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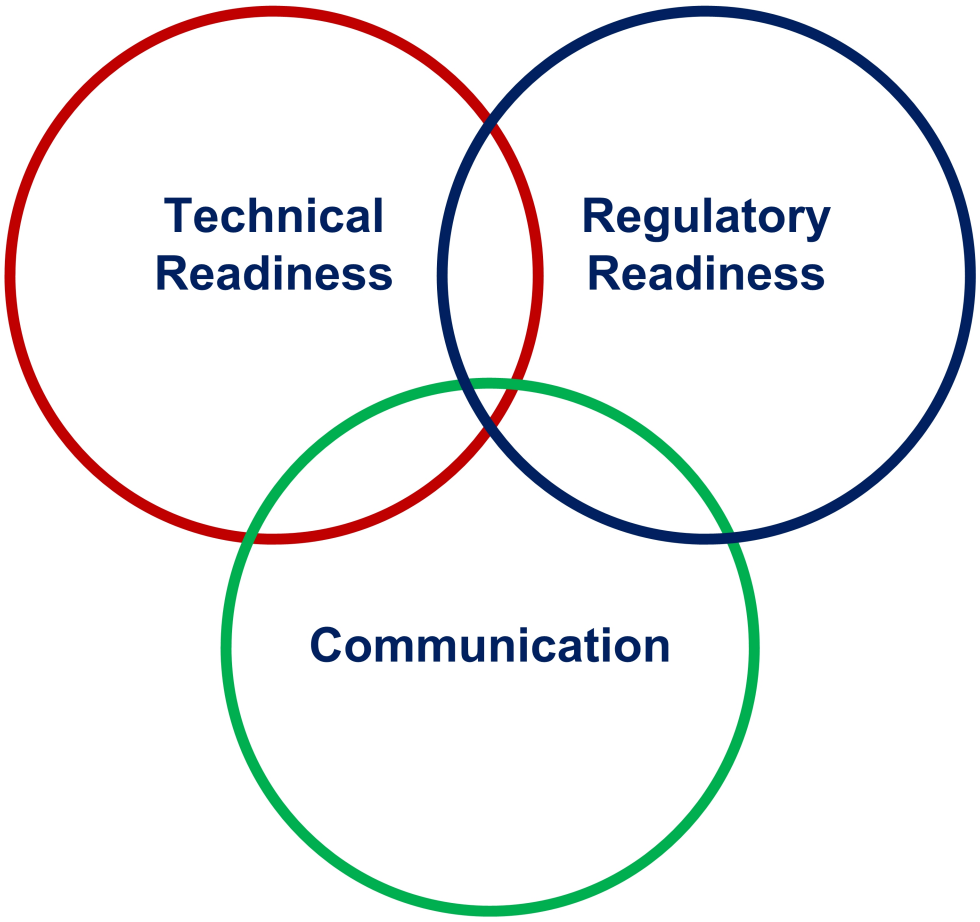
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NRC Vision and Strategy: Safely Achieving Effective and Efficient Non-Light Water Reactor Mission Readiness



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EXECUTIVE SUMMARY

As the U.S. Nuclear Regulatory Commission (NRC) prepares to review and regulate a new generation of non-light water reactors (non-LWRs), a vision and strategy has been developed to assure NRC readiness to efficiently and effectively conduct its mission for these technologies. The domestic and international non-LWR industries have changed significantly since the last U.S. commercial non-LWR was shut down in 1989 (Fort St. Vrain, a high-temperature gas - cooled reactor (HTGR)). The NRC now operates in an environment where potential non-LWR applicants have a wide and varied range of technical, business, and regulatory experience. Additionally, the non-LWR industry has become globalized and commercial non-LWR plants are being designed, constructed and operated abroad. This international activity provides opportunities for information exchanges between the NRC and its international counterparts about non-LWR operating experience, international codes and standards, and computer modeling techniques and programs.

The NRC could review and license a non-LWR design today, if needed. The agency needs to be effective and efficient as it conducts its safety, security, and environmental protection mission, without imposing unnecessary regulatory burden. This requires the NRC to consider the effects of a more dynamic domestic regulatory environment and a globalized non-LWR industry. Furthermore, the NRC recognizes the benefits of having a flexible regulatory framework, allowing potential applicants to select a best-fit path towards regulatory reviews and decisions. Examples of these flexibilities are described in the report.

The vision and strategy described in this report, once executed, will achieve the goal of assuring NRC readiness to effectively and efficiently review and regulate non-LWRs. The strategy has three strategic objectives: enhancing technical readiness; optimizing regulatory readiness; and optimizing communication. The steps needed to reach the readiness target are described in a series of supporting strategies and contributing activities, to be executed during near-term, mid-term, and long-term timeframes. Example schedules that help inform the vision and strategy implementation with potential non-LWR development, application, construction, and operation timeframes are also discussed. These schedules help align the NRC non-LWR vision and strategy with the Department of Energy (DOE) non-LWR vison and strategy.

The approach has two phases. Phase 1 is the conceptual planning phase used to lay out the vision and strategy, gather public feedback, and finalize the NRC's approach. Phase 2 includes detailed work planning efforts and task execution. Both phases began in 2016, and a target completion date of not later than 2025 has been set for Phase 2.

The NRC principles of good regulation—independence, openness, efficiency, clarity, and reliability—are embodied in this vision and strategy. While the NRC does not promote any particular reactor technology, its responsibilities as a regulator include working effectively with all stakeholders, clearly communicating its requirements, and providing regulatory information and feedback in a timely manner. Above all, the NRC mission remains unchanged but the means to achieve its mission must be optimized. Achieving this non-LWR readiness goal should also provide significant regulatory certainty to the non-LWR industry, potential applicants, and other stakeholders.

1.0 INTRODUCTION

As the U.S. Nuclear Regulatory Commission (NRC) staff prepares for regulatory interactions and potential applications for non-light water reactor (non-LWR) technologies, the staff has been directed to update its plan to review and regulate non-LWRs. Recent feedback from a variety of industry, public, and congressional sources reinforces the importance of providing this updated plan to all NRC stakeholders.

The NRC has conducted three significant non-LWR readiness assessments since the early 2000's. In 2001, the staff issued SECY-01-0188, "Future Licensing and Inspection Readiness Assessment,"[1] that included licensing readiness for both light-water reactors (LWRs) and non-LWRs. In 2008, the NRC and DOE submitted a jointly developed report to Congress for the Next Generation Nuclear Plant (NGNP) licensing strategy supported by an internal assessment of NRC readiness to license an NGNP plant.[2] In 2012, NRC published its strategy for and approach to preparing for the licensing of non-LWRs in a report to Congress.[3]

In the 2012 report, six key activities were listed to support the preparation for reviews of applications related to the design, construction, and operation of non-LWRs. The key activities were:

- Identify and resolve significant policy, technical, and licensing issues.
- Develop the regulatory framework to support efficient and timely licensing reviews.
- Engage in research focused on key areas to support licensing reviews.
- Engage reactor designers, potential applicants, industry, and the DOE in meaningful preapplication interactions and coordinate with internal and external stakeholders.
- Establish a non-LWR training curriculum for the NRC staff.
- Remain cognizant of international developments and programs.

Since 2012, the NRC has made progress on these activities, consistent with the maturity of the non-LWR industry. These activities remain at the core of the NRC vision and strategy to achieve non-LWR mission readiness.

The NRC Strategic Plan[4] describes the agency's mission and vision as follows:

Mission: "The U.S. Nuclear Regulatory Commission licenses and regulates the Nation's civilian use of radioactive materials to protect public health and safety, promote the common defense and security, and protect the environment."

Vision: "A trusted, independent, transparent, and effective nuclear regulator."

Note that the NRC mission and vision are independent of any specific reactor technology. That said, this report specifically addresses how the NRC continues to prepare to efficiently and

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1 SECY-01-0188, "Future Licensing and Inspection Readiness Assessment," October 12, 2001 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML012640279)

2 "Next Generation Nuclear Plant Licensing Strategy – A Report to Congress," August 2008 (ADAMS Accession No. ML082290017)

3 "Report to Congress, Advanced Reactor Licensing," August 2012 (ADAMS- Accession No. ML12153A014).

4 "Strategic Plan – Fiscal Years 2014 – 2018," NUREG-1614, Vol. 6, August 2014 (ADAMS Accession No. ML14246A439)

effectively review and regulate non-LWR technologies intended for use as commercial nuclear power plants (NPPs) producing electricity or process heat. Regulation and oversight of non-LWR research, test, and prototype facilities are also within the scope of this report. Additionally, the scope includes the full fuel and NPP life cycles for non-LWR technologies. Finally, this vision and strategy also incorporates the non-LWR activities that have been initiated prior to the development of this planning framework. Examples include the ongoing development of the Advanced Reactor Design Criteria (ARDCs), and NRC support for the DOE Gateway for Accelerated Innovation in Nuclear (GAIN) initiative.

In 1986, the Commission published a policy statement on the regulation of advanced reactors. The objectives of the policy were to: 1) maintain the earliest possible interaction of applicants, vendors and government agencies with the NRC; 2) provide all interested parties, including the public, with the Commission's views concerning the desired characteristics of advanced reactor designs; and 3) express the Commission's intent to issue timely comments on the implications of such designs for safety and the regulatory process. The policy was subsequently updated in 1994 to address the Commission's policy on metrication, and again in 2008 to integrate additional security and emergency preparedness expectations with the policy.[5] The original objectives of the policy remained intact after each of these revisions. The policy also describes the desired attributes of advanced reactors, but does not further specify whether advanced reactors are LWRs or non-LWRs.

