BGE BUNDESGESELLSCHAFT FÜR ENDLAGERUNG

Public meeting of NWTRB

German Site Selection Procedure – current status and lessons learned

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June 09, 2026

GZ: SG01201/1-9/9-2026#9 | Objekt-ID: 16641310

Public meeting of NWTRB

Outline

BUNDESGESELLSCHAFT FÜR ENDLAGERUNG

01 History of the Site Selection Procedure in Germany

02 Main principles and requirements according to the Site Selection Act

03 Representative preliminary safety analyses (rvSU)

04 Current status of rvSU

05 Lessons learned

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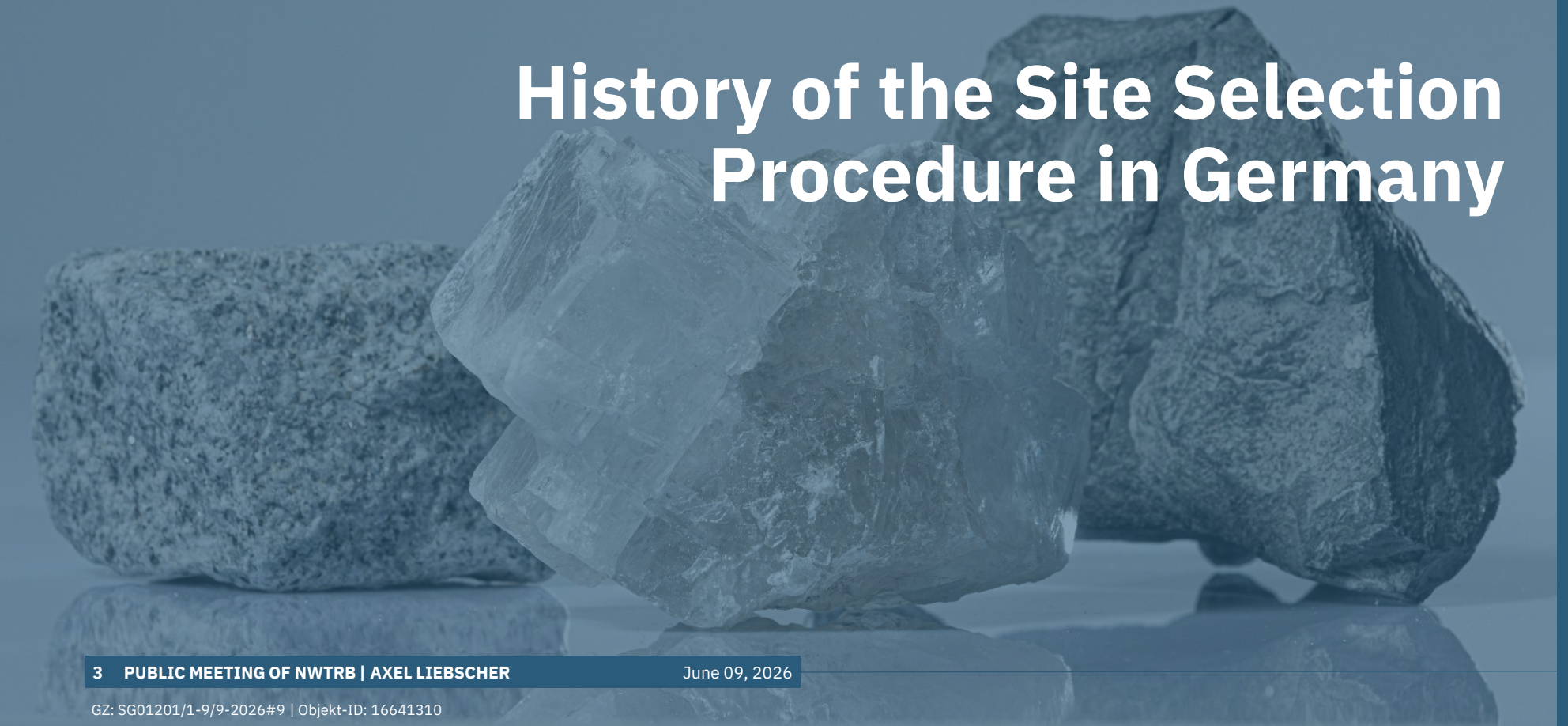
History of the Site Selection Procedure in Germany

01



History of the Site Selection Procedure in Germany

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1977	Selection of Gorleben as disposal center (containing a final repository) by the state parliament of Lower Saxony
2011	After Fukushima: Moratorium and decision to opt out of the nuclear energy program by 2022
2013	Enactment of the Repository Site Selection Act (*Standortauswahlgesetz (StandAG) für ein Endlager für hochradioaktive Abfälle*)
2014–2016	Consultation of the Repository Commission
2016	Reorganization of responsibilities and actors
2017	Reorganization of financing (repository funds)
2017	**Amendment of StandAG and start of the repository search**
15.10.2020	Safety ordinances (EndlSiAnfV and EndlSiUntV)
April 2023	Final shutdown of last three nuclear power plants

Interim storage for low-, intermediate-, and high-level radioactive waste

low- and intermediate-level radioactive waste

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Waste inventory (1/2)

High-level radioactive waste

- Forecast: approx. 1,750 castor containers
- Approx. 10,500 tons of heavy metal
  - Spent nuclear fuel
  - 3,836 canisters with vitrified waste from reprocessing

99% radioactivity

5% volume

Where?

➢ **Precise knowledge** of the **inventory** and its **quantities**, due to the opting out of the nuclear energy program by 2022 in Germany

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Waste inventory (2/2)

High-level radioactive waste

Waste type	Spent fuel elements from nuclear power plants	Canisters with vitrified waste from reprocessing	Spent fuel elements from research, experimental, and prototype reactors
Inventory	12,170 DWR-BE (UOX) 1,265 DWR-BE (MOX) 15,143 SWR-BE (UOX) 825 SWR-BE (MOX) 5,048 WWER-BE	3,136 CSD-V 560 UK-HAW 140 WAK	288,161 AVR-BE 617,606 THTR-BE 2,416 KNK-II-BS 71 KNK-BS from KfK 52 BS “Otto Hahn“ ca. 105 FRM-II-BE 66 BER-II-BE 951 RFR-BE 89 FRMZ-BE

(*As of 12/2023)

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Main principles and requirements according to the Site Selection Act

02

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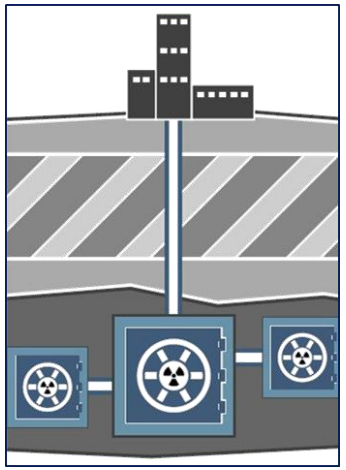
Site Selection Procedure

Main principles and requirements according to the Site Selection Act (StandAG)

- Starting with “**white map**”
- **Deep geological disposal** within **claystone, crystalline rock, and rock salt** as host rock
- Repository site located in Federal Republic of **Germany**
- Best possible safety for a period of **1 million years**
- **Reversibility** of repository facility is a key requirement
  - **Retrievability** during operating phase
  - **Recoverability** for 500 years after closure
- **Participative, science-based, transparent, self-questioning,** and **learning** procedure
- If permissible, final disposal of low- and intermediate-level radioactive waste at the same site



