OECD NEA review of underground research laboratories in NEA countries

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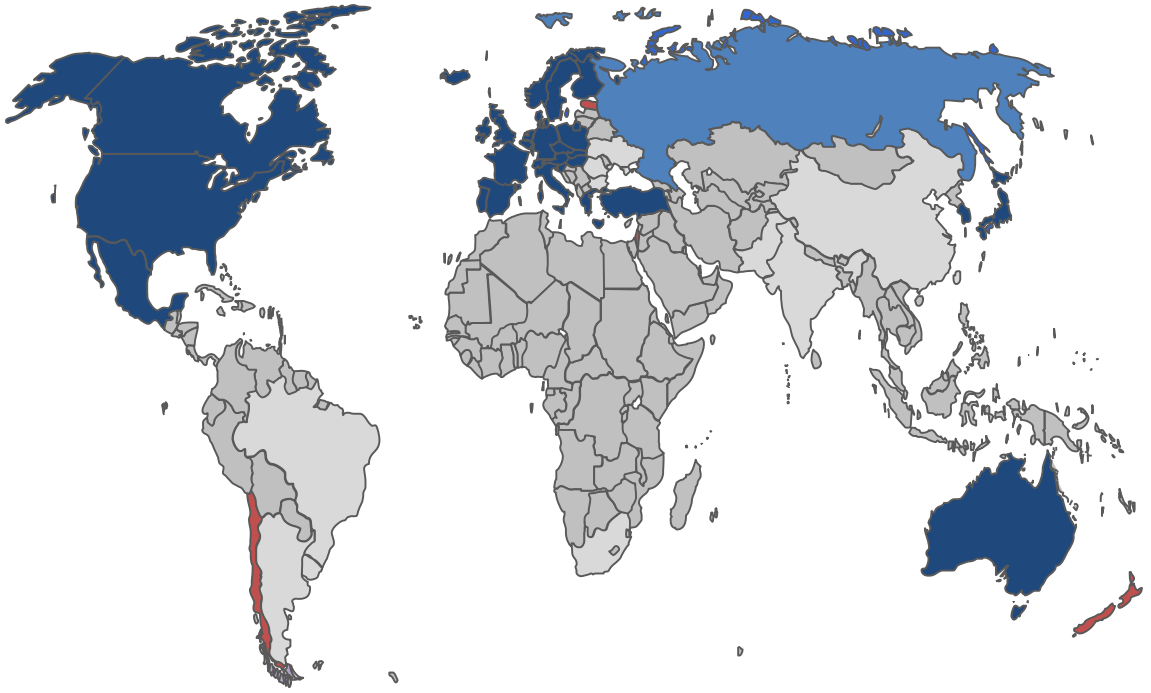
NEA member countries and mission

