School of Geological Disposal

Äspö Hard Rock Laboratory, Sweden

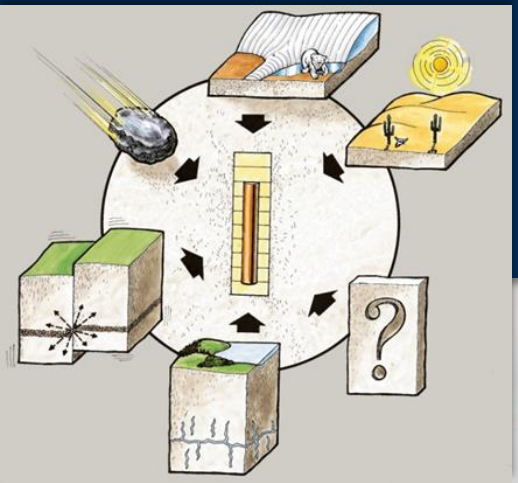
Oct. 22-26, 2018

SKB International and SKB are delighted to offer a scientific training course covering important issues governing a national nuclear waste disposal programme.

Based on the experiences gained by SKB during the past 40 years the course will present the planning and execution of a successful programme. The starting point being a strategic and graded approach with an early safety prediction via detailed understanding of processes, research achievements and gains in correctly defined targets and how this leads to a communicative safety case based on a solid and well defined safety assessment.

Final Registration and Schedule

In the following package you will find the up-dated final schedule, detail programme description and information about recommended accommodation, transport and invoice details and registration form.



The course is given by senior experts from SKB, many with world renowned reputation in their field, and will cover the relevant topics for geological disposal of nuclear waste. The course programme will launch from the fundamentals of safety assessment and its defined safety functions. We will present SKB's experiences and knowledge based on selective research, successful experiments confirming assumptions and share experiences gained from failures. The lectures and discussions will provide extensive, profound information coupled to cutting edge applications when applicable. We aim to transfer theoretical knowledge and practical experience to the course participants efficiently and effectively all in an informal and inclusive atmosphere encouraging open discussions and networking.

Attendants will obtain course material (English), information material about SKB, and general information on Oskarshamn such as map, tourist information, etc. during the welcome reception to further enhance the positive experience of the course.

Full course details and a registration form are available at SKB web site: www.skb.se/2018-SGD

Further information contact: erik.moller@skb.se

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When:	October 22-26, 2018
Time:	One full workweek, 08:00-17:00, Final and detailed schedule in this information package
Location:	Äspö Research village, accommodation in Oskarshamn
Price:	€4000, including lunches & local transport, one dinner
Registration:	Full registration form to be submitted by **2018-06-22**

Important information:

Registration:

- Full registration must be submitted by 2018-06-22.
- Registration form is attached to this information packages or can be downloaded from the web site: www.skb.se/2018-SGD
- A brief presentation of the participant is requested, will be used to adapt the presentations.

Accommodation:

- A discounted price of 1290 SEK/night & room is available at the Clarion Collection Hotel Post for all participants:
  www.nordicchoicehotels.com,
  Phone: +46 491 160 60
  E-mail cc.post@choice.se
  - ✓ Participants arrange with reservation via telephone or e-mail, submitting event code: **SDG2018**
  - ✓ Discounted price valid until the 2018-08-31
  - ✓ Included in the price of the room, Hotel Post offers breakfast and light evening meals.
- Other accommodations are available in Oskarshamn.
  - ✓ Transports will be arranged from/to Hotel Post.
  - ✓ Please inform secretariat of your accommodation plans.

Transportation:

- All local transport between Hotel Post and SKB facility, Monday through Friday is arranged.
- Closest airport is: Kalmar Öland Airport
  - ✓ Transport to/from airport is not included.

Payment:

- Invoice will be sent to each participants affiliation after final registration.
  - ✓ Non-refundable registration fee of €1500, shall be payed 30days after registration (2018-07-22)
  - ✓ Final payment will be invoiced during September 2018

Participants must make their own travel and hotel arrangements.

