

Tender

Closure planner

Specification of services

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1. General starting situation

In line with international practice, the Swiss waste management concept calls for the deep geological disposal of radioactive waste. The Federal Council approved the “Sectoral Plan for Deep Geological Repositories” (SGT; *Sachplan geologische Tiefenlager*) in 2008; this specifies the procedure for selecting geological siting regions.

In Stage 3 of the SGT, the three siting regions remaining in the process (Jura Ost (JO), Nördlich Lägern (NL) and Zürich Nordost (ZNO)) will be investigated in depth and site-specific geological knowledge will be supplemented with further geoscientific investigations (3D seismics, deep boreholes). The waste producers are expected to announce the selection of the site for the general licence application (ASR, *Auswahl Standort für die Vorbereitung des Rahmenbewilligungsgesuchs*) in 2022. This decision is underpinned by a safety-based comparison of the siting regions, taking into consideration in-depth geological knowledge and the further concretisation of the site-specific surface infrastructure working together with the regions and the siting Cantons. The decision will also specify whether two separate repositories (i.e. one for low- and intermediate-level waste (L/ILW) and one for high-level waste (HLW)) will be planned at two locations or a combined repository at one location. Based on this, the corresponding general licence application (RBG, *Rahmenbewilligungsgesuch*) and the first stage of the environmental impact report (UVB, *Umweltverträglichkeitsbericht*) will be prepared and are expected to be submitted in 2024.

Nagra will conduct all the work required for submitting the RBG within the framework of the overall project “Stage 3 of the Sectoral Plan/General licence application (SGT-E3/RBG, GP E3)”. The main project “Facilities, Operation, Spatial and Environmental Planning” (HP ABU, *Hauptprojekt Anlagen, Betrieb, Raum- und Umweltplanung*), under which this contract is awarded, is part of the overall project and provides part of the technical basis required for the ASR and RBG. This includes

- stage-appropriate planning of the repository projects
- designation of the surface infrastructure based on the cooperation with the regions and Cantons (concretisation of the repository projects at the surface)
- presentation of the aspects that are relevant for decision-making for the ASR in terms of concepts for operation, facilities, realisation and closure, as well as for the technology and implementation of the engineered barriers
- clarification of the spatial and environmental impacts (incl. Stage 1 of the UVB)
- systematic analysis of the available flexibility in terms of the layout and placement of the individual components of the deep geological repository
- identification of the uncertainties and risks in terms of engineering feasibility

2. Project starting-point

According to the Nuclear Energy Act (NEA) Article 13 (1c), a general licence can be issued *when a concept is available for the monitoring phase and the closure of the installation*. According to NEA Article 37 (1b), for the operating licence it is required to show that *it is possible to retrieve the radioactive waste without undue effort up till closure of the repository*. As retrieval of the waste is closely linked with emplacement and backfilling of the disposal containers, an outline concept has to be developed in the current stage with a view to the general licence but also to participation. The *emplacement of the backfill material, the removal of backfill material for the purpose of potential retrieval of waste packages and the technology for the retrieval of waste packages also have to be tested and their functionality demonstrated* (Nuclear Energy Ordinance (NEO) Article 65).

With a view to the submission of the RBG, the goal in Stage 3 of the Sectoral Plan is therefore to evaluate and further develop the existing concepts for the following aspects, taking into consideration the legal requirements as well as the guidelines of the Swiss Federal Nuclear Safety Inspectorate (ENSI, *Eidgenössisches Nuklearsicherheitsinspektorat*) [1]:

- emplacement of the disposal containers for L/ILW and HLW
- backfilling and sealing of the drifts and caverns, including the selection of suitable materials
- closure of the access structures
- retrieval of disposal containers

In principle, several variants are possible, and conceivable, for emplacement, backfilling, sealing, closure and retrieval. To limit the range of options, the following assumptions are made regarding the overarching boundary conditions for the generic development of the concepts:

- waste scenario: 2b (in accordance with Waste Management Programme 2016 (EP16, *Entsorgungsprogramm*), NTB 16-01, Table 2-1), i.e. 60-year operation of the nuclear power plants (NPPs) and the new Radiological Protection Ordinance (RPO). This waste scenario includes the maximum realistic waste volumes (based on the current status of planning)
- repository type: combined repository
- operating scenario: overlapping emplacement operations over 10 years, total of 20 years of emplacement operations)
- underground test areas: joint for L/ILW and HLW repository sections

These assumptions are in no case to be understood as prior (limiting) decisions. Rather, they were selected to allow simple derivation of potential variants for a deep geological repository.