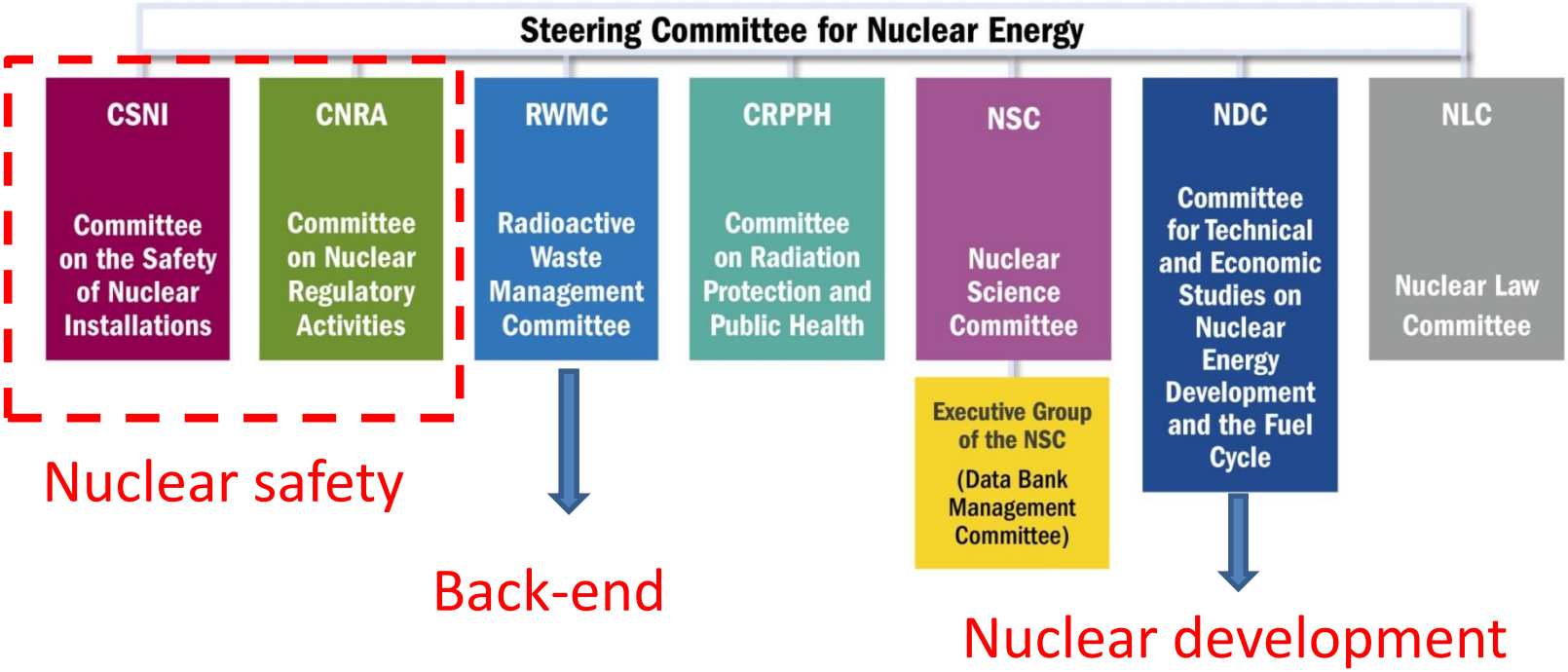
Chile, Estonia, New Zealand and Israel are OECD members but not NEA
The Russian Federation is an NEA member, but not yet member of the OECD

- **To assist its member countries in maintaining and further developing**, through international co-operation, the scientific, technological and legal bases required for a safe, environmentally friendly and economical **use of nuclear energy** for peaceful purposes.
- To provide authoritative assessments and to forge common understandings on key issues as **input to government decisions on nuclear energy policy** and to broader OECD policy analyses in areas such as energy and sustainable development.



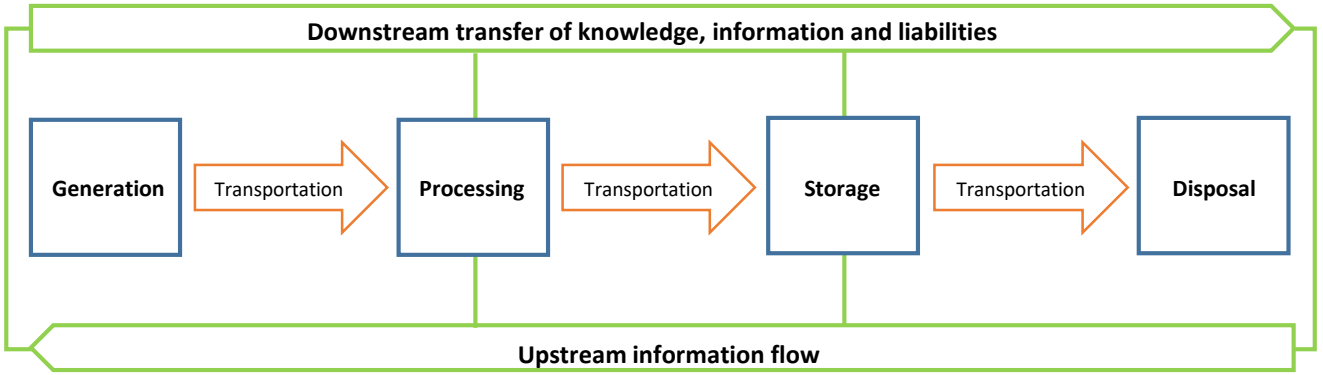
The NEA's current membership consists of 33 countries in Europe, North and South America and the Asia-Pacific region.
Together they account for approximately 90% of the world's installed nuclear capacity.

