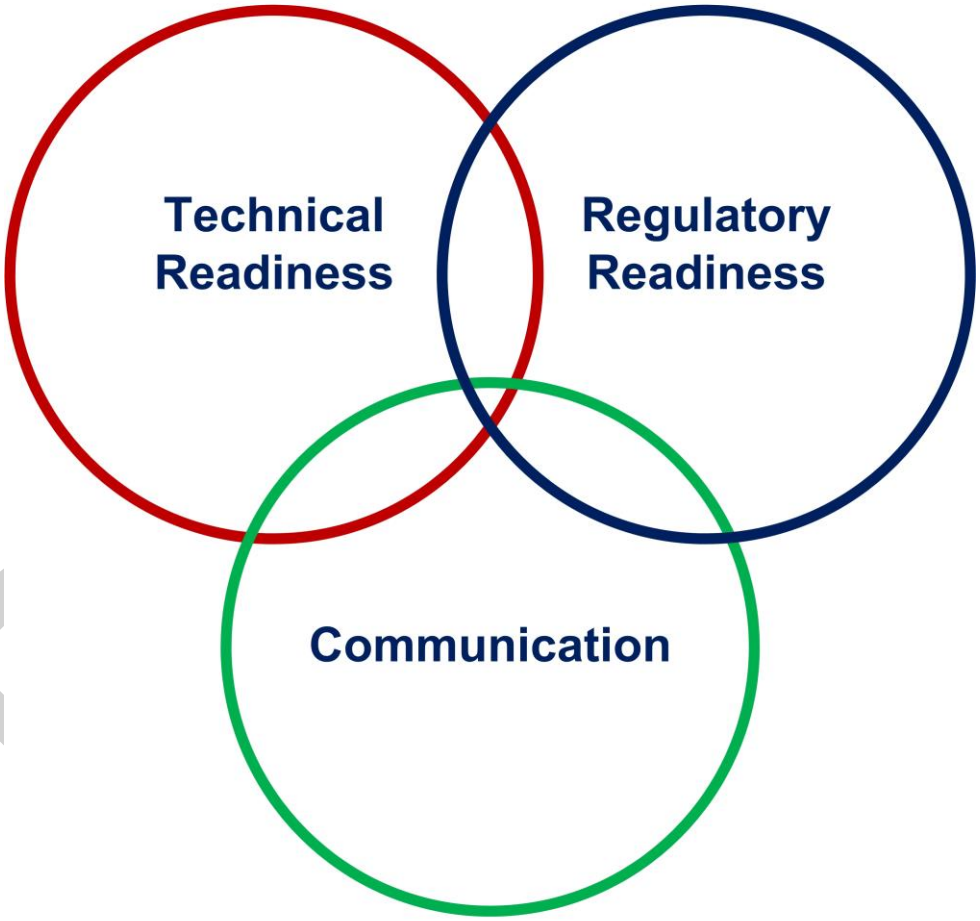
(Public Discussion Version)

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

NRC Non-Light Water Reactor (Non-LWR) Vision and Strategy - Staff Report: Near-Term Implementation Action Plans



Volume 1 – Executive Information

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, including fuel cycles and waste forms. In July, 2016, the NRC published the draft vision and strategy document for public comment in the Federal Register. The non-LWR vision and strategy document provides a connection to other NRC mission, vision, and strategic planning activities, and describes the objectives, strategies, and contributing activities necessary to achieve non-LWR mission readiness.

At the highest level, this report provides a planning tool that describes: 1) what work must be done to achieve non-LWR readiness, 2) how the work should be sequenced, 3) how to prepare the workforce to do the work, and 4) considerations for organizing work execution for maximum effectiveness and efficiency. Achieving readiness to review and regulate non-LWRs, as defined within the vision and strategy document, will be a long-range project.

The project has been organized into two phases. Phase 1 is the conceptual planning phase used to lay out the vison 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 have planned completion dates of the end of 2016 for Phase 1 and not later than 2025 for Phase 2 (including execution of planned tasks). The planning process for this work is broken down into three periods: near-term (0-5 years), mid-term (5-10 years), and long-term (greater than 10 years).

This staff report covers Phase 2 actions to be taken in the first five years (the near-term activities), and will be supplemented with the mid-term and long-term plans later. The near-term actions identified in Phase 1 of the non-LWR vision and strategy roadmap have been further developed using the Implementation Action Plan (IAP) format in Phase 2. The purpose of the IAPs is to identify specific, actionable tasks that, once completed, will lead to accomplishment of the NRC's non-LWR strategic objectives: enhance technical readiness, optimize regulatory readiness, and optimize communications. The IAPs also form a basis for budget development by quantifying the resources required to accomplish the identified tasks.

The Phase 2 report is presented in two volumes. The first volume provides an executive level summary of the relationship of the IAPs to the non-LWR vision and strategy; overviews of the approaches used to develop each of the six strategies and contributing activities; recommended strategy prioritization; and jobhour/FTE/cost estimate summaries for the proposed activities.