This vision and strategy report addresses non-LWR designs only, and supports the Commission's advanced reactor policy statement in all other regards.

Coordination of this Vision and Strategy with the DOE

The DOE is also establishing its vision and strategy for the development and deployment of non-LWRs. While the DOE and NRC have fundamentally different missions as described in each organization's respective enabling legislation, it is in the best interests of all stakeholders to coordinate the non-LWR vision and strategy of both agencies. Where appropriate, the NRC report identifies coordination points or milestones that are complementary to the DOE strategic activities.

2.0 BACKGROUND

Industry interest in the use of non-LWRs for commercial purposes has varied since the last domestic commercial non-LWR ceased operations in 1989. DOE has provided support for non-LWRs through its laboratory research and development (R&D) programs, the Global Nuclear Energy Partnership (GNEP) and the Next Generation Nuclear Plant (NGNP) program mandated by the Energy Policy Act of 2005. More recently, as interest in non-LWR designs has grown, an interest in the ability of the NRC to review and regulate these technologies has also grown.

One facet of this growing interest is understanding the roles and responsibilities of the NRC and the DOE. The division of responsibilities between the organizations is clear. The NRC mission

[5] *See* http://www.nrc.gov/reading-rm/doc-collections/commission/policy/73fr60612.pdf

is to license and regulate the civilian use of nuclear materials to ensure adequate protection of public health and safety, to promote the common defense and security, and to protect the environment.

The DOE mission is "…to ensure America's security and prosperity by addressing its energy, environmental and nuclear challenges through transformative science and technology solutions." The Energy Policy Act of 2005[6] reaffirmed DOE's responsibilities to conduct research and development (R&D) programs comprising civilian nuclear energy research, development, demonstration, and commercial application. Program objectives included enhancing nuclear power's viability as part of the United States' energy portfolio, and supporting technology transfer and other appropriate activities to assist the nuclear energy industry, and other users of nuclear science and engineering, including activities addressing reliability, availability, productivity, component aging, safety, and security of nuclear power plants. Two examples of DOE's non-LWR support and development programs are the Advanced Test/Demonstration Reactor study issued in spring 2016 and DOE participation in the administration's Gateway for Accelerated Innovation in Nuclear (GAIN) program.

In short, the DOE civilian nuclear program mission is oriented towards R&D and nuclear technology promotion activities. The NRC is an independent regulator, focused on protecting public safety, security, and the environment, regardless of the reactor technology being considered.

2.1 AEC and NRC Historical Non-LWR Licensing Experience

The NRC and its predecessor agency, the Atomic Energy Commission (AEC), have significant historical experience with non-LWR designs dating back to the construction and operation of the first experimental breeder reactor in 1951 and the establishment of an experimental reactor program in 1954.[7] While the bulk of the regulatory and coordination activities for these non-LWR designs occurred prior to 1975, the NRC reviewed a variety of conceptual designs, at varying levels of detail, between 1978 (Hanford Fast Flux Test Reactor) and 2010 (pebble bed modular reactor (PBMR) and General Electric-Hitachi (GEH) PRISM). Unlike the AEC, the NRC has not licensed a commercial non-LWR NPP for construction or operation. More recently, in February 2016, the NRC reviewed and approved a construction permit for a new and innovative medical isotope production facility submitted by SHINE Medical Technologies, Inc. (the "SHINE" facility).[8] This project demonstrated the NRC's ability to review new and innovative facility designs.

A review of the AEC's and NRC's historical experience in reviewing non-LWRs can provide insights on how best to incorporate past review experience when developing future review processes. The AEC and the NRC reviewed 20 non-LWR projects between 1951 (EBR-1) and 2010 (PBMR and GEH PRISM). Six of the projects were reviewed and licensed for operation by the AEC and four were licensed for operation by DOE. The NRC performed various staff

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6 42 U.S.C.§ 16271, Energy Policy Act of 2005, Title IX - Research and Development, Subtitle E – Nuclear Energy, August 8, 2005

7 *See* "The Atomic Energy Commission," A. Buck, July 1983, U.S. Department of Energy, http://energy.gov/sites/prod/files/AEC%20History.pdf

8 "NRC to Issue Construction Permit for SHINE Medical Isotope Facility," NRC News, February 25, 2016 (ADAMS Accession No. ML16056A148)

reviews on the remaining projects after 1975 but did not grant construction or operating licenses for any of them, due to factors such as application withdrawals by applicants and DOE program cancellations.

Three commercial non-LWRs have been built and operated in the United States. These plants were licensed by the AEC using a construction permit (CP) and an operating license (OL) licensing process. The first was Fermi 1, a 200 megawatts thermal (MWt) sodium-cooled reactor located near Newport, Michigan, which received a Construction Permit in 1956 and operated from 1963 to 1972. The second was Peach Bottom 1, a 115 MWt high temperature gas-cooled reactor (HTGR) located near Delta, Pennsylvania, which was constructed between 1961 and 1963 and operated between 1967 and 1974.[9] The third non-LWR plant was Fort St. Vrain, a 330 MWe HTGR, located approximately 35 miles north of Denver, Colorado. The plant was constructed between 1968 and 1974 and operated until 1989, when it was permanently shut down.[10]

The AEC (and later, the DOE) also built and operated several research and test non-LWRs, such as the Experimental Breeder Reactors (EBR-I and EBR-II) and the Molten-Salt Reactor Experiment, which provided additional non-LWR operational experience to the DOE, industry, plant designers, and the NRC.

In 1975, the NRC was established and docketed its first construction permit application for the Clinch River Breeder Reactor Plant (a liquid sodium-cooled fast breeder demonstration reactor) in Oak Ridge, Tennessee. The staff performed the required safety and environmental reviews and issued a safety evaluation report (SER) for the plant in March, 1983.[11] Public hearings for issuance of the NRC construction permit were also held in 1983. Following the October 1983 vote in Congress to deny additional funds for the project, the applicant cancelled the project and no construction permit was issued.

In the late 1980s and early 1990s, the NRC conducted preapplication reviews of other non-LWR vendor designs. At the end of the reviews, the staff issued preapplication safety evaluation reports (PSERs). The staff's final PSER for the PRISM project is an example.[12] The practice of conducting preapplication reviews was guided by the NRC Policy Statement on Advanced Reactors described in NUREG-1226, "Development and Utilization of the NRC Policy Statement on the Regulation of Advanced Nuclear Power Plants."[13] The issuance of PSERs allowed designers of innovative technologies to obtain a preliminary assessment from the NRC on whether that design could meet the applicable licensing criteria and allowed for the NRC staff to obtain experience in the technology prior to the review of an actual application.

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9 *See* NRC public website at http://www.nrc.gov/info-finder/decommissioning/power-reactor/peach-bottom-atomic-power-station-unit.html

10 NUREG/CR-6839, "Fort Saint Vrain Gas Cooled Reactor Operating Experience," January 2004 (ADAMS Accession No. ML040340070)

11 NUREG-0968, Vol. 1, "Safety Evaluation Report related to the construction of the Clinch River Breeder Reactor Plant," March 1983 (ADAMS Accession No. ML0802380939)

12 NUREG-1368, "Preapplication Safety Evaluation Report for the Power Reactor Innovative Small Module (PRISM) Liquid-Metal Reactor," February, 1994 (ADAMS Accession No. ML063410561)

13 NUREG-1226, "Development and Utilization of the NRC Policy Statement on the Regulation of Advanced Nuclear Power Plants, June 1988 (ADAMS Accession No. ML13253A431)

The required contents of a conceptual design submitted for NRC review by a potential applicant during preapplication are not specifically defined in 10 CFR Part 50 or in Part 52. As described in this report, in the near-term the NRC is currently evaluating the development of procedures and guidance (similar to NUREG-1226) in two specific areas, conduct of conceptual design assessment and development of a staged regulatory review process. Activities in both of these areas are initially expected to be within the scope of the current regulations, with possible development of a revised regulatory framework for non-LWRs in the long-term.

3.0 DISCUSSION

3.1 Current Non-LWR Regulatory Review Capability

The NRC is fully capable of reviewing and reaching a safety, security, or environmental finding on a non-LWR design if an application were to be submitted today. However, the agency has also acknowledged the potential inefficiencies for non-LWR applications submitted under 10 CFR Part 50 or Part 52 that are reviewed against existing LWR criteria, using LWR-based processes, and licensed through the use of regulatory exemptions and imposition of new requirements where design-specific review, analysis, and additional engineering judgement may be required.

The vision and strategy described in this report is intended, once implemented, to address these potential inefficiencies and to provide increased regulatory certainty to non-LWR stakeholders. It will guide the development of Implementation Action Plans (IAPs) during Phase 2 that support achievement of the agency's overarching strategic goals and objectives, including assuring readiness to efficiently and effectively review and regulate non-LWRs.

3.2 "Readiness" for Non-LWRs

In the context of this plan, "readiness" means that the elements needed to conduct the NRC's regulatory operations to support its mission are in place and optimized. These elements are discussed below, and expressed more fully in Section 4.0 of this paper that describes non-LWR strategic objectives, strategies, and contributing activities.

- **People**
  The technical, support, and management staff of the NRC (and its external support resources such as DOE laboratory experts) are critical to achieving the agency's goals and mission. For non-LWRs, the staff must be familiar with a range of potential technologies, must have adequate training support in place, must have a non-LWR knowledge base available, and must have familiarity with system and integrated plant operations. The staff must also be knowledgeable of any unique environmental or security challenges posed by a particular non-LWR technology. While many aspects of non-LWR designs may be technology-neutral (that is, independent of the particular non-LWR technology being reviewed), subject matter expertise for technology-specific aspects of the designs is also required. The NRC must have the right number of people with the right skills at the right time in order for the staff to conduct an effective and efficient review.

