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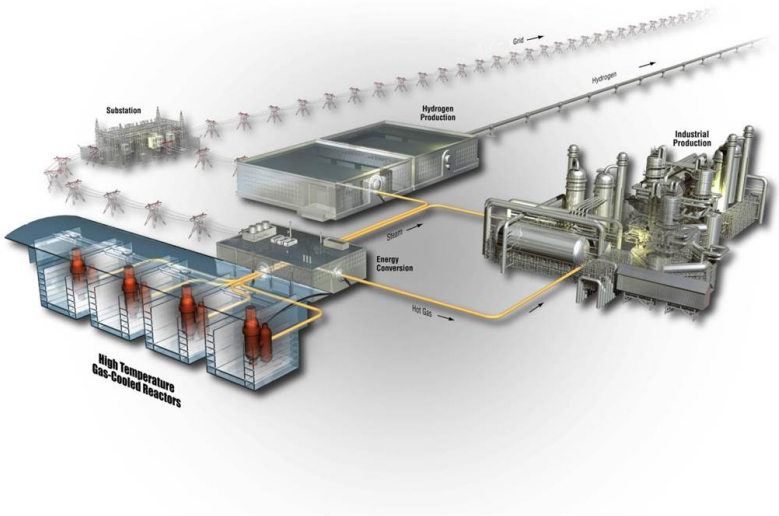
Revision 0

Non-LWR Regulatory Framework

September 2020

Jason A. Christensen



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Non-LWR Regulatory Framework

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Technical Reviewer: (Confirmation of mathematical accuracy, and correctness of data and appropriateness of assumptions.)

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SUMMARY

This report provides an end-of-year summary that reflects the progress and status of Idaho National Laboratory's activities concerning advanced reactor regulatory framework development and implementation in the U.S. This work was done in FY20 and supported regulatory development for the U.S. Department of Energy (DOE) Advanced Reactor Technologies Program. These activities are managed by Idaho National Laboratory on behalf of the U.S. DOE.

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ACRONYMS

AGR	advanced gas reactor
AIA	Aircraft Impact Assessment
AM	advanced manufacturing
AMT	AM techniques
ANR	advanced nuclear reactors
ARs	advanced reactors
ARCAP	Advanced Reactor Content of Application Plan
ARRTF	Advanced Reactor Regulatory Task Force
ARSM	Advanced Reactor Stakeholder Meetings
ART	Advanced Reactor Technology
CFR	Code of Federal Regulations
DOE	Department of Energy
DOE-NE	Department of Energy Office of Nuclear Energy
EPRI	Electric Power Research Institute
FY	fiscal year
GAIN	Gateway for Accelerated Innovation in Nuclear
GEIS	Generic Environmental Impact Statement
HTR	high-temperature reactor
INL	Idaho National Laboratory
LMP	Licensing Modernization Project
LWR	light-water reactor
NEI	Nuclear Energy Institute
NEIMA	Nuclear Energy Innovation and Modernization Act
NIC	Nuclear Industry Council
NGNP	Next Generation Nuclear Plant
NRC	Nuclear Regulatory Commission
NTD	National Technical Director
PPE	plant parameter envelope
R&D	research and development
SMR	small modular reactor
TICAP	Technology Inclusive Content of Applications Project
TRISO	tristructural isotopic
UCO	Uranium Oxycarbide

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Non-LWR Regulatory Framework

1. Purpose

This report provides an end-of-year summary that reflects progress and status of the Idaho National Laboratory's (INL's) Regulatory Development department activities concerning advanced reactor (i.e., non-light-water reactor [LWR]) regulatory framework development and implementation. This report was developed to address and satisfy the U.S. Department of Energy (DOE) milestone M4AT-20IN070101022 under INL work package AT-20IN07010102.

2. Objective

The activities performed under the non-LWR Regulatory Framework Development activity are intended to support the non-LWR community in establishment of a clearly defined regulatory framework, and support for the implementation of regulatory and licensing strategies for newly emerging commercial nuclear power technologies. Additionally, this activity was initiated to engage in the progress of regulatory activities by industry and government agencies and interact with stakeholders on matters important to licensing in support of commercial deployments.