Volume 2 provides the detailed IAPs for each strategy; the accompanying detailed estimates of jobhours, FTEs, and contract support costs at the office and FY levels; bases and assumptions; and extensive background information as needed to assist staff assigned to execute these plans.

There are six individual strategies addressed in the near-term IAPs. They are:

1. Acquire/develop sufficient knowledge, technical skills, and capacity to perform non-LWR regulatory activities
2. Acquire/develop sufficient computer codes and tools to perform non-LWR regulatory reviews
3. Establish a flexible 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.
4. Facilitate industry codes and standards needed to support the non-LWR life cycle (including fuels and materials)
5. Identify and resolve technology-inclusive (not specific to a particular non-LWR design or category) policy issues that impact regulatory reviews, siting, permitting, and/or licensing of non-LWR nuclear power plants (NPPs)
6. Develop and implement a structured, integrated strategy to communicate with internal and external stakeholders having interests in non-LWR technologies

A summary list of the near-term strategies and contributing activities is provided in Section 5.0.

Note that the strategies and contributing activities described in this report are assumed not to be constrained by budget or by other agency mission priorities. The purpose of making this foundational assumption is to facilitate the exercise of describing the activities and sequencing needed to accomplish non-LWR readiness, and to estimate the resources that will be needed to complete those activities, without fiscal prejudice. By doing so, the NRC will have in place a work plan that can be executed as resources become available. Resource availability will then govern the pace of achieving readiness, but will not significantly change the activities to be done or the appropriate work sequencing.

Having a comprehensive jobhour/cost estimate for achieving non-LWR mission readiness provides the NRC's basis for future budget formulation and informs discussions of NRC resource needs relative to other Commission, Executive branch, and Congressional priorities.

These IAPs are intended to be an internal work planning product supporting integrated agency work planning and prioritization efforts. As such, they are expected to be "living documents," updated when appropriate

1.0 INTRODUCTION

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, including fuel cycles and waste forms. In July, 2016, the NRC published the draft vision and strategy document for public comment in the Federal Register. The non-LWR vision and strategy document provides a connection to other NRC mission, vision, and strategic planning activities, and describes the objectives, strategies, and contributing activities necessary to achieve non-LWR mission readiness.

At the highest level, this report provides a planning tool that describes: 1) what work must be done to achieve non-LWR readiness, 2) how the work should be sequenced, 3) how to prepare the workforce to do the work, and 4) considerations for organizing work execution for maximum effectiveness and efficiency. Achieving readiness to review and regulate non-LWRs, as defined within the vision and strategy document, will be a long-range project.

The project has been organized into two phases. Phase 1 is the conceptual planning phase used to lay out the vison 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 have planned completion dates of the end of 2016 for Phase 1 and not later than 2025 for Phase 2 (including execution of planned tasks). The planning process for this work is broken down into three periods: near-term (0-5 years), mid-term (5-10 years), and long-term (greater than 10 years).

This staff report covers Phase 2 actions to be taken in the first five years (the near-term activities). These strategies and activities are expected to be initiated during the identified timeframes, and may carry over as longer-term work actions when necessary.

1.1 Achieving Mission "Readiness" for Non-LWRs

The IAPs contained in this report list the near-term actions to be completed as the NRC moves towards achieving non-LWR mission readiness. In this context, "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 the Vision and Strategy (ADAMS Accession No. ML16139A812) 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 waste management, 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.

