Management of Spent Fuel from the Perspective of the German Industry

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IAEA Vienna
International Conference on Management of Spent Fuel from Nuclear Power Reactors
31 May – 4 June 2010

Spent Fuel Management in Germany

Reprocessing

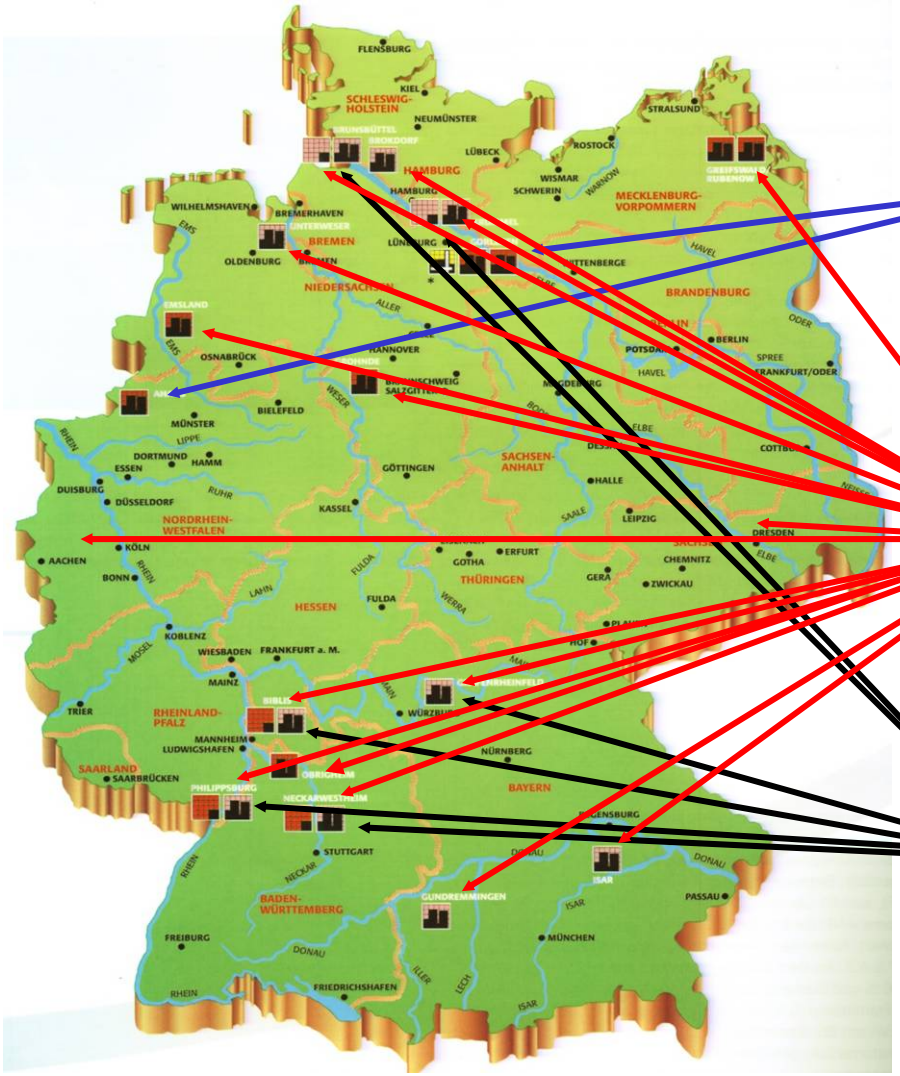
- The only way to manage waste up to the 1980/90s
- Since June 2005 prohibition to transport spent fuel to reprocessing plants
- Return of reprocessing residues until about 2024
- About 6000 t Heavy Metal

Direct Disposal

The only possible way to manage waste since June 2005

- Development began in the 1970s: Reference concept
- Completion of the Pilot Conditioning Plant (PKA) in 2000
- About 10,000 t Heavy Metal