The underground facilities can be presented in a simplified way in the form of system sketches as in Figure 1.

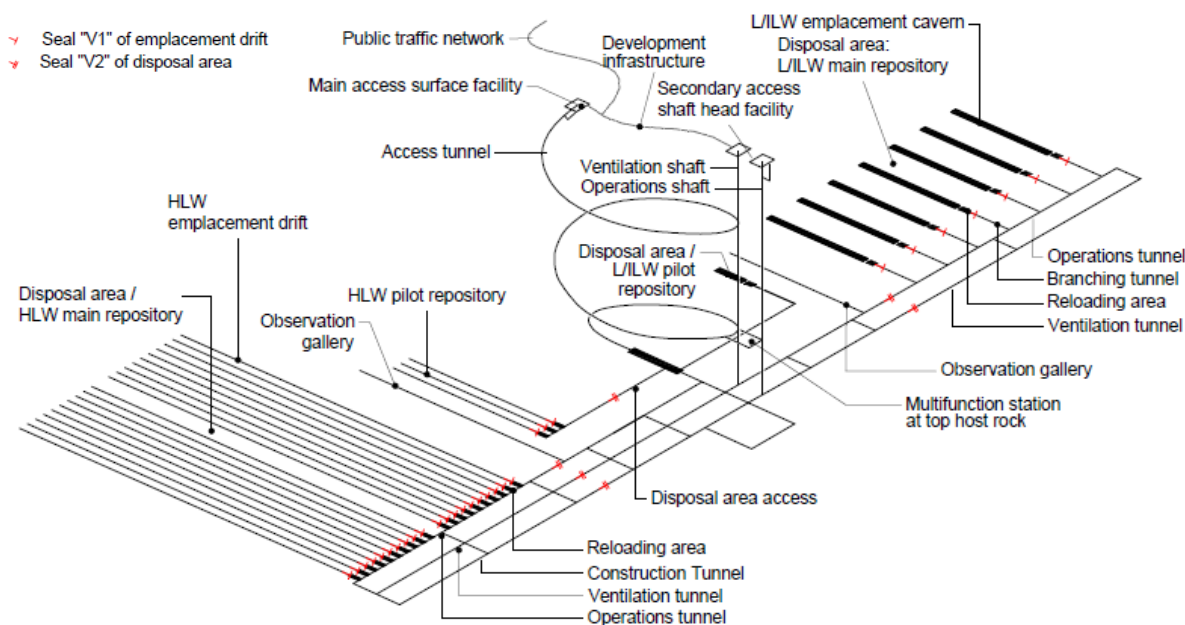


Figure 1: Generic system sketch of the closure system of the combined repository

The activities of the closure planner (VP) are clearly divided from those of the facilities planner (*Anlagenplaner*, AP). It is assumed that the latter is responsible for transport of the waste packages and the closure materials from the surface to below ground. The interface for transport-specific issues is the reloading area for HLW or L/ILW, respectively (i.e. the facilities planner is responsible for the transport

of waste packages and closure materials up to this interface and, from there on, responsibility lies with the closure planner).

3. Purpose and project goals

Within the framework of the tendered contract described here, the relevant site-independent (generic) concepts are to be further developed, evaluated and advanced to the maturity level of a generic preliminary project based on existing concepts for:

- transporting the disposal containers to the emplacement drifts and caverns
- backfilling and sealing of the drifts and caverns, subdivided into:
 - backfilling the emplacement drifts and caverns (so-called “near-field barriers”)
 - backfilling and closing the structures located at disposal level, including seals
- closing the access structures
- the possibility for retrieving the waste packages from backfilled and sealed emplacement drifts.

In addition, the backfilling and sealing materials for the individual underground, repository-type-specific structures will be defined considering the respective long-term safety requirements; the design of the sealing structures and their engineering feasibility also have to be demonstrated.

