



**KBP1019**  
**Dismantling and**  
**evaluation of LOT**  
**S2 and A3**

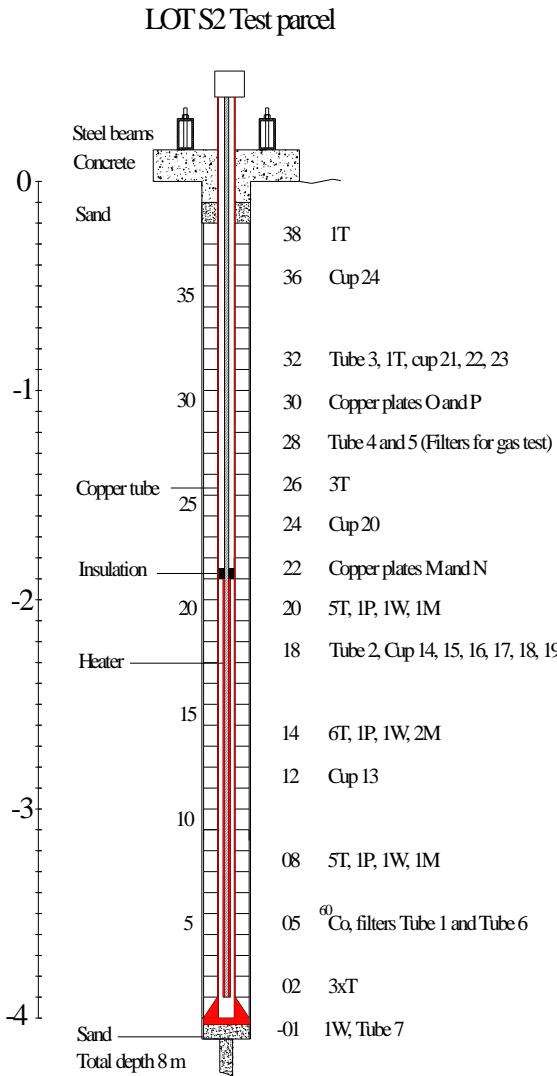
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# Purpose

- This presentation is produced to show how SKB manages, implements and quality assures project ***KBP1019, Dismantling and evaluation of LOT S2 and A3.***

# Background



LOT aims to identify and quantify mineralogical changes in the bentonite resulting from exposure to conditions analogue to those found in a repository. In addition, related processes in the bentonite concerning copper corrosion and diffusion of cations are investigated.

## LOT-experimenten, A = Adverse conditions, S = Standard conditions

Test	Max T, °C	Controlled parameters	Test duration, years	Remark	Installed	Terminated
A1	130	T, [K+], pH, am	1.3	pilot test	Nov 1996	Mars 1998
A0	120-150	T, [K+], pH, am	1.9	A1 complement	Dec 1999	Nov 2001
A2	120-150	T, [K+], pH, am	6.1	main test	Oct 1999	Jan 2006
A3	120-150	T	20	main test	Oct 1999	Sep 2019
S1	90	T	1.4	pilot test	Oct 1996	Feb 1998
S2	90	T	20	main test	Sep 1999	Oct 2019
S3	90	T		main test	Sep 1999	