- **Processes**
  The staff must have established work processes, procedures, and internal guidance established and available to conduct independent safety, security, and environmental reviews for non-LWRs. These processes need to reflect unique aspects of non-LWR technologies, which fundamentally differ from LWR designs.

- **Organization and Infrastructure**
  An efficient and effective organizational structure is necessary to enable the staff to perform their work within the required timeframes. The structure must be adaptable and flexible to enable the best use of staff resources. Examples of possible structures include Centers of Expertise, discipline-based organizations, and project-based matrix organizations. Adequate infrastructure, such as information technology platforms and systems, and project management systems with sufficient capacity to manage non-LWR task planning and execution, are basic requirements for readiness.

- **Tools**
  The staff must have adequate computer models and other analytical resources to conduct its review of non-LWR designs in an independent manner.

- **Policies**
  The staff must have policy decisions in place to govern the acceptability of non-LWR designs. Examples of these policy issues may include emergency preparedness requirements for high-safety, low-consequence designs, and commercial concerns such as NRC fees and insurance requirements.

- **Decision Criteria**
  Criteria must be established for non-LWRs that allow the staff to reach a safety, security, and environmental finding for a particular technology and design. Processes alone will not produce a result absent appropriate decision criteria. The NRC plans to develop a regulatory framework for non-LWRs, including defining decision criteria recognizing the differences in reactor designs. To the degree possible, the NRC framework will consider previous efforts, consensus codes and standards, and international standards. The framework and decision criteria will also be developed recognizing the goals and objectives of possible non-LWR applications.

- **Transparency and Clarity of Requirements**
  Non-LWR potential applicants and other stakeholders need to know and understand what the NRC requires from them to reach a successful safety, security, or environmental finding, as well as what requirements must be met throughout the NPP life cycle.

- **Communication**
  The NRC must ensure that it has effective means of exchanging information with its stakeholders, using a variety of channels and messages appropriate for target audiences. This information ranges from general regulatory or industry topics of public interest, to specific guidance that is available to potential applicants to assist in preparing and presenting non-LWR applications for review by the NRC. The ongoing series of NRC/DOE non-LWR workshops is an example of effective communication exchange.

3.3 Non-LWR Technologies that the NRC Should Be Prepared to Review

The NRC, like other organizations, has a finite set of resources available to prepare for and execute its mission. There are currently many non-LWR technologies under development in the private sector or in partnership with DOE. Which non-LWR technologies should the NRC be prepared to review?

Consistent with its mission, the NRC is not chartered to favor one particular nuclear technology over another. But, the NRC does have some means to assess non-LWR technologies and to prioritize which particular technologies are more likely to become ready for the agency's regulatory reviews.

First, the agency has opportunity for direct contact with a wide range of industry stakeholders, including the Nuclear Energy Institute (NEI) and non-LWR vendors interested in engaging in the regulatory review process in a variety of public fora. Of particular note, the NRC provides an annual Regulatory Issue Summary (RIS) to LWR and non-LWR stakeholders to collect industry feedback on their design readiness and timeframes in which they expect to engage the NRC.

Second, the NRC communicates frequently with the DOE and receives DOE feedback on non-LWR designs that appear to be maturing. Also, DOE periodically supports Funding Opportunity Announcements (FOAs) for non-LWR technology demonstration projects and the NRC is able to benefit from the DOE assessment of FOA applicants once the information has become public.

Finally, the NRC maintains awareness of international non-LWR activities through extensive interactions with international organizations. These include the International Atomic Energy Agency (IAEA) and the Nuclear Energy Agency (NEA). The NRC also has bilateral agreements with China, France, and Japan to share non-LWR operating experience.

The goal of these interactions is to provide the NRC with insights that will lead to the most efficient and effective application of its resources when considering non-LWR activities and applications.

4.0 NRC MISSION, VISION, NON-LWR STRATEGIC GOAL, AND STRATEGIC OBJECTIVES

4.1 Alignment with the NRC Strategic Plan

The NRC vision and strategy for reviewing and regulating non-LWR designs align with the agency Strategic Plan by adopting a common mission, vision, and structure. That structure is shown in Figure 1.

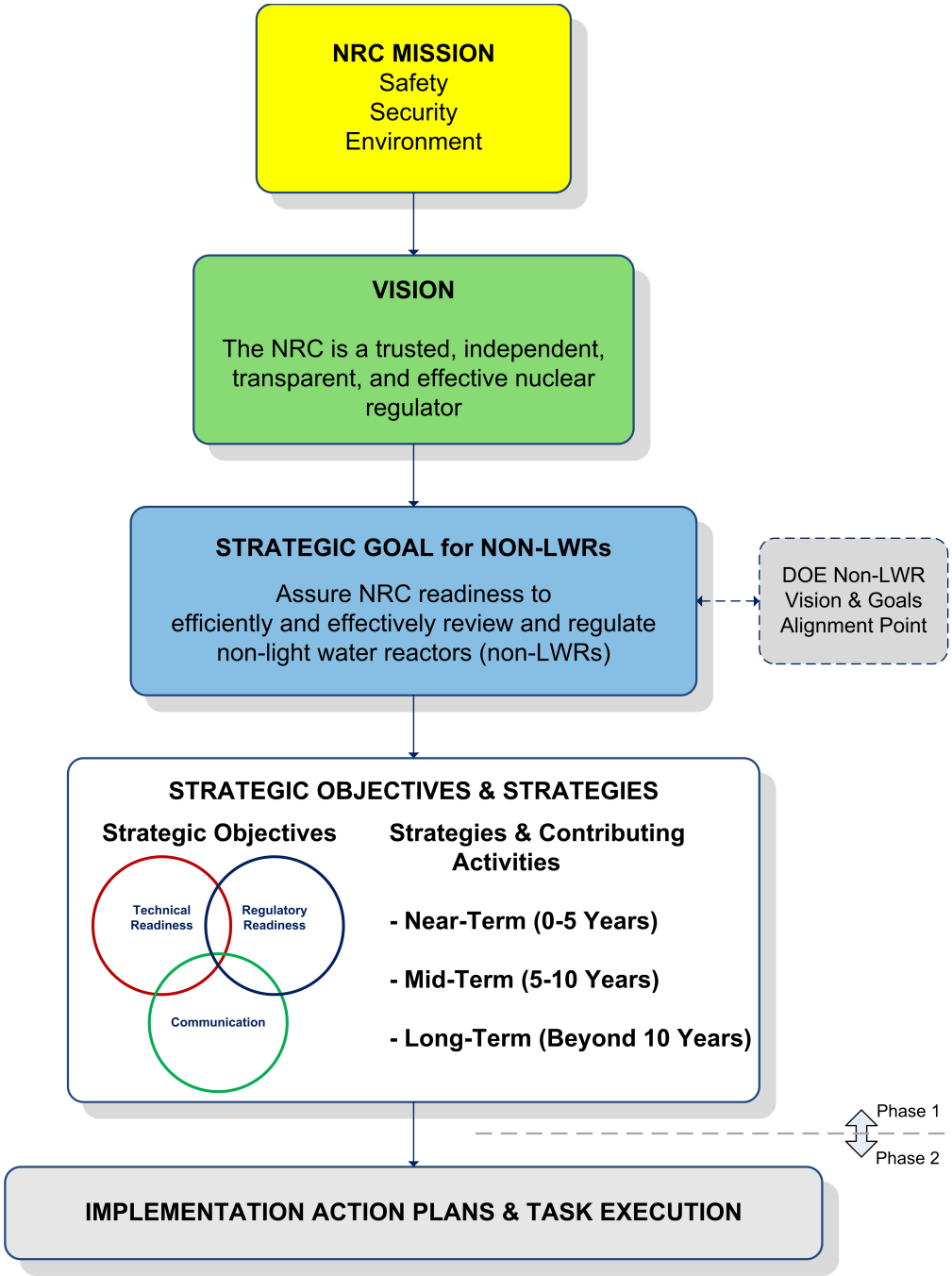
Figure 1

4.2 Non-LWR Vision and Strategy (the “Roadmap”)

The NRC non-LWR vision and strategy is organized into two distinct phases of work. Phase 1 includes development of the non-LWR strategic goals, objectives, strategies, and contributing activities at a conceptual level. The strategies and contributing activities necessary to achieve the strategic objectives are binned in near-term (0-5 years), mid-term (5-10 years) and long-term (beyond 10 years) timeframes. These strategies and activities are expected to be initiated during the identified timeframes, and may carry over as longer-term work actions when necessary. Phase 1 also includes opportunities for public feedback, appropriate alignment of the conceptual level vision and strategy with staff senior management and executive management, and informing the Commission of the staff’s plans.

Phase 2 of the non-LWR vision and strategy includes development of IAPs, coordination with agency budget formulation activities, task authorization, and task execution. The IAPs will include implementation-level details that flow down from the Phase 1 strategies and contributing activities, jobhour estimates, estimated work durations, expected staff support needs by organization, and other work breakdowns sufficient to support agency work planning and task execution efforts. Figure 2 shows the organization of this vision and strategy, called the “NRC Non-LWR Mission Readiness Roadmap.”

