

## Davis-BesseNPEM Resource

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**From:** CuadradoDeJesus, Samuel  
**Sent:** Friday, July 29, 2011 9:54 AM  
**To:** 'custerc@firstenergycorp.com'; dorts@firstenergycorp.com  
**Subject:** FW: Teleconference call request  
**Attachments:** Clarification Questions Related to the Resposne to DB RAI 3.1.2.2-2 v3-1 7-26-2011.docx

**Cliff:**

Let me know at what time we can have a teleconference next Tuesday on the following topics.

- 1) Follow-up Clarification (see attachment) Related to the DB Response to RAIs 3.1.2.2-1 and RAI 3.1.2.2-2**
- 2) DB Response to RAI 3.3.2.3.14-1**

### **Question RAI 3.3.2.3.14-1**

In LRA Table 3.3.2-14, the applicant identified loss of material and cracking as aging effects for steel bolting exposed to an external environment of raw water. As identified in EPRI NP-5769 and NUREG-1833, loss of pre-load for bolting can occur in any environment.

In LRA Table 3.3.2-14, the applicant did not identify loss of pre-load for steel bolting exposed to an external environment of raw water.

Justify why loss of pre-load is not identified as an aging effect for steel bolting in an environment of raw water.

### **RESPONSE RAI 3.3.2.3.14-1**

Loss of pre-load is not identified as an aging effect requiring management for the submerged steel bolting in the Fire Protection System that is exposed to a raw water environment, as described below.

The aging management review for the Fire Protection System was conducted with the guidance provided in EPRI Technical Report 1010639 (the "Mechanical Tools"). In accordance with the Mechanical Tools, loss of pre-load is an applicable aging effect as a result of thermal effects, gasket creep, embedment (including cyclic load embedment), and/or self-loosening.

Loss of pre-load can be promoted by thermal effects (high temperature) through a process called stress relaxation. However, stress relaxation is only a concern at extremely high temperatures (above 700°F for low-alloy steels), although there may be bolting of some grades that could be susceptible to stress relaxation at temperatures slightly lower than 700°F. The submerged bolting in the Fire Protection System is associated with the diesel fire pump column that is submerged in raw water supplied by Lake Erie. The normal temperature of this water is no greater than 85 °F, which is well below the temperature at which stress relaxation occurs. Therefore, for the submerged steel bolting in the Fire Protection System, loss of pre-load due to thermal effects is not

an aging effect requiring management.

Loss of pre-load may occur as a result of gasket creep. However, gasket creep has a very small effect on pre-load (2 - 5%) and occurs, and will be evident, very soon after initial loading (10 - 20 minutes). Therefore, for the submerged steel bolting in the Fire Protection System, loss of pre-load due to gasket creep is not an aging effect requiring management.

Loss of pre-load may occur after initial loading as surfaces (e.g., threads in the bolts and joint members), which are initially in contact only on high spots, settle in together, a process called embedment. However, the effect of embedment is considered to be small and to have minimal effect on the integrity of the bolted connection. Additionally, bolted connections subjected to large cyclic loads will embed and relax more than those under static loads. However, the diesel fire pump is normally in a standby mode, and, being located in a relatively stagnant atmospheric pool, is not subject to large thermal, vibrational, or pressure-induced cyclic loading. Therefore, for the submerged steel bolting in the Fire Protection System, loss of pre-load due to embedment is not an aging effect requiring management.

Loss of pre-load due to self-loosening may occur as a result of vibration, flexing of the joint, cyclic shear loads, thermal cycles and other factors. In addition to the discussions of these factors above, self-loosening is precluded by good bolting practices and, if it occurs, is usually detected and corrected early in the service life of the component, as during maintenance activities. Therefore, for the submerged steel bolting in the Fire Protection System, loss of pre-load due to self-loosening is not an aging effect requiring management.

### 3) **DB Response to RAI B.2.34-01**

#### **Question RAI B.2.34-1**

##### Background:

The preventive actions program element of Generic Aging Lessons Learned (GALL), Rev. 2, aging management program (AMP) XI.M3, "Reactor Head Closure Stud Bolting," references the guidance outlined in Regulatory Guide (RG) 1.65, Materials and Inspections for Reactor Vessel Closure Studs," and NUREG-1339, "Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants." AMP XI.M3 states that one of the preventive measures that can reduce the potential for stress-corrosion cracking includes using bolting material for closure studs that has an actual measured yield strength less than 150 ksi. During its audit, the U.S. Nuclear Regulatory Commission (NRC or the staff) noted that the FirstEnergy Nuclear Operating Company's (FENOC or the applicant) program basis document for its Reactor Head Closure Studs Program states that the reactor head closure studs and nuts are manufactured from SA-540, Grade 23 material.

##### Issue:

License renewal application (LRA) Section B.2.34 and the applicant's program basis document do not include the preventive action of using stud materials with an actual measured yield strength level less than 150 ksi. The staff needs to confirm the actual measured yield strength of the applicant's reactor head closure stud material to determine whether the applicant's program is adequate

to manage stress-corrosion cracking.

Request:

The staff requests the following information:

1) Clarify whether the actual measured yield strength of the reactor head closure stud material is less than 150 ksi. If the reactor head closure stud material has a measured yield strength level greater than or equal to 150 ksi, justify the adequacy of the AMP to manage stress-corrosion cracking in the high-strength material.

