

C.2 Application Regulatory Topics

C.2.3 Small Modular Reactors and Design-Specific Review Standards

Prospective applicants have notified the NRC of their intent to submit applications under Part 52 for light-water small modular reactor (SMR) designs. The characteristics of SMRs present several potential policy, technical, and licensing issues for the NRC. However, the NRC staff has identified these issues and developed plans to address them, and is prepared to review applications for all types of light-water SMRs as discussed in SECY-14-0095, "Status of the Office of New Reactors Readiness to Review Small Modular Reactor Applications," August 2014 (ADAMS Accession No. ML14073A710).

Design-specific review standards (DSRSs) provide a means to enhance the effectiveness and efficiency of the NRC staff's review of light-water SMR applications that incorporate new and/or innovative design features. Each DSRS is specific to a particular SMR design. The DSRS is developed by the NRC staff, based on plant design and other information provided by the prospective applicant, during the pre-application timeframe. The development of a DSRS requires approximately two years. The completed DSRS serves the same purpose and has the same objectives as NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," for non-SMR application reviews. The development and use of a DSRS is not a requirement and is voluntary at the discretion of the prospective SMR applicant.

OVERVIEW

Commission Policy

In response to Commission direction, the staff prepared SECY-11-0024, "Use of Risk Insights to Enhance the Safety Focus of Small Modular Reactor Reviews," February 18, 2011 (ADAMS Accession No. ML110110688). In a Staff Requirements Memorandum issued in 2011 (ADAMS Accession No. ML111320551), the Commission approved, and directed the staff to implement, the staff's recommendations in SECY-11-0024 for development of a design-specific, risk-informed review plan for each SMR design.

NRC Staff Implementation

Consistent with Commission direction and the staff's recommendations in SECY-11-0024, the staff developed a review framework for light-water SMRs and documented the approach and provisions for implementation in a revision to NUREG-0800 – Introduction, Part 2, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: Light-Water Small Modular Reactor Edition," January 2014 (ADAMS Accession No. ML13207A315). The light-water SMR review framework documented in this NUREG-0800 revision is distinct from that used by the staff for non-SMR applications; however, it satisfies the same objectives and purposes, and does not change any NRC requirements for either applications or applicants. The key element of the light-water SMR review framework is the development and use of a DSRS.

The NRC staff intends the SMR review framework to enhance the effectiveness and efficiency of the application review process by aligning the staff review focus and resources with risk-significant SSCs and other aspects of an SMR design that contribute most to safety. The SMR review framework builds upon the review process used for non-SMR applications. The staff implements the review framework for a specific SMR design during pre-application interactions

and the application review process. The success of the implementation depends on both the willingness of the prospective applicant to engage with the NRC staff and the availability and timeliness of detailed safety and risk information from the prospective applicant. The staff documents the results of applying the review framework for the specific design in the DSRS.

NUREG-0800 and DSRSs

NUREG-0800, the standard review plan (SRP), is the comprehensive and integrated document that provides the NRC staff reviewer with guidance describing methods or approaches that the staff has found acceptable for meeting NRC requirements. The staff's implementation of the guidelines and the review criteria contained in the SRP during the review of applications provides assurance that a given design will comply with NRC regulations and provide adequate protection of the public health and safety. The SRP is maintained current through an on-going update and revision process and is publicly available. For SMR applicants who choose not to engage the NRC staff in development of a DSRS, the staff reviews a submitted application using current SRP guidance and methods.

Each DSRS serves the same purpose and has the same objectives that the SRP has for non-SMR application reviews. For a prospective applicant that agrees to participate in the DSRS pre-application activities, described below, the staff develops a DSRS for the prospective applicant's specific SMR design. The DSRS aligns with the SRP and each DSRS includes a "safety review matrix" which provides a detailed cross-reference to the SRP.

Application Review Schedule

The schedule for NRC review of a specific SMR application is contingent upon a number of factors including both the extent of pre-application engagement with the NRC staff and the completeness and technical sufficiency of the application. For light-water SMR design certification reviews, the staff developed a 39-month baseline review schedule, considered to be optimal, and held a public meeting to discuss the schedule and underlying bases and assumptions on February 24, 2014 (ADAMS Accession No. ML14083A599). One assumption for this schedule is that a DSRS was developed and is complete at the time of docketing.