Crystalline rock

Rock salt

Claystone

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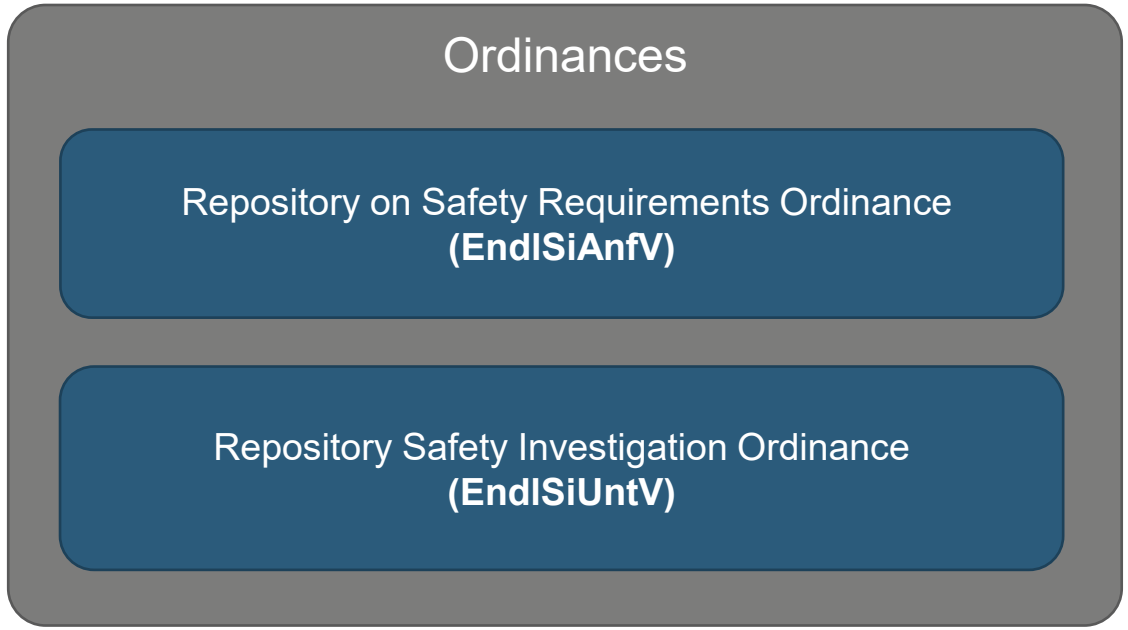
Site Selection Procedure

Regulatory framework in Germany

Site Selection Act (StandAG)

Different aspects of StandAG are concretized



- Regular updates – adaptive process
- Define implementation of preliminary safety assessments
- E.g., EndlSiAnfV gives limit values for the release of radionuclides (< fraction 10^{-4} overall and 10^{-9} annually over 1 million years (by mass and amount))
- Additional annual dose must be < 10 µSv

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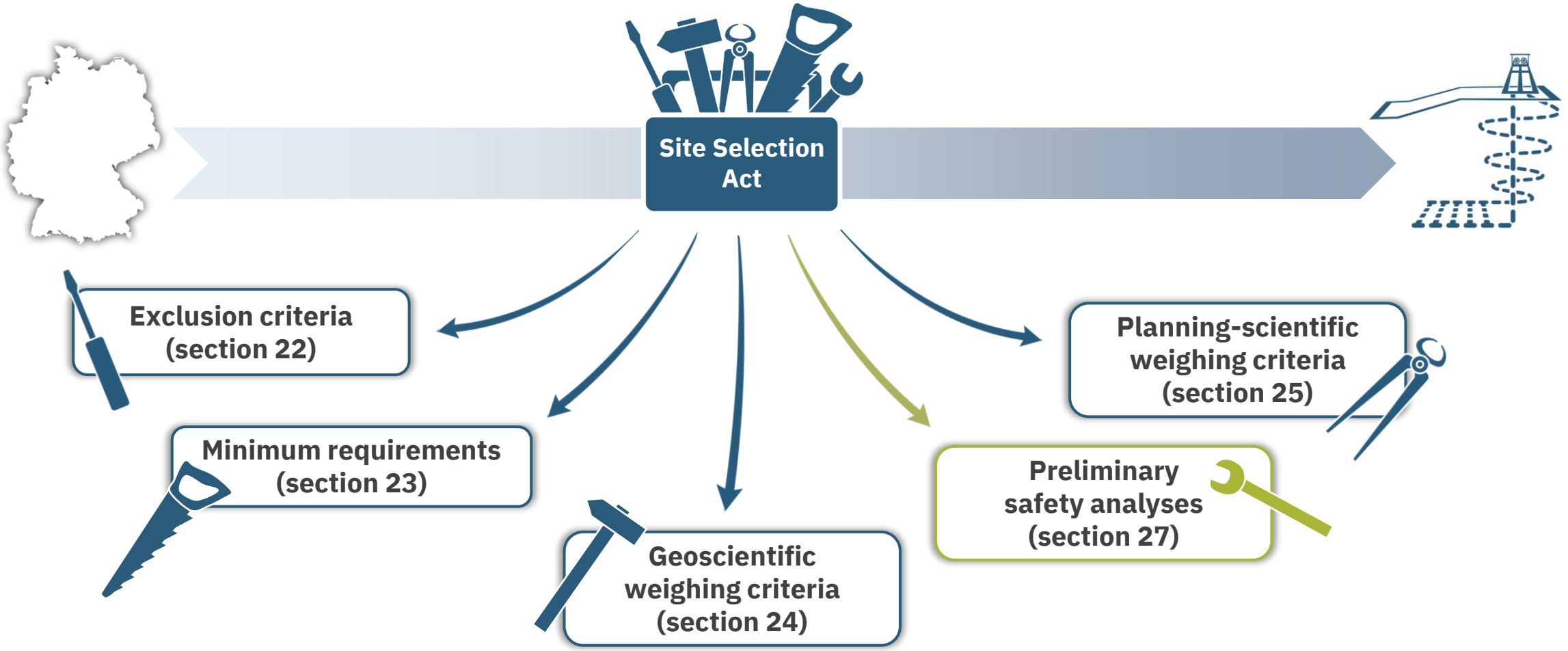
Site Selection Procedure

Tools in the Site Selection Procedure



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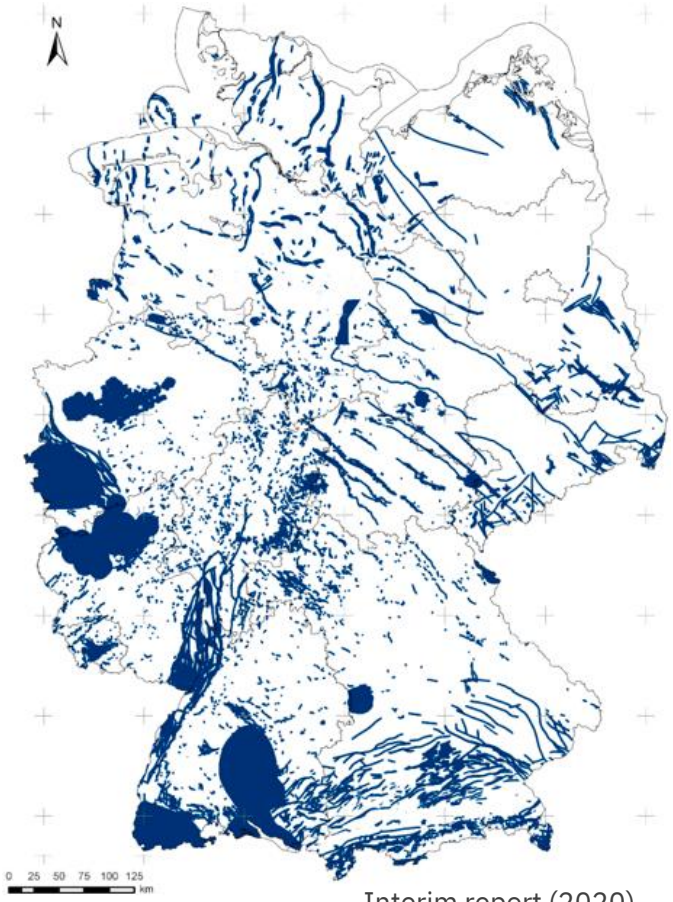
Exclusion criteria (section 22, StandAG)



Interim report (2020)

An area is classified as unsuitable as a repository site if <u>one</u> of the following exclusion criteria applies:

