TOPSEAL 2006
Olkiluoto 17.9-20.9 2006

# HLW Disposal in Germany – R&D Achievements and Outlook

Introduction

Waste Policy

Responsibilities & Objectives for R&D

Achievements

International Cooperation

Outlook

Federal Ministry of Economics and Technology

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Water Technology and Waste Management (PTKA-WTE)

Projektträger Forschungszentrum Karlsruhe (PTKA)

- 12 nuclear power plants, 17 reactors
- nominal output 21 GW
- gross power generation 86 TWh/yr first half year 2006
- still about 30 % of total electricity production
- 19 nuclear reactors decommissioned (NPP, prototype reactors)

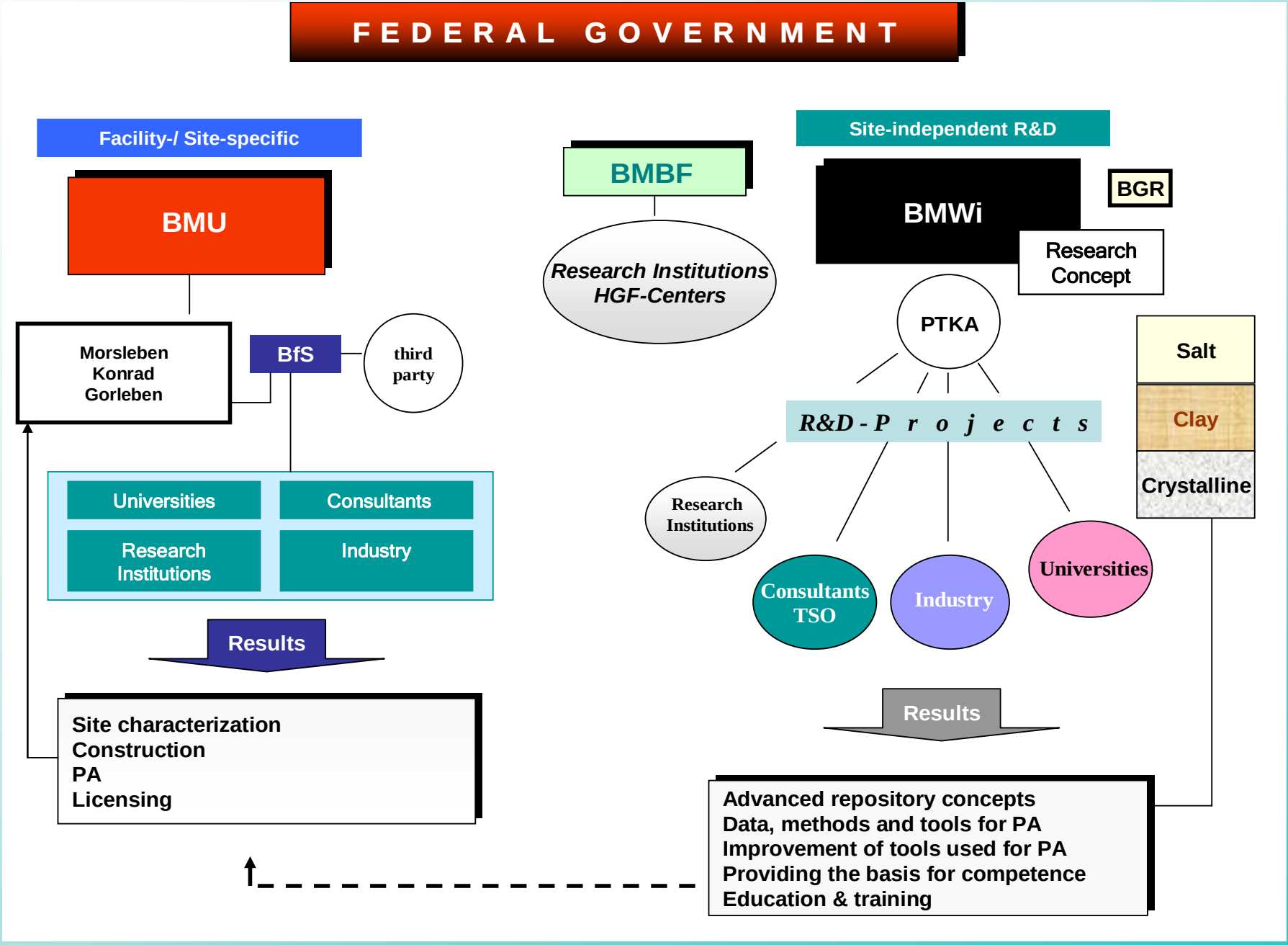
| | |
|---|---|
| Reprocessing | since July 1st, 2005, terminated |
| Transport | shipments of vitrified waste back to Germany acc. international treaties<br>shipments from storage sites not allowed until a repository is in operatio |
| Reactor lifetime | determined by electrical output, limit 2000 TWh, off line in 2022, no further NPP |
| Interim storage | central interim storage facilities (Ahaus (THTR,SF), Gorleben (vitrified waste, SF),<br>de-centralized storage facilities at NPP licensed, storage period 40 yr |

