February 2, 2012

Frederick P. Schiffley
BWROG Chairman
Exelon Generation Co., LLC
Cornerstone II at Cantera
4300 Winfield Road
Warrenville, IL 60555

Subject: FEEDBACK ON BWROG-11060, "BWROG [BOILING WATER REACTOR (BWR) OWNERS' GROUP] ECCS [EMERGENCY CORE COOLING SYTEM] SUCTION STRAINERS BYPASS TEST PLAN"

Dear Mr. Schiffley:

By letter dated November 29, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML11335A262), the BWROG submitted for U.S. Nuclear Regulatory Commission (NRC) staff informal review and feedback BWROG-TP-11-025, "BWROG ECCS Suction Strainer BWR Downstream Effects Bypass Test Plan, 'BWROG Emergency Core Cooling System Suction Strainers Committee's plan for measuring debris that bypasses the ECCS suction strainers after a LOCA [loss-of-coolant accident].'"

The NRC staff's feedback is provided below. The NRC staff suggests a telephone call with the BWROG to discuss the staff's comments and questions; however, a written response from the BWROG addressing the comments and questions may be beneficial prior to the telephone call.

Staff Comments on BWROG Bypass Test Procedure (some comments or questions may be repeated if the procedure has more than one area addressing the same issue):

1) Testing without particulate may result in non-conservatism for some cases. This should be addressed. For a case where a moderate amount of fiber may transport to the strainer, testing without particulate may add significant non-conservatism. This effect may be exaggerated for strainers that collect debris non-uniformly due to variations in flow rate through different areas of the strainer. Without particulate included in the test, a majority of the fiber may collect over the relatively small high flow area of the strainer. In a test with particulate a relatively high head loss bed would form at the high flow area resulting in flow (and fiber) diverting to other areas of the strainer. This process would continue until the entire strainer could be covered with a filtering bed. The presence of particulate could result in higher fiber bypass.
2) Page 8 – 3.1.4 – 0.032 is very small. Likely this should be 0.082 per the data in the appendix.
3) Pages 8-9 – The relevance of the statement regarding fiber concentration is not clear.

4) Page 9 – Please provide adequate details of the various strainer designs that justify that the General Electric and Enercon strainers will provide results adequate to estimate bypass for other strainers. In particular, strainer geometry and uniform flow properties should be provided.
5) Page 9 – 3.3 – The staff is aware that under some conditions the chemistry of the water being used (tap vs. demin vs. filtered) can affect the head loss properties of a debris bed. It has been hypothesized that the water chemistry may affect the attraction between small particles such as those that may bypass a strainer. This could affect bypass results. The use of water that represents that in the suppression pool and reactor coolant system would eliminate questions associated with water quality.
6) Page 9 – What is the basis for any remaining material being deposited on the filters being conservative? What is the purpose of the control filter and what would be the effect of miscellaneous material deposited on it?
7) Page 11 – 3.5 – How will it be shown that a debris bed will fully cover the strainer in the plant? Is it valid to assume this will occur? Would this occur differently for different strainer types?
8) Page 11- 3.5 – How will it be determined that bypass has stopped or reached a constant rate between batch additions and for test termination?
9) Page 11 – 3.6 – How was it determined that the test approach velocities will adequately model the velocities in the plant since the maximum test velocity is only about half of the maximum plant velocity? Is the behavior linear with velocity? Are there discontinuities in the behavior? The test facility should be able to bound the plant approach velocities.
10) Page 11 – 3.6 – Some of the no fiber and atypical plants are not bounded by the velocity values listed.
11) Page 11 – 3.6 – If the strainers are not designed for uniform flow, it may be necessary to test at a range of velocities because the velocity near the pump suction may be significantly higher.
12) Page 11 – 3.6 – Do the calculated velocities include a sacrificial area for miscellaneous debris?
13) Page 11 – 3.7 – How is the range of concentrations in the suppression pool determined? Is it based on limiting debris amounts or potentially smaller amounts from less limiting breaks and less limiting transport? Suspect that 1/64 inch additions may be conservatively small, possibly overly conservative, but tests with large additions may be non-conservative.
14) Page 12 – 3.8 – What is the basis for the assertion that the method of adding turbulence adequately models the plant condition? Is the timing conservative? Do safety relief valves lift later in the accident response? If so, would their blowdown affect the debris bed? Could fiber size due to fragmentation be more affected by the plant condition?
15) Do some plants stop and restart pumps or otherwise change pump alignments as a part of recovery actions? Does this need to be addressed?