- Large-scale vertical movements
- Active fault zones
- Influences from current or past mining activities
- Seismic activity
- Volcanic activity
- Groundwater age

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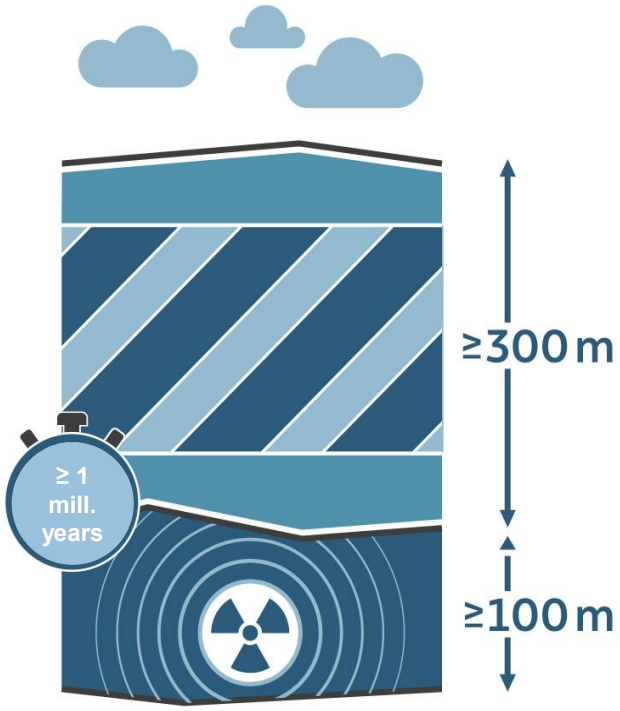
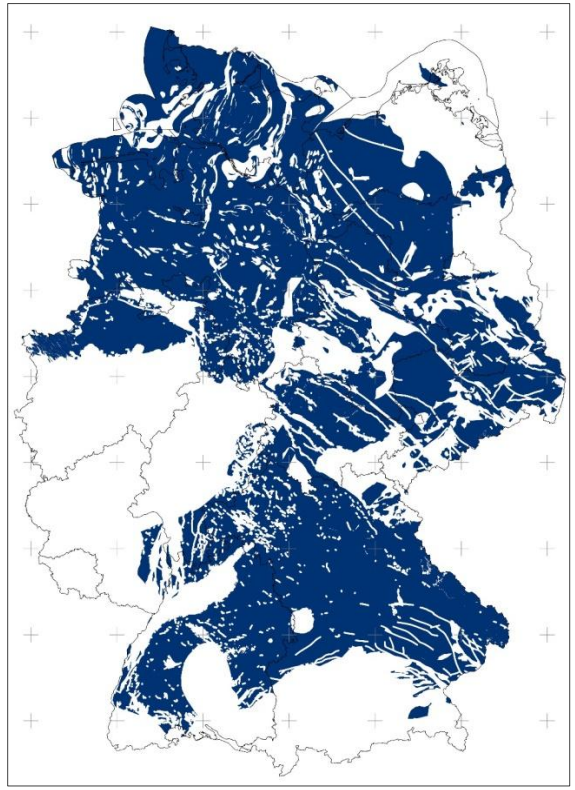
Site Selection Procedure

Minimum requirements (section 23, StandAG)



1. Hydraulic conductivity of the rock < 10^{-10} m/s
2. Thickness of the effective containment zone ≥ 100 m*
3. Minimum depth of the containment providing rock zone ≥ 300 m below ground surface*
4. Sufficient areal extend
5. Integrity of barrier over 1 million years

* For crystalline host rock and steep rock salt formations specific requirements apply.



Interim report (BGE 2020)

Identified areas
(minimum requirements fulfilled)

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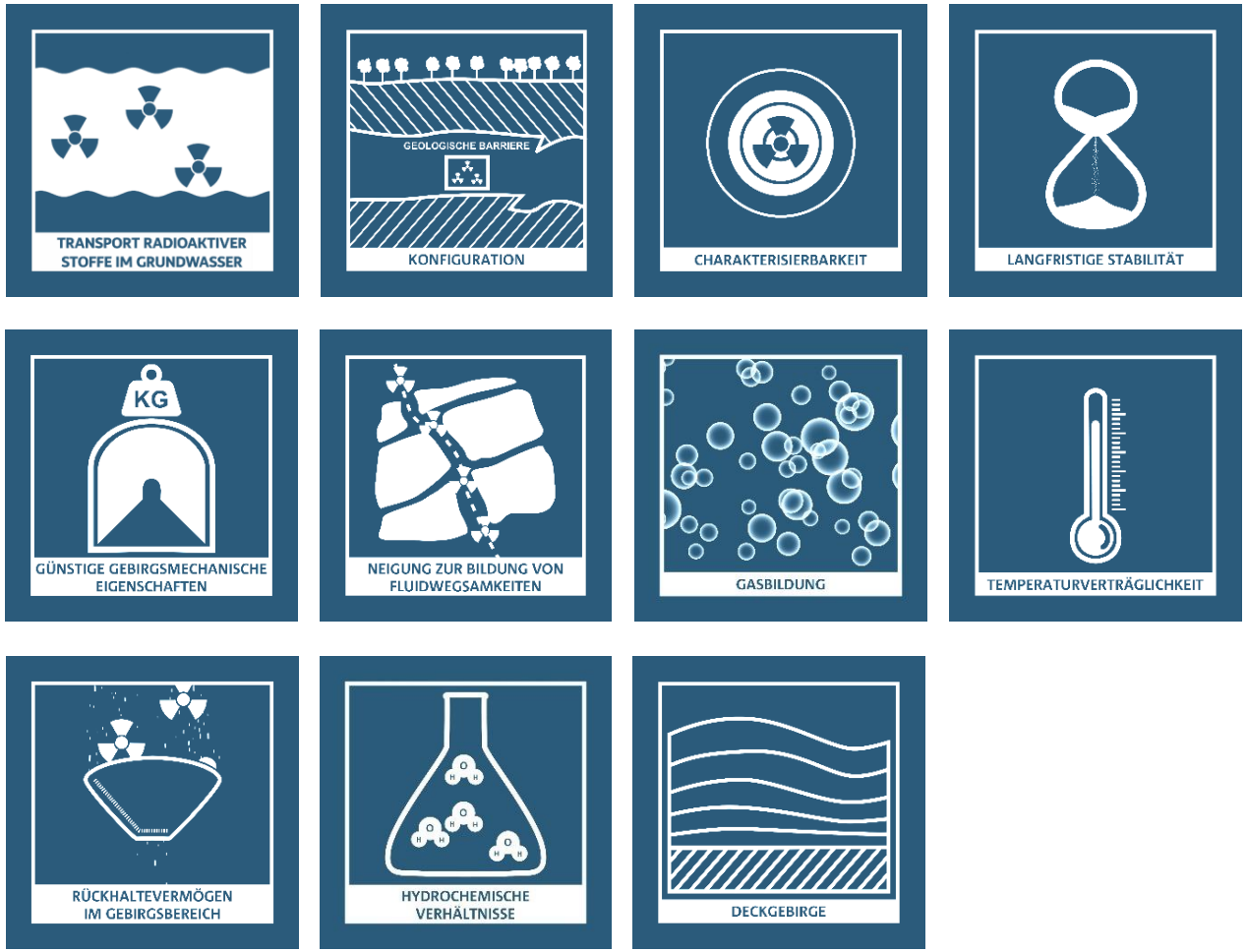
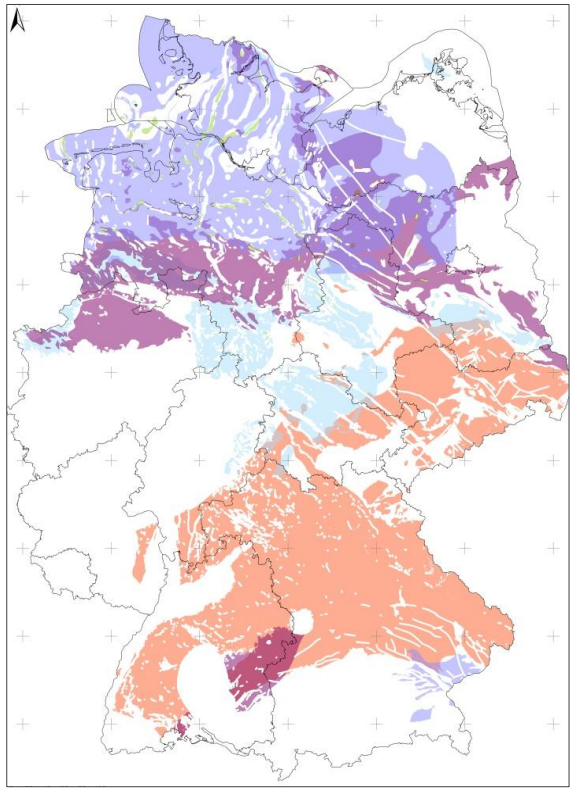
Site Selection Procedure

