IGD-TP
WG 2: Canister Design

Cordoba

October 25, 2016

Waste Canister for HLW and Spent Fuel

WG 2: Objectives

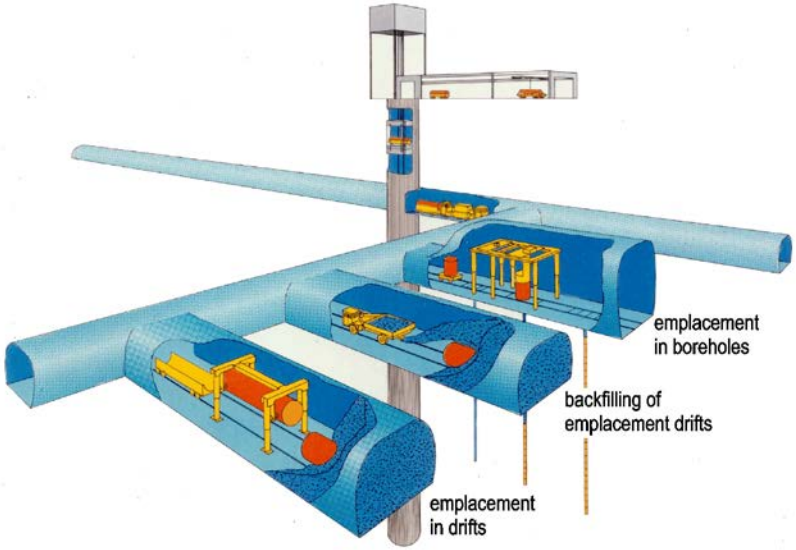
- Information exchange on approaches how to derive design requirements (regulatory, host rock specific, repository concept specific)
- Information exchange on state of the art on waste canister design, manufacturing and demonstration
- Information exchange on waste canister coating and lid/head welding
- Identification of RD&D needs for waste canister design, manufacturing and demonstration
- Recommendations to the IGD-TP

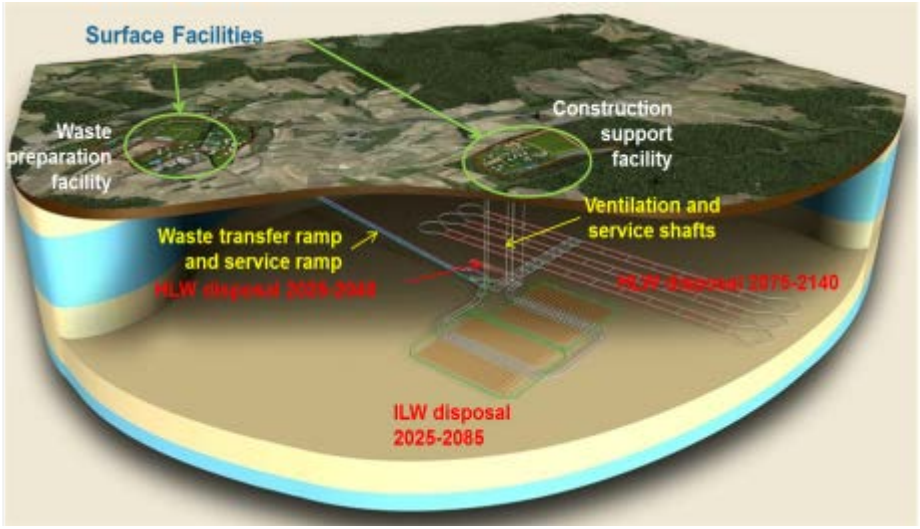
Waste Canister for HLW and Spent Fuel

WG 2: Introductory remarks

Common disposal concepts

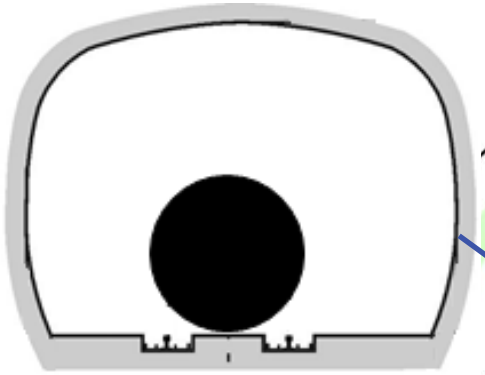
- Deep geological repositories will be sited, designed, constructed, operated and closed to isolate RW from the accessible biosphere;
- Surface operations are as important as activities in the underground (UG); infrastructure like shafts and/or ramps that connects the UG with the surface;



