

May 30, 2012

Dr. J. Sam Armijo, Chairman  
Advisory Committee on Reactor Safeguards  
U.S. Nuclear Regulatory Commission  
Washington, DC 20055-0001

SUBJECT: RESPONSE TO ACRS RECOMMENDATIONS ON EXTREMELY LOW  
PROBABILITY OF RUPTURE PROJECT

REFERENCE: Letter to Mr. R.W. Borchardt, Executive Director for Operations, from J. Sam Armijo, Advisory Committee on Reactor Safeguards Chairman, dated April 23, 2012, Subject: "EXTREMELY LOW PROBABILITY OF RUPTURE PROJECT": ADAMS Accession No. ML12122A030.

Dear Dr. Armijo:

The referenced letter from the Advisory Committee on Reactor Safeguards (ACRS) contains discussions and conclusions regarding the ongoing extremely low probability of rupture (xLPR) project. The ACRS conclusions were based on the review of the presentation material and discussions with the U.S. Nuclear Regulatory Commission (NRC) staff during the 593rd meeting of the ACRS on April 12-14, 2012. The ACRS Materials, Metallurgy, and Reactor Fuels Subcommittee also reviewed the xLPR project during a meeting on March 8-10, 2012. This memorandum responds to the ACRS conclusions.

#### ACRS Conclusions

The ACRS conclusions on the xLPR Project were as follows:

1. The project to develop the xLPR modular probabilistic fracture mechanics computer code is well structured, organized, and responsive to the Office of Nuclear Reactor Regulation's (NRR's) request.
2. The most challenging technical issue in the xLPR code development will be the crack initiation phenomenon. Developers should make it a priority to make an early determination of whether a realistic crack initiation model is feasible.
3. Should the development of the crack initiation module prove to be intractable, the major advances in the xLPR code in fracture mechanics, the characterization of weld residual stresses, and treatment of uncertainties will greatly improve our capability to determine component rupture probabilities.

#### Discussion

The NRC staff appreciates the thorough ACRS review, technical discussions, conclusions, and recommendations for the xLPR project at the Subcommittee and Full Committee meetings.

Regarding Conclusion #2, the staff agrees that crack initiation phenomenon is the most challenging technical issue facing the xLPR code development. The staff is currently working with a panel of subject matter experts in the field of stress-corrosion cracking initiation to determine if an accurate crack initiation model is feasible within the resources allocated for the project. The expert panel is considering both phenomenological and empirical-based models. The staff is happy to provide a presentation on the crack initiation effort after the expert panel has finalized its review and made a recommendation to the xLPR project team.

Regarding Conclusion #3, the staff agrees that technical items, such as advanced fracture mechanics, weld residual stress analyses, and uncertainty quantification and handling are essential to the development of component rupture probabilities. As with crack initiation, subject matter experts are currently developing, validating, and coding appropriate physics based models for use within the xLPR code. The xLPR team is also working diligently to develop a protocol for proper and consistent quantification of uncertainty. The staff plans to request additional review meetings with the ACRS Materials, Metallurgy, and Reactor Fuels Subcommittee on relevant technical topics as the xLPR program progresses.

Summary

The staff appreciates the recommendations and comments provided by ACRS. The staff is working diligently to provide the most accurate and reliable technical models to be used in the xLPR code for predicting reactor coolant piping leaks and ruptures. We plan to ask the ACRS Materials, Metallurgy, and Reactor Fuels Subcommittee for further reviews and advice on technical topics related to the xLPR program.

Sincerely,

***/RA by Michael F. Weber for/***

R. W. Borchardt  
Executive Director  
for Operations

cc: Chairman Jaczko  
Commissioner Svinicki  
Commissioner Apostolakis  
Commissioner Magwood  
Commissioner Ostendorff  
SECY

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