SKB offers a reduced rate at the Clarion Collection Hotel Post, via conference are listed on the

Full registration essential to participate on the course and study visits to:

- Central Interim Storage of Spent Nuclear Fuel - Clab
- Canister Laboratory and Instrument workshop
- Äspö Research Village; Chemistry lab., Bentonite lab. & Hard Rock Laboratory (URL)

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Schedule

Time	Day 1 - 22nd Oct.	Day 2 - 23rd Oct.	Day 3 - 24th Oct.	Day 4 - 25th Oct.	Day 5 - 26th Oct.
08:00 - 09:30	➢ **Introduction** ➢ Participants presentation & expectations	➢ **The role of the Äspö** HRL in the Swedish nuclear waste management programme. ➢ Study visit to **the Äspö Research Village** incl.: ➢ Safety instructions ➢ Tunnel visit ➢ Bentonite & ➢ Chemical Laboratory	➢ Study visit to **Canister laboratory**. ➢ Non-destructive testing ➢ Friction stir welding ➢ Instrumentation workshop	➢ **The siting process** in Sweden: ➢ Selection ➢ Investigations	➢ **Interaction between implementer and regulators.** ➢ Early political discussion ➢ The RD&D process ➢ Application process for licence to construct
30 min	BREAK		BREAK	BREAK	BREAK
10:00 – 12:00	➢ **Overview of Nuclear Waste and Repository concepts** in different geological environments		➢ **Geological Barrier**, incl.: ➢ Host rock types ➢ Petrology ➢ Mineralogy ➢ Fracturing ➢ Hydrology ➢ Chemistry	➢ **The siting process** in Sweden, continued. ➢ Comparison and decision	Cont. ➢ Consequence and Future plans based on response from The Swedish Radiation Safety Authority and The Swedish Environmental Court
1h.	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
13:00 – 15:00	➢ **Safety assessment fundamental**	➢ **Engineered Barrier system** (EBS) - Criteria and demands incl.: ➢ Canister ➢ Buffer ➢ Backfill	➢ **Geology**, from basic to Safety assessment: ➢ Thermal, mechanical properties. ➢ Structural geology ➢ Seismology ➢ Hydraulic and chemical conditions	➢ Social aspects of nuclear waste disposal ➢ **Public acceptance** and **confidence building**	➢ **Transport system** ➢ National/international regulations ➢ Design of a nuclear/radioactive waste transport system ➢ Safety and security aspects
30 min	BREAK	BREAK	BREAK	Transportation to Clab Facility	Poster session, Presentation of group assignment
15:30 – 17:00	➢ **Characteristics of the SNF**	➢ EBS cont.	➢ **Site Descriptive Modell** (SDM) – a systematic way of collecting all data to give an optimal description of the rock volume	➢ Presentation and visit to the **Central Interim Storage facility** (Clab)	➢ Summary and course evaluation. ➢ Examination and certificate of completion of the School of Geological Disposal.
Evening activity	**Sunday 21st Oct.**: 18:00-20:00 Welcome Reception	Course Dinner, TBD			(*depending on transportation options, course may close around 16:00*)

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Detailed programme description

Sunday evening, the 21st of October:

- A school representative will be available at the **Hotel Post** reception from 17:00.
- Registration package including local information, list of participants, name tags, and a full course documentation will be distributed to all participants.
- **Welcome Reception** between 18:00-20:00 at the **Hotel Post** hosted by SKB International, including snacks and drinks.

Monday, the 22nd of October:

- Buss transport to Äspö Research Village depart the **Hotel Post** main entrance at 07:30.

Monday Technical Programme:

- ✓ Introduction and Background to the course by Erik Möller. This section includes a presentation of the waste management company SKB, responsibilities, working procedures and financing. It includes a presentation of geological disposal concepts and its relation to waste forms/waste acceptance. We also expect a short presentation by each of the participants on their background and expectations from the course (max. 1 min).

- ✓ Overview of Nuclear Waste and Repository concepts in different geological environments by Johan Andersson. This section presents disposal options which are tailored for different geological media (crystalline rock, clay formations and salt). The focus is to present the similarities and differences which are due to the geological properties of the different media. A brief description of the KBS-3 concept is given.

- ✓ Safety Assessment Fundamentals by Allan Hedin. This section presents the through safety assessment methodology which has been developed by SKB ever since the presentation of the KBS-3 disposal system in 1983. This systematic assessment is presented as

  1) Background
  - SKB's licence application to construct the repository for Spent Nuclear Fuel (SNF)
  - The KBS-3 concept and its safety functions
  - The Forsmark site
  - Regulations

  2) Overview of the safety assessment SR-Site
  - Methodology
  - Safety functions
  - Reference evolution and scenarios
  - Conclusions

- ✓ Characteristics of the Spent Nuclear Fuel by Lena Z Evins. This section starts with the criteria and demands to be put on the SNF as waste form. It presents the outcome of more than thirty years experimental (laboratory) investigations of SNF dissolution and solubility of radionuclides in the conditions relevant in a KBS-3 repository.

