



U.S. NUCLEAR REGULATORY COMMISSION STANDARD REVIEW PLAN

INTRODUCTION - PART 2

Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: Light-Water Small Modular Reactor Edition

PURPOSE OF THE STANDARD REVIEW PLAN

The Standard Review Plan (SRP) provides guidance to U.S. Nuclear Regulatory Commission (NRC) staff in performing safety reviews of light-water nuclear reactor power plants. The SRP scope includes construction permit (CP) or operating license (OL) applications (including requests for amendments) submitted under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50. The scope also includes applications for early site permits (ESP), design certifications (DC), combined licenses (COL), standard design approvals (SDA), or manufacturing licenses (ML) under 10 CFR Part 52 (including requests for amendments).

The principal purpose of the SRP is to assure the quality and uniformity of staff safety reviews. It is also the intent of this plan to make information about regulatory matters transparent, widely available, and to improve communication between the NRC, interested members of the public, and the nuclear power industry, thereby increasing understanding of the NRC review process.

Revision 0 – January 2014

USNRC STANDARD REVIEW PLAN

This Standard Review Plan (SRP), NUREG-0800, has been prepared to establish criteria that the U.S. Nuclear Regulatory Commission (NRC) staff responsible for the review of applications to construct and operate nuclear power plants intends to use in evaluating whether an applicant/licensee meets the NRC regulations. The SRP is not a substitute for the NRC regulations, and compliance with it is not required. However, an applicant is required to identify differences between the design features, analytical techniques, and procedural measures proposed for its facility and the SRP acceptance criteria and evaluate how the proposed alternatives to the SRP acceptance criteria provide an acceptable method of complying with the NRC regulations.

The SRP sections are numbered in accordance with corresponding sections in Regulatory Guide (RG) 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)." Not all sections of RG 1.70 have a corresponding review plan section. The SRP sections applicable to a combined license application for a new light-water reactor (LWR) are based on RG 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)."

These documents are made available to the public as part of the NRC policy to inform the nuclear industry and the general public of regulatory procedures and policies. Individual sections of NUREG-0800 will be revised periodically, as appropriate, to accommodate comments and to reflect new information and experience. Comments may be submitted electronically by e-mail to NRO_SRP.Resource@nrc.gov

Requests for single copies of SRP sections (which may be reproduced) should be made to the U.S. Nuclear Regulatory Commission, Washington, DC 20555, Attention: Reproduction and Distribution Services Section, or by fax to (301) 415-2289; or by email to DISTRIBUTION@nrc.gov. Electronic copies of this section are available through the NRC public Web site at <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0800/>, or in the NRC Agencywide Documents Access and Management System (ADAMS) at <http://www.nrc.gov/reading-rm/adams.html>, under Accession # ML13207A315.

This part of the SRP Introduction describes and incorporates the review philosophy and framework to be applied by the staff for new light-water Small Modular Reactor (SMR) applications made under 10 CFR Part 52, and incorporates staff commitments made in SECY-11-0024 (see Background).

In current terminology, SMRs may be either light-water or nonlight-water designs, with an electrical generation capacity of 300 MWe or less per module. The 300 MWe classification is consistent with the International Atomic Energy Agency (IAEA) definition used for small and medium sized reactors (“SMR” in IAEA terminology) found in IAEA-TECDOC-999 and other IAEA publications. For the purposes of this NUREG, an SMR is a light-water power reactor design, with the same electrical generating capacity limitation per module described above. Nonlight-water designs are not included in this revision of the SRP introduction.

This SMR review framework (the “framework”) is distinct from the approach used for non-SMR applications and license amendments; but it satisfies the same SRP purposes described above. Incorporation of this framework in the SRP does not change NRC requirements for applications or applicants.

Applicants¹ are not required to engage with the NRC in the pre-application activities described herein. Submittals by applicants that choose not to engage the NRC in pre-application activities associated with development of a Design-Specific Review Standard (DSRS) will be reviewed by the staff using current SRP guidance and methods rather than using a DSRS in the risk-informed and integrated review framework discussed in this part of the SRP Introduction. However, it is the staff’s belief that early engagement with the NRC as described in this review framework will positively benefit all review process stakeholders. The extent of benefits realized will depend directly on the depth and timing of pre-application engagement by applicants. All applicants are encouraged to engage the NRC in pre-application coordination, regardless of the application review methodology chosen.

A summary of the changes in Revision 0 appears on the last page of the document.

Background

The NRC first issued the SRP in 1975 as NUREG-75/087. It was developed from many years of Atomic Energy Commission experience in establishing safety requirements and staff experience in applying those requirements in evaluating the safety of various designs for nuclear facilities. The Office of Nuclear Reactor Regulation (NRR), in Office Letter No. 2 dated August 12, 1975, established the SRP as a routine tool for the NRC staff to use in evaluating the safety of nuclear power plant designs. Specifically, that Office Letter described the SRP as representing “the integrated result of the hundreds of conscious choices made by the staff and by the nuclear industry in developing design criteria and design requirements for nuclear power plants” and “the most definitive basis available for specifying the NRC’s interpretation of an acceptable level of safety for light-water reactor facilities.”

Following an extensive revision program, the NRC reissued the SRP as NUREG-0800 in July 1981. This revision identified all NRC requirements that were relevant to each review topic, described how a reviewer would determine that safety requirements had been met, and

¹ For convenience throughout the introduction, the term “applicant” also includes entities interested in engaging the NRC in pre-application activities which may lead to application under 10 CFR Part 52.

incorporated a number of newly established regulatory positions, including those related to the Three Mile Island (TMI) Action Plan.

In 1991, the NRC established the Standard Review Plan Update and Development Program (SRP-UDP) to update NUREG-0800 for use in reviewing future reactor design applications. The staff subsequently issued an "Implementing Procedures Document (IPD)," NUREG-1447, in May 1992 to describe the SRP-UDP and establish procedures for updating the SRP. This update reflected the experience of the safety reviews conducted on design certification applications for evolutionary nuclear power plant designs. The SRP-UDP resulted in a draft revision to the SRP in 1996. The NRC staff used acceptance criteria and procedures introduced in the 1996 draft in reviewing license amendment applications and new applications submitted under 10 CFR Part 52, provided that the changes embodied in it were based on new regulations or regulatory guidance approved through other means. In addition, new SRP sections issued as part of the 1996 draft were used as the primary means to evaluate new applications submitted under 10 CFR Part 52 (e.g., Section 14.3, "Inspections, Tests, Analyses, and Acceptance Criteria") since these sections represented the only guidance available for the given review area.

