**From:** Jason Schaperow, RES
**To:** Andrew Murphy, Charles Tinkler, Christopher Boyd,.. Jack Rosenthal, Nathan Siu
**Date:** Wed, Sep 27, 2000 10:19 AM
**Subject:** Spent Fuel Pool Accident Risk

I am coordinating the response to the September 11, 2000, User Need Letter on spent fuel pool accident risk. I have put together a draft version of our response. I need your assistance in completing this response. For each area in which we performed work, we need to add a couple of sentences describing the insight gained from our effort. Also, in the seismic area, I do not have the references for the work we performed. Finally, my understanding is that, at some point, we did some work in the area of human reliability (operator actions to refill spent fuel pool). We should also add that to the response. I need your assistance as soon as practicable, because our response is due to the RES Director by COB tomorrow.

**CC:** John Flack, Steven Arndt

I-4

Draft of September 27, 2000 (10:09AM)

MEMORANDUM TO: Samuel J. Collins, Director
Office of Nuclear Reactor Regulation

FROM: Ashok C. Thadani, Director
Office of Nuclear Regulatory Research

SUBJECT: RESPONSE TO USER NEED REQUEST FOR TECHNICAL STUDY OF SPENT FUEL POOL ACCIDENT RISK AT DECOMMISSIONING PLANTS

This memorandum responds to NRR's user need request of September 11, 2000, (Reference 1) for additional RES support on a technical study of spent fuel pool accident risk at decommissioning plants.

As part of its effort to develop generic, risk-informed requirements for decommissioning, NRR is performing a generic technical study to provide insight into the risk associated with spent fuel pool accidents at decommissioning plants. This study includes certain key elements including evaluations of the frequency of beyond-design-basis seismic events, thermal hydraulics and accident progression, and offsite radiological consequences. We have supported NRR by performing detailed technical analyses in these areas.

With regard to seismic events, NRR has requested analyses of the frequency of seismic events and the effect on the structural integrity of the spent fuel pool (Reference 2). RES has performed the requested analyses (Reference 3). The most recent NRR user need letter (Reference 1) requests additional RES effort in this area. Specifically, this letter requests an evaluation of the conservatism and uncertainty in the treatment of seismic issues. It also requests an assessment of the most likely spent fuel pool failure modes and locations and the expected level of offsite collateral damage. RES has performed the requested additional analyses (References 4 and 5).

With regard to thermal hydraulics and accident progression, NRR has requested analyses of the thermal hydraulic response for accidents involving an instantaneous, complete drain-down of the spent fuel pool as a result of a seismic event (Reference 6). RES has performed the requested analyses (References 7 and 8). The objective of these analyses was to estimate the critical decay time using an integral three-dimensional computational fluid dynamics model of the spent fuel pool and spent fuel pool building. Critical decay time refers to the time required to ensure that natural circulation air flows will keep the fuel temperatures below a specified value after a complete loss of pool coolant to prevent significant offsite releases. NRR also has requested (Reference 9) a reexamination of the temperature criteria used in conjunction with the thermal hydraulic analysis to assess (a) the decay time needed to provide sufficient time to carry out an ad hoc evacuation prior to significant fission product release and (b) the critical decay time. We expect to provide the results of this reexamination by _____.

With regard to consequences, NRR has requested a quantification of the offsite radiological consequences of spent fuel pool accidents occurring up to one year after final reactor shutdown

and analyses of related issues (References 10 and 11). RES has performed the requested evaluations (References 12 through 17). These evaluations included consideration of the reduction in consequences associated with reduced fission product inventory resulting from radioactive decay from 30 days to one year and the additional time available for evacuation associated with spent fuel pool accidents. The focus of these evaluations was for accidents occurring at one year after final shutdown. Recently, NRR requested additional consequence calculations using fission product inventories at 30 and 90 days and one, two, five, and ten years after final shutdown to provide additional insight into the effect of reductions in inventory available for release (Reference 18). We expect to provide the results of these additional consequence calculations by _____.

In addition to the NRR requests for specific RES evaluations of seismic, thermal hydraulics, and radiological consequence issues, NRR requested, in August 1999, RES perform an overall review and comment on a draft version of the technical study (References 19 and 20). RES performed the requested review (Reference 21 and 22). The most recent NRR user need letter (Reference 1) requests that RES review and comment on the final version of the technical study. RES is willing to perform this review. However, the technical study contains separate evaluations of accident frequency, thermal hydraulic response, accident progression, and offsite radiological consequences using a number of bounding assumptions. If not appropriately recognized, these bounding assumptions will tend to drive the decision making process. To preclude the institution of unnecessary conservatism generally associated with bounding assumptions, RES is willing to support a plan for integral analysis of spent fuel pool accidents using more realistic assumptions. We recommend a meeting to discuss such a plan.

References:

1. User Need Request for Technical Study of Spent Fuel Pool Accident Request at Decommissioning Plants, memorandum from S. Collins to A. Thadani, September 11, 2000
2.
3.
4.
5.
6. Technical Support for Spent Fuel Pool Heatup Analysis, memorandum from G. Holahan to T. King, April 16, 1999
7. Completion of 3D CFD Analysis for Spent Fuel Pool and Containment, memorandum from F. Eltawila to J. Wermiel, February 4, 2000
8. Final Report: Predictions of Spent Fuel Heatup after a Complete Loss of Spent Fuel Pool Coolant, memorandum form F. Eltawila to G. Holahan, June 29, 2000
9.
10. Technical Support for Spent Fuel Pool Zirconium Fire Consequence Analysis, memorandum from G. Holahan to T. King, March 26, 1999
11. Support for Spent Fuel Pool Accident Risk Assessment for Decommisioning Plants, memorandum from J. Hannon to F. Eltawila, December 3, 1999
12. Technical Support for Spent Fuel Pool Zirconium Fire Consequence Analysis, memorandum from C. Rossi to G. Holahan, May 25, 1999
13. Spent Fuel Pool Risk Assessment, memorandum from A. Thadani to S. Collins, November 12, 1999
14. Opportunities to Reduce Uncertainty in consequence Assessment for Spent Fuel Pool Accidents, memorandum from F. Eltawila to J. Hannon,

December 10, 1999
15. Issues Related to Spent Fuel Pool Accident Analysis, memorandum from F. Eltawila to J. Hannon, January 19, 2000
16. Effect of Fission Product Inventory and Air Ingression on Spent Fuel Pool Accident Consequences, memorandum from F. Eltawila to J. Hannon and R. Barrett, March 29, 2000
17. Risk-Informed Requirements for Decommissioning, memorandum from F. Eltawila to G. Holahan, August 25, 2000
18. Consequence Calculations for Decommissioning Probabilistic Risk Assessment, memorandum from R. Barrett to J. Flack, August 25, 2000
19. Request of Review of Draft Technical Study of Spent Fuel Pool Accidents for Decommissioning Plants, memorandum from G. Holahan to T. King, August 3, 1999
20. Memorandum from G. Holahan to J. Craig, August 18, 1999
21. Review of Draft Technical Study of Spent Fuel Pool Accidents for Decommissioning Plants, memorandum from J. Craig to G. Holahan, November 19, 1999
22. Review of Draft Technical Study of Spent Fuel Pool Accidents for Decommissioning Plants, memorandum from T. King to G. Holahan, November 23, 1999