Geoscientific weighing criteria (section 24, StandAG)





Interim report (BGE 2020)

- Claystone
- Crystalline host rock
- Steep rock salt formations
- Stratiform rock salt formations

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Site Selection Procedure

Planning-scientific weighing criteria (section 25, StandAG)

Weighting class 1

Distance to existing construction residential and mixed areas

Emissions (e.g., noise, pollutants)

Shallow drinking groundwater resources

Floodplains / flooding areas

Weighting class 2

Nature reserves and protected areas according to sections 23 and 32 of the Federal Nature Conservation Act

Important cultural assets

Deep drinking groundwater resources

Weighting class 3

Installations that are subject to the 12th ordinance implementing the Federal Immission Control Act

Mining of mineral resources, including fracking

Geothermal use of the subsurface

Use of the subsurface as underground storage (compressed air, CO_2 injection, gas)

Stronger — **WEIGHTING** — **Weaker**

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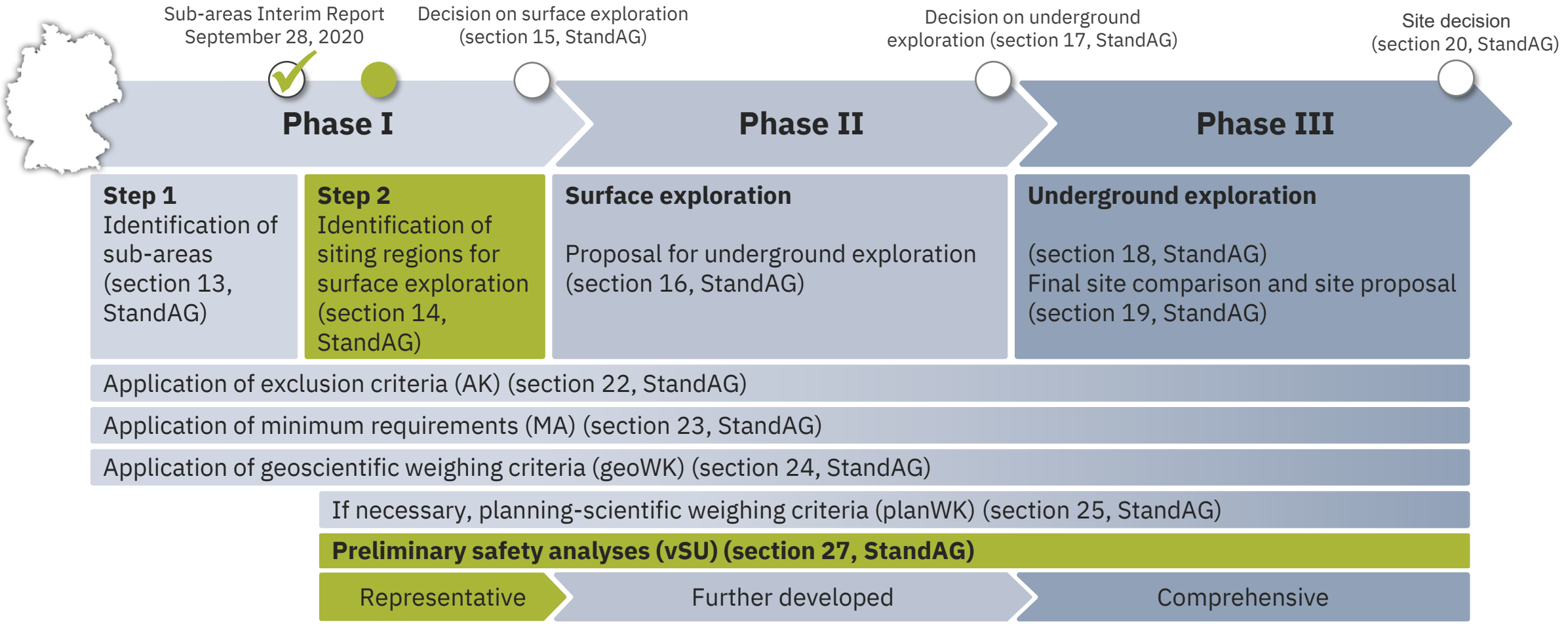
Site Selection Procedure

Sequence of procedure steps



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Representative preliminary safety analyses (rvSU)

03

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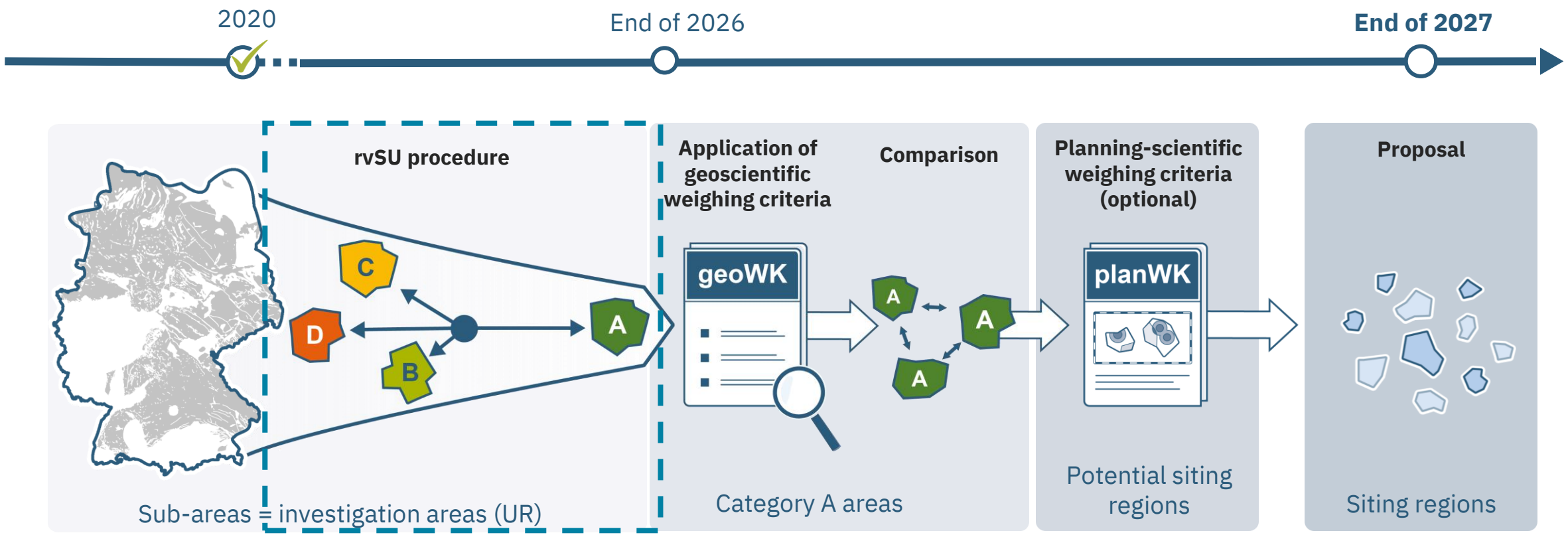
From sub-areas to siting regions



