

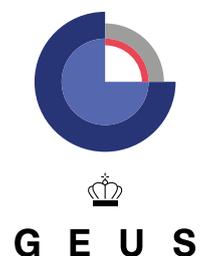
# Guideline to Core and Sample Handling at GEUS

Department of Geoenergy and Storage

March 2026

GEOLOGICAL SURVEY OF DENMARK AND GREENLAND

DANISH MINISTRY OF CLIMATE, ENERGY AND UTILITIES



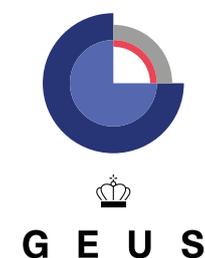
# Guideline to Core and Sample Handling at GEUS

Department of Geoenergy and Storage

March 2026

GEOLOGICAL SURVEY OF DENMARK AND GREENLAND

DANISH MINISTRY OF CLIMATE, ENERGY AND UTILITIES



## **Table of Contents**

1. Introduction and Scope
2. GEUS Reference Framework
3. General Principles for Core Handling
4. Core Slabbing and Inspection Sections
5. Core Preservation – General Requirements
6. Special Considerations for Saline Aquifers
7. Sidewall Cores and Drill Cuttings
8. Delivery of Material to the GEUS Core Store
9. Operator Checklist for Delivery

## 1. Introduction and Scope

These GEUS guidelines on core handling, preservation, transport, and storage are prepared in accordance with the *Executive Order on Submission of Samples and Other Information about the Danish Subsoil* and the *Guidelines for Drilling and Well Operations Onshore Denmark (2024)* issued by the Danish Energy Agency (DEA).

These guidelines refer to the Danish Subsoil Act (Consolidated Act No. 1461 of 29 November 2023) with reference to the § 34 Executive Order (Executive Order No. 543 of 22 May 2025).

Pursuant to the Subsoil Act and associated executive orders, license holders are required to submit physical samples and related information obtained during subsurface activities to the Danish Energy Agency and the Geological Survey of Denmark and Greenland (GEUS). GEUS is responsible for the long-term storage, documentation, and management of physical samples in support of national subsurface knowledge and future use.

**These GEUS guidelines provide a technical elaboration of, and practical guidance for compliance with, the requirements set out by the Danish Energy Agency regarding submission of samples and subsurface information.**

The purpose of the present GEUS guidelines is to:

- clarify expectations related specifically to core material, sidewall cores, drill cuttings, and formation fluids,
- support operators in planning drilling, sampling, preservation, and logistics activities,
- ensure that material delivered to GEUS is suitable for long-term archiving and future scientific and regulatory use.

These guidelines supplement the DEA's regulatory framework and do not replace operator obligations under applicable legislation.

The guidelines apply to material acquired during onshore drilling activities in Denmark, including exploration, appraisal and production wells for geothermal energy, CO<sub>2</sub> storage (CCS), hydrogen, compressed air, and any other subsurface uses covered by the Subsoil Act.

GEUS' role is to receive, curate, and archive material in a condition that preserves its physical and chemical integrity over decades. Detailed planning and execution of drilling, sampling, preservation techniques, and transport arrangements remain the responsibility of the operator.

## **2. GEUS Reference Framework**

GEUS' approach to sample handling and preservation is aligned with *Core Analysis – A Best Practice Guide* (McPhee et al., 2015), which provides internationally recognised best practices for the collection, handling, preservation, and documentation of core material.

GEUS' recommendations further build on Danish Energy Agency guidelines for drilling, well operations, and submission of subsurface samples, with emphasis on long-term archiving and re-use.

### **3. General Principles for Sample Handling**

All subsurface samples shall be handled in a manner that:

- ensures correct depth and orientation labelling,
- preserves physical integrity and original fabric,
- minimises drying, oxidation, and mechanical damage,
- ensures suitability for long-term storage and future re-analysis,
- allows visual inspection and representative sampling without unnecessary destruction.

Sample handling procedures shall be planned as part of the drilling and sampling programme submitted to the Danish Energy Agency.

## 4. Core Slabbing and Inspection Sections

After recovery and initial on-site documentation, full-diameter cores shall be slabbed in accordance with established good industry practice and with due regard to the objectives of long-term archiving and future re-use.

