

LSNReviews

From: Oleg Povetko
Sent: Thursday, October 30, 2008 4:03 PM
To: 'Susan E. Cooper'; Chang, James
Cc: Ann Ramey-Smith; Peters, Sean; Cooper, Susan; 'Razvan Nes'; Sippel, Timothy; Whaley, Sheena
Subject: RE: HRA needs

Susan,

We review this portion to determine compliance with 10 CFR Part 63.114(b),(d) and (f) requirements:

"63.114. Requirements for performance assessment. Any performance assessment used to demonstrate compliance with § 63.113 must:...(b) Account for uncertainties and variabilities in parameter values and provide for the technical basis for parameter ranges, probability distributions, or bounding values used in the performance assessment.

...

(d) Consider only events that have at least one chance in 10,000 of occurring over 10,000 years.

...

(f) Provide the technical basis for either inclusion or exclusion of degradation, deterioration, or alteration processes of engineered barriers in the performance assessment, including those processes that would adversely affect the performance of natural barriers."

The applicant excludes potential criticality event from consideration arguing that it would have less than one chance in 10,000 of occurring over 10,000 years.

In the criticality screening argument DOE estimated a bound on the probability of criticality using simple calculations for two selected initiating events (as opposed to using the event tree/fault methodology from configuration generator model). DOE did not demonstrate that these simple calculations would bound fault tree/event tree analysis. The low values of probabilities of criticality for different scenarios are based on low probabilities of (1) canister manufacturing and (2) assembly misloading errors.

If you have access to the X: (shared) drive, then you can find some more detailed explanation and also links to the documents in "October 7, 2008" entry in the file X:\Oleg Povetko\Familiarization Review\Familiarization Review Progress Reports Povetko.doc Most of the documents are in X:\Oleg Povetko\Criticality\Misloads folder.

You might also look at the only draft RAI that we started crafting on HRA in "October 20, 2008" entry called "

Draft RAI on assembly misload."

Regarding manufacturing error, the applicant used B&W data ((NRC Bulletins No. 78 – 12, 78 – 12A available on <http://www.nrc.gov/reading-rm/doc-collections/gen-comm/bulletins/1978/bl78012.html> and <http://www.nrc.gov/reading-rm/doc-collections/gen-comm/bulletins/1978/bl78012a.html>) and assumed that this improper material selection can be represented by HEP (page 6-37 of X:\Oleg Povetko\Criticality\Misloads\Analysis of

Mechanisms for Early Waste Package Drip Shield Failure ANL-EBS-MD-000076 REV 00.pdf report). That's why we review it solely as a human error.

Please let me know if you don't have access to the X: drive or if you need specific page numbers in these documents. The volume of information is not large but it's spread around these reports.

Oleg.

From: Susan E. Cooper [REDACTED]
Sent: Thursday, October 30, 2008 1:31 PM
To: 'Oleg Povetko'; 'James Chang'
Cc: 'Ann Ramey-Smith'; 'Sean Peters'; 'Susan Cooper'; 'Razvan Nes'; 'Timothy Sippel'; 'Sheena Whaley'
Subject: RE: HRA needs

Oleg – NMSS staff have brought some of the issues below to my attention in the past. Although the specifics of the submittal couldn't be known, I've anticipated that review of the post-closure area would be challenging.

There are no immediate answers to your questions; this is the heart of what I'd expect the HRA review to address.

Regarding the misloading failures, the SNL work is still extremely useful in that we have a body of knowledge that we can draw on for our HRA review – both preclosure and postclosure. If an HRA process and quantification method are used, we will expect that DOE to have addressed these issues in such analyses.

The manufacturing errors is a more difficult issue to address from the HRA standpoint. I'm not certain I followed all of your discussion. However, the approach to some of these sorts of issues may not be solely an HRA problem. For example, precedents in other parts of the NRC so far as accepting credit for some of the things you mentioned below. Any further comments on this area I think are premature.

I think that the bottom line would be to let RES HRA review team look at the specific areas in the submittal that are relevant. Because I anticipate HRA issues to crop up in places we might not expect, it's important for everyone on the review team to "keep their eyes open" for areas that we should review.

Regarding the issues you raise below, I'd appreciate if you (or someone) could direct me to the specific documents and section(s) in the submittal that are relevant. I think it's important for the HRA review to be based on the submittal, with relevant sections in context as opposed to extracted excerpts (as specific references or hints may be included to help us hunt down the information we need to see).