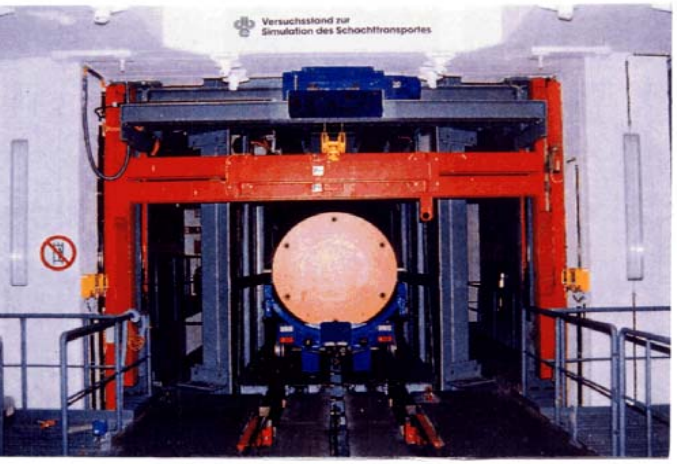
oratorium still effective,
n-site maintenance
uestions related to safety and
onceptual issues discussed
ynthesis report is being reviewed
y GRS
o indication for a premature end
the moratorium


- Licensing procedure completed
- On March 8, 2006, complaints rejected, complainants will sue against this decision
- Start of operation hopefully in 2013

