Implementation of Repositories for Low and Intermediate Level Radioactive Wastes

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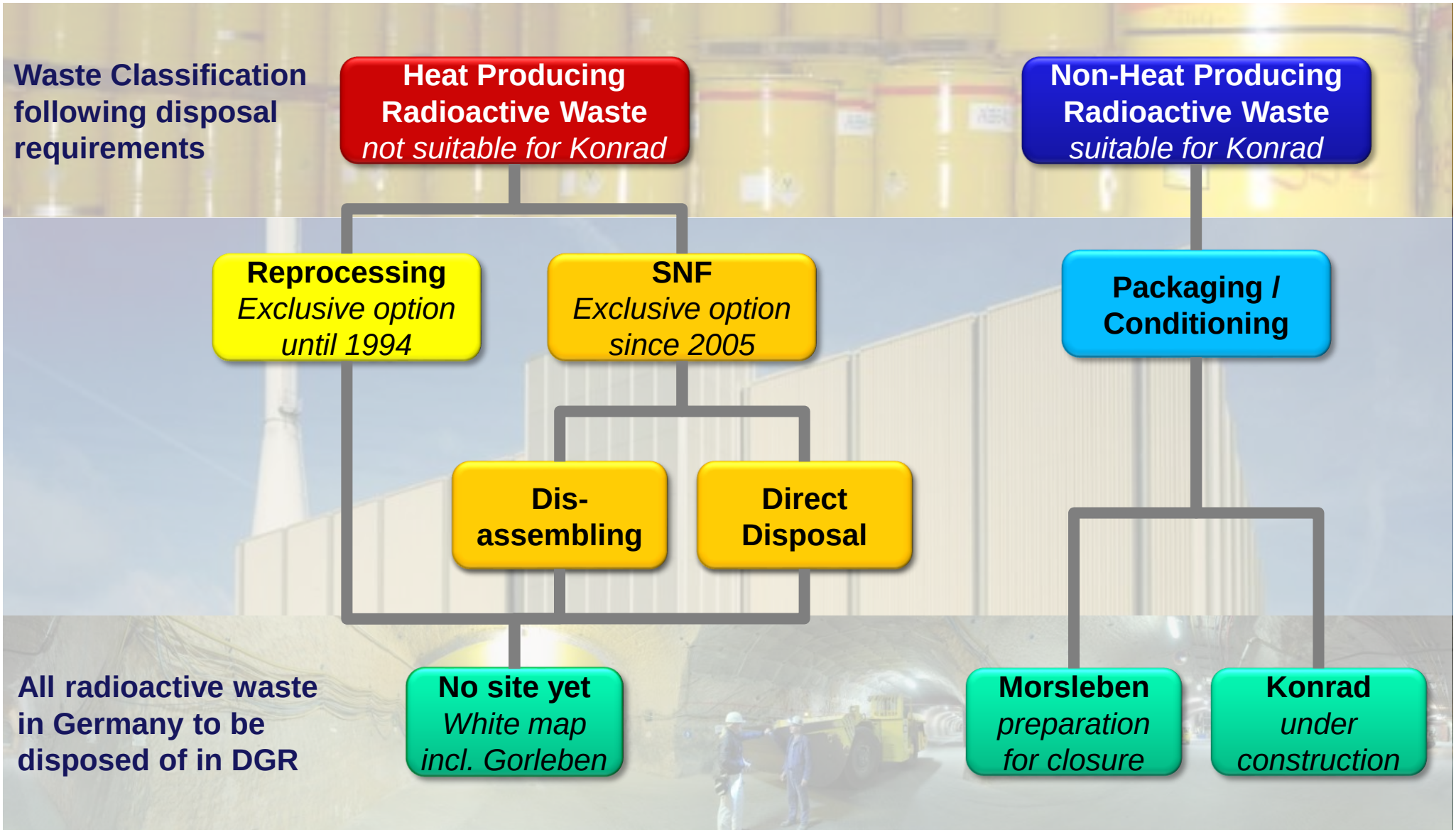
Outline

- German Radioactive Waste Disposal Programme
- LILW Disposal Projects
  - Overview
  - Site Selection for LILW Repositories
  - Licensing of LILW Repositories
  - Public Involvement in LILW Disposal Projects
- International Examples
- Conclusions

German Programme – History

- 1963 • Agreement to dispose of radwaste in DGR, preferably in salt
- 1967 • Start of research in the research mine of Asse salt mine
- 1971 • Begin of disposal in Morsleben (ERAM)
- 1975 • Start of evaluation of the Konrad iron ore mine
- 1979 • “Entsorgungsnachweis” requirement for NPP operation
- 1979 • Begin of exploration in Gorleben salt mine
- 1981 • Begin of construction of Gorleben interim storage facility
- 1995 • 1st SNF storage in Gorleben interim storage facility
- 1999 • 1st licence application for on-site interim storage (Emsland)
- 2000 • 1st Gorleben moratorium (for 10 years)
- 2002 • 1st SNF storage in on-site interim storage (Emsland)
- 2011 • New radioactive waste disposal facility road-map
- 2012 • 2nd Gorleben moratorium

