

C.3 Application Regulatory Topics

C.3.8 Design Acceptance Criteria

[Record-keeping: This guidance updates RG 1.206 *C.III.5 Design Acceptance Criteria* (2007)]

OVERVIEW

Design certification (DC) applications are expected to represent an “essentially complete” design, as described in 10 CFR 52.47. In the Statements of Consideration accompanying the original promulgation of 10 CFR Part 52 (54 *Federal Register* (FR) 15372; April 18, 1989), an “essentially complete nuclear power plant” is defined as a design that includes all structures, systems, and components that can affect safe operation of the plant, except for site-specific features such as the service water intake structure and the ultimate heat sink. In addition, the Statements of Consideration specify that an essentially complete design is a design that has been finalized to the point that procurement specifications and construction and installation specifications can be completed and made available for audit if such information is necessary for the Commission to make its safety determination.

The Commission established policy in its February 15, 1991, Staff Requirements Memorandum (SRM) for SECY-90-377, “Requirements for Design Certification under 10 CFR Part 52,” November 8, 1990. Section III, “Level of Detail,” of this SRM addresses the expected level of application detail in DCs. Specifically, the design should be complete, except for adjustment within established design envelopes during the procurement and installation process. The Commission, however, did not expect in all instances that design detail would be developed to the level found in actual procurement and construction specifications, affording some flexibility to accommodate as-procured characteristics. In the SRM, the Commission approved the NRC staff’s proposal for a graded approach to the level of needed design detail, reflecting the safety significance of the structure, system, or component. The Commission considered an appropriate level of detail to be that provided in the final safety analysis report at the operating license stage for a recently-licensed plant (except site-specific, as-procured, and as-built information).

In SECY-92-053, “Use of Design Acceptance Criteria during 10 CFR Part 52 Design Certification Reviews,” dated February 19, 1992, the NRC staff described topics for which the design could not be completed to the level of detail originally envisioned in SECY-90-377 and its associate SRM. Instead, design acceptance criteria (DAC) were defined as a set of prescribed limits, parameters, procedures, and attributes upon which the NRC relies, in a limited number of technical areas, in making a final safety determination to support a design certification. For these technical areas, DAC and associated methodologies, design processes, and acceptance criteria could be included in the DC application. Objective and measurable DAC would enable the NRC staff to make a final safety determination, subject only to satisfactory design implementation and verification by the combined license (COL) licensee through appropriate inspections, tests, analyses, and acceptance criteria (ITAAC).

The NRC implemented the policy of approving DAC in a limited number of design areas. Some certified designs to date have used DAC in the areas of radiation protection, piping, instrumentation and controls (I&C), and human factors engineering (HFE). Recent designs have not used DAC for radiation protection. The NRC has allowed the use of DAC if applicants justified one of the following two conditions:

1. Providing detailed design information was not desirable because associated technologies could change so rapidly that the design could be rendered obsolete before it was built

(cited for I&C and HFE).

2. Completing the final design was impractical given the unavailability of sufficient as-built or as-procured information (cited for radiation protection (shielding) and piping).

GUIDANCE

Developments in technology and experience with construction since the creation of DAC in the 1990's may mean that sufficient information is available at the application stage to define an "essentially complete" design, either obviating the need for DAC or completing DAC from the referenced DC before a COL is issued. The NRC staff strongly encourages this approach without DAC as an ideal means of consolidating design information in the application. An approach without DAC can remove certain complexities from the licensing and construction processes, such as potential late-stage design or licensing changes resulting from analyses performed after a COL is issued (e.g., structural adjustments needed after shielding calculations are completed), the regulatory burden and schedule risk of construction-stage inspections of design information, and potential contentions related to completion of the DAC ITAAC when an opportunity for hearing is provided under 10 CFR 52.103(a)). The NRC staff anticipates that this approach will result in a more efficient review process in particular for applicants with previous procurement and construction experience for their design, or whose designs include simplified systems (e.g., with fewer safety-significant piping systems) compared to traditional large light-water reactors.

Design Certification Applications

The DC applicant should initiate early engagement with the NRC staff regarding any design areas for which the use of DAC is being considered in the application. It is crucial that both the applicant and the NRC staff understand the proposed approach and the justification. The extent to which the DC applicant's justification will be accepted by the NRC staff, as well as the level of detail that will be needed in the application, depends on design-specific technical considerations.

