



WISMUT

47. ročník symposia Hornická Příbram ve vědě a technice

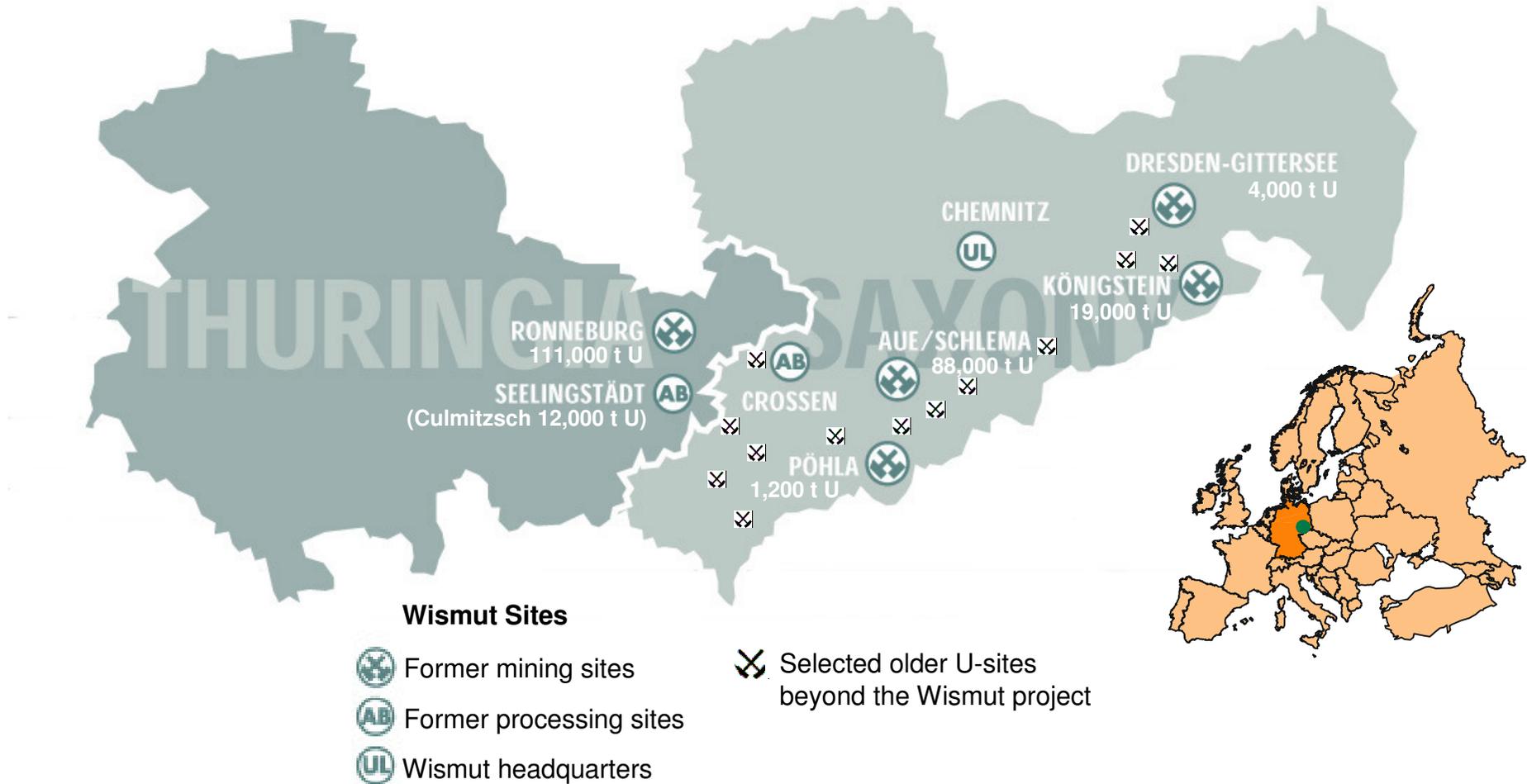
RECENT STATUS OF THE WISMUT REMEDIATION PROJECT

Dr. Stefan Mann, Dr. Michael Paul, **Dr. Ulf Jenk**





Wismut Remediation Area





Implementation of Closure and Remediation

- | After a **preliminary survey**, the **remediation focused** on
 - **five mining sites** Ronneburg, Aue, Pöhla, Königstein, Gittersee
 - **two processing sites** Seelingstädt and Crossen
- | Majority of projects
 - Demolition of contaminated buildings and structures
 - Area clean-up,
 - Waste rock piles,
 - Industrial tailings ponds,
 - Underground and open pit mines,
 - Water treatment.