German Programme – Classification and Disposal Routes



German Programme –Project Overview

- **Operated by Asse GmbH**
  - Asse salt mine used only as URL since 1978, currently under decommissioning
- **Operated by DBE:**
  - Gorleben: Heat-generating waste in salt, underground survey starts 1990's, on hold
  - Konrad: Non heat-generating waste in iron ore embedded in clay, under construction
  - Morsleben: Operational Waste (1980's until 1998) in salt, planning for decommissioning

Verantwortung für Generationen
Responsibility for Generations
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German Programme – Site Selection Act

Objective:

- Select repository site offering best possible safety for disposal of HLW / SNF

Rational:

- Stepwise site selection approach with public and Parliamentarian participation

Implementer:

- Currently: Federal Office for Radiation Protection (BfS)

Regulator:

- Newly established:
  Federal Office for the Regulation of Nuclear Waste Management (BfE)

Preparatory Phase of Implementation:

- The Federal Parliament established a dedicated commission in April 2014
- Report for Parliament on site selection approach by commission until June 2016

Selected Issues:

- Discussion on re-organisation of responsibilities for disposal
- Consideration of alternatives to Geologic Disposal
- Consideration of specific waste streams (Asse, U-tails from enrichment), ie. potential extension of task to LILW (non-heat-producing waste)

LILW Disposal – Overview: History of URL Asse

- 1901 – 1964: Industrial operation of Asse
- 1906: Sinking of Shaft Asse II
- 1908 – 1925: Production of potash
- 1916 – 1964: Production of rock salt
- 1965 – 2009: Helmholtz-Zentrum Munich is mine operator
- 1967 – 1978: (Experimental) Radioactive waste disposal
- 1967 – 1992: Research and Development work
- 1988: Brine solution access discovered
- 1995: Proposal for closure
- 1995 – 2004: Backfilling of southern part
- 2007: Licence application for final closure of mine
- 2009: BfS becomes mine operator and transferal to nuclear facility
- 2010: Decision of BfS to retrieve waste to ensure long term safety
- Since 2010: In-depth inquiry of facts (trial phase)

LILW Disposal – Overview: Main Activities at URL Asse

- **Comparison of different decommissioning options:**
  - **Retrieval of waste:**
    → Recovering of waste and underground re-packaging
    → Off-site interim storage and conditioning of waste
  - **Relocation of waste inside mine:**
    → Mining of new cavities
    → Underground re-packaging and transport to new cavities
  - **Complete backfilling of mine:**
    → Waste remains untouched
- **With view to long term safety of the Asse mine it was decided that the 'retrieval of waste option' shall be the preferred one.**
- **Current activities are thus underway:**
  - **Trial phase:** Determine status of selected chambers by trial drills
  - **Emergency planning:** Construction of flow barriers*
  - **Securing operability:** Refurbishment of spiral gallery
    Refurbishment of shaft Asse 4*

BfS

* With substantial support from DBE TECHNOLOGY GmbH

LILW Disposal – Overview: History of Konrad

- 1965 – 1976: Production of iron ore
- 1975: Following staff's initiative preliminary survey as candidate site
- 1982: Site Suitability statement
- 1982: License Application submitted
- 1992 – 1993: Public hearing (75 hearing days)
- 2000: Consensus Agreement (i. a. Finalisation of licensing process)
- 2001: Radiation protection ordinance amendment
- 2002: Licence granted
- 2002 – 2008: Litigation
- 2008 – 2010: Start of repository construction
- 2013/14: First planned commencement of operation date
- 2014: Complaints of BfS about imprecise planning of DBE
- 2019: Current formal commencement of operation date
- > 2021: Current officially announced commencement of operation date

LILW Disposal – Overview: Main Activities at Konrad

- **Underground facilities**
  - Refurbishments of shaft 1 (for conventional transport / ventilation inflow)
  - Refurbishment of shaft 2 (for waste transport / ventilation outlet)
  - Refurbishment and upgrade of infrastructure facilities
  - Closure of existing mine
  - Erection of new repository
- **Aboveground facilities**
  - Refurbishment of shaft tower of shaft 1 (industrial monument)
  - Replacement of buildings and equipment at shaft 1
  - New build of buildings and equipment at shaft 1
- **Infrastructural measures**
  - Construction of connections to public infrastructure
  - Security fence
  - Precaution measures (eg. water pollution control, World-war 2 remnants)

