agreement State, as the number of materials users would further decrease from about 700 to 300. The NRC will continue to monitor these transitions and consider developing a plan if Michigan becomes an Agreement State to ensure that any capacity impacts would be mitigated.

In addition, the senior reactor analyst position is a critical position for performing evidence-building analysis supporting the oversight function. Filling this position has presented challenges because there is no clear pipeline for developing and preparing staff for this position. The NRC should consider developing a program specifically designed to prepare staff for this.

5.2.2 Quality, Methods, Independence, and Effectiveness

5.2.2.1 Focus Groups, Surveys, and Interviews

The NRC held three focus groups for oversight with 76 staff who completed the survey. The participants included 8 SES managers, 14 Branch Chiefs, and 54 staff members covering the range of areas subject to NRC oversight. When aggregating the survey results from oversight staff, Figure 9 shows that most participants provided positive responses ("usually" or "always"), which reflects well on the NRC's capacity for performing the oversight function.

Results from the focus group surveys include the following:

- As shown in Figure 9, the NRC's oversight function has an overall maturity score of 3.2 out of 4. According to the NRC's Capacity Assessment Maturity Model, the NRC oversight function has an overall "High Capacity" rating for performing analysis.

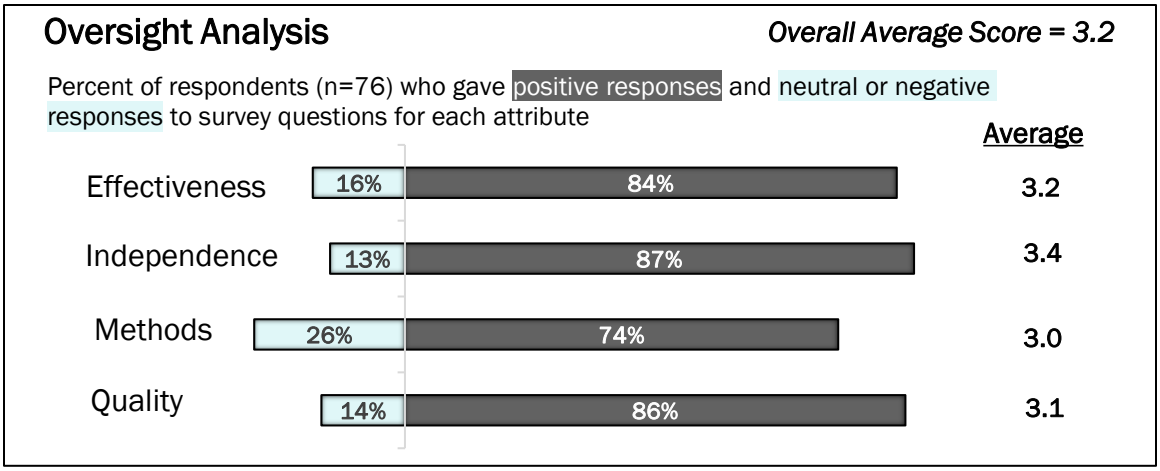


Figure 9 - Oversight Analysis Survey Responses by Attribute

- Review of quantitative survey responses shows that the methods attribute has the most potential for improvement with the lowest average score of 3.0. Among the five survey questions on the methods attribute, the question on knowledge management resources and processes received by far the most negative or neutral responses. This may indicate that the oversight function would benefit from greater use of knowledge management resources and processes. Oversight staff members have recently been using weekly knowledge management discussions to transfer knowledge, which perhaps shows that the staff is aware of this opportunity for improvement and is working to address it.
- Qualitative survey responses were received regarding the decline in the number of reactor inspection findings. The NRC has observed that the number of reactor inspection findings has been consistently and significantly decreasing year after year since 2015. This trend is observed for reactors across all four NRC regions. In 2015, there were 811 total findings (about 8 per reactor), while in 2020 and 2021, there were only 251 and 177 total findings, respectively (about 2–3 per reactor).[26]
- Qualitative survey responses were received regarding recruitment and retention for resident inspectors and senior resident inspectors. The NRC anticipates challenges with the Resident Inspector Program regarding recruitment and retention. In addition, the program lacks a data-driven method for monitoring and assessing the health of the program. The Resident Inspector Program needs to offer sufficient incentives to ensure that resident inspector vacancies can be promptly filled.
- Review of qualitative survey responses provided several additional potential opportunities for improvement of the NRC's oversight program. However, none of these additional opportunities were significant enough to warrant its own finding and mitigating strategy as part of this capacity assessment.

[26] This is the number of findings as of November 17, 2021.

5.2.3 Findings and Mitigating Strategies

Below are the findings and associated mitigating strategies to improve the NRC's capacity for performing analysis to support oversight. Other findings and associated mitigating strategies that impact oversight as well as other NRC functions are discussed in Section 5.7 on Crosscutting Items.

Finding: The SWP results indicate that the largest expected staffing gaps are in the following oversight evidence-building positions: project engineer (RIDP), resident inspector, health physicist (materials inspector/license reviewer), and reactor inspector. In addition, filling the senior reactor analyst position has presented challenges because there is no clear pipeline for developing and preparing staff for this position.

- **Mitigating Strategy:** The NRC should proactively use various recruiting, retention, and knowledge management resources to identify ways to ensure that qualified staff can perform NRC oversight functions. The NRC should consider developing a program specifically designed to prepare staff for the senior reactor analyst position.

Finding: The NRC has observed that the number of reactor inspection findings has been consistently and significantly decreasing year after year since 2015. This trend is observed for reactors across all four NRC regions. In 2015, there were 811 total findings (about 8 per reactor), while in 2020 and 2021, there were only 251 and 177 total findings, respectively (about 2–3 per reactor).[27] The NRC has been identifying the relationship between the declining trend and its causes.

- **Mitigating Strategy:** The NRC should continue to monitor and fully assess the causes of the observed trend, as well as the potential effects.

Finding: The NRC anticipates challenges associated with the Resident Inspector Program regarding recruitment and retention and would benefit from a data-driven approach for monitoring and assessing the program's health. NRC senior leadership have reported challenges in attracting and retaining high-quality senior resident inspectors and resident inspectors to staff the Resident Inspector Program. The program needs to offer sufficient incentives to ensure that resident inspector vacancies can be promptly filled.

- **Mitigating Strategy:** The NRC should continue to assess specific options using a data-driven and evidence-based approach to address the anticipated resident inspector recruitment and retention challenges.

[27] This is the number of findings as of November 17, 2021.

5.3 Research

The NRC's research program supports the agency's mission by providing technical advice, tools, and information to NRC program offices to identify potential safety and security issues and resolve them as appropriate. The research staff assesses risk and other nuclear safety and security issues and develops and coordinates regulatory guidance. This includes conducting experiments and analyses, developing technical bases to inform the NRC's safety decisions, and preparing the agency for the future by evaluating the safety aspects of new technologies and designs for nuclear reactors, materials, waste, and security. The research staff collaborates with licensing, oversight, rulemaking, and other staff at the NRC, as well as external organizations including commercial entities, national laboratories, other Federal agencies, universities, and international organizations. Research staff members also identify and oversee research through the Future-Focused Research Program. This program is designed to supply needed resources to important projects with longer term horizons supportive of transformation and the vision of becoming a more modern, risk-informed regulator. In addition, through the University Nuclear Leadership Program, the NRC's research function funds research and development grants related to the NRC's mission, as well as scholarships and fellowships to support education in nuclear science and engineering.

5.3.1 Coverage

5.3.1.1 Distribution of Evidence-Building Activities and Program Resources

Research is a collection of efforts directed toward gaining greater knowledge about the production of useful materials, devices, and methods. Research activities often include physical experimentation, modeling, and simulation. To leverage outside organizations' research facilities and expertise, the research staff often carries out this work in partnership with universities, national laboratories, research organizations, other Federal agencies, foreign regulators, and technical support organizations.

The NRC's research function involves about 5 percent of the agency's personnel and uses about 7 percent of its contracting funds. Most of the NRC's research budget supports the Nuclear Reactor Safety Program, as shown in Figure 10. Typically, 70–80 percent supports the maintenance of operating reactor safety and security, and this segment has decreased slightly over the past few years from $60 million in FY 2018 to $55 million in FY 2021. New and advanced reactor research makes up about 20–25 percent of the research budget and has increased from FY 2018 (~$15 million) to FY 2021 (~$18 million) as the staff has been preparing for the review of many non-LWR designs. Figure 10 also shows that 66 significant research projects were completed in FY 2021, supporting the NRC's Reactor Safety Program. Significant research project completions, shown in both Figure 10 and Figure 11, are not shown before FY 2021 because they were tracked in different ways and with different systems which did not allow for a consistent and repeatable method.

A consistent approach to tracking significant research project completions was developed in FY 2021 and will be used going forward. The data point for FY 2021 provides a baseline from which to compare workload and productivity in future years.

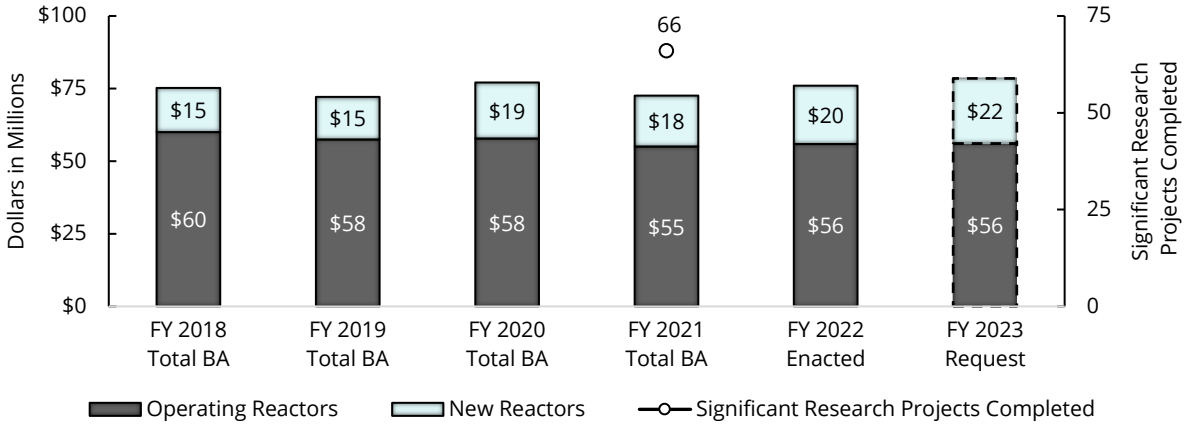


Figure 10 - Nuclear Reactor Safety Program Research Resources

As shown in Figure 11, the research budget also supports the Nuclear Materials and Waste Safety Program. This research supports Spent Fuel Storage and Transportation, Nuclear Materials Users, Decommissioning, and Low-Level Waste. Together these make up about 2–5 percent of the research budget. Figure 11 also shows that 10 significant research projects were completed in FY 2021 supporting the NRC's materials and waste safety program. The data point for FY 2021 provides a baseline from which to compare workload and productivity in future years.