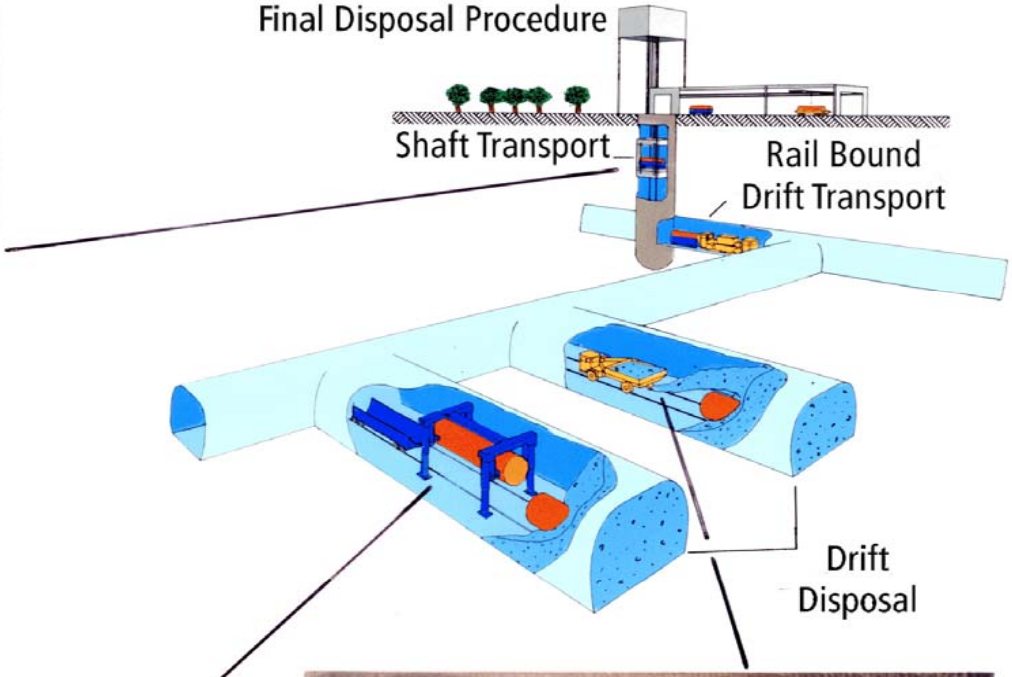

Licensing procedure initiated

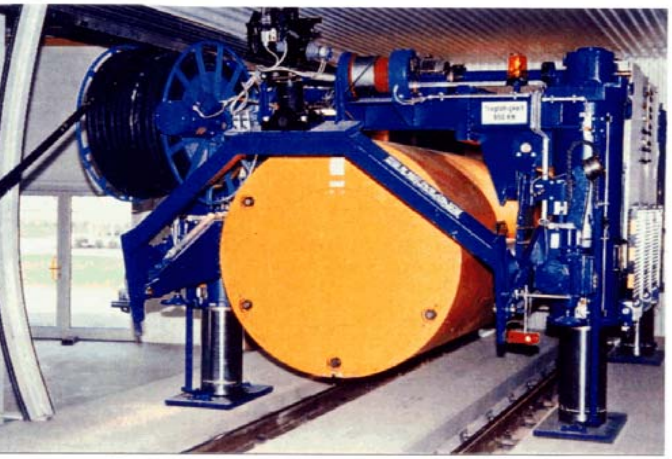
Activities necessary for licensing
closure of the mine and the repos
tory areas


FEDERAL GOVERNMENT
Facility-/ Site-specific
BMU
Morsleben
Konrad
Gorleben
BfS
third party
Universities
Consultants
Research Institutions
Industry
Results
Site characterization
Construction
PA
Licensing
Site-independent R&D
BMBF
Research Institutions
HGF-Centers
BMWi
BGR
Research Concept
PTKA
R&D - P r o j e c t s
Research Institutions
Consultants TSO
Industry
Universities
Salt
Clay
Crystalline
Results
Advanced repository concepts
Data, methods and tools for PA
Improvement of tools used for PA
Providing the basis for competence
Education & training




