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Rehabilitation of Mining in Portugal

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MIN-GUIDE Policy Laboratory 4:
Innovations and Supporting Policies for Waste Management and Mine Closure

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Rehabilitation of abandoned mines in Portugal

- **Why?**
 - Mining is a very old activity in Portugal, since Roman times (from I B.C. to IV A.C.);
 - There are mines of tungsten, tin, uranium, pyrite, copper, lead, gold and silver;
 - Until 1990 there was no legal obligation for environmental remediation/rehabilitation of the mining sites;
 - There are “Orphan”/Legacy mining sites;
 - There are **environmental impacts** resulting from the exploitation and essentially from the abandon of mining activities.

- **Focus on:**
 - Mining Wastes Management
 - Control and Reduce Mine water and AMD
 - Mine Water Treatment Systems (Passive, Active and Mixed)
 - Soil decontamination
 - Landscape integration
 - Heritage preservation

Rehabilitation of abandoned mines



- Main players:



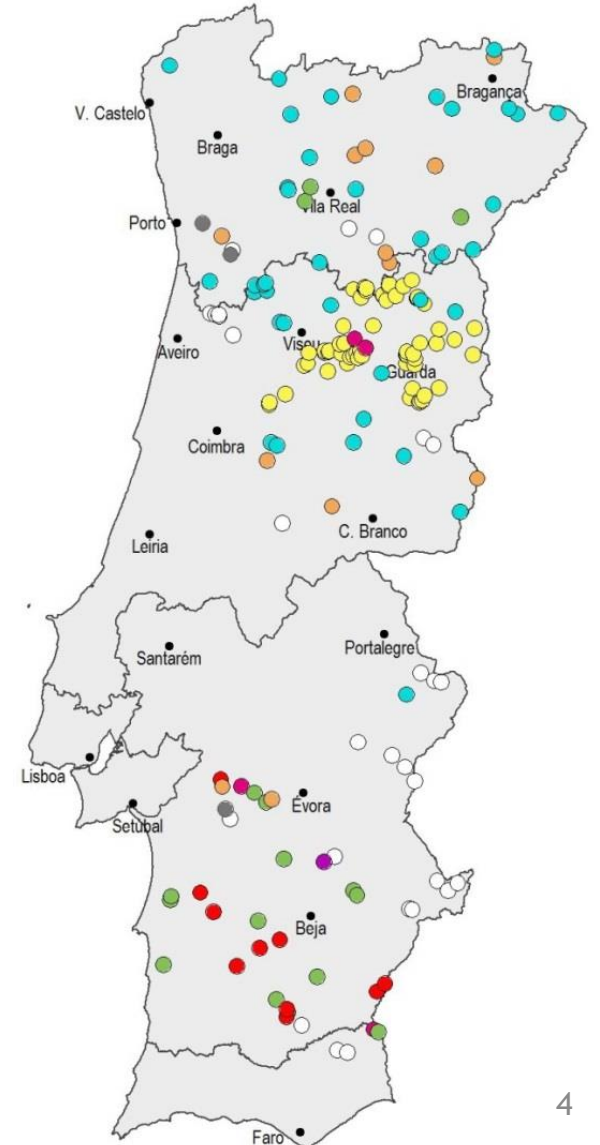
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- EDM-Empresa Desenvolvimento Mineiro (Portuguese State owned company).
 - Act as a State representative operating under a concession granted by the Portuguese government.
 - EDM develops and conducts the environmental remediation and monitoring of abandoned mining sites in Portugal.
- DGEG-Direção Geral de Energia e Geologia (Portuguese Mining Authority).
 - DGEG supports the activity of EDM and also finances part of the remediation work through the royalties new policy, 50% of the total income from royalties (paid by operating mining companies) goes to EDM for the rehabilitation of abandoned mines.

