3-4

* Incomplete Note (Never used, never developed further) 10/20/00

The licensee's risk assessment consists of two components. The first component assesses the probability of spontaneous rupture and the conditional probability of induced rupture during a postulated MSLB. The licensee terms this component the "Monte Carlo analysis." The second component consists of a risk assessment using the probability of rupture results from the Monte Carlo analysis as input.

My review focused on the licensee's Monte Carlo analysis. I have the following observations:

- The Monte Carlo analysis is highly contrived, being based on assumed flaw size distributions which are only loosely benchmarked against physical observations. These contrived distributions result in an unrealistic prediction that there was a 90% chance that leakage at IP-2 was to be expected to occur during the first 3 months of cycle 14. The licensee concedes this is unrealistic, but maintains that this is conservative. I note that this approach is only conservative to the extent the frequency of "failure" (leak rates between roughly 75 gpm and 225 gpm), the frequency of "rupture" (leak rates exceeding 225 gpm), and the conditional probability of failure and rupture under MSLB conditions is being conservatively evaluated.

- The Monte Carlo analysis assumes that the potential leak rate associated with any through wall penetration of the tube wall to be bounded by curve which is a function of crack length and which is benched marked to the leak rates experienced at IP-2 and Surry 2 for crack lengths of 2.4 inches and 4.5 inches. The crack opening displacement for each of the events were relative limited such that the leak rates were less than what is assumed for a design basis SGTR. However, the licensee has provided an inadequate basis to assume that this is a bounding curve. In the case of the IP-2 crack, the expected burst pressure for a 2.4 inch long crack is 1480 psi for a tube with mean value material properties adjusted for strain hardening associated with the bending process. Thus, a tube with mean material properties and containing the R2C5 crack would be expected to burst at the normal operating pressure of 1530 psi. However, for material properties at the + 1 sigma values, the expected burst strength is XXXX psi, exceeding the normal operating pressure of 1530 psi. Based on the variability of material properties at IP-2, I estimate the probability of burst associated with the R2C5 crack geometry to be 0.7. The probability of gross ligament tearing, which is what actually occurred, is 0.3. These numbers assume that ligament tearing and crack opening displacement prior to burst is not cut short as a resultFor the Surry case which involved a 4.5 inch long crack, complete burst was not a possibility since ligament tearing led to a leak rate (330 gpm) high enough to cause immediate depressurization before a bust configuration could be obtained.

JTB