Hoisting Cage for 85t Payload

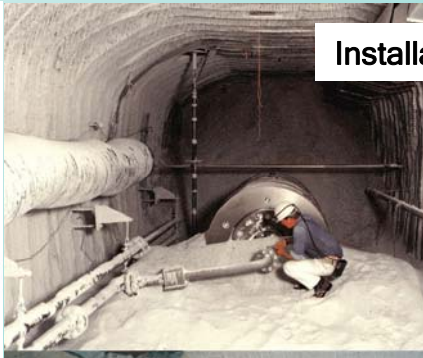


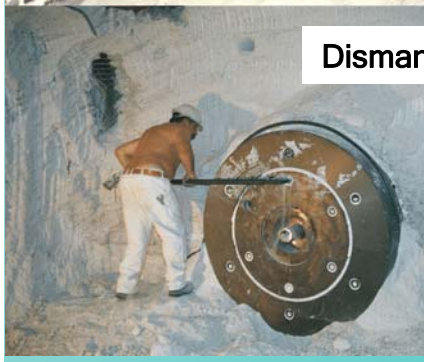



Waste Emplacement Machine

Source: DBE Tec

Backfilling Slinger Truck in a Disposal Drift



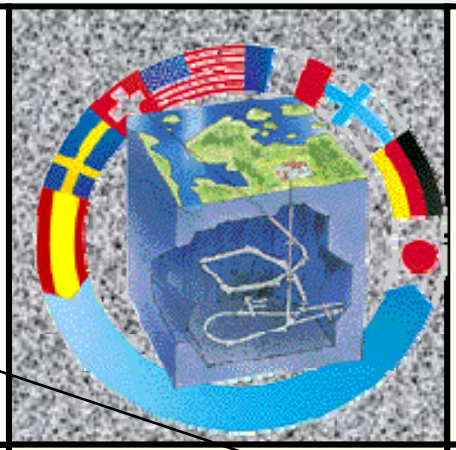

**Bambus Experimen**

One of the longest runn
in situ heater experime
(10yr)
Study backfill and rock
behavior, nine partners
from six nations

## LABORATORY EXPERIMENTS

## SYSTEM ANALYSIS

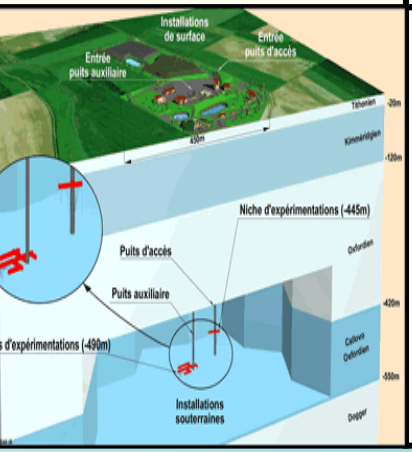
SKB
Svensk Kärnbränslehantering AB



nagra.

Federal Ministry
of Economics
and Technology


Mont Terri
Consortium




ANDRA


Rosatom

# Phase VI

FM

RN Migration
Colloids

nagra.

