**Integration Group for the Safety Case (IGSC) Symposium 2024**  
*MOVING TOWARDS THE CONSTRUCTION OF A SAFE DGR – GETTING REAL*

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| **Abstract Title: Enhancing decision-making in the site selection process for a deep geological repository in Germany: An application of the Analytic Network Process (ANP) decision technique.** | |
| **Abstract (300-500 words):**  The German site selection procedure for a deep geological repository was initiated with the identification of ninety subareas of interest throughout Germany. These subareas feature three types of host rocks: Claystone, crystalline, and rock salt. The methodology adopted for the site selection is a stepwise, spatial screening process, integrating a spectrum of criteria and requirements, including but not limited to a group of geoscientific weighting criteria as outlined in the German Site Selection Act (StandAG). The current phase focusses on delineating regions eligible for surface exploration within the initially identified subareas: It begins with the execution of representative preliminary safety investigations across the areas of interest aiming at narrowing down the superficies under consideration. Following these investigations, the remaining regions will be subjected to a second round of evaluation using the geoscientific weighting criteria.  As the site selection process transitions from identifying larger areas to selecting smaller regions for surface exploration, a complex decision problem emerges. The relevance of each weighting criterion is expected to vary significantly, with some criteria becoming more critical, while others diminish in importance as the focus moves from one phase to another, from one host rock to another, and from one subarea to another.  The German Repository Safety Investigation Ordinance (EndlSiUntV) stipulates that the relevance of these geoscientific criteria for the overall evaluation of a potential repository system must be assessed with regards to three aspects: 1) The criterion's significance regarding the safety functions of the repository system and its components, 2) the current state of knowledge pertaining to the respective criterion, and 3) the potential knowledge gain through future exploration activities.  Focusing on the first aspect, we introduce a methodology that leverages the Analytic Network Process (ANP), a technique within the Multi-Criteria Decision Analysis (MCDA) framework, to quantify the relevance of the geoscientific weighting criteria regarding the safety functions of the geological components of the repository system. Unlike traditional decision-making techniques, ANP accommodates the complex interdependencies and feedback loops among criteria, enabling a comprehensive evaluation of how individual and combined criteria contribute to the repository system’s overall safety. It integrates both qualitative and quantitative data, facilitating a holistic assessment and yielding a clear outcome thorough information processing. Additionally, ANP’s capabilities of including multiple expert judgments, enhances the collaborative decision-making process. And through its network-based structure, ANP allows the evaluation of the potential interactions within criteria, providing a systematic approach to decision-making that aligns with the site selection process’s multifaceted requirements. It not only streamlines the evaluation process but also ensures a certain degree of adaptability to additional data and stakeholder insights.  The objective of our work is to enhance the decision-making process by offering a detailed and adaptable evaluation framework. The outcome is not only a methodology for assessing criteria’s relevance but also a strategic tool that supports informed decisions in the continuously evolving landscape of the search for a repository site, ensuring that each step forward is aligned with the overarching goal of long-term safety. | |