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Chief, Rules Review and Directives Branch
U.S. Nuclear Regulatory Commission
Mail Stop T6-D59
Washington, DC 20555-0001

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SUBJECT: Comments on NUREG-1829, draft.

Greetings:

Aside from the fact that I was a contributing panel member in the elicitation process, I want to express my compliments on the effort made by the NRC management and staff to produce realistic and useful results. I believe with the significant research performed in recent years coupled with the accumulated operating experience, reasonable estimates of LOCA frequencies can be made. NRC has recognized these facts and acted accordingly and appropriately. That said, I also wish to express my opinion on the some of the details of the elicitations process and portions of the subsequent analyses about which I disagree, but with the acknowledgement that had they been done differently, the results would not change significantly (i.e., the reported results would probably be reduced by less than an order of magnitude).

The first issue relates to the interpretation of the LOCA frequencies and associated uncertainties. The instructions given to the panel members stated that we were to make a best-estimate of the "single 'true' value" for the industry-wide (or more accurately BWR-wide and PWR-wide) LOCA frequency. This is an issue because I do not believe a "single true value" exists for the LOCA frequency. Specifically, I believe each plant has differences in design, construction, operations, age, and maintenance such that in reality the plant-to-plant variation in LOCA frequencies will be quite large. These two interpretations can be made consistent however, if the "single true value" is viewed as an average or mean value of the population of frequencies. While on the surface this might seem to be a question of semantics and appears to have little significance, the implication of the interpretation on the uncertainty characterization is significant.

If the "single true value" interpretation is employed, the question becomes, what does the uncertainty associated with this value represent. Since the implicit assumption is that plant-to-plant variability does not exist (otherwise how can there be a single frequency appropriate for the entire industry?), then there is no stochastic or aleatory uncertainty associated with the estimate. That is, the presence of outliers (or event plant-to-plant variability) in the population of nuclear power plants (NPP) is ignored. The uncertainty therefore represents the level of confidence of each panel member's estimate of this single true frequency. Given that the uncertainty represents an individual's confidence in their own estimate, what is the basis for automatically assuming the probability distribution associated with this confidence uncertainty is not symmetrical? Or to ask more specifically, with this interpretation of the point estimate value and associated interpretation of the uncertainty, why do the authors assume that the uncertainty surrounding each panel member's estimate should be a lognormal distribution that is weighted toward higher (conservative) values? While I agree that the uncertainty associated with LOCA frequencies should be asymmetrically weighted toward higher values; this is based on the observation that not all plants are identical, and that if a LOCA occurs at a plant, that plant will likely be shown to be a poor performer, not

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representative of the fleet as a whole. This is not the same as assuming the confidence uncertainty surrounding the estimates provided by the panel members, of a "single true value" should be represented with a lognormal (which was done in the elicitation). [Note: the use of the lognormal distribution became entrenched in PRA with its use in WASH-1400 (1975). However, the model employed then was motivated by the sparse data available from the commercial nuclear power industry at that time. Data used in that study were collected from many different industries and sources. These data were used to develop a probability distribution of the *population* of possible values, effectively capturing the *random* component of the uncertainty. Specifically, the authors of WASH-1400 did not know which value in the population of values collected, was the most appropriate value to use. Therefore the entire population of values was characterized in the probability distribution. The data were not combined, or averaged to estimate a single value, and the uncertainty modeled with the lognormal distribution was not meant to describe a statistical confidence on a single true value, but used to describe the variability in possible values. Quoting directly from WASH-1400: *"Because of the large spread, the failure rate data were treated as random variables, incorporating both the physical variability and the uncertainty associated with the rates. Moreover, since the study's results were to apply to a population of approximately 100 nuclear plants, it was important to show the possible variability and uncertainty in this population."*]

The consequences of employing the lognormal distribution to characterize each individual panel member's uncertainty, manifests itself in how the estimates were interpreted and processed (by the authors) and in the effects of the overconfidence adjustment made to the base case results. Specifically, the best-estimates solicited by the authors of this "single true value" were interpreted as median values of the lognormal distribution, allowing for the derivation (by the authors) of a higher mean value. [Note that for any probability distribution skewed toward higher values, the lognormal being one example, the mean will always be greater than the median.] This calculated mean value was then used to represent the panel member's input to the aggregation process used for generating the LOCA frequency results. Additionally, this assumption of a lognormal for the uncertainty on each panel member's estimate, has the additional impact of calculating an even higher (compared to the non-adjusted calculated mean) mean value after the widening of the uncertainty in the overconfidence adjustment.

My concerns are twofold. First, the opinions of the panel members were solicited, *and then modified (increased) by the authors*. Irrespective of the instructions and discussions during the elicitation process, this point was viewed with dismay by more than one panel member. Second, the processes and analyses employed have introduced a conservative bias into the final base case results, with additional conservative bias inserted in the various sensitivity studies. This "creeping conservatism" is not necessarily undesirable given the significant uncertainties and the uses to which the results will be employed, however, it should be explicitly acknowledged and clearly stated rather than obscured in the details of the analyses.

Sincerely,
William J. Galyean

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