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A Systems Modeling Approach for Performance Assessment of the Mochovce National Radioactive Waste Repository, Slovak Republic

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The Mochovce Repository is a near surface disposal facility for low-level and intermediate-level radioactive wastes in the Slovak Republic. Waste generators include nuclear power plants, laboratories, hospitals, research institutes, and other radiological facilities. A performance assessment (PA) is required to determine the degree of potential risk posed to workers and the future public by these wastes, and to inform decisions about how that potential risk might be reduced.

Since 1993, PAs of Mochovce have evolved as knowledge has improved, as computer-based analytical platforms have become more sophisticated, and as the repository has been upgraded to improve its operational capabilities and its long-term performance. The experience gained in this evolutionary modeling informs the current chain of deterministic one- and two-dimensional process models that constitute the bulk of the PA modeling.

In order to evaluate the significance of different modeling techniques and of the uncertainty inherent in the parameters that are entered into such models, a probabilistic modeling framework has been developed using the GoldSim systems analysis computer program. In the new GoldSim model presented here, the essential behaviors of the process models are captured in simpler equivalent functions that are implemented in the GoldSim model. The uncertainty inherent in the imperfect state of knowledge about the repository's engineering, failure modes, the natural environment surrounding the repository, and the locations and behaviors of potential future human receptors is reflected in the definition of modeling parameters as stochastic variables.

The new, integrated Mochovce Repository GoldSim Model is part of the evaluation of the facility. The model facilitates comparison of the repository's performance to regulatory dose limit objectives. In this new probabilistic implementation it can be used for other purposes as well. For example, analysis of the probabilistic results can provide insight into the uncertainty inherent in the modeled system, the significance of that uncertainty, and possible approaches to reduction of uncertainty. Furthermore, the PA model can be used to support optimization of decisions concerning waste acceptance and disposal, closure, and long term maintenance of the Mochovce disposal facility.