Spent Fuel Storage Facilities in Germany

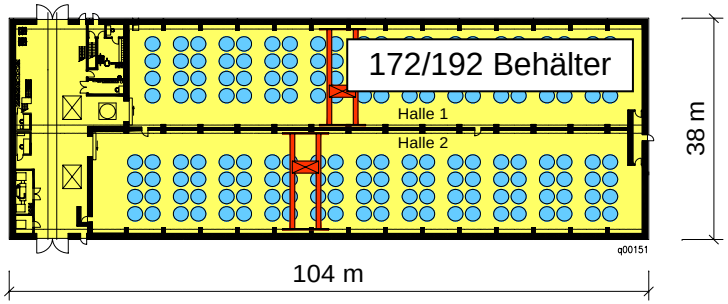


2 Central Interim Storage Facilities
Ahaus & Gorleben

15 On-site Interim Storage Facilities
at Nuclear Power Plants

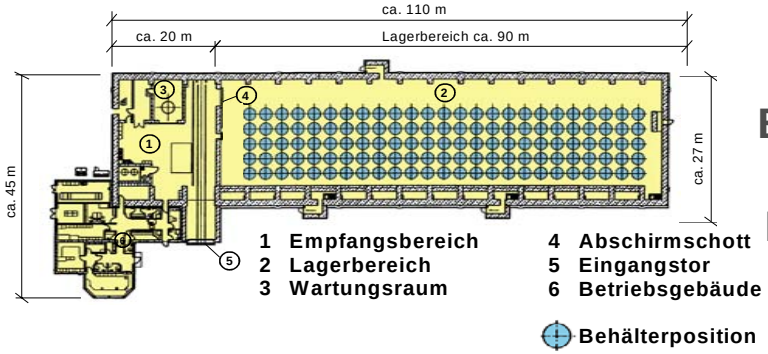
6 Temporary Storage Facilities
(5 to 8 years) – Out of service

Three different Concepts for Interim Storage



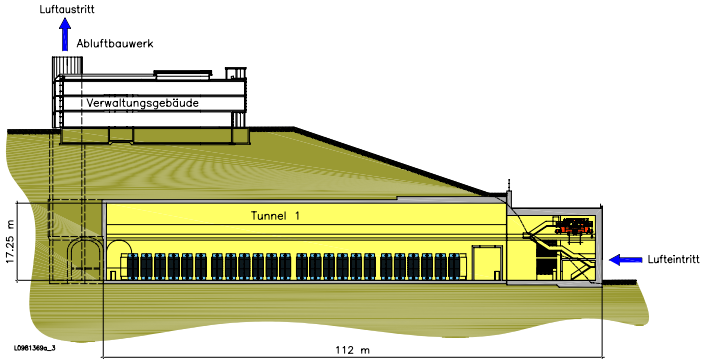
WTI

Biblis, Grafen-rheinfeld, Gundremmingen, Isar, Philippsburg



STEAG

Brokdorf, Brunsbüttel, Emsland, Grohnde, Krümmel, Unterweser



TUNNEL

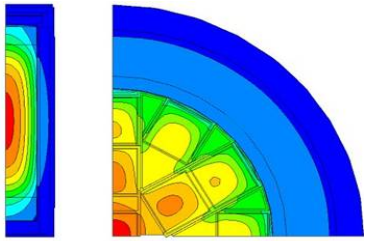
Neckarwestheim

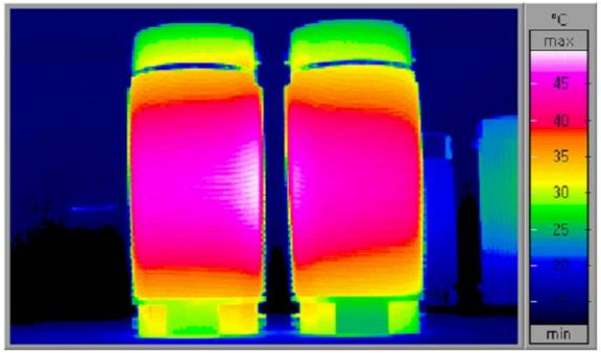
Interim Storage in Germany

GNS-Gruppe

Calculations

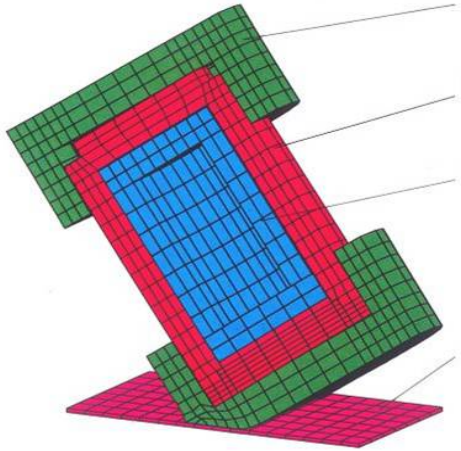
- nuclear calculations
- burn-up calculations and planning of loadings
- thermodynamics
- mechanics and stress analyses