Mont Terri
Consortium

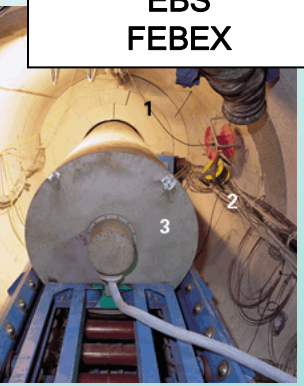
Hydrogeology
Diffusion

Gas production
Gas migration
GMT


Geochemistry
Microbiology

Rock mechanics
EBS

Near Field
EBS
FEBEX




Visualization
Interpretation

BGR

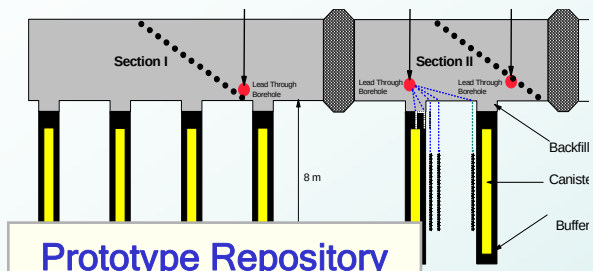
DBETEC

INE

GRS

Permeability
THM(C) processes

RA



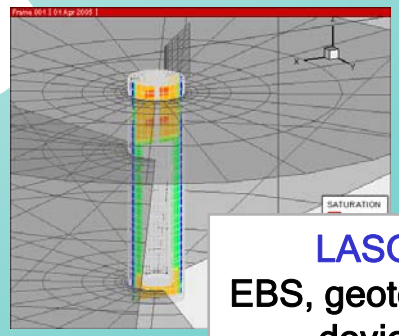

**Prototype Repository**
EBS, geotechnical devices, PA

**Actinides & Colloids,** processes, equipment, models

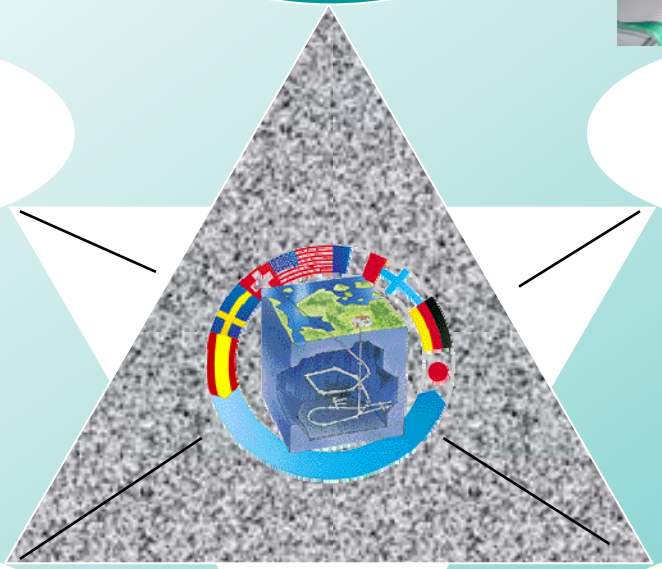
INE

GRS

BGR

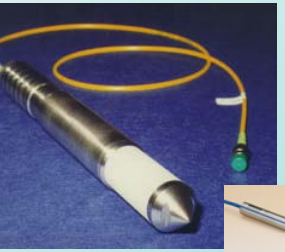


