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Management of Radioactive Waste and Spent Fuel, Balance of Reprocessing

Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management
Second Review Meeting
May 17th, 2006

Dr. Ulrich Alter, Dr. Christian Götz
Federal Ministry for the Environment,
Nature Convservation and Nuclear Safety
Bonn

Dr. Werner Mester
Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) mbH
Köln

Wolf Koch
Federal Office for Radiation Protection

Salzgitter

Simone Mohr
Institute for Applied Ecology

Darmstadt

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Content

- Inventory of Spent Fuel
- Inventory of Radioactive Waste
- On-site Interim Storage Facilities for Spent Fuel
- Balance of Reprocessing

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Production of Spent Fuel

- Annual unloading per reactor: 15 to 30 tHM/a
- Total annual production in Germany: ~ 400 tHM/a
- Produced by end 2005: 11,810 tHM
- Storage (December 2005): 5,140 tHM
- Expected quantity produced by 2025: ~ 17,200 tHM

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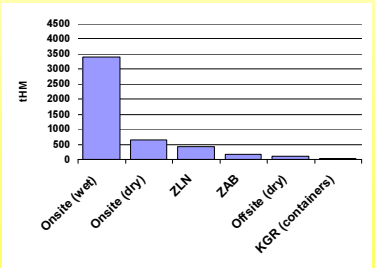
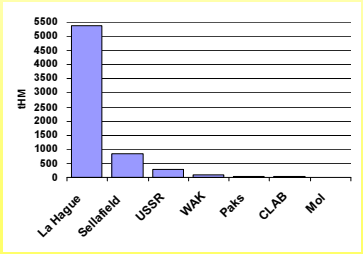
Amounts of Spent Fuel (December 2005)

Produced in Total:
11,810 tHM

Stored in Germany:
5,140 tHM

Shipped/Reprocessed:
6,670 tHM





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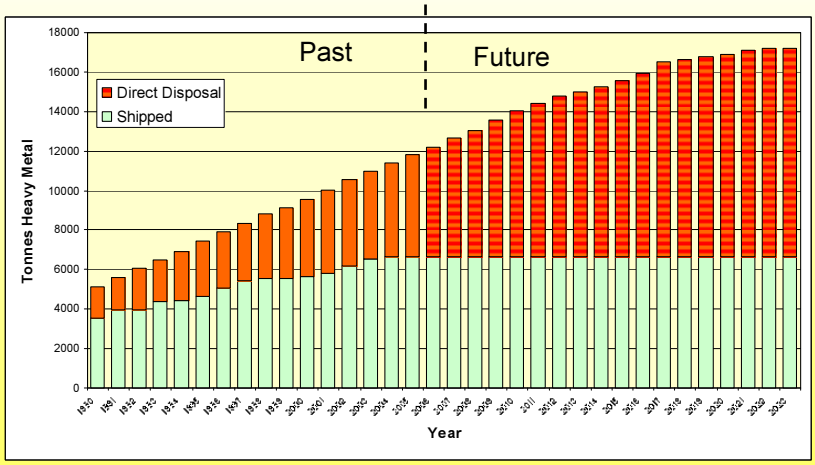
Cumulated Spent Fuel Arisings



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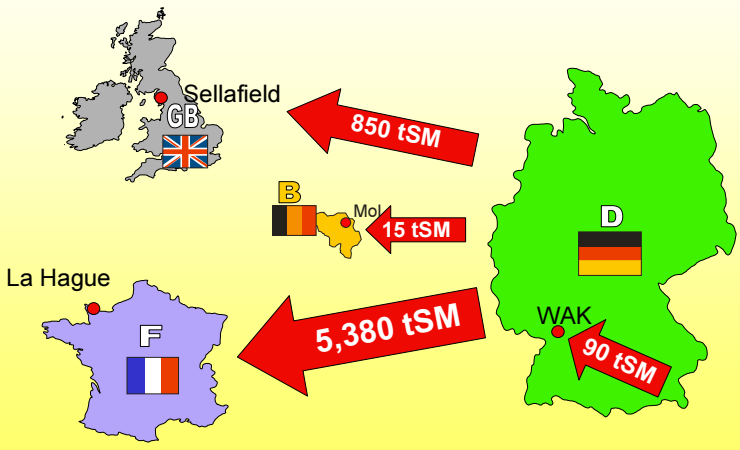
Spent Fuel Shipped for Reprocessing