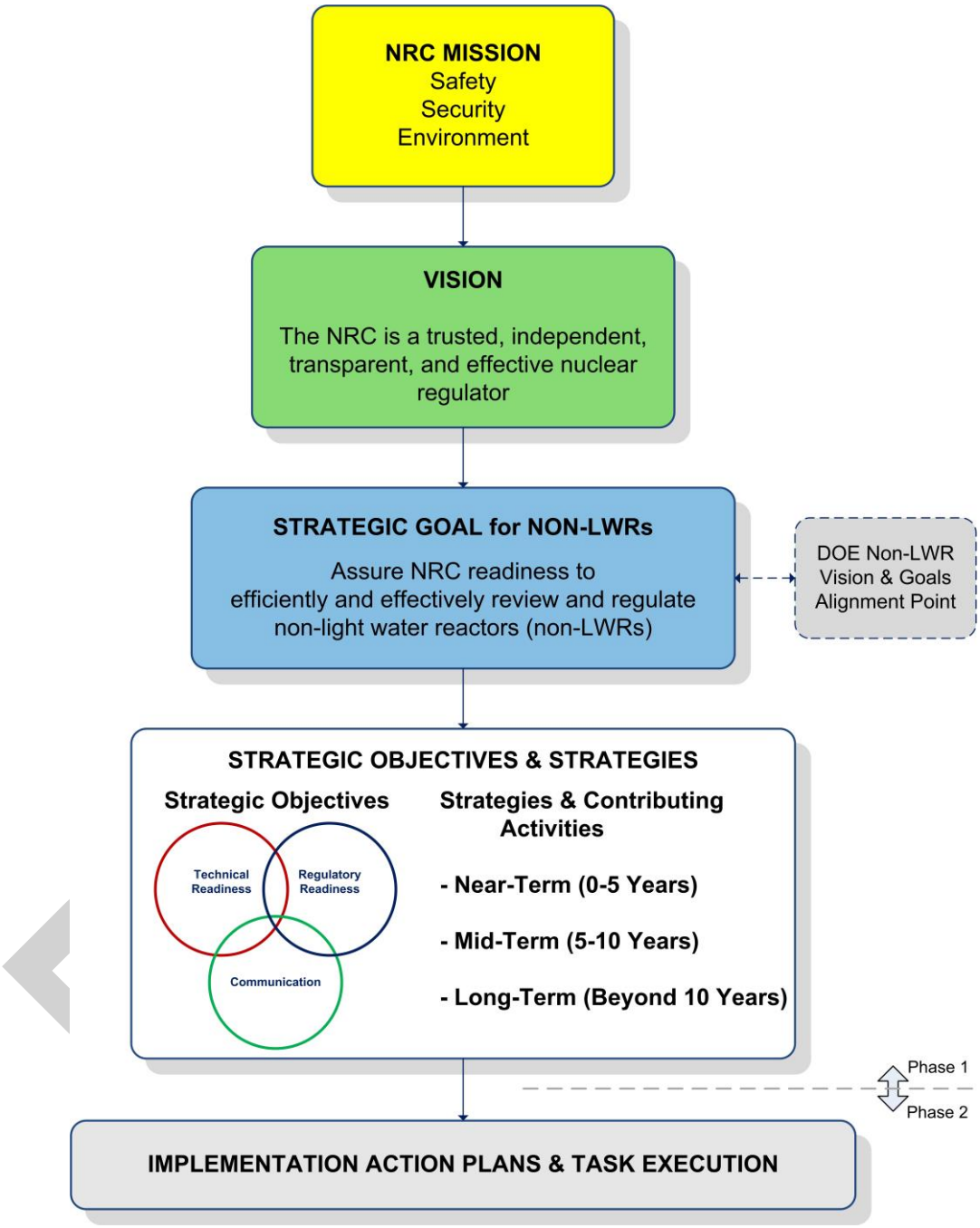
- **Communication**
  The NRC must ensure that it has effective means of exchanging information with its stakeholders, using a variety of channels and messages appropriate for target audiences. This information ranges from general regulatory or industry topics of public interest, to specific guidance 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.

1.2 Non-LWR Vision and Strategy (the "Roadmap")

Figure 1 shows the organization of the NRC's non-LWR vision and strategy, called the "NRC Non-LWR Mission Readiness Roadmap." This report addresses the second phase of the project, which includes development of IAPs, coordination with agency budget formulation activities, task authorization, and task execution. The IAPs 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 1 - NRC Non-LWR Mission Readiness Roadmap



2.0 OVERVIEWS OF NEAR-TERM STRATEGIES

2.1 Strategy 1: Acquire/develop sufficient knowledge, technical skills, and capacity to perform non-LWR regulatory reviews

This strategy supports the NRC's strategic objective of enhancing non-LWR technical readiness. As described in the NRC's vision and strategy for improving the agency's readiness to regulate non-light water reactor (non-LWR) technologies, the strategic objective for enhancing technical readiness is:

> Ensuring that the staff has the requisite knowledge, expertise, tools, and processes needed to efficiently and effectively evaluate non-LWR applications, and to reach an independent safety, security, or environmental finding.

To support accomplishment of this objective, the vision and strategy document described readiness for "people" (the staff) as follows:

> 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. 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 non-LWR system and integrated plant operations. The staff must also be knowledgeable of any unique waste management, environmental or security challenges posed by a particular non-LWR technology. While many aspects of non-LWR designs may be technology-inclusive (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 approach taken for this strategy is based on the principle of designing and maintaining the workforce consistent with the work to be accomplished, in the time frame needed. Work design outputs from the contributing activities and support tasks reflected in other near-term IAPs are the drivers for the workforce design, development, and skills maintenance processes.

The near-term IAP for this strategy focuses on identification of work requirements, identification of critical skills and staff capacity requirements, assessment of the current staff's non-LWR technical readiness, and technical readiness gap closure by a variety of methods. The mid-term and long-term IAPs will address items such as long-range training and staff development for non-LWRs, mentoring programs, and attrition planning. Certain foundational activities, such as organizational assessments, knowledge capture, knowledge management, workforce competency modeling, and strategic workforce planning are conducted across all readiness preparation timeframes. OCHCO is an integral partner in conducting these foundational activities.

To facilitate the Strategy 1 planning efforts for technology-specific activities, molten salt reactors (MSRs) have been selected as the example non-LWR technology. This technology was selected because, like industry, the staff has the least practical knowledge and experience with MSRs in comparison to the available knowledge base for sodium-cooled fast reactors (SFRs) and high temperature gas-cooled reactors (HTGRs). Therefore, the preparations and level of effort required to achieve staff technical readiness for MSRs should bound similar readiness

efforts for other more familiar non-LWR technologies. Figure 1 illustrates these efforts using an MSR as an example.