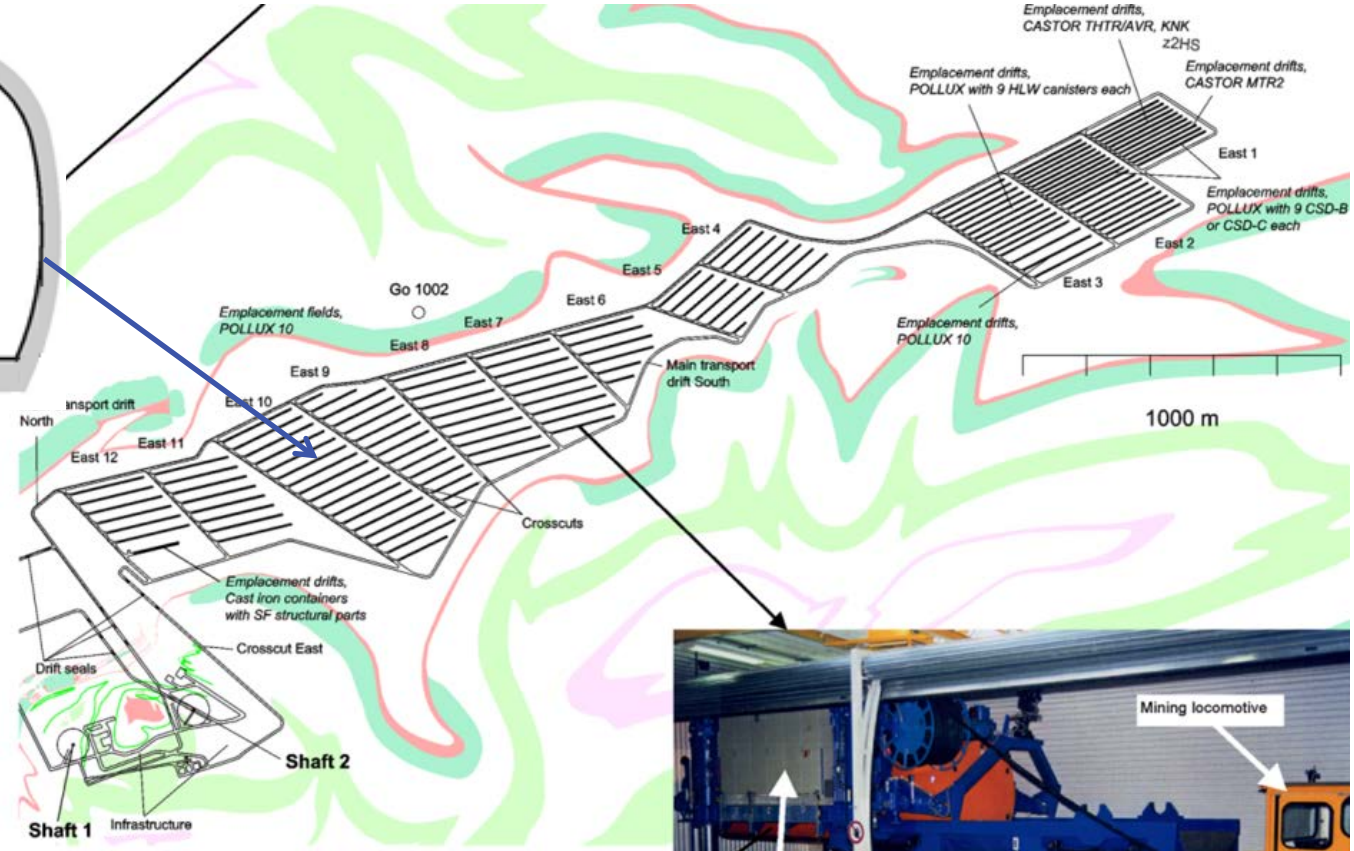


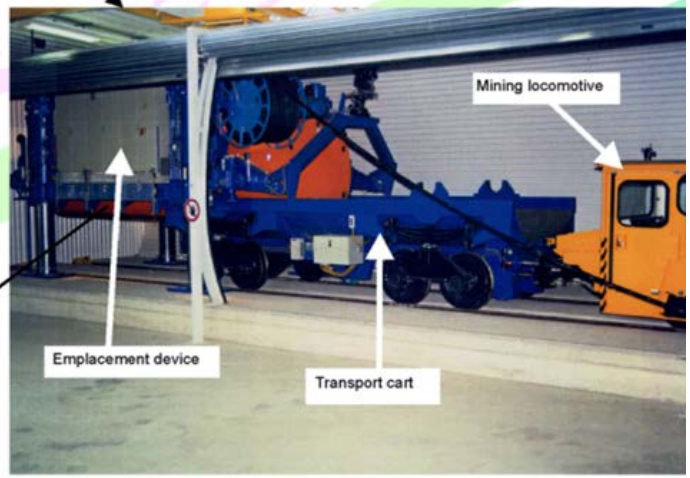
- Deep geological repositories may remain operational for long period (up to 100 yrs), may be expanded if needed;
- ALARA and the defence-in-depth strategy along with engineered barriers are often applied to minimize exposure risks.

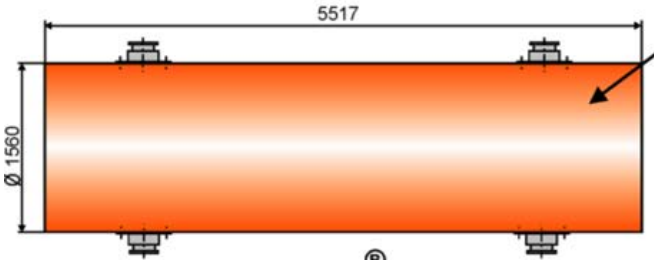
Repository Design: Drift Disposal Concept in Rock Salt



