

## **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). There are certain plant-specific safety analyses which may have been 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.

TAA requirements may have evolved and are plant-specific. As indicated in 10 CFR 54.30, the adequacy of the plant's current licensing basis (CLB), which includes TLAAs, is not an area of review. Potential concerns or enhancements regarding the CLB is to be addressed under the backfit rule (10 CFR 50.109) and are 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 that are based on TLAAs. However, the initial license renewal applicants have found no such exemptions for their plants.

An applicant has the flexibility to determine the set of analyses for which an evaluation is performed, provided that this set encompasses the TLAAs for which the Commission has determined an evaluation is required. Therefore, the reviewer should not review all analyses that the applicant has identified as TLAAs, because 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 define acceptable methods for meeting the requirements of the Commission's regulations in 10 CFR 54-21(c)(1). The staff should find no omission of TLAAs, as defined in 10 CFR 54.3, from the applicant's 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, and component to perform its intended functions, 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 of this review plan section, the following review procedures are followed:

The reviewer verifies that the TLAAAs identified by the applicant meet the following criteria (Ref. 1).

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 staff review guidance on the scoping and screening methodology, 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 a calculation or analysis that explicitly includes 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 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 may have reached a different safety conclusion.
5. Show capability of the system, structure, and component to perform its intended functions, 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, and components are not TLAAAs.
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 safety evaluation reports (SERs), Technical Specifications, the fire protection plan/hazards analyses, correspondence to and from the NRC, quality assurance (QA) plan, and topical reports included as reference to the FSAR or correspondence to the NRC. Calculations and analyses that are not in the CLB or not incorporated by reference are not TLAAAs. When the code of record is mentioned 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 Commission. The following examples illustrate TLAAs that need to be addressed and were not previously reviewed and approved by the Commission:

- The FSAR states that the design complies with a certain national code and standard. A review of the code and standard reveals that a TLAA is required. The actual calculation was performed by the licensee to meet code and standard requirements, the specific calculation was not referenced in the FSAR, and 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 of TLAAs 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 (Ref. 1). 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 specific TLAAs for its plant that is not shown in these tables.

The reviewer should use the plant Updated Final Safety Analysis Report (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. The reviewer may select analyses based on the information in Tables 4.1-2 and 4.1-3 of this review plan section because these analyses have been identified as TLAAs for some plants. In addition, the reviewer may select analyses that are not shown in these tables.

There are staff members from other branches of engineering reviewing the application in their assigned areas separate from the identification of TLAAs. However, they may come across situations where they may have a question on why the applicant did not identify certain analyses within their areas of review as TLAAs. Should this be the case, the reviewer should coordinate the question resolution with these other staff members and determine whether these analyses should be included as TLAAs.

Should an applicant identify a TLAA, which 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.

The reviewer should find no omission by the applicant to make the staff finding that there is reasonable assurance that the applicant has identified the TLAAAs for its plant.

#### **4.1.4 Evaluation Findings**

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

The staff concludes that the applicant has provided a list of acceptable TLAAAs 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 Commission regulations.

#### **4.1.6 References**

1. NEI 95-10, Revision 1, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule," Nuclear Energy Institute, January 2000.
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**

<b>Example</b>	<b>Disposition</b>
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. 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.	This example does not meet criterion (4) of the TLAA definition in 10 CFR 54.3 and therefore is not considered a TLAA. The membrane was not credited in any safety evaluation.
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 related to 40 year operating life for this component.
Containment tendon lift-off forces are calculated for the 40-year life of the plant. This data is 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 limited to 40-year values currently and are needed to perform a required Technical Specification surveillance.

**Table 4.1-2. Potential Time-Limited Aging Analyses**

Fatigue
Reactor vessel neutron embrittlement
Environmental aging (Environmental qualification)
Loss of prestress in concrete containment tendons
High density neutron poisons (e.g., Boraflex) of spent fuel racks
Metal corrosion allowance
Inservice flaw growth analyses that demonstrate structure integrity 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 stainless steel cladding. Low-temperature overpressure protection (LTOP) analyses.
Fatigue analysis for the main steam supply lines to the turbine-driven auxiliary feedwater pumps.
Main steam isolation valves operating cycles.
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).