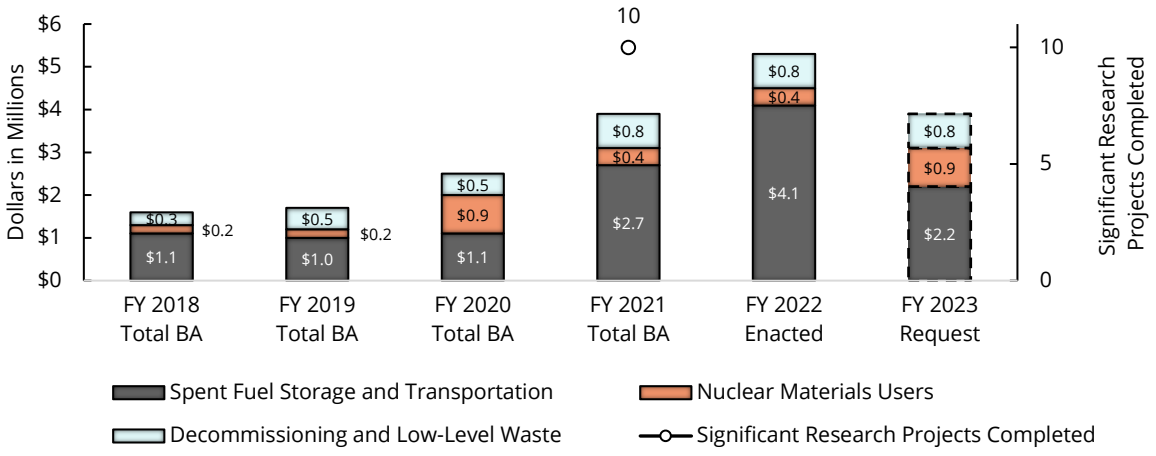


Figure 11 - Nuclear Materials and Waste Safety Program Research Resources

5.3.1.2 Workforce Gaps and Surpluses

The NRC's FY 2021 SWP process indicates that about 130 staff are in research core positions, the vast majority of which perform evidence-building research as an essential

component of their work. By FY 2026, the SWP estimates that the NRC will have a gap of approximately 23 research staff members, considering attrition and workforce demand changes if no actions are taken to fill these positions. Figure 12 shows the four position categories with the largest projected gaps. These include reliability and risk engineer/analyst (gap= -5), reactor systems engineer (neutronics) (-3), reactor systems engineer (severe accident and source term) (-3), and human factors analyst (-3).[28] The projected workload for reliability and risk engineers/analysts is relatively flat; therefore, the gap is driven largely by attrition. Each of the other three positions identified have a projected increased workload of three staff members by FY 2026, and all three positions project zero attrition. Therefore, these gaps are solely driven by increased workload.

For the reactor systems engineer—neutronics position, workload is projected to increase to support non-LWR analyses, particularly for fast neutron reactor designs. Workload for the reactor systems engineer—severe accident and source term position is expected to increase to support non-LWR source term analysis, as well as analysis of ATF in LWRs. For the human factors analyst position, workload is expected to increase to support non-LWR analysis, as well as agency innovation programs. In addition, the NRC staff has identified the need for increased data analytics and data science positions in the future to support research efforts in many technical areas (see Section 5.7.5 for a discussion on data).

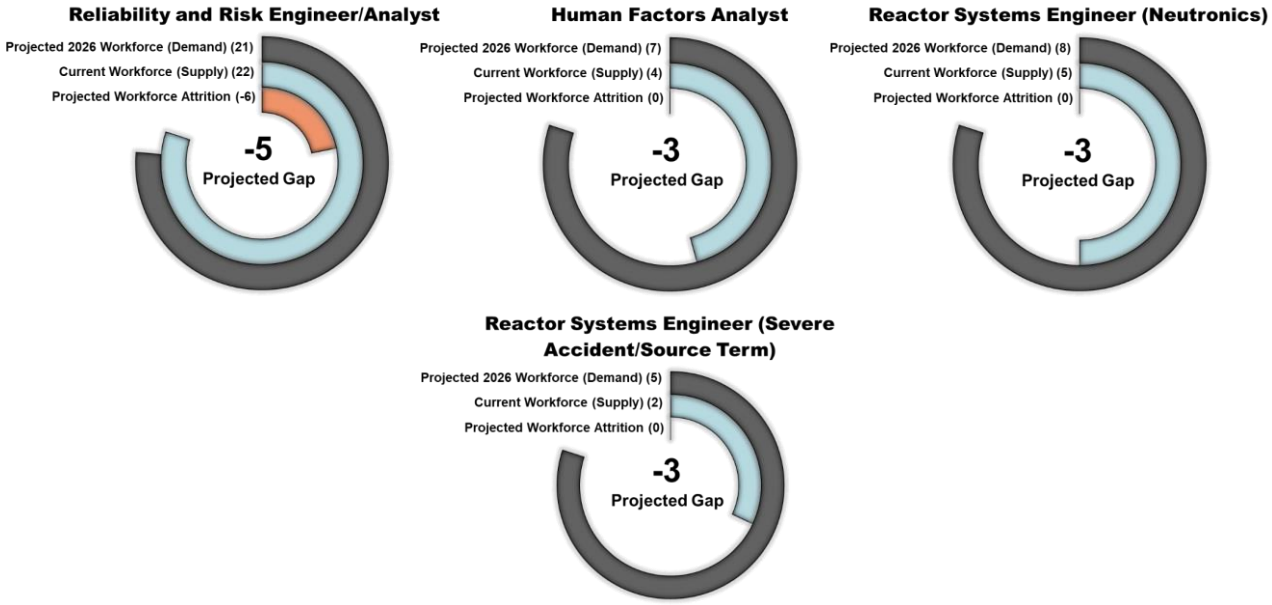


Figure 12 - Research Evidence-Building Positions with the Largest Projected Gaps between FY 2021–2026

The SWP data were also analyzed to identify specific positions that may be particularly susceptible to attrition losses. To that end, the staff identified positions with at least

[28] Human Factors Analysts assess factors affecting human performance issues, such as whether control room simulators would improve training.

40-percent total attrition projected over the 5-year period from FY 2021 through FY 2026. Within the research function, the environmental engineer and project manager positions are projected to face significant attrition. Therefore, these positions also warrant additional attention to ensure that the NRC's research capacity is not negatively impacted.

The NRC has prepared strategies to address projected workforce gaps in the future. These strategies include posting external vacancies, double encumbering positions, and seeking internal candidates.

5.3.2 Quality, Methods, Independence, and Effectiveness

5.3.2.1 Focus Groups, Surveys, and Interviews

The staff held two focus groups for research with 37 people who completed the survey. The participants included 6 SES managers, 4 Branch Chiefs, and 27 staff members covering the many technical areas of research. When aggregating the survey results from research staff, Figure 13 shows that most participants provided positive responses ("usually" or "always"), which reflects well on the NRC's capacity for performing research.

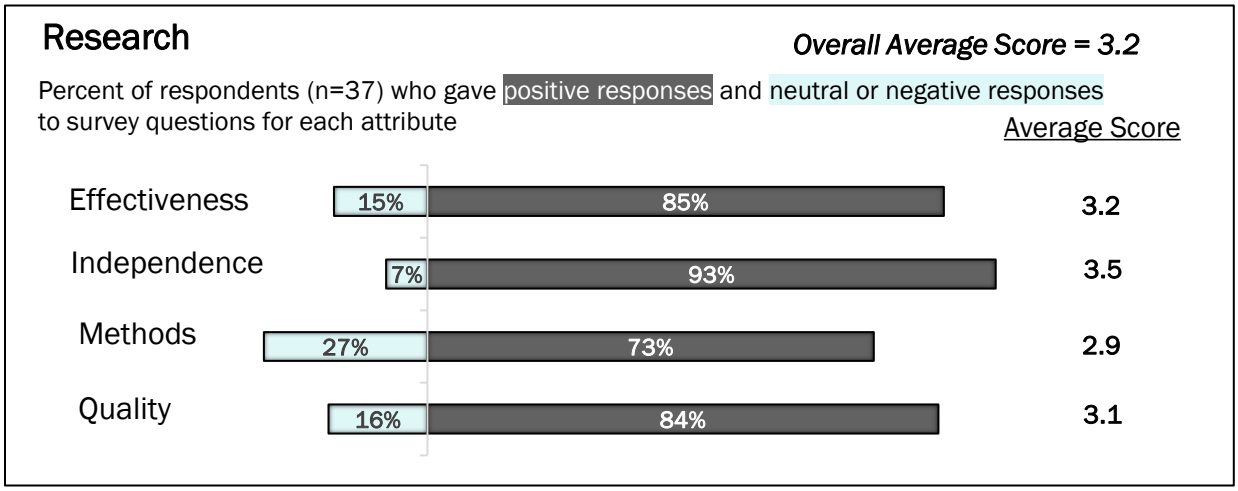


Figure 13 - Research Survey Results

Results from the focus group surveys include the following:

- The NRC's research function has an overall maturity score of 3.2 out of 4.0. According to the NRC's Capacity Assessment Maturity Model, the agency's research function has an overall "High Capacity" rating for performing research.
- Review of quantitative survey responses shows that the methods attribute has the most potential for improvement with the lowest average score of 2.9. Among the five survey questions on the methods attribute, the question on knowledge management resources and processes had by far the most negative or neutral responses. This may indicate that the research function would benefit from greater

use of knowledge management resources and processes to capture best practices for performing research.

- Qualitative survey responses were received regarding the Future-Focused Research Program. This program is critical to ensure that the agency is prepared for emerging research topics. This would benefit from an evaluation to ensure that the program is meeting its' intended outcomes and NRC is prepared for technological advancements. This was validated and led to a finding and associated mitigating strategy discussed in the following section.
- Review of qualitative survey responses provided several additional potential opportunities for improvement of the NRC's research program. However, none of these additional opportunities were significant enough to warrant its own finding and mitigating strategy as part of this capacity assessment.

Analysis of data associated with the research program's capacity to manage research contracts may provide insights that can increase capacity. Significant changes have been made to the acquisition process in the past that may have impacted the overall efficiency and effectiveness of managing research contracts. However, historical data is not readily available. The staff will continue to monitor data and further assess as more data becomes available. For example, the number of contracts assigned to each active contracting officer representative (COR) or the dollar value (ceiling, obligated, etc.) of contracts assigned to each active COR (Figure 14), if tracked over time, may provide insights. As of May 2021, the Office of Nuclear Regulatory Research had 100 active contracts managed by 47 CORs. The average number of contracts per COR was 2.1, and the average ceiling amount per COR was $3.2 million.

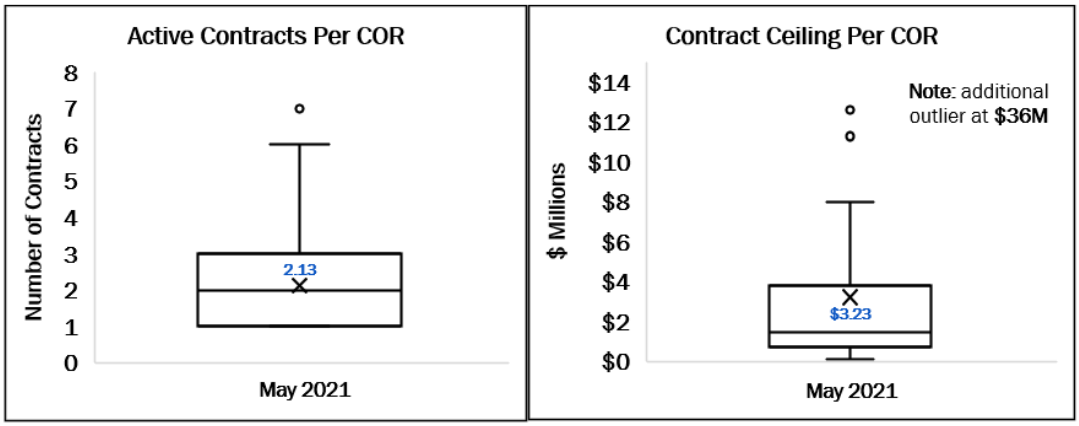


Figure 14 - Research Contract Data as of May 2021

To further assess the NRC's capacity for performing research, survey data were analyzed to determine the quality and timeliness of research products. When research products are completed, research program staff send a quality survey to sponsoring office staff. Research staff use survey input to identify areas where improvement is needed; however, this is primarily for individual projects with the lowest responses rather than in a holistic agencywide manner. This survey should be analyzed to maximize the usefulness of survey results, and the survey results should be shared in a more open and transparent manner so that research staff can identify issues affecting capacity and act to address those challenges. Figure 15 shows the average scores on a 1–5 scale for the eight research quality elements for the 3 years with available data (FY 2019 through FY 2021). As shown, all elements scored above 4; however, timeliness is perhaps a greater challenge compared to the other quality elements.

