PROJ. 690

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NUCLEAR ENERGY INSTITUTE

Douglas J. Walters
SR. PROJECT MANAGER, LICENSING
NUCLEAR GENERATION

October 13, 1999

Mr. Christopher I. Grimes, Chief
License Renewal & Standardization Branch
Division of Regulatory Improvement Programs
U.S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: Active License Renewal Issue No. 98-0087, "Evaluation of Containment Temperature Program"

PROJECT NUMBER: 690

Dear Mr. Grimes:

Active license renewal issue number 98-0087, captures our comment on the Working Draft Standard Review Plan (SRP) regarding the loss of strength and modulus for BWR containment components. The purpose of this letter is to further clarify our comment, which we have done by enclosing a mark-up of the SRP for your consideration.

Also, the existing SRP guidance directs the NRC reviewer to verify certain information to establish that loss of strength and modulus is not an aging effect of concern. The renewal rule does not require the application to include a justification for why specific aging effects are deemed not applicable. The application need only identify the aging effects requiring management. The enclosed mark-up reflects our view on the information that the reviewer should look for in a renewal application relative to this topic.

If you have questions or wish to discuss the enclosed material in more detail, please contact me at (202) 739-8093.

Sincerely,

Douglas J. Walters

Douglas J. Walters

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Enclosure

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prestress analysis is a review area under time- limited aging analyses in Section 4.2 of this SRP. Affected containment components listed in Table 3.4-1 are:

- Mark II Concrete Containments components –
  prestressed tendons and ducts.

4. Loss of Strength and Modulus

Loss of concrete strength and modulus can be caused by elevated temperatures. This has the potential to impair containment pressure boundaries by leading to failure of concrete walls and basemats and penetrations, and to impair Mark I pressure suppression by failure of drywall and torus concrete. . Degradation of reinforcing steel (rebar) can be caused by elevated temperatures. *[Note: this sentence is added because II.B.4 does not mention elevated temperatures as an aging effect for rebar, even though it is discussed in other sections dealing with loss of strength and modulus caused by elevated temperatures.* -Affected containment components listed in Table 3.4-1 are:

- Common Components –
  penetration sleeves.

- Mark I Concrete Containments components –
  drywell and torus concrete, and
  drywell and torus reinforcing steel.

- Mark II Concrete Containments components –
  containment concrete,
  concrete containment reinforcing steel,
  concrete fill in the annulus, and
  concrete basemat and reinforcing steel.

- Mark III Steel Containments components –
  concrete basemat and reinforcing steel, and
  concrete fill in the annulus.

- Mark III Concrete Containments components –
  concrete containment wall above grade,
  concrete dome,
  concrete containment wall below grade,
  containment wall reinforcing steel,
  dome reinforcing steel,
  concrete basemat, and
  basemat reinforcing steel.

maintained at temperatures <316°C (600°F). ~~Affected containment components listed in Table 3.4-1 are:~~

- ~~Common Components--~~
  - ~~penetration sleeves.~~
- ~~Mark I Concrete Containments components--~~
  - ~~drywell and torus concrete, and~~
  - ~~drywell and torus reinforcing steel.~~
- ~~Mark II Concrete Containments components--~~
  - ~~containment concrete,~~
  - ~~concrete containment reinforcing steel,~~
  - ~~concrete fill in the annulus, and~~
  - ~~concrete basemat and reinforcing steel.~~
- ~~Mark III Steel Containments components--~~
  - ~~concrete basemat and reinforcing steel, and~~
  - ~~concrete fill in the annulus.~~
- ~~Mark III Concrete Containments components~~
  - ~~concrete containment wall above grade,~~
  - ~~concrete dome,~~
  - ~~concrete containment wall below grade,~~
  - ~~containment wall reinforcing steel,~~
  - ~~dome reinforcing steel,~~
  - ~~concrete basemat, and~~
  - ~~basemat reinforcing steel.~~

[Note: The list of components is deleted in this section because it is redundant to the list in II.B.4.]

Acceptable methods for managing the loss of prestress of prestressed tendons due to warm temperatures are to augment the tendon surveillance program described in Subsection II.C.3 of this SRP section by including additional tendons in the test sample.(3) These additional tendons should be selected based on their sun exposure or proximity to hot penetrations.

5. Scaling, Cracking, and Spalling(2,3)

Acceptable methods for managing scaling, cracking, and spalling caused by freeze–thaw of specific affected containment components listed below are periodic visual examinations of concrete surfaces in accordance with ASME Section XI, Subsection IWL,(4) examination category L-A, "Concrete." The affected containment components listed in Table 3.4-1 are:

reviewer verifies that the applicant has an aging management program that will manage the effects of elevated temperature such that there is reasonable assurance that the intended functions will be maintained during the period of extended operation.