emplacement drift



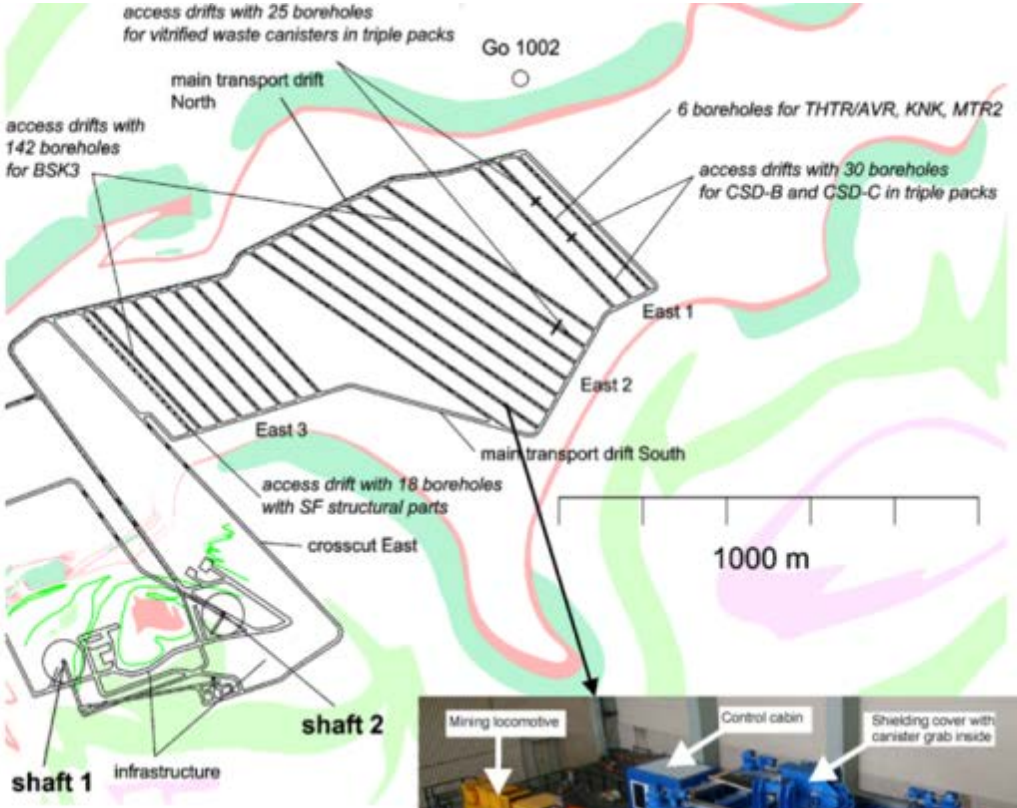


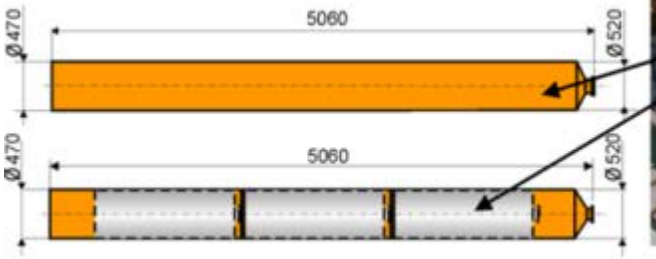


POLLUX-cask (dummy)

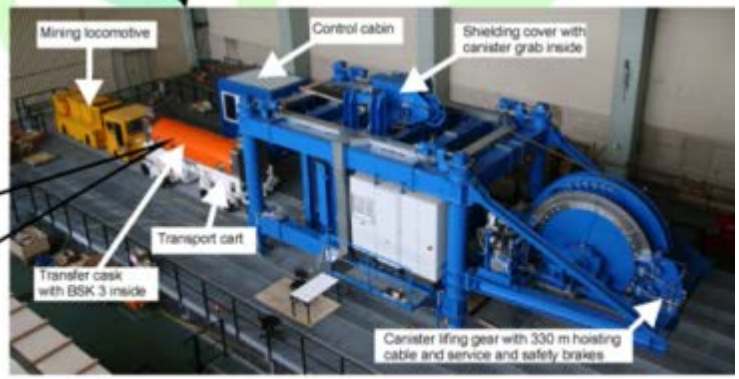
(after: preliminary safety assessment for the Gorleben site,VSG)

