Supplement of Safety of Nuclear Waste Disposal

Demonstrating the possibility of safe operation in the first phase of the site selection procedure in Germany

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Demonstrating the possibility of safe operation in the first phase of the Site Selection Procedure in Germany

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AGENDA

Demonstrating the possibility of safe operation in the first phase of the Site Selection Procedure in Germany

01 INTRODUCTION

02 METHODOLOGY WITHIN THE rvSU

03 SUMMARY
INTRODUCTION
SITE SELECTION PROCEDURE

Sequence of procedure steps

Phase I

1. Identification of sub-areas (section 13, StandAG)
2. Identification of siting regions for surface exploration (section 14, StandAG)

Phase II

Surface exploration
Proposal for underground exploration (section 16, StandAG)

Phase III

Underground exploration (section 18, StandAG)
Final site comparison and site proposal (section 19, StandAG)

Application of exclusion criteria (AK) (section 22, StandAG)
Application of minimum requirements (MA) (section 23, StandAG)
Application of geoscientific weighing criteria (geoWK) (section 24, StandAG)
If necessary, planning-scientific weighing criteria (planWK) (section 25, StandAG)

Preliminary safety analyses (vSU) (section 27, StandAG)

Site decision

Phase I:
- Sub-areas Interim Report: September 28, 2020

Phase II:
- Decision on surface exploration (section 15, StandAG)
- Proposal for underground exploration (section 16, StandAG)

Phase III:
- Decision on underground exploration (section 17, StandAG)
- Final site comparison and site proposal (section 19, StandAG)

Source: BGE
OPERATIONAL SAFETY IN THE FIRST PHASE OF THE SITE SELECTION PROCEDURE

Excerpt from § 7 EndlSiUntV (Analysis of the disposal system)

(3) “The operational safety and the long-term safety of the disposal facility shall be analyzed according to §§ 8 and 9”

By derogation from para. 3, the following applies for Phase I:

(6) “For the representative preliminary safety analyses […] the following procedure shall be adopted […]:

4. the basic possibility of safe operation shall be demonstrated, but a complete operational safety analysis does not need to be performed”

Excerpt from the final report of the “Endlagerkommission” (repository commission), K-Drs. 268, p. 293

“Within the framework of the safety investigations, investigations are also carried out with regard to the suitability of the location of the above-ground plants and with regard to operational safety. […] The safety investigations on the above-mentioned points thus also have an influence on the site selection of the above-ground facilities.“ (Translated from original)
OPERATIONAL SAFETY IN THE SITE SELECTION PROCEDURE

Levels of detail of the processing in the different steps of the process

- § 17 EndlSiAnfV: Full processing only required as part of the license application for a repository at a selected site
- § 8 EndlSiUntV: Operational safety analyses in Phase II and III
- § 7 (6) No. 4 EndlSiUntV: Demonstrating the possibility of safe operation in the Step 2 of Phase I
  - No complete safety analysis, content not clearly defined
  - Method is developed by BGE
  - Aspects from § 17 EndlSiAnfV and § 8 EndlSiUntV considered with limitations
METHODOLOGY WITHIN THE rvSU
PROCEDURE TO DEMONSTRATE THE SAFE OPERATION IN STEP 2 OF PHASE I (1/3)

1. **Requirements**
   - Preliminary design of the disposal facility (§ 6 (4) EnlSiUntV)

2. **Internal and external events (EVI & EVA)**
   - Specified normal operation
   - Accident
   - Consequences actions

3. **Assessment**
   - Possibility of safe operation for investigation area
   - Robustness of safe operation within the investigation area

**Assessment**
- Possibility of safe operation for investigation area
- Robustness of safe operation within the investigation area

**Site-independent consideration**
- Consideration within the investigation area

Source: BGE
PROCEDURE TO DEMONSTRATE THE SAFE OPERATION IN STEP 2 OF PHASE I (2/3)

Site-independent consideration

Consideration within the investigation area

Requirements

- Preliminary design of the disposal facility (§ 6 (4) EnlSiUntV)
- Laws, regulations, etc.
- Safety concepts
- Long-term safety
- Requirements from non-radiological aspects (work safety, mining law, etc.), according to the level of detail in Phase I
- Host rocks
- Repository concept
- System sketches
- Definition of subsystems
- Definition of operational process

Source: BGE
PROCEDURE TO DEMONSTRATE THE SAFE OPERATION IN STEP 2 OF PHASE I (3/3)

Requirements

- Description of the intended operation
- Regulatory requirements
- Preventive actions
- Operational monitoring

Preliminary design of the disposal facility (§ 6 (4) EndlSiUntV)

- Collection
- Laws, regulations, etc.
- National and international publications (BASEL, Nagra, etc.)