In 2005, the Commission directed the staff to revise applicable sections of NUREG-0800, other guidance documents, and office procedures to ensure up-to-date guidance would be available for staff responsible for reviewing and licensing new sites and new reactors. The staff was to develop an integrated and continuing plan for updating licensing review guidance and provide the plan, along with a schedule for completion, to the Commission². The staff response to this SRM is contained in SECY-06-0019, "Semiannual Update of the Status of New Reactor Licensing Activities and Future Planning for New Reactors," dated January 31, 2006. In the next semiannual update, SECY-06-0187 dated August 25, 2006, the staff informed the Commission that they had accelerated the SRP revision schedule to March 2007. The staff completed the revision of all SRP sections per the SECY-06-0187 schedule.

In 2010, the Commission provided direction to the staff on the preparation for, and review of, SMR applications, with a near-term focus on integral pressurized water reactor (iPWR) designs. As used in this document, iPWRs are a subset of SMRs. The Commission directed the staff to more fully integrate the use of risk insights into pre-application activities and the review of applications and, consistent with regulatory requirements and Commission policy statements, to align the review focus and resources to risk-significant structures, systems, and components (SSCs) and other aspects of the design that contribute most to safety in order to enhance the effectiveness and efficiency of the review process. The Commission directed the staff to develop a design-specific, risk-informed review plan for each SMR to address pre-application and application review activities³. In 2011, the staff responded to this SRM in SECY-11-0024, "Use of Risk Insights to Enhance the Safety Focus of Small Modular Reactor Reviews," dated February 18, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML110110688). On May 11, 2011, the Commission issued an SRM approving the use of the risk-informed and integrated review framework for staff pre-application and application review activities pertaining to SMR/iPWR design applications (ADAMS Accession

² Refer to Staff Requirements Memorandum (SRM) M050406, "Briefing of Status of New Site and Reactor Licensing," dated May 10, 2005 (ADAMS Accession No. ML051300673).

³ Refer to SRM - COMGBJ-10-0004/COMGEA-10-0001, "Use of Risk Insights to Enhance Safety Focus of Small Modular Reactor Reviews," dated August 31, 2010 (ADAMS Accession No. ML102510405).

No. ML111320551). This SRP Introduction, Part 2, incorporates the Commission-approved SMR risk-informed and integrated review framework described in SECY-11-0024.

Objectives of the SRP

The SRP is intended to be a comprehensive and integrated document that provides the reviewer with guidance describing methods or approaches that the staff has found acceptable for meeting NRC requirements. Implementation of the criteria and guidelines contained in the SRP by staff members in their 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 also makes the staff's review guidance for licensing nuclear power plants publicly available and is intended to improve industry and public stakeholder understanding of the staff review process. It should be noted that the SRP is not a substitute for NRC regulations, and compliance with the SRP is not required. However, when using methods or approaches other than described in the SRP, applicants are expected to provide sufficient information for the staff to conduct independent evaluations to confirm the results and conclusions are in compliance with the regulations.

In addition to documenting current methods of review, the SRP provides a basis for orderly modification of the review process. The NRC disseminates information regarding current safety issues and proposed solutions through various means, such as generic communications and the process for treating generic safety issues. When current issues are resolved, it is necessary to determine the need, extent and nature of revision that should be made to the SRP to reflect new NRC guidance.

The staff should use the SRP as superseded or supplemented by new or revised regulations, regulatory guidance, staff analyses of previous applications, and other published staff positions to perform its review of a power reactor application or a proposed change to an existing license under 10 CFR Part 50, or a new reactor license application or amendment under 10 CFR Part 52.

For SMR applications submitted by applicants that agree to participate in risk-informed and integrated review framework pre-application activities, DSRSs are developed by the staff specifically for the SMR design. The DSRS serves the same purpose and has the same objectives that the SRP has for non-SMR application reviews. Each DSRS includes a "Safety Review Matrix" as a cross-reference indicating which SRP sections are "use-as-is" (no corresponding DSRS section required), which SRP sections are usable with minor modifications, which SRP sections will be replaced by new DSRS sections, and which SRP sections do not apply to the particular SMR design being reviewed.

Scope of Review of License Applications (Initial Applications and Amendments)

Because the staff's review constitutes an independent audit of the applicant's analysis, the staff may emphasize or de-emphasize particular aspects of an SRP section, as appropriate, for the application being reviewed. Prior to the initiation of a review, the technical branch chief and assigned reviewer establish the scope and depth of the review to be performed, including the use of acceptance criteria and review guidelines to be used. In some cases, the staff may propose justification for not performing certain reviews called for by the SRP. These areas of increased or decreased emphasis are acceptable, if the reviewer has management approval and documents the scope and depth of the review in the Safety Evaluation Report (SER).

Examples of acceptable variations in the scope of a review include reduced emphasis on design reviews if the design and its underlying conditions of acceptance are identical to that of another unit that was recently reviewed and approved or increased emphasis on certain aspects of the design review as a result of recent operating experience or consideration of unique design features that are not addressed in the SRP. Risk-insights can also be used in determining the depth of review. The staff should generally limit its review of a proposed amendment to an existing license to those parts of the SRP that are directly affected by the proposed change.

The staff review scope and flexibilities described above are further detailed below under “SMR Design Pre-Application Activities and Application Reviews.”

In addition to the guidance provided for applications and amendments submitted under 10 CFR Part 50, the SRP provides pertinent review guidance to the staff for review of new license applications submitted under 10 CFR Part 52. This includes ESP, DC, COL, SDA, and ML applications. The SRP sections applicable to a COL application are consistent with the organization of guidance contained in Regulatory Guide (RG) 1.206, “Combined License Applications for Nuclear Power Plants (LWR Edition).” The SRP sections applicable to an ESP and a DC application are consistent with the site-related sections and design-related sections of RG 1.206. Furthermore, RG 1.206 delineates different content based on whether the COL application references an ESP, a DC, both or neither. In general, review of a SDA or a ML application will be similar to that of a DC.