NEA Mission and Committee Structure



The NEA's Committees bring together top governmental officials and technical specialists from NEA member countries and strategic partners to solve difficult problems, establish best practices, and to promote international collaboration

Back-end activities (RWMC)



Separation
Characterisation
Packaging

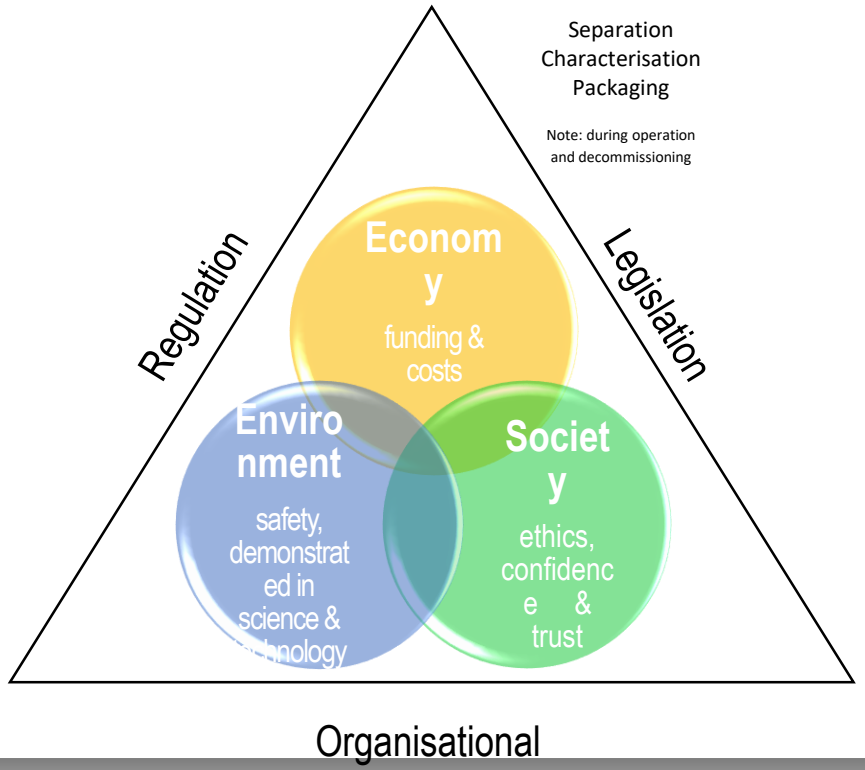
Note: during operation and decommissioning

Separation
Characterisation
Treatment
Conditioning

Note: all kinds of radioactive materials

Safety & Security
Long-term behaviour
Aging Management

Siting
Construction
Operation
Closure
Post-closure



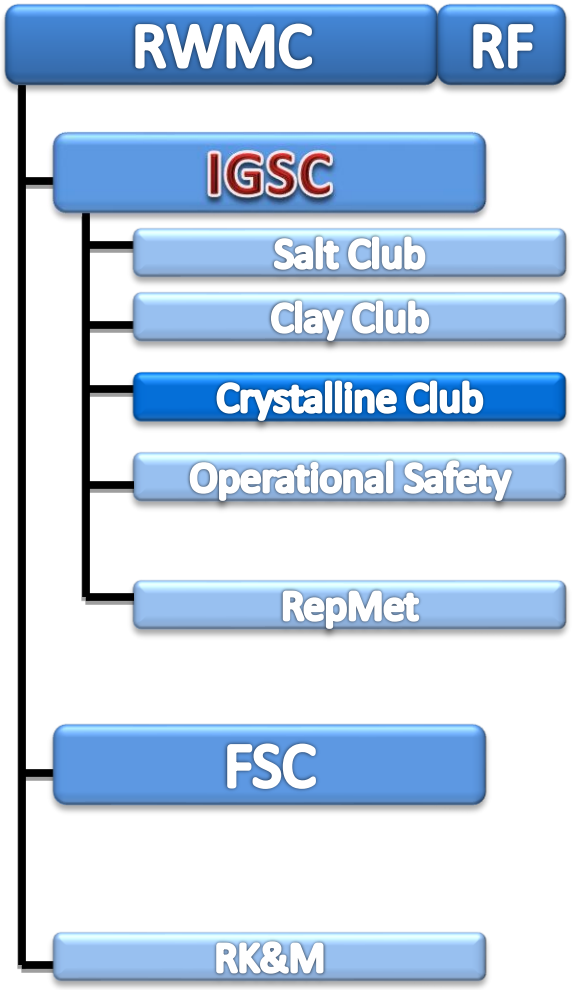
The purpose of the RWMC is to support international co-operation in the management of material from nuclear installations, including facility decommissioning and long-term waste management.