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~~The reviewer verifies that the applicant's discussion in the renewal application indicates that the affected BWR containment components are not exposed to temperature that exceeds the temperature limits (operating temperature <66°C (150°F), local area temperature <93°C (200°F)). The reviewer may perform an on-site review of operating and maintenance records to confirm this information.~~

~~For BWR containment components that operate above the temperature limits (operating temperature <66°C (150°F), local area temperature <93°C (200°F)), they are reviewed on a case-by-case basis to ensure that the effects of elevated temperature will be managed to maintain their intended functions during the period of extended operation.~~

[Note: The 2 paragraphs above are deleted because they are redundant to information in II.B.4 and II.C.4. The following comments apply to III.C.4 as written:

1. *The SRP assumes the applicant will discuss loss of strength and modulus as an aging effect, even if it is not applicable/plausible for the particular power plant. The rule does not require, and NEI 95-10 does not include, that the application includes justification for why an aging effect is not applicable/plausible. The rule only requires that applicable/plausible aging effects be discussed in the application.*

2. *The SRP requires the reviewer to confirm that both the general area temperature limit of 150F and local area limit of 200F are not exceeded. Most plants monitor the bulk temperatures only. Plants generally do not have local temperature indication for concrete structures. The design of plants is such that the HVAC systems are designed to provide the needed cooling so that monitoring the bulk temperature will provide assurance that the local temperatures do not exceed 200F. Where the design is such that this cannot be accomplished, design provisions are made to prevent concrete structures from exceeding 200F, such as providing thermal insulation or barriers to protect the concrete.*

3. *The SRP can be read to require that the applicant show that there are no local temperatures above 200F. This would require the installation of a local temperature monitoring system to monitor concrete temperatures. If this is the expectation, this is essentially a requirement to confirm the design of the plant, contrary to the intent of the Rule.]*

Increases in temperature also increases the prestress loss in prestressed tendons.[3] Prestress losses increased from 8 percent to 14 percent when the temperature was increased from 20°C (68°F) to 32°C (90°F).[11] Thus, temperatures due to sun exposure or proximity to hot penetrations may increase the prestress loss in tendons. The tendon surveillance program described in Subsection III.C.3 of this SRP section is based on a small sample size, that is, a 4 percent random sample including a repeat tendon. Tendons subject to warm temperatures may not be tested because of this small sample size. The reviewer verifies that the applicant is committed to augmenting the tendon surveillance program for the period of extended operation by including additional tendon samples in the tendon surveillance program. These additional tendon samples should be selected based on their sun exposure or proximity to hot penetrations.

5. Scaling, Cracking, and Spalling

ASME Section XI, Subsection IWL,[4] examination category L-A, "Concrete," specifies (VT-1C and VT-3C) visual examinations of all accessible containment concrete surfaces, including coated areas, to determine the conditions of concrete surfaces by identifying areas of concrete deterioration and distress. The examinations include development of plans and procedures for examination for concrete surfaces, evaluation of examination results, and preparation of repair procedures. The acceptance criteria specified in IWL-3110 include acceptance by examination, evaluation, or repair. IWL-4000 provides rules and requirements for repair of concrete containments. Freeze-thaw results in scaling, cracking, and spalling. Any freeze-thaw degradation would initially appear in the exposed concrete surfaces. Examination category L-A would detect concrete scaling, cracks, and spalling due to freeze-thaw. Affected Mark III concrete containment components listed in Table 3.4-1 are:

- Mark III Concrete Containments components –
  concrete containment wall above grade,
  concrete containment wall below grade, and
  concrete dome.

Tendon prestress analysis is evaluated as discussed in Section 4.2 of this SRP.

4. If the BWR containment components are exposed to temperature that exceeds the temperature limits (operating temperature <66°C (150°F), , the FSAR supplement must contain a summary description of the aging management program(s) credited by the applicant for managing the effects of aging. ~~local area temperature <93°C (200°F)); loss of strength and modulus caused by elevated temperature is reviewed on a case-by-case basis. The summary description should contain the basis for the NRC staff determination that the effects of elevated temperature would be adequately managed to ensure their intended functions for the period of extended operation. The affected containment components are:~~

- ~~Common Components~~
  - ~~penetration sleeves.~~

- ~~Mark I Concrete Containments components~~
  - ~~drywell and torus concrete, and~~
  - ~~drywell and torus reinforcing steel.~~

- ~~Mark II Concrete Containments components~~
  - ~~containment concrete,~~
  - ~~concrete containment reinforcing steel,~~
  - ~~concrete fill in the annulus, and~~
  - ~~concrete basemat and reinforcing steel.~~

- ~~Mark III Steel Containments components~~
  - ~~concrete basemat and reinforcing steel, and~~
  - ~~concrete fill in the annulus.~~

- ~~Mark III Concrete Containments components~~
  - ~~concrete containment wall above grade,~~
  - ~~concrete dome,~~
  - ~~concrete containment wall below grade,~~
  - ~~containment wall reinforcing steel,~~
  - ~~dome reinforcing steel,~~
  - ~~concrete basemat, and~~
  - ~~basemat reinforcing steel.~~

[Note: The sentence in the above paragraph about the basis for the NRC staff determination is deleted because this information is not required in the FSAR. Also, the applicant would not have this information available when preparing the FSAR supplement. The above list is deleted because the component list is provided in II.B.4.]

settlement for Mark II and Mark III Concrete Containments and Mark III Steel Containments bearing on soil or piles and/or experiencing significant changes in groundwater condition.