For DC, SDA, and COL applications submitted under 10 CFR Part 52, the level of design information reviewed should be consistent with the level of review performed for a Final Safety Analysis Report (FSAR) submitted in a 10 CFR Part 50 OL application. For COL applicants, verification that the as-built facility conforms to the approved design is performed through the inspections, tests, analyses, and acceptance criteria (ITAAC) verification process.

For the review of COL applications, applicable sections of the SRP or DSRS will be used to review the operational program descriptions submitted by the applicant. The review will be performed consistent with guidance contained in SECY-05-0197, “Review of Operational Programs in a Combined License Application and Generic Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria,” and the related SRM dated February 22, 2006. Consistent with this guidance, the staff will review and obtain a reasonable assurance finding on the operational program and its implementation schedule. In addition, the staff will include a license condition on subsequent implementation milestones for each operational program description for which specific implementation requirements are not specified in the regulations.

Deviation from the SRP/DSRS by Applicants

Because the SRP and the DSRS generally describe an acceptable means of meeting the regulations, but not necessarily the only means, applications may deviate from the acceptance criteria in the SRP or the DSRS. On March 10, 1982, the Commission approved 10 CFR 50.34(g), “Conformance with the Standard Review Plan (SRP).” 10 CFR 50.34(g) was subsequently renumbered as 10 CFR 50.34(h). Specifically, paragraph 10 CFR 50.34(h) requires applications for light-water cooled nuclear power plant operating licenses docketed after May 17, 1982, to include an evaluation of the facility against the SRP in effect on May 17, 1982, or the SRP revision in effect six months prior to the docket date of the application, whichever is later. The evaluation must include an identification and description of all differences in design features, analytical techniques, and procedural measures proposed for a

facility and those corresponding features, techniques, and measures given in the SRP acceptance criteria. Where such a difference exists, the evaluation shall discuss how the alternative proposed provides an acceptable method of complying with those rules or regulations of the Commission, or portions thereof that underlie the corresponding SRP acceptance criteria.

Similar provisions regarding contents of applications for the different license processes are contained in the Subparts to 10 CFR Part 52. Staff guidance for reviewing the applicant's evaluation is contained in SRP Chapter 1.0, "Introduction and Interfaces."

Alternatively, SMR applicants 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. This is sufficient to meet the intent of the regulations cited above.

As stated in the Introduction to 10 CFR Part 50, Appendix A, the General Design Criteria (GDCs) establish minimum requirements for the principal design criteria for nuclear power plants similar in design and location to plants for which construction permits and operating licenses have been issued by the Commission. The GDCs are also considered to be generally applicable to other types of nuclear reactor designs and are intended to provide guidance in establishing the principal design criteria for such other units.

The modification of existing GDCs or development of new ones may be necessary for some new SMR designs for which the existing GDCs are not sufficient or for which additional criteria must be identified and satisfied in the interest of public safety. Given this recognition, their omission or lack of specificity for some aspects of new reactor designs does not relieve applicants from considering these matters in the design of a specific facility and in satisfying the necessary safety requirements. It is expected that the GDCs may need to be augmented or changed as important new requirements for these design features are identified by the technical staff.

Finally, there may be instances for which compliance with some GDCs may not be necessary or appropriate. In such cases, departures must be identified and justified by the applicant. The DSRS described below is intended to identify specific acceptance criteria that are applicable for the review of individual SMR designs.

Organization of SRP/DSRS

Each SRP/DSRS section is organized as follows:

Review Responsibilities: This subsection identifies the primary and, as applicable, secondary review functions.

I. Areas of Review

The Areas of Review subsection describes the scope of review by the branch having primary responsibility for the identified functional area. Specifically, this subsection contains a description of the systems, components, analyses, data, or other information that is reviewed as part of the particular Safety Analysis Report (SAR) section. It also contains a discussion of the

information needed or the review expected from other branches to permit the primary review branch to complete its review, as well as a list of applicable interfacing sections.

II. Acceptance Criteria

The Acceptance Criteria subsection identifies the applicable NRC requirements including specific regulations, NRC orders, and industry codes and standards referenced by regulations.

For new reactor license applications submitted under 10 CFR Part 52, the applicant is also required to address:

- the proposed technical resolution of unresolved safety issues and medium and high priority generic safety issues that are identified in the version of NUREG-0933 current on the date six months before application, and that are technically relevant to the design
- Three Mile Island (TMI) requirements
- relevant operating experience

These requirements are not identified within specific SRP or DSRS sections; rather, these requirements are identified within SRP Chapter 1, "Introduction and Interfaces." An applicant will tabulate information within Chapter 1, but will address the technical issues to satisfy the requirements within the specific sections, themselves.

This subsection also identifies the regulatory guidance which the staff has determined provides an acceptable approach (i.e., SRP acceptance criteria) for satisfying the applicable requirements. For the purposes of this NUREG, these criteria can be generally classified as design-based acceptance criteria or as performance-based acceptance criteria.

Examples of design-based acceptance criteria include those acceptance criteria related to SSC basic design, materials, and suitability for service conditions.

Examples of performance-based acceptance criteria include those acceptance criteria related to SSC capabilities, reliability, and availability.

The Guidance documents include but are not limited to: RGs, Commission policy as described in SECY papers and corresponding SRMs, NRC approved or endorsed industry codes and standards, certain technical reports (e.g., NUREGs and topical reports and corresponding safety evaluations), and Branch Technical Positions (BTPs), which are provided as appendices to the SRP. BTPs typically set forth solutions and approaches previously determined to be acceptable by the staff in dealing with a similar safety or design matter. These solutions and approaches are documented in this form so that staff reviewers can take uniform and well understood positions as similar matters arise in the review of various applications.

Each SRP and DSRS section explicitly states that the SRP/DSRS is not a substitute for the NRC regulations, and compliance with it 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.

Lastly, this subsection also contains, as necessary, the technical bases for applicability of the requirements to the subject areas of review or relationship of regulatory guidance to the associated requirement.