IGSC – Integration Group for the Safety Case

Formed in 2000;

- **main focus** - safety case for deep geological repository for HLW/SNF in operational and post-closure periods;
- **mission** - to assist member countries to develop effective safety cases for DGR, supported by robust scientific technical bases;

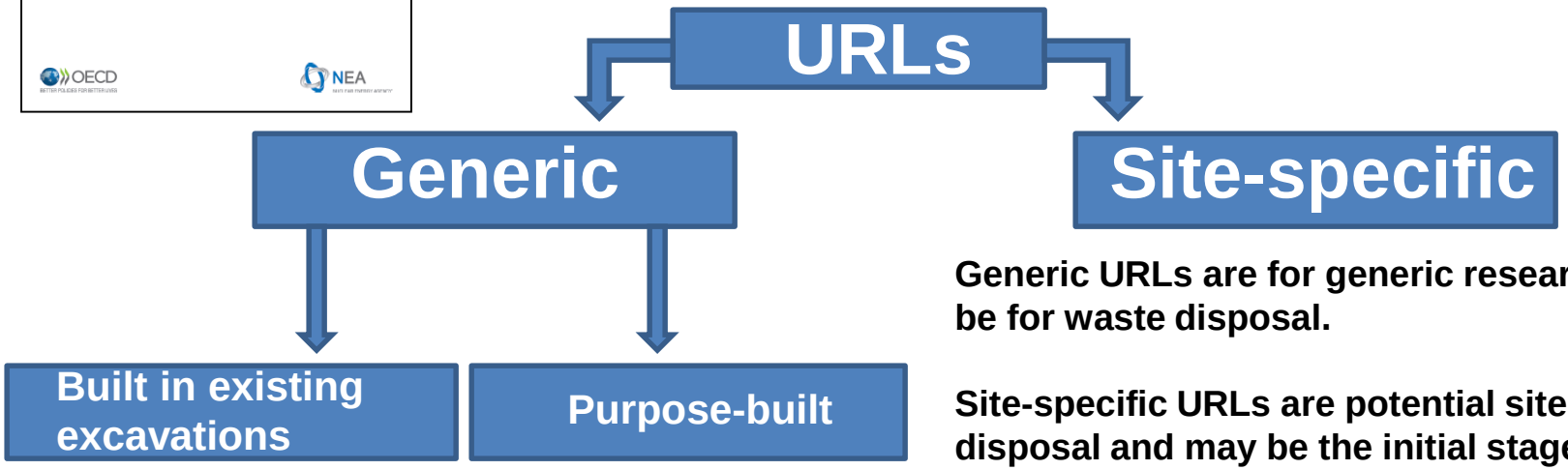
IGSC – Integration Group for the Safety Case



- evaluates safety aspects for DGR and promotes international dialogues to address strategic and policy aspects of repository development.
- supports the RWMC by performing peer reviews for assessing long term safety.
- carries out meetings with discussions of issues and trends in developing safety cases.
- organizes technical projects and workshops to investigate specific topics of the implementation of DGR.

Review of Underground Research Laboratories

- Types of URLs depending on the purpose and the roles of these URLs in DGR development.
- The aspects to be considered when planning a URL.
- URLs development experience.
- The opportunities and benefits of International cooperation programmes in URLs.



Generic URLs are for generic research, site is not be for waste disposal.

Site-specific URLs are potential sites for waste disposal and may be the initial stage of DGR developing at the site.

http://www.oecd-nea.org/rwm/igsc/.

Role of URLs in DGR development

Better understanding of the technical aspects (geological, hydrogeologic, geochemical characteristics of a site) for repository development and enhance confidence building.