This activity coordinates DOE regulatory efforts with industry and Nuclear Regulatory Commission (NRC) staff/stakeholders, thereby ensuring that DOE research and development (R&D) activities are appropriately aligned and adequately address areas of licensing technical requirements that are incompatible or add uncertainty in an evolving regulatory environment.

3. Fiscal Year 2020 Challenges

Interactions with framework development stakeholders and the formulation of transformation opportunities and action plans were moderately affected by the sudden onset of nation-wide pandemic control measures in early calendar year 2020. This created an obstacle to efficient INL Regulatory Development department activities in that it limited anticipated opportunities for formal and informal interactions with developers, vendors, and the license applicant community. Pandemic control measures and associated travel restrictions effectively curtailed many anticipated opportunities for regulatory development information exchange during a large portion of fiscal year (FY)20. As a result, INL staff redirected efforts towards virtual NRC public meetings and stakeholder forums which sought to continue non-proprietary information exchange. This included increased reliance on NRC website tracking, participating in teleconference and webinar meetings, and tracking individual applicant activities such as that which accompanied the Oklo Aurora permit application submission to NRC for licensing review.

4. Summary of Completed Activities

The non-LWR Regulatory Framework Development activity was used by DOE and INL researchers for planning and development of new R&D activities, participation in industry and government interactions associated with non-LWR reactor development, and coordination of DOE and NRC interactions. The following Subsections summarize the work performed by INL Regulatory Development department in FY20.

4.1.1 Meetings and Interactions

INL Regulatory Development department staff regularly participated in a variety of meetings that supported non-LWR regulatory development throughout FY20. Members of the group researched, attended, and participated in the Advanced Reactor Stakeholder Meetings (ARSMs), which were held approximately every six weeks by the NRC at NRC headquarters (and then converted to virtual webinars due to COVID-19). Additionally, members of the INL staff attended the Advanced Reactor Regulatory

Task Force Meetings (ARRTF), which were held by the Nuclear Energy Institute (NEI) in person and later virtually. These meetings were typically held the day prior to the NRC ARSM meetings.

The interactions associated with these meetings proved essential to INL staff in maintaining currency and knowledge of the state of the nuclear industry and more specifically, advanced reactors in order to assist industry in moving forward on regulatory topics. INL Regulatory Development department staff frequently communicated directly with NEI, NRC, DOE, individual applicants, and other National Laboratories to maintain a status of activities. Additionally, INL staff review and provide comments to documents developed by the NEI, NRC, and DOE.

Some of the topics that INL staff interacted with related to non-LWR Framework Development are:

Meeting Name and Date	Major Stakeholders	Major Topics
NRC Public Meeting with Nuclear Industry Groups and Other Stakeholders on Advanced Reactors—12/12/2019	NRC, NEI, INL, Industry	- Technology Inclusive Content of Applications Project (TICAP) (INL Presentation) - Draft Non-LWR Review Strategy - NEI Microreactor Paper
Advanced Reactor Regulatory Task Force—Pre-meeting for NRC ARSM—02/19/2020	NEI, INL, Industry	- Environmental Impact Statement - Alternative Physical Security Requirements for Advanced Reactors - Emergency Planning Proposed Rule - NEI 19-03 AR Codes and Standards Needs Assessment
NRC Advanced Reactor Stakeholder Meeting—02/20/2020	NRC, NEI, INL, Industry	- Environmental Impact Statement - Alternative Physical Security Requirements for Advanced Reactors (ARs) - Emergency Planning Proposed Rule - TICAP
Advanced Reactor Regulatory Task Force—Pre-meeting for NRC ARSM—04/01/2020	NEI, INL, Industry	- Generic Environmental Impact Statement (GEIS) - Codes and Standards for ARs
NRC Advanced Reactor Stakeholder Meeting—04/02/2020	NRC, NEI, INL, Industry	- GEIS - Codes and Standards for ARs

		- U.S. Nuclear Industry Council (NIC) Discussion on Policy Issues
NRC Generic Environmental Impact Statement Scoping Meeting—04/30/2020	NRC, NEI, INL, Industry	- GEIS
NRC Advanced Reactor Stakeholder Meeting—06/12/2020	NRC, NEI, INL, Industry	- Comments on NIC Presentation on Policy Issues
NRC Advanced Reactor Stakeholder Meeting—07/31/2020	NRC, NEI, INL, Industry	- Near-Term Construction Permit Guidance - ARCAP