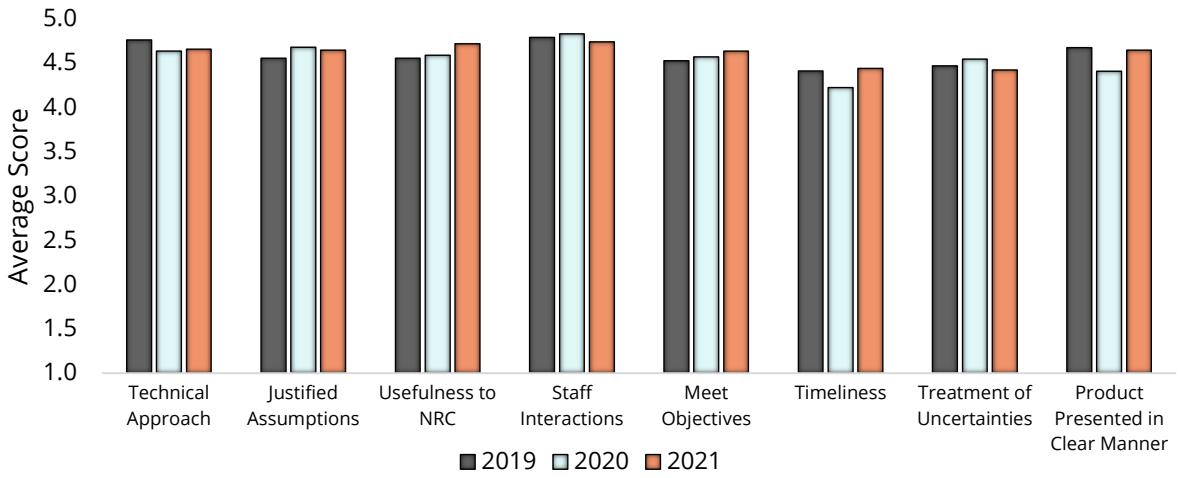


Figure 15 - Quality Survey Results on NRC Research Projects

As discussed in the Agency Environmental Scan in Section 4.2.2, the NRC expects to receive applications for various advanced non-LWR technologies in the near future. The NRC continues to make progress in its activities to support licensing of non-LWRs, such as modernizing the agency's regulatory infrastructure to support licensing as required by Section 103 of the NEIMA. The NRC also continues efforts to enhance its computer codes for modeling non-LWR designs. For more mature non-LWR designs, the staff understands the information, models, and data needed. However, the staff anticipates challenges associated with collecting information, models, and data for those non-LWR models that are less mature, with designs that are currently conceptual in nature.

5.3.3 Findings and Mitigating Strategies

Below are the findings and associated mitigating strategies to improve the NRC's capacity to conduct research. Other findings and associated mitigating strategies that impact NRC's research function as well as other NRC functions are discussed in Section 5.7 on Crosscutting Items.

Finding: The SWP results indicate that the largest expected staffing gaps are in the following positions: reliability and risk analyst, reactor systems engineer (neutronics), reactor systems engineer (severe accident/source term), and human factors analyst. This finding was validated through discussions with research managers.

- **Mitigating Strategy:** The NRC should proactively use various recruiting, retention, and knowledge management resources to identify ways to ensure that qualified staff can perform NRC research functions. The staff should explore opportunities to leverage the university grants program to build a pipeline of researchers in the fields corresponding to the positions with the greatest projected staffing gaps. The staff should build on the evaluation that will be completed to answer the following priority question in the Evidence-Building Plan: "How can the NRC better leverage research conducted through NRC-sponsored University Research and Development Grants?"

Finding: The NRC's Future-Focused Research Program is critical to ensure that the NRC is prepared for emerging research topics. Therefore, this program would benefit from an evaluation to ensure that the program is meeting its' intended outcomes and NRC is prepared for technological advancements.

- **Mitigating Strategy:** The NRC should continue to develop, monitor, and grow the Future-Focused Research Program to identify and fund research that is important to prepare the NRC for the work of the future. As time progresses, the NRC should evaluate the program to determine its effectiveness and develop performance indicators to monitor the program.

Finding: The NRC routinely uses scientific computer codes and analytical tools to perform confirmatory, sensitivity, and uncertainty analyses to independently analyze the safety of advanced reactor designs. These codes and tools help examine safety margins inherent in the design, commensurate with the risk and safety significance of the phenomena applicable to specific reactor designs. The NRC staff anticipates challenges associated with collecting information, models, and data needed for computer code modeling of advanced non-LWR safety and operations, particularly for the less mature designs.

- **Mitigating Strategy:** As discussed in Priority Question 3 of the NRC's Evidence-Building Plan, "To what extent are the NRC's computer codes capable of supporting independent analysis of the safety of advanced reactor designs and operations?", the NRC intends to address this finding by performing analysis and research to (1) identify the computer codes, analytical tools, information, and data for reactor-systems-analysis that the staff may need to use to analyze the safety of non-light-water reactor (non-LWR) designs, (2) assess the existing capability of computer codes, analytical tools, and supporting information, (3) identify gaps in both analytical capabilities and supporting information and data, and (4) interact with

both domestic and international organizations working on non-LWR technologies to enhance collaboration and cooperation.

5.4 Rulemaking

The NRC's rulemaking function supports the agency's mission by developing regulations or "rules." The NRC may initiate a new rule or a change to an existing rule when necessary to protect public health and safety. In addition, any member of the public may petition the NRC to develop, change, or rescind a rule. The Commission directs the NRC staff to begin work on a new rulemaking activity through approval of a staff rulemaking plan. The NRC's regulations impose requirements that applicants must meet to acquire an NRC license or certificate. Once a license or certificate is issued, NRC regulations impose requirements to engage in NRC-regulated activities. These regulations govern the possession or use of NRC-regulated materials at nuclear facilities, such as power plants, research and test reactors, uranium mills, fuel facilities, and waste repositories; the use of NRC-regulated materials for medical, industrial, and academic purposes; and the transportation of these materials. Rulemaking activities may include development of a regulatory basis, proposed rule, final rule, direct final rule, and advanced notice of proposed rulemakings. Most NRC rulemaking activities rely on the analysis evidence-building activity, although the function is also supported to a lesser extent by research and statistics. As NRC's initial capacity assessment, this section focuses only on the analysis supporting rulemaking, however in the future it may be expanded to include other types of evidence-building.

5.4.1 Coverage

5.4.1.1 Distribution of Evidence-Building Activities and Program Resources

Trends in resources and work were examined to determine any challenges to the NRC's capacity to perform analysis in support of rulemaking. Figure 16 shows the trend in resources for rulemaking for the operating reactors and new reactors business lines. As with the other functions discussed, the resources apply to the entire rulemaking function, not just the evidence-building analysis that supports rulemaking. As shown in Figure 16, most of the NRC's annual rulemaking budget is associated with the Nuclear Reactor Safety Program.[29] Resources for Nuclear Reactor Safety Program rulemaking activities have increased slightly since FY 2018, from $11 million to $11.7 million in FY 2021. The number of funded rulemaking activities for reactors increased from 18 in FY 2018 to 24 in FY 2021, which represents a 33-percent increase. Various factors (e.g., number and complexity of public comments, schedule adjustments, timing of Commission direction) can influence the number of rulemaking activities conducted by the NRC each fiscal year.

[29] The NRC budgets for the expected rulemaking workload to ensure that appropriate resources are available to complete planned activities. Note that not all rulemakings require the same level of effort. The CBJ and the Annual Rulemaking report provide additional details.

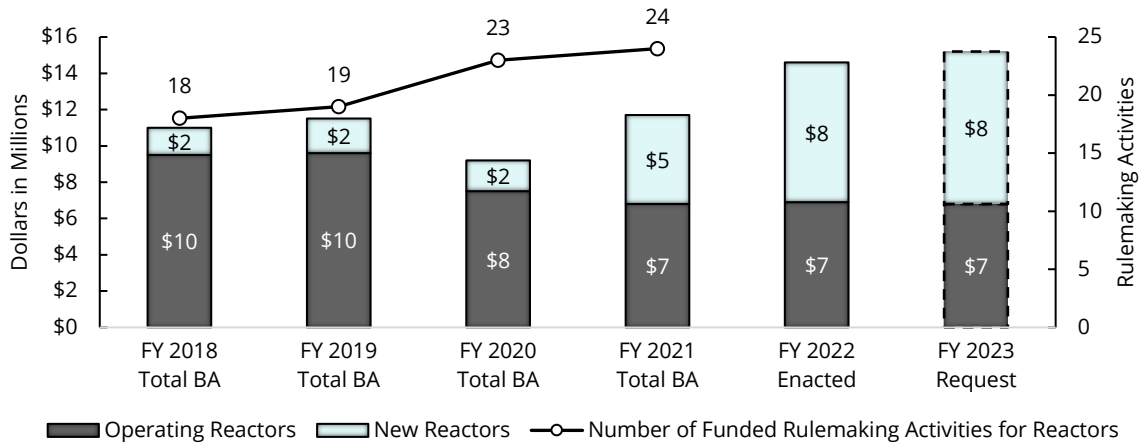


Figure 16 - Nuclear Reactor Safety Program Rulemaking Resources and Actions

Figure 17 shows that rulemaking resources for the Nuclear Materials and Waste Safety Program have declined slightly from $6.3 million in FY 2018 to $5.2 million in FY 2021. The number of funded rulemaking activities for materials increased slightly from 14 in FY 2018 to 15 in FY 2021.

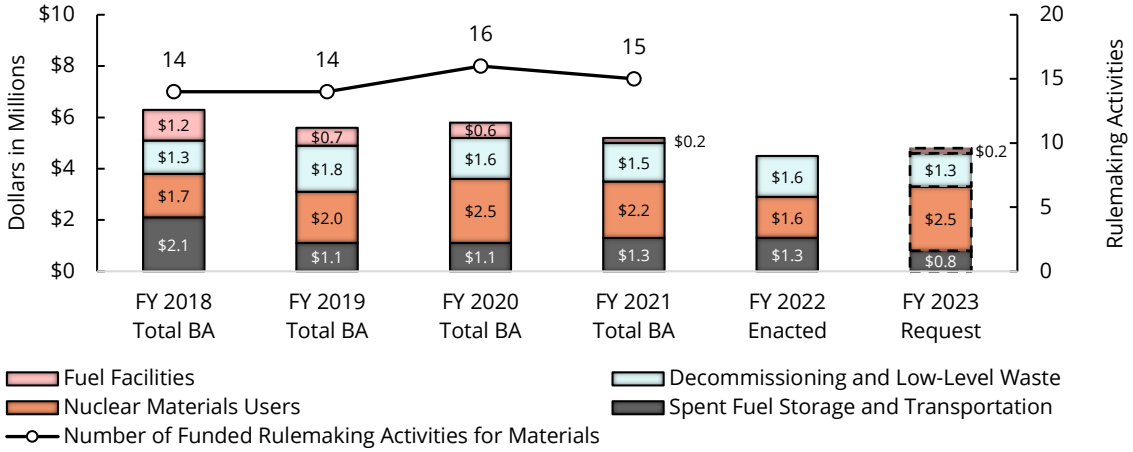


Figure 17 - Nuclear Materials and Waste Safety Program Rulemaking Resources and Actions

Overall, the number of funded rulemaking activities decreased from 40 in FY 2018 to 39 in FY 2019 and then increased to 46 in FY 2021. This represents an 18-percent increase in funded rulemaking activities.[30] As discussed in the FY 2021 CBJ, the NRC staff has been using a Common Prioritization of Rulemaking process to manage rulemaking activities consistently across the agency to use resources more efficiently and effectively. Additionally, the NRC staff is seeking to implement rulemaking process innovations as part

[30] For corporate support, eight rulemaking actions were ongoing in FY 2018; six rulemaking actions were ongoing in FY 2019; and seven rulemaking actions were ongoing in FY 2020 and FY 2021.

of an integrated review of all aspects of the rulemaking process to identify opportunities for improving quality, timeliness, and stakeholder engagement.[31]

5.4.1.2 Workforce Gaps and Surpluses

The NRC has over 30 rulemaking staff members who perform activities in areas such as operating reactors, new reactors, fuel cycle facilities, decommissioning, transportation and storage, and corporate support. The NRC anticipates that a workforce gap of about 13 rulemaking staff members will occur by FY 2026. This gap will need to be filled because of expected attrition (10 staff) from retirements and expected workload increases (3 staff) consistent with the discussion in the environmental scan. Although increases occur because of expected workload in advanced reactors, medical isotopes, and other areas, they appear to be modest in comparison to the number of staff that will be lost due to attrition. Figure 18 shows that key workforce gaps to support the analysis activities for rulemaking include project managers, cost analysts, and regulations specialists.

