THREE MILE ISLAND UNIT 1 SURVEILLANCE HOLDER TUBE REPORT

INTRODUCTION

Metropolitan Edison has discovered during the current refueling outage at TMI-1, damage to the reactor vessel surveillance holder tubes. As a result of this damage, TMI-1 must be operated during Cycle 2 with the surveillance specimen capsules and holder tubes removed. This report demonstrates the acceptability of these actions.

SURVEILLANCE CAPSULE HOLDER ARRANGEMENT

The design of the surveillance capsule holder tube is described in B&W Topical Report BAW-10006A.(1) The surveillance capsules are attached to and secured within the holder tube by a spring-loaded push rod assembly as shown in Figure 2-8 of Reference 2. The plenum flange compresses the push rod assembly spring as the plenum is lowered into the core support shield. The spring-loaded push rod assembly has four spacers mounted along its axial length to provide lateral positioning of the push rod. The top one of these 3-piece spacers, is shown in Figure 2-10 of Reference 2. Both upper spacers are located in the portion of the holder tube which is within the shroud tube. The third spacer is axially located in a portion of the holder tube with a thicker wall and within a journal bearing mounted to the core support shield. The fourth spacer is approximately in the center of the ogee bend in the holder tube.

A female fitting on the lower end of the push rod mates with the top end fitting of the upper surveillance capsule in a manner similar to the between capsule coupling shown in figure 2-6 of Reference 2. The bottom end fitting of the lower surveillance capsule mates with a special fitting in the base of the holder tube which prevents capsule rotation.

SURVEILLANCE TUBE INSPECTION

During specimen capsule removal, two of the three holder tubes were found to be severed at the axial location of the second push rod spacer from the top, thus separating the top approximately six feet of the holder tube. One of these two tubes was also severely worn at the axial location of the first push rod spacer and became separated at that location during capsule removal. The third holder tube was intact following capsule removal.

Remote video techniques were used to inspect for further evidence of wear on the internal surfaces of two of the holder tubes, (the intact tube and one severed tube). In general, the results of these inspections showed evidence of wear at each of the axial locations of the push rod spacer, at the axial location of the holddown spring, and at the axial locations of the surveillance capsule rings.

The wear sites on the holder tube are attributed to contact and relative motion between the push rod spacers, the holddown spring, and the surveillance capsules and the holder tube.

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CORRECTIVE ACTION

B&W has concluded that the most likely cause of the observed tube wear is flow-induced relative motion between the surveillance capsule train and the holder tube. To prevent the possibility of loose parts occurring during Cycle 2, the surveillance capsules and holder tubes will be removed prior to Cycle 2 operation.

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CORRECTIVE ACTION con't

Engineering of the holder tube and push rod assembly design modifications and material procurement will be completed during Cycle 2 to allow installation of the revised design prior to the start of Cycle 3. Removal of the specimens from the reactor vessel for one cycle will not adversely affect the results of future testing of these specimens or the overall results of the surveillance program.

SAFETY EVALUATION

The TMI-1 Technical Specifications provide the operating pressure and temperature limitations applicable up to the end of two EFPY of operation. One specimen capsule was removed at the end of Cycle 1 and those specimens will be tested during Cycle 2. Cycle 1 has accumulated approximately 1.3 EFPY of actual exposure to the reactor vessel wall at 1/4 wall thickness (1/4t).

The neutron fluence at the center of the surveillance specimens is reported in Reference 1 to be approximately 1.7 times the maximum fluence at the reactor vessel wall. A more recent calculation using improved methods reported in Reference 2 for the Oconee class reactors indicates that the neutron flux (E > 1Mev) is 2.4 times greater at the specimen location than the reactor vessel 1/4t location. Thus, the capsules in TMI-1 have received the equivalent irradiation in excess of the first three cycles of operation.

Cycle 2 is planned for 296 EFPD (0.8 EFPY) and Cycles 3 and 4 are each planned for 270 EFPD (0.75 EFPY) of operation. A revision to the technical specification limits will be requested prior to the beginning of Cycle 3 and will be based on the results of testing of the specimens from the surveillance capsule withdrawn at the end of Cycle 1. This revision will be applicable up through the end of at least the first 5 EFPY* of operation and will provide additional assurance that adequate fracture toughness properties are retained through the period of the next surveillance capsule withdrawal and testing.

A revised surveillance capsule withdrawal schedule based on the results of the specimen testing planned during Cycle 2 will be submitted for NRC approval in accordance with Appendix H to 10 CFR 50.

* 5 EFPY Reactor Vessel Exposure

CONCLUSION

It is concluded that operation of TMI-1 with the surveillance specimen capsules and the surveillance specimen capsule holder tubes removed is acceptable during Cycle 2. This change will not result in:

1. An increased probability of occurrence of any accident previously analyzed, or

2. An increase in the consequences of any accident previously analyzed, or

3. An increased probability of malfunction of any equipment important to safety previously analyzed, or

4. An increase in the consequences of the malfunction of any equipment important to safety previously analyzed, or

5. The creation of the possibility of an accident of a different type than previously analyzed, or

6. The creation of the possibility of a malfunction of a different type than previously analyzed, or

7. A reduction in the margin of safety in the basis of any technical specification.

REFERENCES

1. Reactor Vessel Material Surveillance Program, BAW-10006A, Revision 3, Babcock & Wilcox, January 1975.

2. Reactor Vessel Material Surveillance Program - Compliance with 10 CFR 50, Appendix H, for Oconee Class Reactors, BAW-10100A, Babcock & Wilcox, February 1975.