- **Each area** is **systematically reviewed** and **evaluated** based on **defined criteria**
- Submission of **proposal for siting regions for surface exploration** at the **end of 2027**

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Building blocks of rvSU

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For each UR (section 3)

Section 5
Geosynthesis

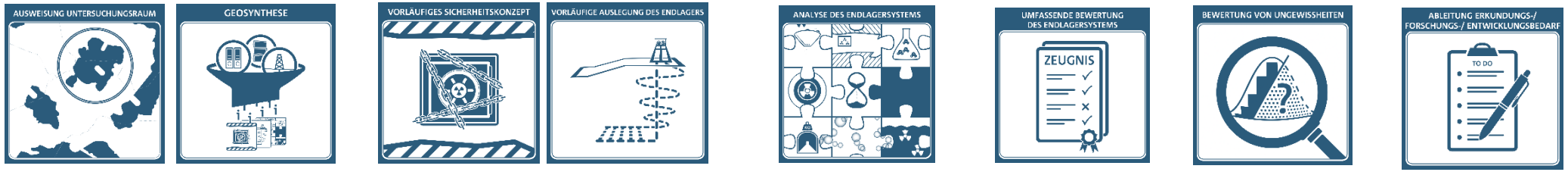
Section 6
Preliminary **safety concept**; preliminary **design** of repository; **optimization** of repository system

Section 7
Analysis of repository system

Section 10
Comprehensive **evaluation** of repository system

Section 11
Evaluation of **uncertainties**

Section 12
Derivation of **exploration, research** and **development** requirements



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Procedure of rvSU

Step 1	Step 2	Step 3	Sub-step 4a	Sub-step 4b
Targeted application of AK and MA	Qualitative safety-oriented suitability testing of the repository system	Compliance with specific limits for mass and substance discharge	Area-specific narrowing down to the areas with largest safety reserves	Testing and evaluation of the suitability level regarding safety and robustness
AK not fulfilled, MA fulfilled	**Predominantly rated well**	**Limits are observed**	**Better suited than other areas within the UR**	**Best suitability**

Category D
Unsuitable

Category C
Unsuitable or low suitability

Category B
Good suitability

Category A
Best suitable

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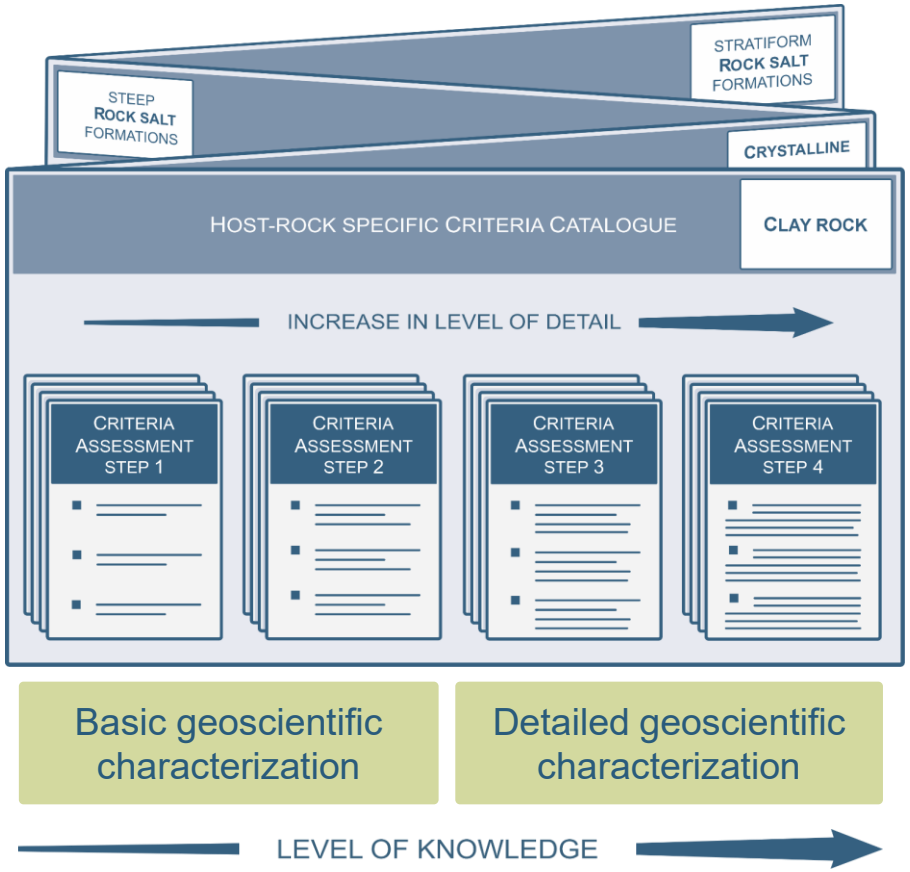
Criteria-based evaluation

Catalogue of safety-oriented criteria



The criteria are becoming **increasingly detailed**,

"the hurdle is getting higher"

Host-rock-specific criteria catalogue

- The **criteria** for performing each assessment step are specified in the **criteria catalogue**
- Each criterion is assigned to a **main category**
- Safety-related aspects can be evaluated **across multiple test steps**

Four successive assessment steps

- **Different criteria** for different assessment steps
- Adaptation of criteria to **data availability**

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rvSU criteria – Thresholds

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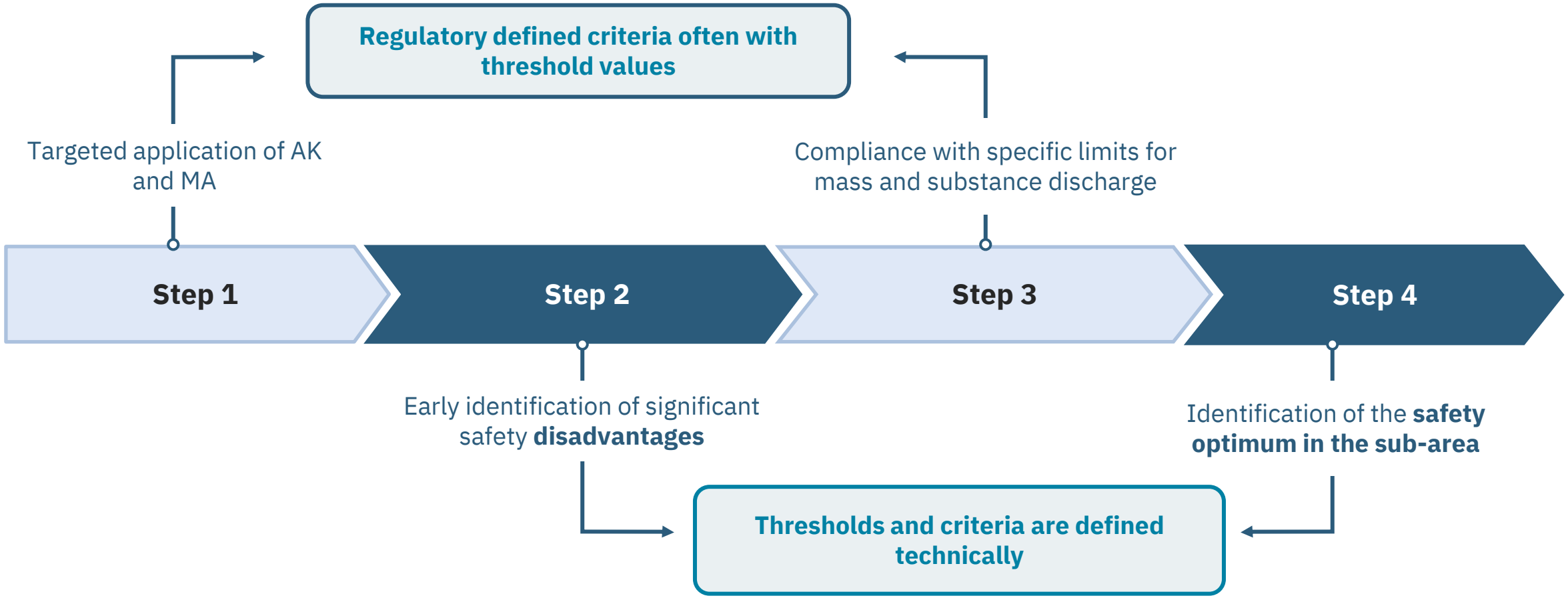

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rvSU criteria – Which aspects are checked?