Figure 18 - Rulemaking Positions with the Largest Projected Gaps between FY 2021–2026

The largest future gap in rulemaking employees is project managers, which shows a gap of seven staff members by FY 2026. This is followed by expected future gaps in cost analysts (-3) and regulations specialists (-3). The NRC staff also examined expected attrition over the next 5 years and found that cost analysts and regulations specialists will have an expected attrition of greater than 40 percent. Filling these positions with experienced employees may be difficult. Specifically, prospective staff with technical and economic experience have turned down offers to work at the NRC for positions elsewhere, there is high demand for experienced staff with rulemaking experience, and there is a very limited pool of people with financial modeling skills and experience. The NRC has prepared strategies to address these future gaps. These strategies include cross-training current staff, placing NRAN graduates, offering job rotation opportunities and internal promotions, and posting vacancy announcements.

[31] Additional information can be found in "Rulemaking Process Innovation at the U.S. Nuclear Regulatory Commission," issued July 2020 (ADAMS Accession No. ML20198M408).

5.4.2 Quality, Methods, Independence, and Effectiveness

5.4.2.1 Focus Groups, Surveys, and Interviews

The NRC held a focus group for rulemaking with 15 people who completed the survey. The participants included three SES managers, three Branch Chiefs, and nine staff members covering the range of rulemaking areas. When aggregating the survey results from licensing staff, Figure 19 shows that most participants provided positive responses ("usually" or "always"), which reflects well on the NRC's capacity for performing analysis in support of the rulemaking function.

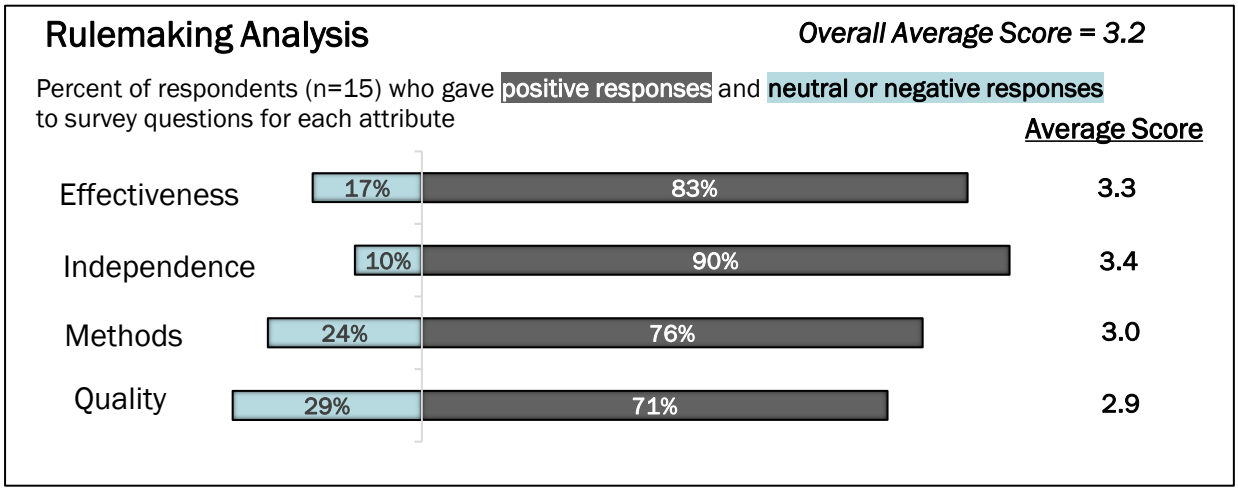


Figure 19 - Rulemaking Analysis Survey Responses

Results from the focus group surveys include the following:

- As shown in Figure 19, out of a Maturity Score of 4, the NRC's rulemaking maturity has an overall score of 3.2. According to the NRC's Capacity Assessment Maturity Model, the NRC rulemaking agency function has an overall "High Capacity" rating for performing analysis activities.
- Review of quantitative survey responses shows that the quality attribute has the most potential for improvement with the lowest average score of 2.9 (rating of Medium Capacity). A review of the responses shows that the questions with the lowest scores concerned the use of the appropriate level of effort for analysis activities and on the availability of data to perform independent analyses. These indicate that rulemaking staff may want to explore ways to obtain and assess objective information related to (1) resource expenditures on rulemaking activities to ensure the appropriate level of effort is used and (2) the availability of data used to support independent analyses.

- Discussions were held with the rulemaking staff to share the survey results, discuss the suggested improvements, and identify any other opportunities for enhancing the NRC's rulemaking evidence-building activities. During this discussion, staff members observed that rulemaking analyses require a different mindset than typical licensing analyses for NRC technical staff (e.g., creating a rulemaking regulatory basis requires a different thought process compared to reviewing a licensee's submittal). NRC technical staff who had recently supported rulemaking activities were interviewed on this topic. Based on these interviews, the following enhancements are recommended to aid in familiarizing NRC staff with the rulemaking process: (1) identify the roles and responsibilities of specific team members, (2) discuss early consideration of data needs, and (3) provide a high-level overview of the rulemaking process with examples of previous rulemaking products. The rulemaking staff has self-identified the need to train new rulemaking working groups and will be considering the incorporation of these recommendations into this training.
- Further, interviews of technical staff members who have recently supported rulemaking analyses revealed that guidance and procedures for performing rulemaking are focused on the rulemaking process and do not look in depth at the technical aspects of rulemaking analyses. Many of the people interviewed have extensive experience in performing technical analyses for rulemaking but noted that informal guidance for technical analyses would have been helpful for the first time they were assigned to support a rulemaking. Business lines should examine whether developing an informal guidance document focusing on best practices for technical staff who support rulemaking analyses would be beneficial. Recognizing that not all business lines have the same volume of rulemaking activities, the costs and benefits should be weighed in considering the need for this informal guidance. Rulemaking staff will support the business lines on the development of this informal guidance, as resources allow.
- Interviews with NRC senior management indicate that the NRC's process for regulatory analysis development should be examined to see if it could be made more effective (e.g., are the estimated benefits and projected costs reasonably accurate). With each rulemaking, the staff develops a regulatory analysis that estimates the impact of a rule change on both the NRC and industry in terms of costs, benefits, and new activities associated with the rulemaking. The regulatory analysis is made available for public comment. An assessment should be conducted to determine if a historical review of previous analyses would provide useful data to improve the development of future regulatory analyses. If this assessment indicates that the benefits of such a historical review would outweigh the resource costs, then an appropriately scoped review should be conducted. Determining the effectiveness of the NRC's regulatory analysis development process would help increase stakeholder confidence in the results.

5.4.3 Findings and Mitigating Strategies

Below are the findings and associated mitigating strategies to improve the NRC's capacity for performing analysis to support rulemaking. Other findings and associated mitigating strategies that impact rulemaking as well as other NRC functions are discussed in Section 5.7 on Crosscutting Items.

Finding: The SWP results indicate that the largest expected staffing gaps are in the following rulemaking positions: project managers, regulations specialists, and cost analysts. This information was verified by confirming that these positions have been identified as future staffing gaps and that strategies have been developed to fill these positions. Discussions with NRC management in the rulemaking area further reinforced this finding.

- **Mitigating Strategy:** Where appropriate, the NRC should collaborate across organizations and develop an agencywide approach to hiring for positions identified to have significant expected attrition. Additionally, given the past difficulties in hiring regulations specialists and cost analysts, the NRAN, summer hire, and other hiring programs should be considered to bring necessary people into the NRC earlier so that they can be trained before the expected retirements.

Finding: Survey results indicate that the quality attribute has the most potential for improvement. The lowest scores within the quality attribute were on the use of the appropriate level of effort for analysis activities and on the availability of data to perform independent analyses.

- **Mitigating Strategy:** The NRC should obtain and assess information related to (1) resource expenditures on rulemaking activities to ensure that the appropriate level of effort is used and (2) the availability of data used to support independent analyses.

Finding: The NRC's technical staff can be challenged when applying their technical knowledge to the rulemaking process. The NRC technical staff who routinely perform analyses to support agency functions such as licensing and oversight are infrequently needed to support analysis activities for rulemakings. While procedures for performing regulatory analyses are well established, staff who infrequently conduct analyses to support rulemakings could benefit from training before participating in the rulemaking process. In addition, some technical analyses (e.g., radiation safety, geologic) used to support rulemakings are unique to the specific regulations being developed or amended. These analyses require staff to make decisions such as which analytical techniques are appropriate, what level of rigor should be applied, and the amount of data required to support a statistically significant result.

- **Mitigating Strategy:** The following should be incorporated into the process when establishing working groups for new rulemakings: (1) identify key points of contact and clearly define their roles and responsibilities, (2) establish data needs and

appropriate analytical techniques early in the process, and (3) provide a high-level overview of the rulemaking process and expectations.

Finding: The NRC needs to determine if the process for regulatory analysis development can be enhanced with a retrospective review of past rulemakings. Interviews with NRC management indicate that it is unclear if the agency's process for regulatory analysis development can be enhanced to be made more effective (e.g., accuracy of the estimates). Determining the effectiveness of the NRC's regulatory analysis development process would increase stakeholder confidence in the agency's rulemaking process.

- **Mitigating Strategy:** The NRC should conduct an assessment to determine if a retrospective review of past rulemakings would provide useful data to improve future regulatory analyses. If this assessment indicates that the benefits of such a retrospective review would outweigh the resource costs, then an appropriately scoped review should be conducted. Such a historical review would focus on whether the regulatory analyses development process appropriately estimates the activities of the NRC and affected entities to support agency decisionmaking.

5.5 Financial Management

The Chief Financial Officer (CFO) is responsible for the NRC's financial management activities, as well as agencywide internal controls. The CFO establishes budgeting and financial management policy for the agency and advises the Chairman and the Commission on these matters. The CFO develops and maintains an integrated agency accounting and financial management system; establishes policy and directs oversight of agency financial management personnel, activities, and operations; and prepares and transmits an annual report that includes the agency's audited financial statement to the Chairman and to the Director of OMB. Other responsibilities include monitoring the financial execution of the NRC's budget in relation to actual expenditures; controlling the use of agency funds to ensure that they are expended in accordance with applicable laws and standards; preparing and submitting timely cost and performance reports to the Chairman; reviewing, on a periodic basis, fees and other charges imposed by the NRC for services provided; and recommending revisions of those charges as appropriate.

The CFO provides an agencywide management control program for financial and program managers to comply with the Federal Managers' Financial Integrity Act and is responsible for implementing the Chief Financial Officers Act at the NRC. The CFO also oversees the management of the agency's Programmatic Internal Control Program.

5.5.1 Coverage

5.5.1.1 Distribution of Evidence-Building Activities and Program Resources

The NRC analyzes financial management data and creates reports from data that reside in multiple systems. The agency is becoming more efficient with the recent transition to

shared service providers and ongoing improvements to data management information technology systems. The increase in shared services and automation of manual processes and reporting is shifting employee skills from developing manual custom reports to an increased need for financial related analytical skills.

As shown in Figure 20, the budget amounts for financial management resources have remained relatively flat. Demand has increased for the analysis of budget execution data to support budget formulation decisions; however, this will be offset by efficiencies resulting from improvements in the Budget Formulation System and other tools to support data analysis. In accordance with NEIMA, for FY 2021 and FY 2022, NRC corporate support functions (of which financial management is a part) are limited to 30 percent of the NRC's total budget justification. This percentage decreases in future years to the maximum extent practicable.

Figure 20 - Financial Management Resources

5.5.1.2 Workforce Gaps and Surpluses

In the financial management function, the two positions with the highest projected workforce gaps are accountant and budget analyst (Figure 21).