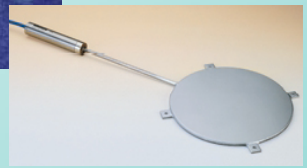
**LASGIT**
EBS, geotechnica devices



**Temperature buffer test**
EBS, fiber optics, models

DBETEC





Forschungszentrum Rossendorf

**Microbe**
Microbial activity


others

Modeling, codes

Federal Ministry of Economics and Technology

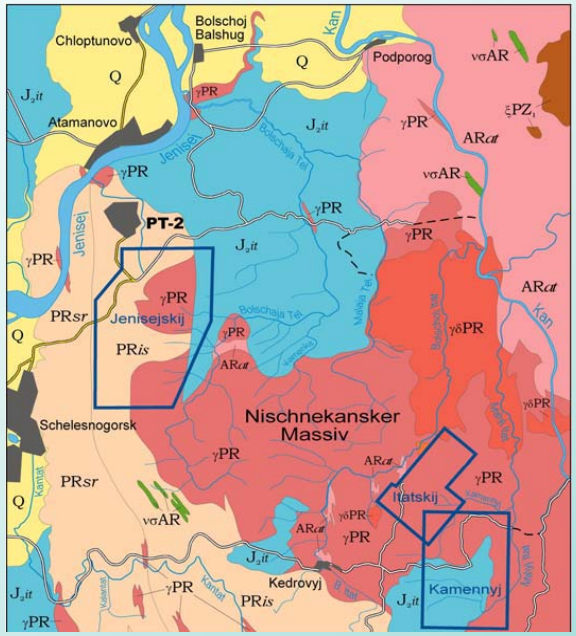
ROSATOM

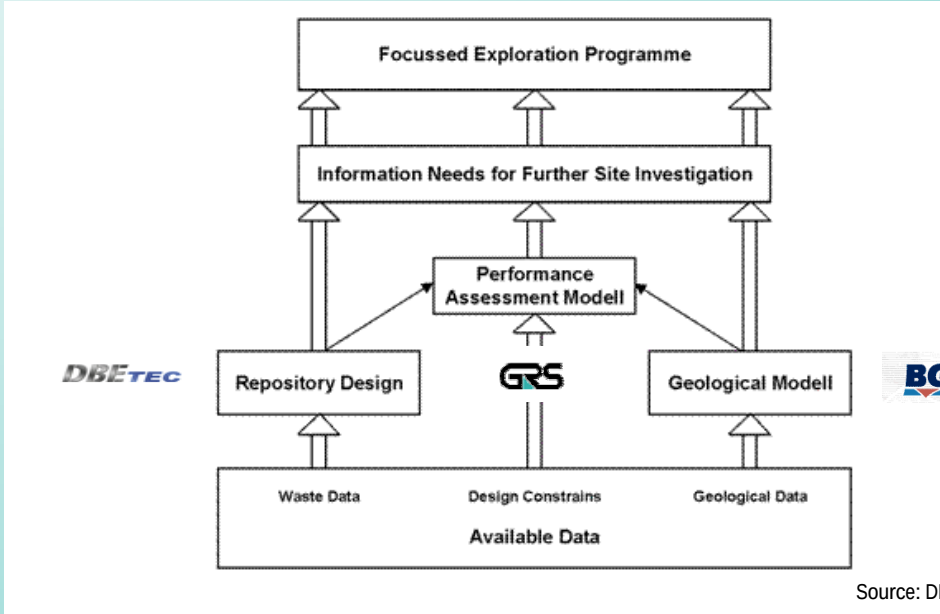
VNIPI PT

BGR

GRS

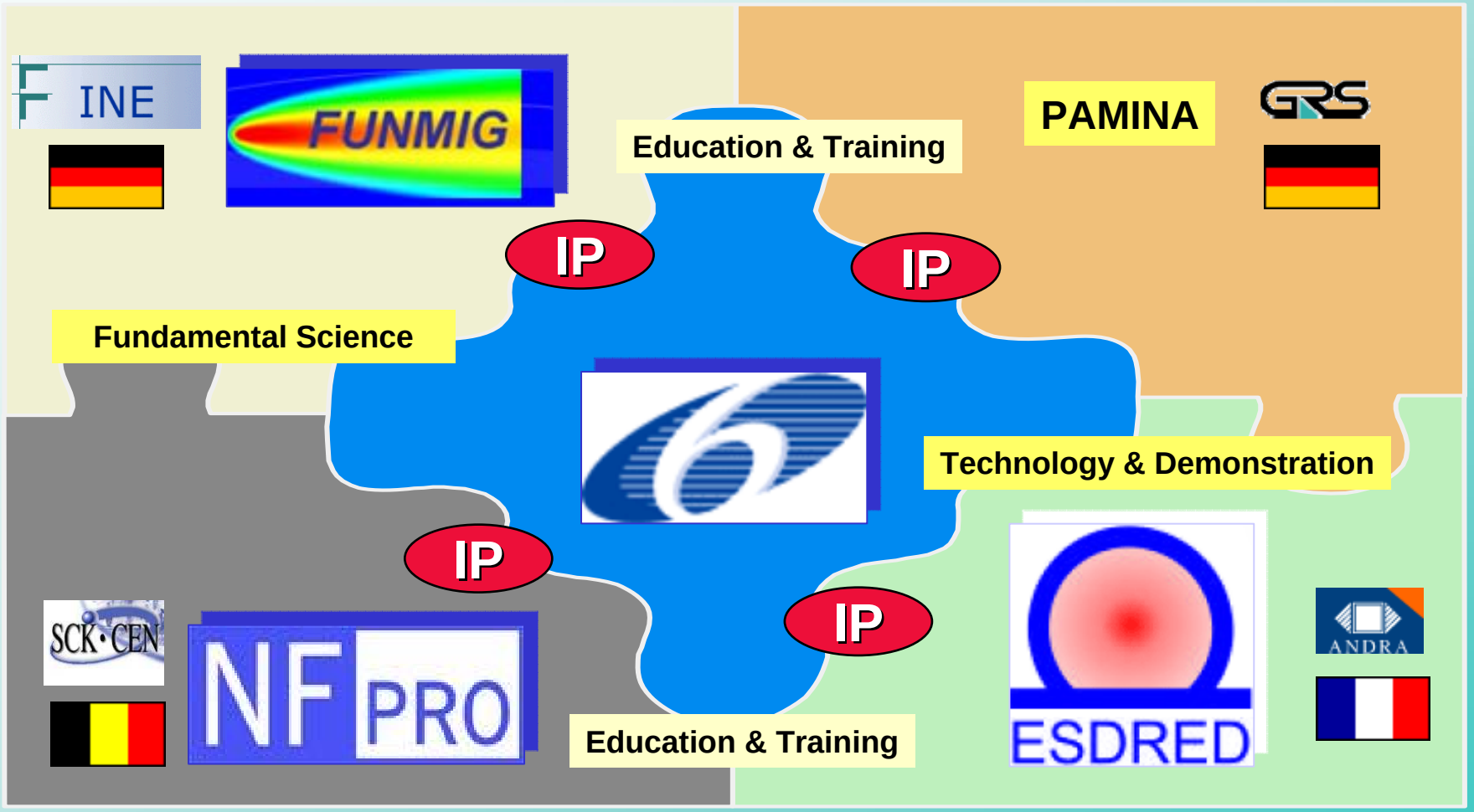
DBE TEC




Source: D

- The **German partners** have the unique opportunity to apply their expertise and th toolboxes