GUIDANCE

A prospective applicant who elects to engage with the NRC staff in pre-application activities for DSRS development should: 1) be familiar with the scope and extent of requisite pre-application activities; 2) be cognizant of the schedule duration (approximately two years); 3) be prepared to commit the necessary budget and resources; and, 4) be prepared to actively interact with the NRC management, regulatory, and technical staff throughout the DSRS development.

The following paragraphs summarize the process and activities for a prospective applicant to engage with the NRC staff to facilitate successful DSRS development.

NUREG-0800 – Introduction Part 2

To prepare for interactions with the NRC staff, the prospective applicant should be familiar with NUREG-0800 – Introduction, Part 2. The prospective applicant's management should have general familiarity to support planning, scheduling, and resource allocations; and, the regulatory and technical staff should have a comprehensive understanding to support engagement with NRC staff and to facilitate development of the DSRS. Although NUREG-0800 – Introduction, Part 2 was prepared to provide detailed guidance to the staff for implementation of the SMR review framework, it contains a comprehensive and detailed description of the regulatory and technical considerations to develop a DSRS.

DSRS Development

The prospective applicant should initiate the DSRS development process by formally notifying the NRC staff of its intent to engage the staff in the development of a DSRS for its SMR design. Following notification, the NRC staff makes the determination that 1) the prospective applicant has sufficient commercial intent, organizational capacity, and design maturity to support meaningful interactions with the NRC staff on regulatory requirements; and, 2) there is a reasonable expectation that the prospective applicant will submit an application. The staff then initiates interactions with the prospective applicant to develop the DSRS.

The prospective applicant should engage the NRC staff in a manner to support parallel development of both the DSRS and the SMR design. Typically, the design evolves from a concept through preliminary stages to a final design. Correspondingly, the DSRS development is iterative and evolves from a partial to a complete draft to a final version over a period of approximately two years. The overall DSRS schedule incorporates both the NRC staff's development of DSRS content and the mandatory publishing in the Federal Register of the draft DSRS for public review and comment. The staff's intent is to complete and publish the publicly-available draft DSRS one year prior to application submittal and to issue the final DSRS for use not later than the date of application docketing.

Consistent with the NRC's principles of good regulation and the purpose and objectives of a DSRS, the NRC staff engages stakeholders, including the public, throughout the development of the DSRS. In general, the staff makes publicly available for review and comment the information authored by either the prospective applicant or the staff. For information the prospective applicant requests to be withheld from public disclosure, the prospective applicant shall comply with the provisions of §2.390, "Public Inspections, Exemptions, Requests for Withholding," to include specific identification and marking of documentation and any applicable affidavit requirements.

Development of the DSRS provides a mechanism for ongoing communications and interactions among the staff, applicant, and other stakeholders to support the early identification and resolution of both technical and regulatory issues. In support of the DSRS development, the prospective applicant may elect to address regulatory and/or technical issues in separate documentation. For example, the prospective applicant may submit white papers, topical reports, and/or technical reports for NRC review. Such documents would be prepared and submitted to assist the NRC staff in understanding the SMR design and/or the prospective applicant's proposed approach to address specific regulatory or technical issues.

The prospective applicant should understand that certain factors within its purview impact the schedule and efficiency of NRC staff activities during DSRS development. For example, the prospective applicant's willingness to share preliminary information regarding the design and the associated probabilistic risk assessment (PRA) with the staff is fundamental to the staff's timely development of a quality DSRS. The ability of the staff to formulate its review strategy and create useful draft DSRS content depends on the quality and timeliness of critical inputs from the prospective applicant. For example, early submittal of finalized or near-final design information for use by the staff minimizes revision of the DSRS sections. Preliminary PRA results and reliability assurance program list categorizations facilitate the staff's understanding of the applicant's safety/risk categorization strategy for the SSCs. If the design incorporates innovative features such as passive systems or simplified controls, early identification of these features to the staff facilitates timely identification of any unique regulatory issues.

The prospective applicant should perform a detailed review and comparison of the SMR design against each section of the current SRP and should identify those SRP sections which are applicable, or not applicable, to the design. The prospective applicant should document the results of the comparison in the form of a gap analysis. To support timely interactions with the NRC staff, the prospective applicant may perform the gap analysis with preliminary design information and, subsequently, refine and revise the gap analysis as the design is finalized.

