The Use of Performance Assessment as a Tool in Focusing Scientific Evaluation of the WIPP Site

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The Question: Should the Probabilistic Risk Assessment (PRA) process be used on large programs? **Answer:** It is the **ONLY** method to control and focus the research thus minimizing the time and costs to complete a project.

Let me begin with a brief history of my involvement in the development of the science of (PRA) and performance assessment. I led three programs where major developments of the science of PRA occurred and I was on a review panel for a fourth program where the PRA methodology was incorrectly used.

The first program was the Subseabed Disposal Program (SDP) (1973- 1986) where many of the critical PRA scientific processes (the PRA Structure) were identified. The SDP was an international program (12 countries and the Nuclear Energy Agency-NEA) where a team of leading scientists in their respective fields were assembled to assess the feasibility of using geologic formations beneath the oceans as a repository for the disposal of spent nuclear fuel.

The second program was the Waste Isolation Pilot Plant (WIPP) (1975-present) which is the world's first and only operating geologic repository for contact and remote handled TRU military wastes. I became director of the WIPP PRA program in 1986 and found it to be in total disarray. Using the PRA science developed in the SDP I rebuilt the WIPP PRA and optimized the PRA processes which the SDP had identified. Using the highly developed PRA process, WIPP opened and began receiving waste in 1999.

The third program was the INEEL spent fuel study. This study had two goals which were: one, to show that the WIPP PRA process would work on other wastes (spent fuel) and other geologic formations (The Yucca Mountain Formation) and two, to do a detailed sensitivity analysis for the INEEL spent fuel program in order to help focus their basic research program.

The fourth program was the Yucca Mountain Program. This program, without a lead laboratory as its scientific advisor until too late in the program, and a lack of understanding and use of the now well documented PRA process, floundered and was extremely costly in both time and money.

Several important PRA themes are present in all of the programs identified above. Figure 1 shows the current PRA research structure which has been developed over the last 35 years and highlights the themes listed below.

First, an exhaustive Feature, Event and Process (FEP) list is needed at the beginning of the program in order to give the management an estimate of its size and scope. When all of the FEPs are either screened out or included in the calculations the PRA process is complete. During the years of the WIPP program the NEA developed FEP lists for several different geologic formations.

Second, there is never a large enough computer capability to run all of the codes. This is the reason that all large programs must complete many iterative PRA Sensitivity/ Uncertainty analyses (S/U) on the subsystems and on the total system. S/U analyses of the subsystems allow the program to identify the parameters within the subsystem which contain most of the uncertainty, thus focusing the basic research needs. S/U analysis of the total system allows the program to identify subsystems that contain little uncertainty and can be turned off or streamlined. Abstractions of the critical processes are not the correct solution for lack of computer power.

Third, the computational subsystem and total system must include the fundamental process equations so that iterative S/U analyses can be rapidly completed. Do not use abstractions for the important (most uncertain) parameters and subsystems.

Fourth, scientists will try to "game the system" or make their research seem most important. To solve this dilemma the scientists must be involved early in the S/U analysis of the parameter or the subsystem. Once you have shown that their (sometimes exaggerated) parameter values contain small or no uncertainty they will be less defensive.

Fifth, place rigid control on the primary data base used for all assessment calculations.

Sixth, streamline the QA process.

How can a future site evaluation process be designed to allow the many necessary and sometime conflicting goals for site evaluation to be met in a credible way within a reasonable time and at a reasonable cost?

Early in the SDP program the international science team found the difficulty in completing a PRA and obtaining a license was directly proportional to the complexity of the geologic formation of interest. Thus, the more uniform and predictable the geologic formation the smaller the PRA requirements and the resultant basic science needs- cheaper and faster. All else being equal, choose the most uniform and predictable geologic formation.

The views presented at this meeting are solely my own and do not represent any organization that I have worked for.