The near-term contributing activities and support tasks throughout the IAPs include both technology-inclusive and technology-specific actions. The staff is assumed to be prepared and able to complete the technology-inclusive activities without specialized preparation or training. Technology-specific tasks and the associated critical skills are identified and detailed with the assistance of subject matter experts (SMEs). These SMEs will be identified and sourced from a variety of organizations as needed.

Sources of available non-LWR expertise include the Department of Energy as well as its national laboratories; commercial engineering and regulatory support firms, international regulatory bodies and their research partners; inter-governmental organizations such as the IAEA, NEA, and the Generation IV International Forum; standards development organizations (SDOs) such as ANSI and ASME; and the non-LWR industry itself. SMEs will be selected for support as needed with the caveat that they are free from conflicts of interest and do not compromise the NRC's independence in conducting its regulatory responsibilities.

2.2 Strategy 2: Acquire/develop sufficient computer codes and tools to perform non-LWR regulatory reviews

This strategy supports the NRC's strategic objectives of enhancing non-LWR technical readiness and optimizing regulatory readiness. In support of those objectives, the vision and strategy document states the staff must have adequate computer models and analytical tools to conduct its review of non-LWR designs in an independent manner.

As part of the staff's review for design certification and licensing of a non-LWR, independent confirmatory calculations of some of the most important design-basis events and key SSCs will be performed. This provides the staff with a basis to examine the applicant's analysis and to confirm the margin of safety for a given design and its operating condition. To perform these independent calculations, the staff will either need to develop or have access to analytical codes suitable for non-LWR application. Currently, the staff has analysis codes that are applicable to conventional and advanced LWRs. For non-LWR reactor designs, the initial tasks will generally include evaluation and down-selecting the codes for use by the staff. This is especially true for design with the least regulatory experience and which have been the subject of only limited code development efforts. The non-LWR technology with the most depth of understanding is the high-temperature gas-cooled reactor (HTGR), resulting from operating experience in the US, UK, Germany, Japan, Russia, and China. Further, in anticipation of gas-cooled reactor licensing in the 2004-2010 time frame in support of the Next Generation Nuclear Plant (NGNP), analytical codes have been selected. Sodium cooled reactors have been constructed and operated in the US, Russia, China, UK, Japan, France and Germany. Of note is France's Rapsodie sodium fast reactor, which had a particularly long operation period from 1967 to 1983. For molten salt designs, there is far less regulatory review history. An 8 MW thermal molten salt experimental reactor was designed and operated by Oak Ridge National Laboratory (1965-1969).

The approach taken for this strategy is to: 1) identify the computer codes and supporting information and data that would be needed to support both the design of a non-LWR and the staff's review of that design; 2) evaluate the existing computer codes and supporting information to identify gaps in both analytical capabilities and supporting information and data; and 3) interact with both domestic and international organizations working on non-LWR technologies to identify opportunities to collaborate and cooperate in closing the gaps, while being mindful of the importance of avoiding conflicts of interest. The emphasis in the staff's approach is to leverage, to the maximum extent practical, collaboration and cooperation with the domestic and international community interested in non-LWRs with the goal of establishing a set of tools and data that are commonly understood and accepted. The community may comprise NRC, DOE, vendors, utilities, and international partners. Having a common understanding of the tools and data, rather than having to develop that understanding during each technical review, would be expected to significantly improve the efficiency of the review process. NRC can maintain its independence by developing expertise in the codes' phenomenological modeling, numerical schemes, and verification and validation process. NRC will also participate in the development process to the degree that resources allow. It is anticipated that NRC will use the codes to run sensitivity analyses and perform uncertainty analyses to help investigate margins in the design. In some technical areas, an applicant is required to submit the code for NRC's review and approval, such as an evaluation model used for design basis analyses. It would be the applicant's responsibility to justify the quality assurance program used in the code development meets NRC's requirements outlined in Appendix B to Part 50. In cases where an applicant uses a code that has been developed by others, commercial grade dedication could be used to verify

the quality assurance of the code development and verification and validation, collectively known as assessment, is extremely resource and time intensive. Therefore, it is not viable for a single organization to undertake all of the required efforts, particularly in light of current budget realities and the deployment timelines that have been suggested by DOE and the industry. Thus, collaboration and cooperation are essential to the success of the strategy.

The staff has a number of ongoing interactions and collaborative efforts with DOE, the domestic research community, and the international community. The approach will build on these existing interactions, developing new cooperative funded activities as appropriate.

For the purpose of developing the IAPs for this strategy, the staff has considered high temperature gas-cooled reactors, liquid metal reactors, and molten salt reactors where the fuel may or may not be dissolved in the coolant, as the designs of interest in the near-term. This choice is made based on the NRC's experience and is not intended as a "down-select" of the potential non-LWR designs currently being explored by industry and DOE. This design set will be reviewed frequently during the near-term execution of IAP tasks in order to make the most effective possible use of the NRC's resources.