The results will form the basis for updating the Waste Management Programme (WMP21) and selecting a site, as well as the decision between a combined repository and separate repositories.

Based on milestone MS 3.2 of the ASR, the repository project for the selected site (planning assumption: 1 combined repository) will be further concretised and documented. The corresponding documents underpin the RBG documentation.

Due to the high requirements on the lifetime of the facilities, Nagra will use the planning process for a deep geological repository to test and progressively introduce the Building Information Modelling (BIM) method. BIM optimises the information flow between the external contractors and provides a consistent basis for everyone involved in the project (e.g. data on land-use planning aspects or geology). Nagra wants to use BIM to implement a high-quality planning procedure whose usefulness goes far beyond the planning phase.

4. Project-specific documentation

The key project-specific documents for the closure planner (VP) contract are:

- [1] ENSI (2009): Specific design principles for deep geological repositories and requirements for the safety case. Guideline for Swiss nuclear installations. ENSI-G03 (available in English).
- [2] Selected extracts of: IG GTS (Engineering company ILF / Zerna) (2012): Conceptual study of a combined repository (underground facilities). document number UTA_SUG_ALL_KOML_BE_011
- [3] Selected extract of: NIB 18-016 Deep Geological Repository Closure, May 2019 (available in English)
- [4] Nagra Guideline RL 5.6-01B authors' guidelines for preparing Nagra reports (Nagra work reports, internal reports, technical reports)
- [5] Nagra report template VO SHB-5.6-01A

The documents will be delivered to the bidder as soon as he has provided Nagra with a legally signed declaration of confidentiality (see confidentiality declaration form, data protection; send scan (for examination purposes) to: abu-stab-admin@gpag.ch).

5. Description of services

5.1 Overview

The tasks are divided into the following overarching services packages (SP):

- SP1: overarching services
- SP2: contributions to developing "Repository Projects ASR" for milestone MS 3.2
- SP3: contributions to developing "Repository Project RBG" for milestone MS 3.3
- SP4 (optional): supporting the RBG procedure up to the decision of the Federal Council

5.2 Service packages (SP)

The detailed description of services for each services package with the expected depth of detail can be found in the services packages document.

SP1 includes overarching topics such as project management and basic development.

As part of SP2, the requirements, design assumptions and descriptions for the areas:

- emplacement technology,
- backfilling,
- sealing and closure,
- and retrieval

are summarised, concretised, further developed and evaluated. In each case, reference concepts must be pre-selected and outlined together with alternative concepts. The concepts are both generic solutions as well as site-specific - particularly for sealing and closure. Emplacement and backfilling technologies are also to be evaluated in terms of potential cost savings, for example by increasing automation or using robotics.

In SP3, the requirements, boundary conditions and concepts are modified and updated in line with the siting decision. At the same time, the expected costs are calculated/estimated and documented. In addition, the backfill materials are specified and a demonstration experiment (quality demonstration for backfill mortar) is prepared for the backfill material for the L/ILW emplacement caverns. The relevant synthesis reports are then finalised as input to the RBG dossier.

SP4 represents an option for any further work following the submission of the RBG (e.g. supplements to the submitted dossier).

5.3 Documentation

Documentation is executed in form of plans and reports (see also document "Service packages").

- Format:
 - In electronic form (pdf and original file) as well as in 5-fold copy for the project folders repository projects ASR and the project folder RBG, respectively (draft and updated version).
 - Style sheet for reports: in line with Nagra specifications (see chapter 4)

- Depth / level of detail (unless otherwise specified):
 - Documents for ASR (MS 3.2), i.e. repository projects ASR: Swiss Society of Engineers and Architects (SIA) 112(2014) paragraphs 312.1; 312.2 and 312.3
 - Documents for the RBG (MS 3.3), i.e. repository projects RBG: SIA 112(2014) paragraph 312.4.
 - For retrieval only SIA 112(2014) paragraphs 312.1; 312.2 and 312.3 applies

6. Project organisation and interfaces

Work for achieving the above-mentioned goals is conducted as a sub-project of the project Monitoring & Closure / Engineered Barriers (*Beobachtung & Verschluss / Technische Barrieren*, BVTB) of the main project ABU (Figure 2).

