ACRS Concerns As Summarized In a Letter From the ACRS to Chairman Meserve, dated April 13, 2000

1. The ruthenium inventory in spent fuel is substantial. **If there are significant releases of ruthenium, the RG 1.174 LERF value may not be an appropriate surrogate for the prompt fatality quantitative health objectives (QHO).** Because of the relatively long half-life of ruthenium-106, it is likely that the early fatality QHO would not longer be the controlling consequence.

2. The staff made additional MACCS calculations which assumed 100% release of the ruthenium inventory. For a 1 year decay time with no evacuation, the prompt fatalities increase by 2 orders of magnitude over those in the draft report which did not include ruthenium release. The societal dose doubled, and the cancer fatalities increased four-fold.

3. The ACRS is concerned about the **appropriateness of the source term** used in the study. The staff did consider the possibility that "fuel fines" could be released from fuel with ruptured cladding (as a result of decrepitation). It did not, believe these fuel fines could escape from the plant site. Evidence suggest that fuel fines could be entrained in the vigorous natural convection flows produced in a SFP accident. Nevertheless, the staff considered the effect of 6×10^{-6} release fraction of fines. This minuscule release fraction did not affect the calculated findings. There is no reason to think that such a low release fraction would be encountered with decrepitating fuel.

4. **The uncertainties associated with many of the critical features of the MACCS code do not seem to have been considered in the analyses of the SFP accident.**

   -One of the uncertainties is that the spread of the radioactive plume from a power plant site is much larger than what is taken as the default spread in the MACCS calculations.
   - The initial plume energy assumed in the MACCS calculations, which determines the extent of plume rise, was taken to be the same as that of a reactor accident rather than one appropriate for a zirconium fire.
   -The consequences found by the staff tend to overestimate prompt fatalities and underestimate latent fatalities just because of the narrow plume used in the MACCS calculations and the assumed default plume energy.

5. The staff needs to review the air oxidation fission products release data from Oak Ridge National Lab. and from Canada that found large releases of cesium, tellurium, and ruthenium at temperatures lower than 1000 C. **Based on these release values for ruthenium, and incorporating uncertainties in the MACCS plume dispersal models, the consequence analysis should be redone.**

6. The staff should keep in mind factors such as the relatively small number of decommissioning plants to be expected at any given time at which they are vulnerable to a spent fuel pool fire.

7. The ACRS has difficulties with the time at which the risk of zirconium fires becomes negligible. Issues related with the formation of zirconium-hydride precipitates in the fuel cladding are spontaneously combustible in air. Spontaneous combustion of zirc-hydrides would render moot the issue of "ignition" temperature which is the focus of the

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staff analysis of air interactions with exposed cladding. The staff neglected the issue of hydrides and suggested that uncertainties in the critical decay heat times and the critical temperatures can be found by sensitivity analysis. Sensitivity analysis with models lacking essential physics and chemistry would be of little use in determining the real uncertainties.

8. The staff analysis of the interaction of air with cladding has relied heavily on geriatric work. New findings through a cooperative international program PHEBUS FP provide information relating to the well-known tendency for zirconium to undergo breakaway oxidation in air whereas no tendency is encountered in steam or in pure oxygen. Other findings relate to how nitrogen from air depleted of oxygen will interact exothermically with zircaloy cladding. **The ACRS does not accept the staff's claim that it has performed "bounding" calculations of the heatup of Zircaloy clad fuel even when it neglects heat losses.**

9. Since the staff has neglected any reaction with nitrogen and did not consider breakaway oxidation, it had not made an appropriate analysis to find this "ignition temperature".

10. **The search for ignition temperature may be the wrong criterion for the analysis.** The staff should be looking at the point at which cladding ruptures and fission products can be released. One arrives at a lower temperature criteria for concern over the release of radionuclides.

11. The staff focuses on eutectic formations when intermetallic reactions are more germane to the issues at hand.

12. Risk-informed decisionmaking regarding the SFP fire issues should use realistic analysis, including an uncertainty analysis. **The ACRS is concerned about the conservative treatment of seismic issues.**

13. Since the accident analysis is dominated by sequences involving human errors and seismic events which involve large uncertainties, the absence of an uncertainty analysis of the frequencies of accidents is unacceptable. **The study is inadequate until there is a defensible uncertainty analysis.**

14. Recommend putting rulemaking on hold until the inadequacies discussed herein are addressed by the staff.

Seismic conservative