3. Loss of Prestress

ASME Section XI, Subsection IWL,(4) examination category L-B, "Unbonded Post-Tensioning Systems," specifies periodic examinations of prestressed containment every 5 years. IWL-2522 specifies examination method for tendon force measurements, and IWL-3221 provides acceptance standards for the measured tendon forces. Repair and replacement are addressed in IWL-4000 and IWL-7000, respectively.

In addition, the 1992 Addenda of Subsection IWL and 10 CFR 50.55a(b)(2)(ix)(A)-(D) have incorporated the recommendations of Regulatory Guide 1.35. These programs are acceptable for maintaining the intended functions of BWR containment components [prestressed tendons and ducts of Mark II Concrete Containment] with respect to reduction of design margin due to loss of prestress.

Further, the applicant has evaluated tendon prestress as a time-limited aging analysis which is being reviewed separately by the NRC staff under 10 CFR 54.21(c)(1) using the guidance in Section 4.2 of this SRP.

4. Loss of Strength and Modulus

[Note: The changes in this section change the order of the sentences so that the information about aging effects is together, and not with the finding when the aging effects are not applicable.]

For BWR containment components that do not exceed the temperature limits (operating temperature <66°C(150°F), local area temperature < 93°C(200°F). Tthe effects of elevated temperature is non-significant, because the BWR containment components are not exposed to temperature that exceeds the temperature limits. ~~Reduction of concrete compressive and tensile strength and modulus of elasticity in excess of 10% begins to occur in the range of 180 to 200°F. The temperature limits (operating temperature <66°C (150°F), local area temperature <93°C (200°F)) are acceptable for maintaining the intended functions of the affected BWR containment components listed below with respect to loss of strength and modulus due to elevated temperature. The affected BWR containment components are:~~

- ~~Common Components~~
  - ~~penetration sleeves.~~

- Mark I Concrete Containments components –
  drywell and torus concrete, and
  drywell and torus reinforcing steel.

- Mark II Concrete Containments components –
  containment concrete,
  concrete containment reinforcing steel,
  concrete fill in the annulus, and
  concrete basemat and reinforcing steel.

- Mark III Steel Containments components –
  concrete basemat and
  concrete fill in the annulus.

- Mark III Concrete Containments components –
  concrete containment wall above grade,
  concrete dome,
  concrete containment wall below grade,
  containment wall reinforcing steel,
  dome reinforcing steel,
  concrete basemat, and
  basemat reinforcing steel.

For BWR containment components that exceed the temperature limits (operating temperature <66°C (150°F), local area temperature <93°C (200°F)), the applicant has provided an acceptable program to manage the effects of elevated temperature to ensure that their intended functions will be maintained consistent with the CLB during the period of extended operation. . Reduction of concrete compressive and tensile strength and modulus of elasticity in excess of 10% begins to occur in the range of 180 to 200°F. The temperature limits (operating temperature <66°C (150°F), local area temperature <93°C (200°F)) are acceptable for maintaining the intended functions of the affected BWR containment components listed below with respect to loss of strength and modulus due to elevated temperature. This program was reviewed on a case-by-case basis.

The affected BWR containment components are:

- Common Components –
  penetration sleeves.

- Mark I Concrete Containments components –
  drywell and torus concrete, and

drywell and torus reinforcing steel.

- Mark II Concrete Containments components –
  containment concrete,
  concrete containment reinforcing steel,
  concrete fill in the annulus, and
  concrete basemat and reinforcing steel.

- Mark III Steel Containments components –
  concrete basemat and
  concrete fill in the annulus.

- Mark III Concrete Containments components –
  concrete containment wall above grade,
  concrete dome,
  concrete containment wall below grade,
  containment wall reinforcing steel,
  dome reinforcing steel,
  concrete basemat, and
  basemat reinforcing steel.

Increase in temperature also increases the prestress loss in prestressed tendons. The applicant has provided an acceptable program to augment the tendon surveillance program for the period of extended operation. The augmented program consists of testing additional tendons exposed to warm temperatures, such as due to sun exposure or proximity to hot penetrations. The augmented program was reviewed on a case-by-case basis.

5. Scaling, Cracking, and Spalling

ASME Section XI, Subsection IWL,[4] examination category L-A, "Concrete," specifies (VT-1C and VT-3C) visual examinations of all accessible containment concrete surfaces, including coated areas, to determine the general structural conditions of concrete surfaces by identifying areas of concrete deterioration and distress. The examinations include development of plans and procedures for examination for concrete surfaces, evaluation of examination results, and preparation of repair procedures. Subsection IWL, examination category L-A would detect deterioration of concrete surfaces due to freeze-thaw, and repairs would be taken. This program is acceptable for maintaining the intended functions of the BWR containment components [concrete containment wall above grade, concrete containment wall below grade, and concrete dome of Mark III Concrete Containments] with respect to freeze-thaw.