

NRR-PMDAPEm Resource

From: Lamb, Taylor
Sent: Thursday, March 03, 2016 2:50 PM
To: Lashley, Phil H. (phlashley@firstenergycorp.com)
Subject: DRAFT 3rd ROUND PRA RAIs - Beaver Valley Units 1 & 2 - NFPA-805 LAR (CAC Nos. MF3301 & MF3302)
Attachments: DRAFT - Beaver Valley 3rd Round PRA RAIs.pdf

Mr. Lashley,

Attached is a **DRAFT** RAI regarding the 12/23/2013 license amendment request that would adopt the National Fire Protection Association Standard 805, "Performance Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants." Please review to ensure that the questions are understandable, the regulatory basis is clear, there is no proprietary information contained in the **DRAFT** RAI, and to determine if the information was previously docketed.

Please let me know if you would like a conference call to discuss.

Thank you,

Taylor A Lamb

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PRA RAI 01.f.ii.01.01

The responses to RAI 01.f. and RAI 01.f.ii.01 did not provide information that the NRC staff can use to conclude that the quantitative fire risk estimates exclude the impact of unrealistically low joint human error probabilities (HEPs). Instead, the response indicates that many thousands of joint HEPs with unrealistically low probabilities are embedded within the logic sequences frequencies. These low probabilities may lead to significant underestimates of affected sequence fire risks and have an indeterminate impact on the NFPA-805 change-in-risk estimates.

The reference to “two” HEPs in RAI 01.f.ii.01 is only a reflection that a “joint” HEP must have at least two individual HEPs and assigns no significance to pairs of HEPs. Longer strings of HEPs can occur frequently and the error associated with simply multiplying individual probabilities in these longer strings can be many orders of magnitude. The responses to RAI 01 extensively discuss “pairs” of HEPs with a limited discussion about how unrealistically low values for longer strings of HEPs are avoided.

The response to RAI 01.f.ii.01 (page 3 of 31, L-15-325) states that the fault tree model supporting split fraction HH102 has four HEPs but only a single action appears in any individual cutset contributing greater than 1E-06 percent of the total split fraction - implying that joint HEPs are non-contributors. This evaluation does not necessarily support that conclusion since it may include joint HEPs that are inappropriately truncated out of the cut sets due to assumed independence. The most common techniques to support the required conclusion is to set all HEPs in the fault tree to 1.0 to see what combinations of HEPs exist within the models, and set all joint HEPs in the cut sets to 1E-05 and see if any of the joint HEPs contributing to the risk should be individually evaluated.

With regards to HH102, Beaver Valley also indicates that the joint HEP for top event HH from the fire PRA model contains four HEPs, but that all four of these HEPs are redundant. Beaver Valley concludes that the “true joint HEP” for the appropriate sequence should remove these extraneous HEPs. Also for the two examples in the RAI response which do a detailed dependency analysis, the joint HEP proposed in each case is not comparable to a minimal cutset, and contains extraneous HEPs. As a result, it seems that the joint HEPs generated to address this RAI are not true joint HEPs, and contain inappropriate HEPs.

The response (pages 2, 3, 5 and 6 of 31) describes an evaluation beginning with the collection of Human Failure Events (HFEs) “used in all possible cutsets for each fault tree, for the single sequence being evaluated” The NRC staff agrees that, “minimal cutsets would actually show far shorter joint HEPs (containing fewer individual actions).” Without identifying the sequence of human actions in the joint HEPs that are actually contributing to the sequences, an expert team evaluation cannot justify the joint HEPs values in the context of the accident sequence in which they appear.

Within every fault tree supporting every split fraction, there are most likely some single HEPs and some joint HEPs where the HEPs lead to potential underestimation of the results for the following reasons:

1. Since the joint HEPs for each split fraction discussed in the RAI response are not constructed properly (i.e. not true joint HEPs), each split fraction could be underestimated.

2. The product of split fractions will be underestimated as a result of underestimation in each split fraction
3. Also, multiplying each split fraction assumes independence between HEPs of different split fractions, where independence may not be a proper assumption for all joint HEPs. Thus, the product of split fractions may be underestimated also because the dependency between HEPs in different split fractions is not assessed.

The contribution to underestimating sequence frequency because of the assumed independence between all these HEPs is indeterminate. Assuming independence between long strings of HEPs produces unrealistic small numbers as illustrated by your joint HEP values of 1E-25 and 1E-21.

The response states, in part, that the RISKMAN structure itself precludes dependency concerns. This is possible if all operator actions are modelled as individual top events, but it does not appear that the BV PRA has this type of modelling.

The staff has accepted applications which have used the following:

1. Minimum joint HEPs of 1E-05 with each sequence, or
2. Correctly constructed, realistic joint HEPs,
 - a. Identifying the number of sequences (or the fraction of core damage frequency (CDF) and large early release frequency (LERF)) in which joint HEP values of less than 1E-05 contribute;
 - b. Describing the range of joint HEP values in sequences where the joint HEP value is less than 1E-05; and
 - c. Confirming that a justification (e.g., narrative) for each joint HEP value below 1E-05 has been documented consistent with the scenario, and that the justification was developed by reviewing each applicable sequence and the joint HEP(s) contributing to the sequence.

Alternately, Beaver Valley Power Station can use an alternative method to demonstrate that every joint HEP value less than 1E-05 is evaluated within the sequence that it is used, and confirm that an evaluation for each joint HEP is documented.

Please provide adequate justification that the quantitative fire risk estimates exclude the impact of unrealistically low joint HEPs.

PRA RAI 08.01.01

The response to PRA RAI 08.01 explains that confined areas behind substantial cable tray stacks are excluded from evaluation of transient fires in the Fire PRA. The response states:

“These spaces are not part of any normal travel path through the plant. The crowded tray spacing and configuration completely encloses the area, making it extremely difficult to enter the space. The excluded locations in this fire compartment contain no equipment, significantly minimizing or eliminating maintenance and modification activities.”

This exclusion is inconsistent with guidance in NUREG/CR-6850, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities, Final Report, (NUREG/CR-6850, EPRI 1011989)". NUREG/CR-6850 states, in Section 6.5.7.2, that areas not precluded by design or operation should be evaluated for transient fires, and although these areas are difficult to access their access is not precluded. Additionally, transient combustibles placed in these areas could go unnoticed. NRC staff notes that FAQ 12-0064, "Hot work/transient fire frequency: influence factors," provides guidance on the use of weighting factors for fire areas less likely to have transient combustibles. Include the evaluation of transient fires for these spaces in the integrated analysis in response to PRA RAI 03.

DRAFT