LILW Disposal – Overview: History of Morsleben (ERAM)

- 1897 – 1912: Production of potash
- 1912 – 1969: Production of rock salt
- 1937 – 1945: Military usage (fabrication of ammunition)
- 1959 – 1984: Hen fattening
- 1971: Approval for experimental LILW disposal
- 1981: Temporary licence for LILW disposal
- 1986: Permanent licence for LILW disposal
- 1990: Federal Facility under BfS, operated by DBE
- 1990 – 1991: Disposal stopped by court decision after reunification
- 1994: Restart of waste acceptance
- 1997: BfS applies for mine closure as ordered by Federal Government
- 1998: Disposal stopped by court decision
- 2001: Final decision of BfS to definitely not restart waste acceptance
- 2011: Public hearing

LILW Disposal – Overview: Main Activities at Morsleben

- New planning assumptions on the basis of the assessment of the statement and recommendations of the Commission on Waste Management (end of January 2013)
- Successive work on requirements will last until 2019
- Especially requirements on backfill and sealing have tightened
  - Water access to the entire mine has to be mitigated (not only to relevant parts)
  - Currently, 1 water access to mine (12 m^3/a)
  - Construction measures to prepare sealing won‘t start before 2016
- Plan Approval Process
  - Start in mid 2017
  - Execution at least 8 years

LILW Disposal – Site Selection

What is the basis for …?	Asse	Konrad	Morsleben
Site proposal	Availability of salt mine	By staff and local public following closure of iron mine	Pre selection of potential salt mines
Site Assessment	Mining safety	Geology, Hydrogeology, Rock mechanics, Seismicity	Availability of volumes and time for transfer
Site Selection	Expert decision, granting of budget by Government	Plan Approval	Licenced by East German nuclear regulator
	For knowledge build up only (URL), late(r) transfer into nuclear facility		After reunification re-approval of licence

LILW Disposal – Licensing Issues

	Asse	Konrad	Morsleben
1960ies	License under Mining Regulation		
1970ies	Introduction of WACs	Site characterisation for plan approval	Nuclear Licence for test operation
1980ies		Plan Approval Process	Temporary and permanent licence
1990ies		Definition of WACs	Preparation for new plan approval
2000s	Transferal to nuclear regulatory regime	Plan Approval after 7 years of litigation	
2010s		Adjustment of WACs	

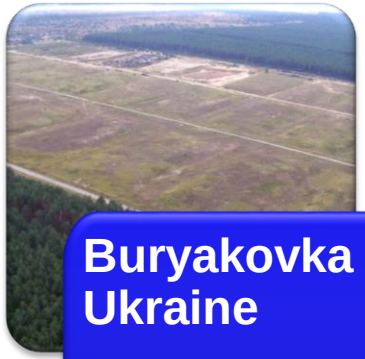
LILW Disposal – Public Involvement

- **Up to now public involvement is foreseen only under Plan Approval Process for affected public**
  - in form of public hearing and
  - by means of litigation against administrative decisions
- **Public involvement for HLW projects**
  - In 70ies community involvement in Gorleben
  - AkEnd (2002) introduced means of involvement (information and decision making) especially for local public / communities
  - Site Selection Act introduces further commission with participation of main social groups on national level

General observation:
Opinion (e.g. on public involvement) change, technologies (including regulation) develop faster than repository projects need to finalise

International Examples

Selection of projects with insight of DBE TECHNOLOGY GmbH into implementation:



Buryakovka Ukraine

- Management of Waste from Chernobyl Accident
- Safety Assessment Review (SAR) and technical optimisation after intial solution
- No site selection

Iraq

- Management of Waste from destroyed Iraqi nuclear facilities
- Development of design and SAR for repository
- Area proposed, but specific site not decided yet

Kozloduy Bulgaria

- Management of Waste from early decommissioning of Bulgarian NPPs
- Development of design and SAR to a level ready for procurement
- Site selected on practical basis

Mochovce Slovakia

- Management of Waste from early decommissioning of Slovak NPPs
- Feasibility Study for enlargement of existing repository
- Existing site was compared against other options

General observation:

Very specific solutions despite „blueprints“, ie. direct transfer of solutions not possible

Conclusions

- **Challenges:**
  - **Public opinion changes faster than repository projects need to finalise**
  - **Long implementation process vs progressing best practice**
  - **No blueprints available:**
    Solutions always subject to national culture, historically grown licensing regime and local conditions (e.g. inventory, infrastructure, geology)
- **Success factors:**
  - **Early, continuous and comprehensive information of public**
  - **Clear commitment to development of specific solution**
  - **Competent and trustworthy organisations**
  - **Commitment of all organisations (including politics) to project**

Thank you!