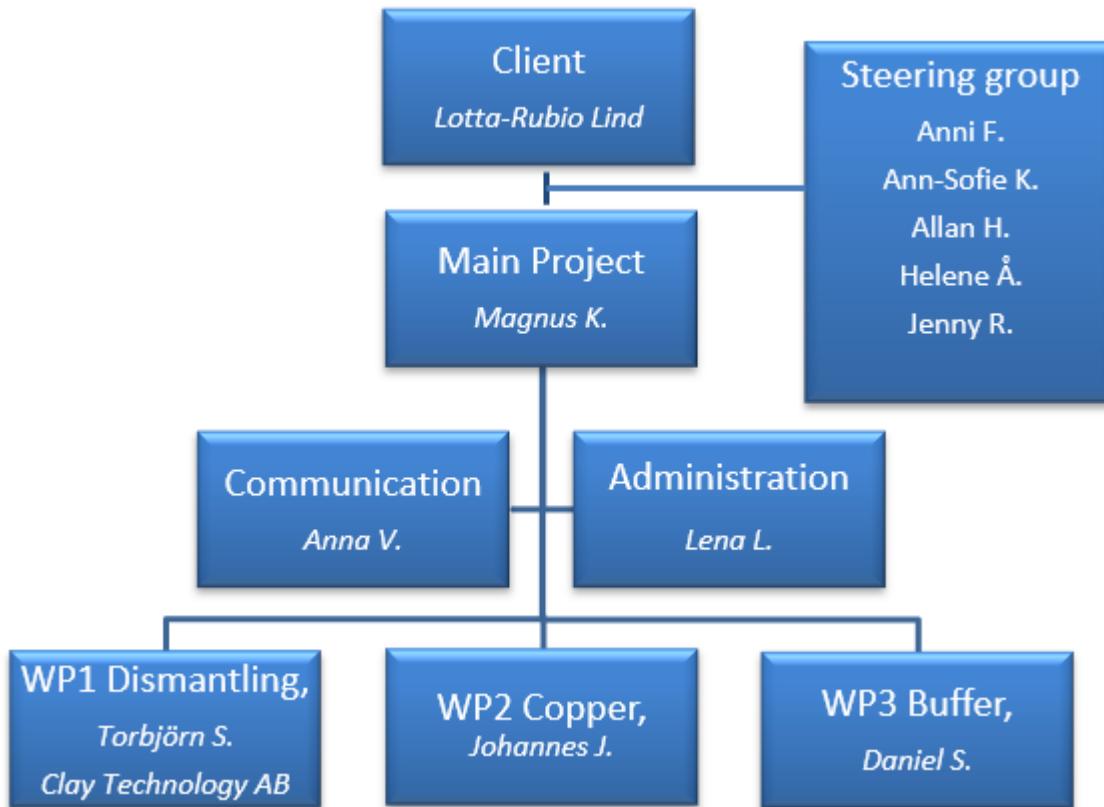
Info and film: <https://www.skb.se/nyheter/langtidsforsok-lyft-efter-20-ar/>

# Project objectives and strategy for fulfilment



- Compile and report installation and monitoring data from LOT S2 and A3.
- Produce measurement data that enables an assessment of how affected the function of the buffer is after 20 years of heating in LOT conditions.
  - Produce measurement data that enables an assessment of how the mineral content of the buffer has changed.
  - Produce measurement data that enables an assessment of whether the buffer has/can have affected the copper in a negative way.
  - Produce measurement data that enables an assessment of whether any previously unknown processes may have occurred.
- Evaluate how affected the function of the buffer is from 20 years of heating and how well the results correspond with current safety analyses.
- Produce measurement data and evaluate the diffusion of Co-60 in bentonite, and compare with results from previous experiments and with model calculations.
- Produce measurement data for the corrosion depth of metallic copper that enables an assessment of how affected the copper is after 20 years of heating in LOT conditions.
- Evaluate whether the measured corrosion depth of metallic copper is consistent with results from previous experiments and with model calculations.
- Compile and report dismantling data, monitoring data and evaluation of LOT S2 and A3

# Organisation



# Implementation and schedule

• Planning and procurement	Dec 2018 - Jul 2019
• Drilling A3 och S2	Aug 2019 - Sep 2019
• Sampling A3 och S2	Sep 2019 - Oct 2019
• Density and water content A3 och S2	Sep 2019 - Oct 2019
• Copper/bentonite-copper interaction, analyses	Oct 2019 - Apr 2020
• Bentonite analyses	Oct 2019 - Apr 2022

## Public reports

- TR-20-11 Installation, monitoring, dismantling and initial analyses of material from LOT test parcel S2 and A3, Results from field tests
  - Printed June 2020
- TR-20-14 *Corrosion of copper after 20 years exposure in the bentonite field tests LOT S2 and LOT A3.*
  - Sep 2020
- TR-22-xx Buffer properties LOT S2 and A3
  - Preliminary Oct 2022

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# Management system and certification

## SKB is certified:

ISO 9001:2015 (quality management)  
45001:2018 (working environment)

## Management System

SKB's management system is the management's tool and communication channel where agreed working methods are continuously documented. The management thereby wants to achieve a planned and quality-assured working methodology, which also provides the conditions for a safe, efficient and environmentally conscious business that achieves high-quality results.

