POLICY ISSUE
(Information)

April 8, 2019 SECY-19-0034

FOR: The Commissioners

FROM: Margaret M. Doane
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SUBJECT: IMPROVING DESIGN CERTIFICATION CONTENT

PURPOSE:

This paper describes the staff's efforts to improve the content of design certifications under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, so that approval from the U.S. Nuclear Regulatory Commission (NRC) is not required for design changes that have minimal safety significance. This paper does not address any new commitments or resource implications.

SUMMARY:

The design certifications issued to date have design information in three categories: Tier 1, Tier 2*, and Tier 2. All departures from Tier 1 or Tier 2* require NRC approval, while departures from Tier 2 may be made under a 10 CFR 50.59-like process. During construction of Vogtle Units 3 and 4, NRC approval has sometimes been required for departures from the AP1000 design that were of minimal safety significance. These departures could have been made without NRC approval under a 50.59-like process, but NRC approval was required because the relevant design information was Tier 1 or Tier 2*. Therefore, the staff is refining the general principles for Tier 1 content so that NRC approval will not be required for design changes of minimal safety significance. These refinements also apply to Tier 2*. The staff's new approach maintains standardization, but standardization restrictions will typically apply at a qualitative and functional, rather than at a numeric, level of detail. The staff is successfully applying this new approach to the NuScale review.

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To illustrate the staff's new approach, this paper describes how the refined principles for Tier 1 content are being applied to the structural integrity review. As discussed below, the new approach significantly reduces the amount of structural design information for which departures automatically require NRC approval.

The staff recognizes the need for further enhancements to the design certification process. Future initiatives include the development of more detailed, objective criteria for Tier 1 content that will reflect consideration of a planned industry proposal on this topic. Also, the staff will consider the broader issue of standardization through the rulemaking process. These initiatives will be informed by the staff's review of the NuScale design certification application and any additional insights from construction of the new Vogtle units.

BACKGROUND:

Promoting nuclear plant standardization is an objective of 10 CFR Part 52. The NRC pursued this objective to enhance safety and resolve design issues before construction.[1] Certification of standard designs is one tool the NRC uses to accomplish standardization.

To maintain the standardization achieved at certification, NRC regulations restrict the changes that may subsequently be made to the design. As relevant to this paper, 10 CFR 52.63(b)(1) requires a combined license applicant or holder referencing a standard design to obtain an exemption to depart from the "certification information." However, 10 CFR 52.63(b)(2) provides that departures from non-certified portions of the design may be made under 10 CFR 50.59.

When promulgating Part 52, the Commission left to each design certification rulemaking the amount of information to be certified.[2] The Commission also stated the following:

> The Commission does expect, however, that there will be less detail in a certification than in an application for certification, and that a rule certifying a design is likely to encompass roughly the same design features that § 50.59 prohibits changing without prior NRC approval. Moreover, the level of design detail in certifications should afford licensees an opportunity to take advantage of improvements in equipment.[3]

In a number of SECY papers in the early 1990s, the NRC established the structure of design certifications and the level of detail to be included therein.[4] These efforts culminated in the promulgation of the design certification rule (DCR) for the U.S. Advanced Boiling Water Reactor (ABWR) in 10 CFR Part 52, Appendix A. Subsequent DCRs have followed the basic approaches established for the ABWR. Thus, each DCR incorporates by reference a design control document with design information divided into tiers: Tier 1, Tier 2, and Tier 2*.

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[1] Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Reactors, 54 FR 15372, 15376 (Apr. 18, 1989) (final rule) (1989 Part 52 Rule).

[2] 1989 Part 52 Rule, 54 FR at 15377.

[3] *Id.*

[4] Significant papers associated with the first three design certification rules are listed in a staff memorandum titled "Regulatory History - Design Certification Rules," dated April 26, 2000 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML003761550).

Tier 1 information is "approved and certified," and an exemption is required for departures from this information.[5] The NRC must consider any decrease in safety resulting from a reduction in standardization before granting an exemption from Tier 1.[6] By contrast, Tier 2 information is "approved but not certified," and departures from Tier 2 are generally subject to a 50.59-like process that has no standardization criteria.[7] In the design certifications issued to date, some design information has been designated as Tier 2*, with a departure from Tier 2* requiring NRC approval, as discussed below.