4.1.2 NRC Activities

INL staff interacted regularly with the NRC throughout FY20, as the NRC staff continued to focus on the completion of priority regulatory framework development activities as outlined in its Near-Term Implementation Action Plan (IAP). The focus of these efforts is on establishing a clearly defined regulatory path for advanced reactor deployments and developing NRC-endorsed and approved guidance for pursuing that path, thereby significantly reducing the regulatory uncertainty that has historically challenged advanced reactor developers. Much of that NRC guidance has been based on industry proposals and ongoing interactions that have been DOE-supported and developed through this Regulatory Development program area. These interactions included participating in stakeholder discussions, reviewing new and revised regulatory documentation, providing comments, and engaging the NRC to discuss proposals, work products, and future licensing activities. Significant progress has been made in many aspects of the IAP, and that progress is reflected in NRC's associated Integrated Schedule, which can be found on NRC's public website at https://www.nrc.gov/reactors/newreactors/advanced.html#advSumISRA

Some of the more significant NRC guidance that resulted from these and other stakeholder interactions included:

- Regulatory Guide (RG) 1.233, "Guidance for a Technology-Inclusive, Risk-Informed, and Performance-Based Methodology to Inform the Licensing Basis and Content of Applications for Licenses, Certifications, and Approvals for Non-Light Water Reactors" [6] (This item is discussed further in Section 4.1.5)
- Proposed rule, "Emergency Preparedness for Small Modular Reactors (SMRs) and Other New Technologies."

INL staff analyzed the impacts of these specific activities and assessed their influences and likely consequences on future advanced reactor licensing. These included:

- Functional Containment (as it relates to a Commission Staff Requirements Memorandum and RG 1.233)
- Emergency Preparedness—now in rulemaking process
- Physical Security—now in rulemaking process.

4.1.3 Nuclear Facility Jurisdictional Boundaries

Ten years ago, industry partners acknowledged that information relating to defining a basis for nuclear facility jurisdictional boundaries was needed for ARs collocated with and directly connected to industrial facilities that are not otherwise regulated by the NRC (in connection with the DOE Next Generation Nuclear Plant (NGNP) project). In FY20, the INL Regulatory Development wrote a white paper[2] that analyzed and proposed a basis for nuclear facility jurisdictional boundaries between a commercial AR facility and a non-NRC-regulated industrial facility (e.g. a user of process heat, such as a retrofit fossil plant or a desalination plant, etc.). Since there are no successful precedents in domestically licensing such collocated facilities, it is unclear where jurisdictional boundaries could be implemented between the NRC-regulated area and the industrial boundary under the existing regulation. Clearly, proposing such an approach must be done in a manner that protects the nuclear facility from hazards imposed by the industrial component and assures adequate public safety.

INL staff presented the white paper to the NEI ARRTF for industry review and comments in July of 2020. The paper was published in August 2020 and transmitted to NEI and other industry stakeholders to use as the basis for proposals to NRC (and perhaps as the basis for an NEI/industry position paper) on how jurisdictional boundaries could be established. This paper was submitted to DOE in completion of milestone M3AT-20IN070101021 of work package AT-20IN07010102 [2].

4.1.4 Work-Scope Planning for FY20 and FY21

Under the framework task, the INL Regulatory Development team evaluated and prepared the work scope for FY20, FY21, and other out-years that included a DOE Integrated Planning List. The group participated in extensive interactive DOE laboratory dialogues and interacted with industry stakeholders, and with researchers across the DOE laboratory complex to develop R&D and regulatory development work scopes and determine resource requirements. Additionally, the group worked to identify and prioritize industry and government needs and use them to develop a work scope for FY21. By coordinating with industry stakeholders, DOE, and NRC, INL staff were able to identify areas of near-term R&D need for current and near-future advanced reactor licensing support activities.