Recycling of Pu as MOX-Fuel

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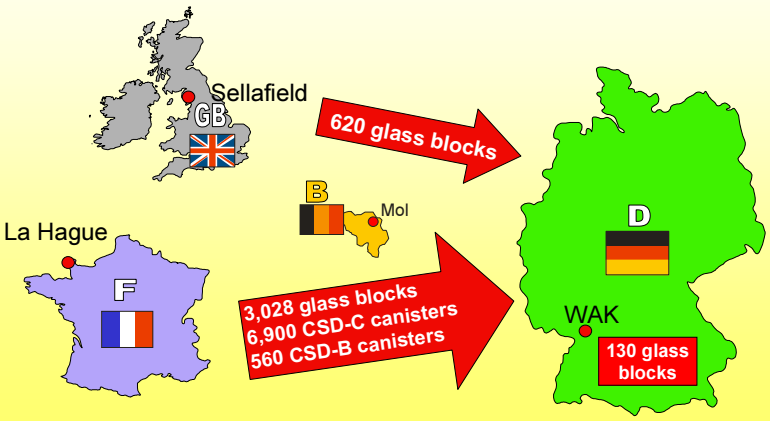
Returning Reprocessing Wastes (1/2)

(Planning Data, December 2005)



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Returning Reprocessing Wastes (2/2)

Gorleben interim storage facility, the storage facility for vitrified waste from reprocessing

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Kind of Waste	With negligible Heat Generation m³	Heat Generating *) in m³
Untreated Waste (utilisable residues and primary waste) *In storage 2004*	29,773	56
Interim Products *In storage 2004*	7,902	–
Interim Products *Arising 2004*	2,019	–
Conditioned Waste *In storage 2004*	82,645	1,743
Conditioned Waste *(reported arising 2004)*	5,331	60
Disposed of Waste in the Morsleben Repository	36,753	–
Emplaced Waste in the Asse Research Mine	47,000	–

*) without spent fuel

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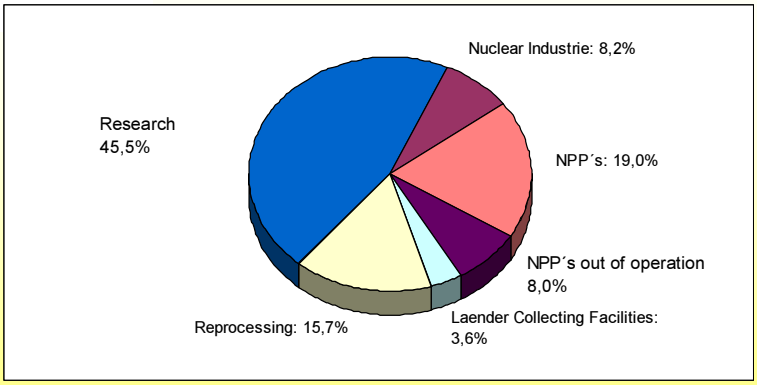

Percentage of stock of conditioned radioactive waste with negligible heat generation as of 31.12.2004, total volume: 82,645 m³

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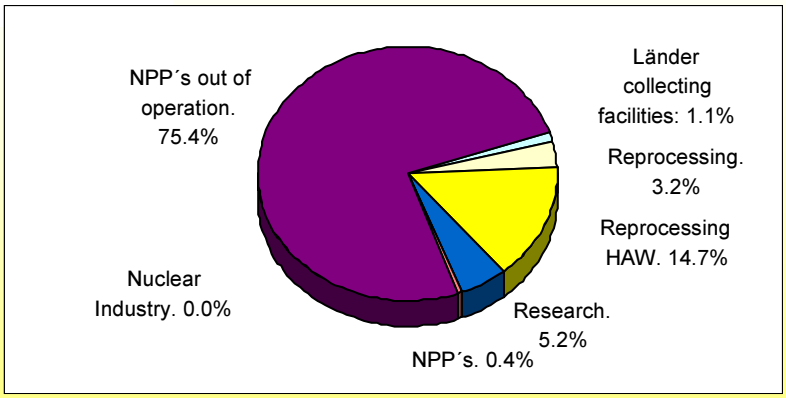