Also, can I assume that these issues are part of the post-closure "vertical slice"? On the preclosure side, review staff agreed yesterday to even more narrowly focus our initial reviews (e.g., one sequence containing 2 HFEs, out of the 12 sequences in the vertical slice). Maybe a similar approach on the post-closure side would be useful, too.

Thank you,
Susan

-----Original Message-----

From: Oleg Povetko [mailto:opovetko@cnwra.swri.edu]
Sent: Thursday, October 30, 2008 12:21 PM
To: 'Susan E. Cooper'; 'James Chang'
Cc: 'Ann Ramey-Smith'; 'Sean Peters'; 'Susan Cooper'; 'Razvan Nes'; 'Timothy Sippel'; 'Sheena Whaley'
Subject: RE: HRA needs

Susan,

Thank you for this detailed clarification. If I am not mistaken, the SNL's subcontractor for repository project was presenting at one of the technical exchanges in Las Vegas that you,

Tina, and I attended. I asked the presenter a question whether they will include assembly loading in the preclosure safety assessment. The 90% of the loading will take place at the NPP sites, not at the repository facility. He said "yes", but the actual LA does not consider loading sites in its preclosure portion. Preclosure safety assessment relies on the loading operator QA programs and considers only those operations at the repository facilities. I believe that ATHEANA is used for preclosure period. My HRA questions are very specific, they originate from the different part of LA, from its postclosure part, where the applicant calculates probabilities of the misloading of assembly into a canister (i.e., loading a wrong assembly) and manufacturing error in neutron absorber plate manufacturing.

The misloading and manufacturing error occur at the NPP sites and manufacturing facilities outside repository but the misloading analysis is done for a single repository hypothetical facility. Their PRA specialist was not involved in these analyses. In case of misloading, the event trees are constructed, and certain top events, such as assembly selection and assembly verification, are assigned probabilities of 0.00125 and 0.0161, respectively, (i.e., nominal general error of commission extracted from page G-1 of NUREG-1278 (0.001) and from item 4 of Table 20-22 of NUREG-1278 (0.01), which is "checking that involves active participation, such as special measurement"). In actuality, there is no any "special measurement" will be made, just "checking ...tags", that has 0.1 HEP assigned by the same table. Note that the median values in NUREG-1278 were converted to mean values for use in SAPHIRE. No mentioning of THERP or any other method are made there and no any additional site-specific analysis is made, either. These two operator initiating two top events will not exist in the current design. This analysis is done for the hypothetical facility where all the loading was supposed to take place at the repository. The design is different now. According to the current LA design and processes, the loading will take place at the NPP sites, not at the single repository facility. The industry data on frequency of misloading at the NPP sites is available but is not used by the applicant.

For manufacturing error, the surrogate probability value based on the industry data (reactor vessel manufacturing) is used (this is surrogate value because the manufacturing processes are very different, i.e., reactor vessel vs fuel canister manufacturing). There was a range of values (i.e., two values) reported by the reactor vessel vendor on using an improper material in reactor vessel manufacturing. The 46 potentially affected reactors were operating at the time when the estimate was made. The applicant assumes that this error is solely caused by a human error and assigns a log-normal distribution to this data (i.e., two values in the range). Then, these two values are assumed to represent 5%-95% range and the mean value of 1.01×10^{-4} HEP is calculated. Then the applicant states that the new instrumentation exist for quick field measurements of material compositions. Here no claims are made on the potential process improvements, but one might assume that these field measurements will significantly improve the industry performance (i.e. by three orders of magnitude). Then, the applicant states that the technician can still make an error in reading digital display and assign this error a value extracted from NUREG-1278 (median value 0.001 from Table 20-10) and converted to the mean value of 0.00125. There is no mentioning of THERP or any other method made here, either. The result is about 10^{-7} value assigned to the canister manufacturing error.

In both cases the values were extracted from NUREG-1278 tables with no site-specific considerations. We have to review what is presented by the applicant, so we don't select the best method. These three selected HEP values directly impact compliance in the postclosure portion of LA.

