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Updating the Standard Review Plan—An Oak Ridge National Laboratory Perspective

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INTRODUCTION

The Nuclear Regulatory Commission (NRC) Standard Review Plan (SRP), NUREG 0800, provides guidance to NRC staff reviewers in the Office of Nuclear Reactor Regulation and the Office of New Reactors who perform safety reviews of applications to construct and operate nuclear power plants. The last approved revision to the SRP was in July 1981. However, a significant effort was made in 1996 to review the applicable documentation and update the SRP. Although much work was completed, this revision to the SRP was never formally reviewed and approved by the NRC. With the anticipation of receiving applications for approximately 30 new nuclear power plants during the next several years, the NRC determined that the SRP needed to be updated and reissued. The NRC updated many of the SRP chapters internally, while a number of chapters were contracted to the U.S. Department of Energy national laboratories for update.

SRP UPDATES MADE AT ORNL

At Oak Ridge National Laboratory (ORNL), 16 SRP sections were updated between August 2006 and January 2007. These updates incorporated the information developed during the 1996 SRP update effort and included a review of all applicable documentation developed between 1996 and 2006. Key issues that ORNL addressed in the SRP updates included the following:

- Keeping the SRPs pertinent for existing designs of nuclear power plants;
- Addressing passive design features of new-generation pressurized-water reactors (PWRs) and boiling-water reactors (BWRs);
- Differentiating the design features among the existing BWRs, advanced boiling-water reactors (ABWRs), and (economic simplified boiling-water reactors (ESBWRs);
- Developing a new section on Inspection, Test, Analyses, and Acceptance Criteria (ITAAC) for Reactor Systems (Tier 1);
- Updating acceptance criteria based on changes in national codes and consensus standards; and
- Restructuring the format of the 1996 versions to meet the specific requirements and format for SRP sections as required in LIC-200, Revision 1, November 6, 2006.

Some specific examples of typical changes to the SRP chapters are discussed below.

Text, equations, and references in SRP Sections 3.3.1 and 3.3.2 on wind and tornado loads were revised to reflect current procedures for transforming wind speed into an equivalent pressure applied to structures that must withstand the effects of the specified design wind speed for the plant. These procedures, which are described in ASCE/SEI 7-05, "Minimum Design Loads for Buildings and Other Structures," take into consideration the geometrical configuration and physical characteristics of the structures and the distribution of wind pressure on the structures. This standard updates the wind-loading provisions in ANSI A58.1-1972 and ASCE Paper No. 3269 that were referenced in the 1996 draft versions of these SRP sections.

When ORNL updated SRP Section 5.2.2, "Overpressure Protection," a major goal of the NRC was to restructure the text to be more user-friendly regarding reactor type and temperature/pressure status. As a result, one aspect of the update specifically divided the review criteria into four categories:

1. BWR power operation
2. BWR low-temperature operation
3. PWR power operation
4. PWR low-temperature operation

Previously, SRP Section 5.2.2 had focused primarily on safety and relief valves for overpressure protection. The section update included consideration of other mechanisms for overpressure protection, such as an oversized pressurizer on a PWR and an isolation condenser on a BWR. Advanced reactor isolation condensers actually prevent any significant pressure rise as the result of an anticipated operational occurrence, leading to a defense-in-depth role for the safety and relief valves. Appropriate ITAAC references were added to the section as well as 10 CFR Part 52 references.

One significant change in nuclear plant design that affected several SRP sections was that the isolation condenser system (ICS) was added as part of the ESBWR design. This new system required reviewing essentially new technology. Although the very early model BWRs had isolation condenser systems, the earlier system designs were for a much-smaller-capacity system and the

ICSs had few safety-related functions. The ICS for the ESBWR is composed of several loops, each of which is safety related. In addition, the ESBWR design includes a new design for the standby liquid control system (SLCS) that necessitates a whole new approach to any review. Finally, the reactor core isolation cooling (RCIC) system has been eliminated from the ESBWR design. Functions that were once performed by RCIC were now being performed by other systems. This requires ensuring that these "moved" functions are still part of the review cycle and are not inadvertently omitted from the review process.

Also, the ABWR design, which has already been certified by the NRC, includes an updated classification for the RCIC. RCIC is now classified as a safety-related system in the ABWR design. Another change in the ABWR is that the design of the SLCS is different from both the current BWR SLCS design and the ESBWR SLCS design. Therefore, each of the different designs has to be accounted for properly in the SRP review process.

As noted above, the SRP section on ITAAC is new. ITAAC is essentially the means by which a licensee demonstrates, and NRC concurs, that a plant has been constructed and will be operated in accordance with a certified design, the Atomic Energy Act, NRC regulations, and the license as authorized by NRC. The licensee identifies the following: (a) design commitments in the form of key features as contained in the design basis for the plant; (b) inspections, tests, and analyses that are required to be performed to determine if the commitment was met (these may take the form of straightforward observations, tests, or other types of examinations or verifications); and (c) acceptance criteria, as taken from assumptions in the plant's safety analysis that provide reasonable assurance that the inspections, test, and analyses have been met. The scope of SRP Section 14.3.4 focuses on ITAAC for reactor systems that include the reactor core, fuel, control rods, reactor vessel, reactor coolant system, and emergency core cooling systems (active and passive) that are significantly related to normal operation, transients, and accidents.

There were three key issues in developing the current ITAAC SRP section:

1. Providing appropriate guidance for the NRC reviewer to evaluate the process by which an applicant identifies or derives Tier 1 information (the top-level design features and performance standards are those that are most important to safety, including safety-related and defense-in-depth features and functions and non-safety-related systems that potentially impact safety) from Tier 2 information.
2. Ensuring appropriate treatment of nonsafety systems in passive designs. Passive-designed reactors use safety systems that employ passive means (natural forces), such as gravity, natural circulation, condensation and evaporation, and stored energy, for accident mitigation.
3. Determining the appropriate use of design acceptance criteria in place of ITAAC.