Scope of the closure program

| 37 km² operational areas incl. 2 mill sites

- 250 000 m³ Concrete (0,2 – 1 Bq/g)
- 16 000 m³ Timber; 7 200 t Wooden railway sleepers;
- 262 200 t Scrap metal (0,5 – 50 Bq/cm² (α -activity))

| 5 underground mines:

Schlema, Pöhla, Königstein, Gittersee, Ronneburg

with a volume of 80 M m³ and 1400 km of tunnels and drifts to be cleaned

| 1,6 km² open pit mine at Ronneburg (84 M m³ open pit volume)

| 311 M m³ waste rock piles, 48 piles

Specific activity/Nuclide content: 0.2...2 Bq/g (Ra-226)

Inventory: 20,000 t Uranium;

| 160 M m³ of tailings (mainly at Seelingstädt/Crossen);

5.7 km² tailings pond surface; Specific Ra-226-activity: 10 Bq/g



Legal Requirements

| Mining Act

- **elimination of any considerable residual risk** on site, especially securing **geomechanical stability** and
- preparation of mining areas for **re-utilisation** after mine closure, in compliance with regional land use concepts

| Water Resources Act and Soil Protection Act

- **long-term protection of ground and surface waters** and soil from contamination

| Atomic Act and subsidiary regulations (e.g. Radiation Protection Ordinance)

- **Justification and optimisation** of any measures
- **Compliance with dose limits** to workers and public
- Individual dose to public **< 1 mSv/a: action level** and **goal of remediation**



Remediation of Waste Rock Dumps

- | Either by **relocation** or by **in situ stabilization**
 - depending on the results of remedial investigations, feasibility study, environmental assessment, optimisation
- | **Objectives**
 - Re-utilisation of the land (often restricted)
 - Safekeeping of radioactive material
 - Reduction of contaminated seepage water
- | **In situ remediation of waste rock dumps:**
 - Reshaping to a long-term stable form and
 - Capping with a soil cover designed to
 - reduce external radiation,
 - radon exhalation and
 - limit infiltration into the pile.
 - The surface of the cover is vegetated to control erosion and to blend in with the surrounding landscape.