- Buss transport to Oskarshamn and Hotel Post at 17:00

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Detailed programme description

Tuesday, the 23rd of October:

- Buss transport to Äspö Research Village depart the **Hotel Post** main entrance at 07:30.

Tuesday Technical Programme:

- ✓ The role of the Äspö HRL in the Swedish nuclear waste management programme by Pär Grahm and Peter Wikberg. This section includes the presentation of Äspö and the underground research laboratory, the history and aim of the facility (both the past and present activities). It also includes a visit in the underground laboratory and surface based supporting labs.

- ✓ Engineered Barrier systems (canister and clay) by Matts Björck, Johannes Johansson, Patrik Sellin and David Luterkort. This section starts with a presentation of the criteria and demands that are put on the engineered barriers and which are dependent on one another and on the bedrock properties. The safety function, criteria and development/manufacturing of the canister are presented. The main points of the lectures are:

    - Iterative Development of Design
    - Requirements
    - Prototype repository
    - Development of buffer and backfill design
    - Production and installation of buffer, backfill, plugs and closure
    - The road ahead, building a repository for spent nuclear fuel
    - Reference evolution and scenarios
    - Conclusions

- Buss transport to Oskarshamn and Hotel Post at 17:00

Tuesday evening, the 23rd of October:

- SKB International invites all participants and lecturers to the **Course Dinner**!
    - ✓ Time: 19:00
    - ✓ Location: To be decided,
      either walking distance from Hotel Post or transportation will be arranged.

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Detailed programme description

Wednesday, the 24th of October:

- Buss transport to Canister Laboratory in Oskarshamn harbour departs the **Hotel Post** at 07:30.
  - ✓ Study visit including:
    - Non-destructive testing of Canister
    - Friction stir welding technology
    - Instrumentation workshop, presentation of measurement systems used in the Swedish programme
- Buss transport to Äspö Research Village depart the **Canistar Lab.** at 09:15.

Wednesday Technical Programme:

- ✓ The Geological Barrier is presented by Raymond Munier and Patrik Vidstrand. This section starts with a presentation of the safety function and criteria expected for the geological barrier. In contrast to the engineered barriers this barrier cannot be manufactured and therefore its properties must be assessed carefully. In addition to the solid (rock)material the properties and aspects of the groundwater flow, chemical composition and potential to transport of dissolved species is highlighted. The geological barrier will provide the long-term stable conditions needed for the engineered barriers to function properly.

- ✓ Site Descriptive Models (SDM) are developed as a result of careful investigation of the bedrock at sites potentially suitable for the construction of a nuclear waste repository. SDM work is a systematic assessment of all data and information useful for describing the properties and function of the host rock. Even though the modelling starts with disciplinary assessment of data, geology, hydrogeology, hydrogeochemistry the very core of SDM is the total integration of all data. In a fractured crystalline rock the existence of fractures and the network of fractures have an important impact on the outcome of flow and transport of dissolved species. Therefore the development of Discrete Fracture Network Models (DFM) is one of the most important components in preparation for the safety assessment.

- Buss transport to Oskarshamn and Hotel Post at 17:00
- Suggested evening activity: Networking and/or Group assignment

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Detailed programme description

Thursday, the 25th of October:

- Buss transport to Äspö Research Village departs the **Hotel Post** at 07:30.

Thursday Technical Programme:

- ✓ Siting, Site Investigation and Selection is presented by Kaj Ahlbom using the Forsmark site as example. During the period 1992 to 2011 this was the most resource intensive work within SKB. Pre-studies were conducted in a total of 8 municipalities in Sweden. Out of these two were selected for detailed site investigations.

- ✓ The selection of the repository site (Forsmark) was based on the outcome of the investigations, which proved the bedrock properties of Forsmark to be superior in comparison to the other investigated site (Laxemar). Thereby the actual selection of Forsmark was a simple task, but it required an intensive amount of investigations and modelling (SDM, DFN) before the choice could be made. The procedure to do the site selection is presented by Johan Andersson.

