



**UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001**

June 3, 2008

Mr. R. W. Borchardt
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

**SUBJECT: RESPONSE TO THE JANUARY 17, 2008, EDO LETTER REGARDING
 SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 AND 2
 EXTENDED POWER UPRATE**

Dear Mr. Borchardt:

In a letter dated January 17, 2008, Mr. Reyes, the former EDO, responded to our report of December 20, 2007, forwarding our conclusions and recommendations on the Extended Power Uprate (EPU) application for the Susquehanna Steam Electric Station (SSES) Units 1 and 2. Two of our recommendations were:

1. The PPL Susquehanna, LLC (PPL) application for the SSES EPU should be approved subject to the conditions imposed in the Safety Evaluation (SE) and the modification in Recommendation 2.

2. An appropriate margin should be added to the Operating Limit Minimum Critical Power Ratio (OLMCPR) as an interim measure to account for uncertainties in the void fraction correlation and the lack of data for its validation at void fraction above 90 percent. This interim measure should be reviewed when PPL submits more detailed analyses that account for the effect of uncertainties in the void fraction on the OLMCPR.

The January 17, 2008, response provides the staff's basis for concluding that additional OLMCPR margin was not necessary to ensure adequate safety.

We are not persuaded by the staff's arguments. To clarify the matter, we have reexamined the influence of uncertainties in void fraction prediction on OLMCPR based on analyses conducted by our consultants.

The OLMCPR is determined by assessing the changes in the critical power ratio (Δ CPR) due to anticipated transients compared to that expected under steady state conditions. The change in the CPR for the most limiting transient is then combined with the Safety Limit Minimum Critical Power Ratio (SLMCPR) to obtain the OLMCPR. In the SSES EPU application, a complex suite of codes was used to evaluate the OLMCPR. With these codes, it was difficult to propagate void correlation uncertainties over their full range, and determine the impact on the transient Δ CPR. Consequently, uncertainties in the transient Δ CPR due to uncertainties in the void fraction correlation were not fully assessed.

Our consultants performed the calculations using TRACE/PARCS following an approach that the Power Uprates Subcommittee suggested to the staff in December 2007 [3]. A summary of these calculations has also been provided to the staff [4]. The calculations were for typical Boiling Water Reactor (BWR) fuel designs at EPU conditions and were not intended to quantify the effects of void fraction uncertainties on the CPR for any specific plant.

Effects on power pulse, core average void fraction, and CPR as a function of time after a turbine trip with bypass and without bypass were first determined using the usual TRACE interfacial friction factors. Due to the time delay in peak heat release from the fuel to the coolant, the limiting Δ CPR occurs some time after the peak neutron flux and power caused by the void collapse. To evaluate the effect of uncertainties in void fraction predictions, the same parameters were calculated for turbine trip with and without bypass using the higher interfacial friction factors representative of homogeneous equilibrium conditions. Due to the highly turbulent conditions in the core during the transients of interest, homogeneous equilibrium is an appropriate limiting condition.

For the conditions evaluated, the Δ CPR values were about 0.04 lower for the limiting homogeneous equilibrium cases than the values obtained with the usual interfacial friction factors. These analyses as well as other assessments [5] indicate that uncertainties in void fraction prediction can result in a significant change in CPR.

We continue to recommend that in view of the many more fuel assemblies that will operate near limiting conditions for the EPU operation, the effects of the uncertainties in void fraction predictions on the OLMCPR be assessed over their full ranges.

Sincerely,

/RA/

William J. Shack
Chairman

References:

1. U.S. Nuclear Regulatory Commission letter dated January 17, 2008, from Luis A. Reyes, Executive Director for Operations, to William J. Shack ACRS Chairman, Subject: "Susquehanna Steam Electric Station, Units 1 and 2 Extended Power Uprate,"(ML080110611).
2. U.S. Nuclear Regulatory Commission letter dated December 20, 2007, from William J. Shack ACRS Chairman, to Dale E. Klein NRC Chairman, "Susquehanna Steam Electric Station Units 1 and 2 Extended Power Uprate Application," (ML073440114).
3. U.S. Nuclear Regulatory Commission letter dated April 9, 2008, from Sanjoy Banerjee, ACRS Member, to Frank P. Gillespie, Executive Director ACRS, "Documentation of the ACRS Propagation of Void Fraction Uncertainty Guidance for SSES EPU Application," (ML081021207).

4. U.S. Nuclear Regulatory Commission letter dated June 3, 2008, from Frank P. Gillespie, Executive Director, ACRS, to Timothy McGinty, Acting Director, NRR, "Summary of Preliminary Analyses of the BWR MCPR Sensitivity to Void Fraction Uncertainties Using TRACE," (ML081550134).
5. U.S. Nuclear Regulatory Commission letter dated February 4, 1981, from Robert Tedesco, Assistant Director of Licensing, "Acceptance for Referencing General Electric Licensing Topical Report NEDO-24154/NEDE-24154P". (ML061880471)
6. "Revised Safety Evaluation Related to Extended Power Uprate at Susquehanna Steam Electric Station Units 1 and 2," November 7, 2007 (Proprietary), (ML073521156).
7. Letter to the U.S. Nuclear Regulatory Commission from McKinney, B. T., PPL Generation, LLC, "Susquehanna Steam Electric Station Proposed License Amendment Numbers 285 for Unit 1 Operating License No. NPF-14 and 253 for Unit 2 Operating Licensing No. NPF-22 Constant Pressure Power Uprate," October 11, 2006, (ML062900160).
8. Letter to the U.S. Nuclear Regulatory Commission from McKinney, B. T., PPL Generation, LLC, "Proposed License Amendment No. 285 for Unit 1 Operating License No. NPF-14 and Proposed License Amendment No. 253 for Unit 2 Operating License No. NPF-22 Constant Pressure Power Uprate Application-PLA-6306," November 30, 2007, (Proprietary).

4. U.S. Nuclear Regulatory Commission letter dated June 3, 2008, from Frank P. Gillespie, Executive Director, ACRS, to Timothy McGinty, Acting Director, NRR, "Summary of Preliminary Analyses of the BWR MCPR Sensitivity to Void Fraction Uncertainties Using TRACE," (ML081550134).
5. U.S. Nuclear Regulatory Commission letter dated February 4, 1981, from Robert Tedesco, Assistant Director of Licensing, "Acceptance for Referencing General Electric Licensing Topical Report NEDO-24154/NEDE-24154P."
6. "Revised Safety Evaluation Related to Extended Power Uprate at Susquehanna Steam Electric Station Units 1 and 2," November 7, 2007 (Proprietary), (ML073521156).
7. Letter to the U.S. Nuclear Regulatory Commission from McKinney, B. T., PPL Generation, LLC, "Susquehanna Steam Electric Station Proposed License Amendment Numbers 285 for Unit 1 Operating License No. NPF-14 and 253 for Unit 2 Operating Licensing No. NPF-22 Constant Pressure Power Uprate," October 11, 2006, (ML062900160).
8. Letter to the U.S. Nuclear Regulatory Commission from McKinney, B. T., PPL Generation, LLC, "Proposed License Amendment No. 285 for Unit 1 Operating License No. NPF-14 and Proposed License Amendment No. 253 for Unit 2 Operating License No. NPF-22 Constant Pressure Power Uprate Application-PLA-6306," November 30, 2007, (Proprietary).

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