Figure 2
NRC Non-LWR Mission Readiness Roadmap



4.3 Non-LWR Strategic Goal and Objectives

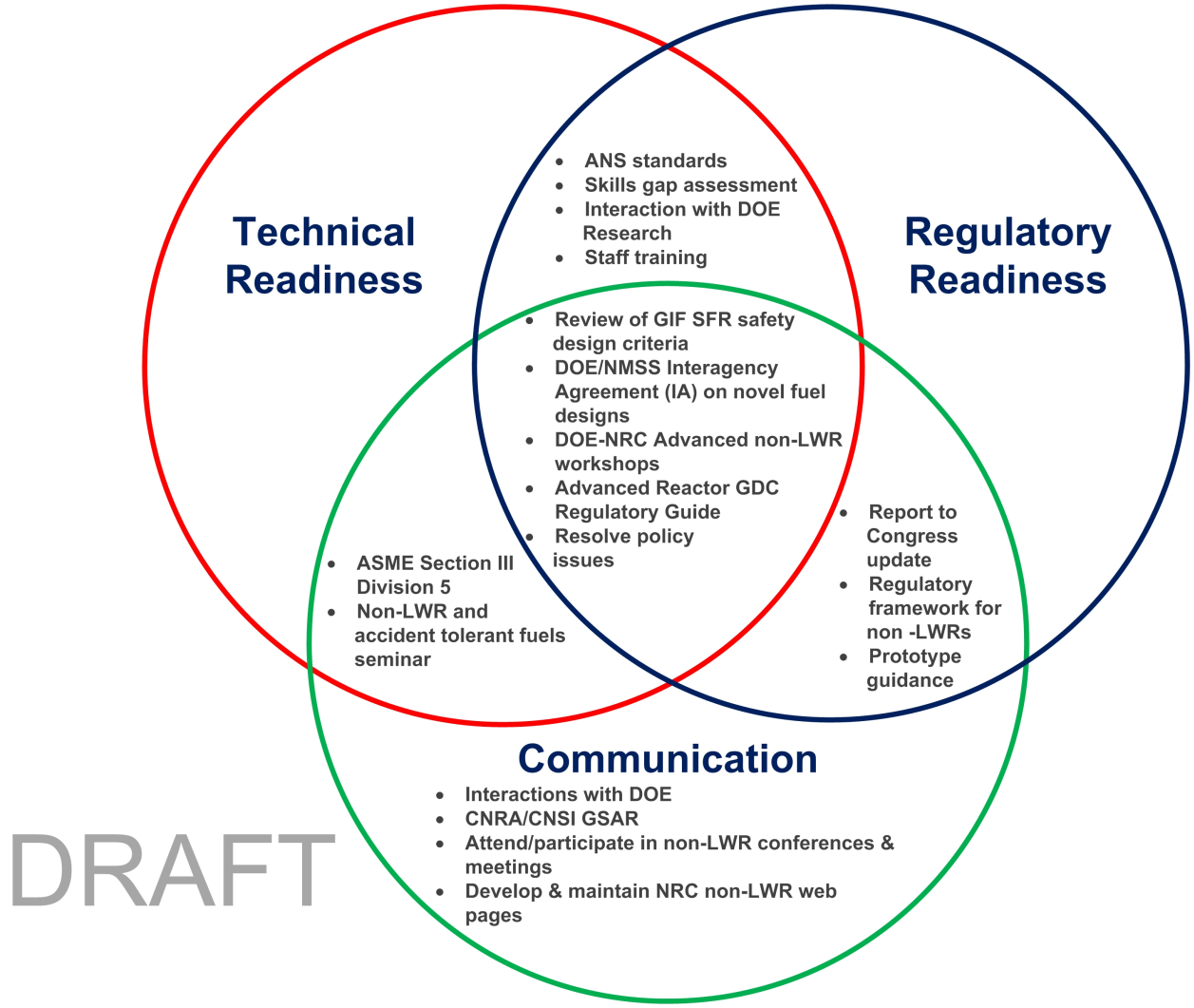
The NRC strategic goal for this effort is to assure NRC readiness needed to efficiently and effectively review and regulate non-LWRs. Readiness in this usage means readiness in all aspects of regulatory operations.

Timing is also an important dimension of readiness. The NRC must consider and balance an array of factors when setting readiness timing targets. These factors include: the maturity of industry and when non-LWR designs may be ready for regulatory reviews; the DOE vision and strategy goals for non-LWR deployment; the availability and development of qualified staff subject matter experts; the market demand for non-LWR power or process heat; and the availability of budgetary resources to convert readiness planning to action. These factors are likely to change as the staff makes efforts to accomplish its strategic objectives, and planning efforts must be flexible to accommodate changes as they occur. Readiness timing is discussed further in Section 6.0.

The staff established and facilitated an expert-based, multi-discipline working group to identify key strategies and contributing activities required to achieve the NRC non-LWR strategic goal. The group conceptually identified the work required to support each of the three strategic objectives: 1) Enhance Technical Readiness; 2) Optimize Regulatory Readiness; and 3) Optimize Communication.

Figure 3 identifies the three strategic objectives with examples of activities either completed or underway. Note that the strategies and contributing activities can support more than one strategic objective.

FIGURE 3 – STRATEGIC OBJECTIVES AND EXAMPLE SUPPORTING ACTIVITIES



Each strategic objective is further discussed in the following paragraphs.

Enhance Technical Readiness

The NRC staff currently has the technical capacity to review and regulate non-LWRs. However, specific technical knowledge, skills, and tools should be enhanced in order to improve the efficiency and effectiveness of this work in the future.

This objective will be met when the staff has the requisite knowledge, expertise, tools, and processes needed to efficiently and effectively evaluate a non-LWR application, and to reach an independent safety, security, or environmental finding. Activities addressed for this objective include training; knowledge capture and knowledge management; development of analytical

tools; staff capacity planning; and long-range staff development. Identification and resolution of policy issues applicable to non-LWRs must also be addressed.

Optimize Regulatory Readiness

Regulatory review processes are optimized when the resources of the NRC and potential applicants are efficiently and effectively used in a way that meets NRC requirements in a manner commensurate with the risks posed by the technology, that maximizes regulatory certainty, and that considers the business needs of potential non-LWR applicants. Additional options for long-range changes for non-LWR regulatory reviews and oversight that would require rulemaking will also be considered. Regulatory readiness includes the clear identification of NRC requirements and the effective and timely communication of those requirements to potential applicants in a manner that can be understood by stakeholders with a range of regulatory maturity.

Optimize Communication

The NRC will optimize its communication with non-LWR stakeholders by disseminating clear expectations and requirements for non-LWR regulatory reviews and oversight. These expectations and requirements will be expressed using multiple channels of communication appropriate to different stakeholder interests. NRC messaging will be consistent and tailored to audiences for maximum communications effectiveness. Stakeholder feedback paths to the NRC will also be optimized to ensure that feedback is received, considered, and addressed in a timely manner, as appropriate.

4.4 Non-LWR Strategies and Contributing Activities

Strategies identify the key areas that will be addressed to accomplish the three strategic objectives: enhance technical readiness; optimize regulatory readiness; and optimize communication. They are intended to be actionable and measurable. Each strategy is supported by a set of Contributing Activities. These activities are more detailed than strategies, and are intended to be a bridge between the relatively high-level strategies and the level of detail needed to create the IAPs during Phase 2.

Note that the Strategies and Contributing Activities shown are not prioritized within the timeframes. These will be prioritized during Phase 2 and development of the IAPs.

Within each time frame, strategies are marked as follows to indicate which objective the topic is primarily aligned with (note that some strategies may apply to more than one objective).

Technical Readiness

Regulatory Readiness

Communication

NEAR-TERM STRATEGIES (0-5 years)

Acquire/develop sufficient knowledge, technical skills, and capacity to perform non-LWR regulatory reviews.

Contributing Activities:

- Prioritize the non-LWR technologies most likely to achieve regulatory review readiness (including non-LWR test or prototype reactors), using inputs from DOE, industry, the public, academia, and international organizations.
- Establish and maintain an inventory of staff non-LWR technical skills and externally available sources of technical expertise, as part of the NRC's ongoing strategic workforce plan (SWP) efforts.
- Identify critical skills gaps and prepare gap closure plans as part of the SWP.
- Engage in international activities with regulatory counterparts and research organizations to obtain experimental data and exchange information on regulatory issues.
- Enhance the NRC's knowledge capture and knowledge management programs to provide complete non-LWR historical resources to the staff.
- Establish agreements, memoranda of understanding, etc., as necessary to obtain non-LWR technical information from external sources, such as the DOE national labs and international organizations.

Acquire/develop sufficient computer codes and tools to perform non-LWR regulatory reviews.

Contributing Activities:

- Prioritize the non-LWR technologies most likely to achieve regulatory review readiness, using inputs from DOE, industry, academia, and international organizations.
- Leverage the experience available from DOE, academia, international counterparts, and industry to determine non-LWR computer codes and tools state-of-the-art.

Establish a more flexible, risk-informed, performance-based, non-LWR regulatory review process within the bounds of existing regulations, including the use of conceptual design reviews and staged-review processes. This flexibility will accommodate potential applicants having a range of financial, technical, and regulatory maturity, and a range of application readiness.

Contributing Activities:

- Establish the criteria necessary to reach a safety, security, or environmental finding for non-LWR applicant submissions. The criteria and associated regulatory guidance are available to all internal and external stakeholders.
- Determine appropriate non-LWR licensing bases and accident sets for highly prioritized non-LWR technologies.
- Identify and resolve current regulatory framework gaps for non-LWRs.
- Develop a regulatory review "roadmap" that reflects the design development lifecycle and appropriate points of interaction with the NRC, and references appropriate guidance to staff reviewers and applicants.
- Provide updated prototype reactor guidance.
- Engage reactor designers and other stakeholders regarding technology- and design-specific licensing project plans and develop regulatory approaches commensurate with the risks posed by the technology.