GEUS recommends that full-diameter cores are cut into **one-metre-long sections** prior to slabbing, unless otherwise technically justified. Each section shall be clearly and permanently marked to indicate orientation.

### 4.1 Orientation Marking

Orientation shall be indicated using continuous colour-coded lines along the core length. GEUS recommends the use of one continuous red line and one continuous black line, applied such that the red line is positioned on the right-hand side black line on the left-hand side. when the core is oriented “up” (top depth facing upwards). Orientation markings shall be maintained throughout slabbing, preservation, and packaging.

### 4.2 Slabbing Procedure and Layout

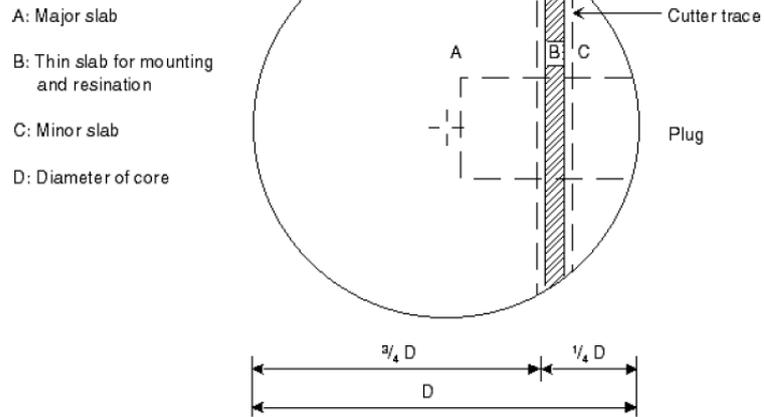
For each one-metre core section, eccentric longitudinal slabbing shall be applied, producing:

- one longitudinal inspection slab (archive/inspection slab – core part B in Figure 1), and
- one or more remaining core fractions available for analysis and sampling (core part A and C in Figure 1).

The inspection slab (section B in Figure 1) shall be continuous along the full length of the core section, representative of the original core fabric, permanently mounted (e.g. epoxy-bonded in trays or on boards), and suitable for repeated visual inspection, photography, and non-destructive analysis.

Depending on the project slabbing may be done before or after core plugging.

### Longitudinal slabbing of core



**Figure 1** The recommended slabbing and preservation layout, ensuring that a permanent visual reference of the core is preserved even if remaining core material is later sampled or consumed.

## 5. Core Preservation – General Requirements

The purpose of preserved core sections is to maintain selected intervals in a condition as close as possible to in-situ physical and chemical conditions, suitable for long-term storage and future re-analysis.

GEUS' position is that approximately **10% of the total recovered core length** shall be preserved as intact whole-core sections, unless otherwise agreed. Preserved sections shall be representative of key lithologies, facies, and intervals of interest, clearly documented and listed upon delivery, and preserved as early as possible after core recovery i.e. before the main work on the cores such as plugging and slapping.

### 5.1 Plug Sampling

Plug sampling frequency shall be adapted to lithological variability and project objectives. As a general guideline, sampling is typically recommended at a frequency of **approximately one sample per foot of core**, unless otherwise technically justified.

Standard plug diameters are typically **1 inch** or **1½ inch**. Where relevant, drilled but unused plugs shall be preserved (e.g. wax sealed) to minimise drying, oxidation, or fluid loss.

GEUS recommends extracting, where feasible:

- at least one plug parallel to bedding (horizontal), and
- at least one plug perpendicular to bedding (vertical), in order to capture directional anisotropy in petrophysical and transport properties.

All plug locations, orientations, dimensions, preservation status, and preparation steps shall be clearly documented.

## 6. Special Considerations for Saline Aquifers Projects

For cores and derived samples from saline aquifers projects, additional considerations apply due to the high salinity of formation brines and the sensitivity of pore-scale properties.

Inspection slab preparation shall take into account potential salt precipitation and redistribution during drying. Preparation procedures should minimise artificial salt growth on slab surfaces that could obscure primary textures or fractures. Where technically justified, controlled removal of excess salts under carefully controlled conditions may be considered prior to embedding. Any such preparation steps shall be documented.

For saline aquifer-related cores, GEUS specifically recommends **wax sealing (wax impregnation)** of intact preserved core sections, as this method effectively limits evaporation and preserves pore fluids over long storage periods.

