IAEA 60 Years
Atoms for Peace and Development

Future Borehole Disposal Systems

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Overview

- There is a continued and widespread need to manage Disused Sealed Radioactive Sources (DSRS) and small quantities of radioactive waste
- A range of solutions exist to meet this challenge
- One next step is to enable a more standardised disposal system
- Member States have expressed interest in a project, in which
  - Member States will come together,
  - Contribute their skills and expertise,
  - To develop and implement a more standardised system for the borehole disposal of DSRS (and small quantities of radioactive waste)

- The IAEA secretariat is preparing the outline of the requested project and is seeking input from Member States – both from Operators and from Regulators

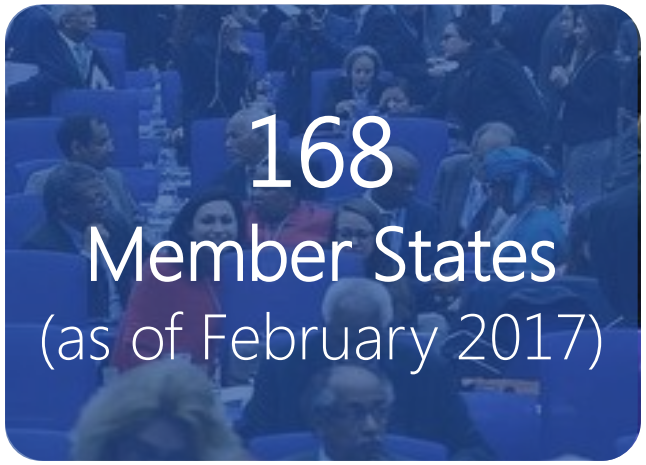
IAEA

Mandate

"Our mandate has been summarized as Atoms for Peace. Today, I feel that our mandate could be better understood as Atoms for **Peace and Development**."

Yukiya Amano, Director General, IAEA

After 60 years…



IAEA in the UN System

- IAEA is an autonomous international organization within the United Nations system
- Reports to UN General Assembly and UN Security Council
- Partners with more than 10 UN organizations

Empowered lives.
Resilient nations.

DSRS

- Scale of the challenge
- End of life options

Quantity - The global need

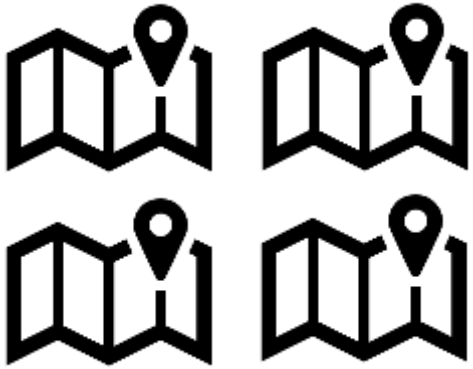
- Sealed Radioactive Sources have many benefits
- It is essential for Member States to safely manage Sealed Radioactive Sources throughout their lifecycle
- The IAEA provides support and has identified a large need for services, which is not fully met, at the moment

Medicine
Teletherapy

Industry
Level gauging

Demand is large and widespread (in the several 10,000's) and is not currently fully met

Challenge



X

+

. . etc . . . .

~ 100 Countries X (DSRS + Small RAW)

Challenge

- The challenge is evident in many Member States
- Many lack the infrastructure and access to knowledge which is required to implement the range of solutions
- The risk of accidents and security incidents remains