Generic URL	Site-specific URL
Development/testing of technology/methodology	Site evaluation/confirmation , scaling rules
Collecting of generic data on host rock, development of processes understanding	Technology demonstration, monitoring for regulation purposes, assess environmental impact
Testing and demonstration of disposal concept/alternatives	Testing of DGR design, operational aspects, engineering barriers system, provision materials for licensing
Building stakeholders' confidence and fostering international cooperation	Building stakeholders' confidence, demonstration of design, systems and safety to regulators and the public

The main knowledge about URLs

The main issues are studied and discussed in the brochure:

- Stepwise repository development and supporting work in URLs;
- URLs planning and their limitations (including factors consider);
- Strategies for URL development;
- URLs Experience in the Past Decade (Bure, KURT, ONKALO);
- Technical information obtained in URLs (table);
- Examples of work performed in URLs;
- Lessons learnt from a generic URL (AECL's URL Canada; ONKALO Finland);
- International Co-operation

URLs planning and designing

Factors to consider in design

Generic URL	Site-specific URL
Site is relevant to searched DGR type and able to be modelled	Site is considered for future DGR
Development/testing methodologies with an emphasis of scientific development	Minimised perturbance to geosphere, saving the integrity of host rock
It is tool for demonstration of ideas and communication	Minimisation of uncertainties and collection of specific data
URL is not intended to be a DGR	Demonstration of future DGR concept and disposal technology

Limitation of work in URLs

Generic URL

- Transfer of results/data to planned repository design
- Programme is short-term comparing with period of safety assessment
- Limitation of radionuclide application (sometimes allowed – Grimsel, Mont Terri, Aspo, Asse)
- Complex boundary conditions in URL built in existing underground facilities (Grimsel)

Site-specific URL

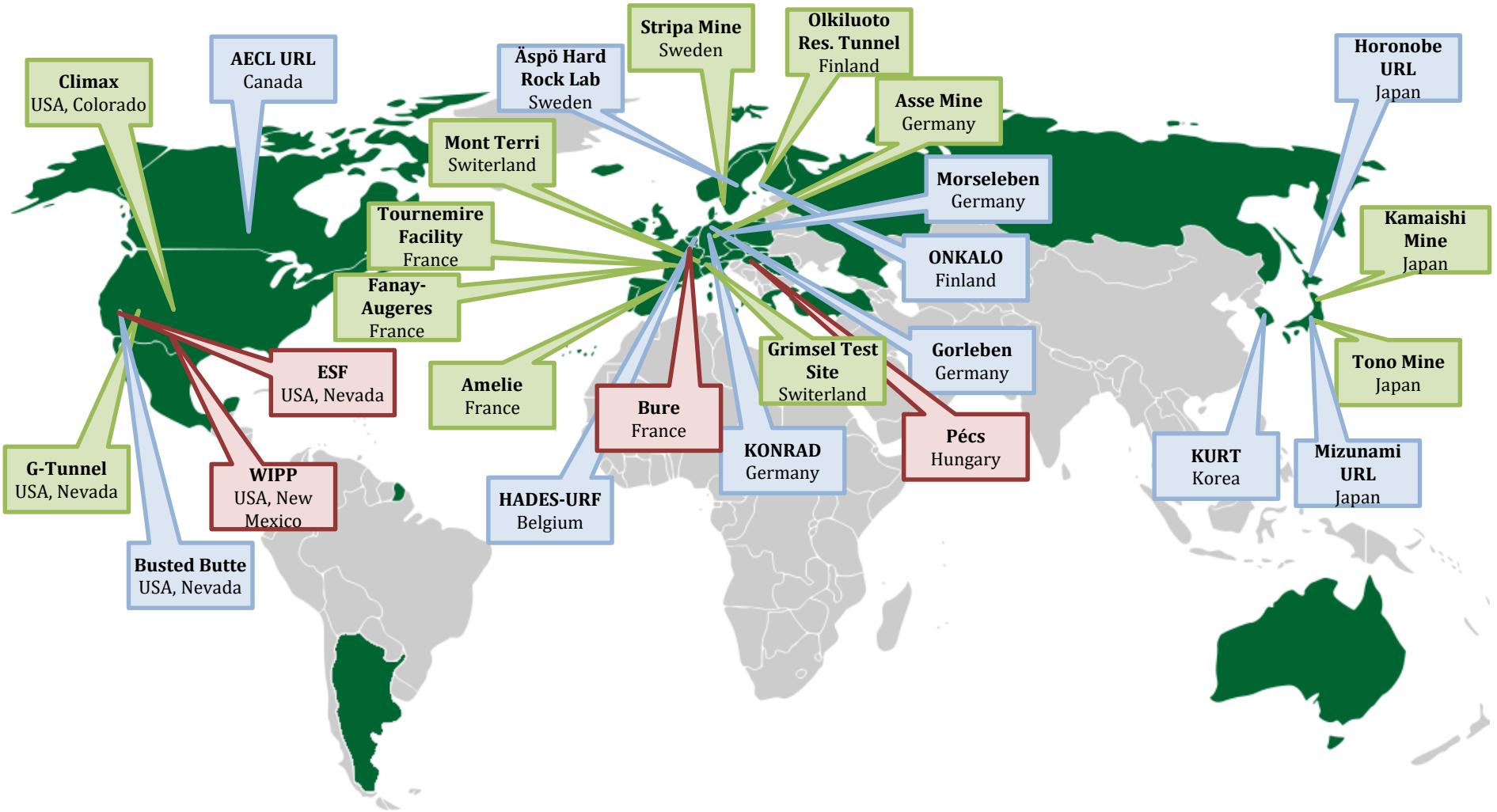
- Damage to the geosphere must be minimised
- Limitation of scaling between URL and real DGR for testing
- Determination of rock properties in detail over the full extent of DGR is impossible