### 6.1 Plugging Fluids and Cleaning

For mudrocks and clay-bearing sandstones, plugging fluids should be selected to minimise clay swelling and chemical incompatibility.

- Where formation water composition is known, **brine or synthetic formation water** is recommended.
- Where formation water composition is unknown or incompatibility is expected, **oil** (e.g. depolarised kerosene, base oil, or mineral oil) or may be used.

Low-temperature cleaning methods, such as **cold solvent extraction**, are recommended. High-temperature cleaning methods (e.g. Dean–Stark extraction) are not generally recommended unless specifically justified. All cleaning procedures shall be documented.

## 7. Sidewall Cores and Drill Cuttings

### 7.1 Sidewall Cores

Sidewall cores (percussion or rotary) are subject to the same submission requirements as other core material under the Danish Energy Agency guidelines. They shall be clearly identified by depth and orientation (where available), packaged in airtight and mechanically robust containers, and documented using the same principles as full cores.

Remaining sidewall core material after analysis shall be returned to GEUS as soon as practicable, in compliance with the one-year deadline set out in § 15(2) of the § 34 Executive Order, unless otherwise agreed.

### 7.2 Drill Cuttings

Drill cuttings shall be collected and submitted in accordance with the requirements set out by the Danish Energy Agency.

In accordance with these requirements, **two cuttings fractions shall be collected and submitted:**

1. **Washed and dried cuttings**, where drilling mud and fines have been removed, intended primarily for lithological description and stratigraphic interpretation.
2. **Unwashed (wet) cuttings**, retained without washing, preserving drilling mud, fines, and adhered material for potential future analytical use.

Both fractions **shall be sampled at the same depth intervals as the cuttings collected for the license holder's own use.**

As part of good practice, GEUS expects that:

- sufficient sample volumes are retained to allow geological description and long-term reference,
- washed and unwashed fractions are clearly distinguished,
- all samples are clearly labelled with borehole ID, depth interval, sampling date, and fraction type.

The applied washing, drying, and handling procedures shall be documented.

GEUS notes that cuttings provide a complementary dataset to core material; however, cores remain the primary archive material.

## 8. Delivery of Material to the GEUS Core Store

This section defines operator responsibilities related to packaging, documentation, transport, and delivery of core material, cuttings, and associated well samples in compliance with the one-year deadline set out in § 15(2) of the § 34 Executive Order, unless otherwise agreed.

### 8.1 Packaging, Core Length, and Pallet Compatibility

The GEUS Core Store uses standard European pallets (1.20 × 0.80 m). To ensure compatibility with storage systems and allow for potential expansion of certain lithologies during drying, GEUS recommends that core sections do not exceed **1.10 m in length**.

Core boxes shall:

- fit securely on EUR-pallets,
- be stackable in a stable manner,
- protect material against mechanical damage during transport and storage.

Core material should not be placed tightly against box ends, as certain lithologies (e.g. clay-rich cores) may expand slightly during drying.

### 8.2 Use of Original Core Boxes

Where cores are delivered in packaging compatible with EUR-pallet dimensions and stacked in a stable manner, GEUS accepts storage in original core boxes or packaging. Repacking will only be undertaken where strictly necessary.

### 8.3 Formation and Production Fluids

Liquid samples (brine, formation water, test fluids) shall be transported under **cooled conditions**, typically **4–8 °C**, unless otherwise technically justified. Cooled transport is intended to limit chemical alteration, reduce biological activity, and preserve dissolved components prior to analysis and archiving.

Samples shall be packed in tight, chemically compatible containers. Upon receipt, liquid samples are stored under cooled conditions at GEUS, depending on sample type and intended use.

Samples shall be packed in tight, chemically compatible containers with secure closure and appropriate secondary containment.

Upon receipt, liquid samples are stored under cooled conditions at GEUS, depending on sample type and intended use.

As a standard reference solution (unless otherwise agreed), GEUS recommends submitting:

- **Two 1-litre samples**
- In tight, chemically compatible, wide-mouth containers (e.g. HDPE)
- With secondary containment
- With durable labelling including:
  - Well ID
  - Depth or test interval
  - Date/time
  - Test type
  - Reason for sampling

Basic fluid metadata (test conditions, sampling method, and relevant chemical information if available) shall accompany the delivery.

#### 8.4 Gas/pressurised samples

Gas samples and other pressurised samples shall be handled and transported in accordance with applicable safety and dangerous goods regulations.