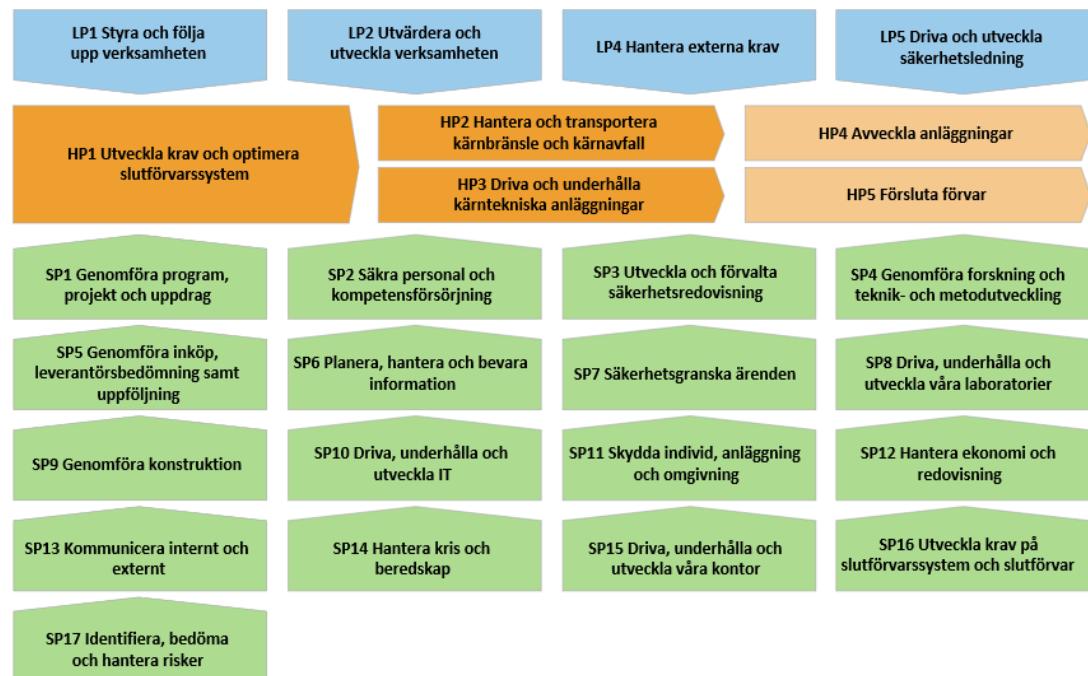


## Our way of working

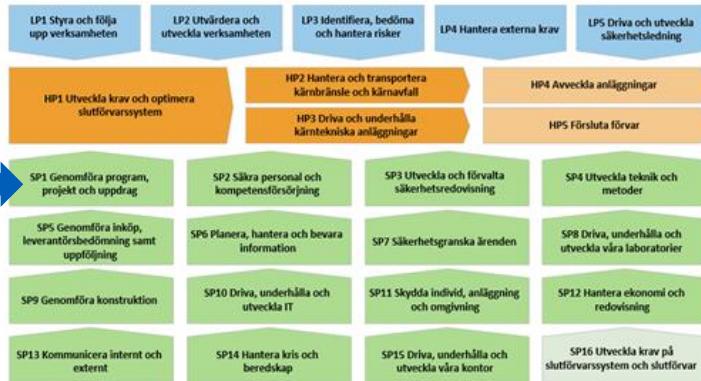
How we should work is described in the room *Our way of working* and this is where we find our processes

- The management processes (LP - the blue processes) that aim to lead, control and develop the business and to provide the business with goals, strategies, visions and overall decisions
- the main processes (HP - the yellow processes) that aim to implement and complete SKB's assignments
- support processes (SP - the green processes) which aim to support main processes and other activities with how different activities are to be carried out.