Strategies for URL development

The main questions to be addressed

- How pressing is the need to dispose of waste?
- Is a URL needed to develop and test a disposal concept?
- Can desired information be obtained by co-operating in work performed in the URL of another country?
- Is going underground the most efficient way to satisfy research and testing needs?
- Can an existing underground facility be adapted for generic URL work in a cost-effective manner?
- Is the overall waste disposal programme sufficiently advanced to provide continuity when the URL work under consideration is completed?

URLs in NEA countries



Generic URL built on pre-existing underground excavations

Purpose-built generic URL

Site-specific URLs

Generic URLs in NEA member countries

URL	Country/operator	Remarks	International cooperation
Clay			
Tono Mine	Japan/JAEA	**Preexisting** uranium mine 1986-2004	France, Switzerland
Mont Terri	Switzerland/Swisstopo	**Preexisting** highway tunnel. Initiated in 1995.	Belgium, Canada, France, Germany, Japan, Spain, United Kingdom, United States.
Tournemire	France/IRSN	**Preexisting** railway tunnel. Operating since 1990.	Canada, IAEA URF network.
HADES-URF	Belgium/EIG EURIDICE	**Purpose-built**, operating since 1984	France, Germany, Japan, Spain, Netherlands, Switzerland.
Horonobe URL	Japan/JAEA	**Purpose-built**, constructiong since 2005	France, Switzerland.
Salt			
Asse Mine	Germany/GSF (Helmholtz Zentrum München)	From 1965-1978; **transfer to repository status** – LLW/ILW; retrieval – preferred strategy	
Amelie	France/ANDRA	**Preexisting** potash mine. Operated 1986-1992.	

