

Non-Additive Ranking of Release Scenarios in a Low and Intermediate Waste Repository

Seong Ho KIM*, Tae Woon KIM, and Jaejoo Ha
Korea Atomic Energy Research Institute
150 Deokjin-Dong, Yuseong-Gu, Daejeon, Korea
(*Corresponding author: shokim@kaeri.re.kr)

In the present study, a multicriteria decision-making (MCDM) problem of ranking of important radionuclide release scenarios in a low and intermediate radioactive waste repository is to treat on the basis of non-additive fuzzy measures and fuzzy integral theory. Ranking of important scenarios can lead to the provision of more effective safety measure in a design stage of the repository. The ranking is determined by a relative degree of appropriateness of scenario alternatives. A MCDM problem is characterized in terms of two factors: relative importance of each evaluation criteria and of appropriateness of each alternative. As an input stage, both importance weights for criteria and preference scores for scenarios with respect to each criterion are obtained through a pairwise comparison in Saaty's analytic hierarchy process (AHP) approach. Then, as a modeling stage, interaction among criteria is dealt with non-additive fuzzy measures such as belief measures and plausibility measures and aggregation of these measures and preference scores is conducted by fuzzy integrals, especially, Choquet integral. Finally, as an interpretation stage, aggregated values are viewed as decision maker's optimistic and pessimistic attitude towards information aggregation. The proposed approach is called a non-additive AHP (NAAHP).

To demonstrate a validation of the proposed approach to ranking of release scenarios, results of the previous AHP study are used and compared with them of the present NAAHP approach. Since the AHP approach uses importance weights based on additive probability measures, the interaction among criteria is ignored. The comparison of scenarios ranking obtained from these two approaches enables us to figure out the effect of different models for interaction among criteria. It is found that the ranking is affected if interaction among criteria is taken into account in a modeling stage. Furthermore, this non-additive AHP approach can provide more easily interpretable information than the classical AHP does. Thus, it suggests that the proposed approach be one of suitable tools to support a decision making problem of the priority among release scenario alternatives.