Click on a process to see how we perform our tasks in a safe and accurate way

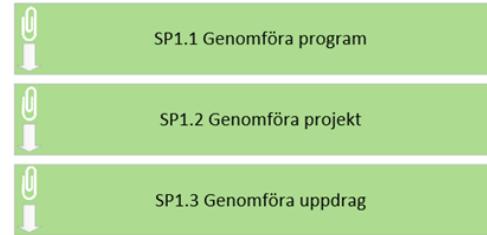


# SP1 Implementing programs, projects and assignments



-Ett unikt behov som har identifierats och dokumenterats i en beställning

## SP1 Genomföra program, projekt och uppdrag



- Resultat eller nytta

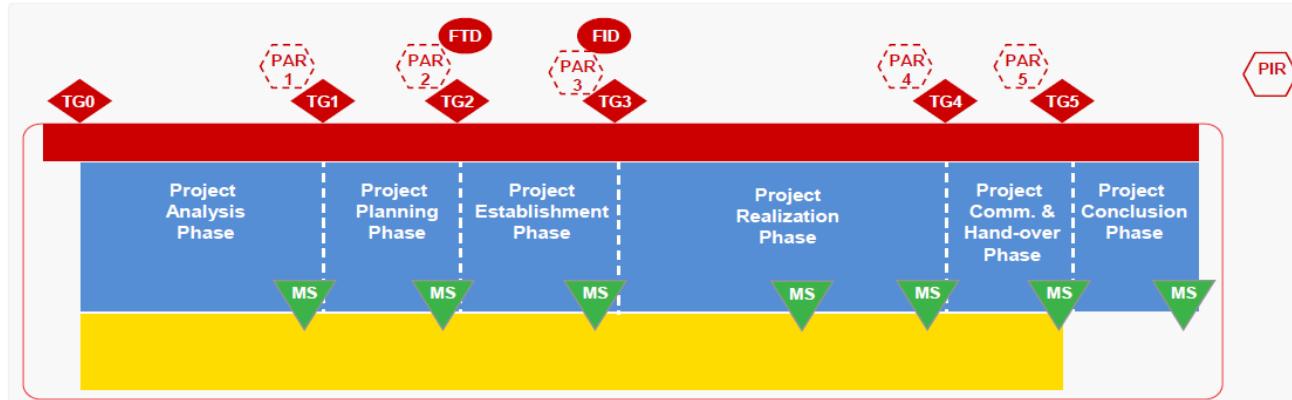
SP1.2 The process shall ensure that the project operations are conducted with a rigorous handling of requirements and decisions in order to be able to deliver agreed results in the best possible way and to be able to follow up and report on what has been done and how it has been done.

# Project management model

1039253 – Projektstyrmodellen

SKB and Vattenfall have very similar documents and Vattenfall's is available in English

## 5 Project Management Lifecycle



### 5.3 Tollgate Decision Making

The main principle is that all tollgates always are to be used, while they can be delegated by the PPO to Project Sponsor and the Project Steering Group.

The general intention of the tollgates are as follows:

TG0 = Decision to start a project

TG1 = Decision on which alternative concept solution to select.

TG2 = Decision on requirements and scope

TG3 = Decision on realising the project result.

TG4 = Decision on start of hand-over to receiving organisation.

TG5 = Decision on accepted hand-over and start conclusion of the project

# SP1:2 Implementing projects steering documents



**The project is controlled, planned, decided, implemented and completed in accordance with:**

1702838 - Project charter för KBP1019 Brytning och utvärdering av LOT

**The project is carried out in accordance with:**

1860815 - Project Management Plan (PMP) för KBP1019 Brytning och utvärdering av LOT S2 och A3

1859797 - KBP1019 – Brytning av LOT, arbetspaket WP1 Brytning

1860852 - KBP1019 Brytning av LOT, arbetspaket Koppar

1860761 – KBP1019 – Brytning av LOT, WP3 buffert

## **Project documents:**

1860884 - Kommunikationsplan KBP1019 Brytning av LOT S2 och A3. Long term test of buffer material

1859185 - Risklista KBP1019 LOT

1859184 - Tidplan

1865072 – Strålskyddsåtgärder vid brytning av LOT paket S2 och A3 (hanterar installerad Co-60)

1859222 - Uppdrag 2019-013 Brytning LOT

G: och extern disk Filmmaterial från hela brytningen

# Project management plan

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DokumentID:  
1860815, (1.0)

