HLWYM NPEmails

From: Albert Wong
Sent: Thursday, August 10, 2006 1:40 PM
To: Brittain Hill; Robert Johnson (NMSS); Mahendra Shah; Christopher Ryder; Rosemary Reeves; Michael Waters
Cc: Andy Campbell; Marissa Bailey; Jon Chen
Subject: Fwd: Re: Action Requested PCSA ISG: Final Bite at the Apple: Center Response to #2, #3, # 5, and #6

Mike -
My thought on comment #10:

Q: >10. In Appendix C, there is a fault tree of the exhaust side of the HVAC system. The presents of the fault tree raises the question of why the fault tree is not solved with the software that is being used for the uncertainty. Why go though the manual calculations as illustrated in the example? (Need Adams/Wong view)

A:
Manual calculations are doable only for relatively simple systems, such as the one presented here. The mathematics quickly becomes overwhelming and cumbersome when (1) more elements are added to the system, and/or (2) system configuration changes (e.g., cross-tie two parallel trains). In most cases, computer software, such as SAPHIRE, is used to solve complex systems.

We all recognize the beauty and utility of computer software when it comes to solving fault trees and calculate uncertainties. The main take-home message in Appendix C is that there are established algorithms to estimate reliability through system modeling. As Chris said in his response, during the LA review, the staff is going to "determine the extent to which it represents the system and operations" DOE proposes, not how to build a FT to model the system. Once a system has been properly modeled, cranking out the numbers using computer codes becomes relatively straightforward.

Albert

>>> Michael Waters 08/09/2006 5:44 PM >>>
FYI

Note CNWRA's final view below. I am inclined to agree with most comments/suggestions, except the ones that require a significant revision (e.g. comment #2).

Very soon , I intend to engage Andy and Marissa to recognize and resolve final comments regarding:

(1) the non-discussion of Event Categorization in Appendix A
(2) the 90th percentile interval position (or non-position) in Appendix A
(3) the "conservative" use of 168-hr mission time in Appendix C
(4) the mean reliability estimate and/or mean release frequency is acceptable for event categorization [Board comment].

I would appreciate your feedback on the other 11 questions with your name next to it, as applicable.

Thanks,

Mike

P.S. I have incorporated the HLWRB comments.

>>> Amitava Ghosh < aghosh@cnwra.swri.edu > 08/07/2006 6:40 PM >>>
Mike:

Here is our combined response to item #2, #3, #5, and #6. We are working on other items. If we have any substantial response, I will get back to you.

#2: Add text on line #9 page A-4:

"It should be noted that the crane systems to be employed in the GROA may have characteristics quite different from the cranes considered in the database NUREG-1774 [2]. Additionally, as discussed before, operator training, maintenance, operational environment, and quality assurance may affect assumptions of equivalence between these cranes to those in NUREG-1774 [2]. As suggested in this Appendix, the reviewer should establish whether the performance information available in NUREG-1774[2] would be applicable for the crane systems proposed to be used in the GROA. In such cases, the estimated reliability presented here using the information from NUREG-1774 [2] would not be applicable for the cranes employed in the GROA."

#3: Add text on line 29 page A-4 after lambda_0.95)

"with 2/x/ and 2(/x/ + 1) degrees of freedom, where/ x/ is the number of drops,"

#5 It is not ok to drop the relation between the results of the example to event categorization. Categorization of the event sequences is the basic requirement to do the reliability estimate. We clearly told that to DOE in the TE. We also emphasized that it will involve more scrutiny when the event frequency falls close to one of the regulatory limits; hence, the need to assess the uncertainty and sensitivity of parameters in those cases.

#6 Appendix A gives sensitivity analysis as it uses an existing database of performance information cranes working at similar facilities, not in the proposed facilities. Although they may be built using the same ASME NOG-1 standard, operator training, maintenance, environment, etc. may make each crane system somewhat unique. In addition, the failure (in this case, the drop) of the crane is assesses based on descriptive information available for the event. Assessing whether the event should be counted as a failure of not requires analyst's judgment. Hence, there is a need to assess the sensitivity of the input parameter (here number of drop events) on the estimated reliability. One of the issue (and key message to DOE) is to assess the database and determine its applicability for the specific task to estimate reliability of a given SSC.
Additionally, different appendices are aimed at highlighting different issues in reliability estimation. There is no implication that sensitivity analysis is not an issue in the other

appendices. In fact, the HVAC (industrial data used to estimate failure rates), Canister (empirical data used to estimate ultimate strength) and Concrete (empirical data used to estimate properties of concrete and rebar) are all connected to this issued. In order to avoid repetitious calculations and conclusions, Appendix A was chosen to be the main case

where sensitivity is explicitly addressed. Where it is in fact highly justified since the reliability is being based on a single number obtained from data that may or may not reflect the cranes at the GROA.

+++++++Appendix A++++++++++

Lines 6 and 7 page A-3:

Recommend removing this sentence: "In practice, this means that the event probability is adequately represented by the frequency (i.e., recurrence rate) of the event."

Line 6 on page A-4:

(i.e., probability < 1) should say (i.e., less than 1 drop).

We actually calculated an expected number of events and got a value of 0.84. The expected number of events during the time period is less than 1. This is not the same as a probability value. Equations for probability values have been removed.