available to an existing site and to broaden the knowledgebase by usi real sites in Russia
- The **Russian partners** can use the German experience concerning repository saf and security in all project phases. Moreover, these activities support the integrati into the international scientific community.


INE
FUNMIG
PAMINA
GRS
Education & Training
IP
IP
Fundamental Science
Technology & Demonstration
IP
IP
SCK·CEN
NF PRO
Education & Training
ESDRED
ANDRA

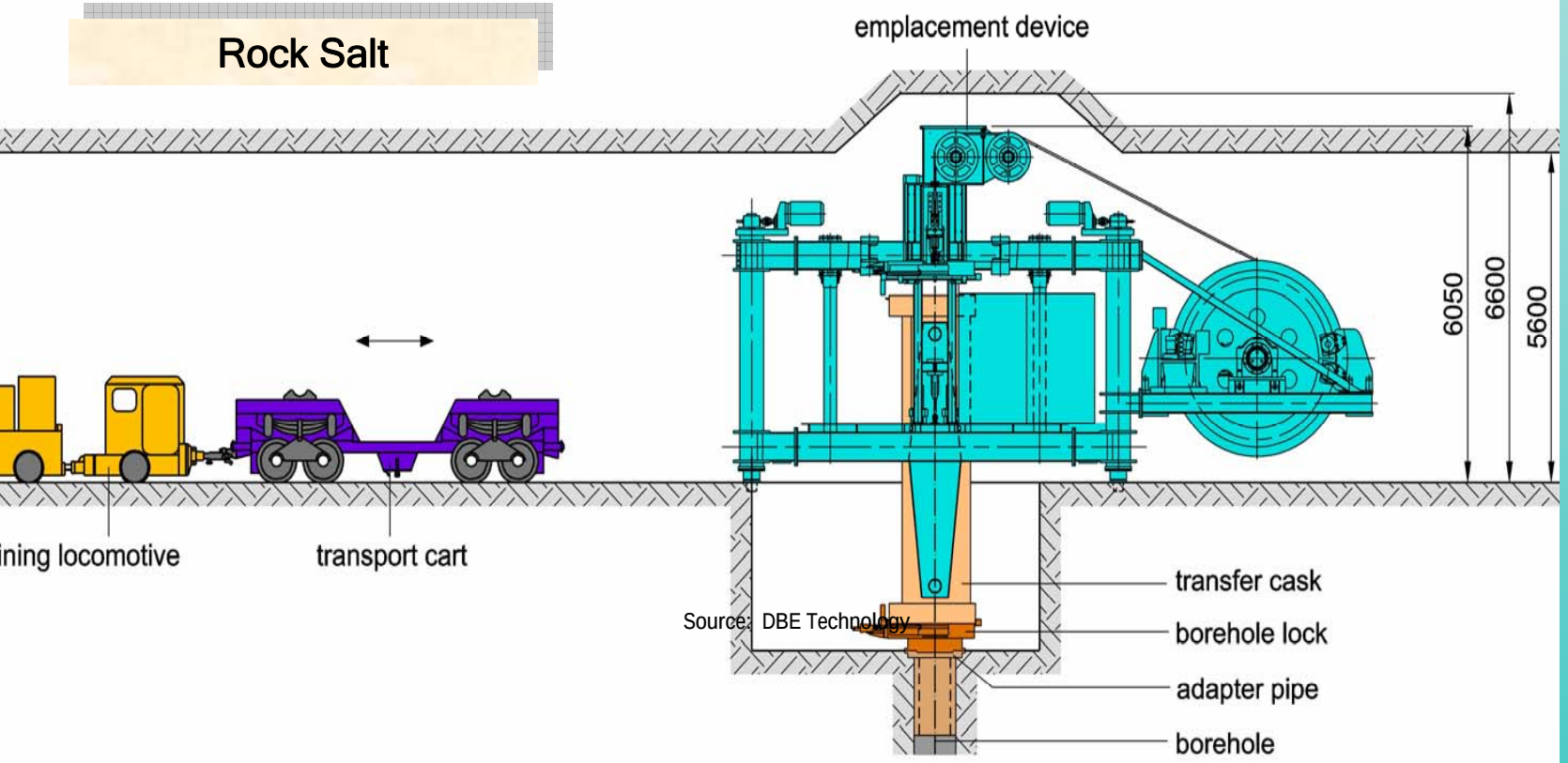
## Engineering Studies and Demonstration of Repository Desig

