Early Lessons Learned from Risk Applications on DOE Nonreactor Nuclear Facilities

Kevin R. O'Kula
M.G. Wentink*

URS Safety Management Solutions LLC
2131 South Centennial Avenue, Aiken, SC 29803-7680;
Email: kevin.okula@wsms.com
***Waste Treatment Plant, Bechtel National Inc., Richland, WA, mgwentin@bechtel.com**

Over the past two years, the Department of Energy has taken several actions to provide an infrastructure for providing appropriate controls and support for use of risk assessments and risk informed decision making as it applies to nuclear safety. These actions include establishing a Risk Assessment Technical Experts Working Group, revising its Nuclear Safety Policy to explicitly address the use and control of risk assessments, and developing a Draft Standard, "Development and Use of Probabilistic Risk Assessments in Department of Energy Nuclear Safety Applications," (December 2010). With respect to the draft standard, its purpose is "to provide guidance and criteria for a standard approach to utilization of probabilistic risk assessments (PRAs) in nuclear safety applications". In particular, it states, "DOE's nuclear safety decision-making processes can be supplemented and strengthened through application of quantitative and probabilistic risk assessment methodologies; such methodologies may be useful in aiding the evaluation of alternatives that comply with DOE nuclear safety requirements, supporting the USQ process, augmenting traditional safety assessment methods, evaluating changes to DOE safety requirements, and in general, enhancing the quality, transparency, and credibility of analytical results and decisions that are made". Given the publication of the draft standard, significant perspectives can be gained by reviewing past and current efforts where full-scope risk analyses were or are being applied to nonreactor nuclear facilities. In this regard, the objectives of this paper are to review past or ongoing risk analyses performed for DOE nonreactor nuclear facilities, and secondly, to identify the lessons learned from these studies as guidance to the current initiatives on risk-informing safety guidance and design, as well as identifying strengths and limitations of risk assessment to the prospective users reviewers, and regulators.

The nuclear facilities selected for this review are the Defense Waste Processing Facility (DWPF) at the Savannah River, and the Waste Treatment and Immobilization Plant (WTP) at Hanford. The two studies are: (1) the full-scope, Probabilistic Safety Assessment (PSA) for DWPF performed in the 1990s (prior to startup); and the Quantitative Risk Analysis (QRA) of hydrogen events in WTP. While very similar to nuclear power plant PSA studies in that it quantified radiological impacts and risks, the DWPF PSA study was never implemented in the safety basis. The QRA is currently in progress and is being used to guide final design to inform the final design of WTP piping systems, but is not a radiological assessment.

The major lessons identified from these studies are:

- Design and operational vulnerabilities are more easily identified and prioritized on a relative basis
- Normal operation tends to dominate risk over abnormal and accident event risk
- The relative risk values are often more useful than the absolute risk values. If the latter are used to inform decision-making then it is critical to be cognizant of the uncertainty or retained margin.
- Prompt effects are not as important for nonreactor facilities, as are latent effects, contamination, and other long-term risks.
- Applicable reliability data for nonreactor facilities should be carefully considered, especially in the design phase. Caution should be exercised to identify applicable data to support nonreactor facility operational frequency analysis.

These and several additional observations will be discussed in the full paper. Use of these perspectives from nonreactor nuclear risk assessments can assist in promoting consistent use of risk assessment tools in throughout the DOE Complex, while recognizing the key lessons from past full-scope applications.

This discussion supports the theme of the Workshop, *Preparing for the Millennium*, by emphasizing how PRA and QRA can be used to inform the safety and design of today's DOE nuclear facilities, and potentially identify vulnerabilities not as readily found through deterministic approaches alone.