Range of options for end of life management

Recycle

Decay
Storage

Repatriate

Dispose

Borehole Disposal

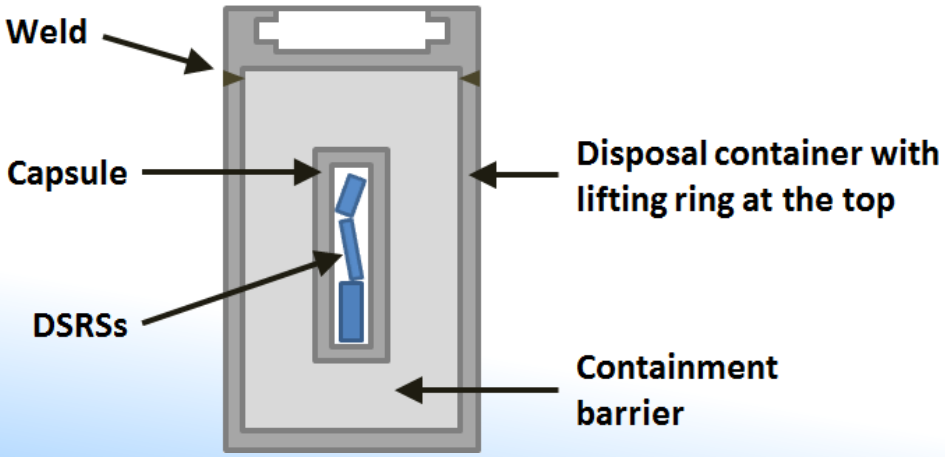
- Current work by Ghana and Malaysia

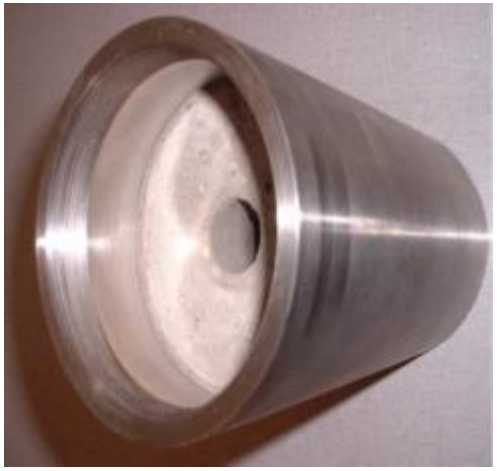
Borehole disposal projects

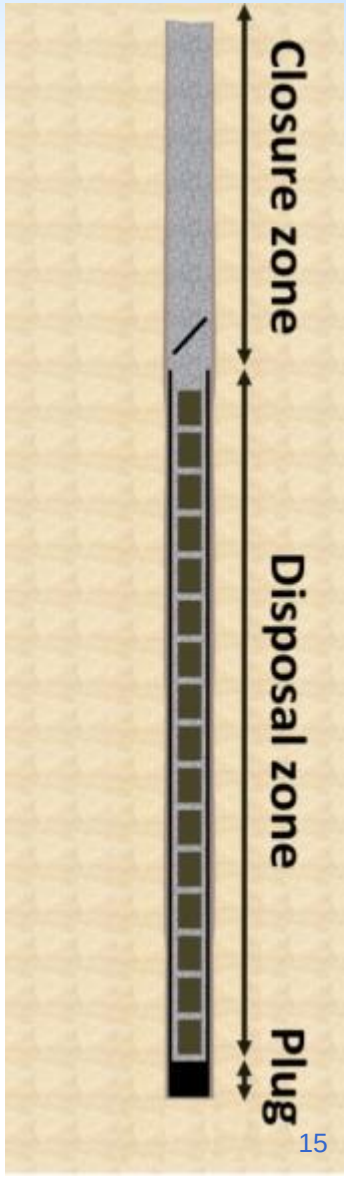
- There are currently 2 borehole disposal projects (ongoing from 2015).
- Ghana and Malaysia are working to dispose of their DSRS inventory in boreholes, within their territories, in 2018
- These projects receive financial support of Global Affairs Canada and IAEA Technical Cooperation Fund
- The IAEA secretariat takes a project management role, to provide assistance, both to the regulator and implementer
- The implementer and the regulator in the Member States retain responsibilities for their duties (safety case preparation, licensing, etc.)