The Tier 2 information is voluminous and roughly corresponds to the information required by 10 CFR 52.47(a) to be included in the design certification final safety analysis report.[8] Tier 1 is similarly broad in scope but has much less detail. Tier 1 information includes the following:

- definitions and general provisions
- design descriptions
- inspections, tests, analyses, and acceptance criteria (ITAAC)
- significant site parameters
- significant interface requirements.[9]

The Tier 1 design descriptions, site parameters, and interface requirements are derived from Tier 2. Design descriptions and ITAAC constitute the vast majority of Tier 1. Decisions approving both Tier 1 and Tier 2 information are considered final agency action, i.e., the nuclear safety issues associated with Tier 1 or Tier 2 are considered resolved in subsequent proceedings involving the design certification, and the NRC must satisfy specified criteria to impose changes on the information.[10]

As discussed in SECY-90-377, a two-tier structure was intended to provide flexibility by allowing the licensee to address "fit-up" problems during construction, incorporate technological innovations, replace equipment that is no longer being made, and have greater input into the procurement process, all without the need for exemptions.[11] Although Tier 2 is not subject to standardization restrictions, the staff believed that market forces "such as the cost of redesign and the possibility for adjudication" would help preserve standardization by discouraging changes to Tier 2. The Commission approved the two-tier structure in the staff requirements memorandum (SRM) for SECY-90-377.[12] Regarding flexibility, the Commission stated that changes to the approved design should be minimized, but "a certain amount of flexibility will be needed to finalize procurement information and to construct the facility."
The Commission, in SRM-SECY-90-377, provided detailed direction on the level of detail to be included in design certification applications, including use of a graded approach where the level

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[5] *See, e.g.*, 10 CFR Part 52, App. A, Sections II.D & VIII.A.4.

[6] 10 CFR 52.63(b)(1).

[7] *See, e.g.*, 10 CFR Part 52, App. A, Sections II.E & VIII.B.5.

[8] *See, e.g.*, 10 CFR Part 52, App. A, Section II.E.

[9] *See, e.g.*, 10 CFR Part 52, App. A, Section II.D.

[10] *See, e.g.*, 10 CFR Part 52, App. A, Sections VI.B and VIII.

[11] SECY-90-377, "Requirements for Design Certification Under 10 CFR Part 52" (Nov. 8, 1990) (ADAMS Accession No. ML003707889).

[12] SRM-SECY-90-377 (Feb. 15, 1991) (ADAMS Accession No. ML003707892).

of detail is commensurate with the safety significance of the structure, system, or component (SSC) in question. But the Commission did not specify what information should go in Tier 1. Instead, the Commission directed the staff to make such determinations in parallel with the staff's review and to incorporate generic conclusions from this process in regulatory guidance.

Section 14.3 of the Standard Review Plan (SRP) contains NRC guidance on review of Tier 1 information.[13] In addition to the detailed guidance contained therein, SRP Section 14.3 also states several general principles regarding the level of detail in Tier 1:

- Tier 1 should include "the top-level design features and performance characteristics" that are "the most significant to safety."
- The level of detail is governed by a graded approach based on safety significance.
- Detailed supporting information on how to perform an ITAAC may be in Tier 2.
- The acceptance criteria in ITAAC should generally be "objective and unambiguous," but acceptance criteria may be more general when the supporting Tier 2 information "does not lend itself to concise verification."
- Decisions on whether to include numeric values in Tier 1 design descriptions should be based on safety significance. For ITAAC, numeric values should be specified in the acceptance criteria "when values consistent with the [Tier 1] design commitments are possible, or when failure to meet the stated acceptance criterion would clearly indicate a failure to properly implement the design or meet the safety analysis."
- The use of codes and standards in Tier 1 should be minimized. With certain exceptions, Tier 1 should state the applicable requirements from codes, standards, and regulations rather than reference them. This approach provides clarity and allows flexibility if the reference changes. If a code is referenced in Tier 1, the specific edition, date, etc. should be specified in Tier 2 rather than Tier 1 to provide flexibility.

These principles derive from staff positions taken during the ABWR review, either in SECY papers or in the final safety evaluation report (FSER). Other than the graded approach, the Commission did not take positions on these principles.