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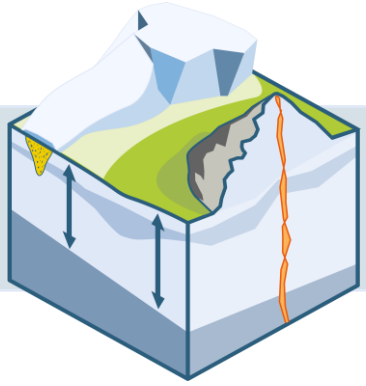
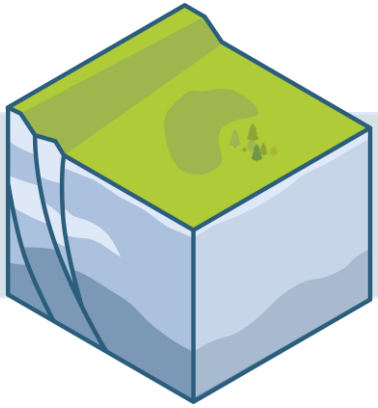


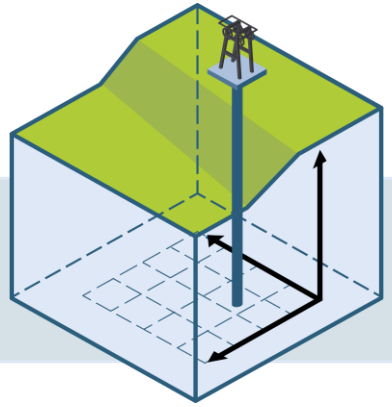
Main categories

1. Long-term stability and integrity (maintenance of barrier effect)

2. Containment properties of the host rock



3. Spatial characterization and reliability of the safety statement



4. Operational reliability and technical feasibility

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Increasing level of detail – Example 1 (1/4)

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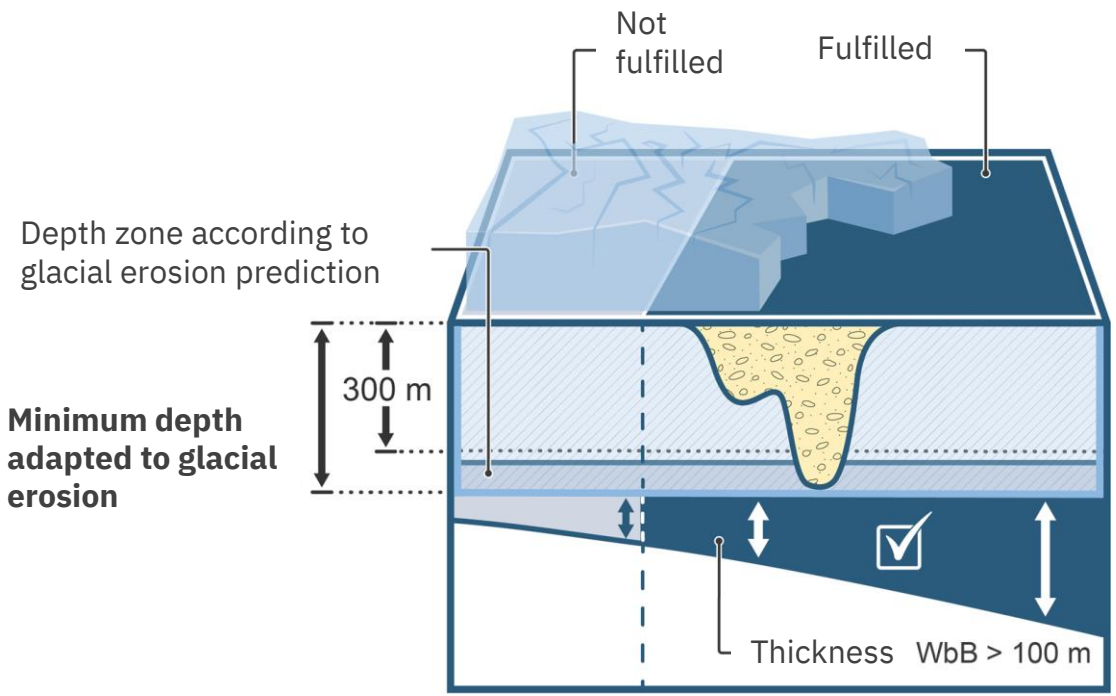
Safety-relevant aspect

Step 1 → **Step 2** → **Step 3** → **Step 4**

Example:
Glacial erosion
(for main category 1 “Long-term stability and integrity”)

rvSU criterion
Minimum depth

→ Depth of influence of glacial overdeepenings can reach deeper than the legally prescribed minimum depth of 300 m



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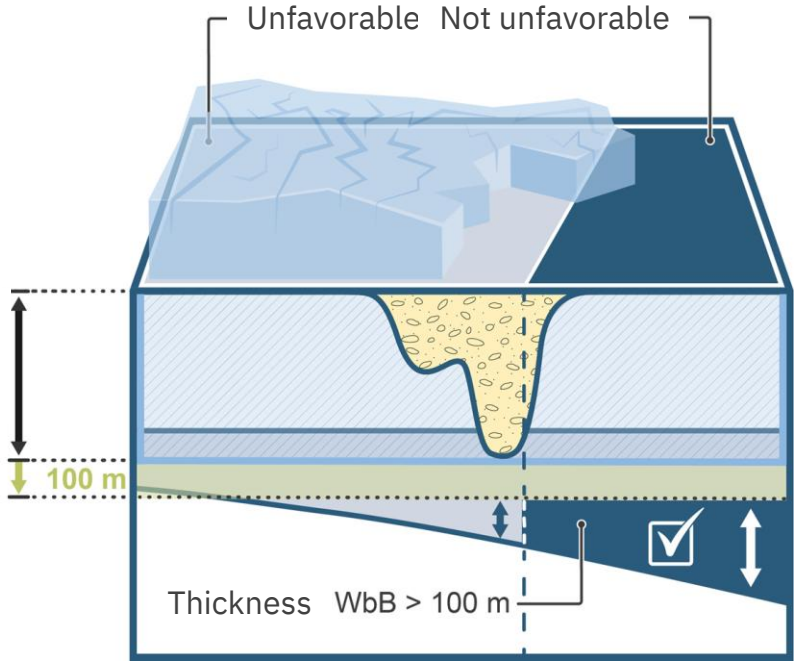
Increasing level of detail – Example 1 (2/4)

BUNDESGESELLSCHAFT FÜR ENDLAGERUNG

Safety-relevant aspect	Step 1	Step 2	Step 3	Step 4

Example:
Glacial erosion
(for main category 1 "Long-term stability and integrity")

rvSU criterion
Unfavorable depth in areas with glacial overprint



→ In addition to "minimum depth" criterion from Step 1, a further safety margin of 100 m with regard to subglacial erosion is applied in Step 2

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Increasing level of detail – Example 1 (3/4)