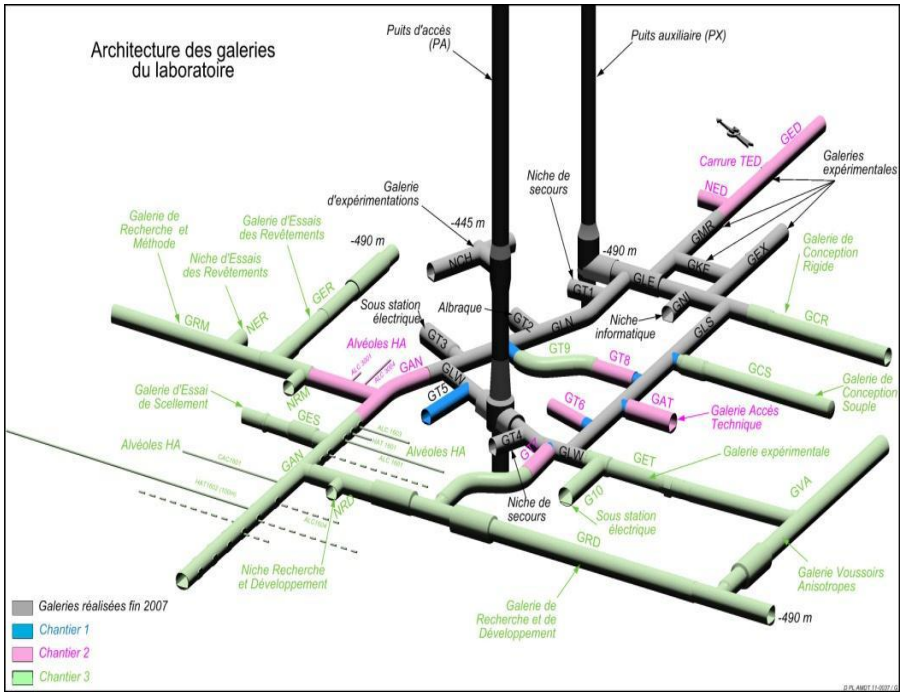
Generic URLs in NEA member countries

URL	Country/operator	Remarks	International cooperation
Granite			
Kamaishi Mine	Japan/JAEA	**Preexisting** iron-copper mine. Operated 1988-1998.	Switzerland
Stripa Mine	Sweden/SKB	**Preexisting** iron mine. Operated 1976-1992.	Canada, Finland, France, Japan, Spain, Switzerland, United States
Grimsel Test Site (GTS)	Switzerland/NAGRA	**Preexisting** service tunnel of a hydroelectric project. Operating since 1984.	Czech Republic, France, Germany, Japan, Spain, Sweden, United Kingdom, Finland, South Korea, United States, EC and the IAEA URF network.
Olkiluoto Research Tunnel	Finland/Posiva	Tunnel adjacent to the Olkiluoto repository for LLW. Operating since 1992.	Sweden
Climax	US/DOE	Drift mined from **preexisting** excavations. 1978-1983.	
Fanay-Augères	France/ISRN	**Preexisting** uranium mine. Operated 1980-1990.	
Whiteshell URL	Canada/AECL	**Purpose-built**; 1984-2010	France, Japan, Sweden, Finland, United States.
Mizunami (MIU)	Japan/JAEA	**Purpose-built**, since 2002	Korea, Switzerland, United States
Äspö	Sweden/SKB	**Purpose-Built**. Operating since 1995	Canada, Finland, France, Germany, Japan, Spain, Switzerland, United Kingdom, United States.

Site-specific URLs in NEA member countries

URL	Country/operator	Remarks	International cooperation
Clay			
Bure	France/ANDRA	Since October 2004	Switzerland, Germany, Japan.
Pécs	Hungary/PURAM	Former uranium mine, operated 1995-1999	
Salt			
Gorleben	Germany/BfS	Constructed 1985-1990	
Morsleben	Germany/BfS	Repository for LLW/ILW 1981 – 1998; decommissioning considered	
WIPP	US/DOE	Repository for LLW/ILW since 1992	Canada, France, Germany, Japan, Sweden, United Kingdom.
Granite			
ONKALO	Finland/POSIVA	Excavation began in 2004	
URL in Krasnoyarsk region	Russia/NO RAO	Construction starts soon	