Borehole Disposal System

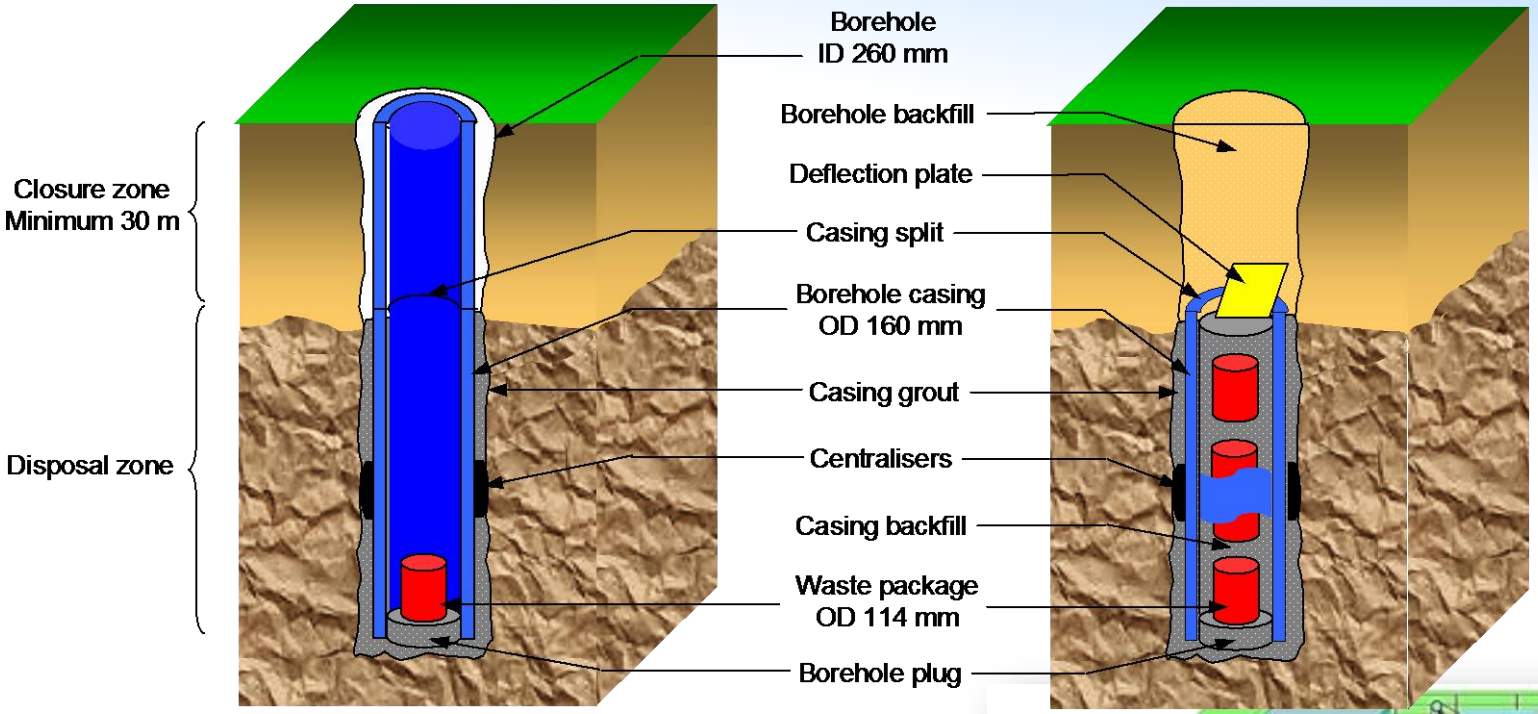
- A safe and economic disposal solution for DSRSs that is applicable for a wide range of DSRSs and a wide range of hydrogeological and climatic environments
- DSRSs are first placed in waste packages and then lowered into a disposal borehole and encased in cement grout.