III. Review Procedures

This subsection discusses how the review is accomplished. The subsection is a step-by-step procedure to be implemented by the reviewer to obtain reasonable assurance that the applicable regulatory requirements have been met. These review procedures are based on the identified SRP/DSRS acceptance criteria. For deviations from these specific acceptance criteria, the staff should review the applicant's evaluation of how the proposed alternatives to the acceptance criteria provide an acceptable method of complying with the relevant NRC requirements identified in specific review areas of Subsection II.

For new reactor license applications submitted under 10 CFR Part 52, this subsection addresses staff review procedures for how pertinent operating experience insights identified in generic letters and bulletins or equivalent international operating experience have been incorporated into the plant design.

IV. Evaluation Findings

This subsection presents the type of conclusion that is sought for the particular review area. For each SRP/DSRS section, the staff's conclusion is incorporated into a published SER. The SER describes the review and the aspects of the review the staff emphasized, and identifies (1) the changes the applicant made to the application (if any), (2) the matters addressed by additional information (if applicable), (3) the matters for which additional information is expected to be forthcoming, (4) the matters remaining unresolved as open items, and (5) deviations from the SRP/DSRS acceptance criteria in design and operational programs, and the bases for the acceptability of such deviations. The SER also clearly identifies any requested exemptions from the regulations and the staff's bases for its determinations on these requests.

V. Implementation

This subsection provides guidance to applicants and licensees regarding the NRC plans for using the SRP/DSRS section. The NRC regulations in 10 CFR 50.34(h) and similar provisions in 10 CFR Part 52 require each application to include an evaluation of the facility against the SRP of record six months prior to docketing, including all differences between the design features, analytical techniques and procedural measures proposed for a facility and those in the SRP acceptance criteria.

The NRC staff will use the SRP/DSRS version in effect at the time of the application review.

VI. References

This subsection lists the references used in the review process.

Maintenance of the SRP

The SRP will be revised and updated periodically as the need arises to clarify the content or correct errors and to incorporate modifications approved by the Director of the Office of Nuclear Reactor Regulation or the Director of the Office of New Reactors.

A revision number and a publication date are printed at a lower corner of each page of each SRP section. Since individual sections have been, and will continue to be, revised as needed, the revision numbers and dates will not be the same for all sections. As necessary, corresponding changes to RG 1.206, “Combined License Applications for Nuclear Power Plants,” will also be made. Comments may be submitted electronically by email to NRO_SRP.Resource@nrc.gov. Notices of errors or omissions should also be sent to the same address.

Comment resolution will be addressed in subsequent SRP revisions. Prior to revision to individual sections, comment resolution may establish a basis for how alternatives to the NUREG-0800 acceptance criteria provide an acceptable method of complying with the NRC regulations.

SMR DESIGN PRE-APPLICATION ACTIVITIES AND APPLICATION REVIEWS

This portion of the SRP Introduction, Part 2, describes the licensing review philosophy and the risk-informed, integrated review framework to be applied by the staff for new SMR applications under 10 CFR Part 52; and incorporates staff commitments made to the Commission in SECY-11-0024 (see Background).

This framework is distinct from the review approach used for non-SMR applications and license amendments. The review framework described below is not intended for use with current non-SMR licensees or applicants.

Incorporation of this framework in the SRP does not change NRC requirements for SMR applications or applicants. As previously noted, applicants are not required to engage with the NRC in the pre-application activities described herein. The submittals by applicants that choose not to engage the NRC in pre-application activities will be reviewed by the staff using current SRP guidance and methods rather than a DSRS.

Use of this framework does not relieve the requirement for SSCs that are important to safety to meet NRC regulations to perform their safety functions, unless granted an exemption or subject to an application-specific order.

Potential benefits of implementing the framework for SMR applications include:

- gains in early awareness of unique or non-traditional SMR generic issues and design or operational features through pre-application exchanges with applicants, stakeholders, and the NRC staff
- enhanced safety focus for SMR application reviews through the use of risk insights
- improved cross-disciplinary staff reviews and interactions

This framework also advances, where appropriate, the use of a performance-based regulatory approach, which is consistent with longstanding goals of the agency.

As used throughout this discussion of the framework, the term “reviewer” means all NRC staff in all disciplines involved with the pre-application and post-application reviews of specific application sections and creation of the associated SERs.

Overview

As described in the “Background” section of this introduction, the Commission directed the staff to more fully integrate the use of risk insights into pre-application activities and the review of applications and, consistent with regulatory requirements and Commission policy statements, to align the review focus and resources to risk-significant SSCs and other aspects of the design that contribute most to safety in order to enhance the efficiency of the review process.

In response, the staff developed a framework to enhance the efficiency of the review process, and to align the staff review focus and resources with risk-significant SSCs and other aspects of an SMR design that contribute most to safety. The framework builds upon the review process used for non-SMR applications, resulting in a risk-informed and integrated process for the review of SMR applications. The staff implements the framework as they conduct SMR pre-application and post-application activities. The success of this approach depends on the availability of detailed SSC safety and risk information from the prospective applicant(s).

Three major elements comprise the framework (see Figure 1). First, it incorporates a risk-informed review approach by considering both the safety classification and the risk significance of SSCs in order to determine the appropriate level of review (i.e., the framework uses a “graded review” approach).

Second, the framework incorporates an integrated review approach by using the satisfaction of selected requirements to provide reasonable assurance of some aspects of SSC performance (for example, performance-based acceptance criteria related to SSC capability, reliability, and availability). Examples of requirements that could be applied for this purpose include 10 CFR Part 50, Appendix A (general design criteria, overall requirements, criteria 1 through 5), 10 CFR Part 50, Appendix B (quality assurance program), 10 CFR 50.49 (electric equipment environmental qualification program), 10 CFR 50.55a (code design, inservice testing and inservice inspection programs), 10 CFR 50.65 (maintenance rule), Technical Specifications (TSs), Availability Controls for SSCs subject to Regulatory Treatment of Non-Safety Systems (RTNSS), the Initial Test Program (ITP), and ITAAC. In preparing the safety evaluation for the application, the staff may use the satisfaction of these selected requirements to augment or replace, as appropriate, technical analysis and other evaluation techniques to obtain reasonable assurance that the performance-based acceptance criteria are satisfied. Under the framework, the staff also has the flexibility to use these selected requirements to demonstrate satisfaction of design-based acceptance criteria for the SSCs with low risk significance. The staff will verify the demonstration of the design-basis capabilities of SSCs that are important to safety as part of the ITAAC completion review prior to plant operation.

