February 4, 2008

Mr. Anthony R. Pietrangelo
Nuclear Energy Institute
1776 I Street, NW, Suite 400
Washington DC, 20006-3708

SUBJECT: DRAFT CONDITIONS AND LIMITATIONS FOR USE OF WESTINGHOUSE TOPICAL REPORT WCAP-16793-NP, REVISION 0, "EVALUATION OF LONG-TERM COOLING CONSIDERING PARTICULATE, FIBROUS AND CHEMICAL DEBRIS IN THE RECIRCULATING FLUID"

Dear Mr. Pietrangelo:

As you are aware, licensee supplemental responses to Generic Letter (GL) 2004-02, “Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors,” are due to the U.S. Nuclear Regulatory Commission (NRC) by February 29, 2008. An important part of each licensee submittal will be a description of the methods used to evaluate in-vessel effects of debris and chemical products that bypass the emergency core cooling system strainers, as well as a summary of the results of the evaluation.

Topical Report WCAP-16793-NP, Rev. 0, “Evaluation of Long-Term Cooling Considering Particulate, Fibrous and Chemical Debris in the Recirculating Fluid," provides guidance for licensees in evaluating in-vessel downstream effects. The NRC’s review of WCAP-16793-NP, submitted for formal review on June 4, 2007, is nearly complete. However, given the near-term submittal date for supplemental responses and licensee interest in referencing WCAP-16793-NP, we believe it important that licensees be aware now of the staff’s draft conditions and limitations for use of the document.

The enclosure lists the draft conditions and limitations for licensee use of WCAP-16793. Changes or additions to the conditions limitations are possible during final review of the NRC’s safety evaluation for WCAP-16793-NP, but we do not expect any to be significant. The staff finds it acceptable and appropriate that licensee supplemental responses to GL 2004-02 discuss the consistency of each licensee’s use of WCAP-16793-NP with these draft conditions and limitations. If the NRC determines that significant changes are needed to these items, we will consider whether any additional licensee actions are needed. We recognize that such changes would not likely be captured in the February 2008 licensee supplemental responses to GL 2004-02.

If you would like to discuss the contents of this letter further, please contact me at (301) 415-3283.

Sincerely,

/RA/

William H. Ruland, Director
Division of Safety Systems
Office of Nuclear Reactor Regulation

Enclosure:
As stated

If you would like to discuss the contents of this letter further, please contact me at (301) 415-3283.

Sincerely,

/RA/

William H. Ruland, Director
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Enclosure:
As stated

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***See previous concurrence**
ADAMS Accession Number: ML080180415 NRR-106

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DRAFT CONDITIONS AND LIMITATION REGARDING USE
OF TOPICAL REPORT WCAP-16793-NP, REVISION 0,
"EVALUATION OF LONG-TERM COOLING CONSIDERING PARTICULATE, FIBROUS,
AND CHEMICAL DEBRIS IN THE RECIRCULATING FLUID"

January 2008

1. WCAP-16793-NP states that licensees shall either demonstrate that previously performed bypass testing is applicable to their plant-specific conditions, or perform their own plant-specific testing. The staff agrees with this stated position.

2. There are very large margins between the amount of core blockage that could occur based on the fuel designs and the debris source term discussed in WCAP-16793-NP and the blockage that would be required to degrade the coolant flow to the point that the decay heat could not be adequately removed. Plant-specific evaluations referencing WCAP-16793-NP should verify the applicability of the WCAP-16793-NP blockage conclusions to licensees' plants and fuel designs.

3. Should a licensee choose to take credit for alternate flow paths such as core baffle plate holes, it shall demonstrate that the flow paths would be effective and that the flow holes will not be become blocked with debris during a loss-of-coolant accident (LOCA) and that the credited flowpath would be effective.

4. Existing plant analyses showing adequate dilution of boric acid during the long-term cooling period have not considered core inlet blockage. Licensees shall show that possible core blockage from debris will not invalidate the existing post-LOCA boric acid dilution analysis for the plant.