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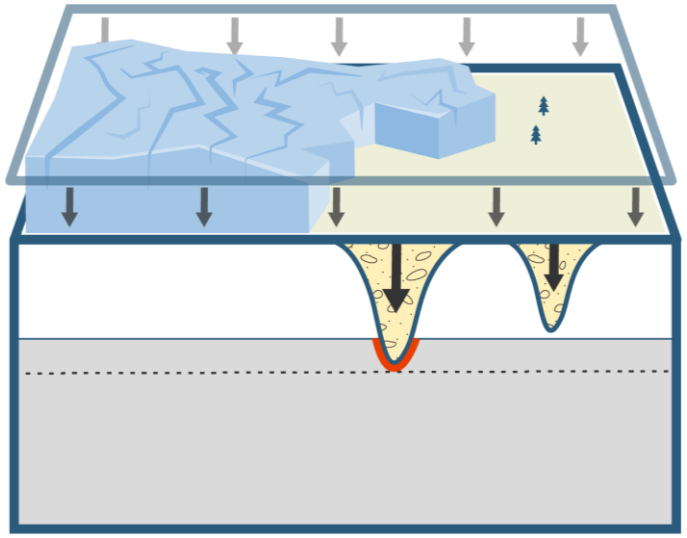
Safety-relevant aspect

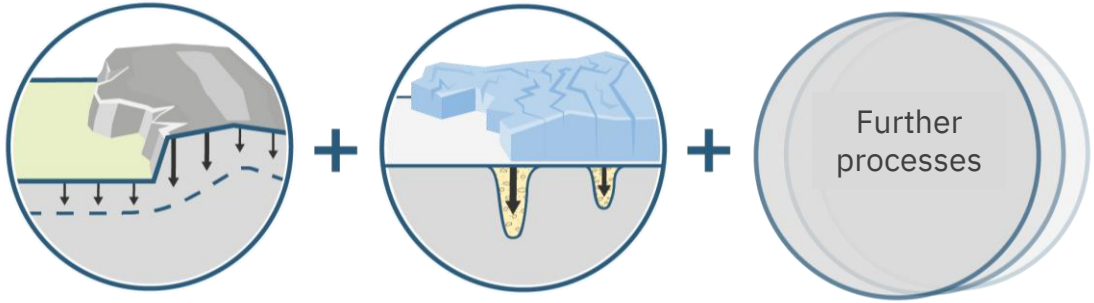
Step 1 → **Step 2** → **Step 3** → **Step 4**

EVENT method

Example:
Glacial erosion
(for main category 1 “Long-term stability and integrity”)



→ Consideration of processes and interactions within the evaluation period



E.g., erosion

E.g., subglacial tunnel valley formation

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Increasing level of detail – Example 1 (4/4)

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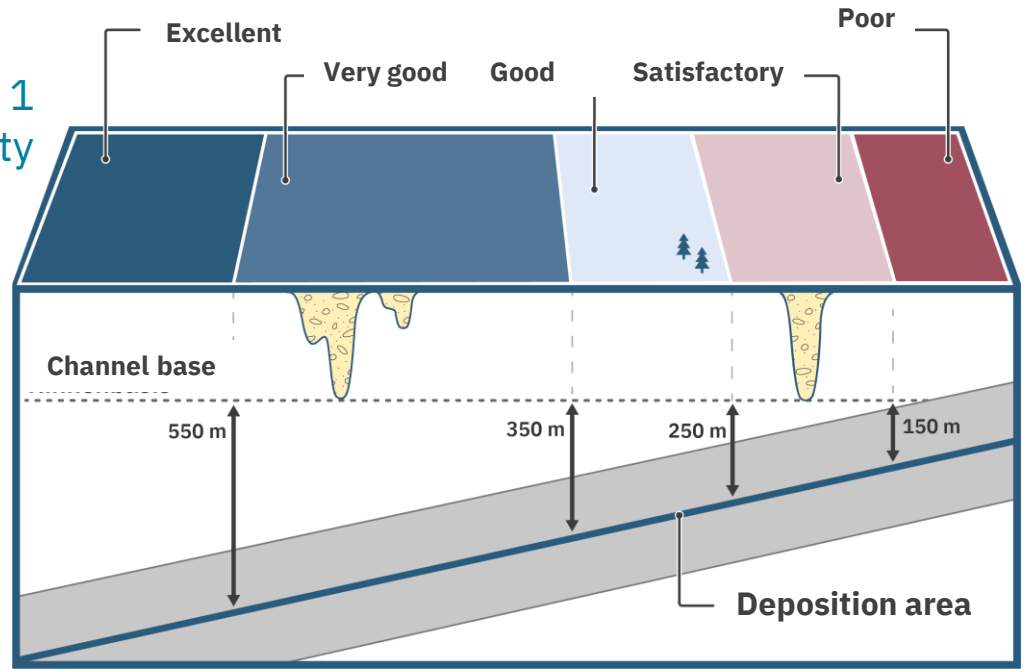
Safety-relevant aspect	Step 1	Step 2	Step 3	Step 4

Example:
Glacial erosion
(for main category 1 “Long-term stability and integrity”)



rvSU criterion
Depth regarding the influence of glacial processes

- Assessment of distance between base of subglacial channels and deposition area
- Assessment of safety margins

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Current status of rvSU

04

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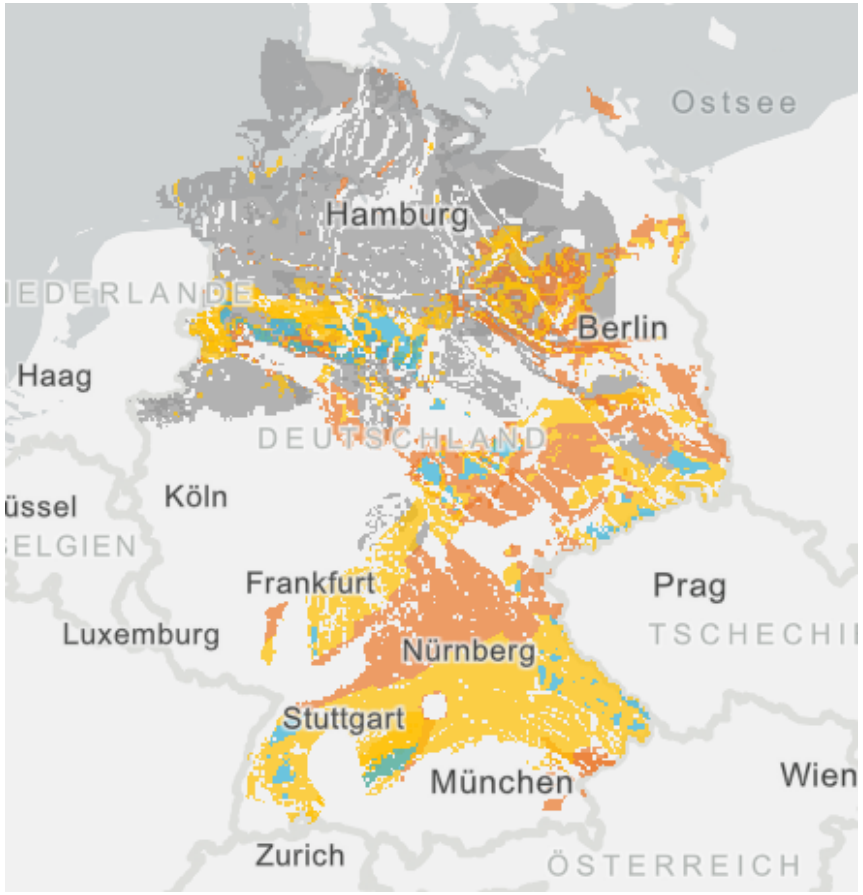
Last published rvSU status of work

Published November 04, 2025



Legend

Sub-areas: preliminary status

Current status of the representative preliminary safety analyses (rvSU)

- Category C
- Category D
- rvSU Steps 1 and 2 still in progress
- rvSU Steps 1 and 2 passed

BGE Repository Search Navigator

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Work progress summary from 2020 to 2026