Through industry, DOE, and NRC coordination, activities were selected, funded, and the initial FY20 plan was fully implemented. Two additional tasks were developed: an Aircraft Impact Assessment (AIA) and Advanced Manufacturing (AM) Regulatory Support. Based on discussions with industry, NEI, and DOE, it was determined that immediate regulatory analysis and proposal development of these tasks would benefit the ARs industry greatly. The revision of the AIA rule is a topic of significant interest to industry, as advanced nuclear plants are typically very small and have a significantly reduced radionuclide inventory when compared to the commercial plants on which the rule was based. AM was also identified to be critical to AR development due to its potential cost saving and technological advantages for construction. AM techniques have the potential to reduce manufacturing cost and complexity that typically add significant resources to the cost of a plant. These activities continue into FY21 and will be discussed in Section 5.

4.1.5 Licensing Modernization Project

The Licensing Modernization Project (LMP) was initiated at INL in April 2016 as an industry-led effort to create risk-informed, performance-based guidance into the existing licensing process. Initial activities focused on the opinions and expertise provided by a small team of nationally recognized licensing and AR technology experts. Later, the project was expanded to include licensing stakeholders for the entire domestic non-LWR regulatory community. A cost-share arrangement was developed (through INL) between the DOE Office of Nuclear Energy (DOE-NE) and key LMP industry participants. The effort was led by Southern Company and coordinated through INL. Additional technology vendors/suppliers, license applicant owners/operators, and other stakeholders participated in various

phases of the LMP project life cycle during the ensuing four years. The INL Regulatory Development department provided project oversight and, along with NEI, supplied collaborative technical inputs and organizational interface support to the LMP working team.

The primary LMP objective was to provide high-value, technology-inclusive guidance that embraced cross-cutting, risk-informed, and performance-based assessment elements that have been proven to be compatible with the current regulatory framework and satisfies the underlying safety basis requirements of current regulation. Another objective was to maximize licensing efficiency and minimize unnecessary administrative burdens.

Operational goals, milestones and specific achievements associated with LMP are summarized in a report that was compiled at the end of the project [3]. While a number of analysis approaches were considered by LMP, the principle guidance pertaining to generic AR licensing produced by the project was documented in NEI 18-04, "Risk-Informed Performance-Based Technology Inclusive Guidance for Non-Light Water Reactor Licensing Basis Development," and submitted to NRC in August 2019 [4]. The evaluation approach described in the document was formally submitted in 2019 for a review by NRC staff for endorsement.

During FY20, INL continued to support the DOE-NE cost-share sponsorship and the industry-led LMP team in advocating acceptance of NEI 18-04 by the Commission. On May 26, 2020, the Commission unanimously approved NEI 18-04 for use as a valid technology-inclusive, risk-informed, and performance-based licensing approach methodology for non-LWR technologies. With this action, the LMP approach directly addresses and resolves a decades-old commission policy issue that restrained the deployment of non-LWR technologies. A risk-informed, performance-based approach is now available to current and future applicants as a reasonable way to establish key parts of a licensing safety basis and appropriate application content for licenses, certifications, and approvals for non-LWRs (accomplished vi NRC staff's endorsement of RG 1.233). Because this effectively fulfilled the original LMP objective, LMP project activities were concluded as of May 2020 and no further work is planned under LMP.

5. Ongoing Activities

5.1 Technology Inclusive Content of Application Plan

Another DOE-industry cost-share effort was initiated in FY19 (through INL) focused on implementing the LMP approach as a follow-up to the adoption of NEI 18-04 as formal RG (see RG 1.233). The TICAP is now underway and actively engaging NRC staff and industry stakeholders in the development of additional LMP-derived guidance. With an estimated project life cycle of 2.5 years, this project is expected to offer users of NEI 18-04 additional insights and options. The insights and options will rationalize inputs based on an affirmative safety case and necessary information to support NRC staff determinations of reasonable assurance to provide adequate safety. The project further proposes to de-emphasize standardized, predetermined application content by employing the following guiding principles:

- The LMP-based affirmative safety case focuses on direct radiological risk to the health and safety of the public
- The safety case is expected to be anchored around the Principal Design Criteria applicable to the specific design and strive to meet underlying safety objectives established by current regulation
- The content and level of detail are to be risk-informed and graded to meet NRC objectives that require information commensurate with the importance of the performed safety function
- The content organization is to be logical and safety focused
- The guidance is anticipated to be applicable to any reactor using the NEI 18-04 methodology.