Repository design: Borehole Disposal Concept



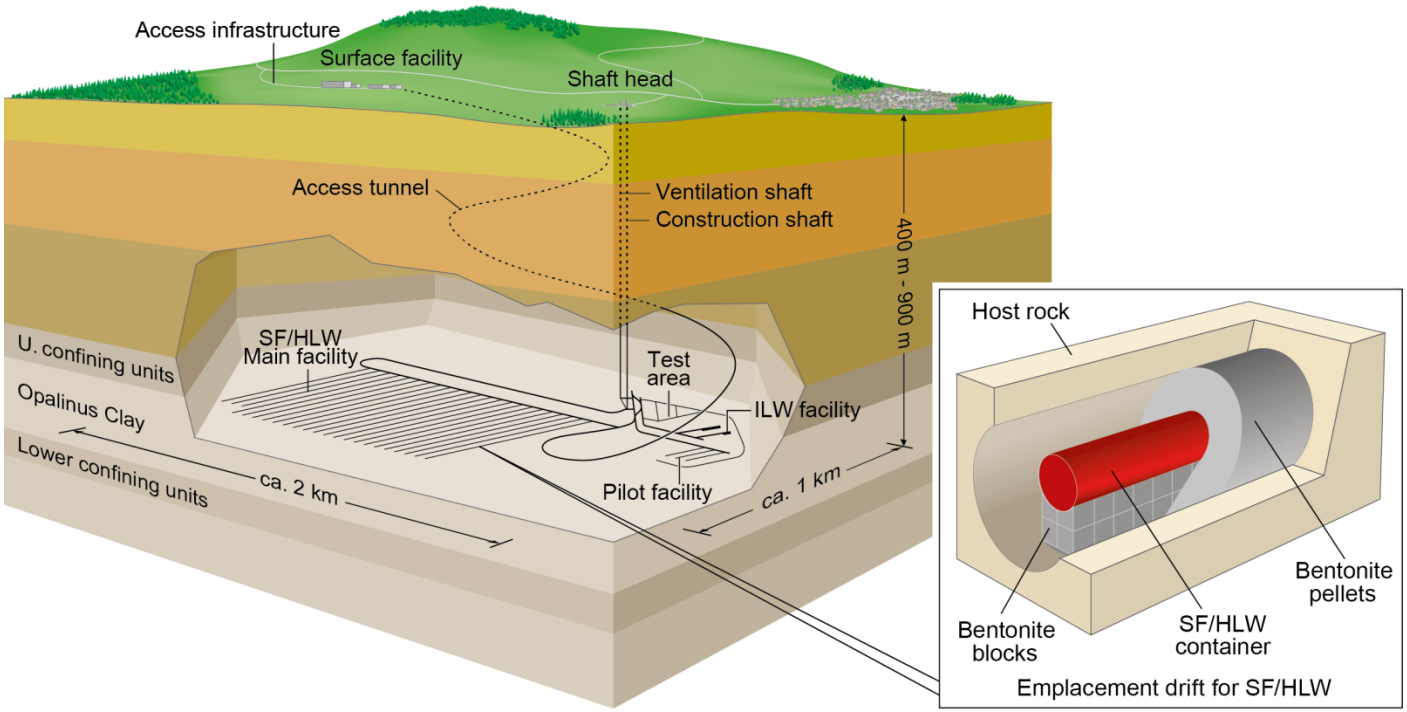


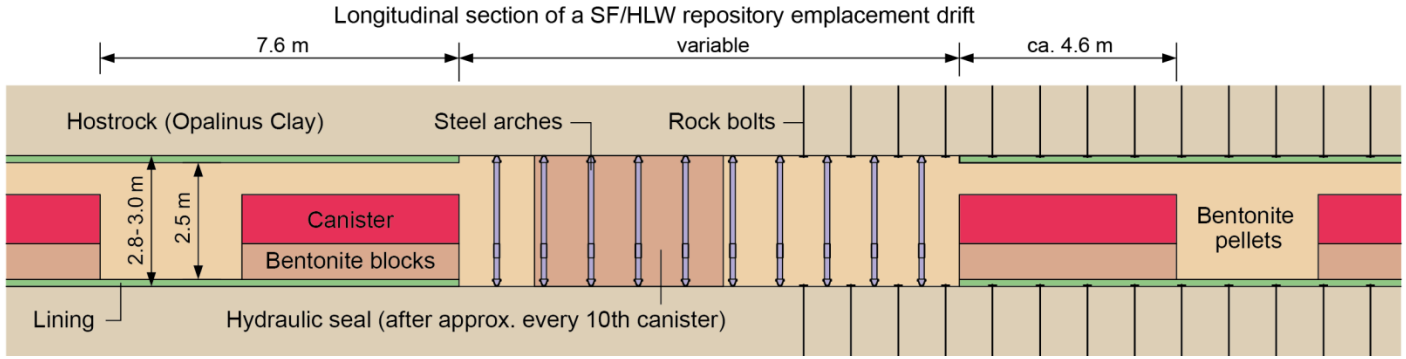
Vitrified Waste and Spent Fuel Canister



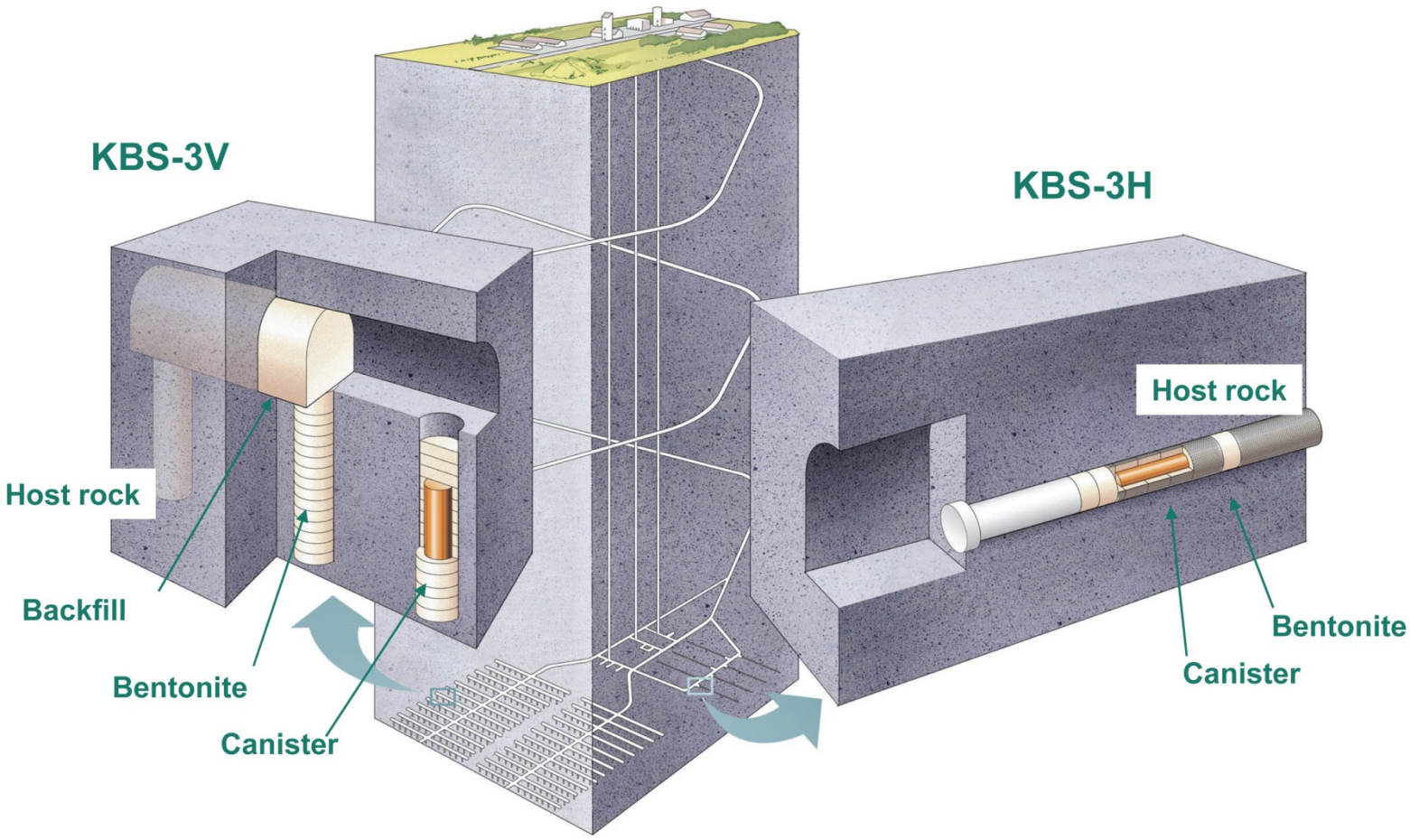
Emplacement tests