This strategy provides the staff's initial assessment of the current state of the computer codes and supporting information and data. The near-term activities described in the IAP involve a more structured assessments of the computer codes, information and data, and of the gaps between the current state and what is needed. From those assessments, the staff will further engage the technical community to identify mutual interests and the potential for collaborative and cooperatively funded activities to close the identified gaps.

Based on a preliminary assessment of the gaps, the staff developed a set of contributing activities and general resource estimates for those activities in order to provide a general sense of the efforts and resources that would be needed to close those gaps. This IAP includes a general assessment of the magnitude of the effort that will be required of the non-LWR technical community. This effort will not be funded by NRC alone, therefore, the staff used an approximate value of 25% of the total costs as a rough estimate to inform NRC budgetary needs, as reflected in the IAP.

Near-term estimated jobhours and contract support costs are also provided in the IAP for budgetary and resource planning.

2.3 Strategy 3: Develop guidance for a flexible non-LWR regulatory review process within the bounds of existing regulations, including the use of conceptual design reviews and staged-review processes

This strategy supports the NRC's strategic objective of optimizing non-LWR regulatory readiness.

As shown in the NRC's non-LWR vision and strategy document, the strategic objective for optimizing regulatory readiness is:

> 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.

Further, in the area of improving the NRC's regulatory readiness for possible non-LWR designs, the near-term strategy is defined as follows:

> Develop Guidance for a flexible 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.

Current interactions between designers and the NRC range from activities in the preconceptual design process to designs in or nearly in the final design process. In addition, plans for the overall deployment of non-LWR designs might include multiple projects involving critical decisions for related research and test reactors, first-of-a-kind (FOAK) large scale plants, and subsequent commercial plants. The NRC's processes and practices need to be flexible enough to support interactions related to this wide variation in design development, recognizing that in some cases the NRC staff may be providing feedback and developing regulatory positions[1] in parallel with designers assessing various alternatives during the conceptual design process. The regulatory interactions are intended to align with other related plans for developing non-LWR technologies. These related plans include plant design, research and development, finance, public policy, and fuel cycle.

The near-term activities described in this strategy can be used to support longer-term efforts to develop, as needed, a new non-LWR regulatory framework that is risk-informed, performance-

[1] In this context, "regulatory positions" may range from preliminary discussions with designers without the creation of documentation to be cited in future applications to Commission decisions (e.g., staff requirements memorandum or policy statement) or other published regulatory position (e.g., interim staff guidance, regulatory guide, or safety evaluation). Communications between the NRC staff and requester need to clearly define expectations for the interactions and the appropriate regulatory vehicles should be used to achieve the desired outcome (see Contributing Activity No. 4, Regulatory Roadmap).

based, and that features staff review efforts commensurate with the demonstrated safety performance of non-LWR technologies.

The NRC's IAP for improving its regulatory readiness for non-LWR designs includes the following contributing activities:

1. Establish the criteria necessary to reach a safety, security, or environmental finding for non-LWR technologies
2. Determine appropriate licensing bases and accident sets for non-LWR technologies
3. Identify and resolve gaps in current regulatory framework
4. Develop a regulatory review "roadmap" reflecting design development lifecycle and appropriate interactions, including potential research and test reactor interactions
5. Update prototype reactor guidance
6. Engage on technology- or design-specific licensing project plans and develop regulatory approaches commensurate with the risks posed by the technology

Several of the contributing activities (e.g., decision criteria, licensing bases, and gap analyses) collectively establish a regulatory framework for a specific non-LWR technology and will be closely coordinated.

The bases section of the IAP for this strategy also explores the potential use of common definitions of design development stages and technology readiness levels (TRLs), similar to the definitions used by DOE and NASA. The purpose of this discussion is to support the "roadmap" development for Contributing Activity No. 4. This discussion also supports the development of common expectations between the NRC and potential applicants on what agency feedback/degree of formality may be reasonably expected for a given level of design development maturity.

Near-term estimated jobhours and contract support costs are also provided in the IAP for budgetary and resource planning.

2.4 Strategy 4: Facilitate industry codes and standards needed to support the non-LWR life cycle (including fuels and materials)

This strategy supports the NRC's strategic objectives of enhancing non-LWR technical readiness and optimizing regulatory readiness.

It is necessary for the NRC to consider adapting its regulatory framework to continue to ensure that new and innovative non-LWR designs are constructed and operated to protect public health and safety and the environment. In line with current practice, it is expected that the use of codes and standards will be an integral part of the NRC's strategy to improve its readiness to regulate non-LWR technologies.

As shown in the IAP for this strategy, the staff intends to enhance the NRC's technical readiness for possible non-LWR designs by applying its established process for incorporating codes and standards into its regulatory framework. This process is described fully in NRC Management Directive (MD) 6.5, "NRC Participation in the Development and Use of Consensus Standards," and consists of three primary steps: 1) Identifying and Prioritizing Needed New and Revised Technical Standards; 2) Participation in Codes and Standards Development; and 3) Endorsement of Codes and Standards.