Portuguese approach: Inventory

- On 1998: Abandoned Mine Inventory by IGM (now DGEG and LNEG)

MINERAL TYPE GROUPS		NUMBER OF MINES	MOST RELEVANT OLD MINES
Radioactive minerals		61	Urgeiriça, Quinta do Bispo, Cunha Baixa e Bica
Polimetallic (114)	Polimetallic Sulphides	10	São Domingos, Aljustrel, Lousal e Caveira
	Tin and Tungsten	40	Argozelo, Covas, Montesinho e Terramonte
	Base Metals	28	Terramonte, Coval da Mó e Miguel Vacas
	Iron and Manganese	16	Orada, Cercal / Rosalgar e Ferragudo
	Coal	3	São Pedro da Cova e Pejão
	Gold	12	Jales, Penedono e Freixeda
	Others	4	Gouveia de Baixo e Cortes Pereira
	Asbestos	1	Arado do Castanheiro
TOTAL		175	



Note: On 2003 ExMIN (now EDM) made a review/update of the inventory

Portuguese approach: New policy and Government will

- **On 2001**: The Portuguese Government launches DL n° 198A/2001, which grants to EDM the concession for environmental rehabilitation of abandoned mines

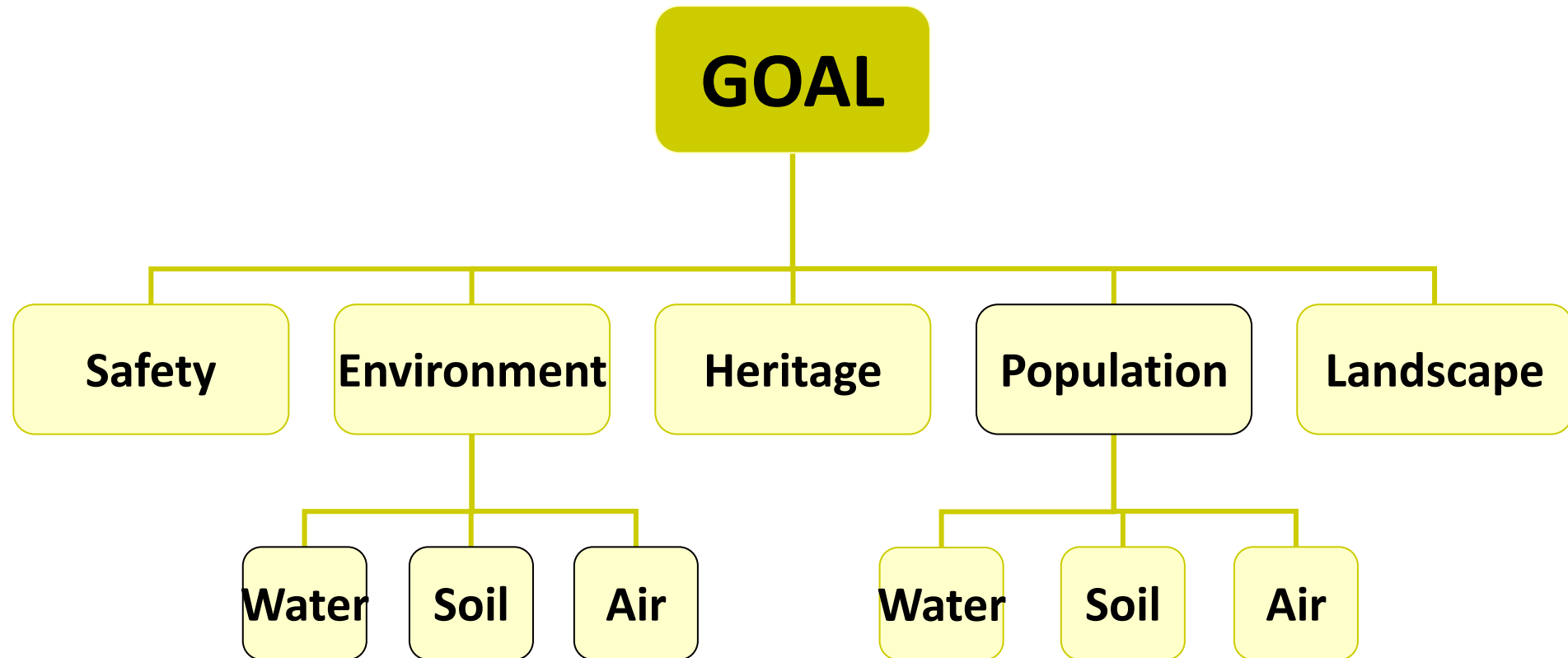
SCOPE: Act on “Orphan”/Legacy mining sites.