Facilitate industry codes and standards needed to support the non-LWR life cycle (including fuels and materials).

Contributing Activities:

- Work with stakeholders (standards organizations, vendors, etc.) to determine and clarify the applicability of codes, standards, and criteria needed for non-LWRs.
- Participate with key standard formulation organizations such as ASME, ANS, and IEEE to develop appropriate standards.

Identify and resolve technology-neutral policy issues that impact the regulatory reviews, siting, permitting, and/or licensing of non-LWR nuclear power plants (NPPs).

Contributing Activities:

- Determine the applicability of previously identified policy issues to non-LWRs
- Identify additional technology-neutral policy issues for non-LWRs.

Develop and implement a structured, integrated strategy to communicate with internal and external stakeholders having interests in non-LWR technologies.

Contributing Activities:

- Provide timely, clear, and consistent communication of the NRC requirements, guidance, processes, and other regulatory topics, and provide multiple paths for external feedback to the NRC.
- Develop consistent NRC messaging suitable to a range of audiences.
- Promote the exchange of non-LWR technical and regulatory experience with the NRC international counterparts and industry organizations.
- Include an educational component in the strategy to provide facts about the NRC mission and responsibilities, and to address stakeholder misperceptions, using the communication channel most appropriate to the target audience.

MID-TERM STRATEGIES (5-10 years)

Identify and resolve technology-specific policy issues that impact the regulatory reviews, siting, permitting, and/or licensing of non-LWR NPPs.

Contributing Activities:

- Activities are dependent on the maturity of specific non-LWR technologies

Continue to acquire/develop sufficient technical skills and capacity to perform regulatory reviews and to conduct oversight of non-LWRs.

Contributing Activities:

- Incorporate non-LWR regulatory review experience and technology-specific review lessons learned into staff and applicant guidance.
- Prepare to conduct regulatory reviews and oversight of non-LWR test or prototype reactors.
- Adapt construction inspection and the construction reactor oversight process to non-LWRs.

Initiate and develop a new non-LWR regulatory framework[14] that is risk-informed, performance-based, and that features staff review efforts commensurate with the demonstrated safety performance of the non-LWR NPP design being considered.

Contributing Activities:

- Review non-LWR regulatory experiences to identify changes needed to the existing regulatory framework based on NRC experience and stakeholder feedback.

LONG-TERM STRATEGIES (greater than 10 years)

Continue development, finalize, and promulgate a new non-LWR regulatory framework (if needed) that is risk-informed, performance-based, and that features staff review efforts commensurate with the demonstrated safety performance of the non-LWR NPP design being considered.

Contributing Activities:

- To Be Developed

4.5 Development of Implementation Action Plans

Phase 2 of the non-LWR vision and strategy includes development of IAPs, and will be coordinated with agency budget formulation activities, task authorization, and task execution. The IAPs will include: the identification of detailed tasks to be performed; preparation of jobhour estimates; estimated work durations; expected participants by organization; and other work breakdowns sufficient to support agency work planning and execution efforts. The IAP development will be incorporated into and managed within the NRC's normal planning and budgeting processes.

4.6 Execution of Implementation Action Plan Tasks

Once authorized for implementation, IAP tasks will be executed based on factors such as: NRC resource availability; the maturity and readiness for review of non-LWR technologies and vendors; task schedule logical dependencies; and the specific needs of the non-LWR

[14] A new regulatory framework could be helpful to potential applicants and to the NRC staff assessing different reactor technologies. The current framework was developed to support licensing LWRs and includes specific technical requirements to address those designs. Non-LWR designs include the use of fuel types, coolants, passive safety features, and other design features that are significantly different from LWRs. The behavior of such plants during plant transients or accidents generally provide longer time constants and result in significantly different risk profiles in terms of probabilities and consequences of design-basis, beyond-design-basis, and severe accidents. Previous NRC and industry efforts have concluded that a revised framework could better integrate risk-insights, address technological differences, and align with various industry and international standards.

stakeholders. Successful completion of the IAP tasks, as measured by the NRC's readiness to efficiently and effectively review and regulate non-LWRs, will be a multi-year effort.

5.0 NON-LWR REGULATORY REVIEW OPTIONS AND FLEXIBILITIES

5.1 Engaging the NRC in the Regulatory Review Processes

The Advanced Reactor Policy Statement states:

> "To provide for more timely and effective regulation of advanced reactors, the Commission encourages the earliest possible interaction of applicants, vendors, other government agencies, and the NRC to provide for early identification of regulatory requirements for advanced reactors and to provide all interested parties, including the public, with a timely, independent assessment of the safety and security characteristics of advanced reactor designs. Such licensing interaction and guidance early in the design process will contribute towards minimizing complexity and adding stability and predictability in the licensing and regulation of advanced reactors."

The NRC has worked with designers and DOE on several non-LWR designs in accordance with the policy statement and provided varying degrees of feedback on designs and testing programs related to the development of non-LWR designs. Examples include the NRC staff review and issuance of preapplication safety evaluation reports for liquid-metal and gas-cooled reactor technologies.[15,16] There are also numerous examples of less formal interactions with specific reactor designers.

The NRC interacts with licensees, applicants, potential applicants, industry and professional organizations, and the public in a variety of ways. The appropriate type of interaction is dependent on the level of technical information, the desired regulatory conclusions, and the resources available to the NRC staff and other involved parties. The use and timing of the various types of interactions provide flexibility for potential applicants at any stage of the reactor and NPP design process and can be used to the mutual benefit of many stakeholders. These interactions and approaches are summarized below.

Early Preapplication Interactions - Early engagement between potential applicants and the NRC staff is particularly valuable. These interactions may be during scheduled public meetings, drop-in meetings, and at industry events, workshops, or conferences where open information exchange can be facilitated. These types of meetings can be particularly helpful to the staff, reactor designers, and industry stakeholders in the early stages of design development.

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[15] NUREG-1368, "Preapplication Safety Evaluation Report for the Power Reactor Innovative Small Module (PRISM) Liquid-Metal Reactor," February 1994 (ADAMS Accession No. ML063410561)

[16] NUREG-1338, "Draft Preapplication Safety Evaluation Report for the Modular High-Temperature Gas-Cooled Reactor," March 1989 (ADAMS Accession No. ML052780497)

Meetings - Meetings with the NRC staff can provide timely feedback on design options and support on-going reviews of submitted material. The feedback can range from preliminary questions, sharing regulatory perspectives, or finalizing needed information to complete a more detailed review. Unless involving sensitive information (e.g., proprietary or security-related), meetings with the NRC staff are usually open to the public. Meeting summaries are prepared to document the interactions but rarely are used to document regulatory decisions.

Preliminary Design Documents - Preliminary, conceptual or preapplication design documents can be provided to the NRC for information or, more formally, to solicit feedback on testing programs, safety analysis approaches, or the overall feasibility of licensing a design. The preapplication design documents and related NRC reviews in the late 1980s and early 1990s involved essentially complete plant designs. More recent preapplication submittals have tended to focus on more general plant designs and on limited scope specific design features (e.g., fuel design).

Correspondence, White Papers, and Technical Reports - Letters and reports outlining potential policy or technical positions can be used to provide information to the NRC staff and to solicit regulatory assessment. These types of reports (often referred to as white papers) are typically used for general information (e.g., a plan describes a reasonable schedule), or to request a preliminary regulatory response (e.g., a submittal template describes a reasonable approach to a submittal. Note that staff responses for these types of documents are generally less specific and provide less regulatory certainty than responses for more formal documents such as topical reports and application submittals. These documents may be submitted during pre-application activities with the NRC (see “Preapplication Design Documents,” above), or post-application.

Topical Reports (TRs) - A topical report is a stand-alone report containing technical information about a reactor or NPP safety topic that can be submitted to the NRC for its review and approval. TRs improve the efficiency of the licensing process by allowing the staff to review proposed methodologies, designs, operational requirements, or other safety-related subjects on a generic basis so that they may be implemented by reference by multiple U.S. applicants or licensees, once approved by the NRC staff. An NRC-approved TR can provide a technical basis for a licensing action. TRs have traditionally been used to obtain NRC approval for the design of key structures, systems, and components (SSCs), methodologies, and computer codes and models, particularly used to evaluate design-basis accidents.

Rulemaking and Regulatory Guidance Development – Stakeholder feedback is requested and considered when the NRC is preparing new or revised regulations, or regulatory guidance documents. Industry guidance documents and consensus codes and standards can be approved as acceptable approaches within NRC regulations or regulatory guidance.

Regulatory reviews of applications under 10 CFR Parts 50, 52, and 70 - Applications submitted in accordance with NRC licensing regulations include:

- <u>Design</u>
    - Standard Design Approval (Part 52, Subpart E)

- Standard Design Certification (Part 52, Subpart B)
- Manufacturing License (Part 52, Subpart F)

- Siting
  - Preapplication Early Review of Site Suitability Issues (Part 50, Appendix Q)
  - Early Site Permit (Part 52, Subpart A)

- Design, Siting, Construction and Operation (NPPs, Research Reactors, Test Reactors, Prototype Reactors)
  - Construction Permit (Part 50)
  - Operating License (Part 50)
  - Combined License (Part 52, Subpart C)
  - Fuel Fabrication Facility Construction and Operation License (Part 70)

The appropriate combinations of the above interactions and applications for a particular non-LWR design depend on the maturity of the design, the longer-term plans for completing the design and constructing the first unit, ability to construct, expectations for construction of units following the first unit, the availability of resources, and many other factors. The flexibility provided by the different interactions and applications can address different circumstances involving the design and construction of a non-LWR reactor. Applicants, potential applicants, licensees, and NRC staff need to coordinate during all phases of designing, testing, licensing, constructing, inspecting, and operating a new nuclear power plant.