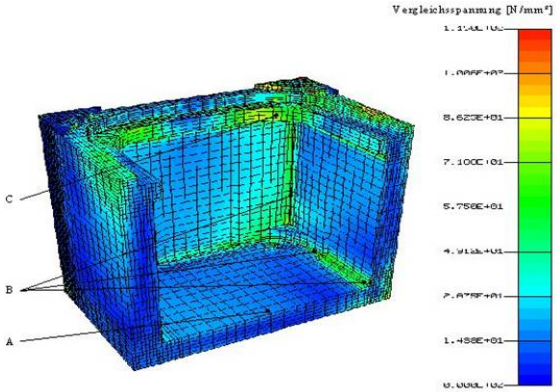


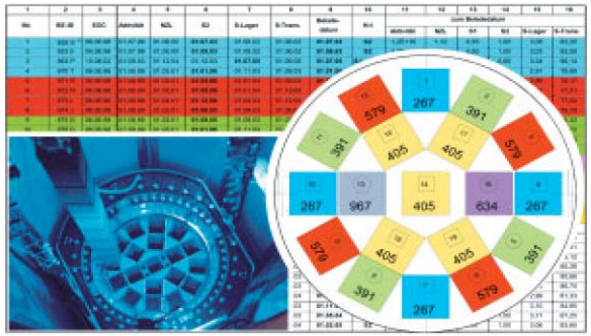


Planning and Projection

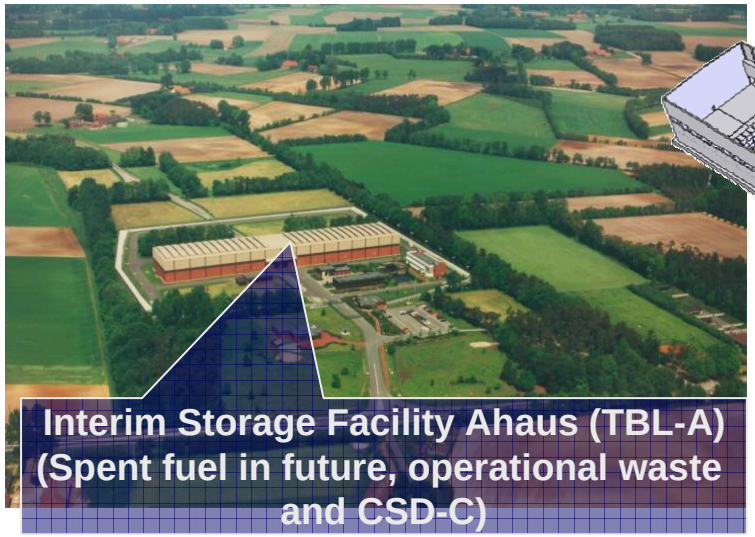
- planning and construction projects
- conversion and decommissioning projects



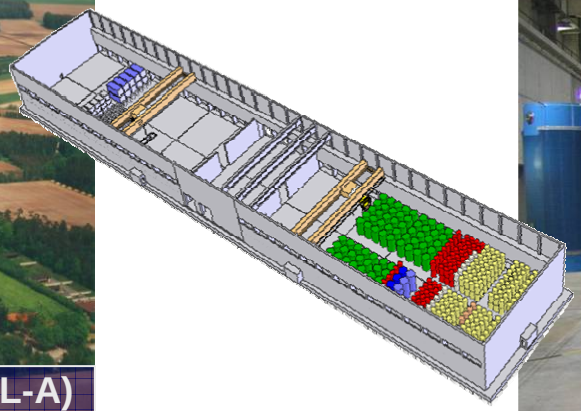




Interim Storage at Ahaus and Gorleben



Interim Storage Facility Ahaus (TBL-A) (Spent fuel in future, operational waste and CSD-C)



Pilot Conditioning Plant (PKA)

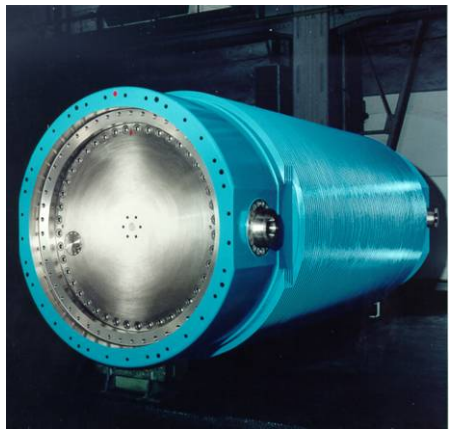
Waste Storage Facility (ALG) (Low level and medium level waste)

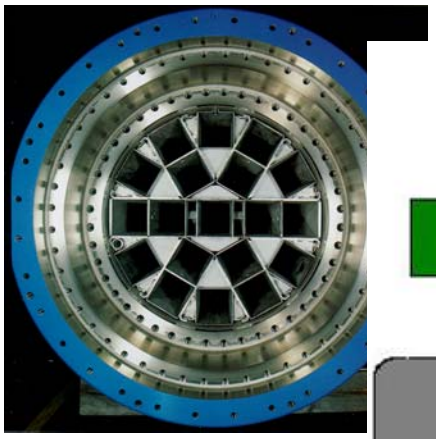
More than 25 years of operational experience with dry storage of spent fuel