Repository design: Disposal in Clay



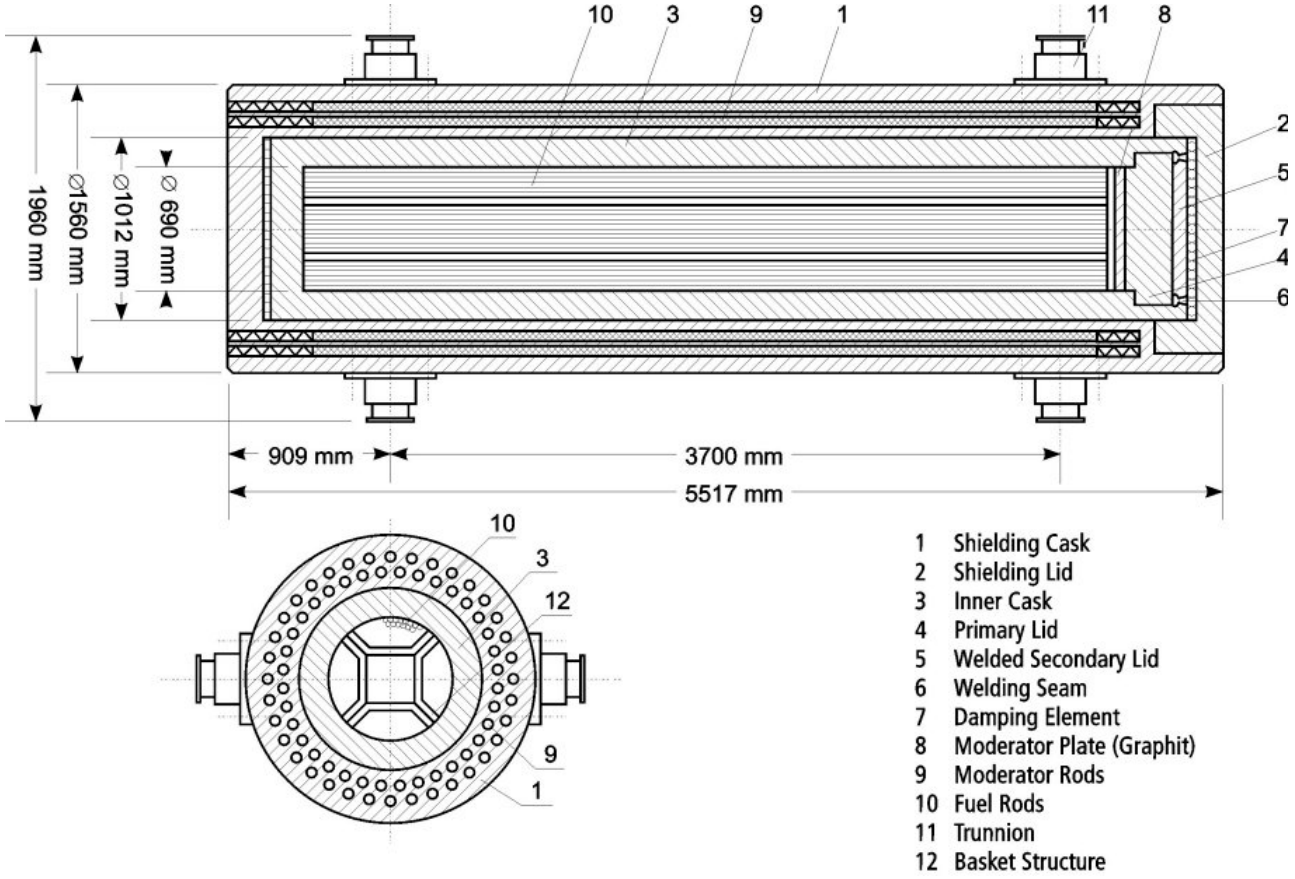


Repository design: Disposal in Crystalline rock



Cask for Drift Disposal Concept

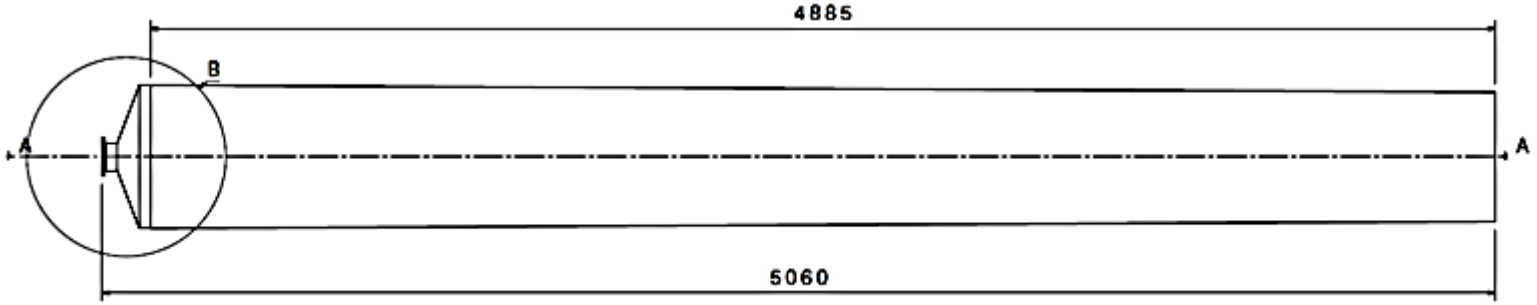
e. g. 65 t POLLUX cask for max. 10 PWR spent fuel elements