Development plans that include the construction and operation of a new research facility requiring NRC licensing (e.g., test reactor facility) require special coordination with the NRC. Many of the options and tools described below for a commercial non-LWR reactor would also apply to a testing or research facility, the licensing of which is a major activity in and of itself. The possible need for a test reactor or other use of special nuclear material or byproduct material by the reactor designer can be a significant part of the licensing plan for the commercial non-LWR design. For the purpose of the examples described below, the NRC assumes that testing can be accomplished with existing licensed facilities (e.g., research or test reactors) or DOE facilities (e.g., the Advanced Test Reactor at the Idaho National Laboratory (INL)).

Regardless of the approval or licensing strategy established by the prospective applicant, the development of a regulatory review plan by the vendor/designer and the NRC should be developed early in NRC engagement activities.

5.2 Non-LWR Regulatory Review Options

There are currently two regulatory review options available in existing regulation for NPP approval; a “two-step” process consisting of a construction permit (CP) and operating license (OL) applications under 10 CFR Part 50, or a “one-step” process for a combined license (COL) that allows construction and preparations for operation based on a complete design under 10 CFR Part 52. For the Part 52 review path, an applicant completing the required design work prior to application may expend a significant percentage of the development efforts prior to application submittal. For the Part 50 review path, less design information (hence, a smaller percentage of the total design effort) is required for the CP; however, a potential owner and site is needed for the application, and construction is started before the operating license is granted.

The NRC is evaluating options that provide a “best-fit” regulatory review path for prospective non-LWR applicants in the near-term that could offset some development and financial risk by providing early regulatory feedback to prospective applicants. These options are based on flexibilities within the existing regulations but that may require additional guidance documents to be developed. One example could be an update of NUREG-1226 to provide additional preapplication guidance for early regulatory feedback requests. Long-range regulatory changes that may require rulemaking in the future will also be evaluated if there is a demonstrated need for broader changes to the non-LWR regulatory framework for non-LWR designs, once additional non-LWR regulatory review experience has been accumulated.

The NRC has identified two near-term options to be considered by prospective non-LWR applicants when developing their regulatory review strategy. The first is the use of an early feedback process called a conceptual design assessment (CDA). The second is the use of a staged-review process as part of a standard design approval (SDA). Each of these options is described below, and will be more fully developed during the second phase of the non-LWR vision and strategy activities once public feedback is obtained.

5.2.1 Conceptual Design Assessments

Conceptual design assessments (or similar processes) may help designers, DOE, and other stakeholders determine whether or not design and testing programs for a non-LWR will support the eventual approval, certification, or licensing of a plant. The scope of the NRC review findings will be dependent on the design maturity and completeness of the submittals provided, and includes safety, security, and environmental considerations. Business case considerations such as operation economics and investment factors must be evaluated by the applicants and are outside of the NRC responsibilities.

Frequently asked questions about the preapplication review process relate to the costs of NRC reviews and ability to provide timely regulatory feedback for consideration within a broader project plan. The broad range of potential applicants and designs limits the ability to define a single product cost and schedule for the assessment of a conceptual design. Instead, the NRC will work with a designer to establish a mutually agreeable plan for a specific conceptual design that includes a defined scope and level of review, desired outcome in terms of regulatory observations, particular areas of focus, estimated review costs, and review schedules. Periodic project management meetings will be conducted during the independent review process to monitor project progress and costs.

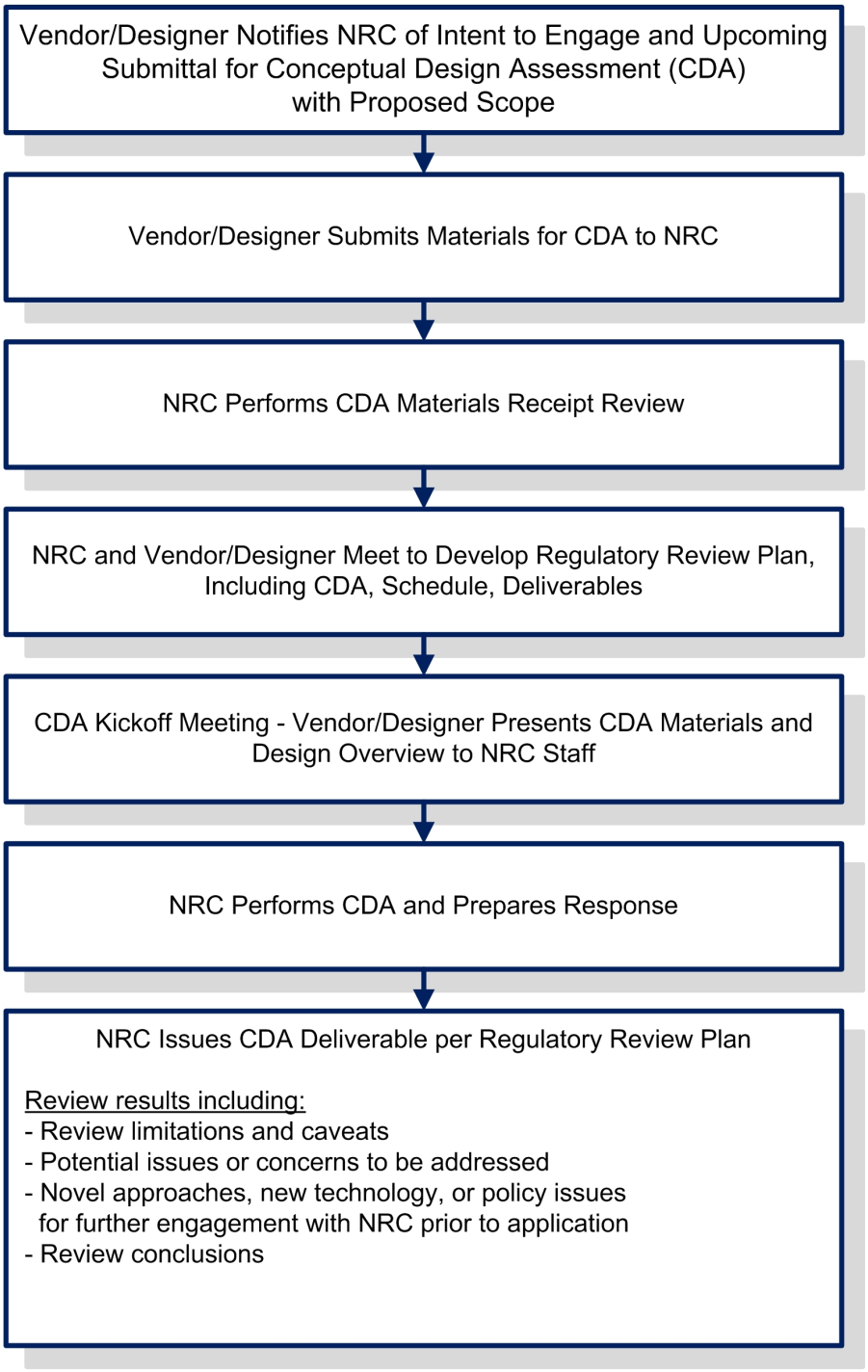
For CDAs where there is a high degree of design completeness, such as the preapplication safety analysis reports previously reviewed, a CDA could result in a statement from the NRC similar to that in the preapplication safety evaluation reports prepared in the 1990s. That is, that the NRC has identified no obvious impediments to the licensing of the subject non-LWR design or major parts of the design provided for review. For conceptual designs with a lesser degree of design maturity, the staff findings would have a commensurate and likely lesser degree of regulatory certainty. If the NRC does identify impediments to licensing during the conceptual design review, that feedback will be also valuable to the potential applicant.

For example, the preapplication safety evaluation reports prepared in the 1990s for liquid-metal and gas-cooled reactor designs helped the NRC identify and develop the needed framework to review non-LWR designs as well as provide confidence in the feasibility of licensing the specific designs. Although circumstances led to those projects being deferred, the NRC's interactions with DOE and the designers identified valuable insights on safety features, research and development programs, and proposed testing needs. The NRC reviews were not meant to result in an approval of the designs, but expectations were that the preapplication efforts would help inform future licensing submittals. The NRC staff were able to conclude at that time that no obvious impediments to licensing the designs had been identified during the reviews.

Prior to submitting a conceptual design for NRC assessment, it is expected that meetings will have been held with the staff to provide a description of the pre-applicant's design and the licensing strategy being pursued. The licensing strategy and conceptual design should then describe the design; relationships to white papers, topical reports, consensus standards, and other activities supporting the design; research and development and confirmatory testing programs; historical and foreign operating experience; and other relevant information. The conceptual design information may include, as available, the principal design criteria being proposed and the acceptance criteria being established for the plant structures, systems and components for normal and abnormal operation, and for a range of possible transients and accidents. Past NRC interactions with non-LWR vendors have included early submittal of white papers on key licensing matters such as licensing-basis event selection and classification of structures, systems and components. The use of such white papers or adoption of related consensus codes and standards can allow the focus of the conceptual design review to be on the actual SSCs included in the plant design.