Line 33 on page A-4:

Should be 2.1 drops (Note: 1.4E-4 * 15000 = 2.1)

Lines 23 and 24 on page A-4:

The statement concerns me a bit. This statement came from Brit's version, but the only reason I used the 90th percentile confidence interval was because a similar example calculation is provided on page 6-6 of NUREG 6823.: "...a 90th percentile confidence interval represents a generally accepted engineering practice for a reasonably characterized operation such as a crane lift."

Mike's version of this text used section B.4.2 of NUREG6823 to develop a statement indicating that .99, .95 and .90 were considered typical. I think the statement the way Mike worded it originally would be better than the sentence above.

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++++++++Appendix C++++++++++++

#9: Mission time is very important to the calculation of reliability.
It is not possible to understand a reliability value without also
understanding the mission time. The appendix shows that mission time is
a key piece of information for the reliability calculation.

#10: The manual calculations illustrate to someone looking at this
system that one train is in normal operation and a standby train is
being relied upon should the normal train fail. When considering the
standby train, both the probability that a component fails to start and
a probability that it fails to continue running need to be considered.
For the normal train, the probability that a component fails to run is
being considered. If just a fault tree and a solution from SAPHIRE were
developed instead, then it may not be clear how the reliability for such
a normal and standby train was developed.

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Thanks.

Amit

Michael Waters wrote:

>Thanks to everyone who contributed to the successful development & presentation of the draft ISG to the HLWRB. The preclosure PM (Rob) and ISG PM (Jon Chen) have some high-level administrative issues to address before issuing the ISG.
>
>More importantly, attached is the current working draft based on selected Board comments that I have incorporated in main body and Appendix A (It has not changed significantly since last version).
>
>We need to work next week to resolve outstanding technical/editorial comments (big & small). Below is a laundry list based on Board comments and other issues that could not be addressed until now. This is your final bite, please let me know what else needs to be tuned up.
>
>At this time, I do not prefer to have revised suggestions via the author/reviewer feature of Wordperfect. (This is difficult when I receive multiple copies) Instead, I would instead prefer redline/strikeout, handwritten markups, or suggestions referenced by specific page and line number.
>
>I would prefer to work with the individuals/team first and then SIR team members to resolve any issues beyond editorial. There is a high-threshold for significant rewrites at this point.

>
>I will touchbase with you all soon.
>
>Thanks,
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>Mike
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>
>Remaining Issues (Big & Small)
>
>ISG Body
>
>1. Mean: Need to clarify statement regarding mean reliability estimates under treatment of uncertainty. Need to check what Statements of Consideration has said regarding use of mean. Are we talking about mean reliability estimate for each SSC, or really the mean estimate of the overall release frequency (e.g. for Event Categorization)? Are we on the same page regarding what "mean" means, and differences between "mean", "averages" and "point estimates"? Can we multiply the mean/average point estimates of the crane, canister, and HVAC failure probabilities to simply get the mean release frequency and categorize the event sequence? What if a large interval of the frequency distribution goes across a Category limit? (too bad?)
>
>How should the ISG be revised (simplistically) to resolve this confusion. (Need Team view)
>
>Appendix A
>
>2. Need to clarify that the empirical analyses is of the crane data, not the probability of the actual crane at the GROA. Can we state upfront that we are using the empirical estimate as a reasonable surrogate value for the crane in the PCSA? (Need Adams/Ryder view)
>
>3. The confidence interval example gives the impression that the chi-square tables in Reference 4 should be used for 3 drops. But the chi-square table is in terms of degrees of freedom. To use this table, the degrees of freedom would have to be calculated using the following equations. For the upper bound, DF(upper) = 2(x+1) and DF(lower) = 2x, where x is the number of events. Does it make more sense to refer directly to Table 10 in the Applying Statistics Book? (Need Adams view)
>
>4. Do we need to clarify that the confidence interval only characterizes one type of uncertainty, but there are others that would need to be considered in a real calculation that leads to event categorization? What are they? Is this true for other Appendices (Need Team View)
>
>5. Is it okay not to relate the results of the example to event categorization, in terms of what the confidence interval shows us? Does the last-minute footnote 2 cover it, or should this be dropped?? (Need Adams view)
>
>6. Why does Appendix A address sensitivity analyses but the other ones do not? Doesn't sensitivity apply to the other Appendices? Does this need to be clarified? (Need Teams view)
>
>7. Appendix A and others could be soften with using "could" instead of "may"
>
>Appendix B
>
>8. Should it be stated up front that uncertainty is not considered in this example? (Need Bis/Mahendra view)
>
>Appendix C
>
>9. Is there a vulnerability using the 168-hr normal mission time in the HVAC example? Is it too conservative as an illustration? Does it need to be explained better? Changes in mission time could affect failure probability by several orders of magnitude (Need SIR team view)
>

>10. In Appendix C, there is a fault tree of the exhaust side of the HVAC system. The presents of the fault tree raises the question of why the fault tree is not solved with the software that is being used for the uncertainty. Why go though the manual calculations as illustrated in the example? (Need Adams/Wong view)
>
>Appendix D
>
>11. The term 'statistical variation' could be clarified in terms of uncertainty and variability. (Need Fernando/Mahendra's view)
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