- ✓ Within the organisations in charge of the Site Investigations was also the responsibility to handle the acceptance by the local politicians, neighbours and other stakeholders. Information and study visits to the SKB facilities was arranged weekly during the site investigation stage. Then and afterwards information activities are made for the students in the secondary school in those municipalities where SKB is located.

- Buss transport to Clab – the Central Interim Storage Facility for Spent Nuclear Fuel – departs Äspö Research Village at 15:00.
  - ✓ Registration and identification control – Bring Passport!
  - ✓ Study visit including:
    - Area for Reception and control of Spent Nuclear fuel
    - Interim Storage pool

- Buss transport to Oskarshamn and Hotel Post at 17:00

- Suggested evening activity: Networking and/or Group assignment

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Detailed programme description

Friday, the 26th of October:

- Buss transport to Äspö Research Village departs the **Hotel Post** at 07:30.

Friday Technical Programme:

- ✓ The interaction between the implementer and the regulator is presented by Johan Andersson. There has been a constant interaction since the first KBS-3 report was presented to the regulator in 1984. In this process the RD&D reports issued by SKB have had an important role in presenting the latest results and the present plans to the regulator every three years. According to the Swedish law, these reports are always accepted by the government, based on the recommendation by the regulator.
- ✓ The second half of this sections deals with the application to construct the Spent Nuclear Fuel repository in Forsmark. This application is assessed by both the regulator and the environmental court.
- ✓ Transport system of all Swedish radioactive waste and spent nuclear fuel is presented by Anna Wikmark. It relates to both the national and international regulations which have a great impact on the waste forms to be handled.
- ✓ Presentation of group assignment
- ✓ Summing up of the course is done by Johan Andersson and Peter Wikberg.

Due to limited flight options departing Kalmar airport, SKB International will arrange with buss transfer from Äspö Friday afternoon that connects with flight: BRA TF667:

- Departure 19:00
- Arrival: Stockholm city airport Bromma
- Information/booking: www.flygbra.se

SKB International AB

Final Registration Form - SGD2018

Registration form
School of Geological Disposal
Äspö Hard Rock Laboratory, Sweden
Oct. 22-26, 2018

Please send completed form to SKB International/E-mail: skb.international@skb.se

Information collected in this form and other documents connected to SGD-2018 will only be used for the Schools purpose and follow SKB's data protection policy, see further information: Personal data and data protection
All personal data will be deleted, no later than one year after the school has ended.

Participant:

Family name

First name

Mr. ☐
Mrs. ☐
Ms. ☐

Date of birth
YYYY / MM / DD

Origin of Identity Document

Passport Number

Valid Until
YYYY / MM / DD

Participant affiliation:

Company/Organization Name

Company/Organization Address

City

Postal Code

Country

Office Telephone No.

Mobil Telephone No.

If invoice address differs from above, enter full invoice address:

Participant information:

Do you plan to stay at the recommended hotel, Hotel Post?

Yes ☐
No ☐ **If NO, what accommodation have you selected:**

Do you plan to attend the Sunday evening Reception on October 21, 2018?

Yes ☐
No ☐

Do you plan to attend the Tuesday Course Dinner on October 23, 2018?

Yes ☐
No ☐

Please let us know if you have any dietary restrictions / food allergies.

Attendees of the conference will receive a printed attendee list containing the following information; Name, Job Title, Organization, & Country.
I *reject* the option to be listed on the attendee list: ☐

To optimise the course and to inform the lecturers of the audience we ask all participants to write a brief background summary; field of expertise, present work focus, managing or scientific position, affiliations main interests in the field of Geological disposal – consultant, scientific expert, managing national programme, etcetera. (*This information will not be distributed outside the group of lecturers*)

E.g. After working 10y with NNP Severe accident management I joined SKB International 2006. At SKB International I've been working within the national programme as project manager and analyst. Main focus.has been on operational safety analysis (SAR), radiological consequences, source term issues and spent fuel characterisation. Regarding long term safety I have been engaged in development of safety functions for the Low and Intermediate repository (SFR). International engagement has been in several countries including France, Belgium, UK, China, Japan etcetera. Including review of spent fuel conditioning facilities, strategy plans for underground research laboratories etcetera. My academical background is nuclear physics, thesis on Acceleration driven systems for transmutation of nuclear waste.