In the designs certified so far, Tier 1 design descriptions have information that generally falls in the following categories:

- Brief narrative descriptions of plant systems and their overall purposes
- General arrangement drawings that are not drawn to scale and do not specify precise locations of plant SSCs
- Tables that state the general requirements applicable to identified SSCs (American Society for Mechanical Engineers (ASME) Code requirements for piping, Class 1E requirements for electrical equipment, seismic categorization, etc.)
- Tables that provide specific dimensions or other numeric values for identified SSCs
- Design commitments that briefly state the top-level functional requirements for the SSCs (e.g., Seismic Category I structures can withstand design basis loads).

[13] NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," Section 14.3 (Mar. 2007) (ADAMS Accession No. ML070660618).

The ITAAC verify the Tier 1 design commitments. Some ITAAC address a complex set of activities (e.g., structural integrity analyses, ASME Code compliance). In these cases, the acceptance criterion usually requires a report demonstrating that the top-level design commitment is met. The detailed methodologies and acceptance criteria for performing these activities are generally in Tier 2, except for ASME ITAAC, where the detailed information is in the ASME Code itself. For ITAAC governing simpler activities, the acceptance criterion might provide a specific value that must be satisfied, reference a table of values in Tier 1, or otherwise describe the objective outcome of an inspection or test (e.g., the valve opens as indicated in the table, the electrical signal is transmitted as required).

As stated above, some design information has been designated as Tier 2*. NRC approval in the form of a license amendment is required before departing from Tier 2*, but the Tier 1 exemption criteria do not apply. Current staff positions on use of Tier 2* are in SECY-17-0075.[14] As stated therein:

- Consistent with established principles, the Tier 2* designation should be applied to information only if it would qualify for inclusion in Tier 1 based on safety significance and there is a demonstrated need for the flexibility of the Tier 2* change process.
- The staff will improve guidance to ensure consistent and appropriate usage of Tier 2*.
- Given the relationship between Tier 2* and Tier 1, improvements to guidance would include more detailed and objective criteria for what should be included in Tier 1.

Neither the Advanced Power Reactor 1400 (APR1400) design approval nor the NuScale design certification application contains Tier 2* information.[15]

DISCUSSION:

In developing design certifications, applicants and the staff have balanced the competing objectives of standardization and flexibility. For designs certified to date, this balancing was performed before a Part 52 plant had ever been constructed. The staff has subsequently learned that previous approaches to Tier 1 and Tier 2* content sometimes result in required NRC approvals for deviations from the certified design that could have been made without NRC approval under a 50.59-like process. However, when Part 52 was promulgated, the Commission expected the certified information to focus on those design features that could not be changed without NRC approval under the 10 CFR 50.59 process.

The staff is taking several steps to improve Tier 1 content so that NRC approval is not required for design changes of minimal safety significance. As a result, standardization restrictions will typically apply at a qualitative and functional, rather than numeric, level of detail. These steps also apply to Tier 2* because information should be designated as Tier 2* only if it qualifies for inclusion in Tier 1.

The staff's new approach to Tier 1 content has several benefits. For example, the licensing process is expected to be more stable and predictable because it will focus on safety-significant matters. Also, resources will not be diverted to regulatory approvals for changes of minimal safety significance. Avoiding such inefficiencies will be particularly important during the last year of facility construction, when substantial resources will be devoted to closure of a large

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[14] SECY-17-0075, "Planned Improvements in Design Certification Tiered Information Designations" (July 24, 2017) (ADAMS Accession No. ML16196A321).

[15] The staff completed its review of the APR1400 design and issued a standard design approval on September 28, 2018. The design certification rulemaking is ongoing.

number of ITAAC, and, potentially, to the ITAAC hearing process. Fundamentally, the staff's new approach promotes safety by focusing licensee and staff attention on those matters most important to safety.

A. General Principles for Tier 1 Content

The general principles for Tier 1 content in SRP Section 14.3 do not adequately emphasize the importance of avoiding unnecessary detail in Tier 1. To address this, the staff is adding two general principles for Tier 1 content: (1) Tier 1 should typically be described at a qualitative and functional level of detail, and (2) Tier 1 should not include detail that could necessitate NRC approval for departures from the certified design that have minimal safety significance. These principles should lead to a more judicious selection of Tier 1 information. In applying these principles, applicants will still need to include the top-level design features of a specific standard design in Tier 1. That is, the information should reflect the specific safety-significant features of the design in question and not just include general statements that apply to classes of reactors.