Percentage of stock of conditioned radioactive waste with heat generation as of 31.12.2004, total volume: 1,743 m³, only surplus from reprocessing (60.4 m³)

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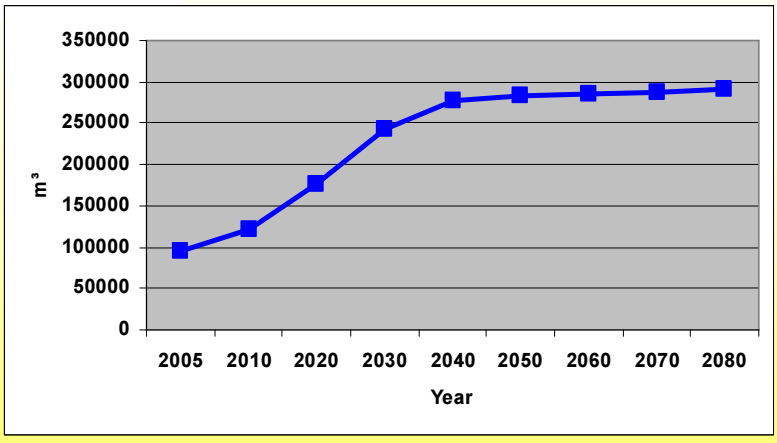

Predicted volumes of Waste Packages (accumulated) with conditioned waste with negligible heat generation until 2080

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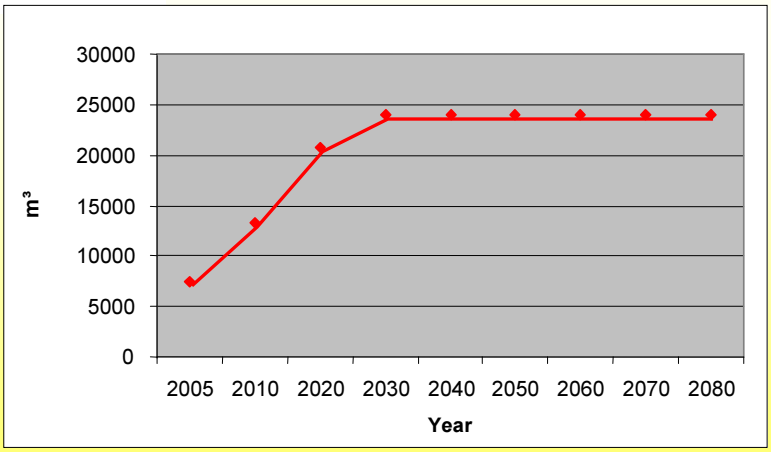

Predicted volumes of Waste Packages (accumulated) with conditioned waste with heat generation until 2080

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On-site Storage Facilities
Temporary Interim Storages

	Nuclear Power Plant Site	In Operation Since	… Positions for containers with [Storage Capacity]	Emplaced [t HM] as at 12 / 2005
1	Neckarwestheim	04 /2001	24 positions with 250 t HM	176
2	Philippsburg	07 / 2001	24 positions with 250 t HM	130
3	Biblis	03 / 2002	28 positions with 300 t HM	285
4	Krümmel	08 / 2004	12 positions with 120t HM	45