Sekreteress  
Företagsintern

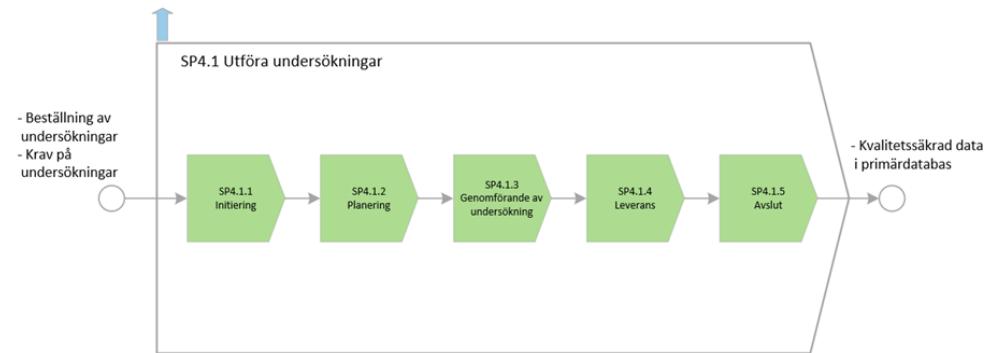
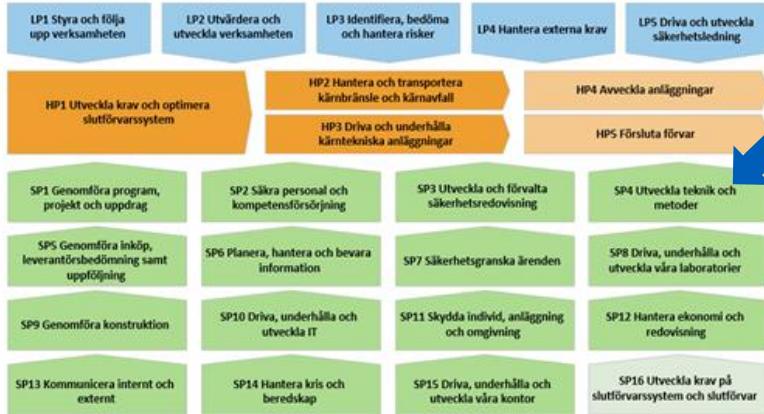
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Project Management Plan (PMP) för KBP1019 Brytning och utvärdering av LOT S2 och A3

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# SP4 Develop technology and methods



The purpose of the process is to produce survey data, models, methods and technical solutions that satisfy the construction of a safe and efficient final repository for radioactive waste.

## Project activities at Äspö HRL follows:

1372932 - Undersökningar

1053624 – Hantering av aktiviteter vid Äspolaboratoriet

Activity plans



# Activity plans

**Activity plans are used to ensure that the activity generates quality-assured and traceable documents and data**

1863807 - AP RD KBP1019 – 19 - 009 – Friborrning och upptag av LOT-paket S2 och A3

1866317 - AP RD KBP1019 – 19 – 010 – Grovdelning och paketering av material. LOT-paket S2 och A3

1866344 - AP RD KBP1019 – 19 – 011 – Bestämning av vattenkvots- och densitetsfördelning. LOT-paket S2 och A3

1889077 - AP RD KBP1019-20-008 Buffertanalyser LOT S2 och A3

Translated excerpt from 1053624 - Management of activities at the Äspö HRL, and examples

## 5.3.1 The purpose of the activity plan

The activity plan shall ensure that the activities are carried out in a safe manner, in accordance with current work environment and safety requirements from SKB and the Äspö HRL. The activity plan shall also be the quality document that ensures that governing documentation for the activity is available, and that the execution of the activity complies with the requirements contained in the governing documentation. By governing documentation is meant here drawing, instruction, job description, method description, etc. The activity plan must also ensure that the activity generates quality-assured and traceable documents and data. For further clarification, see document id 1372923 - Surveys.

An activity plan shall be prepared for all activities covered by this routine in accordance with Chapter 2 Scope and delimitation.

The activity plan shall describe:

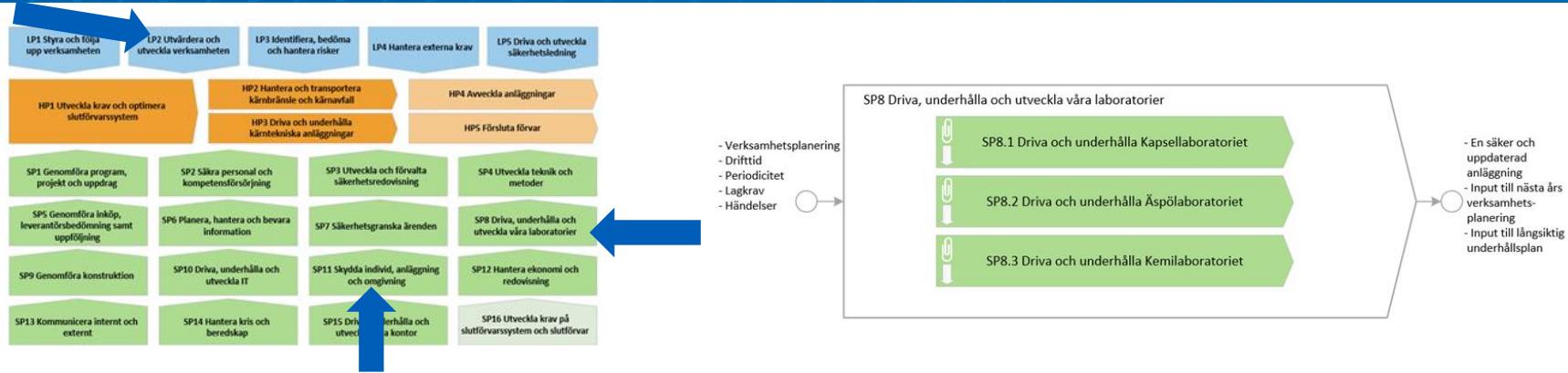
- What to do
- How to do it
- When to do it
- Who is responsible