The goal of the CDA would be to provide an indication, based on vendor statements, of impediments, if any, to eventual licensing and provide feedback on key design features. Once the staff and the vendor agree upon a scope, the vendor would prepare and provide the submittal in the form of a technical report. The vendor should identify, to the extent practical, any novel approaches, new technology, or potential policy issues. After a short-term NRC receipt review, the staff and the vendor would agree upon a regulatory review plan which may include the duration for the staff's assessment and also the feedback and/or statement that would be the target for the assessment. In addition, the staff would identify, to the extent practicable, potential safety, security, or regulatory issues; and any additional novel approaches, new technology, or potential policy issues for which the vendor should engage the NRC prior to application. A sample staff statement for regulatory feedback could be: "If the systems and performance assertions provided in the technical submittal are later demonstrated, then staff does not foresee unsurmountable barriers to an ultimate approval." Figure 4 shows CDA Notional Activities.

Figure 4
CONCEPTUAL DESIGN ASSESSMENT (CDA)
NOTIONAL ACTIVITIES



5.2.2 Staged-Review Process

An NPP vendor or designer can support the regulatory review process prior to an official application using the previously discussed approaches such as conceptual design assessments, meetings, and the submittal of white papers, technical reports, and topical reports. Depending on the level of the staff's review, some of this material can be incorporated by reference (when finalized) into a licensing application or referenced to support material described in an application. The same is true for certain consensus codes and standards or other documents accepted in NRC regulations, regulatory guides, or interim staff guidance.

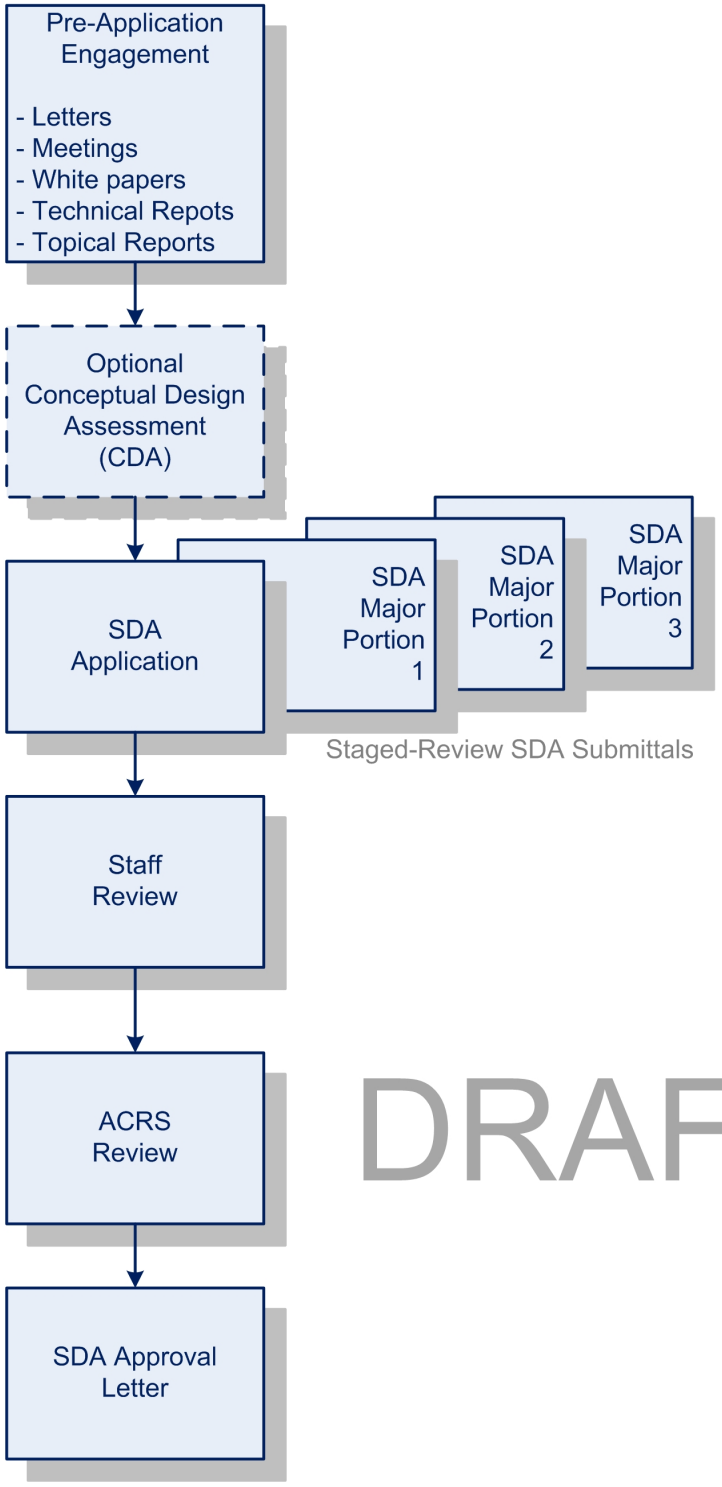
For prospective owner/applicants that have a site selected, the Part 50 process may be advantageous because the development and licensing costs are spread over a wider span of time (a final design is not required for the CP application) than for a Part 52 application, which does require a final design. However, the Part 50 process also requires an OL application after construction, whereas the Part 52 process does not.

For prospective vendor/designer applicants without an identified owner or site, obtaining a standard design certification (DC) or standard design approval (SDA) under Part 52 is the sole application option. For a DC application, the technical content of the application is described in 10 CFR 52.47 and includes a Final Safety Analysis Report (FSAR) for the entire design. For a SDA application, 10 CFR 52.135 describes the option of submitting a final design for major portions of a facility (not a complete design) for approval. The SDA path could thus provide a way to lessen financial risk by allowing a staged submission of major portions of the design for approval, with a final comprehensive SDA issued once the entire design has been submitted and approved.

Note that while the staged-review process using SDAs may allow financial risk to be lessened, possible additional review risks could be incurred. This is driven by the need to integrate the staff's reviews for the SDA major portion submittals (potentially requiring re-submittals and additional staff reviews) to reach a summary conclusion and approval.

Figure 5 illustrates a hypothetical staged SDA submittal and review process.

Figure 5
STAGED-REVIEW PROCESS
PART 52 STANDARD DESIGN APPROVAL PATH (SDA)



6.0 NOTIONAL NON-LWR DEPLOYMENT TIMELINES

The notional schedules shown in this section illustrate two possible development and review scenarios based in part on the DOE's identified goal of having at least two non-LWR designs reviewed by the NRC and ready for construction by the early 2030s.

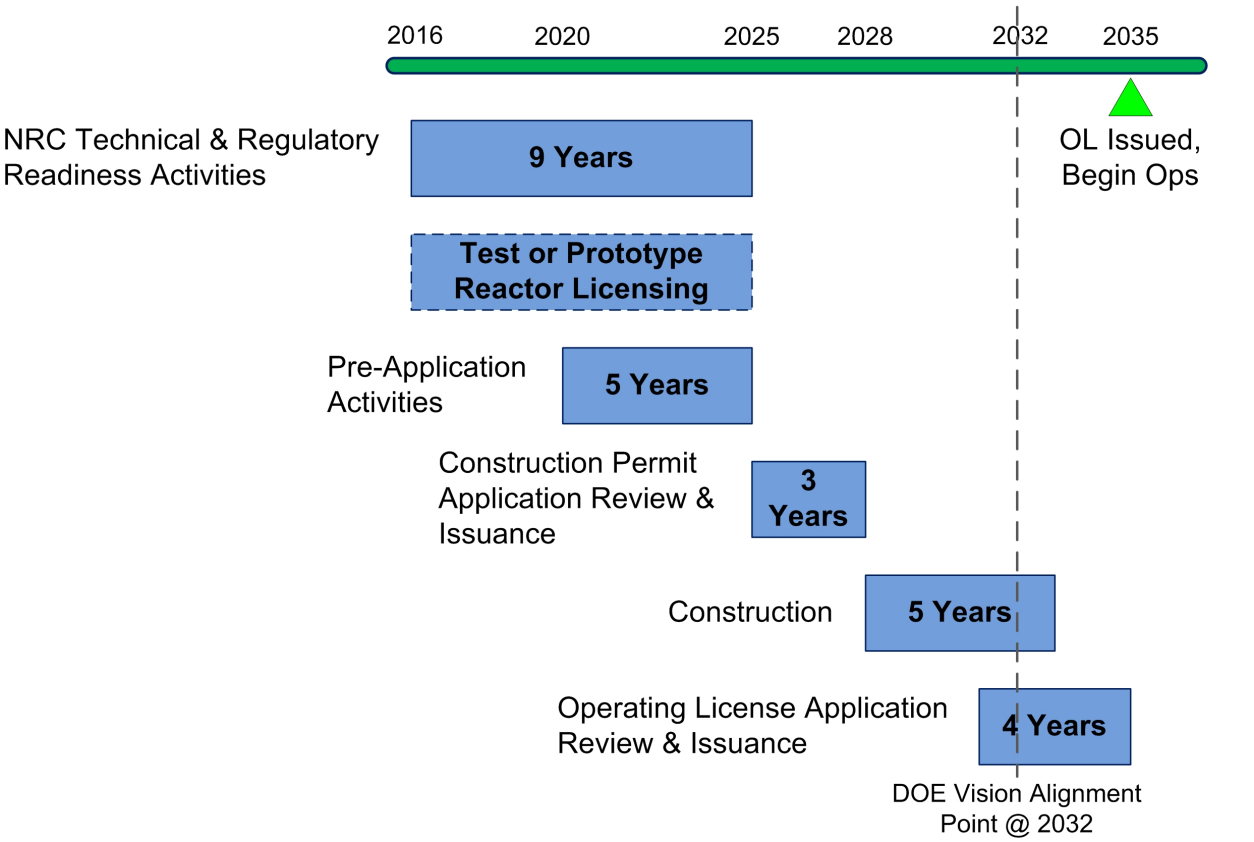
As discussed in Section 4.0, the timing dimension of readiness is key. Per the schedule scenarios in this section, the NRC should be in a position to achieve its strategic goal by not later than 2025 to support the DOE non-LWR constructability goal. The timeframe from 2016 until 2025 will be used to prepare and execute Phase 2 of the agency's non-LWR vision and strategy.