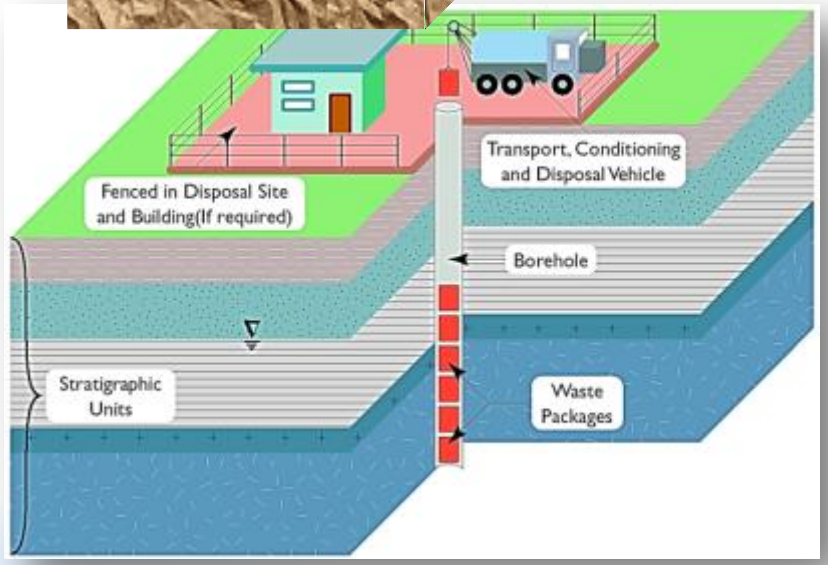






Borehole Disposal System

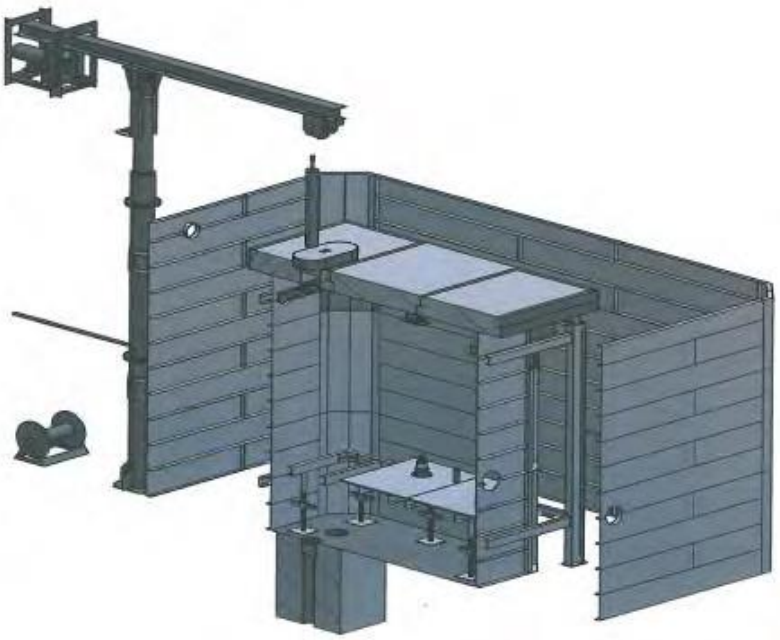


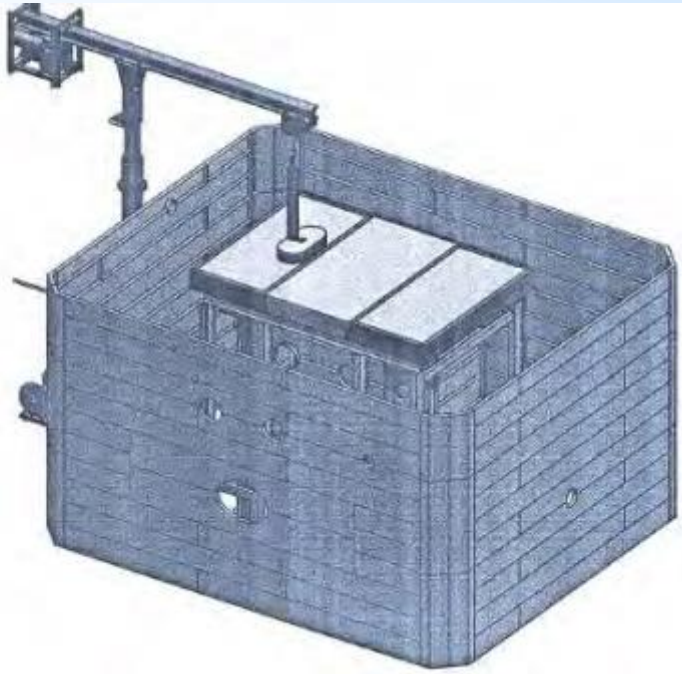


Generic Safety Assessment demonstrates that the concept provides an appropriate degree of long-term safety for the majority of systems, scenarios, and radionuclides