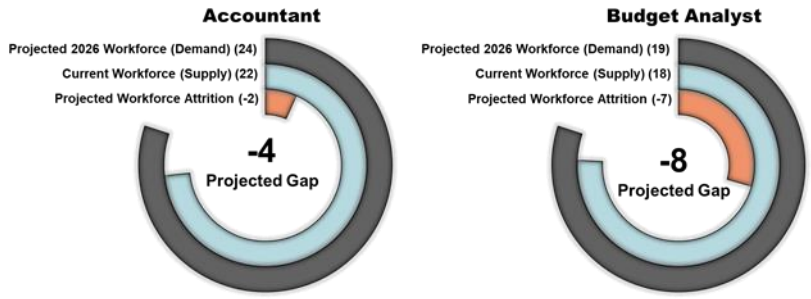


Figure 21 - Financial Management Positions with Projected Gaps between FY 2021–2026

The NRC anticipates a workforce gap of -12 staff that will need to be filled across these positions. The gap will occur because of expected attrition (-9 staff) and workload increases (3 staff).

Workload increases, which account for the need to add two accountants and one budget analyst, are due to additional reporting requirements and increased external interest in budget formulation and budget execution. The largest projected gaps in financial management staff are for budget analysts (-8 staff) and accountants (-4 staff). While slight increases are needed in the workforce to address expected workload needs, the larger challenge is the number of staff who will be lost to attrition. For example, the NRC has experienced attrition due to staff nearing retirement age, challenges hiring during the COVID-19 pandemic, and a consistent high turnover rate because of staff transfers to other roles within the agency or to other agencies.

The expected attrition for budget analysts over the next 5 years is estimated to be 39 percent. The budget analyst position has immediate hiring needs for midlevel staff. Although the projected attrition for the accountant position is lower, the accountant workload is projected to increase.

The SWP results indicated that if hiring is delayed, the impact of the vacancies and the loss of budget analyst competencies will make it difficult to meet critical deadlines associated with budget formulation, funds controls, and other analytical deliverables. The SWP forecast information indicates that the transition to new or upgraded systems requires the staff to build strong analytical skills to (1) bridge the gap between current manual processes, future automation, and standardized reporting and (2) analyze the data from these systems to support management decisionmaking. As discussed in Section 5.7.5, implementation of the Enterprise Data Strategy goals will assist by addressing the needs identified in SWP by establishing roles and responsibilities and providing role-based training.

The NRC has prepared strategies to address these future staffing gaps. These strategies include hiring co-op students, offering student internships, hiring entry-level and midlevel staff, and offering internal job rotation opportunities.

5.5.2 Quality, Methods, Independence, and Effectiveness

5.5.2.1 Focus Groups, Surveys, and Interviews

The staff held two focus groups for financial management with 25 people who completed the survey. The participants included 2 SES managers, 4 Branch Chiefs, and 19 staff members. When aggregating the survey results from financial management staff, Figure 22 shows that most participants provided positive responses (“usually” or “always”), which reflects well on the NRC’s capacity for performing analysis in support of financial management.

A review was done of the qualitative survey responses and followed up with discussions and interviews with management and staff who manage or perform financial management analyses. The discussions supported the findings in Section 5.5.1.2, related to the increased need for data analytics skills and analysis.

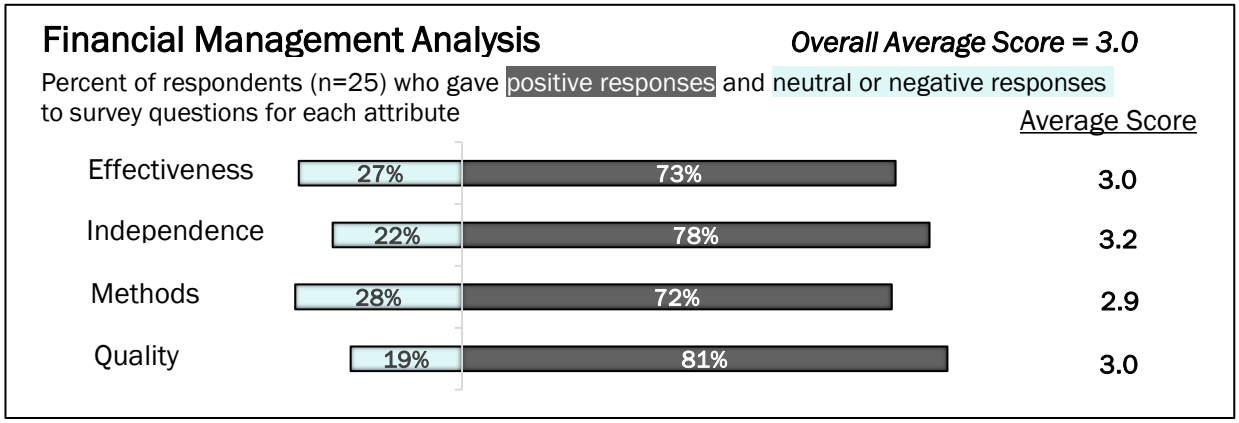


Figure 22 - Financial Management Analysis Survey Responses

5.5.3 Findings and Mitigating Strategies

Below are the findings and strategies to address gaps and development needs and to improve the NRC's capacity for performing financial management evidence-building activities. Other findings and associated mitigating strategies that impact financial management as well as other NRC functions are discussed in Section 5.7 on Crosscutting Items.

Finding: The SWP results indicated that the budget analyst position experiences attrition because of staff who are nearing retirement age or who opted to retire during the COVID-19 pandemic. The position has a consistently high turnover rate due to staff transfers to other roles within the agency or to other agencies.

- **Mitigating Strategy:** The NRC should include the budget analyst in an NRAN-type program or conduct a study to develop a strategic approach to ensure positions are filled at a faster rate.

Finding: The information collected indicated a need for more resources and development of skills in data analytics and analysis based on the continuing transition to new technology and systems.

- **Mitigating Strategy:** The NRC should use the Enterprise Data Strategy implementation to identify the specific data analytics roles and responsibilities needed, provide role-based training, and develop the analysis skills of the financial management staff.

5.6 Evaluation

The Evidence Act elevates evaluation to a key agency function. Evaluations are necessary to accomplish the NRC's mission. Evaluations of significance to the NRC are documented in the annual evaluation plan, which can include evaluations associated with priority questions in the NRC's Evidence-Building Plan or evaluations required by statute, or those of high value to the agency. Evaluations are intended to improve the effectiveness and efficiency of a program, policy, regulation, or organization. In addition, evaluation can identify process improvements to enhance programs and can identify cause and effect to aid in the development of performance measures. Performing evaluations requires specialized skills and expertise to apply the standards outlined in OMB Memorandum M-20-12.

5.6.1 Coverage

5.6.1.1 Distribution of Evidence-Building Activities

The following lists the evaluations identified in the NRC's FY 2022 and FY 2023 Evaluation Plans and the staff supporting these evaluation efforts:[32]

- Risk-Informed, Technology Inclusive Regulatory Framework for Advanced Reactors—Licensing staff will lead this evaluation.
- Annual Self-Assessment of the ROP—Reactor oversight staff will lead this evaluation.
- Radiation Protection Program—Research staff will lead this evaluation.
- Process Improvement—Staff from every area will support this evaluation.
- SWP Process—Staff from every area will support this evaluation.
- Licensing Reviews—Licensing staff will lead this evaluation.

5.6.1.2 Workforce Gaps, Skill Gaps, and Surpluses

The NRC does not have evaluators with training or experience in regularly performing evaluations subject to the standards set by the OMB. These standards require advanced education and evaluation experience (e.g., quantitative, qualitative, and mixed-method evaluation specializations) to properly plan, implement, manage, and oversee evaluations. The NRC will need to build its evaluators' knowledge, skills, and abilities that are required to address this gap. The NRC will need to build a competency model and use it to assess existing staff, identify skill gaps, and track progress toward closing identified skill gaps.

[32] The FY 2022 Annual Evaluation Plan is available in ADAMS at Accession No. ML21053A191, and the FY 2023 Annual Evaluation Plan is available in ADAMS at Accession No. ML21173A247.

5.6.2 Quality, Methods, Independence, and Effectiveness

The NRC will implement its evaluations consistent with the FY 2022 and FY 2023 Annual Evaluation Plans and will strive to ensure that these activities meet the attributes of evidence-building: (1) the evaluations are of high quality, (2) the evaluations use appropriate methods, (3) the evaluations are independent, and (4) the evaluations are effective.

The following gaps should be considered:

- An independent organization is not formally established within the NRC to support the performance of evaluation activities to help ensure that any potential bias and influence on the approach, process, and results are minimized and that these evaluation activities are being performed consistently across the NRC.
- Procedures (e.g., methods) currently being developed should be completed and managed to ensure that evaluation activities are performed consistently across organizational boundaries at the NRC.

5.6.3 Findings and Mitigating Strategies

Below are the findings and associated mitigating strategies to improve the NRC's capacity for performing evaluations.

Finding: The NRC would benefit from institutionalizing program evaluation into agency activities similar to the implementation of enterprise risk management and performance management. Evaluation is a scientific discipline and, as such, "[c]redible evaluations must be managed by qualified evaluators with relevant education, skills, and experience for the methods undertaken."[33] An individual or external firm qualified in designing and performing program evaluations should be hired to enhance the effectiveness and efficiency of the NRC's programs, policies, operations, and organizations. The program evaluator would serve as an agencywide resource for designing evaluations consistent with the standards in the NRC's "Evidence-Building and Evaluation Policy Statement" and applicable guidance from the OMB.

- **Mitigating Strategy:** The NRC should hire an individual or external firm qualified in designing and performing program evaluations to lead and support agencywide evaluation efforts, consistent with the evaluation standards in the NRC's Evidence-Building and Evaluation Policy Statement.

Finding: The NRC staff needs to ensure that its future evaluations use appropriate methods and are high quality.

[33] OMB Memorandum M-20-12, "Phase 4 Implementation of the Foundations for Evidence-Based Policymaking Act of 2018: Program Evaluation Standards and Practices," dated March 10, 2020, page 4.

- **Mitigating Strategy:** The NRC should develop procedures (e.g., methods) to ensure that evaluation activities are performed consistently across the agency. The NRC staff is currently developing a management directive to establish these procedures.

Finding: The NRC does not have evaluators with training or experience in regularly performing evaluations subject to OMB standards. The NRC will need to build its evaluators' knowledge, skills, and abilities that are required to address this gap.

- **Mitigating Strategy:** The NRC should develop a competency model for the "evaluator" role to ensure that the agency has the capability to assess the staff's proficiency and capacity to perform evaluation activities. The NRC should define the knowledge, skills, and abilities for the evaluator role to address the workforce gap by training the staff or hiring qualified personnel.

5.7 Crosscutting Items

The capacity assessment identified findings that crossed into multiple key agency functions. These crosscutting items include staffing gaps, knowledge management, competency modeling, statistical activities, data, AI, environmental justice, recent operational experience, workforce planning process, reduction in support staff, and corporate support resource limits.

5.7.1 Staffing Gaps

The NRC's workforce is critical to performing evidence-building activities necessary to carry out its mission. The NRC's SWP process is used to identify projected workforce gaps over a duration of 5 years. The gaps identified by the SWP process were analyzed for each functional area to provide a more holistic understanding of agency workforce gaps and challenges relative to an office-by-office analysis.

5.7.1.1 Findings and Mitigating Strategies

Finding: The SWP results indicate that there are key evidence-building positions with large, expected staffing gaps across each agency function analyzed in this capacity assessment including licensing, oversight, research, rulemaking, and financial management. In addition, there are key evidence-building positions that are potentially susceptible to high attrition. The specific positions within each functional area are discussed further in Sections 5.1–5.5.

- **Mitigating Strategy:** Where appropriate, the NRC should collaborate across organizations and develop an agencywide strategy to hire for positions with large staffing gaps and those susceptible to high attrition. The NRC should proactively use various recruiting, retention, and knowledge management resources to identify ways to ensure that qualified staff can perform NRC functions.