Waste Rock remediation, Schlema site

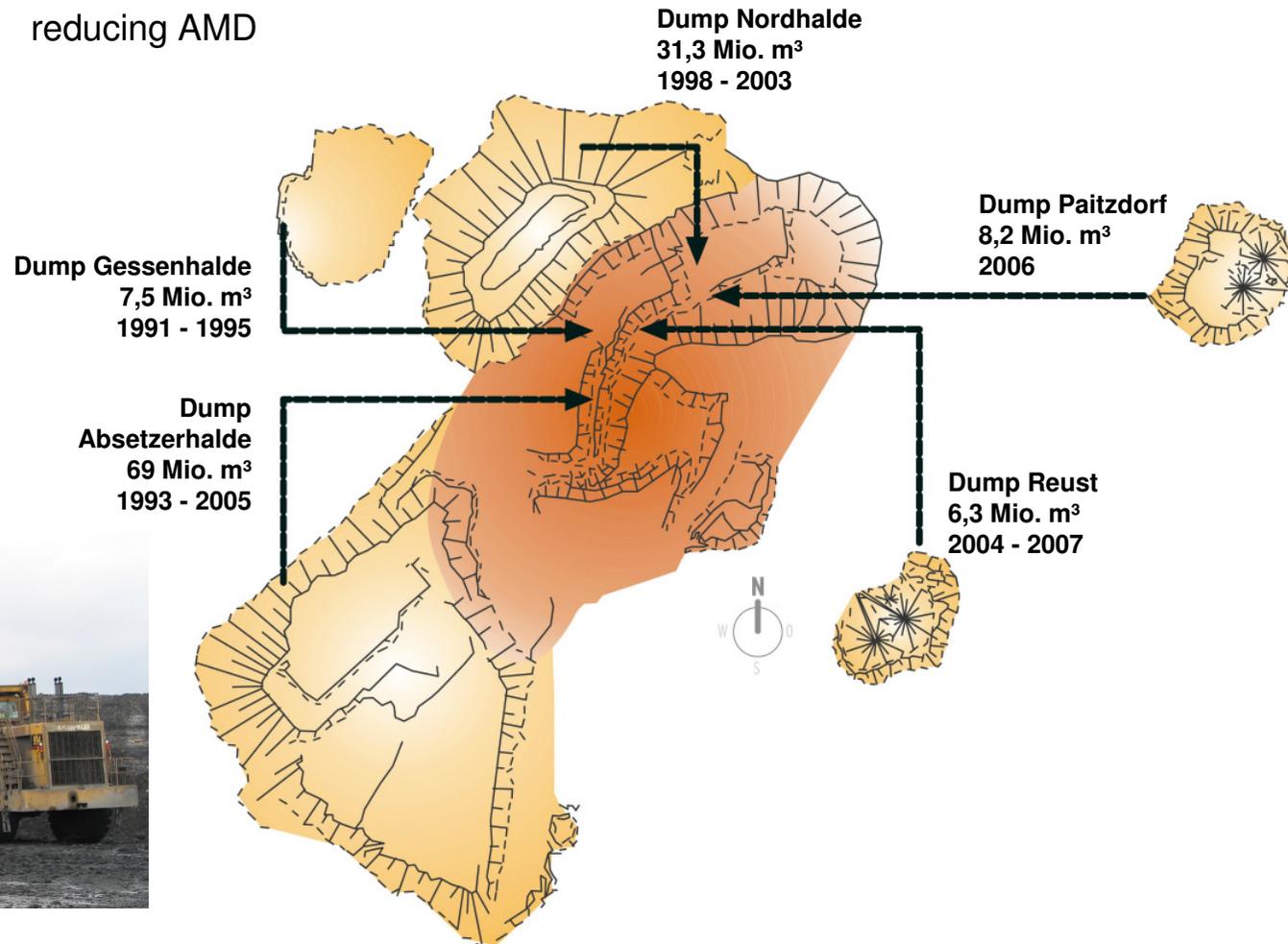
WASTE DUMP 366





Waste Rock Dumps at the Ronneburg Site

- I At the Ronneburg site, most of the dumps were relocated into the close-by Lichtenberg open pit mine
 - reducing AMD

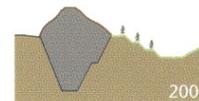
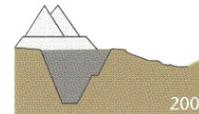
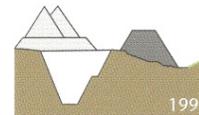




Backfilling of the Lichtenberg Open Pit



- | Operation: 1958 – 1977
- | Area: 160 ha
- | Length: 2 km
- | Width: 1 km
- | Volume: 150 Million m³





Seelingstädt Processing Plant



1992

May 2007

08/09/2008

Dr. Ulf Jenk: Recent status of the Wismut remediation project

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Waste Dump Covers

LOCATION	SCHLEMA (Saxony)	RONNEBURG (Thuringia)	RONNEBURG (Thuringia)
Remediation object	366	Beerwalde	Lichtenberg
Altitude	450 mNN	300 mNN	300...350 mNN
Precipitation	850 mm/a	650 mm/a	650 mm/a
Cover System	2-layers	2-layers	2-layers
Cover Thickness	1,0 m	1,9 m	1,6 m
Design	2 x 0,45 m sealing / storage layer (mineral sub soil) 0,2 m revegetation layer (humus top soil)	0,4 m sealing layer 3 x 0,5 m storage layer	1,2 m loamy soil from interim storage 0,4 m revegetation layer

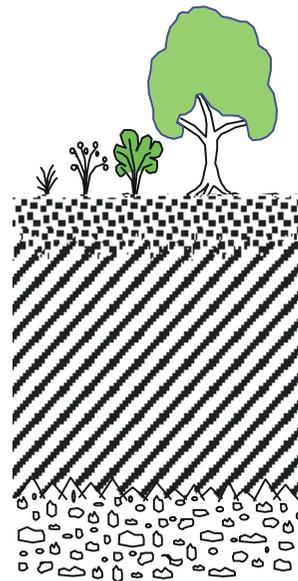


Site Specific Waste Rock Covers

Cover Type „Schlema“

Main objectives:

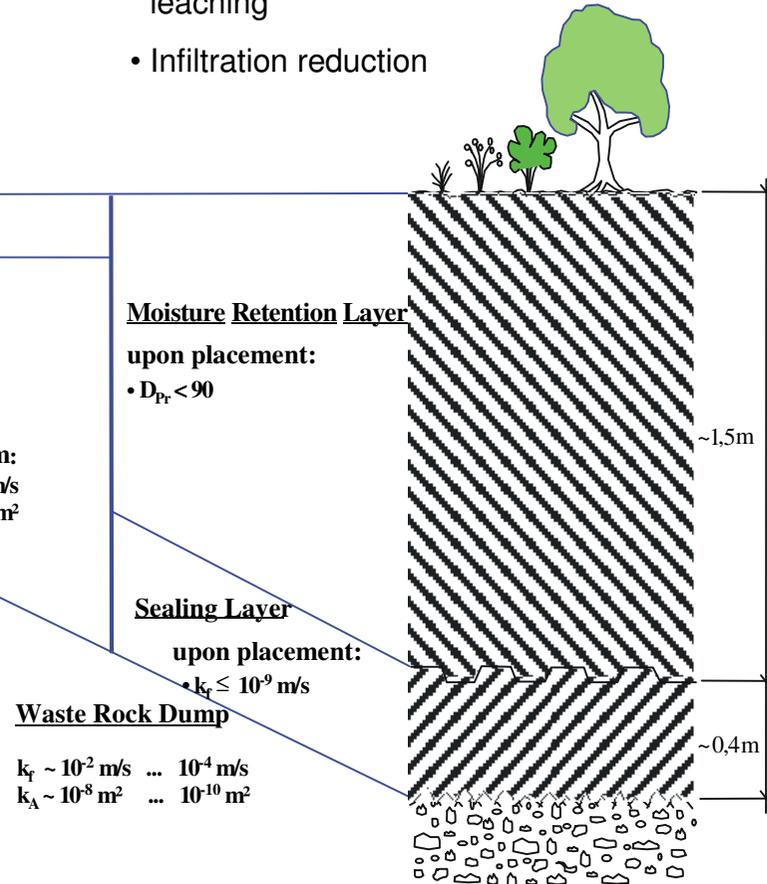
- reduction of Radon exhalation



Cover Type „Beerwalde“

Main objectives:

- Reduction of contaminants leaching
- Infiltration reduction





Remediation of Tailings Ponds: Baseline data

	SEELINGSTÄDT MILL				CROSSEN MILL	
Tailings Impoundment	CULMITZSCH A	CULMITZSCH B	TRÜNZIG A	TRÜNZIG B	HELMSDORF	DÄNKRITZ I
Tailings surface area (ha)	159	76	67	48	205	19
Tailings volume (Mio m ³)	61	24	11	6	45	5
Solid mass (Mio t)	64	27	13	6	49	7
Max. tailings thickness (m)	72	63	30	28	48	23
U _{nat} in solids (t)	4800	2200	1500	700	5000	1000
U _{nat} in solids (t)	7.9	2.4	1.3	0.5	5.5	0.4
U _{nat} in pore water (mg/l)	0.3 ... 3.9	1.0 ... 16.5	1 ... 19	1 ... 20	2 ... 30	10 ... 85
Ra-226 in pore water (mBq/l)	...5000	...2300	630	N.A.	500 ... 2000	N.A.

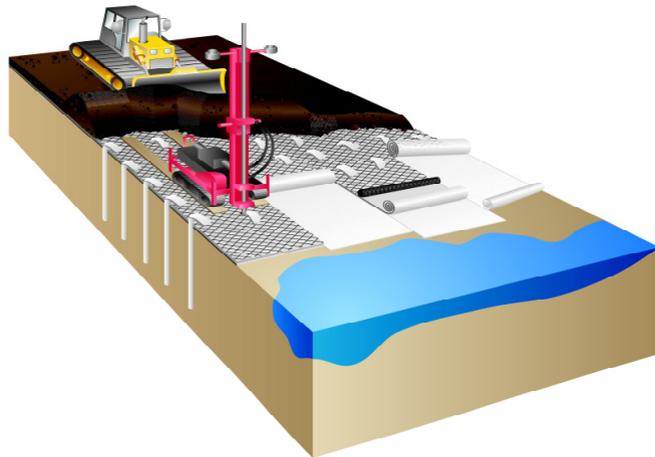


Remediation of Tailings Ponds

- I Remediation steps of “dry” in-situ-stabilisation
 - **Removal of the pond water** consisting of precipitation, surface drainage and pore waters
 - **Geotechnical stabilisation** of the contaminated mud underneath,
 - (a) Placement of an **interim cover** on the tailings surface to provide the consolidation load and create a stable working platform;
 - (b) **Reshaping** of dams with respect to dam stability to the long term
 - (c) Construction of a stable surface contour providing suitable run off conditions for the surface water (**Reshaping**);
 - **Capping** of the surface with a final soil cover
 - **Re-vegetation** of the surface