Improvements for Category 1 - 2 (high activity) DSRS disposal in borehole

The Mobile Hot Cell has been improved, allowing higher category DSRS disposal in a borehole:





Ongoing work :

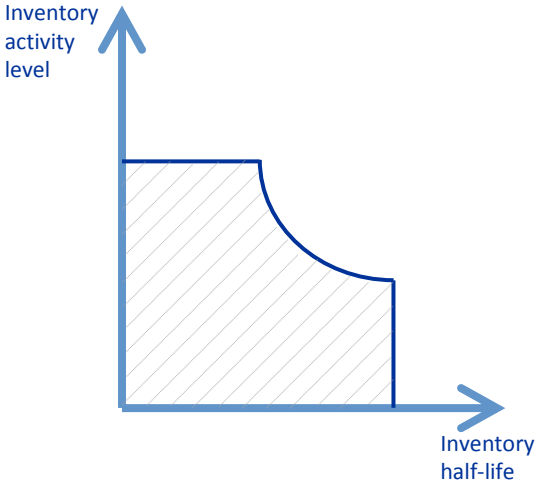
- Finalise the welding machine
- Further testing of all the hardware through a second test operation (commissioning)

The next step - standardisation

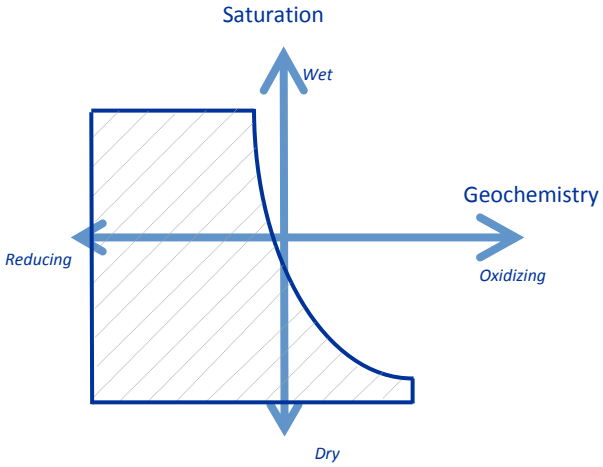
Photo Credit – Rolls Royce

Solution - Develop the specification

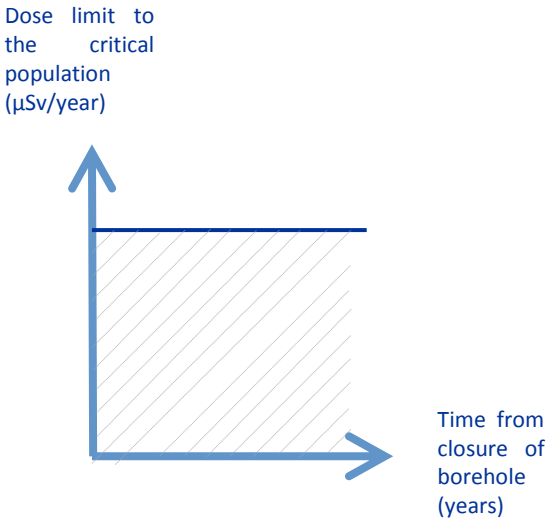
3 Envelopes



Inventory



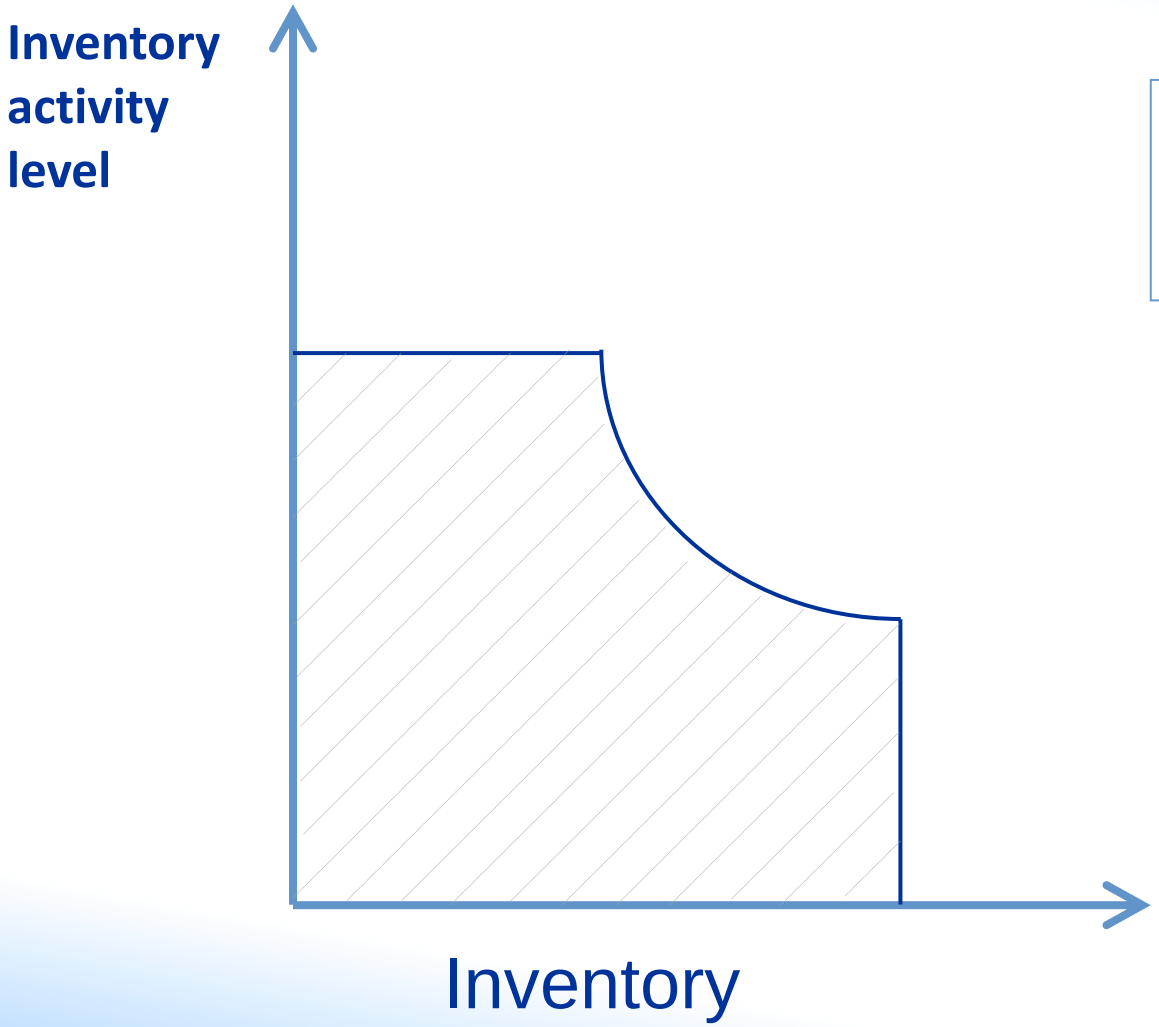
Geology



Dose Limit

Solution - Develop the specification

3 Envelopes



Note;
Conceptual only !
Not to scale !

