

Note:

This is a translation of the recommendation entitled “Leitlinie zum menschlichen Eindringen in ein Endlager für radioaktive Abfälle”.

In case of discrepancies between the English translation and the German original, the original shall prevail.



**RECOMMENDATION of the Nuclear Waste Management Commission (ESK)
Guideline on human intrusion into a repository for radioactive waste**

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1 Introduction

The “Safety Requirements Governing the Final Disposal of Heat-Generating Radioactive Waste” [1] require that the concept and design of the repository shall be developed on the basis of a step-by-step optimisation process making allowance for advancements in the state of the art and increasing levels of knowledge until the completion of decommissioning.

According to the Safety Requirements, optimisation of the repository with regard to reliable isolation of the radioactive waste in the repository from future human activities shall be carried out as a secondary priority to the optimisation targets mentioned in Chapter 5.1. In this respect, the Safety Requirements [1] demand the following:

- “..., a variety of reference scenarios for unintentional human penetration of the final repository, based on common human activities at the present time, shall be analysed...”, and
- “Within the context of such optimisation, the aim shall also be to reduce the probability of occurrence and its radiological effects on the general public.”

The requirements related to the handling of future human activities are specified below. The considerations focus on such human activities that directly compromise the isolation capability of the repository and that are referred to as “human intrusion”.

2 Basis

2.1 Task

The objective of disposal of heat generating radioactive waste in deep geological formations is to ensure the confinement of radionuclides by the effectiveness of geological and technical barriers. As it cannot be ruled out that future human intrusion will impair the effectiveness of the barrier system, these activities must be analysed and, where required, be taken into account in accordance with the Safety Requirements [1].

The Safety Requirements demand taking into account the possibility of inadvertent human intrusion into a repository in the form of reference scenarios. These reference scenarios for human intrusion describe those activities that might compromise the safety functions of the isolating rock zone and the barriers. The applicant must indicate whether appropriate optimisation measures that meet the requirements can be taken.

2.2 Definition

The term “human intrusion” is understood as any human activity after the closure of the repository mine that will immediately damage the barriers within the backfilled and sealed mine workings and the isolating rock zone.

A distinction is made between intentional and inadvertent intrusion. According to the Safety Requirements [1], only inadvertent intrusion is to be considered; the regulations are subject to these guidelines.

2.3 Assumptions and boundary conditions for the analysis

The development of human beings and human society is not predictable over long periods of time. Accordingly, a systematic and covering derivation of human intrusion scenarios is infeasible. Selected stylised scenarios have therefore to be used as a reference, which are based on initiating events being plausible from today's point of view.

The assessment of the technical possibilities available to future generations is to be based on the state of the art in science and technology. For the derivation of human intrusion scenarios, motives that are recognisable from today's point of view, the knowledge available today, and today's technical means are to be postulated.

The Safety Requirements [1] demand documentation and its best possible passing on to future generations. For the first five centuries after sealing of the repository it is assumed that the knowledge about the repository site and the potential danger posed by it is preserved and communicated. In the analysis, inadvertent human intrusion is therefore to be assumed only after 500 years.

With regard to the radiological consequences of inadvertent intrusion, such human intrusion scenarios are to be considered that may lead to a potential radiation exposure of the general public.

3 Handling of human intrusion into a repository for radioactive waste

Based on the site conditions and the repository design, the applicant shall determine, at least for the human intrusion reference scenarios listed under Chapter 3.1, whether these may be relevant for the site and, if so, assess their radiological impacts. In addition, the applicant shall examine in accordance with the requirements in Chapter 3.2, whether further site-specific scenarios for inadvertent human intrusion have to be considered.

3.1 Reference scenarios for human intrusion

The following reference scenarios for human intrusion are to be considered:

- construction of a new mine,
- drilling of a borehole,
- solution mining and operation of caverns in the salt rock, and
- injection or extraction of liquids or gases (fluids) in the vicinity of the repository.

Within case distinctions, the applicant shall investigate in each case whether and how the isolating rock zone could be damaged. When defining the case distinctions, special consideration is to be given to human activities which could be performed according to the state of the art in science and technology at the time of the planning and design of the repository. With regard to the detection of anomalies, etc., the possibilities in use at the time of repository planning are to be considered.

3.2 Development of additional site-specific scenarios

In consideration of the geological conditions and on the basis of past human activities in the underground it is to be examined whether scenarios in addition to those listed under Chapter 3.1 have to be considered for the repository site to be investigated. These are to be considered analogously to the requirements relating to the reference scenarios for human intrusion.

3.3 Measures to reduce impacts on the safety functions of the barriers caused by human impacts

For each of the scenarios, including case distinctions, considered under Chapter 3.1 and Chapter 3.2, the applicant has to determine whether there is potential for optimisation. In a second step, it is to be checked which positive influence these optimisations might have in each case. In a third step, it is then to be checked whether the potential optimisation measures run counter to the primary optimisation targets according to Chapter 5.1 of the Safety Requirements [1].

Optimisation measures against the consequences of human impacts are only necessary if these constitute significant impacts on the safety functions of the safety barriers, if the check in the second step showed ways to significantly reduce the impact, and if the check in the third step did not show any adverse effects on the primary optimisation targets.

4 **References**

- [1] Sicherheitsanforderungen an die Endlagerung wärmeentwickelnder radioaktiver Abfälle,
Stand: 30. September 2010.
Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit
*Safety Requirements Governing the Final Disposal of Heat-Generating Radioactive
Waste, as at 30 September 2010.*
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety