

## Arbeiten im Crystalline Club der OECD/NEA

**Judith Flügge**

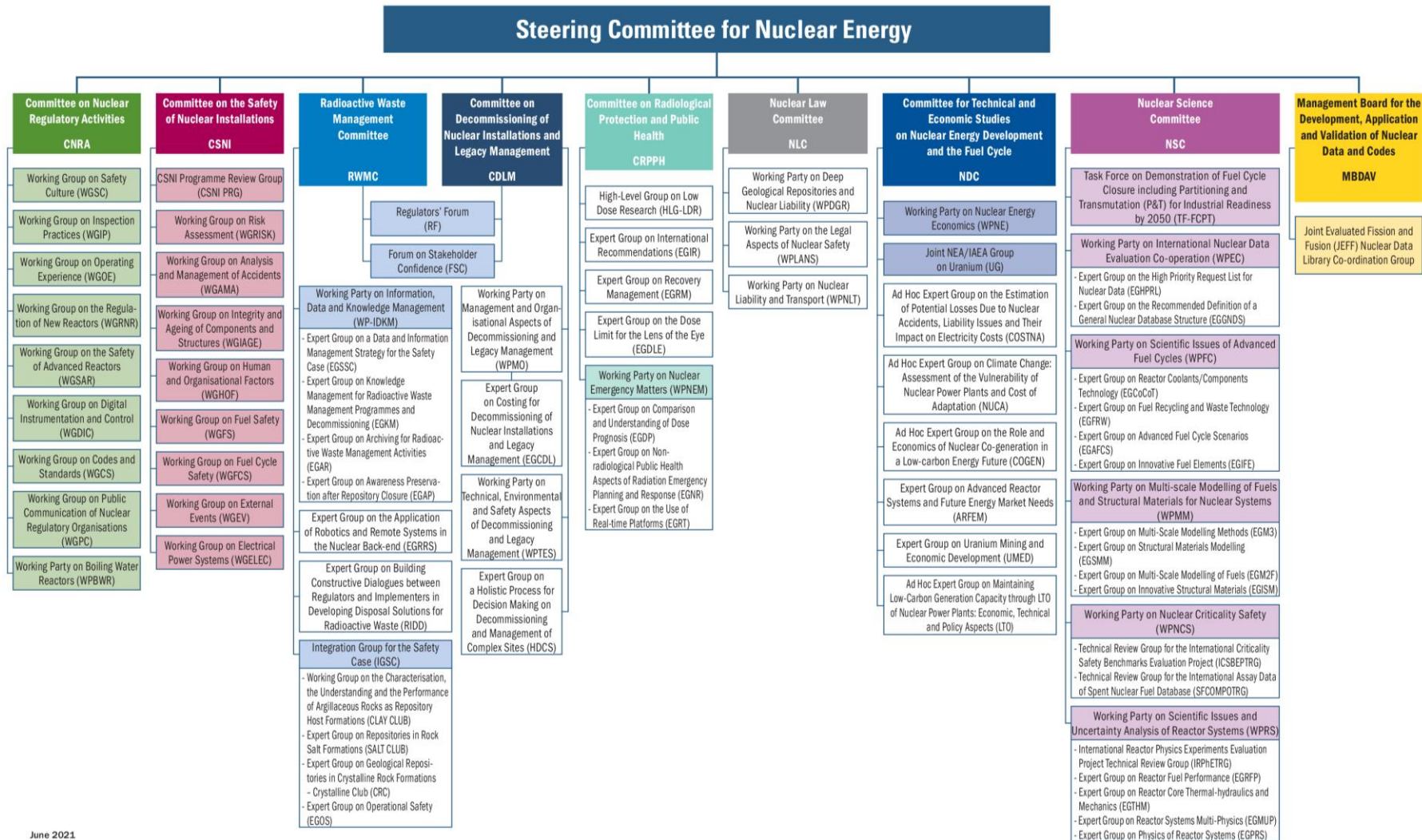
OECD/NEA Crystalline Club Chair

Infoveranstaltung zu CHRISTA-II  
15.06.2021, Online

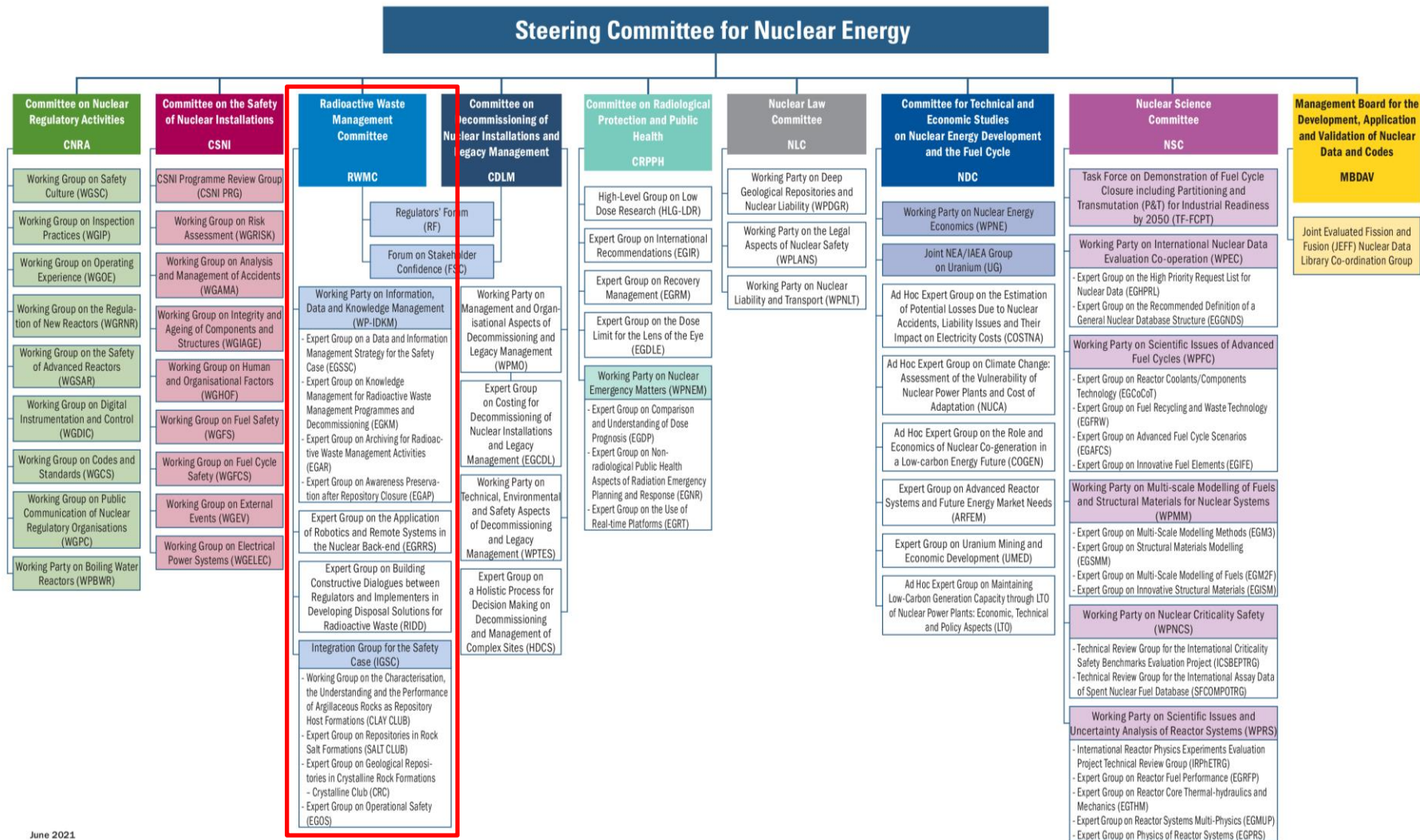
## Background

- October 2015:  
„IGSC-17 Meeting“ – Suggestion by Russian IGSC member
- Supported by Japan and Czech Republic  
Canada, Finland, Sweden interested
- Proposal for CRC by NEA Secretariat  
Review by IGSC Chair
- October 2016:  
„IGSC-18 Meeting“ – Approval of Crystalline Club (CRC)
- December 2016:  
Mandate 2017 - 2018 of the Crystalline Club

## Structure of Nuclear Energy Agency Committees and Subsidiary Bodies



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## Background

- Composed of technical experts with experience in evaluating or reviewing the understanding of crystalline rock as host rocks for deep geologic disposal projects
- Started with **20** members from **6** member countries, now CRC has **41** members from **11** member countries

## CRC Bureau Composition 2021

**Chair:** Judith Flügge (GRS, Germany)

**Co-Chair:** Lukáš Vondrovic (SÚRAO, Czech Republic)

**Vice-Chairs:**

Sarah Hirshorn (NWMO, Canada)

Motoyuki Yamada (NUMO, Japan)

Alice Ionescu (RATEN, Romania)

Vsevolod Igin (NORAO, Russian Federation)

Tiziana Missana (CIEMAT, Spain)

Florian Kober (Nagra, Switzerland)

Paul E. Mariner (Sandia, USA)

Olli Nummi (Fortum Power, Finland)

Sung-Hoon Ji (KAERI, Republic of Korea)

## German CRC Members (June 2021)

BMWi: Sabine Mrugalla, Annika Schäfers

PTKA: Michael Bühler

BASE: Ute Maurer-Rurack

BGE: Matthias Bauer (Sarah Cichy)

BGE TEC: Christian Müller

BGR: Axel Weitkamp

GRS: Judith Flügge

HZDR: Vinzenz Brendler

KIT-INE: Francesca Quinto





Uni Jena: Thorsten Schäfer

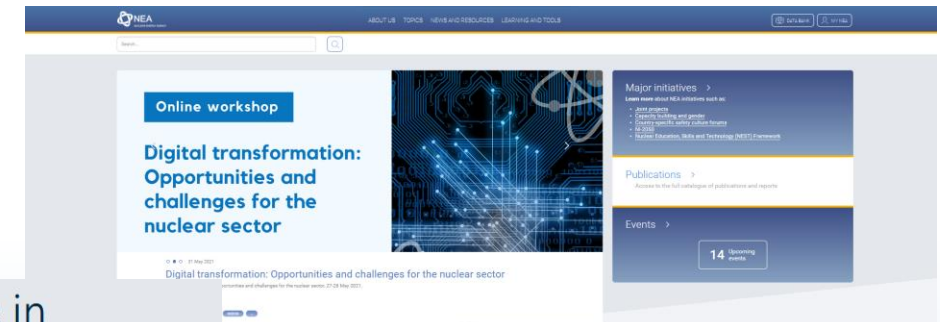


## Aims of Crystalline Club

- Promoting the exchange of information on approaches, methods, methodologies and technologies in order to understand the characteristics of crystalline rocks and to use their advantages to host a repository.
- Developing and exchanging information specific to certain geological media among countries currently pursuing or considering crystalline rock as a candidate deep geological repository medium.
- Identifying areas of interest for fundamental research, i. e. where understanding is incomplete or improvements are required,
- Developing reports and expert recommendations
- Promoting common project and task groups within CRC club, and
- Communicating identified topics of common interest and/or exchange with other working groups or international projects.

## Communication & Outreach

- New NEA Website launched: [www.oecd-nea.org](http://www.oecd-nea.org)
- Including news items
- Publications and reports; newsletter
- Social media    



### Deep geological repositories in crystalline rocks

Published date: 31 March 2021

[Crystalline Club \(CRC\)](#) [Crystalline rock](#) [Deep geological repository \(DGR\)](#)



There is a strong scientific consensus that deep geological repositories are a safe



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- > Mitigating the psychosocial impacts of & community engagement and resilience during radiation emergencies

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- > Specifications for the Generalised Nuclear Database Structure (GNDS)

## Plenary meetings

- 1st CRC meeting: 5-6 December 2017, Prague, Czech Republic
  - Country Programme and R&D status
  - Development of PoW
  - Site tour: Bukov URF visit
- 2nd CRC meeting: 13-14 June 2018, Mizunami, Japan
  - Mandate and programme of work for 2019-2020
  - Topical Session: „Process comprehension using underground research laboratory (JAEA)“: fracture evolution, characterization, modelling
  - Site tour: Mizunami URL



## Plenary meetings

- 3rd CRC meeting:  
25-27 June 2019, Krasnoyarsk, Russian Federation
  - Topical Session:  
„Data acquisition, processing and management for model development“
  - Site tour:  
Zelevnoghorsk URL construction site
- 4th CRC meeting:  
01-03 June 2021, Online
  - Topical Session:  
„Comparison and evaluation of the transfer of data for the compilation of both descriptive and SA models“



## Aim of Program of work (2019) 2021 – 2022

- Comparison of the different safety assessment (SA) approaches in CRC member countries
- Improving the reliability of the crystalline host rock environment safety assessment process
- Identification of the crucial parameters of the crystalline host rock environment and the requirements for the development of siting and design criteria.

## Steps of PoW (2019) 2021 - 2022

- 1) The identification of the key data to be obtained from crystalline rock environments (the geosphere) that are relevant to the safety assessment process;
  - *addressed during CRC-3 (Krasnoyarsk, Russia, 2019)*
- 2) The comparison and evaluation of the transfer of data for the compilation of both descriptive and safety assessment models; and
  - *addressed during CRC-4 (Online, 2021)*
- 3) The identification of requirements for the development of siting criteria concerning crystalline host rock environments and the definition of the main parameters of crystalline host rocks that are of crucial importance for, and exert an impact on, the safety evaluation process.
  - *to be addressed during CRC-5 (Dresden, 2022)*

## Step 1 of PoW (2019) 2021 - 2022

Topical Session:

“Data acquisition, processing and management for model development”

Topical Session Chair: Václava Havlová

Aims:

- The identification of the data to be obtained from crystalline (magmatic and metamorphic) rock environments (the geosphere) that is relevant to the safety assessment process and the development of an R&D strategy.
- Evaluation of data necessity (in term of complexity) in different stages of the site selection process applicable for CRC countries.

## Step 1 of PoW (2019) 2021 - 2022

- 1) Kuno Ota (NUMO): “Data acquisition requirements driven by international perspectives”  
*Systematic approach in different stages of siting process*
- 2) Andre Vorauer & Sarah Hirschorn (NWMO): “Geoscience data availability, use, and assessment of relative suitability during early stages of the site selection process”  
*How to integrate different and incoherent desktop data into consistent site evaluation*
- 3) Sung-Hoon Ji (KAERI): “Data used in developing a safety case of the conceptual disposal system by KAERI”  
*How to predict system evolution based on generic data from URL site*
- 4) Liang Chen (CNNC): „Data collection and management system for geological disposal in China and its application in the site selection“  
*How to clearly collect data and put it into one consistent database*
- 5) Václava Havlová (UJV Řež): “Site-specific data constraints for preparation of safety assessment models: Example from safety assessment of Kraví Hora site, Czech Republic”  
*Comparison between desktop data and initial data from field*



## Step 1 of PoW (2019) 2021 - 2022

Panel discussion:

Requirements towards data in different steps of site selection

Data should be:

- Initial screening: general, reliable, representative
- Preliminary assessment (site selection): systematic, quantitative, deep, equivalent/comparable
- Detailed site evaluation (confirmation): detailed, comprehensive, quantitative, dynamic, persuasive

## Step 2 of PoW (2019) 2021 - 2022

Topical Session:

“Comparison and evaluation of the transfer of data for the compilation of both descriptive and SA models”

Topical Session Chair: Elena Saveleva

Aims:

- Description of procedures employed for the transfer of both the relevant data and the results of the descriptive models to the SA models,
- while taking into account the various advantages and disadvantages, the accuracy of the data obtained and the associated uncertainties.