Interim covering CULMITZSCH CASE

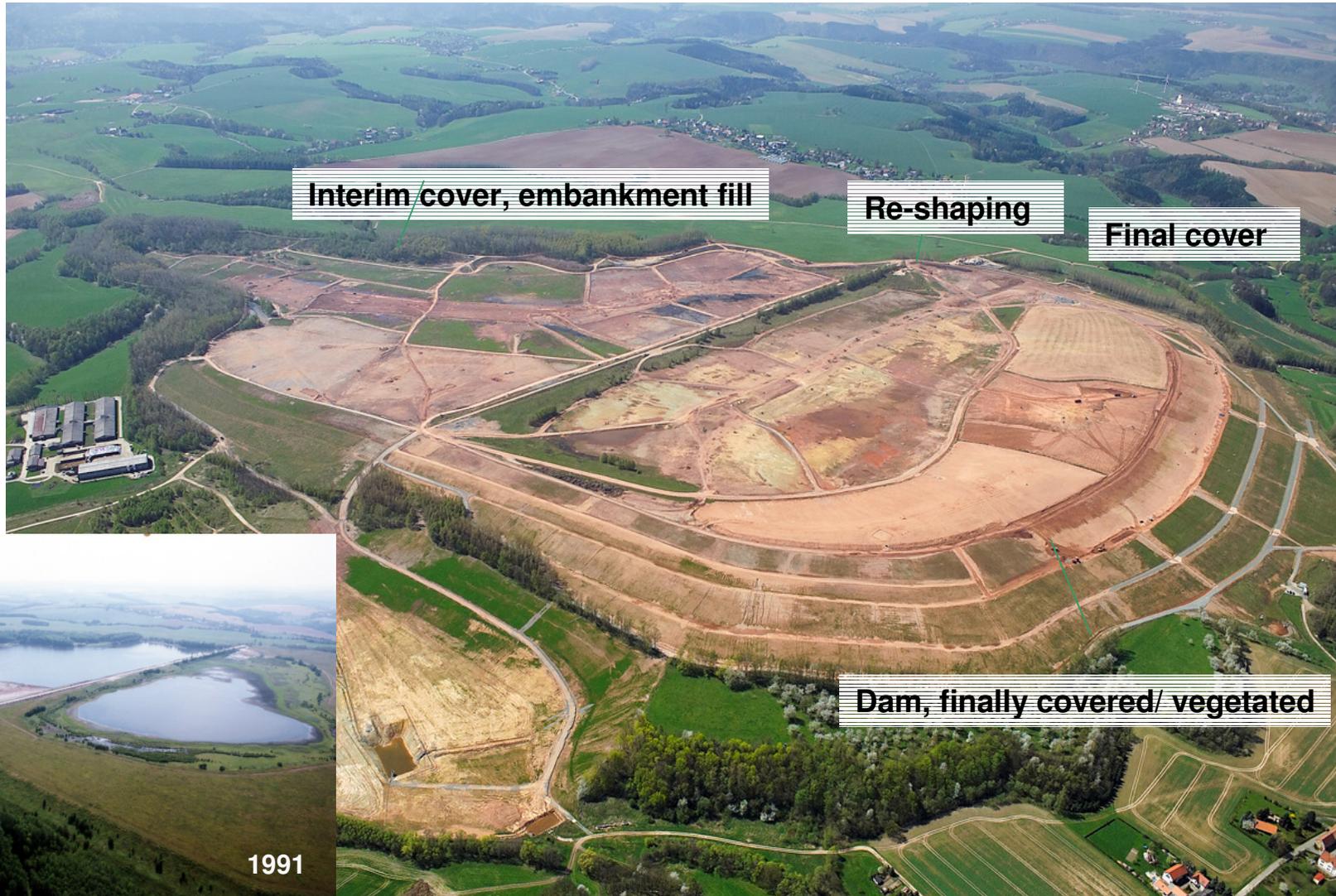


Recent status of the Wismut remediation project



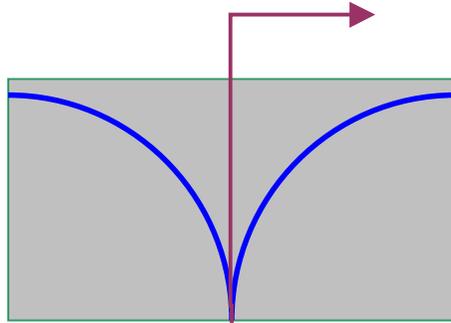
Re-shaping and Final Covering TRÜNZIG CASE