2) Clarify if preventive actions will be added to the Reactor Head Closure Studs Program that would preclude the future use of replacement closure stud bolting fabricated from material with actual measured yield strength greater than or equal to 150 ksi. If not, and in view of the greater susceptibility of the studs for stress-corrosion cracking, describe any preventative actions to avoid exposure of the studs to environments conducive to stress-corrosion cracking. Otherwise, justify why preventative measures to mitigate stress-corrosion cracking of high strength studs will not be required.

#### **RESPONSE RAI B.2.34-1**

1. As confirmed by the certificate of material test report (CMTR), the actual measured yield strength ranges from 151 to 159 ksi, and tensile strength ranges from 166 to 171 ksi for the Davis-Besse reactor head closure studs. The Davis-Besse stud material is SA-540 Grade B-23. As provided in Regulatory Guide 1.65, this material when tempered to a maximum tensile strength of 170 ksi, is relatively immune to stress corrosion cracking (SCC). In addition, the Reactor Head Closure Studs Program provides for examination of the reactor vessel stud assemblies in accordance with the examination and inspection requirements specified in the ASME B&PV Code, Section XI, Subsection IWB (1995 Edition through the 1996 Addenda) and approved ASME Code Cases. Specifically, each stud is volumetrically examined once per each 10-year Inservice Inspection Interval. No unacceptable indications were noted in these examinations. Reactor Head Closure Studs Program preventative measures to mitigate SCC are listed as follows:

- a. There are no metal platings applied to the closure studs, nuts, or washers.
- b. A manganese-phosphate coating was applied to the studs, nuts and washers during fabrication to act as a rust inhibitor.
- c. An enhancement to the program provides for selection of an alternate stable lubricant that is compatible with the fastener material and the environment. A specific precaution against the use of compounds containing sulfur (sulfide), including molybdenum disulfide (MoS<sub>2</sub>), as a lubricant for the reactor head closure stud assemblies will be included in the program.

2. An enhancement will be added to the Reactor Head Closure Studs Program to preclude the future use of replacement closure stud bolting fabricated from material with actual measured yield strength greater than or equal to 150 ksi except for use of the existing spare reactor head closure stud bolting.

The exception to allow future use of the existing spare reactor head closure stud bolting (2 each) is justified based on Davis-Besse plant-specific operating experience of over 30 years that has not experienced SCC of the reactor head closure stud bolting. The existing spare bolting, if used as a future replacement, would experience less than 30 years of service to the end of the period of extended operation.

See the Enclosure to this letter for the revision to the DBNPS LRA.

Thanks

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**Email Number:** 3035

**Mail Envelope Properties** (Samuel.CuadradoDeJesus@nrc.gov20110729095400)

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**Sent Date:** 7/29/2011 9:54:06 AM  
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**From:** CuadradoDeJesus, Samuel

**Created By:** Samuel.CuadradoDeJesus@nrc.gov

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**Options**  
**Priority:** Standard  
**Return Notification:** No  
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## **Follow-up Clarification Related to the DB Response to RAI 3.1.2.2-2**

June 26, 2011

### Background

In the third request item of RAI 3.1.2.2-2, the staff requested that the applicant describe the functional groups for the following two components that are addressed in LRA Table 3.1.2-2: (1) core support assembly (CSA) vent valve body, and (2) plenum cylinder reinforcing plate. The staff also requested that if existent, the applicant describe their link relationships (such as primary/expansion link) with other components. In addition, the applicant was requested to describe the inspection method, including the inspection frequency, for the components.

In its response dated July 22, 2011, the applicant stated that in MRP-227, the reactor internals were assigned to one of the following four functional groups: Primary, Expansion, Existing Programs, and No Additional Measures components. The applicant also stated that the link relationships are consistent with that provided in Tables 4-1 and 4-4 of MRP-227, Rev. 0. The applicant further stated that the inspection frequency and method for the primary and expansion components are provided in Tables 4-1 and 4-4 of MRP-227, Rev. 0.

In addition, the revised LRA Table 3.1.2-2 in response to RAI 3.1.2.2-2 does not include an AMR item to manage reduction in fracture toughness of the CASS CSA vent valve body and plenum cylinder reinforcing plate.

### Issue

The staff noted that MRP-227 Tables 4-1 and 4-4 referenced in the applicant's response do not clearly address information regarding (1) the functional groups, (2) the link relationships, or (3) the inspection method, including the frequency, specified for the CSA vent valve body and plenum cylinder reinforcing plate. In addition, the revised LRA Table 3.1.2-2 does not address reduction in fracture toughness of these CASS components. The staff also found a need to clarify whether or not the applicant's aging management for these components is based on applicant's plant-specific existing inspections (for example, inspections per ASME Code Section XI requirements or Technical Specifications).

### Request

Provide the information regarding (1) the functional groups, (2) the link relationships (if existent) and (3) the inspection method including the frequency for the CSA vent valve body and plenum cylinder reinforcing plate made of CASS.

As part of the response, clarify whether or not the applicant's aging management for reduction in fracture toughness of these CASS components is based on applicant's plant-specific existing inspections (for example, inspections per ASME Code Section XI requirements or Technical Specifications).

In addition, describe the applicant's operating experience in terms of the occurrence of cracking or reduction in fracture toughness of these components.