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The Closure of the Asse Research Mine

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

Dr. Helmut Bossy
Federal Ministry of Education
and Research
Bonn

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Content

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Facts and figures – location, organization

Asse belongs to the GSF - National Research Centre for Environment and Health

→ responsibility of:

Bundesministerium für Bildung und Forschung

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Facts and figures – house for the winding machine and shaft tower

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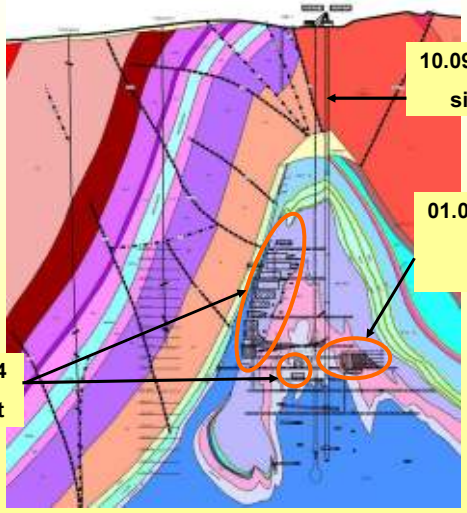
Facts and figures – mining history

North-south section



10.09.1906 – 01.11.1908
sinking of shaft 2

01.03.1909 – 31.12.1925
production of potassium salt

01.01.1916 – 31.03.1964
production of rock salt

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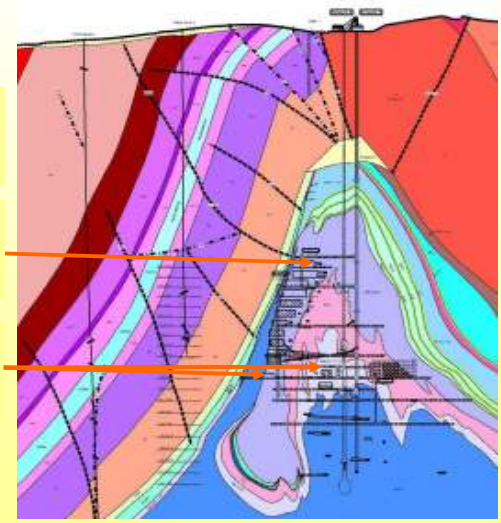
Facts and figures – disposal

12.03.1965
Acquisition of the salt mine Asse by the GSF-research center

31.08.1972 – 18.01.1977
Disposal of medium active waste

04.04.1967 – 31.12.1978
Disposal of low active waste



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Legal basis for disposal (1967 – 1978)

- Disposal took place in 6 phases, for each phase licences were granted by the **mining authority**
- The licences were based on the **first Radiation Protection Ordinance** and the **Atomic Energy Act** of 23 Dec. 1959; the authorizations also covered the **final disposal** of the radioactive waste
- The **4th amendment** of the Atomic Energy Act from 1976 set the legal framework for **final repositories**; existing licenses (as for the Asse) remained unaffected by the 4th amendment
- Last licenses of the Asse mine for disposal expired **31 Dec. 1978**
- Asse mine has always been under **supervision of the mining law; the closure of the Asse mine will also take place according to the regulations of the Federal Mining Act**

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R&D in the Asse mine

Disposal of low active waste – vertical stacking technique

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R&D in the Asse mine

Disposal of low active waste – horizontal stacking technique

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R&D in the Asse mine

Disposal of low active waste – dumping technique

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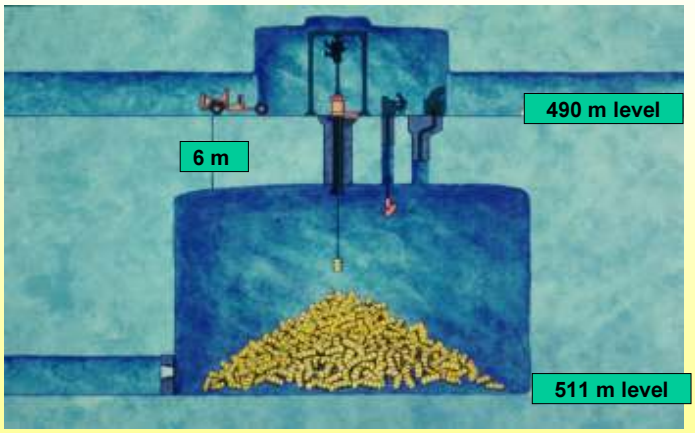
R&D in the Asse mine