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From: Susan E. Cooper [REDACTED]
Sent: Thursday, October 30, 2008 9:01 AM
To: 'James Chang'; 'Oleg Povetko'
Cc: Ann Ramey-Smith; Sean Peters; Susan Cooper
Subject: RE: HRA needs

Oleg – Since 2005, Sandia National Laboratory (SNL) has been working on a project for me related to spent fuel handling, including consideration of misloads and cask drops. A SNL letter report documenting a final, scoping HRA analysis of misloads and cask drop was delivered in July 2006. However, the focus of this report was on qualitative, not quantitative analysis (as the HRA quantification approach we intend to use relies on expert opinion, and our scope and NMSS interest didn't support that effort). Also, SNL is currently working another report to develop HRA-informed insights on cask drops for an expanded scope of cask designs. We've been working with NMSS/SFTS on this project, but only slowly recently as other NRC and SNL projects have had higher priority. When Tina Ghosh was with NMSS, she monitored this project and attended most of the RES/NMSS meetings that we had. Dennis Damon also has attended some meetings and should be generally aware of this effort.

DOE hired SNL's subcontractor away from this project in order to work on the PRA for the Yucca Mountain license application. Consequently, I would expect there to be considerable influence from the SNL work on DOE's license application.

I am aware of THERP being used for a variety of non-nuclear power plant (NPP) applications. I personally made use of this method for applications involving the space shuttle, Minuteman III missile maintenance, and chemical weapons destruction (Chem Demil) facilities. (Others, too, but my memory needs more coffee or something this morning.) Also, I think (if my memory serves me) that EPRI used THERP-like human error probabilities in their bolted cask PRA. (The NRC dry cask PRA used statistical data, which HRA staff in RES have commented extensively on. Albert Wong was my POC in NMSS when I did some of this review work.)

Because HRA methods have historically been developed for nuclear power plants only (and, for at-power operations only), the HRA analyst really doesn't have a choice except to use one of these methods. I haven't yet found an application where context-relevant statistical data was adequate to directly develop human error probabilities.

The one exception to the limitation in HRA methods is the ATHEANA HRA method developed by the NRC. (Some other second generation methods, such as CREAM, could be argued to be free of this limitation, too.) The ATHEANA HRA method allows the flexibility of addressing any operating environment, as long as the analyst understands this environment and the associated important influences on human reliability. (I used this

basic approach in my Chem Demil work, but used THERP-like numbers to quantify because the ATHEANA quantification approach hadn't been completed at that time.) The HRA process used by DOE for the pieces of the application I've seen so far is almost identical to ATHEANA's process. (No accident here.) However, DOE claims that it's too difficult to find experts for the expert elicitation quantification process, so they've mostly used different HRA methods to develop human failure probabilities. (I think I saw a claim that DOE might have used ATHEANA once or twice in the submittal, but I haven't yet had the time to track down that analysis.)

The difficulty is in justifying the use of an HRA method (developed for at-power NPP operations) for a non-NPP application. Because THERP provides tabulated human error probabilities, it is easy to apply (and misapply) this method. (RES' NUREG-1842 that evaluated HRA methods against HRA good practices (NUREG-1792) discusses the problem of HRA method as intended versus how it's been implemented and applied.) On the other hand, since THERP has been in use for over 30 years (since WASH-1400), it's assumed to be largely acceptable. THERP human error probabilities also are used as the basis for some more recently developed HRA methods, including EPRI's Cause-Based Decision Tree (CBDT).

The HRA ISG developed for preclosure was intended to address some of the problems of appropriately matching an HRA method to Yucca Mountain human actions, operating environments, etc. Also, I expect that a good part of the HRA review will involve consideration of the appropriateness and adequacy of the HRA process and quantification methods that DOE used, as applied to Yucca Mountain, as well as how they implemented them.

'Hope this helps,
Susan

P.S. I'm including my branch chief and another colleague on cc: as we are working toward getting a more coordinated HRA team effort to address NMSS' needs for the DOE license application review.

-----Original Message-----

From: James Chang [mailto:James.Chang@nrc.gov]
Sent: Thursday, October 30, 2008 7:03 AM
To: Oleg Povetko
Cc: Susan E. Cooper
Subject: RE: HRA needs

Oleg,

I am not aware of what HRA methods have been applied to HLW applications. Susan (cc'ed) may be a better person to answer your questions.

James

From: Oleg Povetko [mailto:opovetko@cnwra.swri.edu]
Sent: Wednesday, October 29, 2008 5:18 PM
To: James Chang
Subject: RE: HRA needs

James,

Are you aware of any applications of HRA methods for HLW management, fuel reloading or some other operations involving movement of fuel assemblies? Do you know cases when THERP method was applied for other than reactor operations and processes?

Oleg.