Third, the results of the safety/risk categorization and the integrated review approach described above are documented in the DSRS created by the staff for each SMR design. The DSRS serves the same purpose and has the same objectives that the SRP has for non-SMR application reviews.

The framework is applicable to the review of all SSCs, but it is not applicable to the review of programmatic, procedural, organizational, or other non-SSC topics. This is because under the current risk analysis state-of-the-art, it is not yet possible to assign risk metrics to non-SSCs. However, the application of the selected requirements to SSCs is considered when reviewing the risk significance of individual SSCs that fall within the scope of the requirements. Non-SSC

topics screened out of the framework are reviewed by the staff using traditional evaluation methods to reach a finding of reasonable assurance. Examples of these non-SSC topics include quality assurance programs, training, human factors engineering, health physics programs, and operating procedures.

While it may not yet be possible to assign quantitative risk metrics to non-SSCs, the technical branches responsible for these topics are encouraged to identify and consider alternate methods of risk-informing the reviews of these sections.

Additional guidance on implementing the framework is provided in subsequent sections of this introduction.

Implementation of the SMR Framework

The major activities required to implement the SMR framework are described in this section. The intent of describing these activities here is to provide staff with guidance that, when used in conjunction with applicable, detailed internal procedures, will result in a review framework that can be consistently and objectively applied across SMR designs and application reviews.

These activities may be broadly categorized as pre-application activities and post-application activities.

Pre-Application Activities

The framework is implemented as soon as the staff determines that an applicant has sufficient commercial intent, organizational capacity, and design maturity to support commencement of meaningful regulatory interactions and that there is reasonable expectation of an application submittal. The major factors that will govern the level and timing of the staff's pre-application activities include the maturity of the SMR design and associated Probabilistic Risk Assessment (PRA), and the willingness of the applicant to coordinate with the NRC prior to submitting an application.

A number of critical applicant inputs will determine the ability of the staff to formulate its review strategy and create useful draft DSRS documents during the pre-application period. The quality and timeliness of these inputs are key to the effectiveness of the staff's pre-application activities. Early submittal of finalized or near-final design information for reference use by the staff will minimize revisions of the DSRS sections. Preliminary PRA results and Reliability Assurance Program (RAP) list categorizations will assist the staff in gaining an understanding of the applicant's safety/risk categorization strategy for the SMR SSCs. If the SMR applicant intends to use innovative design features such as passive systems, simplified control features, or other similar approaches, early identification of these features to the NRC will facilitate timely identification of unique regulatory issues that may arise as a result.

Additionally, "white papers," Topical Reports, Technical Reports, or other types of information documents may be submitted by the applicant to the NRC for review during the pre-application period. Documents such as these will assist the NRC in understanding the SMR design as early in the design cycle as possible. Requirements for stakeholder engagement, and the receipt and processing of documents, are not changed by implementation of the framework.

DSRS Preparation

The principal risk-informed and integrated review framework pre-application activity for the staff is the preparation of the overall design-specific review plans, including the DSRS, for use as guidance for performing SMR application reviews. The overall plans include identification of the specific pre-application and post-application review activities, development of the schedule for those activities, and creation of the DSRS itself. Each DSRS provides guidance to support the staff's application review activities by tailoring the SRP to the specific SMR design.

To the extent afforded by the cooperation of the SMR applicant, the staff's DSRS development occurs in parallel with SMR design development. Since the design is expected to evolve from conceptual design through final design, preparation of the DSRS is expected to be iterative. The staff's goals are to complete and publish the public draft DSRS one year prior to submittal of the application, and to issue the final DSRS for use not later than the time of docketing of the application.

During development of the individual DSRS sections by the staff, each corresponding section of the SRP is reviewed to determine whether it can be referenced for use-as-is, needs modifications for use, whether an entirely new DSRS section needs to be created, or whether the corresponding SRP section should be deleted from the DSRS (i.e., the SRP section is not applicable to the SMR design). This assessment is documented by the staff in a "Safety Review Matrix" that is developed for and included in the DSRS prepared for each SMR design.

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.

Each DSRS is prepared by the staff in a format that corresponds with the format/content of the SRP previously described under "Organization of SRP/DSRS." Similar to the SRP, each SSC or topic section/subsection includes a description of the scope of review, identification of the acceptance criteria to be satisfied, and relevant references for the reviewer to use determine whether there is reasonable assurance that the applicant has adequately addressed the NRC regulations and requirements listed in the DSRS section/subsection.

The DSRS will incorporate lessons learned from past NRC large light-water reactor application reviews and applicable published Interim Staff Guidance documents. This information will be incorporated into the SRP sections as applicable, during future regular update cycles.

