

CHAPTER 4
TIME-LIMITED AGING ANALYSES

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4.1 IDENTIFICATION OF TIME-LIMITED AGING ANALYSES

Review Responsibilities

Primary - Branch responsible for materials and chemical engineering

Secondary - Other branches responsible for engineering, as appropriate

4.1.1 Areas of Review

This review plan section addresses the identification of time-limited aging analyses (TLAAs). The technical review of TLAAs is addressed in section 4.2 through 4.7. As explained in more detail below, the list of TLAAs are certain plant-specific safety analyses that are based on an explicitly assumed 40-year plant life (for example, aspects of the reactor vessel design). Pursuant to 10 CFR 54.21(c)(1), a license renewal applicant is required to provide a list of TLAAs, as defined in 10 CFR 54.3. The area relating to the identification of TLAAs is reviewed.

TLAAs may have evolved since issuance of a plant's operating license. As indicated in 10 CFR 54.30, the adequacy of the plant's CLB, which includes TLAAs, is not an area within the scope of the license renewal review. Any question regarding the adequacy of the CLB must be addressed under the backfit rule (10 CFR 50.109) and is separate from the license renewal process.

In addition, pursuant to 10 CFR 54.21(c)(2), an applicant must provide a list of plant-specific exemptions granted under 10CFR50.12 that are based on TLAAs. However, the initial license renewal applicants have found no such exemptions for their plants.

It is an applicant's option to include more analyses than those required by 10 CFR 54.21(c)(1). The staff should focus its review to confirm that the applicant did not omit any TLAAs, as defined in 10 CFR 54.3.

4.1.2 Acceptance Criteria

The acceptance criteria for the areas of review described in Subsection 4.1.1 of this review plan section delineate acceptable methods for meeting the requirements of the NRC's regulations in 10 CFR 54.21(c)(1). For the applicant's list of exemptions to be acceptable, the staff should have reasonable assurance that there has been no omission of TLAAs from that list.

Pursuant to 10 CFR 54.3, TLAAs are those licensee calculations and analyses that:

1. Involve systems, structures, and components within the scope of license renewal, as delineated in 10 CFR 54.4(a);
2. Consider the effects of aging;
3. Involve time-limited assumptions defined by the current operating term, for example, 40 years;
4. Were determined to be relevant by the licensee in making a safety determination;

5. Involve conclusions or provide the basis for conclusions related to the capability of the system, structure, or component to perform its intended function(s), as delineated in 10 CFR 54.4(b); and
6. Are contained or incorporated by reference in the CLB.

4.1.3 Review Procedures

For each area of review described in Subsection 4.1.1, the reviewer should adhere to the following review procedures:

The reviewer should use the plant UFSAR and other CLB documents, such as staff SERs, in performing the review. The reviewer should select analyses that the applicant did not identify as TLAAs that are likely to meet the six criteria identified in Subsection 4.1.2. The reviewer verifies that the selected analyses, not identified by the applicant as TLAAs, do not meet at least one of the following criteria (Ref. 1).

Sections 4.2 through 4.6 identify typical types of TLAAs for most plants. Information on the licensee's methodology for identifying TLAAs may also be useful in identifying calculations that did not meet six criteria below.

1. Involve systems, structures, and components within the scope of license renewal, as delineated in 10 CFR 54.4(a). Chapter 2 of this standard review plan provides the reviewer guidance on the scoping and screening methodology, and on plant level and various system level scoping results.
2. Consider the effects of aging. The effects of aging include, but are not limited to: loss of material, loss of toughness, loss of prestress, settlement, cracking, and loss of dielectric properties.
3. Involve time-limited assumptions defined by the current operating term (for example, 40 years). The defined operating term should be explicit in the analysis. Simply asserting that a component is designed for a service life or plant life is not sufficient. The assertion should be supported by calculations or other analyses that explicitly include a time limit.
4. Were determined to be relevant by the licensee in making a safety determination. Relevancy is a determination that the applicant should make based on a review of the information available. A calculation or analysis is relevant if it can be shown to have a direct bearing on the action taken as a result of the analysis performed. Analyses are also relevant if they provide the basis for a licensee's safety determination and, in the absence of the analyses, the licensee might have reached a different safety conclusion.
5. Show capability of the system, structure, or component to perform its intended function(s), as delineated. Involve conclusions or provide the basis for conclusions related to the 10 CFR 54.4(b). Analyses that do not affect the intended functions of systems, structures, or components are not TLAAs.
6. Are contained or incorporated by reference in the CLB. Plant-specific documents contained or incorporated by reference in the CLB include, but are not limited to: FSAR, NRC SERs, Technical Specifications, the fire protection plan/hazards analyses, correspondence to and from the NRC, the quality assurance plan, and topical reports included as references to the

FSAR. Calculations and analyses that are not in the CLB or not incorporated by reference are not TLAAs. If a code of record is in the FSAR for particular groups of structures or components, reference material includes all calculations required by that code of record for those structures and components.

TLAAs that need to be addressed are not necessarily those analyses that have been previously reviewed or approved by the NRC. The following examples illustrate TLAAs that need to be addressed and were not previously reviewed and approved by the NRC:

- The FSAR states that the design complies with a certain national code and standard. A review of the code and standard reveals that an analysis or calculation is required. Some of these calculations or analysis will be TLAAs. The actual calculation was performed by the licensee to meet code and standard requirements. The specific calculation was not referenced in the FSAR. The NRC had not reviewed the calculation.
- In response to a generic letter, a licensee submitted a letter to the NRC committing to perform a TLAA that would address the concern in the generic letter. The NRC had not documented a review of the licensee's response and had not reviewed the actual analysis.