5. The staff expects the Pressurized Water Reactor Owners Group (PWROG) to revise WCAP-16793-NP to address the staff's requests for additional information and the applicant's responses. A discussion of the potential for fuel rod swelling and burst to lead to core flow blockage shall be included in this revision.

6. WCAP-16793 shall be revised to indicate that the licensing basis for Westinghouse two-loop PWRs is for the recirculation flow to be provided through the upper plenum injection (UPI) ports with the cold-leg flow secured.

7. Individual UPI plants will need to analyze boric acid dilution/concentration in the presence of injected debris for a cold-leg break LOCA.

8. WCAP-16793 states that the assumed cladding oxide thickness for input to LOCADM will be the peak local oxidation allowed by 10 CFR 50.46, or 17 percent of the cladding wall thickness. The WCAP states that a lower oxidation thickness can be used on a plant-specific basis if that value is justified. The staff does not agree with the flexibility in this approach. Licensees shall assume 17 percent oxidation in the LOCADM analysis.

ENCLOSURE

9. The staff accepts a cladding temperature limit of 800ºF as the long-term cooling acceptance basis for GSI-191 considerations. Should a licensee calculate a temperature that exceeds this value, cladding strength data must be provided for oxidized or pre-hydrided cladding material that exceeds this temperature.

10. In the response to NRC staff requests for additional information, the PWR Owners Group indicated that if plant-specific refinements are made to the WCAP-16530-NP base model to reduce conservatisms, the LOCADM user shall demonstrate that the results still adequately bound chemical product generation. If a licensee uses plant-specific refinements to the WCAP-16530-NP base model that reduce the chemical source term considered in the downstream analysis, the licensee shall provide a technical justification that demonstrates that the refined chemical source term adequately bounds chemical product generation. This will provide the basis that the reactor vessel deposition calculations are also bounding.

11. WCAP-16793-NP states that the most insulating material that could deposit from post-LOCA coolant impurities would be sodium aluminum silicate. WCAP-16793 recommends that a thermal conductivity of 0.11 BTU/hr-ft-ºF be used for the sodium aluminum silicate scale and for bounding calculations when there is uncertainty in the type of scale that may form. If plant-specific calculations use a less conservative thermal conductivity value for scale (i.e., greater than 0.11 BTU/hr-ft-ºF), the licensee shall provide a technical justification for the plant-specific thermal conductivity. This justification shall demonstrate why it is not possible to form sodium aluminum silicate or other scales with conductivities below the selected value.

12. WCAP-16793-NP indicates that initial oxide thickness and initial crud thickness could either be plant-specific estimates based on fuel examinations that are performed or default values in the LOCADM model. Consistent with Conditions and Limitations item number 8, the default value for oxide used for input to LOCADM will be the peak local oxidation allowed by 10 CFR 50.46, or 17 percent of the cladding wall thickness. The default value for crud thickness used for input to LOCADM is 127 microns, the thickest crud that has been measured at a modern PWR. Licensees using plant-specific values instead of the WCAP-16793-NP default values for oxide thickness and crud thickness shall justify the plant-specific values.

13. As described in the Conditions and Limitations for WCAP-16530-NP (ADAMS ML073520891), the aluminum release rate equation used in WCAP-16530-NP provides a reasonable fit to the total aluminum release for the 30-day ICET tests but under-predicts the aluminum concentrations during the initial active corrosion portion of the test. To provide more appropriate levels of aluminum for the LOCADM analysis in the initial days following a LOCA, licensees shall apply a factor of two to the aluminum release as determined by the WCAP-16530-NP spreadsheet, although the total aluminum considered does not need to exceed the total predicted by the WCAP-16530-NP spreadsheet for 30 days. Alternately, licensees may choose to use a different method for determining the aluminum release, but in all cases licensees shall not use a method that under-predicts the aluminum concentrations measured during the initial 15 days of ICET 1.