

22.39 Homework Problems (PRA)

- 1) The rate of loss-of-coolant accidents at a particular facility is 0.01 per year. Emergency coolant can be provided by a safety system whose unavailability is 0.05 (given that a loss-of-coolant accident has occurred). The losses depend on whether emergency coolant is available as follows: If emergency coolant is available, the losses are lognormally distributed with median equal to \$500,000 and error factor equal to 3. If emergency coolant is unavailable, the losses are also lognormally distributed with 5th and 95th percentiles equal to \$1,000,000 and \$10,000,000, respectively.
 - a. What is the expected loss per year?
 - b. If the lifetime of the facility is 40 years, what is the probability that there will be no accidents with losses greater than \$1,000,000 (each)?

- 2) A fire alarm signal is produced if any two or more out of four nominally identical but independent detectors sense a certain rise in temperature. The failure times of each detector are exponentially distributed with a mean value of 1,500 h.
 - i. What is the reliability of the alarm system as a function of time?
 - ii. What is the mean time to failure of the alarm system?
 - iii. We now realize that there is epistemic uncertainty regarding the MTTF of each detector. This uncertainty is expressed in terms of a lognormal distribution with median equal to 1,500 h and error factor equal to 3. Find the 5th, 50th, and 95th percentiles of the quantities in i and ii above.

- 3) The attached document is a summary of a small LOCA event tree. Select a sequence leading to “stable” and another one leading to “melt” and explain them as best you can given the information given to you.

Several pages removed for copyright reasons.

Section 2.5, "Small LOCA Tree." In *Seabrook Station Probabilistic Safety Study* (SSPSS-1999), June 26, 2000.