This project will also aid NRC staff in expedited licensing framework development activities as mandated under the Nuclear Energy Innovation and Modernization Act (NEIMA, Public Law 115-439). Upon the completion of the principle TICAP guidance document (expected in FY21), it is anticipated that the project will thereafter shift focus and, in FY22, support the NRC review and endorsement of the information as formal regulatory guidance.

5.2 Aircraft Impact Assessment

The AIA task was added to the Advanced Reactor Technologies (ART) work package activities in mid-year of FY20. This task will provide recommendations for changes to current regulations for aircraft impacts on nuclear facilities by reviewing the technical bases for 10 CFR 50.150 against anticipated capabilities and configurations of advanced non-LWRs with consideration of risk-informed insights and approaches. Current regulations for aircraft impacts are focused on large LWRs and were formulated using assumptions that may or may not be valid with respect to certain AR vulnerabilities (i.e., LWRs differ greatly from the sizes and layouts of the ARs, including microreactors). Work for this activity will continue into FY21. A report will be released discussing the gaps of existing regulations and recommendations on changes to support ARs.

5.3 Advanced Manufacturing

A task on AM was also added mid-year FY20. The purpose of this task is to provide industry and NRC regulatory strategy support to the AM National Technical Director (NTD). This task will develop a proposal for the development of guidance for industry and NRC endorsement of Advanced Manufacturing Techniques. Currently, INL staff are supporting the development of the AMT roadmap, which is being developed through the AMT NTD. This roadmap will be the basis for DOE actions in AM and will be important to assisting INL staff in developing future activities to support the industry in the adoption of AMTs. Based on the results of the proposal, this activity will continue into FY21, where INL staff will implement the recommendations in the proposal. Some of the work performed may include reviewing current industry and government projects for AMTs and participating in industry, DOE, and NRC interactions to support AMT endorsement for use on non-LWR applications. This work is intended to support the main goal of the activity: proposing and developing a clearly defined path to AM acceptance and endorsement. Based on the work performed, this activity will continue to progress into subsequent FYs.

5.4 Generic Environmental Impact Statement

A GEIS approach is currently being established for advanced nuclear reactors (ANR) with a small generating output and a small environmental footprint. This action is being done to streamline the environmental review process for future small-scale ANR environmental reviews. More specifically, the ANR GEIS action will determine which environmental impacts could result in essentially the same (generic) impact for different ANR designs and which environmental impacts could result in different levels of impacts requiring a plant-specific analysis.

Up to now, issuing a license to build and operate a nuclear reactor was considered a major federal decision and therefore required a resource-intensive assessment of potential environmental impacts as a normal function of every submitted license application. However, once the proposed regulatory action is completed, environmental reviews for small-scale ANR license applications will be afforded the opportunity to incorporate the ANR GEIS (by reference) and move forward by focusing on providing additional site-specific information and analyses in the form of a Supplemental Environmental Impact Statement, thereby greatly increasing the environmental review process efficiencies and reducing administrative burdens.

In SECY 20-0020[7], the staff informed the Commission of the intent to use a technology-neutral plant parameter envelope (PPE) approach to bound small-scale ANR projects. The staff considered a

"small-scale" ANR as having the potential to generate less then approximately 30 megawatts (thermal) per reactor with a correspondingly small environmental footprint. The actual bounding thermal power level of the ANR and the environmental footprint used in the ANR GEIS is being finalized during the GEIS scoping process.

A technology-inclusive approach (built upon use of a PPE) is being pursued because small-scale ANRs are not defined by any particular reactor design and may be located anywhere in the U.S. that satisfies NRC siting requirements. The PPE will consist of bounding parameters covering various reactor designs. In addition, tables of values representing a site parameter envelope (e.g., size of site, quantity of water used, demographics) are also expected to be developed. The ANR GEIS will evaluate the impacts of a reactor fitting within PPE boundaries for sites that are similarly bounded by the site parameter envelope to determine environmental impact.

Future applications referencing the ANR GEIS would demonstrate that the project is adequately bounded by the ANR GEIS analysis and that no significant new information affecting the evaluation is being overlooked. If successfully demonstrated, the NRC will incorporate (by reference) the ANR GEIS into the license with no further analysis needed. The application would still need to analyze site-specific resources not otherwise resolved generically in the ANR GEIS.

