DT5

From: Gareth Parry NRR
To: Diane Jackson, George Hubbard, Glenn Kelly, Mic... NRR
Date: Fri, May 12, 2000 9:16 AM
Subject: Input to Green Ticket

Diane and George:

Attached is a file that contains input to the green ticket on the ACRS response. It addresses why we think the results we got were OK, both for the seismic and human reliability analysis, and how we have appropriately addressed uncertainties, or at least we will when we make decisions. I have had comments from Mike and incorporated them in this version. It's maybe a little long winded but I believe the ACRS and Dr. Powers in particular need to be reminded that waht we are doing is an analysis that is to be used in decision making,

Gareth

CC: Mark Rubin

Q1184

May 12, 2000

To: Diane Jackson
George Hubbard

From: Gareth Parry

cc: Mike Cheok

Subject: Input to Green Ticket on ACRS letter

This addresses the ACRS recommendation number 3, namely, "uncertainties in the risk assessment need to be quantified and made part of the decisionmaking process". The approach to the use of risk assessment in decisionmaking that is anticipated to be used is modeled on that used in Regulatory Guide RG 1.174. In this approach, when acceptance (in this case performance) guideline(s) are established, it is understood that the appropriate measure with which to make the comparison is the mean value of a distribution characterizing the quantified uncertainty. Uncertainties that cannot be incorporated into this quantification, and that are usually associated with modeling issues or the adoption of specific assumptions, are to be addressed in the decisionmaking process by demonstrating that the adoption of alternate, plausible modeling assumptions would not lead to a change in the assessment that the guidelines have (or have not) been met. This input is then considered as one element in a decisionmaking process as discussed in Section 2.1 of the draft Final Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants.

The ACRS points out two specific areas where the uncertainties are large, namely the seismic analysis, and the assessment of the human performance in response to losses of heat removal and fuel pool inventory. With respect to the accident sequences developed, using a detailed logic model, for losses of heat removal and pool inventory, the frequencies generated for those sequences are point estimates, based on the use of point estimates for the input parameters. The input parameter values were taken from a variety of sources, and in many cases were presented as point estimates with no characterization of uncertainty. In some cases, such as the initiating event frequencies derived from NUREG/CR 5496, and the HEPs derived from THERP, an uncertainty characterization was given, and the point estimates chosen corresponded to the mean values of the distributions characterizing uncertainty. For all other parameters, it was assumed that the values would be the mean values of distributions characterizing the uncertainty on the parameter value. In the case of the SPAR HEPs the authors of the SPAR HRA approach consider their estimates as mean values based on the fact that the numbers were established on the basis of considering several different sources, most of which specified mean values. Consequently, the results of this analysis are interpreted as being mean values. A propagation of parameter uncertainty through the model was not performed, nor was it considered necessary. With the exception of the spent fuel pool cooling system itself, the systems relied on are single train systems. The dominant failure contributions for the spent fuel pool cooling system are assumed to be common cause failures. Thus there are no dominant cutsets in the solutions that involve multiple repetitions of the same parameter, and under these conditions, use of mean

values as input parameters produces a very close approximation to mean values of sequence frequencies. Since typical uncertainty characterization for the input parameters is a lognormal distribution with error factors of 3 or 10, the 95th percentile of the output distribution will be no more than a factor of three higher than the mean value. This is not significant enough to change the conclusion of the analysis.

The numerical results are a function of the assumptions made and in particular, the models used to evaluate the human error probabilities. The staff believes the models used are appropriate for the purpose of this analysis, and in particular are capable of incorporating the relevant performance shaping factors to demonstrate that low levels of risk that are achievable, given an appropriate level of attention to managing the facility with a view to ensuring the health and safety of the public. Alternate HRA models could result in frequencies that are different. However, given the time scales involved, and the simplicity of the systems, we believe that the conclusions of this study, namely that the risks are low, and that the NEI commitments play an important role in determining that low level, are robust.

Certain assumptions may be identified as having the potential for significantly influencing the results. For example, the calculated time windows associated with the loss of inventory event tree are sensitive to the assumptions about the leak rate. The SPAR HRA method is, however, not highly sensitive to the time windows within the ranges determined to be plausible for the scenarios modeled. Consequently, the assumption of the large leak rate as 60 gpm to represent those leaks that require isolation is not critical. For the loss of inventory event tree, the assumption that the leak is self-limiting after a drop in level of 15 feet, may be a more significant assumption that, on a site specific basis may be non-conservative, and requires validation. The assumption that the preparation time of several days is adequate to bring off-site sources to bear may be questioned in the case of extreme conditions. However, the very conservative assumption that offsite recovery is guaranteed to fail would increase the corresponding event sequences by about an order of magnitude, which would still be a very low risk contributor. In conclusion, the staff considers that, by determining that the estimates for the sequence frequencies are equivalent to mean values, and in identifying those assumptions that could affect the numerical results, and in understanding the effects of these assumptions on the numerical results, the uncertainty analysis performed is sufficient to support the decisionmaking.

The ACRS has expressed concern that the seismic analysis is conservative in several respects. These include: the assessments of the frequency of fuel uncovery from seismic events have been performed using the Lawrence Livermore National Laboratory (LLNL) seismic hazard curves, and an assumed HCLPF (high confidence of low probability of failure) value of .5g. The LLNL hazard curves are conservative with respect to those generated by EPRI, but this is a result of different expert judgements. The HCLPF value was chosen on the basis that it was the value that was felt to be attainable by a plant that could meet the seismic checklist. It was recognized by the Staff that in fact the HCLPF value could be greater than .5g. However, in the absence of plant specific assessments of fuel pool capacities, this is a good approximation, which is bounding. The draft report also states that the approach used to evaluate the frequency gives a slightly conservative estimate of the mean value that would be calculated from a convolution of the hazard curve and the fragility curve. Since the treatment of uncertainties is an inherent part

of the development of the characterization of the hazard curves and the fragility curves, this mean value does indeed address uncertainties. While it can be concluded that the frequency of fuel uncovery from seismic events is potentially conservative, it is not considered by the staff that this will impact the quality of the decisions that will be made on a generic basis using this information.