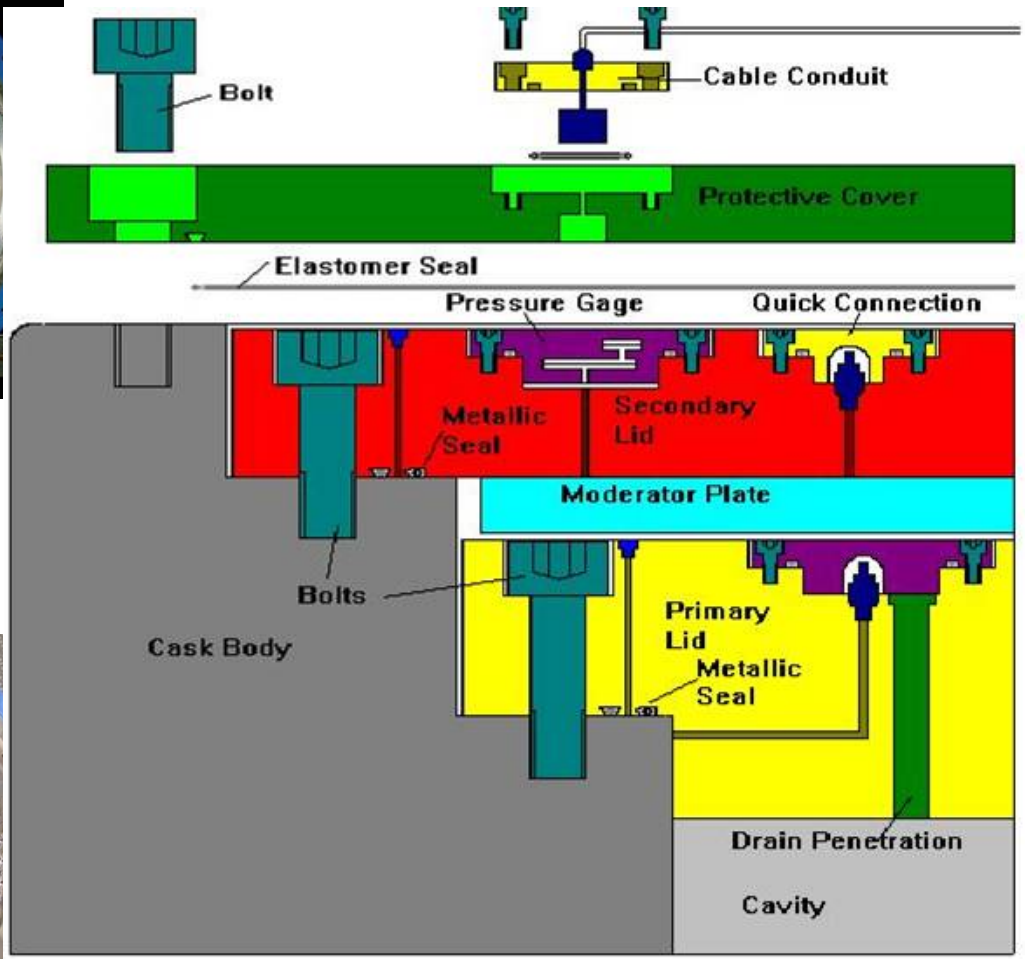
Interim Storage Facility Gorleben (TBL-G) (Spent Fuel and HLW)