## AP RD KBP1019-19-010 - Grovdelning och paketering av material. LOT-paket S2 och A3

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# SP8 Operate, maintain and develop our laboratories



The purpose of SP8 is to describe work methodology, follow-up and document management of maintenance so that the facility can ensure safe operation, cost-effective maintenance and demand-adapted availability

## Project activities at Äspö HRL follows:

1172400 – Uppdragshantering vid Äspölaboratoriet

1255926 -Samordning av arbetsmiljö vid anläggningen Äspölaboratoriet

1052155 - Generella regler för Äspölaboratoriet.

1046020 - Användning av radioaktiva spårämnen vid Äspölaboratoriet

## Work environment, environment and development of the business

1052234 - Systematiskt arbetsmiljöarbete

SP11, Skydda individ, anläggning och omgivning

1044242 - Anskaffning och hantering av kemikalier

SP11, Skydda individ, anläggning och omgivning

1700154 - Rapportera och hantera observationer och erfarenheter.

SP2, Utvärdera och utveckla verksamheten

# SP8:2 Äspö HRL

# SP8:3 Chemistry laboratory



## Laboratory Äspö

1063526 - Lokaler och Miljö

1409211 - Förvaltning av laboratorieutrymmen på Äspolaboratoriet

1063679 - Vågar, termometer och Milli-Q-anläggning

1063678 - Användning av pipetter, automatbyretter och mätkolvar

## Method descriptions laboratory Äspö

1419679 – Bestämning av vattenhalt och vattenkvot i bentonitlera

1431662 – Bestämning av skrym- och torrdensitet för bentonitlera

1481721 - Metodbeskrivning för kemanalys av bentonitlera med röntgenfluorescensspektroskopi, XRF

1481723 - Metodbeskrivning för fasanalys av bentonitlera med röntgendiffraktion, XRD

1417484 - Bestämning av katjonutbyteskapacitet (CEC) i bentonitlera med Cutrietylentetramin/UV-vis

1405486 - Extrahering och bestämning av utbytbara katjoner (EC) i bentonitlera

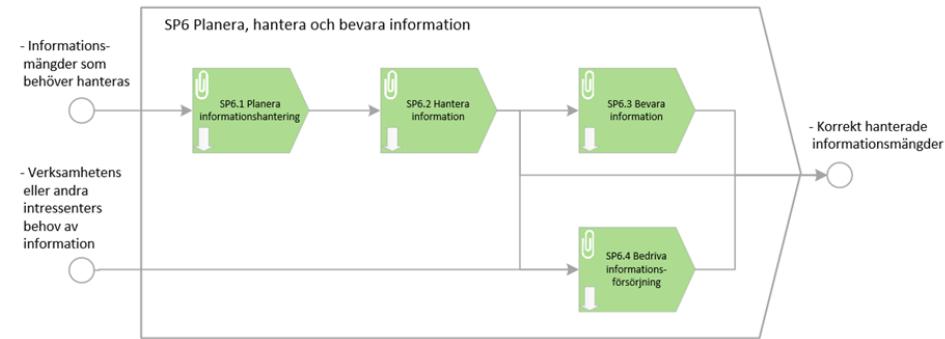
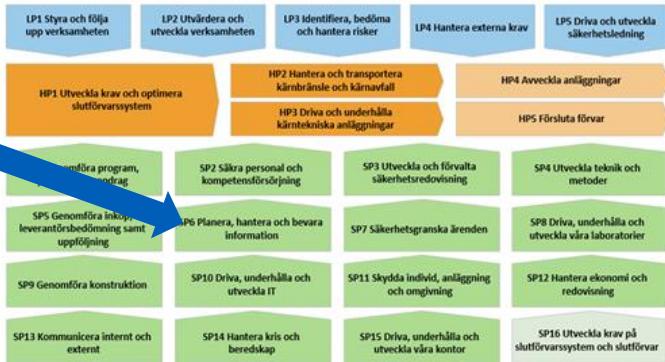
1449389 - Metodbeskrivning för bestämning av Svälltryck och Hydraulisk Konduktivitet.

