

January 17, 2008

Dr. William J. Shack, Chairman  
Advisory Committee on Reactor Safeguards  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

SUBJECT: SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2, EXTENDED  
POWER UPRATE

Dear Dr. Shack:

On October 9 and 10, and November 14, 2007, the U.S. Nuclear Regulatory Commission (NRC) staff presented its review of the Susquehanna Steam Electric Station, Units 1 and 2 (SSES 1 and 2), extended power uprate (EPU) application to the Advisory Committee on Reactor Safeguards (ACRS) subcommittee on power uprates. During the 547<sup>th</sup> and 548<sup>th</sup> meetings of the ACRS, on November 1 and December 7, 2007, respectively, the staff discussed the EPU with the ACRS full committee. By letter dated December 20, 2007, the ACRS forwarded its conclusions and recommendations on the staff's review of the SSES 1 and 2 EPU application to Chairman Klein. In that letter, the ACRS provided the following conclusions and recommendations:

1. The 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.
3. We concur with the staff that the load rejection and main steam isolation valve closure transient tests should not be required. The plant transient testing program adequately addresses the performance of the modified systems.
4. We concur with the staff that the monitoring that will be performed during power ascension to the uprate conditions provides adequate assurance that if vibration modes are induced in the steam dryer, they will be identified.
5. The proposed methodology for reducing the Oscillation Power Range Monitor scram setpoint values to account for errors caused by bypass voiding is acceptable.

6. The staff should develop the capability and perform a thorough review and assessment of the risk of pellet-cladding interaction (PCI) fuel failures with conventional fuel cladding, during anticipated operational occurrences (AOOs).
7. Review Standard (RS)-001, "Review Standard for Extended Power Uprates," provides a structured process for the review of EPU applications. The guidance document should be improved to include cross-referencing of related section between the power uprate safety analysis report (PUSAR) and the staff's SEs.

In addition to the recommendations and conclusions, several ACRS members provided additional comments expressing their concern that the licensee's plan to operate the units with conventional (non-barrier) fuel has increased the risk of pellet-cladding-interaction fuel failures during AOOs at EPU conditions.

In regards to recommendation 2, the NRC staff performed a detailed review of the application of AREVA methods and models to SSES at EPU conditions. In its review, the staff considered several technical points that were unique to the SSES EPU application. First, the fuel vendor (AREVA) provided full scale void fraction test data covering the range of pressure, flow rates, and void fractions up to the point of dry-out for the ATRIUM-10 fuel design. Second, the staff approval of the AREVA neutronic methods is limited to those transients which show margin to the safety limit minimum critical power ratio, and are therefore, effectively bounded by the critical heat flux test results. Third, AREVA performed a detailed sensitivity analysis demonstrating a negligible impact on the OLMCPR for a substantial void fraction bias. The staff agrees that void fraction data above 90% is lacking. However, the staff concludes that for the range of heat flux approved in the application, that any additional uncertainty for nodal void fractions at yet higher values, contributes negligibly to the analyses results such as the dual recirculation pump trip. The staff reviewed the neutronic feedback effects on potential void fraction biases for pressurization events and found that, when considered in an integral sense, the effects resulted in a power/void feedback that is substantially self compensating when determining the operating limit for SSES 1 and 2. The SSES 1 and 2 analysis is fully consistent with the staff's understanding of the power/void feedback phenomenon. Based on these points, the staff has found that an additional penalty to the OLMCPR is not necessary to ensure acceptable safety. The staff appreciates the committee's concerns and helpful insight provided during the review and will avail themselves to the committee, if requested, to discuss this matter at length.

In response to recommendation 6, the NRC staff will investigate current computational capabilities to model the complex phenomena associated with non-uniform fuel pellet expansion and stress-corrosion cracking (SCC). As necessary, the staff will develop guidance related to an application methodology and regulatory approach for implementing a PCI/SCC fuel failure criteria.

In regards to recommendation 7, the NRC staff continues to assess further means for improving the efficiency of the staff's review of EPU applications and to enhance consistency, quality, and completeness of EPU reviews. To that end, the staff continues to encourage both pressurized-water reactor and boiling-water reactor EPU applicants to use the RS-001 numbering scheme to identify the technical review areas in its applications. If an applicant desires to use a different numbering scheme, then the staff encourages EPU applicants to provide a table that cross-references the RS-001 matrix to the licensee's numbering scheme, as

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PPL Susquehanna did in Attachment 12 to its initial EPU application dated October 11, 2006 (the RS-001 matrix was annotated with references to the licensee's PUSAR). The staff will revise its internal guidance to ensure that future transmittals of draft SEs to ACRS include a table that provides cross-references between the staff's SE and the applicable sections of the licensee's PUSAR and supplemental responses.

The NRC staff appreciates the Committee's insights concerning the SSES 1 and 2 EPU amendment review.

Sincerely,

*/RA/*

Luis A. Reyes  
Executive Director  
for Operations

cc: Chairman Klein  
Commissioner Jaczko  
Commissioner Lyons  
SECY

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SECY

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