The NRC will work with standards development organizations (SDOs), non-LWR designers, and other stakeholders to identify and facilitate new codes needed for non-LWR development. The NRC maintains its independence during participation with SDOs by reserving the right to apply conditions on codes and standards used in its regulatory process to ensure that they will meet the NRC's requirements to protect the public health and safety and the environment. The need to impose conditions may, however, be reduced by attempts to resolve outstanding issues through meetings with SDOs and other stakeholders, and active participation during the codes and standards development process.

Codes and standards that could be applied to a range of non-LWR designs are likely to be identified beginning in the near-term (0-5 years) as candidates for facilitation and development. One example is the need for codes for high-temperature materials for operating conditions well above the temperatures encountered in LWR operating conditions. Technology-specific codes and standards required by individual developers will likely be identified in the mid-term (5-10 years) or long-term (>10 years) as the designs mature.

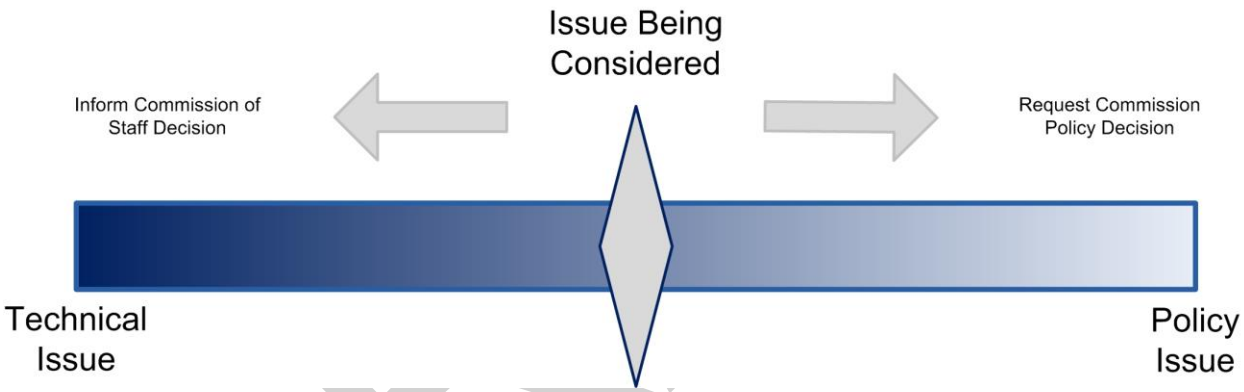
Near-term estimated jobhours and contract support costs are also provided in the IAP for budgetary and resource planning.

2.5 Strategy 5: Identify and resolve technology-inclusive policy issues that impact the regulatory reviews, siting, permitting, and/or licensing of non-LWR nuclear power plants (NPPs)

The identification and resolution of policy issues within the purview of the NRC contribute directly to regulatory certainty, effectiveness, and efficiency. Additionally, early identification and resolution of policy issues helps to achieve the agency's strategic objectives for non-LWRs: enhanced technical readiness, optimized regulatory readiness, and optimized communications.

Technology-inclusive issues; that is, those issues that apply widely to non-LWR designs independent of the specific technologies used, have the broadest applicability for the non-LWR regulatory framework.

The range of issues for non-LWRs can range from strictly technical problems to broadly applicable issues of policy. There is a continuum of factors that must be identified and considered as a particular issue of interest is classified. The following figure illustrates this continuum.



As shown above, the staff's actions for a technical issue involve reviewing the topic and, if warranted, informing the Commission of its decision. As the issue takes on greater policy dimensions, the staff provides inputs and recommendations to the Commission and asks for a policy decision. The Commission also has the option at any time of escalating an issue from a technical concern to a policy concern.

The IAP for this strategy describes the policy-related contributing activities and supporting tasks to be performed in order to reach the NRC's non-LWR strategic objectives of enhanced technical readiness, optimized regulatory readiness, and optimized communications.

Near-term estimated jobhours and contract support costs are also provided for budgetary and resource planning.

2.6 Strategy 6: Develop and implement a structured, integrated strategy to communicate with internal and external stakeholders having interests in non-LWR technologies

As shown in the NRC's non-LWR vision and strategy document, the strategic objective for optimizing communications is:

> 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.

Further, in the area of optimizing the NRC's communications, the near-term strategy is defined as follows:

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

The IAP for addressing communications consists of several contributing activities. These include:

- 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.

These contributing activities begin in the near term, but will continue throughout the process of the implementing the vision and strategy of all three areas of the readiness for non-LWR activities.

Unlike other strategies described in this report, initial development of the NRC's non-LWR communications strategy document was completed in May 2016 and was designed to address the strategic objective described above. Therefore, this IAP is focused on identifying the supporting actions needed to operationalize and maintain the communications strategy to achieve the strategic objective.

Near-term estimated jobhours and contract support costs are also provided for budgetary and resource planning.

