

Applying imprecise probabilities to radioactive waste repository siting

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Abstract

The siting of a radioactive waste repository involves a series of decisions that require an integrated analysis of conflicting ecological, economical and social objectives. While making sure that these criteria are met, the main goal of such decisions is to ensure that the population and the environment are safe.

According to IAEA (2007), the siting process consists of site selection and characterization, conceptual design, performance and safety analysis, operation, post closure safety and performance analysis. Each one of these activities is the result of interaction among several parameters that represent the natural and anthropomorphic processes. Therefore, the siting of a repository requires handling and interpretation of data of very different formats and quality; their uncertainty, aleatory and epistemic, must be integrated in the same framework. During the many phases of the siting process, the analyst must choose between alternatives. For example, in site selection one must compare and rank different sites based on characteristics such as topography, soil composition, geology, hydrography, demography, agriculture, industry, etc. This requires a decision support system capable of integrating qualitative and quantitative data, and their respective uncertainties, with a rigorous mathematical basis.

This work aims at developing a methodology to represent epistemic and aleatory uncertainties, so that they can be integrated in a multi-criteria decision support system. To this end, imprecise probabilities, interval analysis, Dempster-Shafer theory, and fuzzy sets are under investigation. If we can distinguish differences between various forms of uncertainty affecting parameters, we may be able to keep more information, per parameter, than traditional methods can do while supporting decisions [2].

Keywords. Radioactive waste, decision making, fuzzy sets, imprecise probabilities , Dempster-Shafer.

References

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- [2] Walley, P. *Measures of uncertainty in expert systems*, Artificial Intelligence 83 (1996) 1-58.