ESDRED

### OBJECTIVES

- To promote a common European vision in terms of radioactive waste disposal technology applicable to variou repository designs
- To fabricate and test prototypes of technologies for waste emplacement, for backfilling and for sealing of disposal cells or drifts

**Rock Salt**




Source: DBE Technology

Completing the Germar emplacement concept f SF by demonstrating th feasibility of canister emplacement in vertical boreholes


www.funmig.com

- Providing tools for scientifically sound performance assessment for radionuclide migratio
- Covering the variability of different radioactive waste disposal approaches and host rock types under investigation in Europe
- Providing for knowledge transfer in order to foster a common competence level among a European countries
- Ensuring applicability of results for different radioactive waste disposal options and natio needs

- **51 contractors** from national waste management organizations, research organizations, universities and small and medium sized enterprises
- **15 European countries**, including 5 new Member States.
- **Associated groups** are invited to contribute to the overall objectives, especially ensuring public safety interests are reflected.

FUNMIG is a perfect example for a successful cooperation at an excellent scient level. It is of benefit for all people directly and indirectly involved and underlines t necessity of basic research in understanding the complexity of a repository syste

## ROCK SALT

- A lot of know-how, technological, and scientific expertise has been accumulated in the past decades
- Techniques for shaft and drift emplacement are available
- Borehole emplacement of spent fuel is being developed
- PA tools were substantially further developed
- Knowledge for building a repository in rock salt

### PA

FEP catalogue
Scenarios
Safety indicators
Databases
other relevant topics

### Technology

EBS

Backfilling & Sealing

### Safety Case

## ARGILLACEOUS ROCK

A lot of effort needed to reach the same level of knowledge as in rock salt

### Technology

Emplacement technology

Mining

Large-scale demonstration

### Characterization

Effects of heat
Coupled processes
Mechanical and hydraulic conditions
Diffusion
Glass-clay interaction

## Crystall

Activities focused specific problems

**International cooperation**

External expertise
Competence
URLs
Cost sharing
Education Training
Public opinion