## Step 2 of PoW (2019) 2021 - 2022

- 1) Václava Havlová (UJV Řež): “Identification of the key data to be obtained from crystalline rock environments (the geosphere) that are relevant to the SA process”
- 2) Toivo Wanne (BGE Technology): “Key aspects of safety concepts in crystalline host rock“
- 3) Goto Junichi (NUMO): “Data integration & development of SDM for plutonic rocks in Japan“
- 4) Teresa Portone (SANDIA): „Fracture statistics and integration into computational models “
- 5) Jung-Woo Kim (KAERI): “Safety assessment models used in South Korea”

Results are currently being summarized:

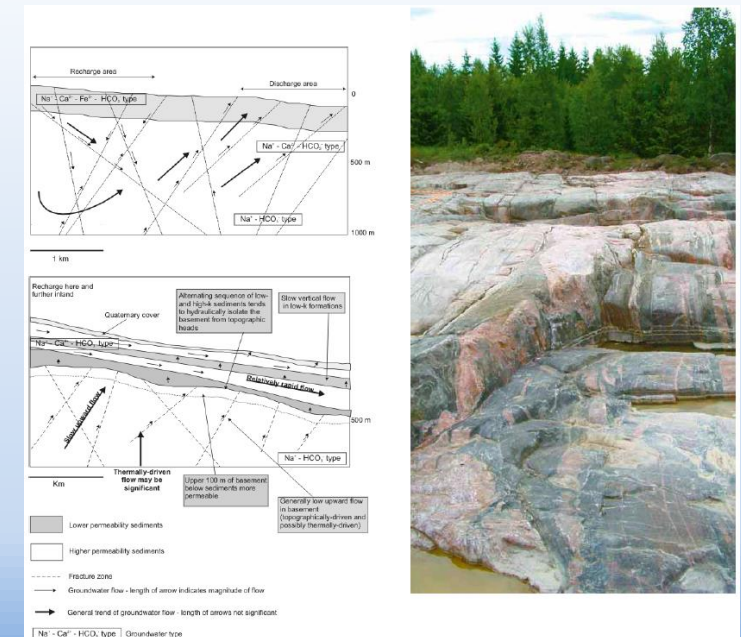
- Upscaling fracture permeability
- Use of FEP in SA modelling
- Uncertainties

## 1<sup>ST</sup> CRYSTALLINE CLUB WORKSHOP

- 11/18/25 March 2021(16 April 2021)
- “Research methods and modern measuring equipment used for site and rock characterisation”
- Part of CRC PoW 2021 – 2022
- Intended outcome:  
Presentations on and discussion of fault characterization in crystalline host rock, including geophysical/geotechnical methods for determination of the location and dimensions of fractures and faults.