The operator is responsible for:

- compliance with ADR and relevant transport legislation,
- use of approved pressure-rated containers,
- appropriate labelling and hazard identification.

Prior to shipment, the operator shall coordinate with GEUS regarding:

- sample type,
- container specification,
- expected pressure and composition,
- storage requirements.

Where technically feasible, duplicate samples are recommended.

GEUS reserves the right to decline receipt of pressurised samples that do not comply with safety requirements.

## 8.5 Cuttings Samples

Drill cuttings shall be collected and submitted in accordance with the requirements set out by the Danish Energy Agency.

In accordance with these requirements:

**Two cuttings fractions shall be collected and submitted:**

- Washed and dried cuttings
- Unwashed (wet) cuttings

Both fractions shall be sampled at the same depth intervals as the cuttings collected for the license holder's own use.

GEUS expects that:

- sufficient sample volumes are retained to allow geological description and long-term reference,
- washed and unwashed fractions are clearly distinguished,
- samples are clearly labelled with well ID, depth interval, sampling date, and fraction type.

The applied washing, drying, and handling procedures shall be documented.

Cuttings shall be packaged to prevent cross-contamination, moisture loss (for wet samples), and mechanical loss of material during transport.

## 8.6 Drilling Fluid (Mud) Samples

**In exploratory drilling, drilling fluid samples shall be taken from the inlet side of the active mud system:**

- whenever a qualitative change in additives occurs,
- prior to production testing,
- and at least for every 300 m drilled.

Sample quantities and packaging shall be aligned with GEUS beforehand.

As a standard reference solution (unless otherwise agreed), GEUS recommends submitting:

- **Two 1-litre sub-samples**
- In tight, chemically compatible, wide-mouth containers (e.g. HDPE)
- With secondary containment
- Clearly labelled with:
  - Well ID
  - Depth (or drilled depth at time of sampling)
  - Date/time
  - Mud type (e.g. WBM, OBM)
  - “Inlet side”
  - Reason for sampling (300 m interval or additive change)

Basic mud metadata (mud type and additive information) shall accompany the delivery.

Drilling fluid samples are normally transported at ambient temperature unless otherwise agreed.

#### 8.7 Prepared Samples (Thin Sections, Slides, Polished Sections, Plugs, etc.)

**Prepared samples derived from core or cuttings (e.g. thin sections, polished sections, grain mounts, SEM stubs, CT-derived materials) shall be submitted where required under applicable regulations or where agreed with GEUS.**

Such samples shall:

- be clearly labelled with well ID, depth, and sample ID,
- be accompanied by preparation documentation,
- include information on laboratory, preparation method, and orientation (where relevant).

Prepared samples shall be packed to prevent breakage, abrasion, or surface damage.

## 8.8 Documentation and Metadata Requirements

Operators shall provide a complete inventory of submitted material, including:

- core inventory (depths, recovery, box numbers),
- preserved core sections,
- plug sampling records,
- cleaning procedures,
- cuttings processing description,
- fluid and mud sampling records,
- analyses performed.

Documentation shall include methods applied, laboratories involved, and unique sample identifiers.

## 9. Operator Checklist for Delivery

Operators shall confirm compliance with the following prior to delivery:

1. Pre-delivery documentation completed.
2. Appropriate packaging and labelling applied.
3. Preserved core sections identified and listed.
4. Core length and pallet compatibility ensured.
5. Required cuttings fractions (washed/dried and wet) identified and labelled.
6. Fluid samples packaged and cooled as required.
7. Mud samples collected and documented in accordance with regulatory requirements.
8. Gas/pressurised samples compliant with transport regulations.
9. Transport arranged using qualified carriers.
10. Delivery coordinated with GEUS and receipt acknowledged. Contact to GEUS CoreStore: [corestore@geus.dk](mailto:corestore@geus.dk)

## References

McPhee, C., Reed, J., Zubizarreta, I. 2015. Core Analyses, A Best Practice Guide. Developments in Petroleum Science, Elsevier, 829p.



Danish Ministry of Climate,  
Energy and Utilities

Geological survey of  
Denmark and Greenland (GEUS)

Øster Voldgade 10  
DK-1350 Copenhagen K  
Denmark

GEUS is a research and advisory  
institution in the Danish Ministry  
of Climate, Energy and Utilities