Casks for Transport and Storage of Spent Fuel

CASTOR® V/19

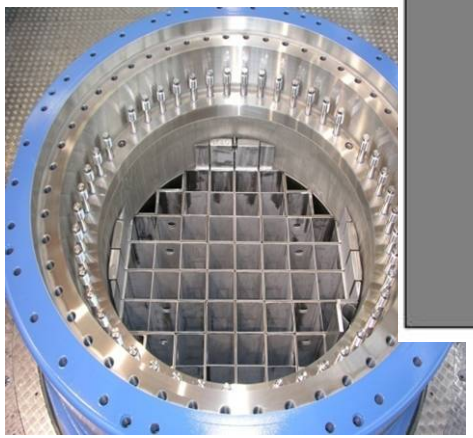






~ 127 Mg; Diameter: ~ 2.5 m; Height: ~ 5.5 m

CASTOR® V/52

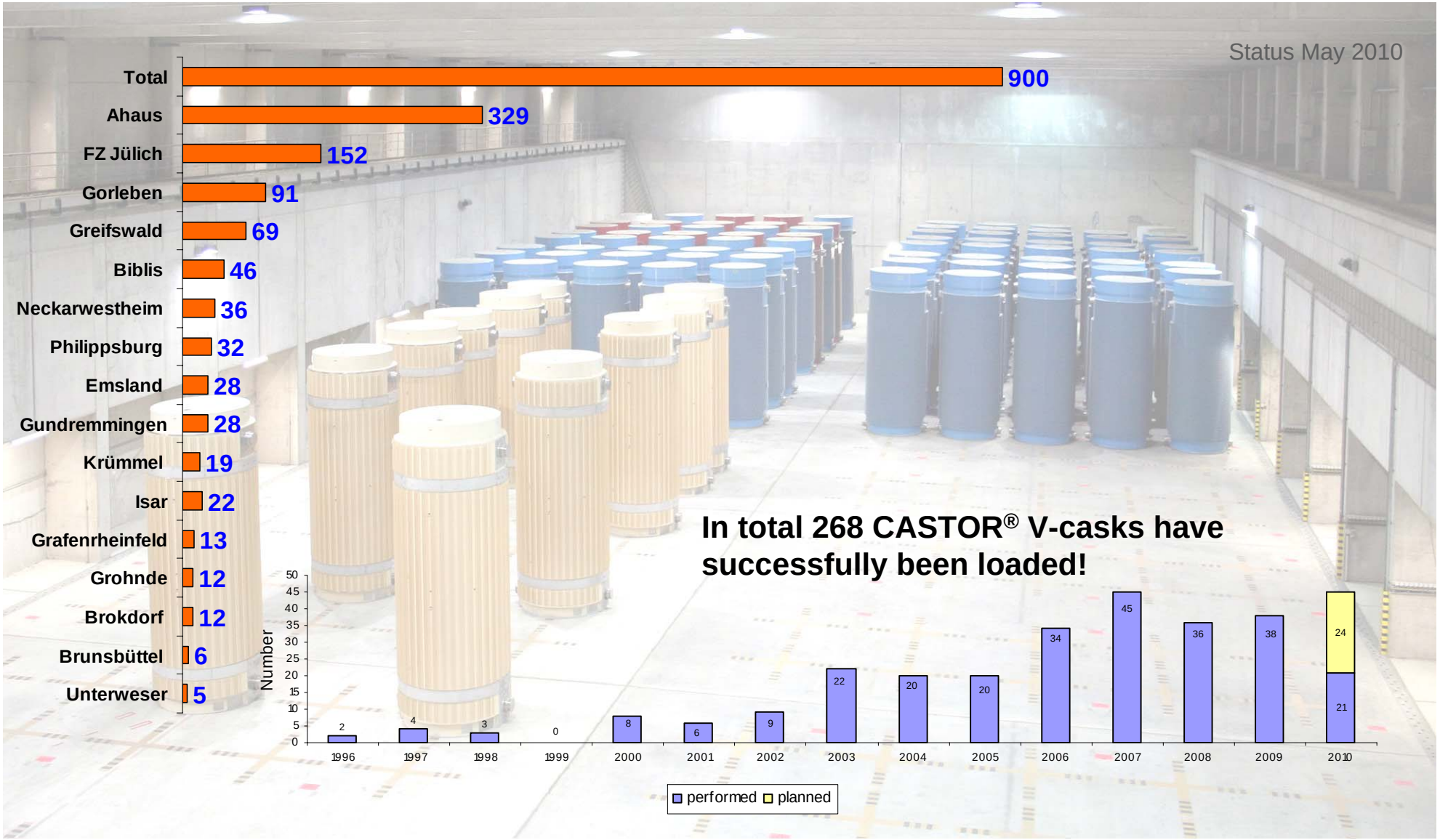


Cask Manufacture and Cask Loading

Cask Machining

Cask Assembly

Interim Storage in Germany



Interim Storage of Spent Fuel in Europe

	NPP sites (in operation)	Interim storage facilities for spent fuel*	
		Wet	Dry
Belgium	2	1	1
Bulgaria	1		1
Czech Republic	2		2
Finland	2	1 central	
France	20		
Germany	12	1	14 + 2 central
Hungary	1		1
Lithuania	1		1
Netherlands	1		
Romania	1	1	1
Slovakia	2	1	
Slovenia	1	1	
Spain	6	6	2
Sweden	3	1 central	
Switzerland	5	1	1 central
United Kingdom	9	1	(1)

(1) = planned

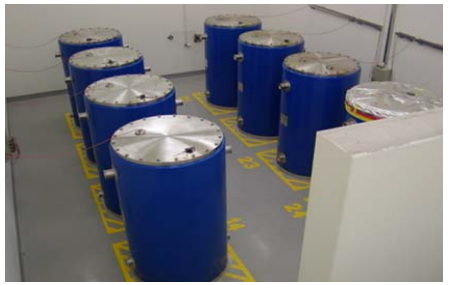
* excluding wet storage facilities at reprocessing sites

Nuclear Casks shipped Worldwide

GNS has developed and manufactured a variety of casks for High Level Waste and Spent Fuel:

