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Date: Wed, Nov 23, 2005 2:27 PM
Subject: Response from "Comment on NRC Documents"

Below is the result of your feedback form. It was submitted by

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Document_Title: Estimating LOCA Frequencies

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Comments: Comments on Draft NUREG 1829, Estimates of LOCA Frequencies
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The following comments are related to the PWR data in draft NUREG 1829

1. Draft NUREG 1829 used plant experiences to estimate the steam generator tube rupture (SGTR) frequency which amounts to greater-than 50% of the total small LOCA frequency. Estimate of the remaining 50% of category 1 LOCA was entirely based on expert elicitation. The resulting category 1 frequency estimates from the panel showed a significant divergence of opinions. I strongly recommend that category 1 LOCA frequency estimate should continue to be related to the large number of years of plant experiences similar to the method used in NUREG 5750. The current lengths of those experiences amount to thousands of reactor-years. They are statistically significant to be used to estimate the annual frequency of events at the 1E-2, 1E-3, and 1E-4 levels. Similar estimates are used in PRA models for numerous other important PRA parameters (such as SGTR).
2. The draft NUREG combined a variety of LOCA sources into each LOCA category. Piping LOCAs and several non-piping LOCAs were pooled together to form each of the LOCA categories. It would be useful for each of the 6 LOCA categories to add a table of LOCA sources and frequency contributions. This breakdown is particularly important for the small and medium LOCA categories. Some contributors to the small and medium LOCAs are modeled separately in most PRA models (SGTR, RCP seals, inter-system LOCAs and others). If the end user does not subtract the separately-modeled LOCA contributors, then the contribution to CDF from those contributors would be conservatively and redundantly modeled.
3. The steam generator tube rupture frequency (merged with LOCA category 1) was reported as mean value = 3.5E-03 based on number of industry events averaged over years of reactor operations. This mean value frequency should be separated from the main small LOCA category and estimated as a " range" consisting of upper and lower bounds. Plants with aging steam generators are encouraged to use the upper bound of the range. And, plants with new steam generators may use the lower bound of the range. Of course, numerous plants would use the overall mean value of 3.5E-03.
4. The various LOCA frequencies are reported in the several tables as cumulative values. In order to isolate the frequency of each LOCA category, one has to subtract the frequency of the next higher ranking category. This reporting format may lead to human errors. Some users may not become aware of the cumulative table format since that description is briefly stated at the later sections of a very large report. Please add a footnote under each LOCA frequency table explain how to obtain the frequency of each LOCA category.
5. The equivalent break diameters used in various PRA models that from boundaries between various LOCA categories are not necessarily matching those used in the draft NUREG. For example, a small LOCA range may extend up to 0.03 square feet equivalent break area (derived through existing capability of high pressure safety injection). The draft NUREG should give a clear guideline on interpolations between the various LOCA frequency values, including advice on arithmetic or geometric preference for interpolation.

SISP Review Complete
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E-RIDS = ADM-03
Add = C. Greene (CAG2)

6. The various LOCA frequency tables provided results for the past 25-year operating time period and for the 40-year average plant life. The more suitable value to select for use in PRA models may well be the expected LOCA frequencies applicable to the next 15 years. That particular selection allows for frequency penalties at aging plants as well as credits at plants with new steam generators and/or improved methods of inspections & leak detections. In order to extract the next 15-year LOCA frequencies from the existing tables, the user has to perform simple arithmetic calculations which may lead to human errors and inconsistent applications across the industry. Please provide frequency estimates for the next 15-year time period.
7. There is insufficient description of small LOCA frequency' "comparison results" relating to those in NUREG 5750 (which is most typically used in current PRA models). If one excludes the contribution of steam generator tube rupture frequency, the draft NUREG 1829 small LOCA value is ONE order of magnitude higher. Please add justifications for that large difference.
8. Provide a section on statistical validation of small LOCA frequency. By using the method of Jeffrey's non-informative prior (over the past 1500 reactor years with ZERO events excluding steam generator tube ruptures), the expected small LOCA frequency is at the 1E-04 level. This frequency is one order of magnitude lower than the frequency reported in the draft NUREG. Plant experiences of >1500 reactor-years of operating history should be considered as valid predictor of small LOCAs. That consideration is further strengthened by improved methods and increased requirements for in-service-inspections & leak detections.
9. Provide a section on probabilistic validation of the small LOCA frequency. Using a Poisson distribution with failure rate of 2.9E-03 (NUREG 1829 category 1 LOCA frequency excluding steam generator tube rupture events). And, approximately 1500 reactor-years, the probability of ZERO small LOCA events (actual industry performance) is ONLY 0.013 (i.e.1.3% chance). This result shows an excessive conservatism in the category 1 LOCA frequency.
Are we to expect an average of ONE small LOCA event (with 74% chance) per 345 reactor-years (equivalent to ~4 calendar years)? I think not.

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