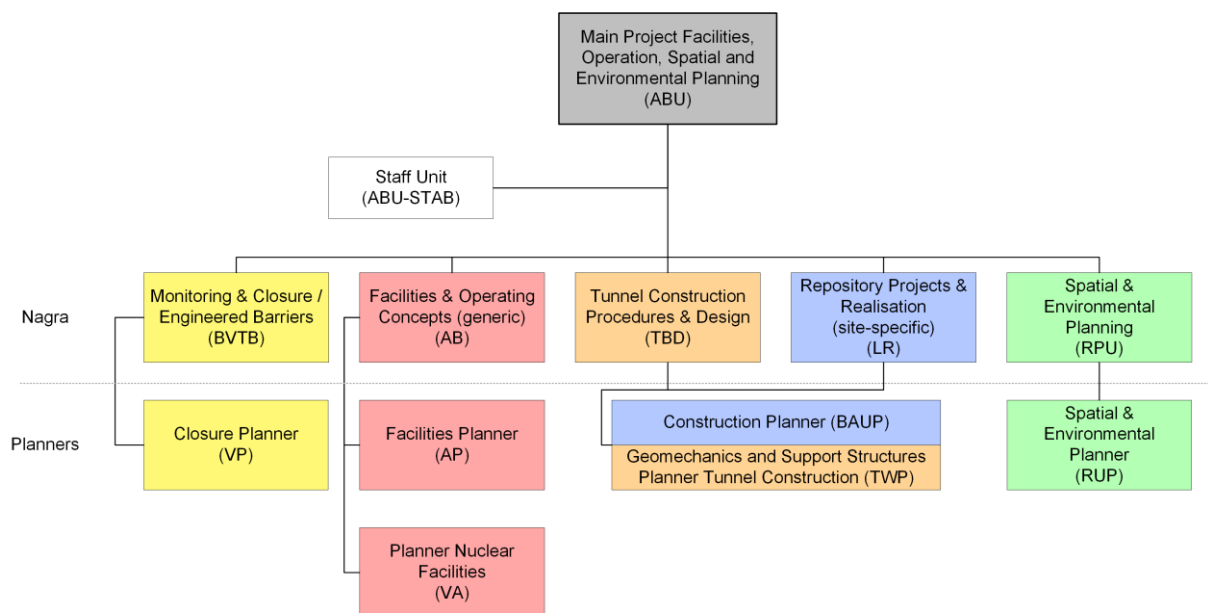


Figure 2: Organigram of the main project ABU

Aside from the closure planner's activities regarding monitoring and closure, there will also be a generic concretisation of the facilities and operating concepts. This planning work will be carried out by a separately contracted facilities planner (*Anlagenplaner*, AP) as part of the project Facilities and Operating Concepts (*Anlagen- und Betriebskonzepte*, AB) and forms an important interface to the mandate described here. The closure planner also delivers input to the engineering risk assessment, which will be carried out by the construction planner / geomechanics and support structures planner, tunnel construction (*Bauplaner-Tragwerksplaner*, BAUP-TWP). In addition, the specifications and requirements for the structures in terms of construction technologies and support structures (type of support, standard profiles, statics) have to be coordinated with these planners. Further interfaces with the closure planner are foreseen in sub-projects with external machine specialists for realising equipment as part of the project Monitoring & Closure / Engineered Barriers (BVTB).

The closure planner's tasks also have to be coordinated with other projects aside from the main project ABU. For example, the VP will receive input from the main project on safety (*Hauptprojekt Sicherheit*, HP SI) regarding long-term safety, occupational safety and radiological protection requirements for emplacement and retrieval technologies, as well as for closure structures. The VP also has to coordinate the expected repository-induced effects and the design of the disposal containers with the main project on repository-induced effects (*Hauptprojekt Lagerbedingte Einflüsse*, HP LBE). A further

interface exists with the main project on field investigations (*Hauptprojekt Feldarbeiten*, HP FA), which is responsible for planning the monitoring phase.

7. Schedule

This planner mandate is part of Stage 3 of the Sectoral Plan for Deep Geological Repositories. The documentation will be prepared up to around 2024.