OBJECTIVES:

- Eliminate the **risk factors** for public health and safety, resulting from water pollution, soil contamination, mining waste and any unprotected areas;
- **Rehabilitate the surrounding** landscape and natural conditions of development in accordance with the previous Habitat;
- Ensure the **preservation of significant heritage** of old mines, both economic and archaeological and the valorization of archaeological remains related to mining activity;
- Provide conditions for **future use of reclaimed areas** such as agricultural or forestry use, tourism and cultural promotion, or another that promotes the community development.

Portuguese approach: Characterization and Hierarchy study

- **From 2001-2005:** Characterization and Hierarchy Study (decomposing, weighing, evaluating)



Portuguese approach: New royalties policy

- On 2007: DGEG starts to increase sustainability on royalties use.

Royalties started being used to finance governance of mining activity and social responsibility.

Until 2007:

Royalties were used to finance budget of geological resources public entities. At the end of each year the remaining amount went to the Government budget.

Since 2007:

Royalties started to be use not only to to finance budget of geological resources public entities but also to support the rehabilitation of abandoned mining sites.

- **50% of royalties received by DGEG**  **EDM**

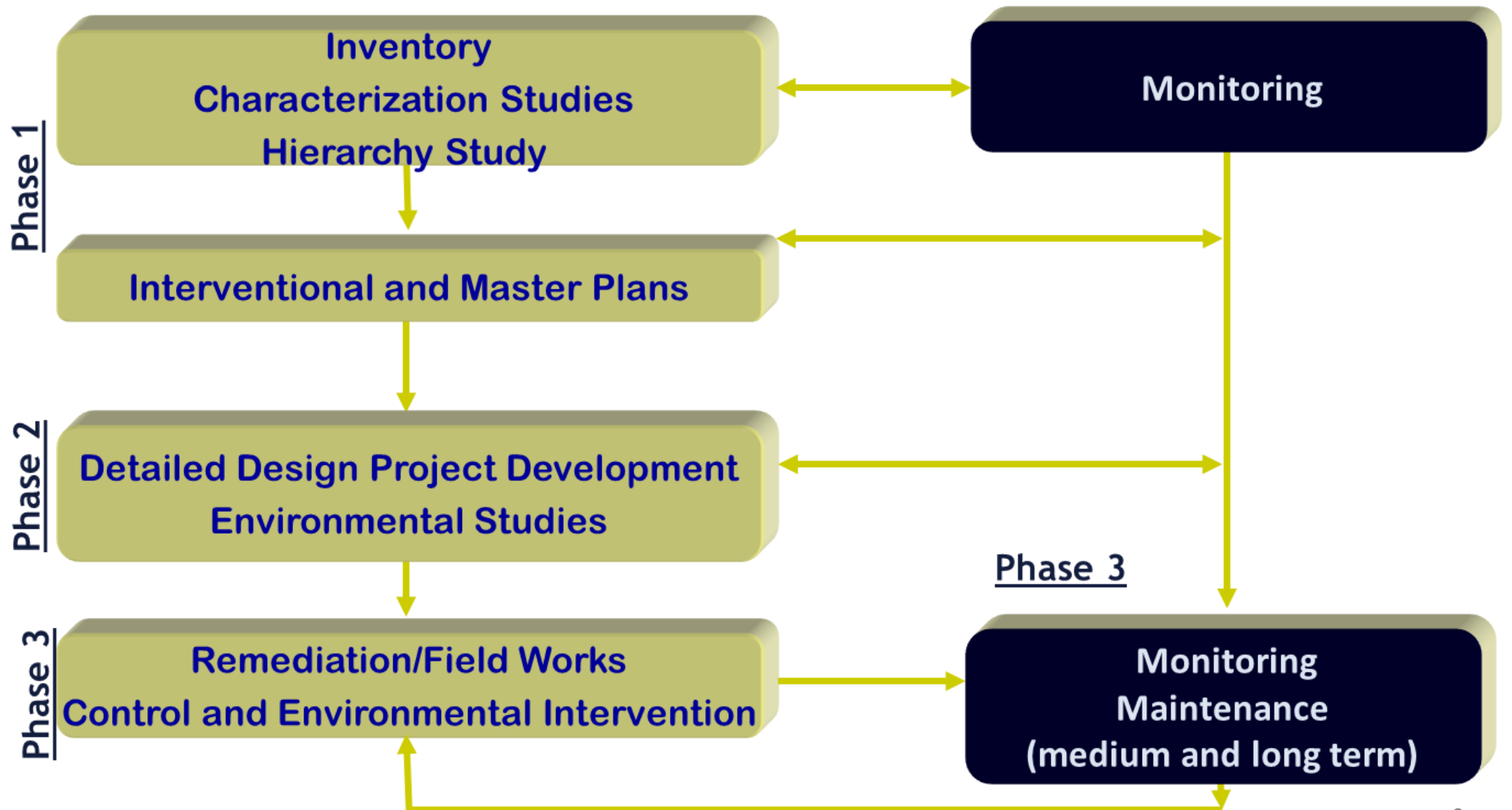
Portuguese approach

DGEG is increasing corporate social responsibility by encouraging actions to support local communities such as:

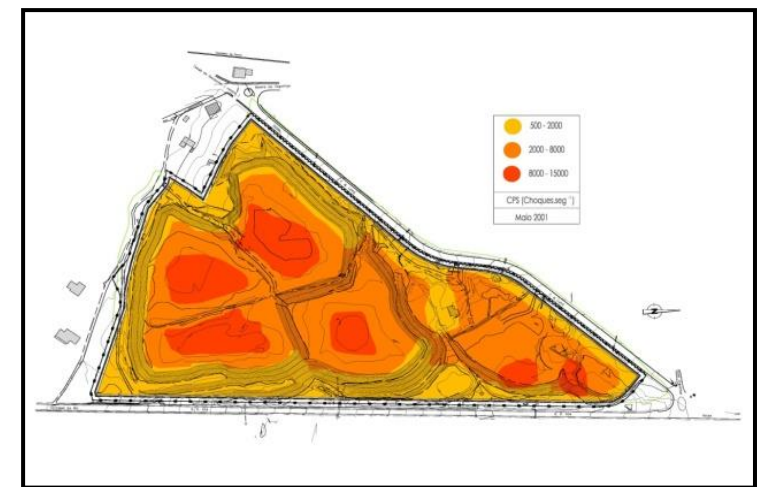
- Social programs
- Environmental programs
- Valuing and promoting mining heritage

Portuguese mines have payed since 2007 more than 50M€ (royalties revenues), and 25M€ have already been applied on environmental rehabilitation of abandoned mining sites.

Portuguese developed strategy



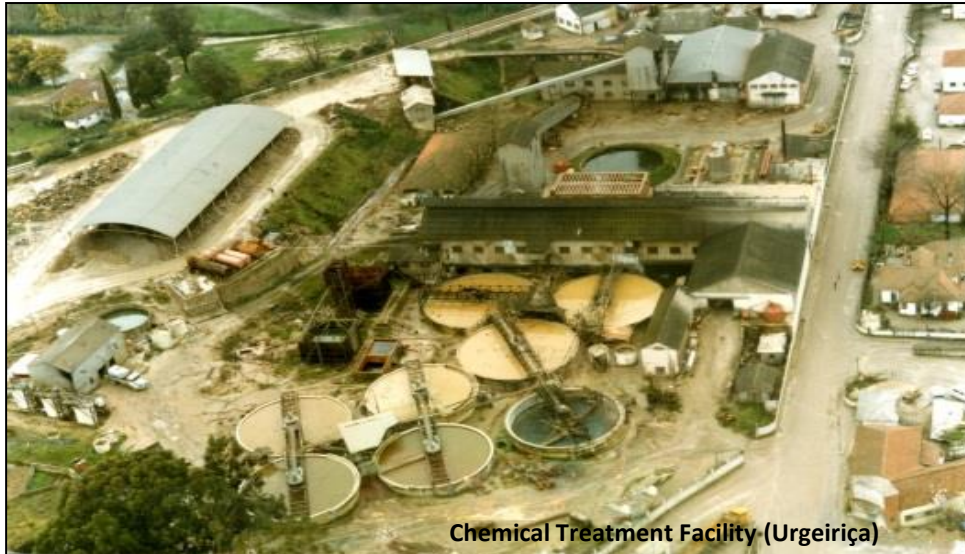
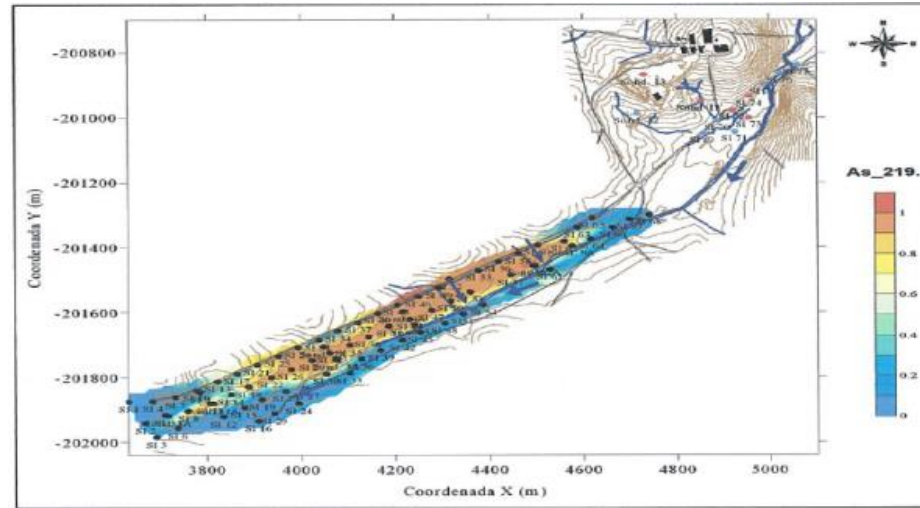
Mining Wastes