Internal and external events (EVI & EVA)

- Consequences of the internal and external effects on safety functions, and operational and long-term safety
- Actions to obtain a safe facility condition
- Actions to reduce the consequences

Specified normal operation

General specification actions

General catalog

Consideration within the investigation area

Site-independent consideration

Source: BGE
GENERAL CATALOG FOR OPERATIONAL SAFETY (STATE OF WORK)

Examples of internal and external events

- **Internal events:**
  - Failure of technical equipment
  - Release of radioactive substances
  - Explosion internal

- **External events:**
  - External power supply failure
  - Lightning strike
  - Flooding
PROCEDURE TO DEMONSTRATE THE SAFE OPERATION IN STEP 2 OF PHASE I

Consideration within the investigation area (1/2)

- Examination of the relevance of the internal and external events
- Specification of the resulting actions
- Assessment of the general feasibility of the operational safety
- Binary, above ground and underground

Requirements

Preliminary design of the disposal facility (§ 6 (4) EndlSiUntV)

Internal and external events (EVI & EVA)

Specified normal operation

Accident

Consequences actions

General specification actions

General catalog

Assessment
Possibility of safe operation for investigation area

Cartographic depiction of location-specific EVA

Site-independent consideration

Consideration within the investigation area

Source: BGE
CARTOGRAPHIC DEPICTION OF LOCATION-SPECIFIC EVENTS

Definition of location-specific events

- External events
- Temporary occurrence in investigation areas
- Can be characterized site-specifically in Step 2 of Phase I
- Impacts on surface subsystems
- No consideration of rock mechanical impacts
  - Not characterizable in the investigation areas
  - Considered in repository design
GENERAL CATALOG FOR OPERATIONAL SAFETY
(STATE OF WORK)

External events – location-specific

- Failure external power supply
- Blowout
- Lightning strike
- Exposure to hazardous substances
- Earthquake
- Explosive pressure wave
- External fire
- Aircraft crash, accidental
- Flooding pit
- Rock mechanical impact
  - Flooding
  - Landslide
  - Wind load
  - Snow load
  - Access of shaft water into the mine
  - Access of solutions and natural gases
  - Sinkhole
  - Other site-related impacts
PROCEDURE TO DEMONSTRATE THE SAFE OPERATION IN STEP 2 OF PHASE I

Consideration within the investigation area (2/2)

- Requirements
  - Preliminary design of the disposal facility (§ 6 (4) EndlSiUntV)

- Internal and external events (EVI & EVA)
- Specified normal operation
- Accident
- Consequences actions

- General specification actions

- General catalog

- Cartographic depiction of location-specific EVA
  - Location-specific EVA and necessary technical precautions
  - Spatial differentiation of locations above ground

- Assessment
  - Possibility of safe operation for investigation area
  - Robustness of safe operation within the investigation area

Source: BGE
ASSESSMENT OF ROBUSTNESS OF OPERATIONAL SAFETY IN rvSU

- Spatial differentiation of locations above ground
- Assessment of robustness of operational safety as a basis for the balancing assessment of the investigation areas in rvSU
  - Method development not completed
- Cartographic representation of site-specific EVA as a basis
- “Investigation area certificate” for robustness of operational safety:
  - No site-specific events
  - Minor technical actions necessary
  - Occurrence of site-specific impacts
  - Extensive technical actions necessary
SUMMARY

- Non-radiological aspects of operational safety not assessed in detail
  - Taken into account in repository design
- Location-independent “general catalog” contains events to be taken into account and corresponding actions
- Assessment of the basic possibility of safe operation
  - Binary
  - Above ground and underground
- Assessment of robustness operational safety
  - Spatial differentiation
  - Surface
ABBREVIATIONS

BASEL

Project „Beurteilung der Abhängigkeiten zwischen dem sicheren Bau und Betrieb eines Endlagers für hochradioaktive Abfälle und der Langzeitsicherheit“

BGE

Bundesgesellschaft für Endlagerung – Federal Company for Radioactive Waste Disposal

EndlSiAnfV

Endlagersicherheitsanforderungsverordnung – Disposal Safety Requirements Ordinance

EndlSiUntV

Endlagersicherheitsuntersuchungsverordnung – Disposal Safety Analysis Ordinance

EVA

Einwirkungen von außen – External events

EVI

Einwirkungen von innen – Internal events

rvSU

Repräsentative vorläufige Sicherheitsuntersuchung – Representative preliminary safety analyses

UR

Untersuchungsraum – Investigation area
REFERENCES

- BT-Drs. 18/11398: Gesetzentwurf der Fraktionen CDU/CSU, SPD und BÜNDNIS 90/DIE GRÜNEN: Entwurf eines Gesetzes zur Fortentwicklung des Gesetzes zur Suche und Auswahl eines Standortes für ein Endlager für Wärme entwickelnde radioaktive Abfälle und anderer Gesetze, Deutscher Bundestag, Drucksache 18/11398 vom 07.03.2017


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SAVE THE DATE

25-28 November 2024

9th International Conference on Clays in Natural and Engineered Barriers for Radioactive Waste Confinement

Hannover/Germany at HCC Hannover Congress Centrum
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plenary sessions · parallel sessions · poster presentations
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