As with the detailed IAPs and similar NRC internal communications plans developed previously, the non-LWR communications strategy document is considered sensitive and intended for internal use only.

3.0 NEAR-TERM TASK PRIORITIZATION & RECOMMENDATIONS FOR USE OF POSSIBLE FY17 OFF-FEE-BASE FUNDS

As noted in the Executive Summary,

> Note that the strategies and contributing activities described in this report are assumed not to be constrained by budget or by other agency mission priorities. The purpose of making this foundational assumption is to facilitate the exercise of describing the activities and sequencing needed to accomplish non-LWR readiness, and to estimate the resources that will be needed to complete those activities, without fiscal prejudice. By doing so, the NRC will have in place a work plan that can be executed as resources become available. Resource availability will then govern the pace of achieving readiness, but will not significantly change the activities to be done or the appropriate work sequencing.

For each of the strategy IAPs, the contributing activities and supporting tasks are shown roughly in preferred execution sequence. However, the actual start dates for many of the activities may not be in FY17. Therefore, it is reasonable to assume that the near-term level of effort shown in this report, and the associated resource demands, will likely require a different time frame than FY2017-FY2021. The actual sequencing of the work will depend on agency priorities, availability of annual appropriations sufficient to perform the work, and coordination with other NRC organizational initiatives, such as Project Aim. External drivers, such as DOE's Project GAIN, may also influence work sequencing. Further, the preferred work sequencing may be revised at any time if a non-LWR vendor commences pre-application activities or submits an application for review in the near-term.

Given the current non-LWR industry state of technical and regulatory maturity, the staff recommends executing the near-term IAPs within available funding constraints, in an order that first supports ongoing activities:

- NRC non-LWR communications efforts (Strategy 6),
- Development of the advanced non-LWR design criteria (ARDCs) (technical and regulatory readiness per Strategies 2, and 3)
- Review of near-term regulatory framework flexibilities such as conceptual design assessments and staged-licensing reviews (Strategy 3)
- Facilitation of industry codes and standards development, such as ASME Section III, Division 5 (Strategy 4), and
- Continued review and resolution of technology-inclusive policy issues that affect non-LWRs (Strategy 5).

Ongoing activities, such as participation in DOE's Project GAIN, international coordination (e.g., GSAR), OCHCO pilot programs for competency modeling and strategic workforce planning, and continued interactions with DOE's CASL and NEAMS projects should continue as funding permits. Remaining non-LWR research efforts (Strategy 2) and technical readiness activities to prepare the staff to review and regulate non-LWRs (Strategy 1) are also key activities. These efforts should begin as soon as specific non-LWR technology certainty permits.

4.0 SUMMARY OF BUDGET RESOURCE NEEDS FOR NEAR-TERM IAP TASK EXECUTION (DRAFT)

(Witheld – For Internal NRC Use Only)

5.0 SUMMARY – NEAR-TERM STRATEGIES AND CONTRIBUTING ACTIVITIES

This list summarizes the strategies and associated near-term contributing activities found in this report.

Strategy 1: Acquire/develop sufficient knowledge, technical skills, and capacity to perform non-LWR regulatory reviews

- Contributing Activity No. 1: Identify Non-LWR Task and Technical Skill Requirements (Work Design Activities)
- Contributing Activity No. 2: Determine and Establish the Necessary Workforce Skills and Capacities (Workforce Design & Establishment)

Strategy 2: Acquire/develop sufficient computer codes and tools to perform non-LWR regulatory reviews

Functional Area: Reactor Kinetics and Criticality

- Contributing Activity No. 1: Upgrade/revise nuclear-analysis capabilities that are capable of predicting core-operating power and flux in the following operating HTGR modes (start-up; quasi-steady state cycle-specific operation; and transient analysis from a limiting point in cycle or equilibrium cycle).
- Contributing Activity No. 2: Identify experimental data needs and begin code assessment.
- Contributing Activity No. 3: Upgrade/revise nuclear-analysis capabilities that are capable of predicting core-operating power and flux in the following operating SFR modes (start-up; quasi-steady state cycle-specific operation; and transient analysis from a limiting point in cycle or equilibrium cycle).
- Contributing Activity No. 4: Identify experimental data needs and begin code assessment.
- Contributing Activity No. 5: Upgrade/revise nuclear-analysis capabilities that are capable of predicting core-operating power and flux in an operating MSR, for steady state and transient analysis.
- Contributing Activity No. 6: Identify experimental data needs and begin code assessment.

Functional Area: Fuel Performance

- Contributing Activity No. 7: Develop knowledge of fuel design, fuel functional requirements, and fuel characteristics critical to safety and accident performance.
- Contributing Activity No. 8: Develop or adopt/update existing fuel analysis code applicable to HTGRs.
- Contributing Activity No. 9: Identify experimental data needs and begin code assessment.
- Contributing Activity No. 10: Develop knowledge of fuel design, fuel functional requirements and fuel characteristics critical to safety and accident performance.
- Contributing Activity No. 11: Develop or adopt/update existing fuel analysis code applicable to SFRs.
- Contributing Activity No. 12: Identify experimental data needs and begin code assessment.

