



## Preface: Research on resilient safety in nuclear waste management

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Resilience is a term that has gained importance over the last years, both in scientific and in public debates. This is probably due to the fact that we live in times of crises; we have seen an economic crisis, the COVID-19 pandemic, a war of aggression in Europe, and climate change due to man-made greenhouse gas emissions to name only a few. There are as many crises and challenges as there are definitions of the term “resilience”. Originating from developmental psychology, the concept of resilience is applied in many academic disciplines and societal contexts, including ecological systems, management strategies, and the security of critical infrastructure. Today it is used for many complex sociotechnical systems and can be understood as the ability to successfully adapt to (unforeseen) negative changes of circumstances and still maintain the core functions of a system. In this sense, resilience means more than just the “robustness” of a system, which is the ability to withstand negative influences.

As the safety of nuclear waste disposal can also be understood as a complex sociotechnical issue, how can the concept of resilience be best applied in this context? The Federal Office for the Safety of Nuclear Waste Management (BASE) has decided to centre the second interdisciplinary research symposium safeND (2023) around this question. As a regulatory body with a safety mission, we want to bring together different academic disciplines to discuss this question. Moreover, how should we design processes of safe nuclear waste management in a resilient way so that safety concepts can be adapted to unforeseen crisis situations? What are our blind spots, and what are our technical and non-technical research priorities? These are pressing issues that we have become aware of due to an unprecedented event during the last year. The Russian war in Ukraine has shown that nuclear facilities, including waste storage facilities, can come under attack dur-

ing warfare. Their resilience is, therefore, a question of substantial significance.

But resilience is also an issue on a less dramatic scale. Legal and administrative processes regarding nuclear safety and the search for disposal sites worldwide are affected by their societal and legal frameworks. The safety functions of these processes need to be resilient to changes in their boundary conditions; they need mechanisms to ensure safety in the short, medium, and long term. In addition, there is a growing need for processes that ensure actual progress in safe nuclear disposal – 8 decades after the beginning of nuclear waste production. From a German perspective, interim storage and the repository site selection procedure are two processes with changing boundary conditions. Both have to show flexibility in order to adjust to the new framework, while focussing on their respective aims, which are safe storage for a limited amount of time and the identification of the disposal site with the best possible safety.

Many more issues in the field of nuclear safety are directly related to the question of resilience. Due to this importance, resilient safety is the key topic both of safeND 2023 and the present abstract volume. It gathers monodisciplinary and interdisciplinary contributions from the scientific community, which deal with a huge variety of topics around nuclear waste disposal, from the technical decommissioning of nuclear installations to the safe geological disposal in a final repository. Resilience gaps, i.e. important and as yet unresolved scientific questions, are at stake. We must set priorities and decide which facets of resilience have to be targeted first from a scientific perspective to make the best progress in terms of nuclear safety.

The present abstract volume offers a synopsis of the state of the art and asks the following questions: where are we on our way to resilient nuclear safety? What has already been

achieved? Which steps need to be taken next to achieve our goals? The symposium and the abstract volume will provide some answers and will, at the same time, create new questions. We hope that safeND 2023, from the present conference proceedings, can provide some inspiration for your own work.