Larkin

JNS-99-23

MEMORANDUM

TO: A. W. Cronenberg
FROM: J. N. Sorensen
DATE: August 30, 1999
SUBJECT: Comments on Draft AWC-101.99

Following are my comments on the subject draft. They range from the possibly significant to the trivial. I sometimes have difficulty telling which is which.

(1) Overall, the paper is well done and thorough, and treats a subject that deserves attention

(2) I suggest adding a column to Table 1-1 which gives the uprated power as a percent increase over the original thermal power. This will give the reader of sense of what kind of changes are being discussed.

(3) As an ex-designer, I note that a design that is reasonably well optimized should not contain any precipices. Small changes in parameters (power, flow, temperature) should result in small changes in performance or safety margins. There should be no remarkable changes in degradation rates or transient response. This should probably noted early in the report, and then exceptions identified by this work can be noted where they occur. I believe there should be a distinction drawn between (a) small changes in parameters that result in large changes in performance or margin (the synergism that the report is exploring), and (b) small changes in parameters that result in the disappearance of deterministic regulatory margins that were already small or non-existent.

(4) The discussion of the Surry-2 main feedwater pipe rupture implies a dependence on feedwater flow rates that is not supported in the paper. The major change was a change in secondary water chemistry which was independent of power level. If the reports you reference implicate the higher feedwater flow, some of that evidence should be presented. I also confess to not understanding why low oxygen is bad.

(5) In your discussion of Zircaloy cladding corrosion, you mention that Zircaloy oxidizes quickly at reactor operating temperature to form a thin adherent film. The discussion

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seems to imply that this occurs during early operation of the fuel. Actually (at least it used to be so), the initial film is established in an autoclave during fuel fabrication.

(6) I think you have made a strong case that high burnups are a source of concern. Mechanical design of the fuel, including adequate allowances for growth and increased residence time. I think the link (synergism) between high burnup and power uprates is not so clear. Hydraulic conditions in the core of a PWR typically don't change very much at higher power. Few, if any, PWRs emmploy variable speed pumps. Thermal conditions in the fuel assembly during normal operation also do not change very much (both BWRs and PWRs). Peak clad surface temperatures will be within a few degrees of saturation, and are almost independent of heat flux. Fuel centerline temperatures will be higher (proportional to heat flux), but that again is a mechanical design problem. Clad surface temperatures will be higher if there is significant crud deposition, but that appears to be more dependent on residence time and reactor coolant water chemistry than on power level.

cc: J. T. Larkins
R. P. Savio