Nathan Siu's comments:

1/24/00

Comments: Draft Final Technical Study on Spent Fuel Pool Accident Risks at Decommissioning Nuclear Power Plants, February 2000

General Comments

1. The revised draft addresses the three main issues raised in earlier review comments (regarding the use of adiabatic calculations, the lack of PRA detail, and the consistent treatment of uncertainties). On the plus side, better heat transfer models are being used and a substantial amount of information is provided on the PRA. On the minus side, uncertainties are consistently treated by using only point estimates. Further, there is little discussion of key parameters/issues, or sensitivity studies to explore their impact. The detailed comments below address issues largely associated with the details of the PRA.

No change.

2. It appears that the study's principal conclusion (that the risk associated with SFPs in decommissioning reactors is low, given certain industry commitments) is correct.

No change.

3. It also appears that the study's conclusion that earthquakes are dominant contributors is at least partially correct. It is not clear if the contributions from other external events (especially tornadoes and hurricanes) aren't comparable or at least visible.

Siu will check again.

4. The study appears to be almost ready for use as a model for risk-informed applications. Two improvements that are needed are: a) treatment of the issues raised in the detailed comments below, and b) explicit identification of key assumptions (beyond compliance with the DICs, e.g., the lowest level that the pool can be drained to) that need to be verified for plant-specific analyses.

Will include hardware config.

Detailed Comments

✓ 1. Section 2.0. The last paragraph states that "the staff has therefore decided that the end state and consequences of a spent fuel pool fire are sufficiently severe that the RG 1.174 LERF baseline criteria of 1E-5 per year ... provides an appropriate frequency criteria for a decommissioning plant SFP risk...". However, there is no explicit comparison of decommissioning plant SFP zirconium fire consequences with the consequences of large early releases for operating reactors. (Appendix 4 only provides an analysis of the SFP consequences.) A comparison is needed to provide a technical basis for the statement. (The previous paragraph only says that care is needed.)

No change.

✓ 2. Section 3.0. Could use a clear statement regarding the specific objectives of the PRA (e.g., develop an order-of-magnitude assessment of level of risk associated with SFPs at decommissioning reactors, identify potential vulnerabilities, develop a basis for guidance for performing SFP PRA).

No change.

3. Section 3.2. Refers to an expert panel which identified attributes necessary for achieving very high levels of human reliability. Not clear who was on the panel, how it was run, etc. Can't find reference to panel in Appendix 2a.

Will address.

4. Section 3.2. What are the requirements/commitments regarding the maintenance of a makeup water supply that might be needed in the event of an extended event?

No change

F/10

5. Section 3.2. Needs a discussion of the key sources of uncertainty and their potential impacts on the results.

will address.

6. Section 3.4.3. It isn't clear if the dismissal of tornadoes (because there are more probable initiators) is sufficiently justified. If the strike frequency is 1.5E-5/yr, and if the tornado destroys the switchyard and the makeup water supply, this sounds like a more important risk contributor than others addressed in the PRA. The same concern holds for hurricanes, which are not analyzed. Note that severe hurricanes will cause widespread demands for emergency reponse resources.

Siu will check again

7. Table 3.1 doesn't properly characterize the seismic result. It appears that according to Section 3.4.1, there are 8 sites for which the probability (frequency?) of failure is greater than 3.0E-6. See also Section 4.1.

We are revising.

8. The results in Table 3.1 basically reflect the following underlying model: events which occur slowly are insignificant risk contributors - it is essentially impossible for the operators to fail to notice and recover such events. Rather than showing frequencies for the 1E-8 and lower scenarios, it might be better to indicate that the frequencies are extremely small. (Especially since the seismic frequency, which is the largest contributor, is indicated as an inequality.)

No change.

9. The LOI result (3E-9/yr) is extremely small. Even after credit has been taken for the NEI commitments 6 and 7, Section 4.5.1.3 of Appendix A estimates the initiating frequency to be 1E-3/yr. This indicates a CCDP of around 1E-6. Section 4.5.2.2 of Appendix A indicates that a "large leak" is assumed to be 60 gpm; this assumption leads to the 40 hour time window for operator action reported in Section 3.3.2. Given the very small CCDP, it would seem that less likely larger leaks could have significantly larger risk contributions, as long as they aren't impossible. Without further analysis, it isn't clear if such larger leaks don't contribute to the SFP risk.

10. Section 4.2.1, p. 30. DICs 2, 3, 4, and 8 are associated with recovery of a loss of cooling or inventory, not identification and diagnosis.

we revised

11. Section 4.2.2, 1st para. Don't think we should say that "the defense in depth function of reactor containment is not appropriate." Perhaps it isn't needed, i.e., sufficient defense in depth can be provided by other features.

editorial

12. Section 4.3.1, last para. Sections 3.3.1 and 3.3.3 refer to a 1-year time window, but this is based on loss of cooling accidents (including LOOP). If, per the earlier comment, LOI events turn out to be important, would this modify this section's discussion of EP? Isn't a 5-year window more appropriate?

same as SMSAB 13

13. The report needs some editorial cleanup (e.g., see use of "creditable" instead of "credible", "form" instead of "from", "unbraced" instead of "unborated".) Appendix 2 has numerous references (to sections or appendices) that need to be provided or corrected. Referenced tables also need to be provided.

editorial

14. Appendix 2a, p. 5. Are there any implications on staffing (e.g., training, qualifications, levels) that need to be reflected in the HRA?

Will add sentence on dedicated operators

R. Barrett liked this comment.

15. Appendix 2a, p. 10. Equation is incorrect as written. It also seems to be needlessly confusing; the point is that the time window is given by 18 ft/0.2 ft/hr = 90 hrs.

16. Appendix 2a, Section 4.4.5.3, p. 50. It isn't clear if the availability of offsite resources should not have a greater impact. This is a scenario for which offsite power recovery was unsuccessful over a very long time period. Some of the same reasons that precluded power recovery could be in effect here. Note that a severe weather event that causes the extended blackout might be severe enough to require non-nuclear emergency responses over the affected region. Might the understanding that things occur very slowly at SFPs affect resource prioritization?

No change.

17. A related point - what is the fragility of the makeup water supply tank (and the fire water supply tank)? Are they susceptible to credible high winds?

Sin will check again

18. Appendix 2a, Section 4.5.2.3. The level of drop observed during an event is the product of the leak rate (e.g., gpm) and the leak duration. The definition of large and small leaks is dependent on the leak rate and not the duration. Therefore, the observation that only 2 events led to drops greater than 5 feet is not directly useful to the estimation of the frequencies of large and small leaks. INEL-96/0334 considered the AEOD data in deriving leak frequencies; it didn't show such a large difference between the large and small leaks. If the CCDP of large leaks is shown to be important (per the earlier comment), the frequency estimation issue needs to be revisited.

Will revise.

19. Appendix 2a, Section 4.5.4.1. The basis for assuming automatic isolation of the leak once the water level reaches 15 feet needs to be provided. Presumably, this is an assumption that needs to be verified against plant-specific details when a plant-specific analysis is done.

Will revise.

20. Appendix 2a, Section 4.5.5.1. Again, the assumption of a 60 gpm leak affects the time available to isolate the leak before normal SFP cooling is lost.

Same as cmt 9 above.