Under current regulations, an application could be presented to the NRC under 10 CFR Part 50 (the "two-step" licensing process) or under 10 CFR Part 52 (the "one-step" licensing process). In either scenario, an applicant may first choose to license a test or prototype reactor for a particular non-LWR technology to obtain operational data, confirm reactor operating characteristic assumptions, or for other purposes. Keeping activity durations similar between scenarios, the overall timeline from application to operations for the Part 50 scenario is shorter than the Part 52 timeline because construction could begin four years earlier than the DOE constructability goal date.

The schedules shown use estimated durations for major activities that are subject to change or confirmation. While these schedules are useful for planning purposes when overlaid against the non-LWR vision and strategies described in this document, it should be noted that a non-LWR vendor could present an application to the NRC for review at any time. The NRC will be able to review the application, but earlier applications would not benefit from the efficiencies gained as the non-LWR vision and strategies are implemented during Phase 2.

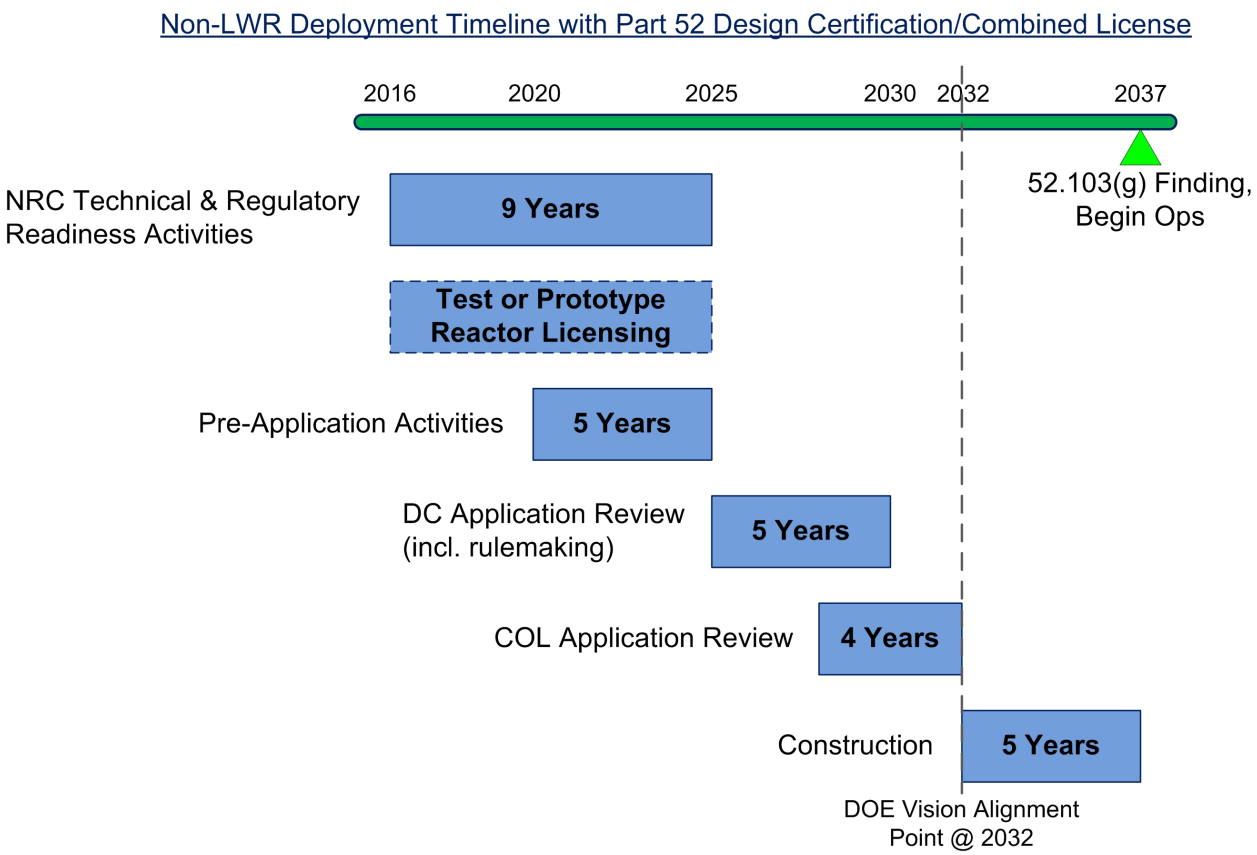
6.1 Possible Non-LWR Deployment Scenario – 10 CFR Part 50

Non-LWR Deployment Timeline with Part 50 Construction Permit and Operating License



Note: The estimated activity durations shown above reflect the longest timeframes allowable in order for the NRC to achieve alignment with DOE's goal of non-LWR deployment (construction) in the early 2030s. They are not to be interpreted as the expected durations for Part 50 or Part 52 non-LWR reviews.

Possible Non-LWR Deployment Scenario – 10 CFR Part 52



Note: The estimated activity durations shown above reflect the longest timeframes allowable in order for the NRC to achieve alignment with DOE's goal of non-LWR deployment (construction) in the early 2030s. They are not to be interpreted as the expected durations for Part 50 or Part 52 non-LWR reviews.

SUMMARY

As the U.S. Nuclear Regulatory Commission (NRC) prepares to review and regulate a new generation of non-light water reactors (non-LWRs), a vision and strategy has been developed to assure NRC readiness to efficiently and effectively conduct its mission for these technologies. The domestic and international non-LWR industries have changed significantly since the last U.S. commercial non-LWR was shut down in 1989 (Fort St. Vrain, a high-temperature gas - cooled reactor (HTGR)). The NRC now operates in an environment where potential non-LWR applicants have a wide and varied range of technical, business, and regulatory experience. Additionally, the non-LWR industry has become globalized and commercial non-LWR plants are being designed, constructed and operated abroad. This international activity provides opportunities for information exchanges between the NRC and its international counterparts about non-LWR operating experience, international codes and standards, and computer modeling techniques and programs.

The NRC could review and license a non-LWR design today, if needed. The agency needs to be effective and efficient as it conducts its safety, security, and environmental protection mission, without imposing unnecessary regulatory burden. This requires the NRC to consider the effects of a more dynamic domestic regulatory environment and a globalized non-LWR industry. Furthermore, the NRC recognizes the benefits of having a flexible regulatory framework, allowing potential applicants to select a best-fit path towards regulatory reviews and decisions. Examples of these flexibilities are described in the report.

The vision and strategy described in this report, once executed, will achieve the goal of assuring NRC readiness to effectively and efficiently review and regulate non-LWRs. The strategy has three strategic objectives: enhancing technical readiness; optimizing regulatory readiness; and optimizing communication. The steps needed to reach the readiness target are described in a series of supporting strategies and contributing activities, to be executed during near-term, mid-term, and long-term timeframes. Example schedules that help inform the vision and strategy implementation with potential non-LWR development, application, construction, and operation timeframes are also discussed. These schedules help align the NRC non-LWR vision and strategy with the Department of Energy (DOE) non-LWR vison and strategy.

The approach has two phases. Phase 1 is the conceptual planning phase used to lay out the vision and strategy, gather public feedback, and finalize the NRC's approach. Phase 2 includes detailed work planning efforts and task execution. Both phases began in 2016, and a target completion date of not later than 2025 has been set for Phase 2.

The NRC principles of good regulation—independence, openness, efficiency, clarity, and reliability—are embodied in this vision and strategy. While the NRC does not promote any particular reactor technology, its responsibilities as a regulator include working effectively with all stakeholders, clearly communicating its requirements, and providing regulatory information and feedback in a timely manner. Above all, the NRC mission remains unchanged but the means to achieve its mission must be optimized. Achieving this non-LWR readiness goal should also provide significant regulatory certainty to the non-LWR industry, potential applicants, and other stakeholders.

7.0 TABLE OF ACRONYMS

ACRS	Advisory Committee for Reactor Safeguards
AEC	Atomic Energy Commission
ARDC	Advanced Reactor Design Criteria
CFR	Code of Federal Regulations
CP	Construction Permit
DCD	Design Certification Document
DOE	Department Of Energy
EBR	Experimental Breeder Reactor
FOA	Funding Opportunity Announcement
FSAR	Final Safety Analysis Report
FY	Fiscal Year
GAIN	Gateway to Accelerated Innovation in Nuclear
GEH	General Electric- Hitachi
GNEP	Global Nuclear Energy Partnership
HTGR	High Temperature Gas-Cooled Reactor
IAEA	International Atomic Energy Agency
IAP	Implementation Action Plan
INL	Idaho National Laboratory
LWR	Light Water Reactor
MWe	Megawatt - Electric
MWt	Megawatt – Thermal
NEA	Nuclear Energy Agency
NGNP	Next Generation Nuclear Plant
Non-LWR	Non-Light Water Reactor
NPP	Nuclear Power Plant
NRC	Nuclear Regulatory Commission
OL	Operating License
PBMR	Pebble Bed Modular Reactor
PSAR	Preapplication Safety Analysis Report
PSER	Preapplication Safety Evaluation Report
R&D	Research And Development
RIS	Regulatory Information Summary
SDA	Standard Design Approval
SDC	Standard Design Certification
SER	Safety Evaluation Report
SWP	Strategic Workforce Planning