- Contributing Activity No. 13: Develop knowledge of fuel design, fuel functional requirements and fuel characteristics critical to safety and accident performance.
- Contributing Activity No. 14: Develop fuel analysis code applicable to MSRs.

Functional Area: Thermal-Fluid Phenomena

- Contributing Activity No. 15: Develop thermal-fluid analysis code applicable to gas-cooled reactors.
- Contributing Activity No. 16: Identify experimental data needs and begin code assessment.
- Contributing Activity No. 17: Develop thermal-fluid analysis code applicable to sodium-cooled fast reactors.
- Contributing Activity No. 18: Identify experimental data needs and begin code assessment.
- Contributing Activity No. 19: Develop thermal-fluid analysis code applicable to molten salt reactors.
- Contributing Activity No. 20: Identify experimental data needs and begin code assessment.

Functional Area: Severe Accident Phenomena

- Contributing Activity No. 21: Develop severe accident analysis code applicable to gas-cooled reactors.
- Contributing Activity No. 22: Identify experimental data needs and begin code assessment.
- Contributing Activity No. 23: Develop severe accident analysis code applicable to liquid metal-cooled fast reactors.
- Contributing Activity No. 24: Identify experimental data needs and begin code assessment.
- Contributing Activity No. 25: Develop severe accident analysis code applicable to molten salt reactors
- Contributing Activity No. 26: Identify experimental data needs and begin code assessment.

Functional Area: Offsite Consequence Analysis

- Contributing Activity No. 27: Perform an initial scoping study identifying and prioritizing potentially relevant modeling needs. Note: mid-term activity, included for information.
- Contributing Activity No. 28: Based on the initial scoping study and design information available to date, implement needed modeling enhancements to be able to analyze offsite consequences for non-LWRs. Note: mid-term activity, included for information.

Functional Area: Materials and Component Integrity

- Contributing Activity No. 29: Assess the performance needs and issues for structural materials to be used in non-LWRs, such as HTGR, SFR, MSR. The assessment will include the state-of-the-knowledge, ongoing domestic and international research, applicable international OpE, codes and standards activities, gaps in knowledge, data, and assessment tools.
- Contributing Activity No. 30: Conduct research activities to develop technical bases to resolve major materials related issues. Collaborate with domestic (DOE, EPRI, vendors) and international partners [based on the recommendations from the assessment report from contributing Activity No. 29].

- Contributing Activity No. 31: Support the development of a draft regulatory framework for materials-related issues (relevant SRP chapters, guidance, etc.) for non-light water reactors.

Strategy 3: Develop guidance for a flexible non-LWR regulatory review process within the bounds of existing regulations, including the use of conceptual design reviews and staged-review processes

- Contributing Activity No. 1: Establish and document 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.
- Contributing Activity No. 2: Determine and document appropriate non-LWR licensing bases and accident sets for highly prioritized non-LWR technologies.
- Contributing Activity No. 3: Identify, document and resolve (or develop plan to resolve) current regulatory framework gaps for non-LWRs.
- Contributing Activity No. 4: Develop and document 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.
- Contributing Activity No. 5: Prepare and document updated guidance for prototype testing, research and test reactors.
- Contributing Activity No. 6: 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.
- Contributing Activity No. 7: Support longer-term efforts to develop, as needed, a new non-LWR regulatory framework 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.

Strategy 4: Facilitate industry codes and standards needed to support the non-LWR life cycle (including fuels and materials)

- Contributing Activity No. 1 - Work with stakeholders to determine the currently available codes and standards that are applicable to non-LWRs and their associated fuels and waste, and to identify the technical areas (i.e. instrumentation and control, civil/structural, inservice inspection and testing, materials, equipment qualification, quality assurance, etc.) where gaps exist.
- Contributing Activity No. 2 - Participate with the Standards Development Organizations that are actively involved in developing codes and standards for non-LWRs

Strategy 5: Identify and resolve technology-inclusive policy issues that impact the regulatory reviews, siting, permitting, and/or licensing of non-LWR nuclear power plants (NPPs)

- Contributing Activity No. 1: Determine the applicability of previously identified policy issues to non-LWRs
- Contributing Activity No. 2: Identify additional technology-inclusive policy issues for non-LWRs
- Contributing Activity No. 3: Analyze and resolve technology-inclusive non-LWR policy issues identified in Contributing Activity Nos. 1 and 2

Strategy 6: Develop and implement a structured, integrated strategy to communicate with internal and external stakeholders having interests in non-LWR technologies

- Contributing Activity No. 1: Provide timely, clear, and consistent communication of the NRC's non-LWR requirements, guidance, processes, and other regulatory topics, and provide multiple paths for external feedback to the NRC
- Contributing Activity No. 2: Develop consistent NRC non-LWR messaging suitable to a range of audiences
- Contributing Activity No. 3: Promote the exchange of non-LWR technical and regulatory experience with the NRC international counterparts and industry organizations