SRXB (Contact: J. Wermiel - J. Staud.)

1. Page 256, Criticality due to chemical stripping of primary piping [Ref. 1] (Tony Ulses)
2. Page 451, Barrett: worst case draining of the SFP. [Ref. 1] (Joe Staud.)
3. Page 60, Ray Shadis: Concern about primary system chemical decon. and the potential for contaminated solution to go overboard into public waters or be flushed back into the SFP. [Ref. 2]
4. Page 14, Shadis statement: During primary system decontamination at decomm. reactors, is it possible to misalign the valves and send corrosive chemicals into the SFP? Could these chemicals precipitate boron from the SFP water? Is there a potential for criticality? Is there a potential for fuel damage? **EMCB assist if needed** [Ref. 2]
5. Page 15, Shadis statement: In a half-empty SFP, if a SFP liner presses racks together, or, if fuel racks or assemblies or boral plates fail, are localized heat and criticality issues to be considered? [Ref. 2]
6. Page 4, Atherton comment: NRC should identify the scenario where a steam explosion is possible because of a severe criticality event and the basis upon which the probability was determined to be "highly unlikely." [Ref. 7]
7. Page 4, Atherton comment: The NRC should identify all radioactivity in the SFP and that capable of being dispersed in an accident (beyond that on p A3-11 to A3-13). [Ref. 7] **RES assist if needed**
8. Orange County (OC) comment: Criticality accident analysis does not consider risk of a criticality accident that arises from placement of low-burnup fuel assemblies in a pool where the licensee relies on burnup credit to prevent criticality. [Ref. 8] (Tony Ulses)
9. OC comment: Study is deficient in that it ignores phenomenon associated with partial draindown of SFP that will suppress convective heat transfer by presence of residual water at the base of fuel assemblies. [Ref. 8]
10. OC comment: Study is deficient in that partial draindown will lead to a steam-zirc reaction producing hydrogen gas which could reach explosive concentrations in the atmosphere of the spent fuel building, potentially leading to a breach of that building. [Ref. 8]
11. Mats Sjöberg/ Ferenc Müller on report: [Ref. 9] Page A1-7 in the report says:

> "When zirconium reaches temperatures where air oxidation is significant, the heat source is dominated by oxidation. The energy of the reaction is 262 kcal per mole of zirconium. In air, the oxidation rate and the energy of the reaction is higher than zirconium-steam oxidation."
>
> We can transfer 262 kcal to other units:
> 262 kcal pel mol Zr = 1.1 MJ per mol Zr (1 mol Zr = 91.2 kg Zr) = 1.1E+06/91.2 = 1.2E+04 J/kg Zr. We can conclude that the air oxidaton energi according to the report is = 1.2E+04 J per kg Zr
>
> The corresponding values for Zr-steam reaktion in the Melcor manual = 6.43E+06 J/kg Zr (Ref. Bottom Head Package, Reference Manual, Table 3.6. Heats of reaction at 1,700 K) The Maap code uses 6.18E+08 J per mol Zr = 6.78E+06 J/kg Zr, for
> Zr-steam reaktion i.e. near the same as Melcor.

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There is a factor 500 difference in the oxidaton energy and to the wrong direction.

12. Mats Sjöberg/ Ferenc Müller on report, Release Fractions, Page A4-5, Table A4-3. 100 % release is assumed for noble gases, iodine and cesium. We feel that this is too conservative. The latest estimates by the Swedish Radiation Protection Institute for the Tjernobyl case says that 100 % of the noble gases, 50-60 % of the iodine and 20-40% of the cesium were released at the accident. [Ref. 9]

RES

13. Page 3, ACRS: 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 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. [Ref. 11]

14. Page 3, ACRS: 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. [Ref. 11]

15. Page 4, ACRS: 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". [Ref. 11]

16. Page 4, ACRS: 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. [Ref. 11]

17. Page 4, ACRS: The staff focuses on eutectic formations when intermetallic reactions are more germane to the issues at hand. [Ref. 11] **RES assist if needed**

18. Page 4, NEI: T/H - Depending on fuel burnup/storage array details, the development of standard methods is needed for consistent application of regulations. [Ref. 10]

19. Page 1, Mats Sjöberg/ Ferenc Müller on report: Licensing limits of Zr-fire. It is very conservative to use 570 degrees C as a licensing limit (gap-release temperature). [Ref. 9]

20. Page 1, Mats Sjöberg/ Ferenc Müller on report: Fire propagation/radioactivity releases. We think it is probable that the Zr-fire, which starts in a fuel element with the highest burnup rate stays within that fuel element. It is very hard to conceive that this fire can propagate to the whole SFP, which also includes fuel from several years old fuel cycles. Limits on fire propagation will directly limit the possible radioactivity releases. [Ref. 9]