If a DC applicant identifies portions of the design that meet one of the two conditions discussed above and intends to request the use of DAC, the applicant should provide a justification for the use of DAC for these topics. The justification should be specific to the applicant's design rather than relying on precedent for previously certified designs. The justification should be provided in the DC application itself, typically in Section 14.3 of the design control document (DCD) where ITAAC are described.

The justification should include the following:

- A description of the specific design area to be addressed by DAC
- A discussion of the condition (rapidly changing information or the need for as-built and as-procured information) being cited and its relationship to the design topic
- References to all information associated with the DAC, including:
 - Methodologies that may be described in DCD Tier 2 (e.g., Section 3.12 for piping)
 - A summary of information that should not be changed without prior NRC approval (e.g., through inclusion in Tier 1)
 - ITAAC presented in DCD Tier 1 and described in DCD Tier 2, Chapter 14
 - Any relevant topical or technical reports
 - Discussion of any possible systems interactions that result from the use of DAC

In addition, the technical portions of the DCD that relate to the DAC should include further technical information as referenced in the justification above, including information such as:

- Sufficient information, through a combination of methodologies, design processes, and

acceptance criteria (including ITAAC associated with design analyses and as-built verification) for the NRC staff to make a safety determination using the relevant requirements and guidance

- Related interface requirements (e.g., for radiation protection DAC, features for maintaining the integrity of shielding material)
- Possible system interactions (e.g., for radiation protection DAC, increased shielding requirements that could affect seismic responses or equipment clearances, or changes in assumed tank venting rates that could affect the required ventilation system flow rate required to maintain specified airborne activity concentrations)

Additional information on application expectations for the technical subjects identified above is presented in Appendix A to this regulatory guide in the following sections:

- Piping: Chapter 3 (Sections 3.6.2, 3.6.3, and 3.12)
- I&C: Chapter 7
- Radiation protection: Chapter 12
- ITAAC and Tier 1 information (relevant to all DAC): Chapter 14
- HFE: Chapter 18

Combined License Applications

A COL applicant referencing a DC with DAC should understand that the path to successfully resolving the DAC and completing the associated ITAAC may include NRC staff inspection of information or procedures that are prepared early in the construction, fabrication, or development processes. These inspections necessitate early involvement by NRC inspectors (e.g., safety system software development). For this reason, it is crucial that a COL applicant using DAC provide NRC staff with timely access to detailed design information to resolve potential issues.

In addition, COL licensees whose applications referenced a DC with DAC may find when completing the analysis associated with the DAC that changes are needed to the plant design or other licensing documents (e.g., technical specifications), some of which may require prior approval of the NRC. For instance, the DCD values for thickness of concrete utilized for structural support and seismic considerations may be insufficient for radiation shielding (which may have DAC for some designs), or changes to the amount of shielding may affect other safety-related analyses. As such, COL applicants should plan for the potential of DAC to expand the scope of post-licensing hearings.

A COL applicant referencing a DC should include sufficiently detailed design information in the design areas where DAC are used in the certified design, if this level of detail is available. In these circumstances, the COL application should include a notification that the ITAAC associated with the design aspects of these DAC have been completed, in accordance with 10 CFR 52.80(a)(3). The NRC staff would review this information in the context of the COL application and, if approved, the NRC staff would indicate completion of these ITAAC in the FR notice required by 10 CFR 52.85. During the construction stage, the NRC staff would verify the final as-built state through the remaining ITAAC. This approach may be used when detailed design has already been completed using the DC referenced in the COL application, potentially as a result of construction of another facility referencing the same DC (e.g., the reference COL).

If a COL applicant determines that additional detailed design information beyond that included in the certified design is not available at the time of COL application, for the reasons identified above in the justification for DAC, the COL applicant should incorporate by reference all of the information associated with the DAC. The COL applicant should also provide implementation

plans, including a schedule (or commitment to provide a schedule) for completion of detailed engineering, procurement, fabrication, installation, and testing information.

A COL applicant that does not reference a DC (i.e., custom COL) should include the same level of design detail that would be appropriate for a DC application, such that the NRC staff can make a final safety finding on the design. A DAC approach may be justified, as described above, or additional design information may be presented if DAC are not necessary. The applicant should initiate early engagement with the NRC staff to address any design areas for which DAC may be proposed.