16) Page 13 – 4.0 – Will background weight gain be assumed to be constant? Would it decrease as the test continues?
17) Page 13 – 4.0 – How is the handling of bags controlled to ensure that inadvertent weight loss of the bag or fiber does not occur?
18) Page 13 – 4.0 – It is not clear why the baseline control filter weight gain would be subtracted from the total weight.
19) Page 14 – 4.1 – Questions on the test facility:
    a. Why put the filters on the suction side of the pump? – This could limit the test loop's ability.
    b. Can a filter be changed with the system in operation?
    c. Is there a method to measure filter differential pressure?
    d. How is it ensured that filter bypass does not occur?
    e. How is it ensured that filters are not damaged due to high dP?
20) Page 17 – appears to be a typo in the 3rd paragraph. (i.e., test acceptance criteria for is given in Section 7.0.)
21) Page 17 – 4.7.1 – Is the level of turbulence specified an adequate or conservative model with respect to that in the plant? Can turbulence affect bypass in ways other than just keeping the strainer clean?
22) Page 18 – 4.7.4 – 5 pool turnovers is probably adequate for timing between batches. May need to do some sensitivity studies to ensure that test termination can be performed at 5 turnovers. Some fiber may release from the bed over time.
23) Page 18 – 4.7.5 – How is the bag swapping performed? How could this process affect the results of the test? What is done to ensure that the test is not affected non-conservatively?
24) Page 18 – 4.7.6 – How is the filter processing and handling controlled to prevent inadvertent fiber or bag weight loss or damage?
25) Page 20 – 5.0 – How and when are data collected during the test to determine how bypass behavior changes as more debris is added to the test facility or how bypass changes with time?
26) Page 20 – 5.0 – When are filter changes performed? How are they performed?
27) Page 21 – Test C2 – Should all tests be stopped at the same amount of debris (e.g., ½-inch) for consistency/comparison?
28) Page 23 – what is the basis for the 1/8-inch fiber addition increment? The behavior based on batch amounts (concentration) may need to be explored at all flow rates, or at least bounding flow rates for each configuration.
29) Page 26 – 5.4 – Again, smaller batch sizes may need to be tested. What is the plant turnover time? What are the potential fiber arrival timing sequences in the plant?
30) Page 26 – 5.4 – How is repeatability ensured?
31) At what point will the test be terminated? How will it be verified that bypass has stopped or reached a constant rate? If it is a constant rate, how will the rate be measured?

32) Page 28 – 7.1 – How will it be demonstrated that the debris load limit measured in test C2 is valid for different strainer designs, hole sizes, approach velocities, etc?
33) Page 28 – If agitation promotes a uniform fiber bed, bypass may be reduced more quickly than if a non-uniform bed is formed. Under what conditions is this considered? Fiber concentration/batch size may have an effect on this phenomenon.
34) Page 28 – 7.2 – Where is system head loss measured?
35) Page 1-1 – In general it is not clear that the tests included in the matrix will ensure that bounding values of bypass for all BWRs under reasonably postulated conditions will be identified. It is likely that test result review will be required for the staff to come to such a conclusion. It is likely that the first several tests should inform the test matrix.
36) Page 1-1 – The suppression pool fiber concentration is not constant throughout a LOCA response. What is the methodology and basis for calculating this value for each plant? How is it ensured to result in a reasonably bounding bypass amount in each case?
37) Page 1-1 – There is no pool fill phase in a BWR. There is not a significant delay between the LOCA initiation and the start of the pumps taking suction from the suppression pool. It is likely non-conservative and unrealistic to assume that all fiber is in the pool prior to pump start. It is likely non-conservative to assume that the maximum amount of fiber, usually used for strainer head loss testing, is destroyed and transported to the suppression pool.
38) Page 1-1 – The bypass load limit may be consistent if the strainer design and flow rates are the same, but the total bypass up to that point will likely depend on how fast the fiber arrives at the strainer.
39) Page 1-1 – Paragraph (2) – The word “compiled” is misspelled twice as “complied.”
40) Page 1-2 – Top of page – Is the statement that the ranges of controlled parameters in the tests will be based on limiting conditions true for velocity? Some plants have velocities significantly higher than that estimated as the maximum test velocity.
41) Page 1-2 – Again, the pool concentration concept may be non-conservative and physically unrealistic.
42) Page 1-2 – Are all strainers uniform flow design?
43) For bypass limit calculations, how is the fiber considered to distribute over multiple strainers?

44) Page 3-1 – Page has no information on fiber size classification.
45) The No Fiber and Atypical plants have parameters outside those described in the body of the paper. Are these plants included in the evaluations?

If you have any questions regarding this matter, please contact Joe Golla at 301-415-1002 or at joe.golla@nrc.gov.

Sincerely,

/RA/

John R. Jolicoeur, Chief
Licensing Processes Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Project No. 691

cc: See next page

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