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Preclosure Safety Analysis of a Fuel Handling Operations Facility for a Geologic Repository

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Abstract

The U.S. Department of Energy (DOE) is currently preparing to submit a License Application (LA) to the U.S. Nuclear Regulatory Commission (NRC) for a potential repository at Yucca Mountain, Nevada. It is expected that surface facilities where the waste is received and handled will be part of the operations leading to permanent disposal of waste into underground emplacement drifts. These operations would be conducted at the geological repository operations area (GROA). As part of the current proposed design of the facilities at the GROA, DOE recently announced that the majority of the spent nuclear fuel will be loaded into transportation, aging, and disposal (TAD) canisters at utility sites and shipped to the GROA facilities. The new approach also includes limited bare fuel handling in a wet handling facility for fuel that cannot be readily packaged into the TAD canisters.

The regulatory requirements for the GROA are established in 10 CFR Part 63 [1], which require demonstrating public and worker safety in a risk-informed, performance-based framework. As such, receiving and handling operations in the surface facilities during the preclosure period must be in compliance with the performance objectives described in the regulation, for which review guidance is provided in the Yucca Mountain Review Plan (YMRP) [2]. As required in 10 CFR Part 63 and further discussed in the YMRP, the preclosure safety analysis will involve a systematic assessment of the site description, the design of structures, systems and components (SSCs) and their related operational procedures, identification of potential hazards and event sequences, and calculation of potential dose consequences.

During the prelicensing period, the NRC staff and the Center for Nuclear Waste Regulatory Analyses (CNWRA) staff have conducted a limited preclosure safety analysis (PCSA) exercise for the spent fuel pool area of a conceptual wet transfer facility at the GROA. This work was done to gain risk insights and prepare for review of DOE's upcoming LA. These activities have included a limited safety analysis exercise of a conceptual spent fuel pool receiving and handling operations using the PCSA Tool [3], a software package specifically developed to aid in the confirmatory preclosure safety analysis of the GROA. The results of these activities are presented here.

The insights resulting from the PCSA exercise of hypothetical spent fuel wet handling operations based on a conceptual design and operational procedures are discussed. This paper includes a study of activities and operations using a risk-informed, performance-based approach; an analysis of areas where uncertainties in the analysis may have the greatest impact on the results; and an understanding of the SSCs that could play a significant role in preventing potential event sequences or mitigating their consequences. Particularly novel considerations highlighted here include the integration of Human Reliability Analysis into the overall preclosure safety analysis.

Disclaimer

This abstract is an independent product of the authors and does not necessarily reflect the view or regulatory position of the NRC. The NRC staff views expressed herein are preliminary and do not constitute a final judgment or determination of the matters addressed or of the acceptability of a license application for a geologic repository at Yucca Mountain. Furthermore, this exercise is not a regulatory review, nor will its results represent an NRC position regarding the adequacy of design for any facility in or component of the GROA that may be described in the DOE license application. All results and conclusions are strictly preclosing activities.

References

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- [2] NUREG–1804. "Yucca Mountain Review Plan." Final Report. Revision 2. July 2003.
- [3] T. Maxwell, B. Dasgupta, G. Adams, R. Benke and N. Eisenberg. Preclosure Safety Analysis (PCSA) Tool Version 3.0 User Guide. San Antonio, Texas: Center for Nuclear Waste Regulatory Analyses. 2005.