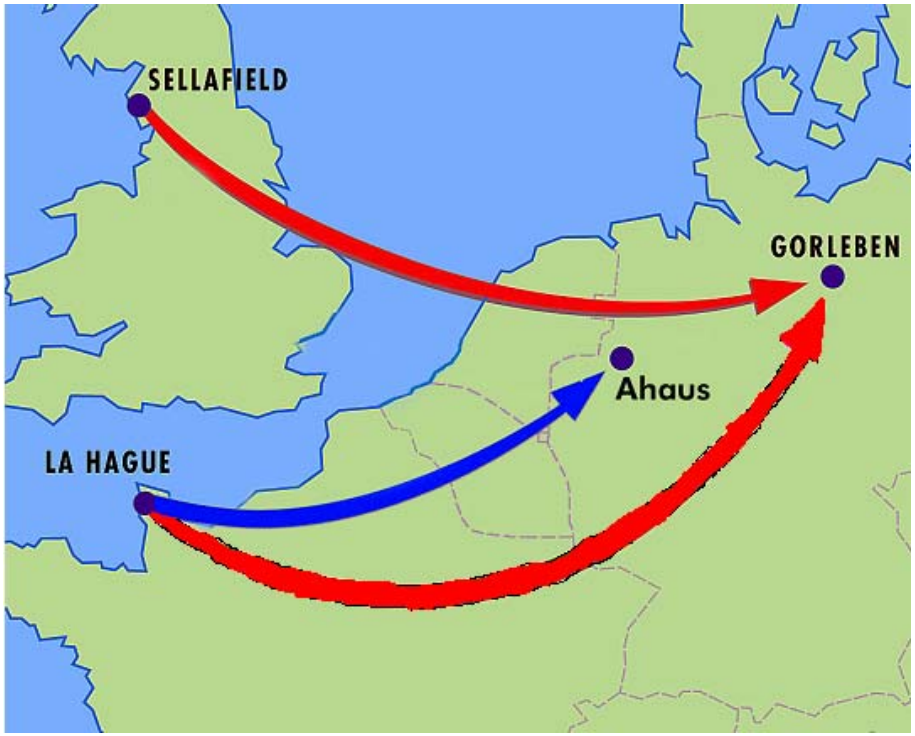
- **1600 casks ordered worldwide**
- **More than 1100 already loaded and intermediately stored**

Germany	868
Lithuania	118
Czech Republic	73
USA	35
Belgium	7
Switzerland	6
South Africa	4



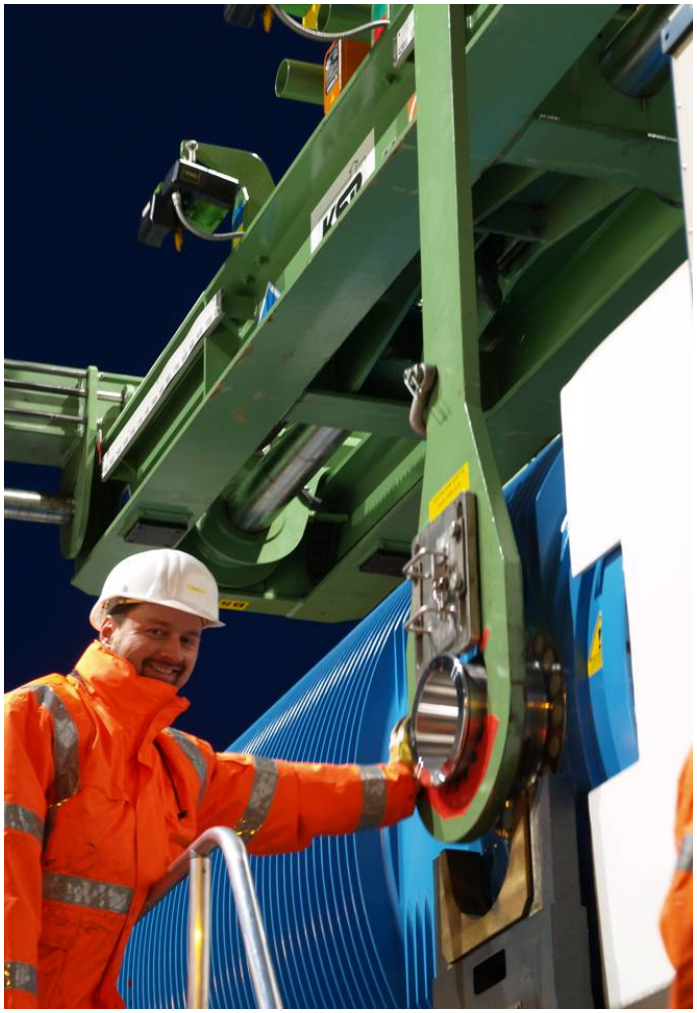
Status May 2010

Return of Waste from Reprocessed Spent Fuel



Repro-cessor	Amount	Waste	Casks	Return Period
AREVA-NC	5.309 t	HLW	108	until 2011
		CSD-C	~150	approx. 2015
		CSD-B	~20	approx. 2014
INS	768 t	HAW	21	approx. 2014

The Transport in Germany



Transports are performed by rail and road according to national and international regulations