Six Month Pre-Application SRP/DSRS Reviews by SMR Applicants

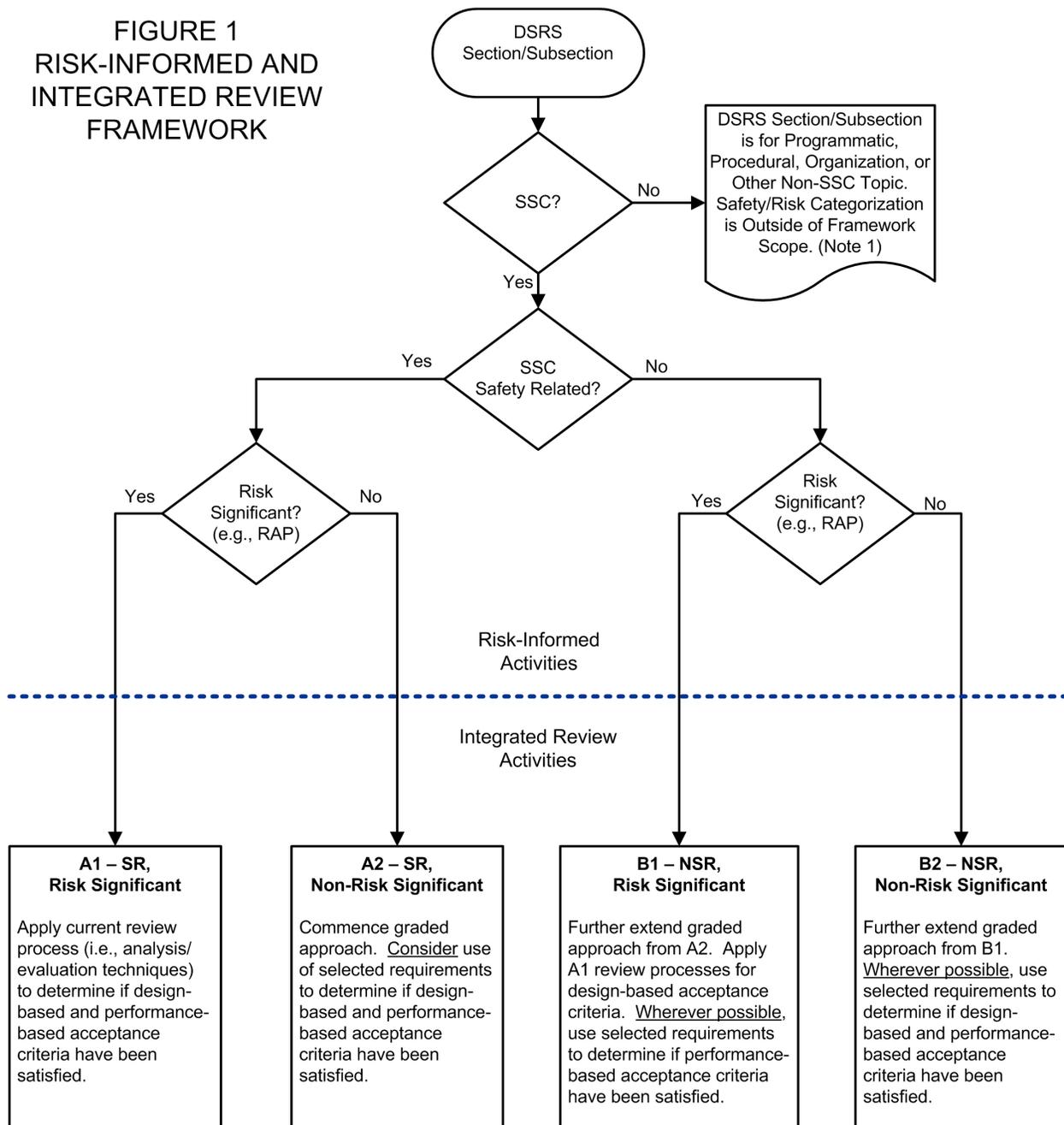
NRC regulations in 10 CFR 52.17(a)(1)(xii), 10 CFR 52.47(a)(9), 10 CFR 52.79(a)(41), 10 CFR 52.137(a)(9), and 10 CFR 52.157(c)(30) state that the applicant for an early site permit, design certification, combined license, standard design approval, or manufacturing license respectively, must include in its application an evaluation of the facility against the SRP revision in effect six months before the docketed date of the application.

Alternatively, SMR applicants 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. This is sufficient to meet the intent of the regulations cited above.

Additional guidance on the timing of the SRP/DSRS evaluation submission is given in SRP Chapter 1.0, Item Number 9. Additional information on the disposition of differences between the applicant's design and the SRP/DSRS is given in the Deviation from the SRP/DSRS by Applicants section of this document.

Following submittal of the application, the NRC staff will determine if design and operational details in the application require adjustments to the DSRS guidance and NRC review approach.

**FIGURE 1
RISK-INFORMED AND
INTEGRATED REVIEW
FRAMEWORK**



Note 1: Programmatic, procedural, organization, or other non-SSC topics (e.g., quality assurance, training, human factors engineering, health physics programs, operating procedures) are outside of the risk-informed and integrated review framework scope and are not subject to the safety/risk categorization process shown in Figure 1. These non-SSC topics will be evaluated using traditional methods as appropriate.

The risk significance associated with these non-SSC topics may be difficult to quantify and evaluate. In these cases, the responsible technical organizations will determine the most appropriate method for demonstrating satisfaction of the acceptance criteria on a case-by-case basis. In doing so, the organizations are encouraged to identify and consider alternate methods of risk-informing reviews of these sections.

Risk-Informed Categorization of SSCs

Performance of the risk-informed categorization of SMR SSCs is a key framework activity in the development of the DSRS, which is risk-informed through identification of the safety and risk attributes of SSCs. In order for the staff to implement the categorization process depicted in Figure 1, the applicant must first categorize SSCs as (1) either safety-related or nonsafety-related using the criteria in 10 CFR 50.2, and (2) either risk significant or not risk significant using the process developed for the RAP; normally documented in Section 17.4 of the DC or COL FSAR. The staff expects to receive preliminary results of the categorization activities as they become available from the applicant in the pre-application phase of the staff's review. The staff will conduct pre-application meetings or audits as necessary to obtain and review the information.

The staff will assign each SSC to one of the four categories shown on Figure 1 based on its review of the information developed by the applicant. It is important that the staff receive the information and complete the initial verification of SSC safety and risk significance as early in the pre-application review process as possible to enable assignment of each SSC to one of the four categories. Complete results of the applicant's categorization activities will be provided in the DC or COL FSAR when the application is submitted to the NRC for review. The staff will review these categorization results as a part of its review of the application. Should the results change as a result of the staff's review, or for other reasons, the staff will adjust its previous category selections accordingly and conduct any additional review dictated by the changes as necessary.

Initial staff activities for this portion of the framework are similar to the existing review practices. Both require a general understanding of the functions of a specific SSC, an overview of design, modes of operation, relationships to other systems, and contributions to risk significance in terms of event initiation or mitigation in order to evaluate information developed by the pre-applicant effectively.

As discussed above, the final safety/risk categorization of SSCs will not be known until the applicant's detailed design and PRA results have been finalized and communicated to the NRC in its application. Therefore, the staff will make best efforts to use the applicant's preliminary categorization assessment to pre-classify SSC safety and risk categorization in order to begin writing the draft DSRS. As the design evolves and the applicant communicates additional information to the staff, the draft DSRS will be reviewed and modified as appropriate.

