Issues for Discussion at the February 13 - 14, 2018, U.S. Nuclear Regulatory Commission Staff and Industry Public Meeting on MRP-175, Revision 1 and MRP-211, Revision 1

1. General

   a. Highlight aging mechanisms for which new data applicable out to 80 years of operation were available and were considered in revising or not revising the screening criteria.

   b. Which mechanisms saturate as fluence increases? Which mechanisms do not saturate as fluence increases?

   c. What are the major data gaps?

2. Screening Criteria

   The minimum stress screening criteria for irradiation assisted stress corrosion cracking (IASCC) in MRP-175, Rev. 1 has been increased from 30 kilopounds per square inch (ksi) to 35 ksi. Given this, how confident are you in weld residual stress (WRS) estimates for reactor vessel internals (RVI) components, e.g. core barrel welds, and the extent of stress relaxation in these welds? Should a margin for uncertainty be added to WRS estimates or the stress threshold lowered to accommodate the uncertainty?

3. IASCC Initiation Data (MRP-211, Rev. 1)

   a. IASCC Initiation test data – How is failure defined? Complete failure or just cracking? Are these tests conservative for RVI components, i.e. would they conservatively predict initiation in a larger, thicker RVI weld?

   b. IASCC initiation tests are only up to 5000 hours – is it possible that initiation would occur at lower stress values if the tests were ran longer?

   c. The majority of the IASCC initiation test data are in MRP-211, Table E-1 are Type 316 cold-worked material. How relevant are these tests to Type 304 solution stainless steel which is used for the majority of components in pressurize water reactor (PWR) internals?

   d. How does the defined stress versus dose curve compare to field data on IASCC initiation? Can boiling water reactor hydrogen-water chemistry field data be used to compare?

   e. How was slow strain rate tensile data used to inform the IASCC screening criteria, if at all?

4. Crack Growth Rates

   The IASCC crack growth rates model is the same one being used as the basis for the draft code case. Was any additional data available to support fluences that are expected for 80 years of operation?

5. Void Swelling

   a. MRP-211, Rev. 1, Section 2.2.3 states that new data is required to assess the effects of higher fluence values >100 displacements per atom on the fracture toughness data. At these fluences, it is likely that void swelling could be greater than 10% and it can reduce the fracture toughness to a value lower than the current lower bound value. The staff notes that thus far, none of the PWR internals exhibited void swelling of 10%, and all PWR units switched to low leakage core arrangement. The staff requests that the MRP provide a brief explanation whether the PWR internals could potentially experience void swelling of 10% and its effect on the loss of fracture toughness value during the subsequent license renewal period.

b. At what percentage void swelling does fracture toughness decrease significantly, and could any PWR RVI components reach this level of swelling in 80 years?