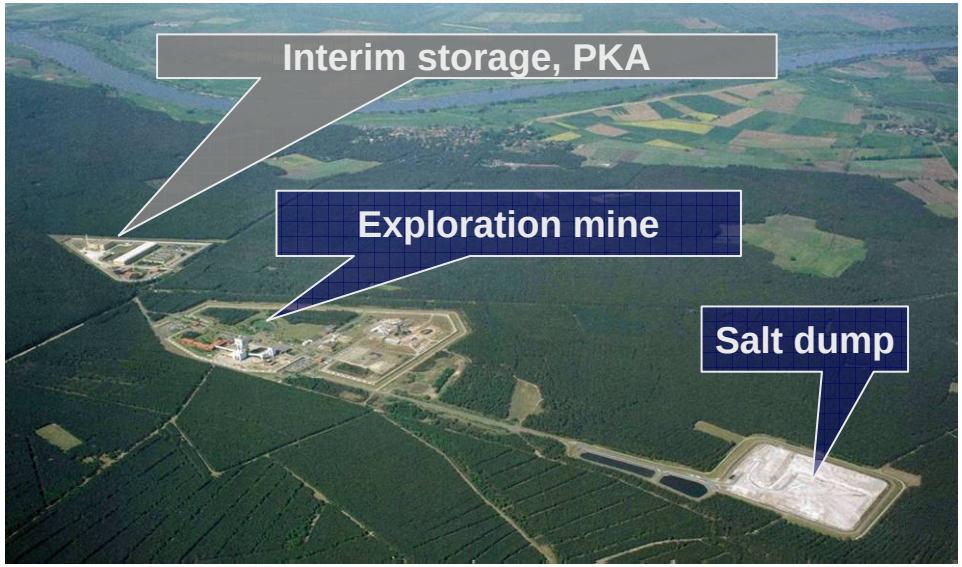
Impressions … during Transport …

After the Transport

„Spent Fuel“ management by opponents …

questionable …

Final Disposal



Responsibilities in waste disposal management

Operator of the nuclear power plants

- Development, construction, operation and decommissioning of NPP
- Development of techniques and processes for the treatment of radioactive waste and fuel elements
- Reprocessing/conditioning
- Interim storage
- Financing of disposal (repository)

Federal Government

Disposal
- Planning, site investigation
- Construction
- Operation
- Decommissioning

Pilot Conditioning Plant at Gorleben

TLB

TLB ohne Sekundärdeckel

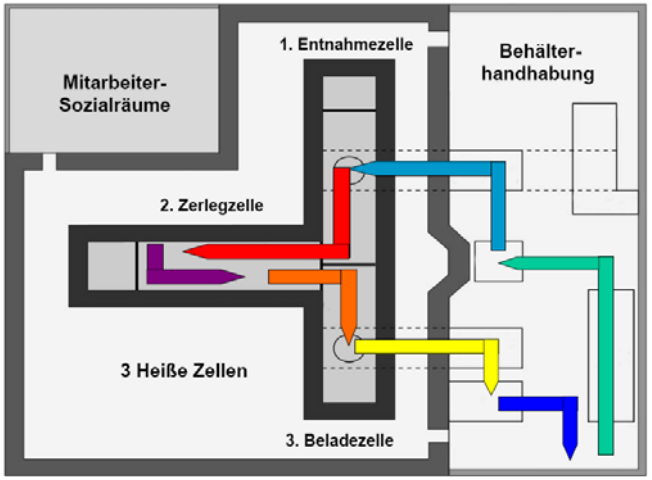
Brennelement

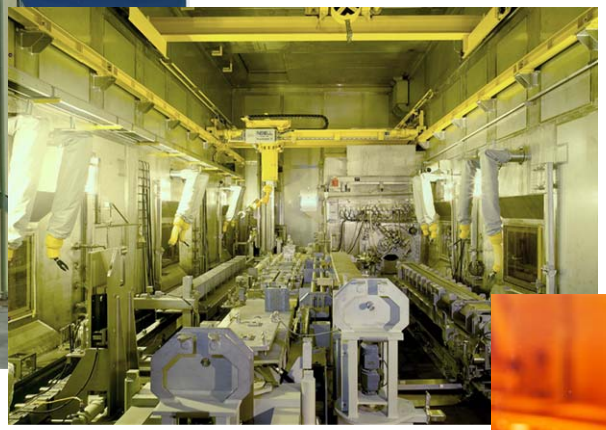
Brennstäbe

Kanister mit Brennstäben

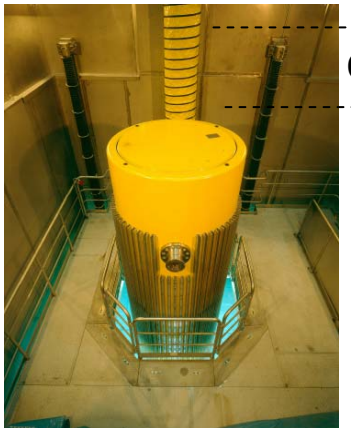
POLLUX®

POLLUX® mit verschweißtem Deckel





Main Concepts for Disposal of Spent Fuel



	reference concept		supplementary concepts	
intermediate storage at the NPP´s site	POLLUX®		BSK 3	DIREGT
	CASTOR® V		CASTOR® V	cask
	Fuel Assemblies segmented			Fuel Assemblies not segmented
conditioning after intermediate storage	POLLUX®		BSK 3	
transfer into repository			transfer cask	cask
emplacement	drift		borehole (BSK 3)	borehole
		BSK 3		
status	emplacement demonstrated above ground in 2000, basis for repository layout		emplacement demonstrated above ground in 2009	feasibility studies ongoing