With regard to risk significance, applicants are responsible for determining which SSCs are candidates for RTNSS, and which are included in the RAP list. The staff assesses and verifies the applicant's categorization once sufficient design detail, PRA information, and RAP list information are available. The verification of whether an SSC is safety-related (i.e., satisfies any of the criteria in 10 CFR 50.2), risk-significant, or both is accomplished through current evaluation and decision processes. Risk significance is measured relative to the likelihood and consequences of severe accidents which involve core damage and can lead to containment failure with a large release of radioactivity. Consequently, risk significance may be determined with the use of insights from the list of risk-significant SSCs included in the applicant's RAP list. The staff reviews the methods and results used by the applicant to establish the list of SSCs included in RAP using guidance in SRP Section 17.4. Guidance for reviewing the selection of SSCs for RTNSS is provided in SRP Section 19.3 and on an SSC-specific basis in the applicable DSRS for a given SSC.

This determination/verification will be documented in the final DSRS prepared for the SMR design. When final, the applicable DSRS sections provide reviewers with SSC design information to guide the determination of whether an SSC meets the definition of safety-related in 10 CFR 50.2 or not. An SSC is considered risk-significant if it has been included in the applicant's RAP or RTNSS program. SSCs that are not included in RAP and RTNSS, but that are still within the scope of the risk analyses (whether modeled or screened out), are considered to have low risk-significance.

Once the safety and risk categorization of the SSC has been provided by the applicant, the NRC requirements specific to the SSC are identified by the technical staff and listed in the SSC-specific section of the DSRS. This list includes the selected requirements that are assigned based on the safety and risk categorization previously developed. The SSC-specific section of the DSRS also lists the acceptance criteria to be met in order to demonstrate satisfaction of the requirements.

Post-Application Activities

Post-application activities for SMR applicants participating in the risk-informed and integrated review framework are similar to those performed for all applicants. Technical reviewers tasked with performing reviews of application sections confirm the applicable SSC safety/risk categorization shown in the DSRS and make adjustments if required based on changes in design information received after initial receipt of the application or resulting from Request for Additional Information responses. Figure 1 will be used as a guide to verify the appropriate framework categorization and associated review approach for the SSC based on the SSC safety classification and risk significance evaluation.

Application of the Integrated Review Approach

Four review levels (labeled as A1, A2, B1, and B2 in Figure 1) correlate to the safety classification and risk significance of the SSC under review. Using a graded approach, the staff applies the most rigorous review techniques to SSCs with the highest safety and risk significance (analogous to the typical review process using the SRP), and a progressively less-detailed review to other SSCs as the assigned safety/risk significance declines.

In the SMR review framework, satisfaction of design-based acceptance criteria for categories A1 and B1 continues to be demonstrated using current methods, including independent analysis and evaluations, confirmatory calculations, computer modeling, and other similar techniques. Satisfaction of design-based acceptance criteria for categories A2 or B2 may also be demonstrated using these current methods, or by the use of selected requirements as discussed below.

Satisfaction of performance-based acceptance criteria in the framework may be demonstrated by use of traditional methods as described above, through the use of test or performance data from selected requirements, or through a combination of these techniques. The blend of techniques selected by the DSRS technical writers and the reviewers are guided by the SSC safety/risk categorization determined by the applicant and verified by the staff.

The NRC requirements that must be met by an SSC do not change under the SMR framework. Under the graded approach, the NRC staff may rely on the applicant's submittal with selected requirements to demonstrate satisfaction of performance-based acceptance criteria in lieu of

detailed independent analyses. They may also be used to demonstrate satisfaction of design-based acceptance criteria for category A2 and B2 SSCs. For example, satisfaction of acceptance criteria related to the capability, availability or reliability of an SSC may be addressed through the satisfaction of these selected requirements, to an extent consistent with the safety/risk categorization of the SSC. The staff will verify the demonstration of the design-basis capabilities of SSCs that are important to safety as part of the ITAAC completion review prior to plant operation.

The staff preparing the DSRS, using safety/risk categorization inputs from the applicant as verified by the staff, makes an initial determination of which selected requirements could be used as an alternate method for demonstrating the satisfaction of the design-based or performance-based acceptance criteria. The review, including decisions on the use of selected requirements and analysis/evaluation techniques, should focus on the functions and characteristics of the SSC that pertain to its safety/risk significance.

Examples of requirements that may apply to an SSC and that could be used to demonstrate the satisfaction of design-based or performance-based acceptance criteria include:

- 10 CFR Part 50, Appendix A, General Design Criteria, Overall Requirements, Criteria 1 through 5
- 10 CFR Part 50, Appendix B, Quality Assurance (QA) Program
- 10 CFR 50.49, Environmental Qualification of Electric Equipment (EQ) Program
- 10 CFR 50.55a, Code Design, Inservice Inspection and Inservice Testing (ISI/IST) Programs
- 10 CFR 50.65, Maintenance Rule requirements (MR)
- Reliability Assurance Program (RAP)
- Technical Specifications (TSs)
- Availability Controls for SSCs subject to Regulatory Treatment of Non-Safety Systems (RTNSS)
- Initial Test Program (ITP)
- 10 CFR 52.47, Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC)

This list of examples above is not intended to be all-inclusive. During preparation of the DSRS by the staff, the list of selected requirements for specific SSCs is determined. This list is included in the "Review Procedures" subsection of each DSRS section. Following receipt of the application, it is the responsibility of the technical reviewers to determine how best to apply the list of selected requirements in order to determine whether design-based and performance-based acceptance criteria have been met.

Once an application has been received, reviewers retain flexibility and discretion in selecting the appropriate review methods to be applied to an SSC based on unique characteristics or

circumstances. For example, the level of review methods to be applied to an SSC initially categorized by the applicant and confirmed by the staff preparing the DSRS as “B1” includes evaluation and analysis techniques for design-based acceptance criteria and the use of selected requirements “wherever possible” to determine the satisfaction of performance-based acceptance criteria. The reviewer may determine that additional analyses are needed to augment the use of selected requirements for a particular SSC to reach a conclusion of reasonable assurance.

When reliance on a selected requirement is used to demonstrate satisfaction of acceptance criteria and SSC performance, the specific requirement sub-element and implementation milestone are to be identified by the reviewer.

The four safety/risk categories in Figure 1 are described below with examples of the integrated review approach.