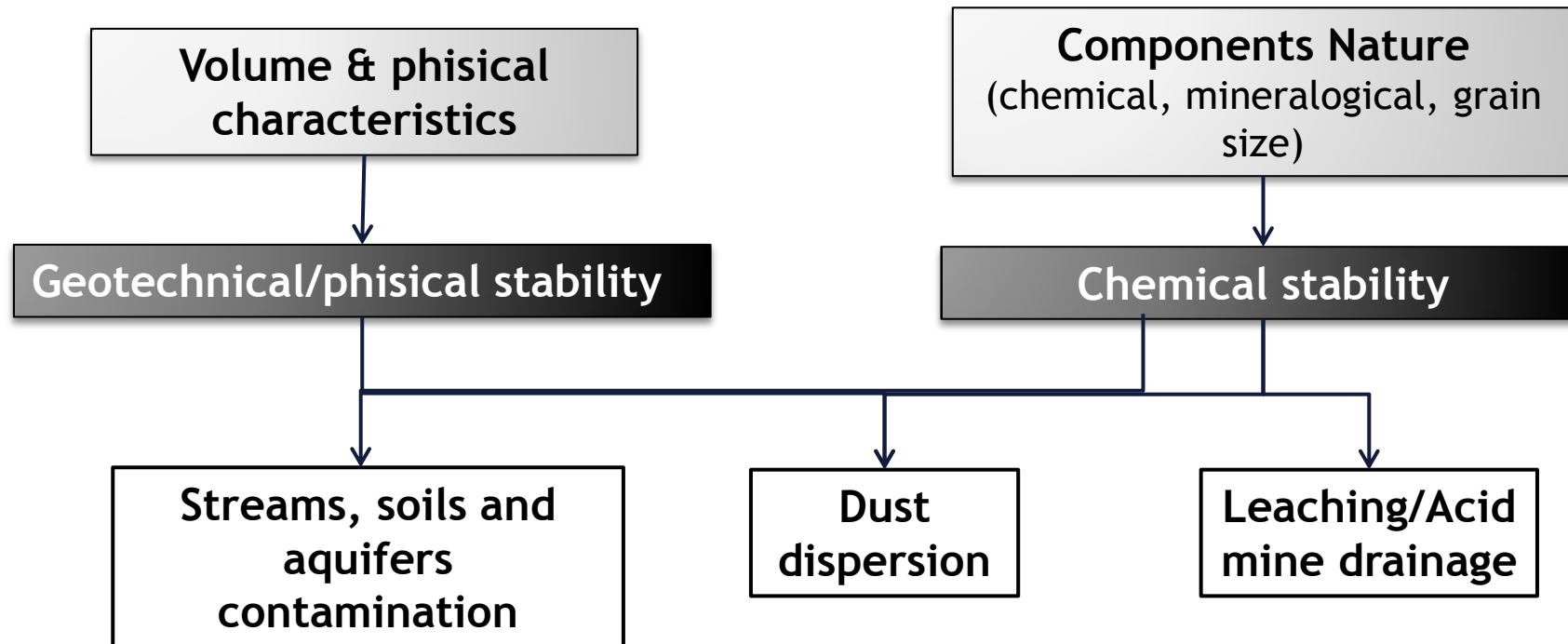
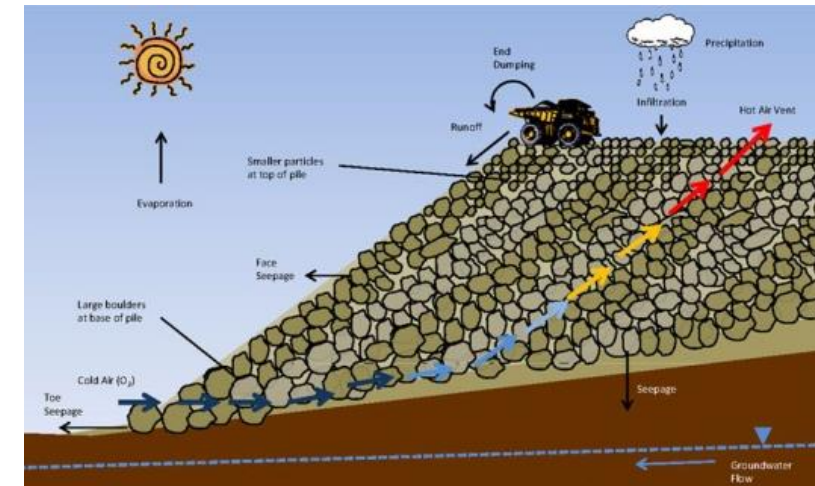