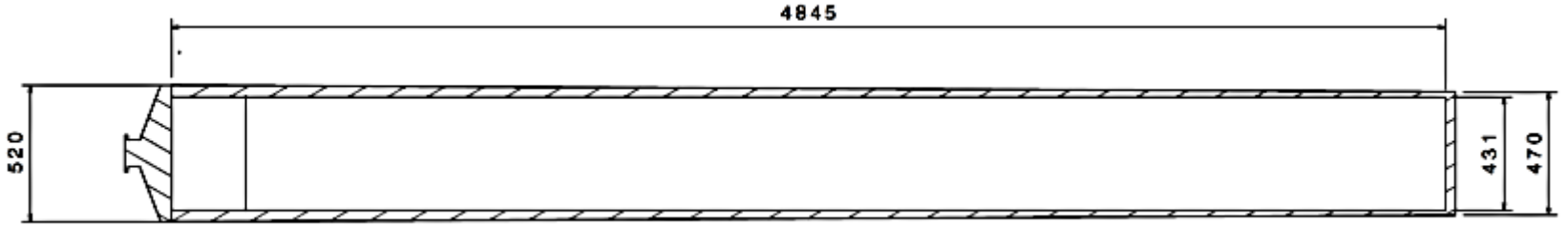
(Source: GNS)

Container Type for Borehole Disposal Concept

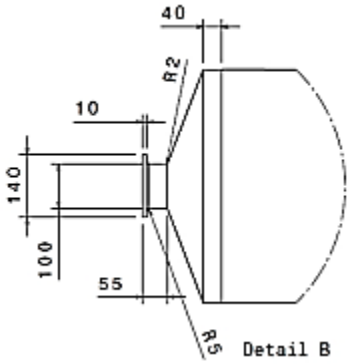
New design (2013) of a single container for HLW canister and SF



Front view

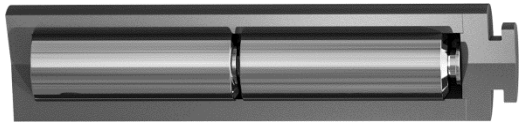


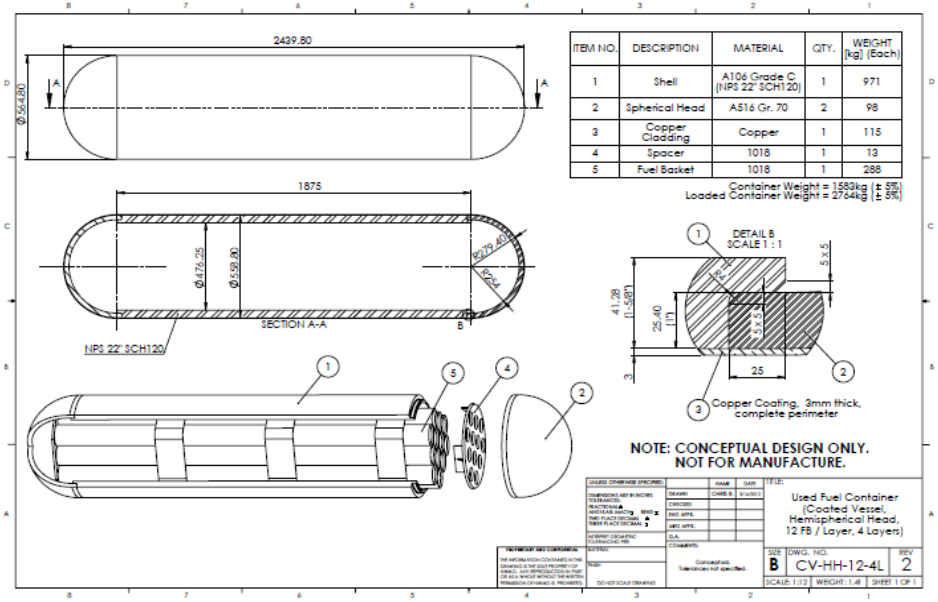
Section view A-A



(Source: nse)

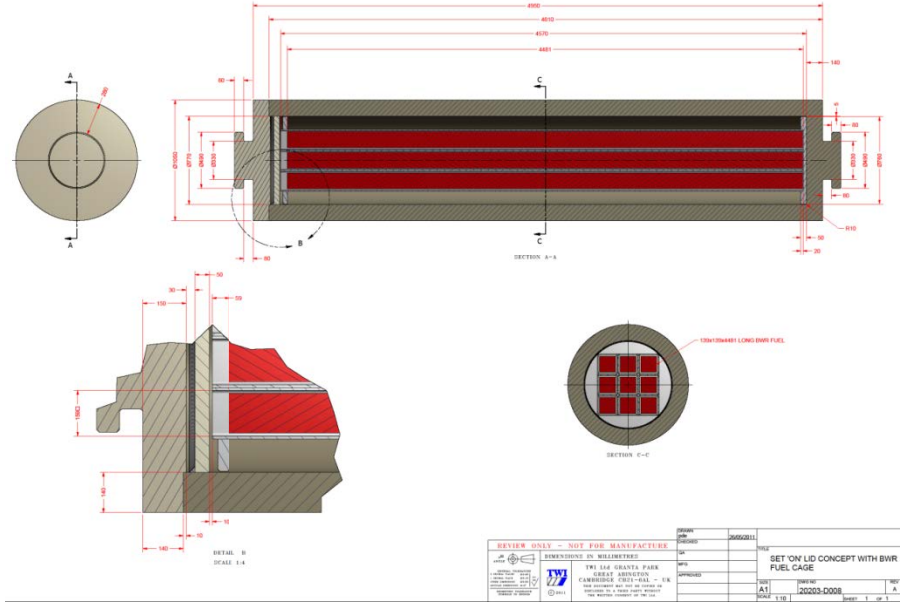
Canister concepts for disposal in Clay





ITEM NO.	DESCRIPTION	MATERIAL	QTY.	WEIGHT [kg] (Each)
1	Shell	A106 Grade C (NPS 22" SCH120)	1	971
2	Spherical Head	A516 Gr. 70	2	98
3	Copper Cladding	Copper	1	115
4	Spacer	1018	1	13
5	Fuel Basket	1018	1	288