To develop the DSRS, the NRC staff performs an in-depth review and comparison of the SMR design against each section of the SRP, similar to that performed by the prospective applicant and, additionally, reviews the prospective applicant's gap analysis. For each section of the SRP, the staff determines whether the respective SRP section should be 1) referenced in the DSRS for "use-as-is" (i.e., the section is wholly applicable to the design); 2) included in the DSRS with minor "editorial" modifications (e.g., the SRP acceptance criteria is applicable but nomenclature changes are needed for design applicability); 3) replaced in the DSRS with an entirely new section (e.g., the design meets a regulatory requirement or accomplishes a safety function in a manner different than described in the SRP section); or, 4) deleted from the DSRS because the SRP section is not applicable to the design (e.g., innovative design features obviate the need for SSCs addressed in the SRP section). This determination for each SRP section is documented by the staff in a "safety review matrix" that illustrates the section-specific correlation between the SRP and the DSRS. The "safety review matrix" serves as both an overview and a table of contents for the DSRS.

The NRC staff prepares the DSRS in a format and with a numbering scheme that corresponds to the SRP. Similar to the SRP, each section/subsection describes the scope of review, identifies applicable requirements, identifies the acceptance criteria to be satisfied, and identifies relevant references for reviewer use to make a reasonable assurance finding that the applicant has adequately addressed the applicable NRC regulations and requirements.

Following submittal of the application, the NRC staff determines, with support from the applicant, if design and operational details require the DSRS content to be adjusted. If appropriate, the staff revises the DSRS. Subsequently, the staff maintains the DSRS as an official agency document analogous to the SRP.

DSRS Use

The prospective applicant should use the DSRS in the same manner that the prospective applicant would use the SRP absent the DSRS because, for the specific SMR design, the DSRS serves the same purpose and achieves the same objectives as the SRP.

The prospective applicant should prepare its application consistent with the content and criteria identified in the DSRS and, further, may evaluate the completed application against the DSRS.

Evaluation against DSRS. Pursuant to 10 CFR 52.17(a)(1)(xii), 52.47(a)(9), and 52.79(a)(41), the applicant for an early site permit, design certification, or combined license, respectively, must include in its application an evaluation of the facility against the SRP revision in effect six months before the docketed date of the application. Alternatively, the SMR applicant may evaluate the facility against the DSRS revision in effect six months before the docketed date of the application. If a final version of the DSRS is not available, the applicant may refer to the latest public draft version of the document to meet the intent of the regulations.

The prospective applicant, as necessary, may deviate from the DSRS as follows:

Deviations from DSRS. Both the SRP and the DSRS describe an acceptable means,

but not necessarily the only means, of meeting the regulations. Accordingly, application content may deviate from the acceptance criteria in the SRP or the DSRS. The SRP/DSRS is not a substitute for the NRC regulations, and compliance is not required. However, applicants are required to identify differences from the SRP or DSRS acceptance criteria and evaluate how the proposed alternatives to the acceptance criteria provide an acceptable method of complying with the NRC regulations.

The NRC staff intends to use the DSRS in the same manner that the staff would use the SRP absent the DSRS for the aforementioned reason. For example, the staff reviews and evaluates applications incorporating the specific SMR design against the methodology and criteria identified in the DSRS.

DSRS and RG 1.206 Appendices

The appendices to Regulatory Guide 1.206 provide detailed guidance for the content and format of application safety analysis reports and the guidance is applicable to all applications, including a SMR with a DSRS. The prospective SMR applicant with a DSRS should adhere to the guidance provided in the applicable appendix (e.g., Appendix C – Standard Design Certification FSAR) consistent with the correlation of the DSRS to the SRP as identified in the DSRS “safety review matrix.” For example, for DSRS sections identified in the “safety review matrix” with no change in content from the corresponding SRP section (i.e., “use-as-is”), the guidance in Appendix C is directly applicable; and, for DSRS sections identified as revised with “minor modifications,” the guidance in Appendix C is likely directly applicable. For entirely new DSRS sections, the guidance in similar-topic sections of Appendix C is useful (e.g., level of technical detail necessary for SSCs, inclusion of figures/drawings for illustrative clarity, discussion of uncertainties associated with technical analyses).