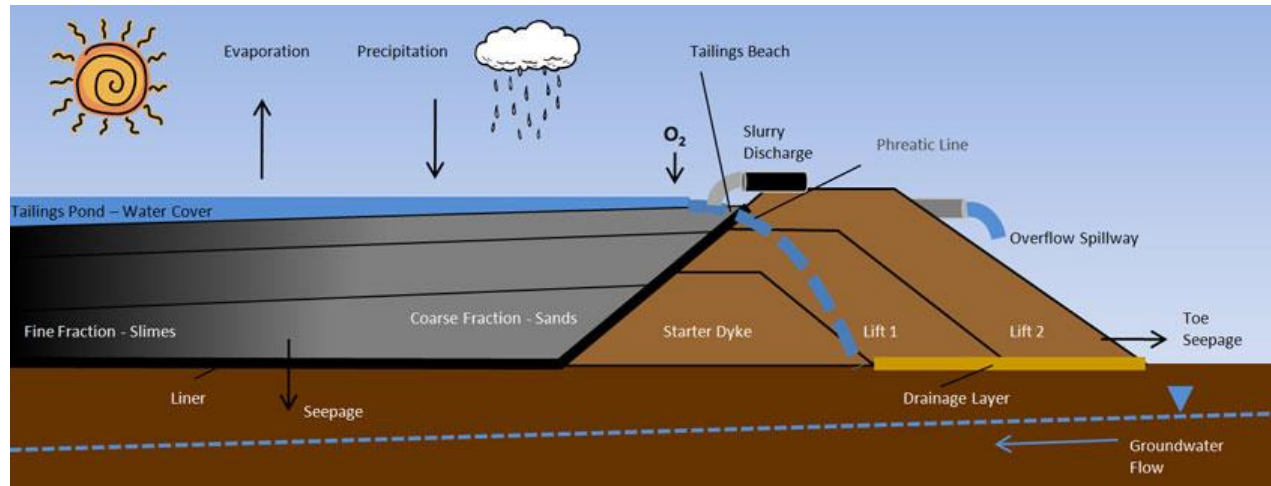
Acid Mine drainage (Mine Water)