5.7.2 Knowledge Management

Survey responses showed that half of surveyed staff (n=218) usually use knowledge management tools and processes to capture best practices, but followup discussions indicate that these tools could be better utilized. Knowledge management is important for all staff at varying levels of NRC experience, however it takes on greater urgency given that approximately 26 percent of the NRC's workforce is currently eligible to retire and approximately 44 percent will be eligible to retire within the next 5 years. Discussions were held with survey participants on the results, and participants commented that knowledge management is generally considered lower priority than other work.

In addition, a focus group discussion and survey were conducted to gain further insights on knowledge management with 14 employees recently hired (within approximately 1 year) using the same survey methodology discussed in Section 3.2. Many of the recently hired employees use internet search engines and the NRC's public website instead of existing knowledge management resources as their first source for finding information. The recently hired employees indicated that some information is incomplete or does not exist within the NRC knowledge management wiki (Nuclepedia), and they found it difficult to search across all platforms. In addition, when they did find information on internal knowledge management resources, it consisted of background information on the subject and additional discussions with senior staff were required to gain key insights and best practices. This would leave a gap in critical knowledge once the senior staff retire. Knowledge management remains an integral part of the NRC's internal strategic processes for capturing and preserving knowledge to assist with employee development and performance, both for current and future staff.

5.7.2.1 Findings and Mitigating Strategies

Finding: Knowledge management tools are not utilized to their fullest extent to ensure successful capture and transfer of knowledge to staff. Survey results for each of the key agency functions show that approximately half of surveyed staff and management usually use knowledge management resources and processes (internal wiki site, videos, publications, etc.) to capture best practices. Knowledge management will influence agency performance over the next 5 years, given that approximately 26 percent of the NRC's workforce is currently eligible to retire and approximately 44 percent will be eligible to retire within the next 5 years. High attrition over the next 5 years could negatively impact some positions identified in this assessment and will leave a critical knowledge gap.

- **Mitigating Strategy:** The NRC should evaluate the NRC's knowledge management program to better align the efforts with expected outcomes. The evaluation should explore ways to elevate the priority and urgency of capturing critical knowledge and best practices. Attention should be focused on the positions with highest projected attrition as identified through the SWP. The evaluation should consider methods to increase knowledge management engagement with the NRC's senior-level staff. The

evaluation should include a cost-effectiveness analysis to better understand the cost compared to the expected outcomes. To measure effectiveness, performance indicators should be established as a result of the evaluation. In addition, usage data for Nuclepedia should be thoroughly tracked and analyzed to find how to maximize the usefulness of this resource for the NRC.

5.7.3 Competency Modeling

The NRC uses competency models to identify skill gaps across the workforce. Competency models and assessments improve workforce agility by (1) providing a means of comparing an employee's current skillset to the skills needed now and, in the future, and (2) helping to ensure a workforce with the necessary skills to be successful in a dynamic environment with the identification of training, mentoring, and rotations to address skill gaps.

In FY 2020, the agency started competency model assessments on a voluntary basis with approximately 44 percent of the staff taking competency model assessments. Far fewer used them in FY 2021, with at least a partial completion rate of about 25 percent as of August 2021.[34] In addition, manager participation was low in FY 2020 and FY 2021, at about 20 percent and 2 percent, respectively, having used competency modeling to assess their staff by August 2021. This low participation rate by staff and managers has made it difficult to identify specific skill gaps.

Figure 23 illustrates that only 18 of the 91 competency models had sufficient data for this process, corresponding to models with at least 10 staff using them and at least a 70-percent participation rate for all staff assigned to a given model. For the competency models with sufficient data, a set of criteria were applied to identify the individual competencies with potential skill gaps. Among the competency models with sufficient data, 46 individual competencies were identified with potential skill gaps warranting further analysis. However, the subsequent analysis and discussions showed that none of the 46 passed the validation process. In many cases, the potential skill gaps were found to apply only to a small subset of positions that used the model. In other cases, the apparent skill gaps were found to relate to a rarely needed skill or task, such as "prepare Commission correspondence." Staff commented that they did not see value in completing a competency model assessment if their supervisor did not complete their portion of the assessment. Although this capacity assessment does not identify skill gaps, it was useful to more fully understand how the competency modeling process needs to be improved to achieve its full potential.

[34] The due date for completing FY 2021 competency modeling assessments changed from August 2021 to December 2021.

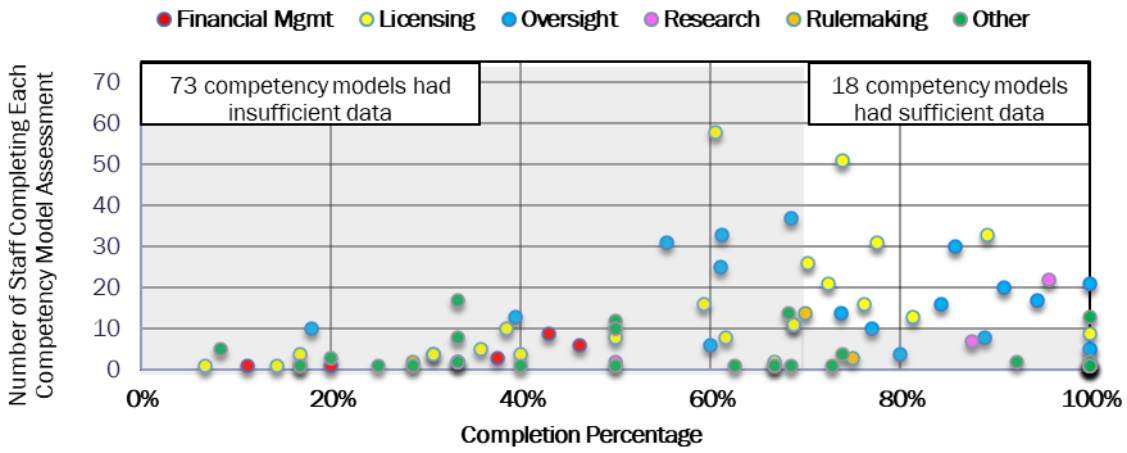


Figure 23 - Identification of Competency Models with Sufficient Data

5.7.3.1 Findings and Mitigating Strategies

Finding: The NRC competency modeling program requires refinement in order to provide insights into agencywide skill gaps. The NRC's competency modeling program has the potential to be a powerful tool for identifying agencywide skill gaps that, if addressed, would strengthen agency evidence-building capacity. However, the competency model assessment data from FY 2020 and FY 2021 were not sufficient to identify critical skill gaps. Analysis of FY 2020 and FY 2021 competency model assessment results has enabled a better understanding of the ways to improve this tool so that skill gaps may be identified in future capacity assessments. Potential improvements to this tool include (1) increasing participation rates for both staff and managers, (2) establishing a core set of skills for competency models with the same position across offices (e.g., project managers, engineers), (3) adding competency models for staff without a model currently assigned, (4) refining the existing models to verify that staff are assessed only for competencies that apply to them, (5) ensuring a more consistent approach for establishing target ratings, and (6) addressing limitations to the current tool to improve reports and the ability to produce individual development plans directly from the system.

- **Mitigating Strategy:** The NRC should develop an updated plan to implement competency modeling. The plan should clearly document the program's overall objectives and quantitative goals that need to be reached to support meeting the overall objectives. An assessment should be performed to fully determine what improvements should be made to ensure the longevity and success of the program. The quantitative goals should include both staff and manager participation rates, as well as consider feedback on the quality and relevance of the competencies assigned to each staff.

5.7.4 Statistics

Statistical activities are defined as the collection, compilation, processing, or analysis of data for the purpose of describing or making estimates concerning the whole, or relevant groups, or components within the economy, society, or the natural environment.[35] The NRC has many staff who perform statistical activities as an element of their broader analysis activities. For example, statistics is used to plan and analyze surveys, experiments, calculations of nuclear power plant accident frequencies and consequences, and many other aspects. However, very few staff members perform statistical work as a primary part of their job. The NRC is not considered a statistical agency; therefore, this capacity assessment does not include a specific assessment of this type of evidence-building activity, and any findings that would result from the key agency functions that perform analysis (i.e., statistical analysis). If future focus groups, interviews, and discussions reveal opportunities to improve the NRC's capacity for statistical activities, a future version of this report may identify these changes. In addition, the NRC uses external firms, such as national laboratories, when additional statistical capacity is needed.

5.7.5 Data

The NRC continues to upgrade systems, consolidate data into a data warehouse, and improve desktop technology. These changes have prompted a need to produce higher quality reporting of data and an increased need for data analytics skills. One area recognized for enhancement is the capability to perform content searches across NRC systems and platforms. The recently developed Information Technology Roadmap has identified this as an NRC priority. As a result, the agency has been exploring ways to enhance search and discovery and has identified a set of actionable initiatives and associated resource needs to address this issue.

In addition, the NRC has developed an Enterprise Data Strategy with a goal of promoting the continual data management maturity of agency staff and processes. This goal aims to (1) establish roles and responsibilities, (2) provide role-based training, (3) improve data management resources, and (4) integrate data into application lifecycle management. The implementation of this data strategy will enable the NRC's training and development staff to prepare training plans and curricula to support the agency's strategic goals. A data management resource pool would ensure that key data roles are staffed in the areas of information and records management, data architecture, data science, and data analytics. The NRC Enterprise Data Strategy, as drafted, provides key steps in determining the data management workforce needs of the agency by establishing roles and responsibilities associated with the management of data throughout its life cycle and role-based training.

[35] 44 U.S.C. § 3561(10)

Investing in information technology modernization is key to ensuring that staff have the tools and knowledge to perform evidence-building activities effectively. As a result of budget constraints, the NRC has invested a smaller percentage of its information technology budget toward development, modernization, and enhancement (DME) compared to the Federal Government as a whole (Figure 24). This limited DME investment has resulted in slower introduction and more limited use of new data technologies than desired to support the NRC's data strategy goals. For example, increasing the use of data analytics has occurred at a rate slower than needed as a result of underfunding supporting technology projects such as the development and expansion of the NRC Enterprise Data Warehouse; and purchasing of additional licenses to support increased use of data analytics tools. To fully realize the benefits of increased data use at the NRC, the information technology DME budget should be more aligned with the Federal Government DME percentage.

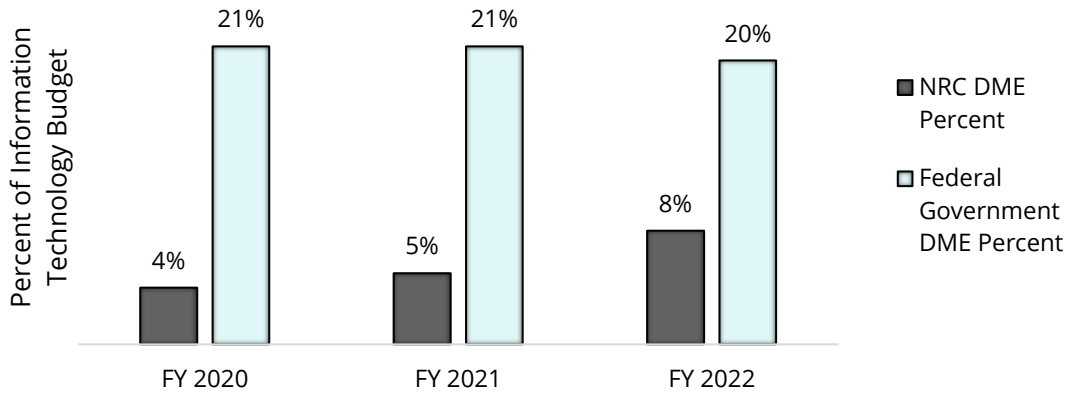


Figure 24 - Information Technology Budget Spent on DME NRC and the Federal Government

5.7.5.1 Findings and Mitigating Strategies

Finding: A recent agency data literacy survey showed that 75 percent of participants scored a 3 or higher on a 5-point scale on the skills related to analyzing data for decisionmaking, selecting relevant data sources, and formulating meaningful questions.[36] Participants scored lower on skills related to accessing data, organizing data collections, and maintaining data resources to ensure sufficient data quality. Additionally, the NRC has recognized the need to make data more accessible to agency staff. The NRC's DME percentage of the overall information technology budget is much smaller compared to the Federal Government DME percentage, and this may continue to hamper the introduction of new technologies to NRC staff. For example, increasing the use of data analytics has occurred at a rate slower than needed as a result of underfunding supporting technology

[36] The agency survey referred to a score of 3 as "Applied." Staff at this level can complete data-related tasks consistently, accurately, and independently. Help from an expert may be required from time to time.

projects such as the development and expansion of the NRC Enterprise Data Warehouse; and purchasing of additional licenses to support increased use of data analytics tools. Additionally, the inability to fund technology modernization activities has delayed efforts to improve search capability of NRC's Enterprise Content Management System.