Container Weight = 1582kg (± 5%)
Loaded Container Weight = 2764kg (± 5%)

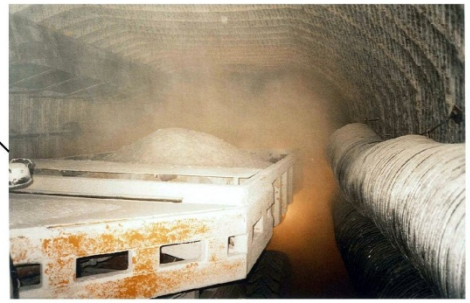


Canister concepts for disposal in Crystalline rock

Main Transport and Emplacement Systems

Shaft transport

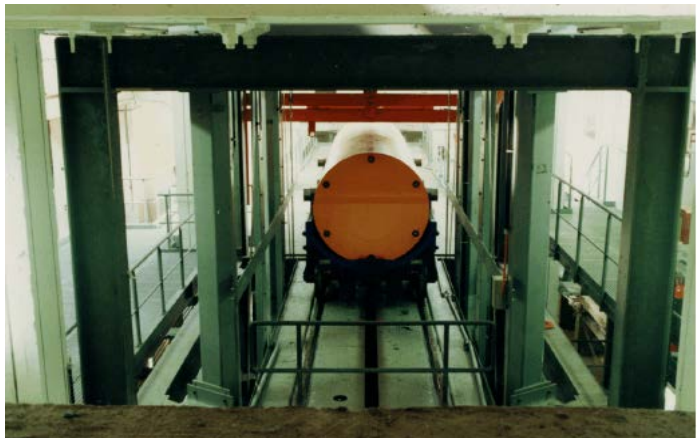
Borehole emplacement



Backfilling Slinger Truck
in a Disposal Drift

Drift emplacement

Demonstration of Transport- and Emplacement Techniques



Shaft Transport system
for Payloads up to 85 t

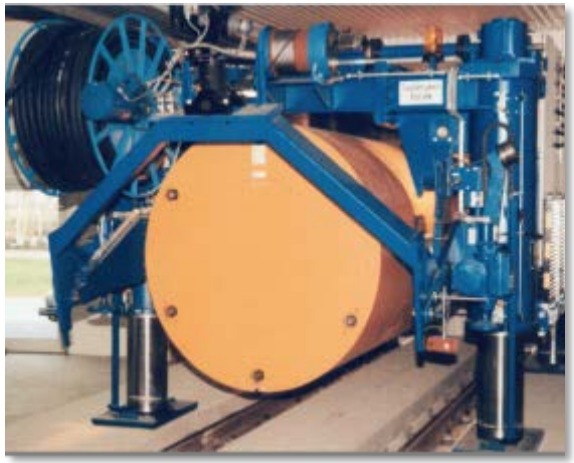
Emplacement Technique for
POLLUX-Casks

In situ-Heating Test (10 years)
to Proof POLLUX-Cask Emplacement
Concept

Demonstration Tests with
Neutron Sources on Surface
and Underground

Repository operations:

- **Underground :** typical processes include:
  - Ready packages are transferred in shielded (transfer) cask;
  - Placement of disposal canisters in boreholes or cells;

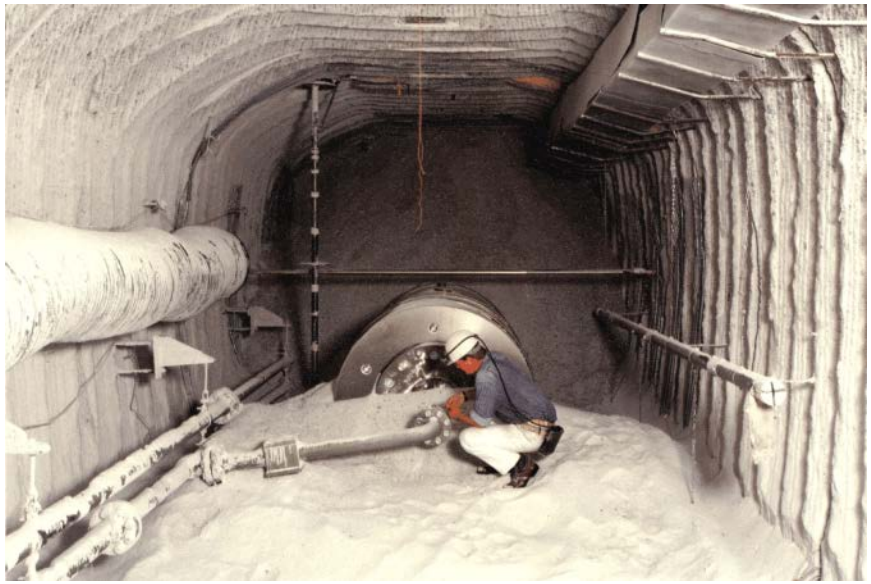


e.g.: shaft transport and emplacement of POLLUX casks (German concept)

Exposure to workers and the public during the operational phase is likely similar low as in other nuclear facilities.