Solution - Develop the specification

3 Envelopes

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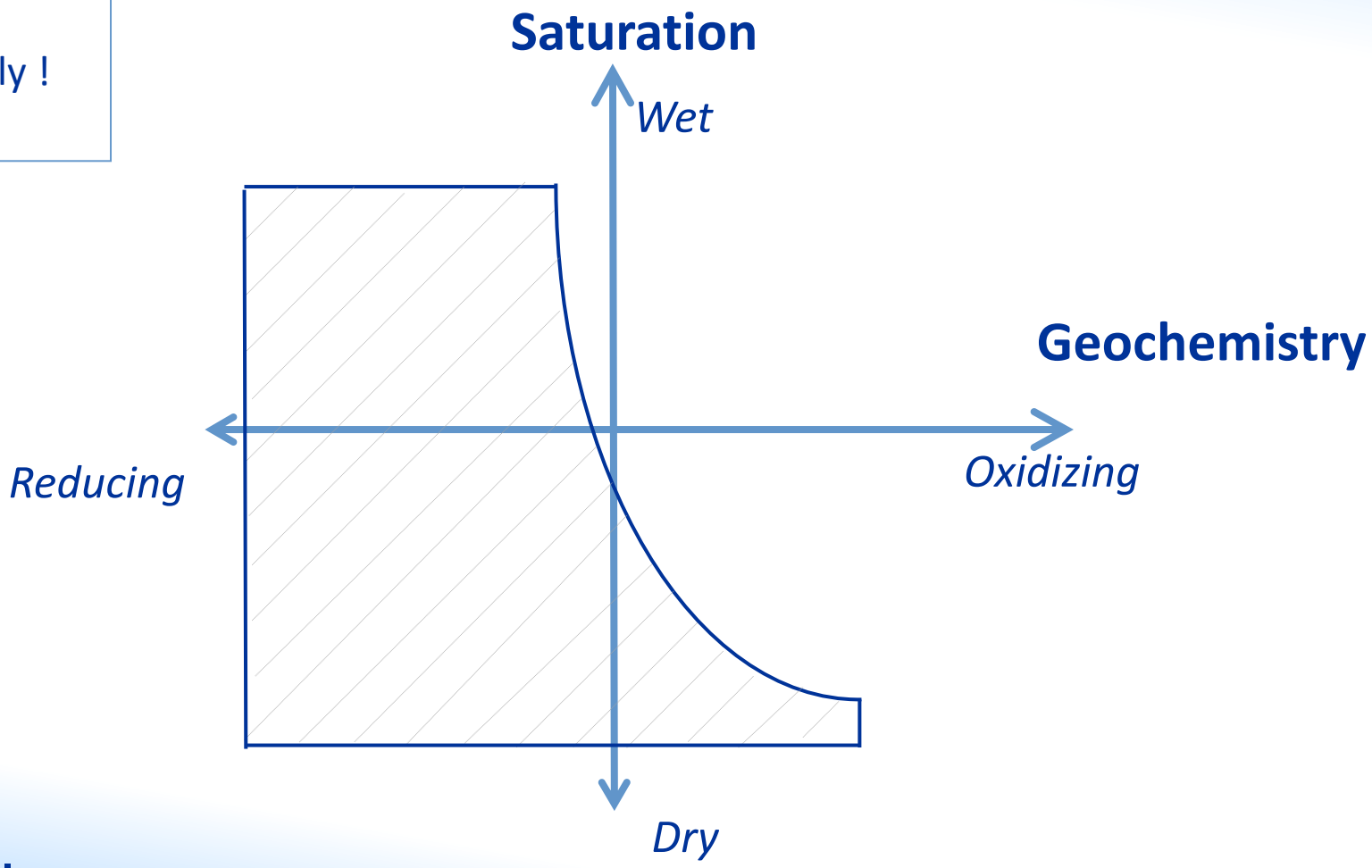
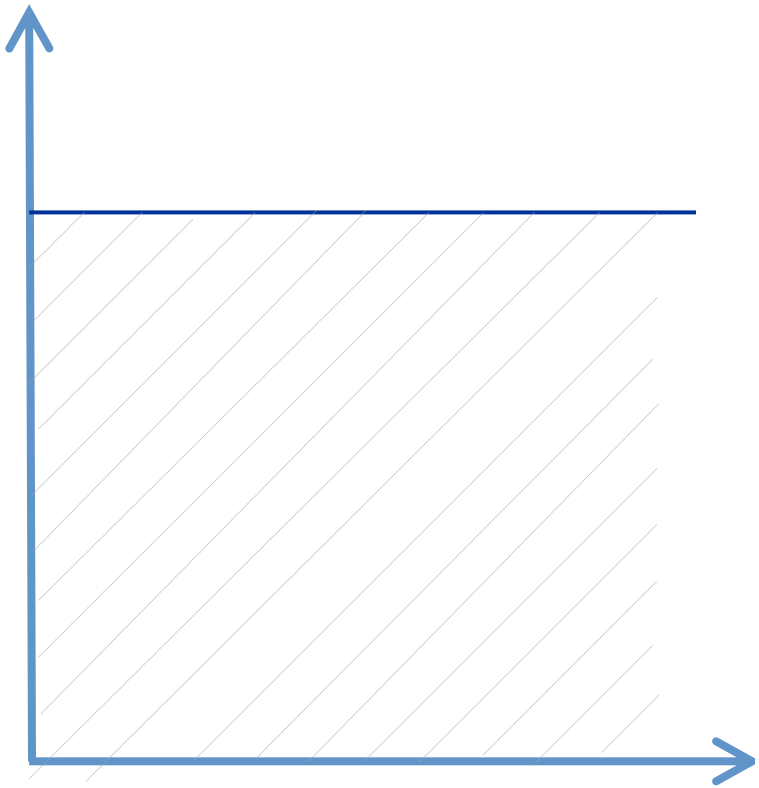