- **Mitigating Strategy:** The NRC should develop an implementation plan to ensure that goals and actions within the Enterprise Data Strategy and the Information Technology Roadmap are achieved. Future enhancements to NRC content search capability across agency systems and platforms will help the NRC staff identify and collate data more effectively and efficiently. The NRC should continue to strive to increase the DME percentage of the information technology budget so that investments can be made in new technologies.

5.7.6 Artificial Intelligence

AI tools can be a powerful and beneficial asset to the NRC. AI can be used to improve operations, processes, and procedures; meet strategic goals; reduce costs; increase efficiency and mission effectiveness; improve quality of services; improve safety; train the workforce; and support decisionmaking. However, AI tools are highly dependent on the quantity and quality of the data that support them. To maximize the usefulness of AI tools, the NRC needs to identify and develop high-quality datasets spanning the range of technical and corporate support fields within the agency. The NRC plans to conduct an evaluation to address a priority question from the NRC's Evidence-Building Plan: "What data received and maintained would be most beneficial for use in advanced analytical tools (e.g., artificial intelligence) to support NRC decisionmaking?"

In addition, the nuclear power industry is expected to adopt AI tools more widely. The NRC is studying how the use of AI technologies in NRC-regulated activities may be applied to ensure public health and safety. In spring 2021, the NRC staff conducted an exploratory scan to ascertain the scope of existing projects that may fall within the technical area of data science and AI. The scan identified projects ranging from using machine learning and natural language processing to develop license application resource predictions to conducting workshops on the regulatory viability of digital twins. Depending on the application, the use of AI technology may be subject to an NRC safety or security determination or regulatory oversight.

The NRC staff currently has limited technical capacity to review and regulate technologies relying on AI. The staff needs to be familiar with a range of potential technologies, have adequate training support in place, and have a knowledge base available in data science and AI. In addition, the transformative and rapidly advancing nature of AI requires that the NRC adapt its culture, skills, and approaches. To succeed, the NRC will need an iterative, risk-informed approach to AI implementation.

The NRC will need to cultivate the talent of its existing workforce by investing in and providing comprehensive AI training, while simultaneously recruiting AI talent. The agency currently has four data scientists and is actively developing training and qualification plans to increase the skills of existing NRC staff. In addition, three staff members recently completed the Federal Data Science Training Program.

5.7.6.1 Findings and Mitigating Strategies

Finding: The NRC needs a sufficient knowledge base to effectively regulate nuclear facilities which use AI and leverage software that has integrated AI technologies within NRC's processes. AI tools can be a powerful and beneficial asset to the NRC. To maximize the usefulness of AI tools, the NRC needs to have (1) sufficient staff knowledge and familiarity with them, (2) access to the latest programs, software, and libraries, and (3) high-quality datasets. The NRC is exploring the potential ways that applicants and licensees can use AI and digital twins. However, the NRC staff currently has limited technical capacity to review and regulate technologies relying on AI. Technical knowledge and skills should be enhanced to improve readiness in the future. The staff needs to be familiar with a range of potential technologies, have adequate training support in place, and have a data science and AI knowledge base available. The NRC needs to develop a way to track its progress toward achieving technical and regulatory readiness to review such applications to ensure sufficient licensing and oversight capacity.

- **Mitigating Strategy:** The NRC should develop an implementation plan to ensure that goals and actions within the Data Science and AI Strategic Plan are achieved. The NRC needs to complete the development of its AI strategic plan and track its progress toward meeting the goals in the plan including (1) building staff AI expertise through training and qualification programs, (2) acquiring and deploying the necessary software tools to test, evaluate, and develop AI applications, and (3) establishing a data science and AI governance structure to coordinate research and development activities across the agency. Finalizing these strategies and executing their goals will provide a foundation to enhance evidence-building capacity.

5.7.7 Environmental Justice

Environmental justice involves identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of an agency's programs, policies, and activities on minority and low-income populations. The NRC issued its "Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions" in 2004.[37] This policy statement presents a comprehensive

[37] This is available at the Federal Register at 69 FR 52040.

statement of the Commission's policy on the treatment of environmental justice matters in NRC regulatory and licensing actions.

The NRC is currently systematically reviewing how the agency's programs, policies, and activities address environmental justice. The NRC is benchmarking practices of other Federal, State, and Tribal agencies and evaluating whether it should incorporate environmental justice beyond implementation through the National Environmental Policy Act. The agency is reviewing the adequacy of the 2004 Policy Statement. The NRC is also considering whether establishing formal mechanisms to gather external stakeholder input would benefit future environmental justice efforts. The NRC is soliciting viewpoints from internal and external stakeholders representing a broad range of perspectives.

5.7.7.1 Findings and Mitigating Strategies

Finding: Prior to 2021, the NRC had not systematically and holistically reviewed the effectiveness with which its programs, policies, and activities address environmental justice.

- **Mitigating Strategy:** The NRC should complete its ongoing systematic review of how the agency's programs, policies, and activities address environmental justice. This has already been identified as a priority question within the NRC's Evidence-Building Plan: "To what extent are the NRC's programs, policies, and activities addressing environmental justice?" The NRC should take into consideration recent Executive Orders like Executive Order 14008, "Tackling the Climate Crisis at Home and Abroad," issued on January 27, 2021, in its analysis.

5.7.8 Recent Operational Experience

In response to the challenges of the COVID-19 pandemic, the NRC quickly identified temporary alternative and risk-informed methods for conducting licensing and oversight analyses while continuing to provide reasonable assurance of adequate protection of public health and safety. In alignment with the methods attribute for evidence-building, the NRC would benefit by identifying lessons learned and documenting temporary changes made to the NRC licensing and oversight processes in response to the COVID-19 pandemic. To enhance the methods used by the NRC staff, these lessons learned should be further analyzed to determine potential benefits and improvements to the agency's licensing and oversight processes.

5.7.8.1 Findings and Mitigating Strategies

Finding: The NRC's licensing and oversight analyses may be enhanced by lessons learned from the COVID-19 pandemic and other recent operating experience.

- **Mitigating Strategy:** In the NRC's Evidence-Building Plan, Priority Question 1 asks, "How can the NRC improve licensing and oversight, based on recent operational

experience (including lessons learned from the COVID-19 pandemic)?" Responses to the priority question will identify lessons learned and collectively document temporary changes made to NRC licensing and oversight processes in response to the COVID-19 pandemic. The NRC will further analyze these, and other lessons learned to determine potential benefits and improvements to the agency's licensing and oversight processes.

5.7.9 Workforce Planning Process

From 2017 to 2020, the NRC performed a phased rollout of the SWP process on an annual basis to analyze the critical or core positions that perform evidence-building activities. A gap analysis, part of the process to compare the current workforce against projected future workforce needs in 5 years, identifies positions with the highest attrition (e.g., retirements), which may cause a critical loss of knowledge, skills, and abilities. Short- and long-term strategies and action plans are developed to enable the NRC to recruit, retain, and develop a skilled and diverse workforce with the competencies and agility to address emerging needs and workload fluctuations. Action plans to address critical skill gaps and projected future vacancies include recruiting, hiring, potentially cross-training, or enhancing the skills of the current staff. The NRC also has a program to develop college graduates through targeted hiring by using the NRAN program and other hiring programs.

This capacity assessment took a holistic approach to analyzing the results of the SWP process by key agency function versus by office or region. This perspective challenges some of the existing SWP strategies to address the gaps for positions that exist across the agency. For each key agency function, the staff identified gaps in positions that represent an attrition rate of approximately 40 percent or higher over the next 5 years, conducted interviews, and discussed the findings with staff and management. Mitigating strategies were developed for each key agency function of the capacity assessment to address the newly identified gaps.

5.7.9.1 Findings and Mitigating Strategies

Finding: At the end of each phase or year, the process is reviewed and improved based on lessons learned from participants. Now that the entire agency has participated, it is an appropriate time to conduct a comprehensive evaluation of the effectiveness and efficiency of the processes, procedures, and technology used to support the process.

- **Mitigating Strategy:** The NRC's FY 2023 Annual Evaluation Plan includes a priority question from the NRC's Evidence-Building Plan that is designed to evaluate whether the agency's approach to workforce planning is effective in meeting its intended goals and whether it is being implemented efficiently. The results of this evaluation should improve the process and give the NRC the ability to effectively and efficiently build and maintain a workforce of appropriate size and makeup, with the flexibility necessary to adjust for various factors as needed.

5.7.10 Reduction in Support Staff

The NRC has conducted several agencywide efforts to gain effectiveness and efficiency for mission and corporate support functions over the past several years. A main goal of these efforts has been to centralize mission and corporate support functions to reduce potential duplication of effort. The centralization of these functions resulted in an overall reduction in mission and corporate support staff (e.g., licensing assistants, budget analysts). However, while the number of mission and corporate support staff were reduced, many of their responsibilities were shifted to other mission and corporate support staff in addition to the centralized staff (e.g., budget analyst activities shifted to technical assistants and licensing assistant activities shifted to project managers). In addition, corporate support reductions have continued to achieve compliance with the requirements in NEIMA, which is discussed in Section 5.7.10. As shown in Figure 25, in 2021, the number of mission and corporate support staff have decreased by 39 percent relative to 2016 staffing.[38] This decrease outpaces the reduction in technical staff and managers that perform licensing analyses during the same period, which saw a 28-percent decrease.

Figure 25 provides a snapshot that indicates that NRC is working to ensure that its' mission and corporate support functions represent a smaller portion of the budget. What remains to be examined is the impact these reductions have produced and whether the intended outcomes were achieved.

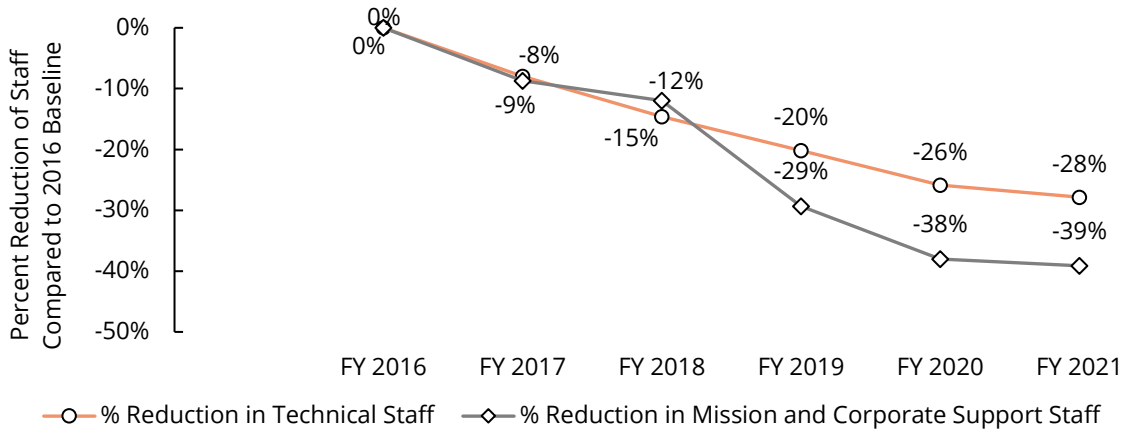


Figure 25 - Technical and Support Staff Reductions

5.7.10.1 Findings and Mitigating Strategies

Finding: The NRC should assess the extent to which past reductions in mission and corporate support staff (including NEIMA reductions) have led to efficiency gains in program functions. An assessment should be performed to determine if the reduction in

[38] Figure 25 compares the number of licensing assistants and mission and corporate support staff (e.g., Division of Resource Management and Administration staff, and Division of Program Management, Policy Development, and Analysis staff) for the lead offices of the Reactor Safety and Nuclear Materials and Waste Programs to the number of technical staff and managers in those lead offices.

support staff has led to NRC technical staff performing more non-technical business support work. This crosscutting issue may affect the capacity of NRC staff to perform licensing, oversight, research, and rulemaking analyses.