2007

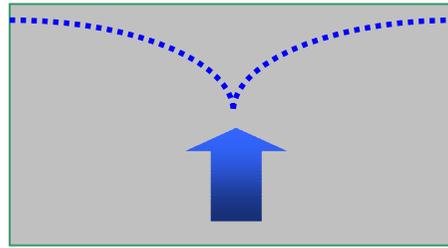




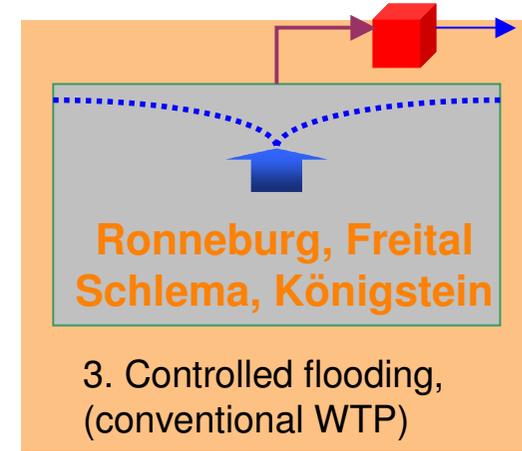
Closure of underground mines/mine flooding



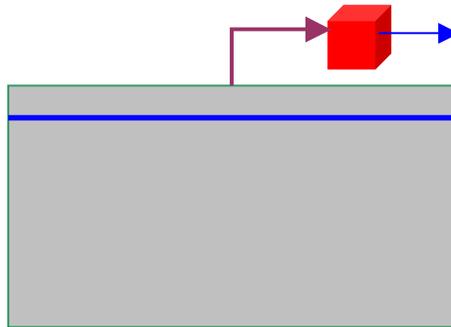
1. Closure of operation, preparation for rebound



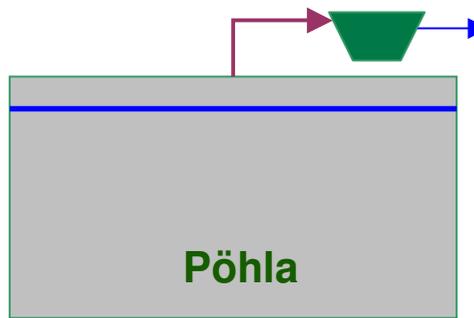
2. Uncontrolled flooding



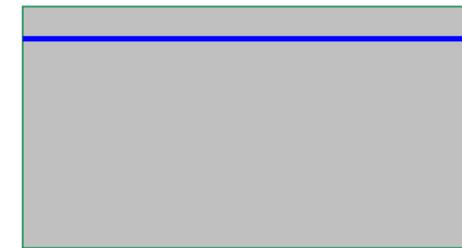
3. Controlled flooding, (conventional WTP)



4a. Groundwater rebound complete, conventional WTP



4b. Groundwater rebound complete, passive WTP



5. Mine closure complete (no further action)

— steady state scenario

..... transient scenario



State of Remediation as of End of 2007, in %

UNDERGROUND

Abandonment of open cavities		99 %
Plugging and sealing of shafts		97 %
Backfilling mine workings (near surface)		99 %

ABOVE GROUND

Facilities/buildings demolished		89 %
Mine dumps excavated/relocated		89 %
Mine dumps/open pit capped		78 %
Lichtenberg open pit filled		99 %
Tailings ponds		100 %
interim covering		
re-shaping		31 %
final covering		13 %
Reclamation of areas		65 %



Status of the Remediation program

- | Completion ~ 85 % using 78 % of the budget
- | To be finished by 2015
- | Objects w/ remaining risk potential have to be carefully monitored and maintained (institutional control)
- | Highly standardized technologies and workflows available
- | Internationally accepted benchmarking project
 - Technologies,
 - Project management,
 - Monitoring,
 - Data & Know how management



Long Term and Post Remedial Activities

- | Water treatment
- | Care and maintenance of restored land
- | Care and maintenance of ancillary mine workings
- | Mine damage control and compensation
- | Long-term environmental monitoring
- | Management of data, documents and information



Thank you very much for your attention



BUGA Ronneburg (Thuringia) October, 14, 2007