BWR OWNERS' GROUP

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Attention: Mr. Joe Golla (NRC)

Subject: BWROG ECCS Suction Strainers Action Item No. 2 Status

Reference:
1) Summary of August 10 and 11, 2010 Public Meeting with the Boiling Water Reactor Owners' Group (BWROG), September 8, 2010 (ML102360056)
2) Summary of October 20, 2010 Public Meeting with the Boiling Water Reactor Owners' Group (BWROG), November 4, 2010 (ML103010393)
3) Utility Resolution Guide for ECCS Suction Strainer Blockage, NEDO-32686-A, BWROG, October 1998
4) BWROG ECCS Suction Strainer Issue Resolution Schedule Update, BWROG-10042, August 31, 2010
5) "The Marviken Full-Scale Jet Impingement Tests, Fourth Series," Reports MXD-206, MXD-207, MXD-208 and MXD-210; Results from Test 6, 7, 8 and 10; Joint Reactor Safety Experiments in the Marviken Power Station, Sweden, (April-June 1981)

The purpose of this letter is to provide a status on Action Item No. 2, originally recorded in the referenced summary of the August 10 and 11, 2010 BWR Owners' Group (BWROG) Emergency Core Cooling System (ECCS) Suction Strainers Status Meeting (Reference 1), and to request NRC Staff feedback on the position described in this letter. Written feedback is requested within seven weeks (35 working days) of the NRC Staff's receipt of this letter, an interval which was agreed upon during the October 20, 2010 public meeting (Reference 2).

Presentations at the meeting under Reference 1 described the BWROG ECCS Suction Strainers Committee's resolution strategy for Issue 7, Zone of Influence (ZOI) Adjustment for Air Jet Testing. The BWROG presentation described why air jets produce higher damage pressures than saturated steam jets and saturated water jets and are therefore conservative for defining Boiling Water Reactor (BWR) ZOIs. Part of the Issue 7 resolution strategy is to document the basis for the continued acceptability of using the air jet test results described in the BWROG Utility Resolution Guide (Reference 3) for BWRs. These air jet test results have been used to determine assumed ZOIs for debris generation analyses. The NRC staff has requested that PWRs take an additional 40% reduction in debris damage pressures. The BWROG position is that BWRs do not need to take an additional 40% reduction in the debris damage pressures because postulated BWR Design Basis Accident main steam line and recirculation line breaks result in steam jets and essentially saturated-water jets and therefore are conservatively modeled by the air jet tests.

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Action No. 2 was updated during the October 20, 2010 BWROG ECCS Suction Strainers Status Meeting (Reference 2). The updated action was for the BWROG to identify BWR operating process parameters and relative amounts of water subcooling and how these relate to jet pressures. This letter is in response to the updated Action Item No. 2, and supports activities contained in the program schedule (Reference 4), specifically task 7.1.3, "Prepare a report incorporating the technical expert comments and bolstering the analysis [of air jet testing results]." The following summarizes the results of our internal analysis.

The BWROG Utility Resolution Guide included damage pressures for insulation materials based on tests performed with air jets. These damage pressures were used to calculate spherical zones of influence inside of which the various insulation materials are assumed to fail in BWRs.

The Marviken tests (Reference 5) – a series of large-scale tests performed in Sweden in the early 1980s – showed that jets originating from a steam reservoir, or steam line, produce slightly higher jet pressures at a given distance from the jet discharge nozzle than jets from a saturated water reservoir. The Marviken tests started with jet discharges from a reservoir having water that was about 60°F subcooled relative to saturation. The test results show that the jet discharge pressures at the target with this subcooled water are essentially equivalent to the jet discharge pressures from a saturated water reservoir or pipe provided the distance from the discharge nozzle is at least four (4) times the diameter of the discharge nozzle.

Two (2) of the Marviken tests measured jet target pressures at jet centerline distances from the discharge nozzle of 1.2 and 2.0 times the jet nozzle diameter. For these two (2) tests the jet pressures at the target were significantly higher at the start of the test with the 60°F subcooled water discharge. The jet pressures at the target for these tests decreased as the amount of subcooling in the water decreased to approximately 10°F subcooling. Once the subcooling in the water decreased to less than about 10°F, the jet pressures at the target became essentially the same as the pressures produced when the reservoir contained saturated water. The test results imply that for two-phase jets originating from a reservoir or pipe containing subcooled water, the jet pressures at distances close to the rupture are related to both the amount of subcooling in the water as well as the distance from the rupture, i.e., the jet pressures are higher with greater water subcooling and at distances closer to the break. A jet pressure reduction with distance from the break is consistent with jet thermal-hydraulics as the jet expands in the drywell.

The water in BWR recirculation lines has about 20°F of subcooling, which is less subcooling than the starting conditions for the Marviken tests. Insulation damage zones determined by the air jet tests range from several times the jet break diameter to much larger multiples of the break diameter. Therefore, because of the small amount of subcooling in BWR recirculation lines and because insulation damage zones are at least several times the break diameter, a BWR recirculation line break would not produce higher two-phase jet pressures (than a saturated water break) at the outer diameter of the zone of influence, i.e., there would be no increase in the size of the zone of influence volume or the quantity of damaged insulation for recirculation lines relative to saturated water conditions.

Thus, the NRC guidance to reduce debris damage pressures by 40% for two-phase jets in PWRs with sub-cooled water should not be applied to BWR recirculation lines since a recirculation line break can realistically be treated as a saturated-water line break. NRC Staff feedback on this position is important for completion of tasks under Issue 7, as the final position of the NRC Staff determines the next several

steps for the BWROG ECCS Suction Strainers Committee under this issue. Please contact me or Rob Whelan, BWROG PM, at (910) 200-1006, with any questions. Thank you.

Regards,

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