Safety risks, soil contamination, cultural heritage impacts...

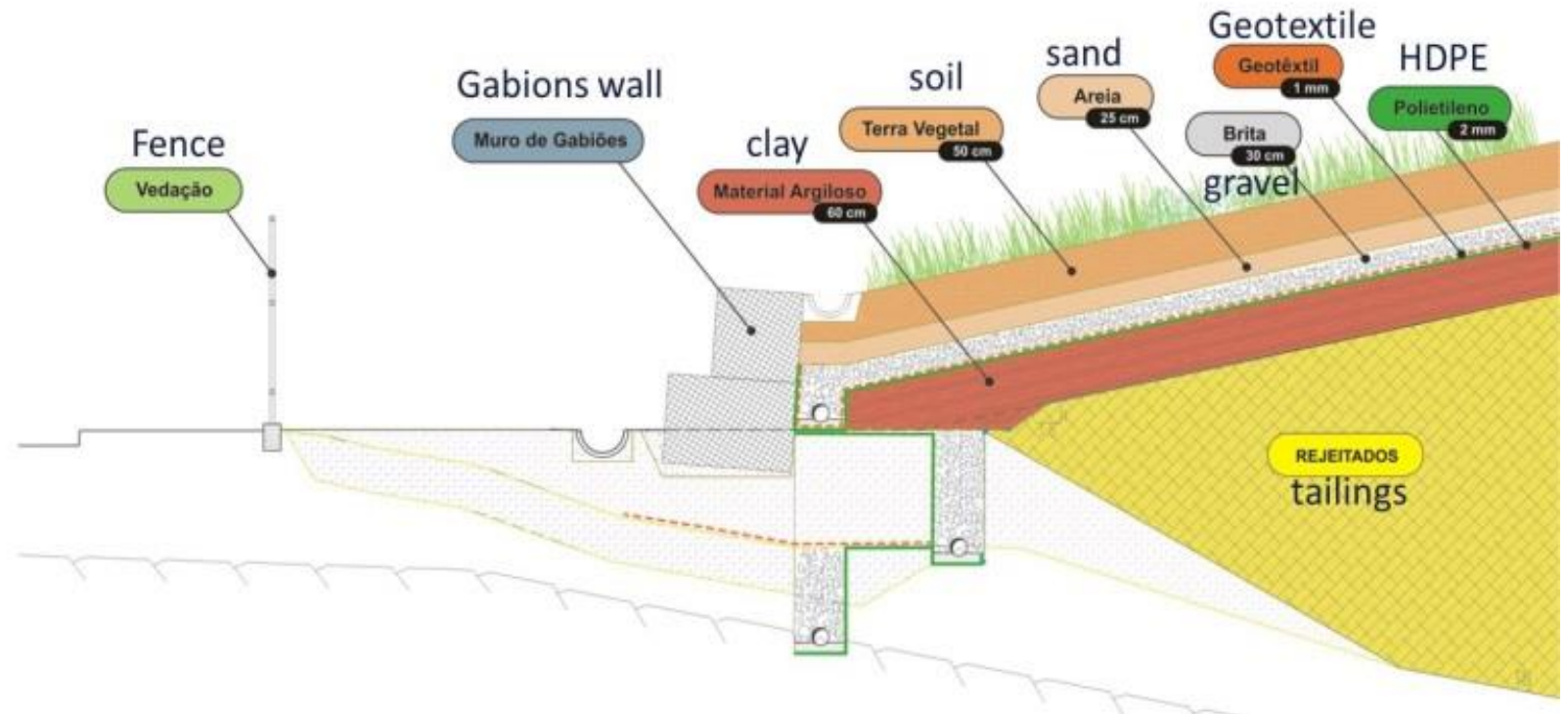


Environmental approach for mining waste



Environmental approach for radioactive mining waste

- Multilayer cover system for radioactive mining waste
 - Tailings
 - 0,60 m clay ($k= 10^{-9} \text{ cm.s}^{-1}$)
 - HDPE Liner 2 mm
 - 0,30 m gravel
 - 0,25 m sand
 - 0,25 m sand
 - 0,50 m soil
 - vegetation
 - (Geotextile)