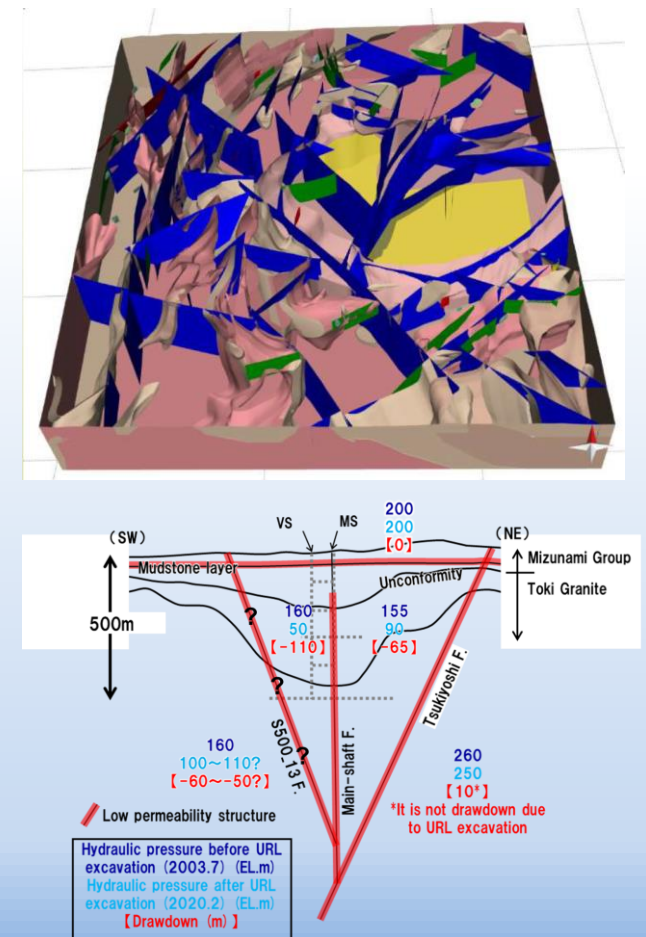
## INTRODUCTION KEYNOTE

- Johan Andersson (SKB, Sweden):  
“Feedback from Safety Assessment on what is important to characterise”
- Dr. Andersson provided information in following points:
  - ✓ Assessment of post-closure safety.
  - ✓ Safety function and requirements.
    - repository should have multiple safety functions.
  - ✓ Key safety characteristics of the geosphere and of crystalline rocks.
  - ✓ Key factors affecting safety of KBS-3 design.



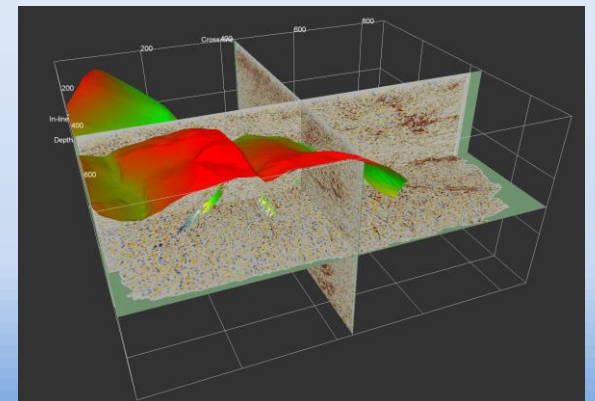
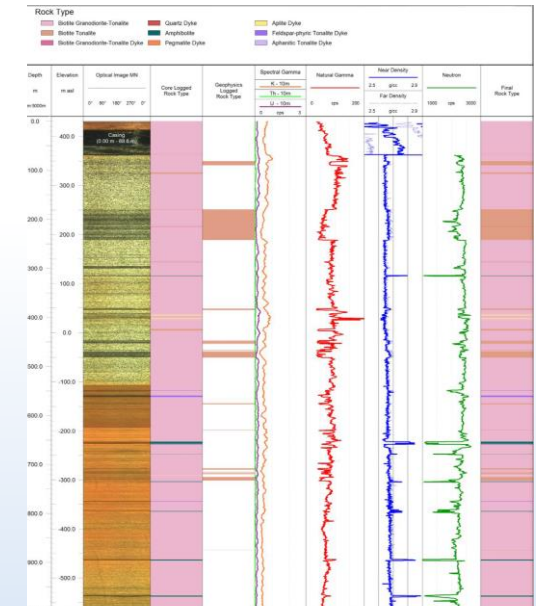
## FAULT CHARACTERISATION