storage facility at Biblis

storage facility at Neckarwestheim

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On-site Storage Facilities

	Nuclear Power Plant Site	In Operation Since	… Positions for containers with [Storage Capacity]	Emplaced [t HM] as at 12 / 2005
1	**Lingen**	**12 / 2002**	**120 positions; 1,250 t HM**	**210**
2	**Brunsbüttel**	**02 / 2006**	**80 positions; 450 t HM**	
3	**Grafenrheinfeld**	**02 / 2006**	**88 positions; 800 t HM**	
4	**Grohnde**	**04 / 2006**	**100 positions; 1,000 t HM**	
5	**Biblis**	**05 / 2006**	**135 positions 1,400 t HM**	
6	Brokdorf	12 / 2006	100 positions; 1,000 t HM	
7	Krümmel	09 / 2006	80 positions; 775 t HM	
8	Unterweser	03 / 2007	80 positions; 800 t HM	
9	Philippsburg	09 / 2006	152 positions; 1,600 t HM	
10	Gundremmingen	07 / 2006	192 positions; 1,850 t HM	
11	Isar	03 / 2007	152 positions; 1,500 t HM	
12	Neckarwestheim	12 / 2006	151 positions; 1,600 t HM	
13	Obrigheim	Application from April 22th, 2005		
			1,430 positions; 14,025 t HM	

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Storage Facilities (1/5)

Interim Storage Facility Emsland (STEAG concept)

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Storage Facilities (2/5)

Interim Storage Facility Emsland

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Storage Facilities (3/5)

Interim Storage Facility Grafenrheinfeld (WTI concept)

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Storage Facilities (4/5)

Interim Storage Facility Emsland (STEAG concept)

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Storage Facilities (5/5)

Interim Storage Facility Emsland

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Zentrales Abfalllager
Kernbrennstoffe (ZAB)

Zwischenlager Nord

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Balance of Reprocessing Quantities

Reprocessing Plant	Transported to reprocessing plants [tHM]
UP 02/03 La Hague (France)	5,400
THORP Sellafield (UK)	850
Total	6,250

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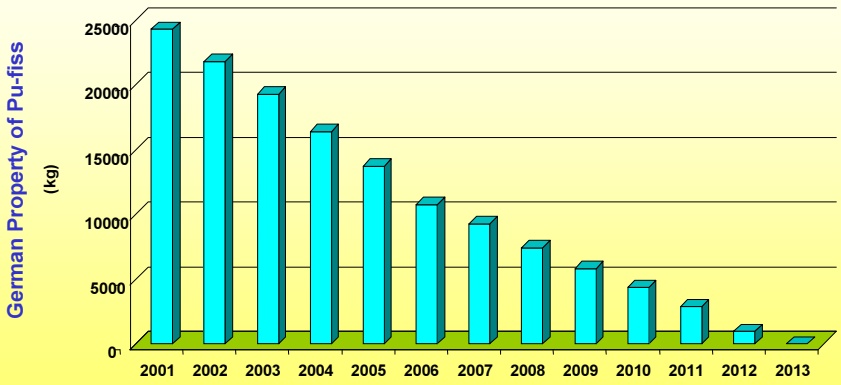
Reduction of Pu_{fiss} Stock by Use of MOX Fuel



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Ongoing Reuse of Separated Plutonium

- **Sufficient capacity in German Nuclear Power Plants for reuse**
- **Possible delay only if problems in MOX Fuel Facilities arise**
- **Transfer of all separated Plutonium in MOX fuel elements expected until 2013**
- **All spent MOX fuel elements in fuel pools expected until 2017/2018**

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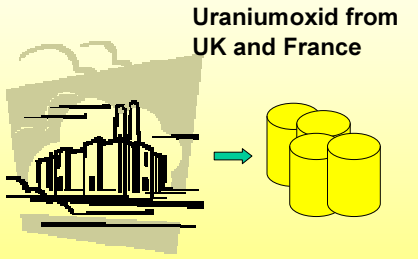
Reuse of Reprocessed German Uranium (1)



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Reuse of Reprocessed German Uranium (2)
U_{rep} Fuel Assemblies

reprocessed Uranium (**0,7% U-235**) → reenrichment & conversion **(4,6% U-235)** → fuel fabrication facility →

Only 9 U_{rep} fuel assemblies were irradiated in two reactors in 1999 in Germany.

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Reuse of Reprocessed German Uranium (3)

ERU Fuel Assemblies

reprocessed Uranium

highly enriched Uranium (**20-90% U-235**)

blending (**4,1% U-235**)

fuel fabrication facility

~ 400 tHM ERU fuel assemblies were manufactured and reused in 5 NPPs (as of 1/2006)