Disposal of medium active waste (schematic view)

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R&D in the Asse mine

Experimental disposal of highly radioactive sources (cold test)

- experiment was canceled in 1992, radioactive sources were not emplaced -

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Inventory

Delivering party (waste origin)	Waste packages (%)	Total activity (%)
Karlsruhe research center	50	90
Jülich research center	10	2
Nuclear power plants	20	3
Other delivering parties	20	5
Total	**100**	**100**

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Inventory

Determination of inventory

By analysis of documentation, questioning of waste producers, calculations, etc. **radiological and chemo-toxic** inventory was determined.

Results

124,494 packages of LAW	**1.9 E15 Bq (60% of total activity)**
1,293 packages of MAW	**1.2 E15 Bq (40% of total activity)**
	3.1 E15 Bq total activity (01.01.2002)
	47,000 m^3 volume

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Inventory

102 Mg uranium

87 Mg thorium

11.6 kg plutonium

Radionuclide	Half-life	Activity [Bq]		
	[a]	LAW	MAW	total
H-3	1,2E+01	9,2E+11	3,5E+11	1,3E+12
C-14	5,7E+03	3,6E+12	2,2E+11	3,9E+12
Co-60	5,3E+00	1,6E+13	1,3E+14	1,5E+14
Ni-63	1,0E+02	8,2E+13	6,8E+14	7,6E+14
Sr-90	2,9E+01	1,9E+14	1,4E+14	3,3E+14
I-129	1,6E+07	2,0E+08	1,2E+08	3,2E+08
Cs-137	3,0E+01	3,6E+14	2,1E+14	5,7E+14
Ra-226	1,6E+03	2,0E+11	1,8E+02	2,0E+11
Th-232	1,4E+10	3,5E+11	1,2E+07	3,5E+11
U-235	7,0E+08	5,2E+10	1,9E+08	5,2E+10
U-236	2,3E+07	1,2E+10	7,7E+08	1,3E+10
U-238	4,5E+09	1,3E+12	1,9E+09	1,3E+12
Pu-238	8,8E+01	3,6E+13	1,3E+12	3,7E+13
Pu-239	2,4E+04	1,8E+13	1,0E+12	1,9E+13
Pu-240	6,6E+03	2,1E+13	1,0E+12	2,2E+13
Pu-241	1,4E+01	1,1E+15	4,5E+13	1,1E+15
Am-241	4,3E+02	8,8E+13	7,2E12	9,4E+13
Total alpha	-	1,7E+14	1,2E+13	1,8E+14
Total beta/gamma	-	1,7E+15	1,2E+15	2,9E+15

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Status of closing - goals

Goals

✓ **Obtain final operational plan (i.e. license to close mine) from mining authority on the basis of the long-term safety assessment for the radioactive waste**

✓**close mine on the basis of final operational plan**

The legal requirements to be taken into account are in particular

- Radiation Protection Ordinance (Strahlenschutzverordnung)
- Federal Water Act (Wasserhaushaltsgesetz)

Requirements concerning safety and the protection of the environment are the same in the two statutes mining law and atomic law!

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Status of closing – boundary conditions

- **Long opening of the mine (> 50 years)**
  → reduced mechanical stability
- **Inflow of NaCl brine (12 m^3 per day)**
  → flooding can not be excluded
- **Open chambers in the carnallite formation**
  → dissolution of structures by the NaCl brine

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Status of closing – conclusions and concept

→ **Closure of the mine is to be performed without delay**

→ **Asse has its own concept**

- **$MgCl_2$ brine as protection fluid**
- **System of salt concrete barriers (MgO concrete)**
- **Magnesium depots**