1610910 - Jonbyte, fraktionering och dialys av bentonitlera

1617056 - Malning av bentonitlera med Retsch kulkvarn PM 400 för preparering laboratorieprover

SEM- Förfarande beskrivet i rapport

# SP6 Plan, manage and preserve information



The purpose of SP6 is to plan, manage and preserve information in a correct way and ensure efficient and secure information management and knowledge in information management

## Data and handling of information

1053152 - Dataleverans till respektive från Sicada och GIS

1251512 - Avdelning R informationshanteringsplan.

1210369 - SKB Gemensam informationshanteringsplan.

# SP6.4.5 Produce reports and publications

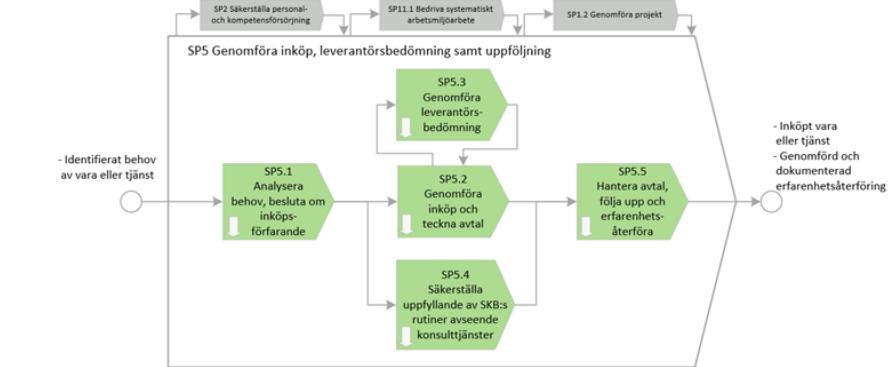
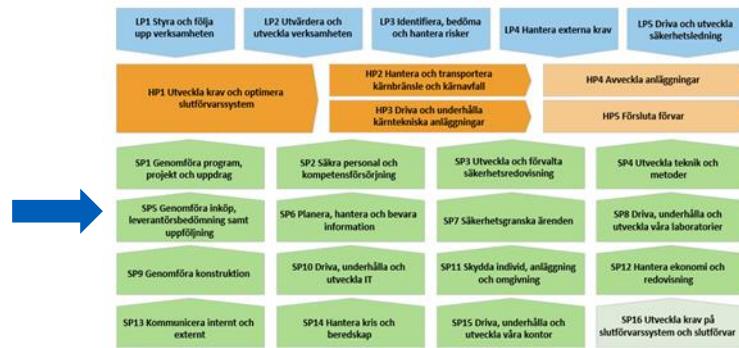
## Public reports

- 1066520 - Framtagning av publika rapporter
- 1050857 - Sakgranskning
- 1215757 - Angivande av referenser i SKB:s publikationer
- 1063774 - Bilder - hantering och kvalitetskrav
- 1394728 - Checklista - Granskning och kvalitetskontroll av publika rapporter inom RS

## Reporting and review

- 1889205- TR-20-11 Installation, monitoring, dismantling and initial analyses of material from LOT test parcel S2 and A3, Results from field tests
- 1889091 - TR-20-11 - Granskningsplan - Installation, monitoring, dismantling and initial analysis of material, LOT S2 and A3
- 1889093- Sakgranskning av Rapport - Installation, monitoring, dismantling and initial analyzes of material, LOT S2 and A3 - Granskare 1
- 1889095- Sakgranskning av Rapport - Installation, monitoring, dismantling and initial analyzes of material, LOT S2 and A3 – Granskare 2
- 1900516-TR-20-14 Corrosion of copper after 20 years exposure in the bentonite field tests LOT S2 and LOT A3.
- 1895707 - TR-20-14 Review instruction
- 1895742 - Factual review of TR-20-14 Reviewer 1
- 1895741 - Factual review of TR-20-14 Reviewer 2

# SP5 Carry out procurement, supplier assessment and follow-up



The purpose of SP5 is to ensure access to goods and services that meet all requirements, at the right quality and price, and that follow-up, supplier assessment and experience feedback take place in accordance with current legislation and routines