- **Mitigating Strategy:** In the FY 2023 Evaluation Plan, the NRC has a priority question planned to evaluate whether the NRC's approach to workforce planning, including associated processes and procedures, is effective in meeting its intended goals and whether it is being implemented in an efficient manner. The results of this evaluation should include an examination as to whether additional work has shifted to NRC technical staff due to reductions in support staff.

5.7.11 Corporate Support Resource Limit

Section 102(a) of NEIMA places a cap on the NRC's corporate support costs with respect to its annual budget justification, to the maximum extent practicable, beginning at 30 percent of the annual budget justification in FY 2021 and FY 2022 and stepping down to 28 percent in FY 2025 and beyond. On October 4, 2021, the NRC submitted a report to Congress, as required by Section 102(e) of NEIMA, which discussed the reductions to comply with NEIMA as well as the impacts of the corporate support resource limit. The report noted that "the continuation of a reduction to the corporate support cap is expected to negatively impact the agency's ability to directly support its safety and security mission."[39]

5.7.11.1 Findings and Mitigating Strategies

Finding: Attempts to meet the NEIMA cap on corporate support costs have caused the NRC to reduce or postpone critical investments and services. Continued postponements of critical investments and services will negatively impact the NRC's capacity to perform evidence-building activities to support the agency mission. These reductions and postponements have slowed the rate at which modern data analytics tools may be used across the agency to support evidence-building activities. The NRC identified major efficiencies and areas for cost savings within corporate support just prior to, and within the initial implementation of NEIMA, and has prioritized spending that is integral to the success of the agency's mission. Continued reductions to meet the corporate support cap are not sustainable, are already negatively impacting the agency, and will have an even greater impact as the corporate support cap declines in future years.

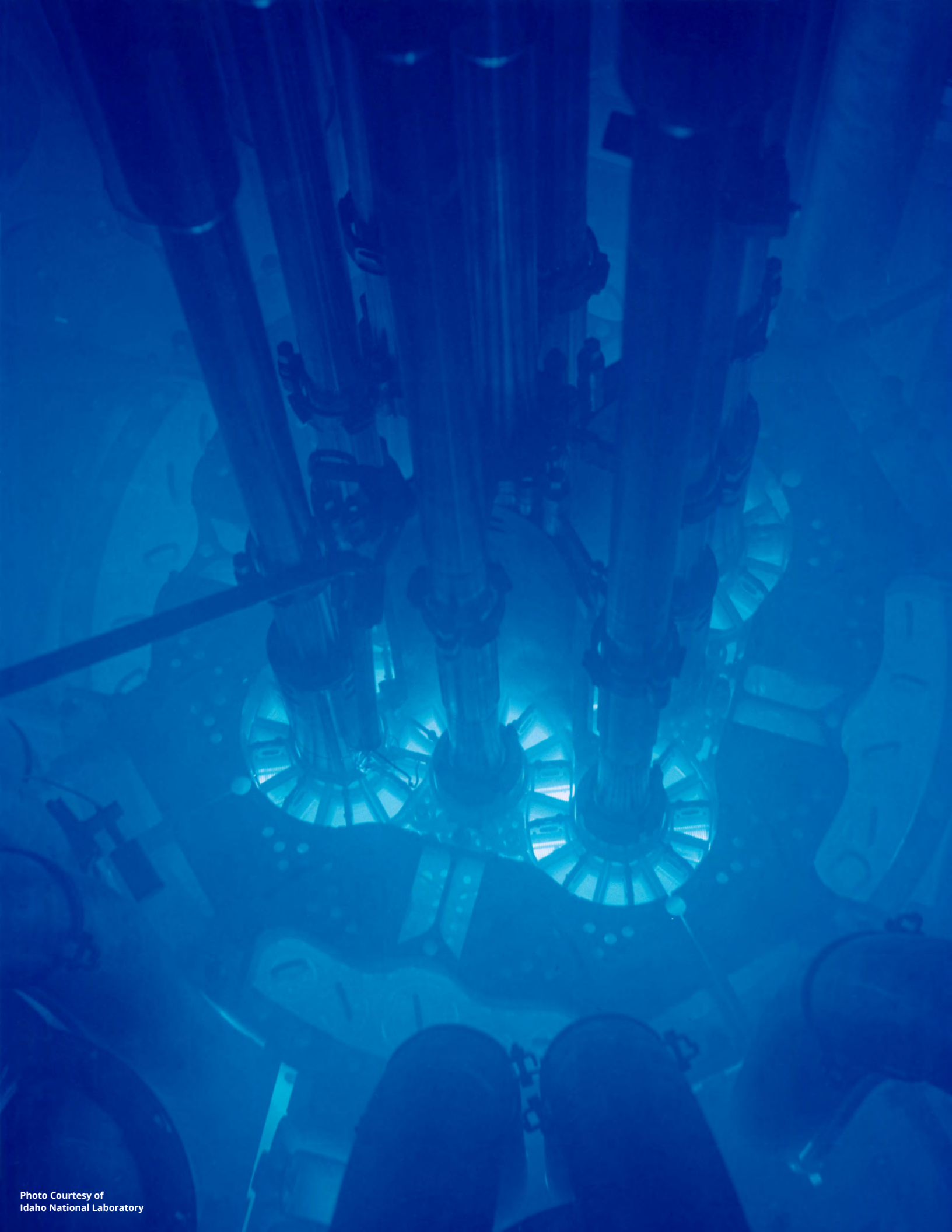
- **Mitigating Strategy:** The NRC should continue to closely monitor the impacts of NEIMA's cap on corporate support costs in its annual budget justification. The NRC should continue efforts to assess the constraints on corporate support and allow the agency to address needed capacity. The NRC will continue to make efforts agencywide to meet the cap.

[39] Letter to the Honorable Thomas R. Carper, Chairman, Committee on Environment and Public Works, dated October 4, 2021, available in ADAMS at Accession No. ML21238A132 and ML21237A033.

6. LIST OF EVIDENCE-BUILDING ACTIVITIES

The NRC's evidence-building activities span key agency functions including licensing, oversight, rulemaking, research, evaluation, and corporate support (e.g., financial management). Information on the agency's evidence-building activities is available to the public on the NRC's Agencywide Evidence-Building Activities webpage.[40]

[40] The NRC's Agencywide Evidence-Building Activities webpage is available at: https://www.nrc.gov/about-nrc/plans-performance/evidence-building-and-evaluation/agencywide-evidence-building-activities.html.



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10. SUPPLEMENTARY NOTES

11. ABSTRACT (200 words or less)

The U.S. Nuclear Regulatory Commission (NRC or the agency) is an independent agency established by the Energy Reorganization Act of 1974, which began operations in 1975 as a successor to the Atomic Energy Commission. The NRC is required by the Foundations for Evidence-Based Policymaking Act of 2018 to generate a capacity assessment, which is an accounting of NRC's capacity to carry out the evidence-building activities needed to meet its functions (i.e., the NRC's mission is to license and regulate the Nation's civilian use of radioactive materials, to provide reasonable assurance of adequate protection of public health and safety, and to promote the common defense and security and to protect the environment) and its capacity to disseminate and use evidence. This capacity assessment uses a structured approach for assessing and building the agency's capacity (e.g., staffing, funding, infrastructure, and processes) to carry out evidence-building activities (e.g., analysis, research, and evaluation) necessary to support agency functions. This approach identifies areas where new or different investments could strengthen or improve the agency's ability to meet its mission and strategic goals. The capacity assessment identified 27 findings and associated mitigating strategies that represent opportunities to enhance the NRC's capacity.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)

Capacity, Capacity Assessment, Evidence, Evidence Act, Evidence-Building, Analysis, Research, Evaluation, Coverage, Quality, Methods, Independence, Effectiveness, Licensing, Oversight, Research, Rulemaking, Financial Management

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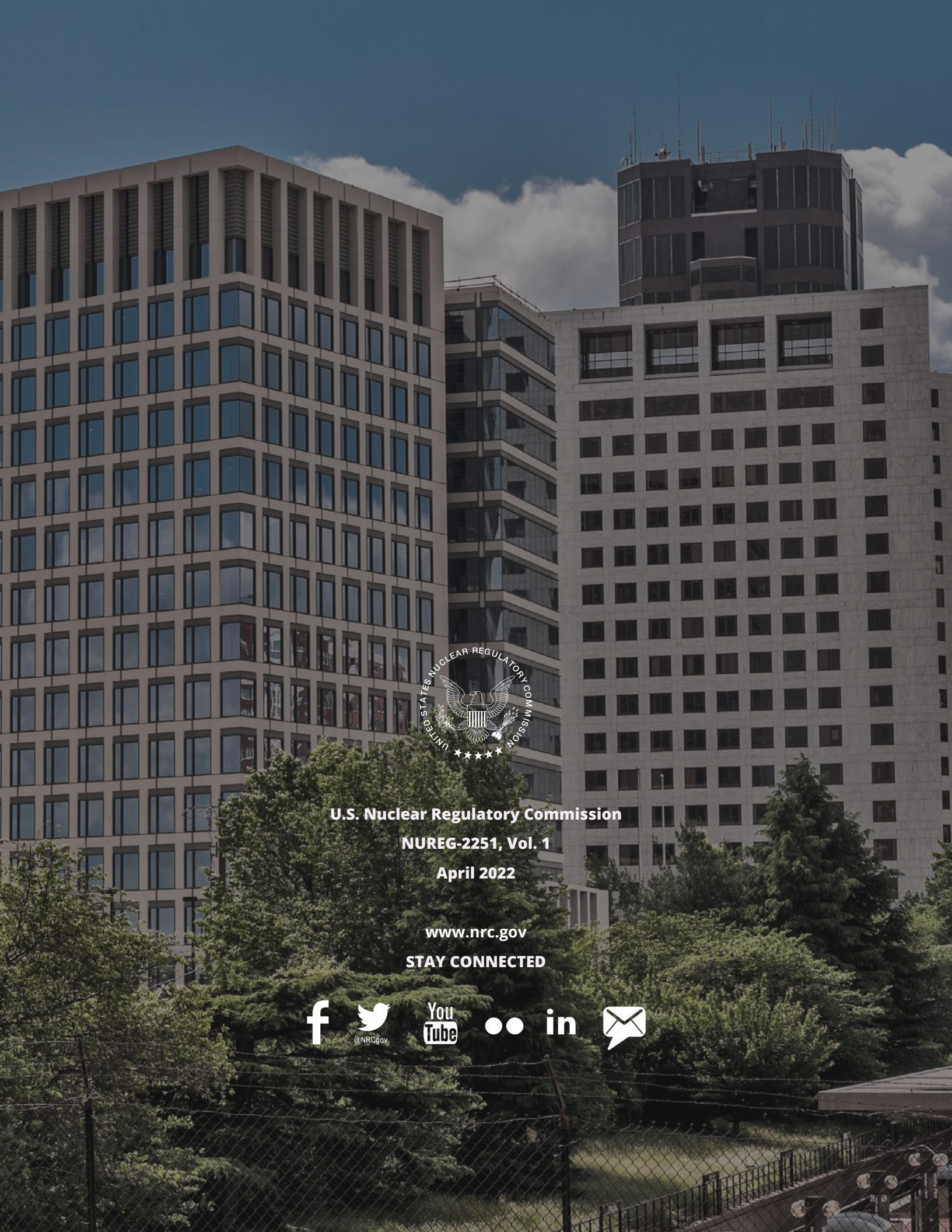

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