- A1 - For SSCs determined to be both safety-related and risk-significant, the level of review is denoted as A1. For such SSCs, the review is consistent with the typical review process using the SRP in that the review typically involves detailed analysis and evaluation techniques to demonstrate satisfaction of the DSRS design-based and performance-based acceptance criteria. In addition, the DSRS identifies those selected requirements applicable to the SSC.

For example, the staff will verify as part of the application review that A1 SSCs satisfy all special treatment requirements applicable to those SSCs including QA, EQ, 10 CFR 50.55a, MR, RAP, ITP, and ITAAC.

- A2 - For SSCs determined to be both safety-related and not risk-significant, the level of review is denoted as A2. Similar to A1, the NRC staff continues to be required to reach a reasonable assurance finding for the capability of safety-related SSCs categorized as A2 to perform their safety-related functions prior to issuing a license or design approval.

However, the graded review approach commences at the A2 level for design-based and performance-based acceptance criteria. The reviewer identifies selected requirements that may be considered for use in lieu of some analysis and evaluation techniques to demonstrate satisfaction of specific acceptance criteria.

- Under the framework for category A2 SSCs, the staff has flexibility in determining how best to apply the selected requirements listed above to demonstrate satisfaction of acceptance criteria. For example, the applicant may provide a certification in its submittal that NRC requirements for design-basis capability will be satisfied with because of the applicant’s reliance on selected requirements, such as QA, and others as applicable. The reviewer may determine that for a particular SSC, the applicant’s certification commitment to these requirements is sufficient to reach a finding of reasonable assurance for the SSC being reviewed and the reviewer may include an ITAAC to verify that the A2 SSC is built as designed. System performance of the A2 SSC will be verified during pre-operational testing to satisfy the ITAAC combined with demonstration verification of the design-basis capability of the A2 SSC during the review of pre-operational testing to verify ITAAC completion prior to plant operation, is sufficient to reach a finding of reasonable assurance for the SSC being reviewed.

- B1 - For SSCs determined to be both nonsafety-related and risk-significant, the level of review is denoted as B1. For design-based acceptance criteria, the review is similar to the review for A1 SSCs.

For performance-based acceptance criteria, the graded review approach is further extended from the A2 level. The review emphasis shifts from applying analysis and evaluation techniques to identifying those selected requirements that satisfy DSRS acceptance criteria wherever possible. If any of the proposed selected requirements satisfies the acceptance criteria, it can be used to augment or replace some of the review procedures. For those acceptance criteria that cannot be satisfied, either in whole or in part, by performance-based activities (e.g., tests or inspections) within selected requirements, the appropriate analysis and evaluation techniques are applied (i.e., relying on existing review methods described in the DSRS). Note that for SSCs determined to be highly risk-significant, it may be appropriate to perform more detailed reviews using methods associated with reviews performed at the A1 level.

- B2 - For SSCs determined to be both nonsafety-related and not risk-significant, the level of review is denoted as B2. The graded review approach is further extended from the B1 level. At the B2 level, both the design-based and the performance-based acceptance criteria are anticipated to be minimal. The review is focused on identifying those performance-based activities (e.g., tests or inspections) within the selected requirements that can be used to satisfy the design-based or performance-based acceptance criteria. If any of the proposed requirements satisfies the acceptance criteria, it can be used to replace some of the review procedures.

However, there may be SSC design-based acceptance criteria that cannot be satisfied solely through the use of selected requirements. For such SSCs, the reviewer considers application of appropriate analysis and evaluation techniques to be the alternative review method.

Review levels A1 through B2 reflect a graded approach to reviews in that performance-based activities within selected requirements are increasingly applied to satisfy DSRS acceptance criteria in lieu of applying traditional analysis and evaluation techniques. This approach involves the professional judgment of the reviewer and, therefore, the extent to which selected requirements are applied to satisfy the acceptance criteria during A2, B1, and B2 reviews will vary, as do the traditional review approaches given the flexibilities with the SRP.

In addition, in cases where SMR designs include features that differ significantly from large LWR designs, the staff considers the risk significance of the subject SSCs in the implementation of the additional analysis and testing requirements required by 10 CFR 50.43(e).

When a technical reviewer has determined that a particular requirement will be used to satisfy a specific acceptance criterion, the reviewer ensures that the documentation submitted by the applicant includes the specific method to be used to satisfy the criterion. The use of the selected requirement to satisfy the criterion is also documented in the final SER. If the application does not include the specific requirement used as a basis for satisfaction of the design criterion, the NRC requests that the application be revised to include the commitment in the design basis of the plant. An example could be a request for a particular test or inspection to be included in the plant initial test program if it was not already included.

For example, a technical reviewer may determine that an “A2” system flow rate needs to be at least 40 gallons per minute to support a finding of reasonable assurance. The reviewer may determine, based on the safety and risk significance classification of the SSC, that a detailed analysis or independent calculation is not necessary for this parameter and the information provided in the applicant’s submittal is sufficient to support the safety finding. System performance will be verified during pre-operational testing to satisfy the ITAAC associated with the minimum system flow rate.

The reviewer has options regarding the best way to incorporate the requirement for the performance test. These options are informed by the safety and risk categorization of the particular SSC. The test requirement could be included in the applicant’s ITAAC submittal as a Tier 1 or Tier 2 item in the Initial Test Program (ITP), the test requirement could be added as a COL action item, or the reviewer could request the applicant to add the test requirement to the application submittal.

Paperwork Reduction Act Statement

The information collections contained in the Standard Review Plan are covered by the requirements of 10 CFR Part 50 and 10 CFR Part 52, and were approved by the Office of Management and Budget, approval numbers 3150-0011 and 3150-0151.

Public Protection Notification

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.

**SRP Introduction – Part 2
Summary of Changes**

**“STANDARD REVIEW PLAN FOR THE REVIEW OF SAFETY ANALYSIS REPORTS FOR
NUCLEAR POWER PLANTS: SMALL MODULAR REACTOR (SMR) EDITION”**

Standard Review Plan Introduction – Part 2 is a new SRP section not previously included in NUREG-0800. It has been developed to provide an overview of the “Risk-Informed and Integrated Review Framework” review methodology to be used for SMR applications under 10 CFR Part 52, when applicants choose to participate in pre-application coordination with the NRC.