**Procurements of contractors and laboratories are carried out in accordance with:**

1056110 – Inköpsinstruktion

AB04 Allmänna bestämmelser för byggnads-, anläggnings-, och installationsentreprenader

**Orders (main ones are listed to 2020-05-25, there are additional orders)**

22501 - Arbetspaketledning KBP1019 LOT, Clay Technology AB

22834 - Brytning, provtagning och rapportering KBP1019 LOT, Clay Technology

22932 - Analys av korrosionsprover från fältförsöka (LOT), Rise Kimab AB

23867 - FIB och TEM på kopparprover Swerim AB

23078 - Friborning och upptag av LOT paket S2 och A3, Uppländska Bergborrnings AB

23144 - HM-analys av LOT-material, Clay Technology AB

23864 - Analyser av bentonitlera prover, Lev 1

21580 - Laboratorietekniker (inhous-konsult), Lev 2

24445 - Factual review of report TR-20-14, Lev 3

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# Uppländska bergborrning AB

## Drilling and retrieval



- Uppländska Bergborrning is ISO-certified according to
  - 9001:2015 – Quality
  - 14001:2015 – Environment
  - 45001:2018 – Working environment
- The work was carried out according to:
  - Beställning, 23078 - Friborrning och upptag av LOT paket S2 och A3 (AB04)
  - 1863807 - AP RD KBP1019 – 19 - 009 – Friborrning och upptag av LOT-paket S2 och A3
  - Uppländska Bergborrning AB, Miljö- & Kvalitetspolicy

# RISE KIMAB AB samt Swerim AB

## Copper analyses



- RISE KIMAB AB and Swerim AB is ISO-certified according to
  - 9001:2015 – Quality
- The work was carried out according to:
  - Beställning, 22932 - Analys av korrosionsprover från fältförsök (LOT), RISE KIMAB AB
  - Beställning, 23867 - FIB och TEM på kopparprover (beställt av linjen), Swerim AB
- RISE KIMAB AB methods:
  - XRD
  - SEM-EDS
  - Gravimetri enligt SS-EN ISO 8407:2014
  - LOM
  - Leco
  - GDOES
- Swerim AB methods:
  - FIB/TIM
- All instruments are calibrated before measuring by the operator
- Annual calibration is performed by supplier/service technician
- Audit carried out by Swerea KIMAB AB, 2017, Audit report SKBdoc ID 1610897
  - Conclusion: The supplier can be considered to have a sufficiently good management system for the work it performs for SKB.
  - The quality system looks similar today (2020-05), however, a division into Swerim AB and RISE KIMAB AB has been implemented

# Clay Technology AB

## WP management, sampling and hydromechanical analyses



### Project LOT

Within the LOT project, Clay Technology has worked with three different orders:

1. KBP1019-19-1 Work package management. Development of a plan for the work.
2. KBP1019-19-2 Dismantling, sampling and reporting. Within this order, three Activity Plans have been produced:

- AP RD KBP1019-19-009 Drilling
- AP RD KBP1019-19-010 Sampling
- AP RD KBP1019-19-011 Analysis

3. KBP1019-19-3 Hydromechanical analyses of LOT materials. Within this order, a test plan has been developed:

- Experimental matrices and methodology (A Dueck, Clay Technology AB, 2019-11-19)

### Business system

Clay Technology works according to an operating system based on ISO 9001: 2015 and is most recently certified 2019-10-29. The business system includes management of the company, requirements for documentation, project management, administration and quality work etc. The business system is available on the company's intranet and accessible to all employees. External and internal audits are carried out according to a set schedule.

### Lab handbook

As part of the business system, there is a lab handbook that describes the company's routines and activities in the laboratory. This describes requirements for staff, premises and equipment. Special documents describe general routines such as:

- Calibration routines
  1. Power calibration
  2. Checking the scale
  3. Deformation calibration
  4. Rh calibration
- Routines for laboratory work
- Handling of chemicals
- Checklist for experiments
- Checklist for non-standard methods

### Method descriptions

With regard to specific methods, Clay Technology has produced method descriptions for these. To the extent that deviations from these are made, this must be stated in the current report. For the following methods, there are method descriptions:

- CEC Cu-trien
- Densitet
- Flytgräns
- Hydraulisk konduktivitet
- Svälltryck
- Vattenkvot
- Enaxliga tryckförsök
- Dialysrening
- Granulstorleksfördelning

Byggforskningsrådets geotechnical instructions or other described methods can also be used, but this must then be stated and described in the report.