

NRC RISK-INFORMED STEERING COMMITTEE - UNCERTAINTY WORKING GROUP

ISSUE DESCRIPTION

As risk results and insights have been increasingly relied upon to support licensee and regulatory decisions, the appropriate treatment and consideration of uncertainties in the PRAs supporting the decision-making processes has also become important. This recognition of the importance of properly addressing uncertainties has increased with the inclusion of hazards in the PRA models that have larger uncertainties than the internal events at full power PRAs (e.g., internal fires, seismic events, external floods, and low power and shutdown PRAs). The risk-informed decision-making process outlined in NRC's Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," states that risk-informed approaches must address uncertainties in the modeling and risk results and the decision-making must also address compliance with regulations, defense-in-depth, safety margins, and performance measurement strategies. The industry and NRC have both identified the issue of appropriately treating uncertainties as an area where additional guidance would be beneficial in improving the risk-informed decision-making process.

MAJOR OBJECTIVES

The application of risk-informed decision-making can be hindered by: a) different assumptions included in the development of PRA models used for risk-informed decision-making, b) the lack of a more specific/practical framework to address the implications of the differentiated treatment of uncertainty when considering the risk profile from multiple hazards, c) the lack of a consistent framework for addressing the quality of uncertainty treatment in PRAs (that accounts for expectations on the treatment of both aleatory and epistemic uncertainties), etc.. In order to pursue activities that can address these issues, the industry and NRC has identified four specific objectives:

Identify the specific causes for not being able to appropriately treat uncertainties in current risk-informed applications

The initial effort is to ensure the working groups have identified the specific causes for not being able to treat, or limited treat of, uncertainties in current risk-informed applications. Specific causes that inhibit the appropriate consideration or characterization of uncertainties may include: assumptions that are overly conservative (e.g., assumed failure of non-safety equipment for large external hazard events) or non-conservative (e.g., assumed hazards can be screened out of the PRA because the design meets specified guidance ignoring the potential for larger events), phenomenology that is not completely understood, modeling simplifications, limited scope PRAs (e.g., only including internal events at power), multiple, application risk calculation simplifications (e.g., scaling equipment failure rates with proposed extended test intervals), etc. This initial task should result in a compilation of specific causes/limitations that will be addressed in the follow-on tasks.

Evaluate current approaches to addressing uncertainties in risk-informed decision-making and identify any gaps that need to be resolved

In order to identify the best path forward, there is a need to characterize the underlying causes of the different types of uncertainties influencing decision-making and assess the existing approaches to their characterization and the overall guidance on the propagation and representation of uncertainty in the estimates of risk metrics in order to determine the key gaps. A number of relevant resources already exist including: RG 1.174, NUREG-1855, NRR Office Instruction LIC-504, and various EPRI documents, including EPRI 1026511. The goal is to identify the key areas where additional guidance and/or training may be beneficial in order to focus the near-term efforts.

Propose a framework for addressing the appropriate consideration of the treatment of uncertainty in risk-informed decision-makingTo appropriately address the treatment of uncertainties in risk-informed decision-making likely requires an improved “framework.” This “framework” may take the form of new guidance on how to address the different types of uncertainty (e.g., very large irreducible uncertainties) or coordinated enhancements to existing guidance, but in either case the approach needs to be consistent and rooted in the same principles for good decision-making. The proposed improved framework will also ensure that the unique advantage of PRAs, in their ability to generate quantitative information using appropriate data and methods and qualitative insights, are maintained.

Identify potential training and education mechanisms, for both PRA practitioners and broader audiences, with respect to the treatment of uncertainty in multi-hazard PRAs

One known obstacle in this area involves the level of understanding of risk-informed decision-making by PRA practitioners, non-practitioners, and management/decision-makers in both the industry and NRC. A natural extension of the framework definition would be the development and administration of additional training on risk-informed decision-making and also training on what decision-makers must know (and analysts must present) in light of the issues discussed above, once an enhanced framework is achieved.

WORK PRODUCT/GOAL

The working groups will collaborate throughout this initiative; while reporting to their associated risk-informed steering committee. The initial work product will be a scoping document/white paper on treatment of uncertainty in risk-informed decision-making that will evaluate the current situation and outline framework enhancements. Following agreement on the options for addressing the issues identified above, the working groups will present these options to the industry and NRC risk-informed steering committees. As directed by the steering committees, the working groups will develop enhancements to existing guidance or develop new guidance, consistent with their role (e.g., industry may enhance or develop new NEI guidance or EPRI guidance, such as EPRI 1026511 and 1016737, to be reviewed and endorsed by NRC, and/or NRC may enhance or develop new NRC guidance, such as RG 1.174 or NUREG-1855).