Disposal - Statements

Extracts from the press release of the Federal Ministry of Environment of 15 March 2010

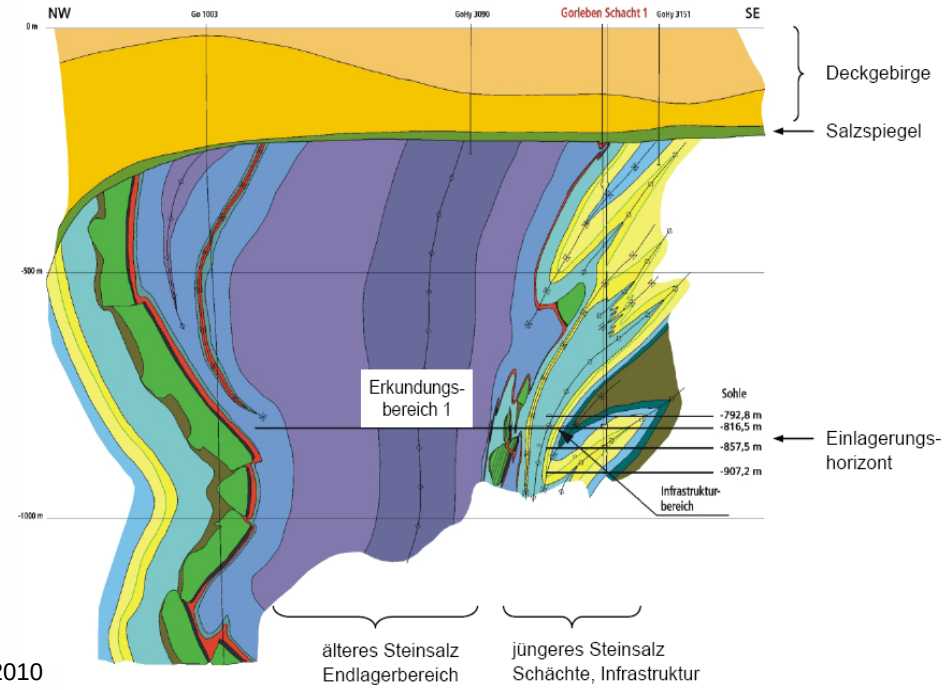
Federal Minister of Environment Röttgen:

We must face the responsibility to manage the radioactive waste. The exploration of Gorleben shall continue. Transparency and reliability of the decision-making process come first.

- The moratorium of the exploration work in the salt dome Gorleben in terms of final repository for heat-generating radioactive waste shall be cancelled.
- The suitability of Gorleben as a final repository shall first be examined in a multi-level procedure based on a safety analysis, an updated final repository concept and an international peer review.
- In case this procedure turns out to be positive a plan approval procedure based on atomic law shall be instituted.
- Transparency and traceability of the procedure shall be granted by intensive participation of the citizens right from the start and in all phases.

Tentative Time Schedule of the Federal Ministry for Enviroment[1)]

2010	Mutual consent of all Federal States to safety requirements of a final repository for heat-generating waste
2010 – 2012	Preparation of a provisional safety analysis
2012 - 2013	Examination of the safety analysis by an international peer review. Presention of the results by the end of the current legislative period (mid 2013)
As from 2013	Adaptation of the final repository concept and exploration programme
2017	Completion of exploration works
2018	Approval of suitability and institution of approval process according to atomic law
As from 2030	Commissioning of a final repository (technically feasible)



1) Source www.bfs.de, announced by Federal Ministry for Enviroment, Dr. Röttgen, 15.03.2010

Conclusion

- The spent fuel management in Germany is, to a large extent, technically solved or solvable.
- The exploration results for the Gorleben salt dome obtained so far, are supporting the assumption of its suitability as a repository for heat-generating waste
  → It is of great importance to finish the exploration rapidly, to have a sound basis for a decision on the construction of a final repository, especially in view of our responsibility for the future generation

- International regulations and discussions can support the process of spent fuel management and enhance public acceptance in Germany as well as in Europe
  → International bodies as ENISS – European Nuclear Installations Safety Standards initiative should be involved e. g. to
  - strengthen the influence on the revision work of the IAEA Safety Standards
  - cooperate with the European institutions on regulatory issues in the area of nuclear safety, radiation protection, waste management and decommissioning

Spent Fuel Management

…don´t disturb me with negligible matters…

Eurobarometer Survey

Source: FORATOM Press Release Brüssel, 29. April 2010

- **59 % of respondents are confident in nuclear operators‘ ability to run nuclear plans safely**
- **68 % of respondents think that nuclear energy helps reduce the EU´s dependence on gas and oil, thereby enhancing security of energy supply**
- **56 % want nuclear energy to be maintained or increased (exceeding 8% of the 2007 survey results).**

All these figures will increase if a decision is made on a solution for a final repository.

Thank you for your Attention!