From a current perspective, Stage 3 includes the following main milestones:

- MS 3.2: ASR / Decision on combined repository end 1st quarter 2022
- MS 3.3: Submission of RBG approx. end 2024

To develop the required planner services, in particular considering the interdependencies with other projects, the following milestones have to be observed as part of the tendered services:

Main milestones HP ABU

- MS 3.2.1: Draft project folder repository projects ASR 4th quarter 2020
- MS 3.2.2: Update project folder repository projects ASR 3rd quarter 2021
- MS 3.3.1: Draft project folder repository project RBG 2nd quarter 2023
- MS 3.3.2: Update project folder repository project RBG 3rd quarter 2024

Milestones for the closure planner BVTB:

- VP-MS 1.2: Underpinning documents evaluated, list of questions resolved, potentially acquire additional basic input 4th quarter 2020
- VP-MS 2.3.1: Report on emplacement concepts (description and visualisation); for the draft project folder repository projects ASR 4th quarter 2020
- VP-MS 2.3.2: Update emplacement concepts; for the project folder repository projects ASR 3rd quarter 2021
- VP-MS 2.4.1: Report on backfilling concepts (description and visualisation); for the draft project folder repository projects ASR 4th quarter 2020
- VP-MS 2.4.2: Update backfilling concepts; for the project folder repository projects ASR 3rd quarter 2021
- VP-MS 2.5.1: Report on generic sealing and closure concepts; for the draft project folder repository projects ASR 3rd quarter 2020
- VP-MS 2.5.2: Report on generic sealing and closure concepts; for the project folder repository projects ASR 4th quarter 2020
- VP-MS 2.6.1: Report on site-specific sealing and closure concepts; for the draft project folder repository projects ASR 3rd quarter 2020
- VP-MS 2.6.2: Report on site-specific sealing and closure concepts; for the project folder repository projects ASR 3rd quarter 2021
- VP-MS 2.7.1: Report on retrieval concepts; for the draft project folder repository projects ASR 3rd quarter 2020
- VP-MS 2.7.2: Retrieval concepts; for the project folder repository projects ASR 4th quarter 2020
- VP-MS 3.1.1: Update requirements for emplacement 3rd quarter 2021
- VP-MS 3.1.2: Chapter contributions on emplacement for reports "Concept for Facilities & Operation of a Deep Geological Repository" and "Information on Costs"; for the draft project folder repository project RBG 2nd quarter 2023

- | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| • VP-MS 3.1.3: Update chapter contributions on emplacement for reports "Concept for Facilities & Operation of a Deep Geological Repository" and "Information on Costs"; for the project folder repository project RBG | 3rd quarter 2024 |
| • VP-MS 3.2.1: Update requirements on backfilling | 3rd quarter 2021 |
| • VP-MS 3.2.2: Quality demonstration backfill mortar for L/ILW and backfill specifications | 4th quarter 2021 |
| • VP-MS 3.2.3: Chapter contributions on backfilling for reports on "Concept for Facilities & Operation of a Deep Geological Repository" and "Information on Costs"; for draft project folder repository project RBG | 2nd quarter 2023 |
| • VP-MS 3.2.4: Update chapter contributions on backfilling for reports on "Concept for Facilities & Operation of a Deep Geological Repository" and "Information on Costs"; for the project folder repository project RBG | 3rd quarter 2024 |
| • VP-MS 3.3.1: Chapter contributions on sealing and closure for reports on "Concept for Facilities & Operation of a Deep Geological Repository" and "Information on costs"; the draft project folder repository project RBG | 2nd quarter 2023 |
| • VP-MS 3.3.2: Update chapter contributions on sealing and closure for reports on "Concept for Facilities & Operation of a Deep Geological Repository" and "Information on Costs"; synthesis report; for the project folder repository project RBG | 3rd quarter 2024 |
| • VP-MS 3.4.1: Update requirements and design of the retrieval concept | 4th quarter 2021 |
| • VP-MS 3.4.2: Chapter contributions on retrieval; synthesis report; for the draft project folder repository project RBG | 2nd quarter 2023 |
| • VP-MS 3.4.3: Update chapter contributions on retrieval; synthesis report; for the project folder repository project RBG | 3rd quarter 2024 |

The milestones and services packages are presented in the scheduling document.

The milestones refer to definitive dossier submission. Prior to submission, at least 1 to 2 (as required) drafts are to be submitted for internal review.