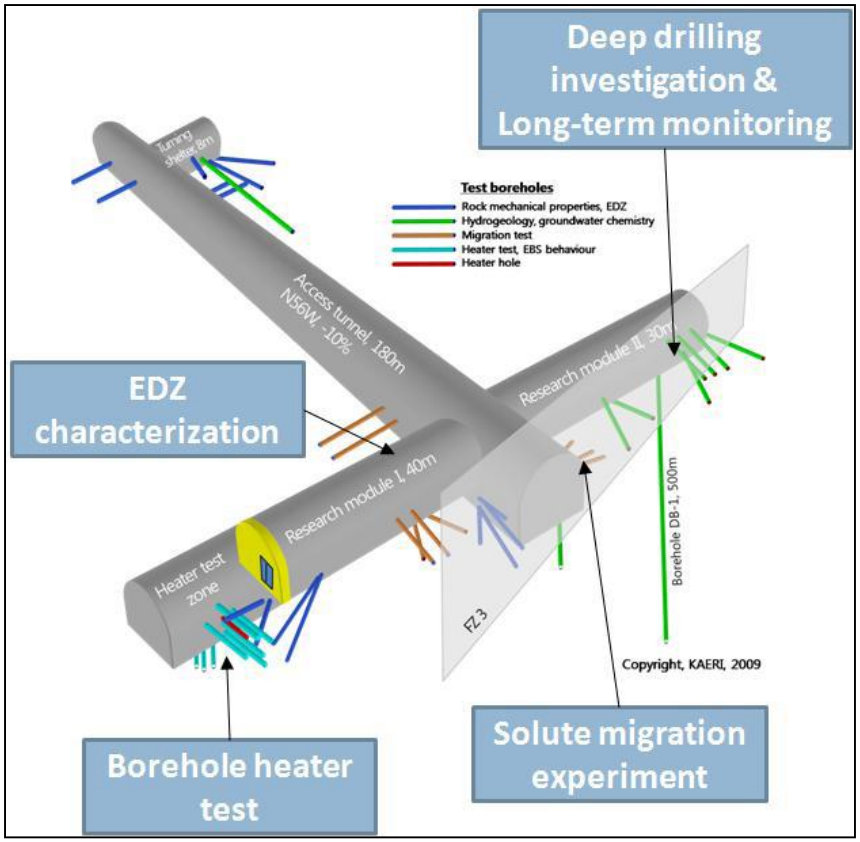
Examples of URL constructions



Site-Specific URL Bure (France)

Costs for Bure URL as of 2010:
- Construction cost: 280 M€.
- Operational R&D programme including exploitation costs: around 60 M€/year.

Generic P-B URL KURT (S. Korea)



Crystalline Club

- Requested by Russian Federation, supported by Czech Republic and Japan, approved in IGSC-18 in 2016, and created in 2017.
- Building upon the success of the Clay Club / Salt Club, primary objective is to promote scientific studies on characterization of *crystalline rocks* via joint undertakings of common interests.
- Membership: 24 official members from 7 countries (Canada, Czech Republic, Germany, Japan, Russian Federation, Spain, United States).

Crystalline club

Objectives:

- Perform fundamental research into areas where understanding is incomplete, or improvements are required.
- Promote 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.
- Develop and exchange information specific to certain geological media among countries currently pursuing or considering crystalline rock as a candidate deep geological repository medium.
- Communicate identified topics of common interest and/or exchange with other working groups or international projects on issues of common interest.

Crystalline Club (cont'd)

- Kick-off teleconference – 4 April 2017 with 17 participants from 10 organizations.

Chair	Lukas VONDROVIC, Czech Republic	
Vice Chairs	Judith FLÜGGE	Germany
	Motoyuki YAMADA	Japan
	Anna TALITSKAYA	Russian Federation
	Miguel Angel CUNADO PERALTA	Spain
	Paul E. MARINER	United States

-Discussion on Programme of Work

✓ The Club decided to develop the status report on characterization of crystalline rocks as a first step.

- 1st plenary: 5-6 December 2017 in Prague

Expert Group on Operational Safety (EGOS)

- 5th EGOS meeting: 9 October 2017 in Paris.
- 21 participants from 10 countries.
- Project Update
  - Fire risk and ventilation methodology → NEA report in Q2 of 2018
  - Transportation and emplacement methodology of waste package → NEA report in 2018
  - Waste acceptance criteria → NEA report in 2018
  - Development of NEA hazard database

EGOS (cont'd)

- EGOS Programme of Work for 2018-2019.
  - New activities
    - ✓ Credible fire assessment methodology
    - ✓ Interactions between operational safety and long-term safety and the methodology of the assessment
    - ✓ Management of material inventories and residual materials in view of operational safety and post closure safety

REFERENCES

- 1. “The nature and purpose of the post-closure safety cases for geological repositories” Radioactive Waste Management NEA/RWM/R(2013)1 (2013).
- 2. “Methods for Safety Assessment of Geological Disposal Facilities for Radioactive Waste” Radioactive Waste Management NEA ISBN 978-92-64-99190-3
- 3. “Underground Research Laboratories (URL)” Radioactive Waste Management NEA/RWM/R(2013)2

http://www.oecd-nea.org/rwm/igsc/.

Thank you for your attention!