- Chair: Eiji Sasao (JAEA, Japan)
- Aim: Describe two different techniques in different scale applied in crystalline rock in early stage of siting of DGR
- Two scales:
  - Zita Bukovská (SÚRAO, Czech Republic): Regional scale characterization - Analysis and interpretation of Digital Terrain Model
  - Eiji Sasao (JAEA, Japan): Site scale characterization - Geological investigations and hydrogeological properties



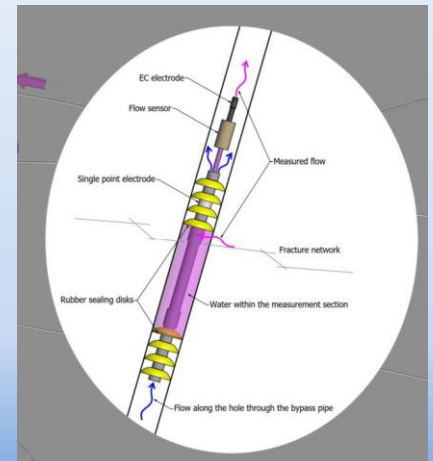
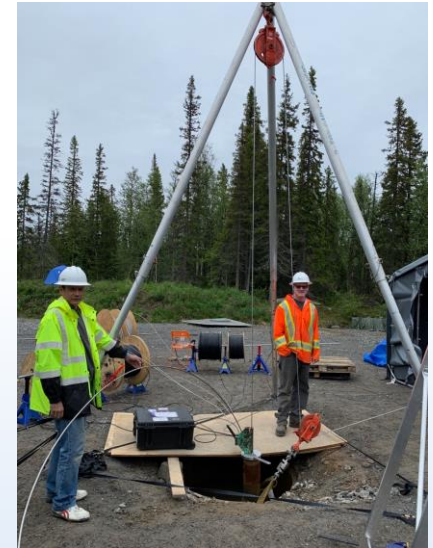
## GEOPHYSICAL IN-SITU MEASUREMENT

- Chair: Lukáš Vondrovic (SÚRAO, Czech Republic)
- Aim: Describe two different techniques applied in crystalline host rock in different stages of site DGR development
- Two scales:
  - Aaron DesRoches (NWMO, Canada):  
Small scale characterization  
(borehole geophysics)
  - Hartwig von Hartmann (LIAG, Germany):  
Regional scale characterization  
(geophysical seismic exploration)



## HYDRAULIC IN-SITU CHARACTERISATION

- Chair: Judith Flügge (GRS, Germany)
- Aim: Application of different exploration techniques and transfer of collected data into models
- Field scale fracture characterisation:
  - Pat Dobson (LBNL, USA):  
Case study (borehole) – integrated fracture characterization and transfer to DFN models
  - Jere Komulainen (Posiva, Finland):  
New technique to characterize (single) fracture flow and application to modelling and DGR construction





## SUMMARY

- Fractures are key safety characteristics of the geosphere and of crystalline rocks.
- Different methods for fault characterization are available
  - Field scale to lab scale
  - Different questions require different methods
- Challenges:
  - Characterization of bulk data vs. single fracture data
  - Integration of results into models
  - Uncertainties
- New developments are addressing some of the open issues.

## Summary & Outlook

- Member states in different stages of the siting process
- Main issues of common interest:
  - In-situ characterization of fractured rock
  - Handling discontinuities in (hydrogeological) models and integration in SA models
  - Dealing with uncertainties
- CRC-5: 2022, Germany
  - Topical session (tentative): Identification of requirements for the development of siting criteria and the definition of the main parameters that are of crucial importance for the safety evaluation process

## Thank you for your attention!

Gefördert durch:



Bundesministerium  
für Wirtschaft  
und Energie

aufgrund eines Beschlusses  
des Deutschen Bundestages

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<https://www.oecd-nea.org/rwm/crystallineclub/>