Consistent with the new principles, the staff has revisited its guidance on numeric detail in Tier 1. SRP Section 14.3 states that numeric values should be included "when values consistent with the [Tier 1] design commitments are possible." However, this practice can lead to unnecessary NRC approvals because a small change to the specified value requires NRC approval even if the changed value is also consistent with the Tier 1 design commitment.

The staff will employ a more restrictive approach to numeric values, similar to the approach described in SECY-91-178.[16] In that paper, the staff stated that numeric values would be specified in ITAAC acceptance criteria "only ... when failure to meet the stated acceptance criteria would clearly indicate a failure to properly implement the design." However, the subsequently-issued ABWR FSER Section 14.3 described the more expansive approach to numeric values that is reflected in current guidance.

The staff surmises that the more expansive approach was intended to make the ITAAC objective and unambiguous. Part 52 has the clear purpose of resolving as many issues as possible before construction begins. Thus, ITAAC are intended to be "very narrow," as discussed in the SRM for SECY-02-0067.[17] However, numeric acceptance criteria are not the only way to accomplish this purpose. The ITAAC are still narrow if the acceptance criteria clearly state the functional requirement and Tier 2 includes detailed methodologies and criteria for verifying that the functional requirement has been met. Such an approach is already used for more complex ITAAC, and finality attaches to Tier 2 as well as Tier 1. The licensee might depart from Tier 2, but finality also attaches to the departure if the licensee follows the 50.59-like process in the design certification rule.[18]

The staff now believes that numeric information in Tier 1 should be minimized. Numeric values could be used for basic descriptions of the design, such as numbers of modules, pumps, or diesel generators. Values might also be specified when a deviation from the value clearly indicates a failure to meet fundamental design criteria. Examples include numeric values in regulations, specified periods for maintaining core cooling (e.g., 72 hours), significant site parameters, etc. The staff intends to not require numeric values in Tier 1 for items such as

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[16] SECY-91-178, "[ITAAC] for Design Certifications and Combined Licenses" (June 12, 1991) (ADAMS Accession No. ML003707907).

[17] SRM-SECY-02-0067 (Sept. 11, 2002) (ADAMS Accession No. ML022540755).

[18] *See, e.g.*, 10 CFR Part 52, App. A, Section VI.B.6.

structural dimensions and loading values. Instead, Tier 1 would focus on the fundamental functional requirement for the SSC in lieu of numeric values; the detailed values would reside in Tier 2 and be controlled through a 50.59-like process.

The staff recognizes that applicants might wish to include numeric values in Tier 1 beyond what the staff now proposes, or that licensees might want to mitigate the disadvantages of Tier 1 values in existing design certifications without removing numeric values from their licenses. In such cases the staff will entertain alternatives to the staff's revised position on numeric values. For example, a licensee might request a departure from Tier 1 that would seek to retain certain structural dimensions in Tier 1 as a design goal but allow for construction deviations from these values if a reconciliation analysis shows that the as-built structure still accomplishes its required functions. Other examples include the use of bounding values or appropriate tolerances.

B. Revisiting the Amount of Structural Information that Should Be Included in Tier 1

The enclosure to this paper explains how the staff is applying the revised general principles for Tier 1 content to structural design descriptions and ITAAC. As discussed in the enclosure, Tier 1 would typically describe the major features of the structure at a qualitative and functional level of detail; this should not result in required NRC approvals for design changes of minimal safety significance. For the structural integrity review, the ITAAC would generally be sufficient if they verify that the as-built safety-significant structures maintain their structural integrity under design basis loads in accordance with the supporting Tier 2 information, and that as-built Seismic Category I structures are appropriately protected from adverse interaction with SSCs that are not Seismic Category I. The specific analysis methods and criteria for meeting the ITAAC would reside in Tier 2 but not Tier 1.

The enclosure also describes how the staff's new approach compares with the approach taken with the AP1000 certified design. Under the new approach, the following information would ordinarily not need to be included in Tier 1 from a structural integrity perspective:

- The structural codes and seismic analysis methods that were designated as Tier 2* for the AP1000
- The critical section, critical location, and structural module descriptions that were Tier 2* for the AP1000
- Numeric values, such as structural dimensions and thicknesses, that were Tier 1 or Tier 2* for the AP1000.