→ **Closure measurements are not to anticipate the final operational plan**

→ **Closing of mine concluded around ~ 2013**

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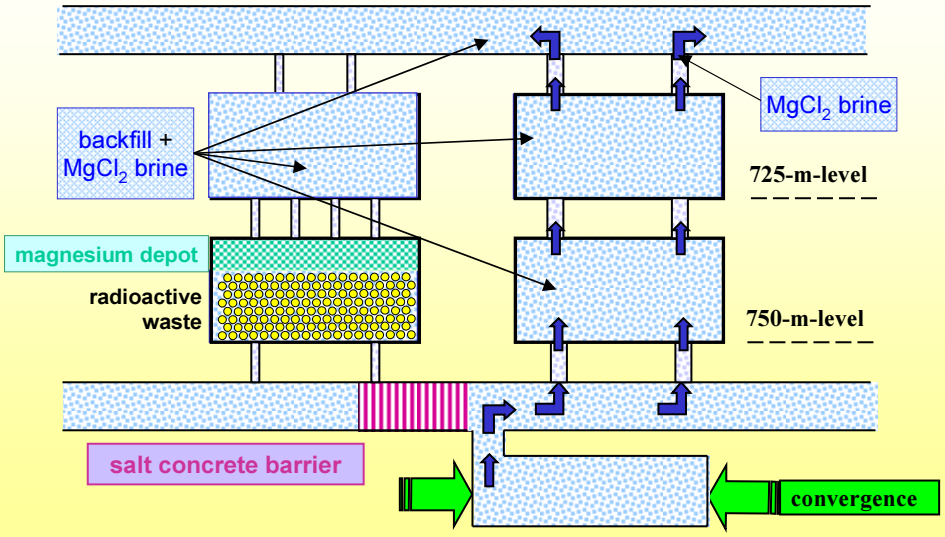
Status of closing - closing concept



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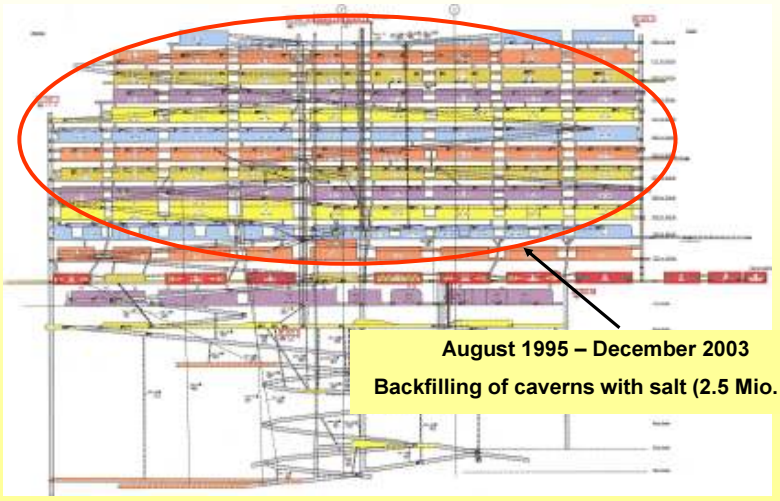
Status of closing - measurements



August 1995 – December 2003

Backfilling of caverns with salt (2.5 Mio. m^3)

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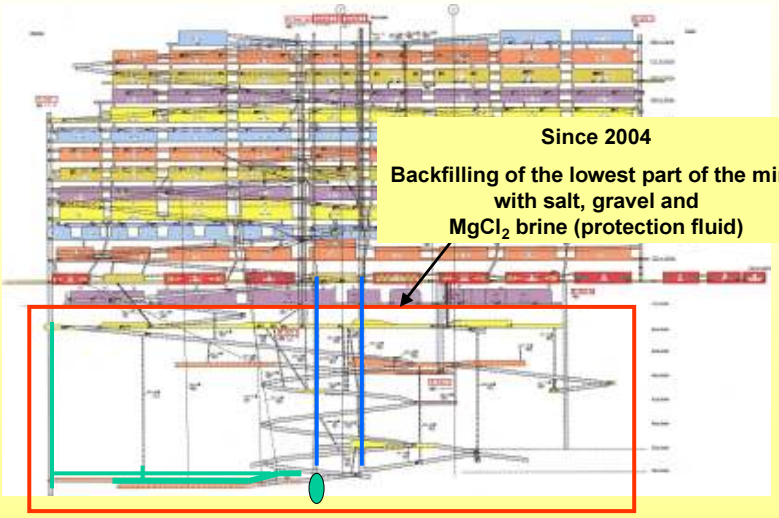
Status of closing - measurements



Since 2004

Backfilling of the lowest part of the mine with salt, gravel and $MgCl_2$ brine (protection fluid)

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