Geology

Solution - Develop the specification

3 Envelopes

Dose limit to the critical population (µSv/year)



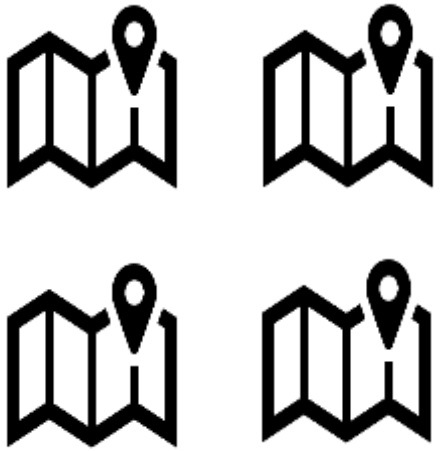
Time from closure of borehole (years)

Note;
Conceptual only !
Not to scale !

Dose Limit

Proposed Project

Countries
(3 to 6 ?)



Jointly develop
***standardized*, *common*. . .**

. . Safety Assessment

. . Design & Procedures

. . Licensing

And implementation. . .

IAEA secretariat facilitation

Benefits

- Specify the challenge

- Focus efforts on a standardised, common solution. Member states will . .
  - Contribute their effort and ideas
  - Bring specialist skills to the project
  - Share ideas and knowledge
  - Challenge each other
  - (Attractive to donors)

- Improved
  - Safety
  - Security
  - Effectiveness
  - Widespread understanding of the solution

Borehole Disposal - Future

- This project will involve the design, safety case development, licensing and implementation of a common, standardised disposal system for DSRS.
- Led by Member States (MSs) and facilitated by the IAEA secretariat.
- It is expected that several of the MSs involved have more developed nuclear programmes.
- At the end of the project, the common system is agreed upon by the group of MSs. It will then be available for use by further MSs (with suitable checks in place), with a high level of safety, and with less effort and cost being required for these further MSs.
- To be successful, the support of all relevant organisations, in several MSs, will be required. It is expected that this will involve the radioactive waste management organisation, the regulatory body (or bodies, involving radiological, environmental and security aspects).

Project key success factors

- The project will be viewed as successful if . . . .
  - At least 2 MSs have licensed and implemented a common, standardised, engineered disposal solution for DSRS;
  - The common, engineered solution can be successfully implemented, based on an assessment of the ‘envelopes’ of inventory, geology and dose rate to the critical population, placing a greater emphasis on the engineered barrier system;
  - All the required elements of such a system (designs, operating procedures, safety cases, licensing guidelines and so on) are available for confirmation and use by other MSs, with suitable checks in place before implementation,
  - Mechanisms for capturing feedback, to enable further stages of improvement, are in place and are supported by MSs

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Thank you!