The GEIS development process will be tracked to ensure that the action adequately bounds emerging ANR technologies and addresses the concerns of the regulated community. The following outlines the schedule for GEIS development:

1. April 30, 2020—Federal Register notice of intent to prepare GEIS and conduct scoping (85 FR 24040)
2. June 30, 2020—Scoping comment period ends
3. May 1, 2021—Draft GEIS issued for comment
4. May 1, 2022—Final GEIS issued.

5.5 Tristructural Isotopic (TRISO) Fuel Particle Qualification

Numerous modular high-temperature reactor (HTR) concepts are being actively developed for near-term commercial construction and operation within the U.S. As a key core design feature, these designs rely on spherical TRISO fuel particles (approximately 60 mm in diameter) embedded in graphite prismatic-blocks or graphite pebbles. Fundamental to TRISO fuel particle design is a microsphere (i.e., kernel) of nuclear material encapsulated by multiple layers of pyrocarbon and a silicon carbide layer to form a multicoated layered system that retains radioactive products generated by fission of nuclear material in the kernel during normal operation and all licensing basis events.

Assuring robust TRISO-coated fuel particle performance is critical to HTR design safety. This makes the qualification of TRISO particle fuel to stringent performance requirements essential to licensing success. Because of its importance to commercial deployment, starting in 2017, DOE (through INL and in collaboration with HTR industry stakeholders) began to fund an industry cost-shared project that compiled and summarized initial findings, information, and conclusions relevant to qualifying uranium-oxycarbide-TRISO-coated particle fuel.

On May 31, 2019, the Electric Power Research Institute (EPRI) submitted a technical document entitled "Uranium Oxycarbide (UCO) Tristructural Isotropic (TRISO) Coated Particle Fuel Performance: Topical Report EPRI-AR-l(NP)," to the NRC [5]. This topical report contained information largely generated at INL and was transmitted to NRC on behalf of industry to facilitate future regulatory reviews, approvals, and qualification of the TRISO fuel design for use in commercial thermal spectrum HTRs.

The report examined initial results obtained through the Advanced Gas Reactor (AGR) Fuel Development and Qualification Program. The program was established by DOE in 2002 and included

in-pile irradiations at INL facilities. The work was initiated to provide a U.S. facility the capability to fabricate high-quality UCO TRISO fuel and demonstrate its performance under all applicable licensing design basis conditions. This topical report specifically focused on results obtained from the first two fuel irradiation tests done in the AGR program (designated AGR-1 and AGR-2). Conclusions found that the irradiation and post-irradiation high-temperature accident safety tests of AGR-1 and AGR-2 for UCO-TRISO-coated fuel particles constituted a valid performance demonstration of the particle design over a range of normal operating and off-normal accident conditions. Such testing is necessary to provide a foundational basis for using the particle design in TRISO-fueled HTR designs (that is, designs with pebble or prismatic fuel and a helium or salt coolant).

NRC staff started a technical review of topical report information shortly after the submission by EPRI. Assessment activities included an onsite (i.e., at INL) audit of the AGR TRISO fuel topical report information on October 8–9, 2019. During the audit, NRC representatives reviewed AGR program attributes in detail and requested additional information with both INL AGR staff and HTR industry representatives present. A summary of the audit was released on November 19, 2019 and can be found on the NRC website under ADAMS Accession No. ML 19310F085.

On July 8, 2020, the NRC Advisory Committee on Reactor Safety arrived at a generally favorable conclusion after completing their review of the TRISO fuel topical report. At this time, the NRC is continuing with the administrative processes leading to a formal acceptance of the report. If endorsed by NRC, it is anticipated that a Safety Evaluation will be issued for the material contained in the TRISO fuel topical report, thereby making aggregate AGR-1 and AGR-2 fission product release data and fuel failure fraction information (as summarized in the report) available to applicants for use in future licensing actions for reactors that employ UCO-TRISO-coated fuel particles within the parameter envelope described in the report. With this, a license applicant will "lock-in" available UCO TRISO particle fuel performance data and regulatory effects analysis in a manner that greatly increases future safety review process efficiency for affected design certifications and license applications.