The following examples illustrate analyses that are *not* TLAAs and need not be addressed under 10 CFR 54.21(c):

- Population projections (Section 2.1.3 of NUREG-0800) (Ref. 2).
- Cost-benefit analyses for plant modifications.
- Analysis with time-limited assumptions defined short of the current operating term of the plant, for example, an analysis for a component based on a service life that would not reach the end of the current operating term.

The number and type of TLAAs vary depending on the plant-specific CLB. All six criteria set forth in 10 CFR 54.3 (and repeated in Subsection 4.1.2 of this review plan section) must be satisfied to conclude that a calculation or analysis is a TLAA. Table 4.1-1 provides examples of how these six criteria may be applied (Ref. 1). Table 4.1-2 provides a list of potential TLAAs (60 FR 22480). Table 4.1-3 provides a list of other plant-specific TLAAs that have been identified by the initial license renewal applicants. Table 4.1-2 and 4.1-3 provide examples of analyses that potentially could be TLAAs for a particular plant. However, TLAAs are plant-specific and depend on an applicant's CLB. It is not expected that all applicants would identify all the analyses in these tables as TLAAs for their plants. Also, an applicant may have performed specific TLAAs for its plant that are not shown in these tables.

Staff members from other branches of the Division of Engineering will be reviewing the application in their assigned areas without examining the identification of TLAAs. However, they may come across situations in which they may question why the applicant did not identify certain analyses as TLAAs. The reviewer should coordinate the resolution of any such questions with these other staff members and determine whether these analyses should be evaluated as TLAAs.

In order to determine whether there is reasonable assurance that the applicant has identified the TLAAs for its plant, the reviewer should find that the analyses omitted from the applicant's list are not TLAAs.

Should an applicant identify a TLAA that is also a basis for a plant-specific exemption granted pursuant to 10 CFR 50.12 and the exemption is in effect, the reviewer verifies that the applicant has also identified that exemption pursuant to 10 CFR 54.21(c)(2). However, the initial license renewal applicants have found no such exemptions for their plants.

4.1.4 Evaluation Findings

The reviewer verifies that the applicant has provided sufficient information to satisfy the provisions of this review plan section, and that the staff's evaluation supports conclusions of the following type, to be included in the staff's safety evaluation report, as appropriate:

The staff concludes that the applicant has provided an acceptable list of TLAAs as defined in 10 CFR 54.3, and that no 10 CFR 50.12 exemptions have been granted on the basis of a TLAA, as defined in 10 CFR 54.3.

4.1.5 Implementation

Except in those cases in which the applicant proposes an acceptable alternative method, the method described herein will be used by the staff in its evaluation of conformance with NRC regulations.

4.1.6 References

1. NEI 95-10, Revision 3, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule," Nuclear Energy Institute, March 2001.
2. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports Nuclear Power Plants," July 1981.

Table 4.1-1. Identification of Potential Time-Limited Aging Analyses and Basis for Disposition

Example	Disposition
NRC correspondence requests a utility to justify that unacceptable cumulative wear did not occur during the design life of control rods.	Does not qualify as a TLAA because the design life of control rods is less than 40 years. Therefore, does not meet criterion (3) of the TLAA definition in 10 CFR 54.3.
Maximum wind speed of 100 mph is expected to occur once per 50 years.	Not a TLAA because it does not involve an aging effect.
Correspondence from the utility to the NRC states that the membrane on the containment basemat is certified by the vendor to last for 40 years.	The membrane was not credited in any safety evaluation, and therefore the analysis is not considered a TLAA. This example does not meet criterion (4) of the TLAA definition in 10 CFR 54.3.
Fatigue usage factor for the pressurizer surge line was determined not to be an issue for the current license period in response to NRC Bulletin 88-11.	This example is a TLAA because it meets all 6 criteria in the definition of TLAA in 10 CFR 54.3. The utility's fatigue design basis relies on assumptions defined by the 40-year operating life for this component, which is the current operating term.
Containment tendon lift-off forces are calculated for the 40-year life of the plant. These data are used during Technical Specification surveillance for comparing measured to predicted lift-off forces.	This example is a TLAA because it meets all 6 criteria of the TLAA definition in 10 CFR 54.3. The lift-off force curves are currently limited to 40-year values, and are needed to perform a required Technical Specification surveillance.

Table 4.1-2. Potential Time-Limited Aging Analyses

Reactor vessel neutron embrittlement
Concrete containment tendon prestress
Metal fatigue
Environmental qualification of electrical equipment
Metal corrosion allowance
Inservice flaw growth analyses that demonstrate structure stability for 40 years
Inservice local metal containment corrosion analyses
High-energy line-break postulation based on fatigue cumulative usage factor

Table 4.1-3. Additional Examples of Plant-Specific TLAs as Identified by the Initial License Renewal Applicants

Intergranular separation in the heat-affected zone (HAZ) of reactor vessel low-alloy steel under austenitic SS cladding. Low-temperature overpressure protection (LTOP) analyses
Fatigue analysis for the main steam supply lines to the turbine-driven auxiliary feedwater pumps
Fatigue analysis of the reactor coolant pump flywheel
Fatigue analysis of polar crane
Flow-induced vibration endurance limit, transient cycle count assumptions, and ductility reduction of fracture toughness for the reactor vessel internals
Leak before break
Fatigue analysis for the containment liner plate
Containment penetration pressurization cycles
Reactor vessel circumferential weld inspection relief (BWR)