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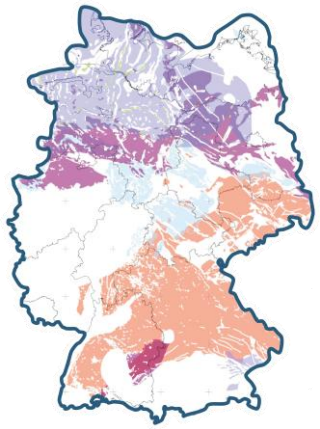
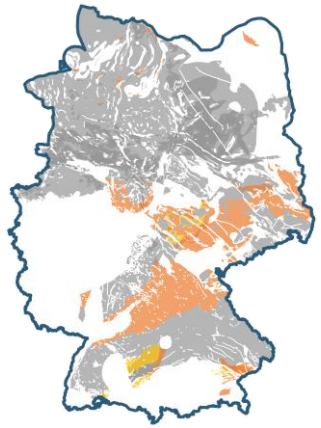
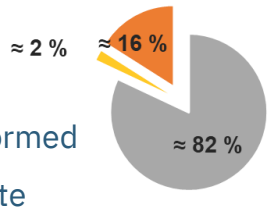
2020 | 2024 | 2025 | 2026 | 2027

Publication of **interim report (BGE 2020)**

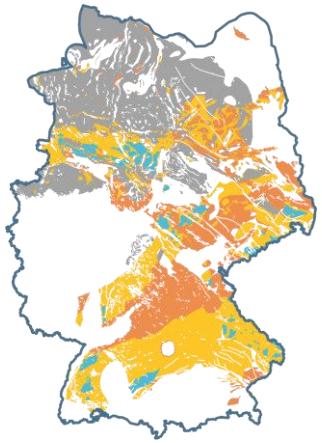


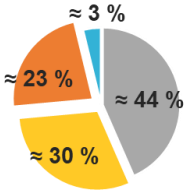
Publication of **rvSU status 2024**





Publication of **rvSU status 2025**

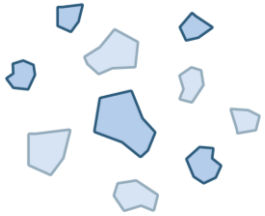




Publication of **rvSU status 2026** (planned 27.10.2026)

Expected with areas of **Category B**

Proposal for **siting regions**



Category D | Category C

Steps 1 and 2 of the rvSU still to be performed

Steps 1 and 2 of the rvSU mostly complete

% relative to the cumulative area of the sub-areas

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Lessons learned

05

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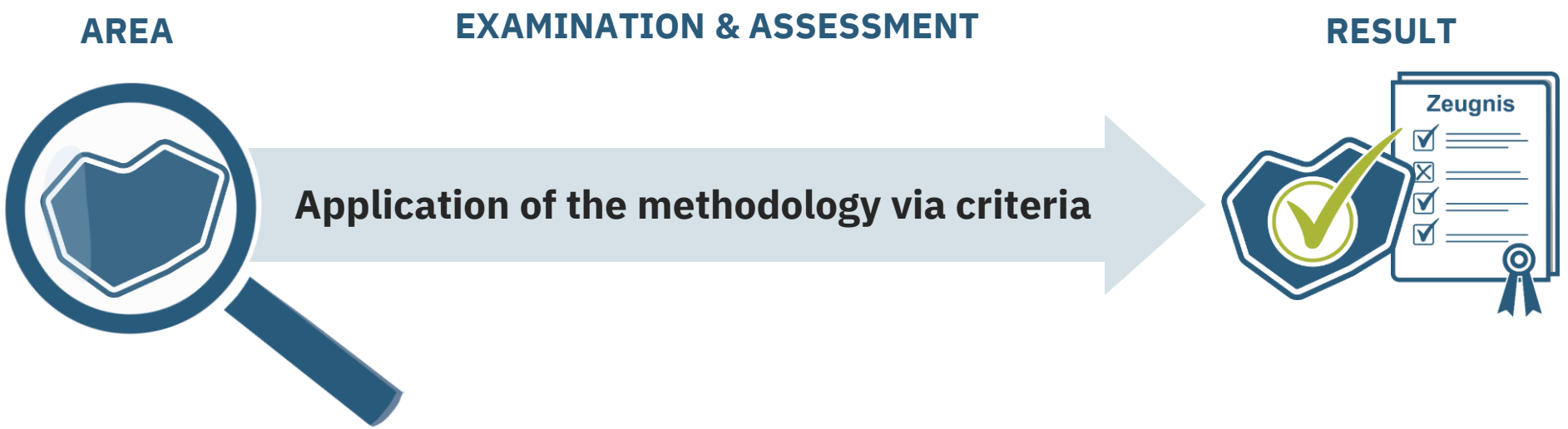
Lessons learned (1/2)



- **rvSU criteria** with **thresholds** are either **defined by regulations** or are **developed by BGE** based on the regulatory framework
- **rvSU criteria** lead to an **increasingly detailed analysis** of the area, with thresholds becoming stricter as the suitability of areas increases
- **rvSU criteria** lead to a **transparent narrowing down** and **evaluation** of areas. Ultimately, areas with the **highest safety reserves** are identified

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Lessons learned (2/2)

- **Requirements and regulations** laid down in the Site Selection Act provide **systematic** and **robust framework** for **Site Selection Procedure**

However

- **“Generic” host rock-independent criteria** defined in the Site Selection Act **need to be specified** to **adequately narrow-down areas to siting regions**
- **Specific, host rock-dependent criteria** for preliminary safety assessments had to be **defined by BGE**

➢ Development of **methodology** for **final comparison** between areas within different host rocks is **needed** and is **in progress**

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Abbreviations

AK	*Ausschlusskriterien* – Exclusion criteria
BGE	*Bundesgesellschaft für Endlagerung mbH* – German Federal Company for Radioactive Waste Disposal
EndlSiUntV	*Endlagersicherheitsuntersuchungsverordnung* – Repository Safety Investigation Ordinance
EndlSiAnfV	*Endlagersicherheitsanforderungsverordnung* – Repository Safety Requirements Ordinance
geoWK	*geowissenschaftliche Abwägungskriterien* – Geoscientific weighing criteria
MA	*Mindestanforderungen* – Minimum requirements
NWTRB	Nuclear Waste Technical Review Board
planWK	*planungswissenschaftliche Abwägungskriterien* – Planning-scientific weighing criteria
rvSU	*Repräsentative vorläufige Sicherheitsuntersuchungen* – Representative preliminary safety analyses
StandAG	*Standortauswahlgesetz* – Repository Site Selection Act
UR	*Untersuchungsraum* – Investigation areas

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Literature

- BGE (2020): Zwischenbericht Teilgebiete gemäß § 13 StandAG (Stand: 28.09.2020). Peine: Bundesgesellschaft für Endlagerung mbH. https://www.bge.de/fileadmin/user_upload/Standortsuche/Wesentliche_Unterlagen/Zwischenbericht_Teilgebiete/Zwischenbericht_Teilgebiete_barrierefrei.pdf
- EndlSiAnfV: Endlagersicherheitsanforderungsverordnung vom 6. Oktober 2020 (BGBl. I S. 2094)
- EndlSiUntV: Endlagersicherheitsuntersuchungsverordnung vom 6. Oktober 2020 (BGBl. I S. 2094, 2103)
- StandAG: Site Selection Act - Standortauswahlgesetz vom 5. Mai 2017 (BGBl. I S. 1074), das zuletzt durch Artikel 8 des Gesetzes vom 22. März 2023 (BGBl. 2023 I Nr. 88) geändert worden ist

Thank you for your attention!
Would you like to read more about it?

BUNDESGESELLSCHAFT FÜR ENDLAGERUNG

Sub-areas Interim Report with all documents and annexes

Interactive map with all sub-areas and excluded areas

Interactive introduction to the preparation of the Sub-areas Interim Report

Fact sheets of areas for methodological development

Work progress methodology of representative preliminary safety analyses

NBG report on methodological development

Work progress methodology of planning-scientific weighing criteria

Approach to identification of siting regions in the sub-areas

Statements and expert classifications of BGE

Your questions and our answers

BGE Repository Search Navigator

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