Proof of Repository Design (Drift Disposal Concept)

… by means of demonstration tests



***in-situ test field* in the Asse mine with electrically heated casks (POLLUX-cask emplacement concept)**

Installation of test casks and monitoring system (left) 1990

Dismantling and cask removal 10 years later (right)

Borehole Emplacement Technique

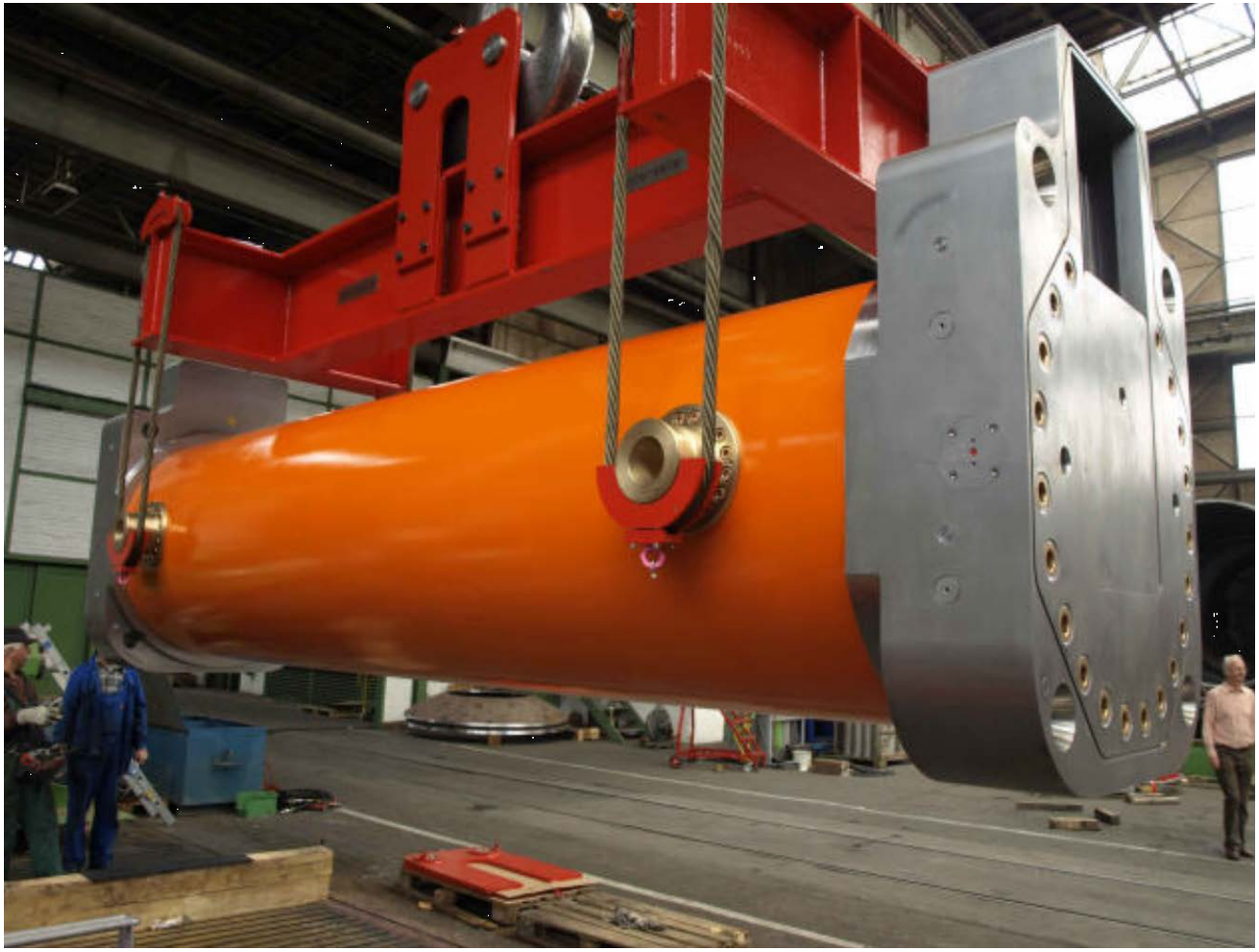


photo of the manufactured transfer cask (designed for safely shielding the spent fuel canister (BSK 3) during transport to underground and during emplacement process)

Borehole Emplacement Technique

photo of the manufactured transport cart (designed for the transport of the transfer cask from surface through the shaft to the underground)

WG2: Main subjects

Requirements & options (materials, design,…)

Technical Requirements for High Level Waste Disposal Containers with regard to their Retrievability during Operation and Recovery after Repository Closure

T. Orellana Perez - BAM

Candidate Material Solutions for the Design of Nuclear Waste Storage Canisters

S. Holdsworth - EMPA

Czech Disposal Canister Programme

I. Pospiskova - SURAO

WG2: Main subjects

Canister manufacturing and sealing/welding

Experience in manufacturing of nuclear storage containers via casting, forging and machining techniques

M. Blackmore - SFIL

Implications of canister design and materials on closure welding for deep geological disposal canisters for high level nuclear waste and spent fuel

C. Punshon - TWI

WG2: Main subjects

Copper coatings

Developments of the Canadian Copper Coated Used Fuel Container

P. Keech - NWMO

Electroplated copper and alternative design possibilities

A. McClusky - BEP

Overview of Cold Spray Coating Technology

H. Lovelock – TWI

Mechanical-Corrosion Effects on the Durability of High Level Waste and Spent Fuel Disposal Containers

C. Padovani - RWM

WG2: Special Feature

Corrosion

Sharing information on container materials for High Level Waste and Spent Nuclear Fuel (IGD-TP activity JA11a)

C. Padovani - RWM