6. Anticipated Future Activities

6.1 Near-Term Activities (FY21)

In order to increase regulatory flexibility and licensing certainty for near-term applicants, LMP and TICAP were scoped to expeditiously adapt existing regulatory requirements and release those adaptations to users in the form of endorsed guidance. This strategy avoided the need for the resource-intensive and time-consuming rulemaking that would otherwise have been necessary to rebuild key regulatory requirements. It should be noted, however, that LMP and TICAP work products were crafted to support a such a rulemaking should one be deemed necessary in the future. To that, current non-LWR community consensus does suggest that many important benefits could still be achieved if a fuller reassessment were performed as a function of a formal NRC rulemaking process. At this time, NRC has indicated an intention to pursue a rulemaking that establishes a formal technology-inclusive regulatory requirements framework by December 31, 2027. This new approach would likely be an option for use by commercial ANR applicants and research and test reactor applicants and might also include SMR, LWRs and fusion reactors (as mandated under NEIMA, Public Law 115 439, as enacted on January 14, 2019[8]). Expectations are that the rulemaking will be a logical extension of the guidance development activities previously pursued to enable a technology-neutral regulatory framework. Moreover, this action will likely be heavily influenced by recent activities, such as the foundational guidance contained in NEl-18- 04, "Risk-Informed Performance-Based Guidance for Non-Light Water Reactor Licensing Basis Development" (ADAMS Accession No. ML18271A172)[4].

The anticipated rulemaking is sometimes colloquially referred to as the “Part 53 rulemaking” action and will demand extensive interactions with AR developers, industry groups, DOE, other federal

agencies, and other stakeholders. These interactions are expected to begin in earnest during FY21 and will intensify in FY22 and beyond. INL anticipates that establishing Part 53 will be a very dynamic undertaking that will rely on many and varied technical resources to inform and support regulated community and NRC staff dialogues. Resources may be required from INL and other DOE labs and may include leveraging existing reports and information like those developed in support of previous rulemakings, the NGNP Program, the DOE Advanced Reactor Technology Programs (ART), the DOE Gateway for Accelerated Innovation in Nuclear (GAIN) activities, and other sources of DOE guidance for reactor and nonreactor facilities. DOE may also need to consider the technical support and programmatic controls described in consensus codes and standards, requirements and guidance prepared by other regulatory agencies in the U.S, frameworks or regulations developed in other countries, and standards and guidance prepared by the International Atomic Energy Agency or other international organizations.

6.2 Longer Term Activities (Beyond FY21)

The INL Regulatory Development team anticipates a large increase in AR demonstration projects over the next decade. These projects will be done primarily to obtain integrated proof-of-concept technical information as well as safety information that is essential to regulatory safety assessments and licensing. This will require a general shift in focus from the largely technology-inclusive efforts described in this report to the advanced reactor technology-specific topics that are restraining developers. Establishing this shifting focus will require extensive interactions with technology developers/vendors, license applicants, and NRC staff. DOE and the National Reactor Innovation Center managed at INL will also be essential stakeholders in these interactions.

6.2.1 NRC Rulemaking Activities

Besides the 10 CFR Part 53 rulemaking, some other anticipated NRC rulemaking activities that will be supported by INL staff include:

- Emergency Preparedness Requirements for Small Modular Reactors and Other New Technologies. (NEIMA Section 103(a)(2))
- The published regulatory basis for the "Rulemaking for Physical Security for Advanced Reactors." Physical security will be a critical area for AR designers due to the smaller layout and reduced radionuclide content. Some ARs could be allowed reductions in physical security requirements due to this and due to a highly reduced potential risk of significant accident.

7. Conclusion

The INL Regulatory Development department has utilized funding provided under the activity entitled “Non-LWR Regulatory Framework Development” to support many critical activities during FY20, while achieving specific results that aid in reactor deployments. The funding has been critical to maintaining relationships and interactions with the AR community, including industry partners, applicants, DOE, and NRC. COVID travel restrictions provided a challenge for INL staff, who would have normally attended many activities in person. Though performing these activities via the phone or via the internet limited many face-to-face interactions, INL staff has maintained communications successfully.

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