Although this information could reside only in Tier 2 from a structural integrity perspective, the staff acknowledges that some numeric values (e.g., wall thicknesses) might also be relevant to other technical disciplines. The other uses of these values would need to be assessed to determine whether the relevant safety issues warrant Tier 1 treatment. If Tier 1 treatment is justified, it would be preferable to address the safety issues through less-detailed Tier 1 functional requirements instead of numeric detail. Even if some Tier 1 treatment is warranted, the staff's new approach should result in a substantial reduction in the amount of structural information for which departures automatically require NRC approval. For the information that resides solely in Tier 2, the 50.59-like change process will continue to require prior NRC approval for safety-significant changes.

C. Applicability of New Approach to Tier 1 Content

The staff will apply its new approach for Tier 1 content to future design certification applications. The staff is also applying the new approach to the NuScale review. Use of the approach has not resulted in any significant open issues. For issued design certifications and the APR1400

standard design approval (which is nearing certification), the staff will entertain proposals to apply the new approach on either a wide-ranging or more limited basis. Such proposals may come in the form of a requested amendment to the design certification rule or a plant-specific departure from Tier 1 (or Tier 2*).

D. Future Initiatives

As discussed in SECY-17-0075, NRC guidance should be revised to include more detailed and objective criteria for Tier 1 content. The development of these detailed criteria will be informed by the general principles described above, the staff's review of the NuScale application, and any additional insights from construction of Vogtle Units 3 and 4. The detailed criteria will ultimately be reflected in an update to the SRP.

Relatedly, the Nuclear Energy Institute (NEI) provided a white paper proposing a set of "first principles" for Tier 1 content, with examples to illustrate the application of these principles.[19] On November 16, 2017, the staff held a public meeting on the white paper and provided feedback to NEI. NEI has informed the staff that it will consider this feedback in the development of a new NEI guide that will supersede the white paper. The staff understands that NEI plans to submit the new NEI guide in 2019 and request staff endorsement of it. If and when this occurs, the staff will evaluate NEI's request for endorsement and consider NEI's guide during the development of updated staff guidance on Tier 1 content.

The staff will address the broader issue of standardization and the associated design certification regulations through the rulemaking process. In the SRM for SECY-15-0002,[20] the Commission approved, among other things, the staff's recommendation to revise Part 52 and supporting regulations to reflect lessons learned from recent new reactor licensing activities. A public meeting was held on January 15, 2019, to hear stakeholder views on what the lessons learned update should include. The staff is considering these views in determining the proposed scope of the rulemaking and will inform the Commission once a proposed rulemaking scope has been developed. The staff will subsequently develop a draft regulatory basis for the rulemaking, which the staff intends to make available for public feedback via public meetings and publication for comment in the *Federal Register*.

CONCLUSION:

As a result of experience associated with construction of Vogtle Units 3 and 4, the staff has refined the general principles for Tier 1 content so that NRC approval will not be required for design changes of minimal safety significance. Applying these principles should significantly reduce the amount of structural design information for which departures automatically require NRC approval. Standardization will be maintained, but standardization restrictions will typically apply at a qualitative and functional level of detail. Tier 1 will still include the most safety-significant information, and safety-significant changes to Tier 2 will still require prior NRC approval pursuant to a 50.59-like process. The staff will continue its efforts to enhance the design certification process by developing more detailed, objective criteria for Tier 1 content and by addressing the broader issue of standardization through the rulemaking process.

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[19] "First Principles for Use in Developing Design Certification Tier 1 Information and [ITAAC]" (June 2017) (ADAMS Accession No. ML17235A591).

[20] SRM-SECY-15-0002 (Sept. 22, 2015) (ADAMS Accession No. ML15266A023).

COORDINATION:

The Office of the General Counsel reviewed this paper and has no legal objection.

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Enclosure:
Structural Information in Tier 1 Design
Descriptions and ITAAC

ADAMS Accession Nos.: Package: ML19080A032; SECY Paper: ML19080A034
Enclosure: ML19080A033 **SECY-012**

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