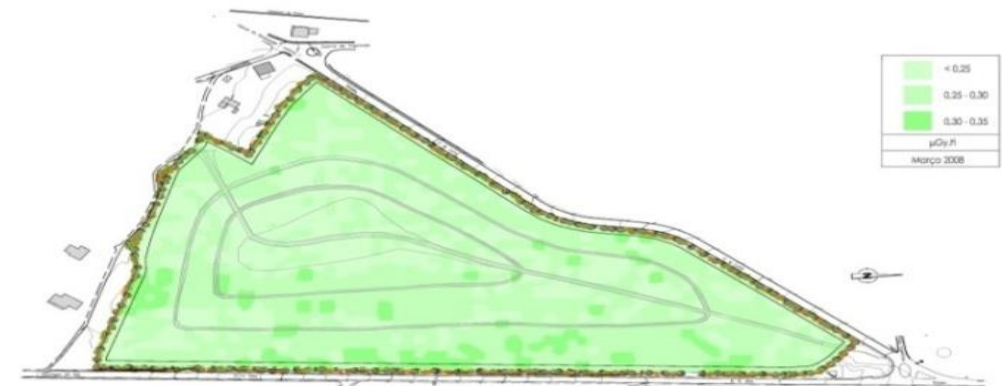
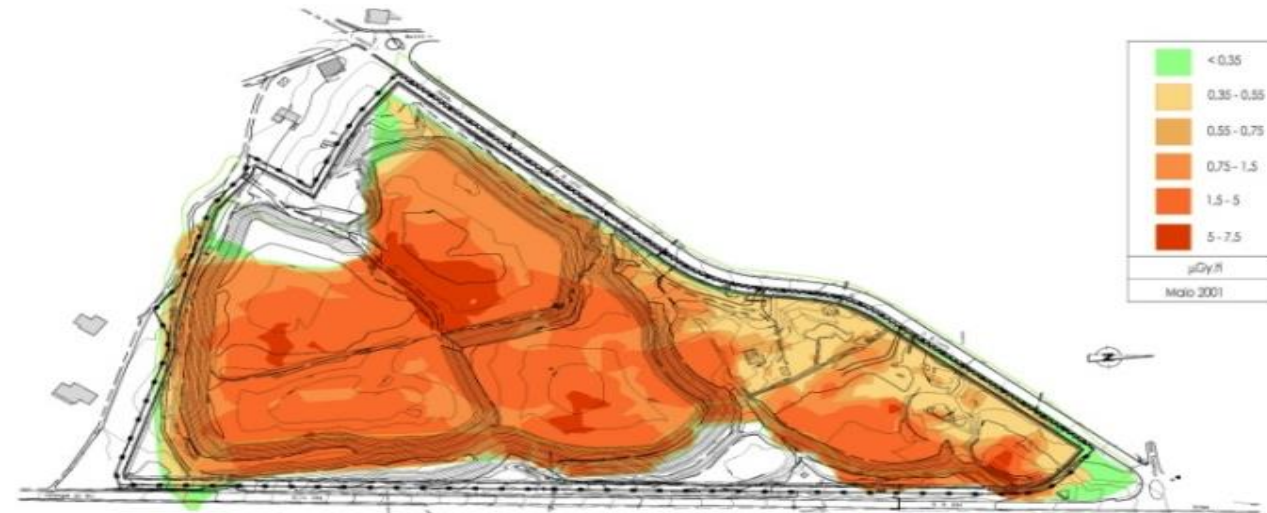


Environmental approach for radioactive mining waste

- Results “Old tailings dam” Urgeiriça mining area:
 - Superficial radiometry (Cintilometry, SPP2)
 - Initial: **15.000 c.p.s.** (máx.)
 - External radiation
 - Initial: **7,5 $\mu\text{Gy/h}$** (máx.)

After works: **300 c.p.s.** (máx.)

After works: **0,35 $\mu\text{Gy/h}$** (máx.)



Results...

- 95 mining areas intervened until 2015 → 89 M€ investment between 2001-2015
- 9 mining areas with ongoing remediation works → 26,6 M€ ongoing investment 2016-2019
- 51 planned interventions in remaining mining areas until 2022 → 87 M€ of planned investment 2016-2022

Mining Areas	Inventory	Concluded	Ongoing	Planned	With restraints *
		2001-2015	2016-2019	2020-2022	
Radioactive	61	34 52,6 M€	8 20 M€	19	0
Polymethalic Sulphides	114	61 36 M€	1 6,6 M€	32	20
Total	175	95 88,6 M€	9 26,6 M€	51 60 M€	20
		155			
		175			

(*) Prospection areas (16), Protected Areas (1), Quarry license(1) and Archaeological Areas(2).

Main funding sources ...

→ Cohesion Funds



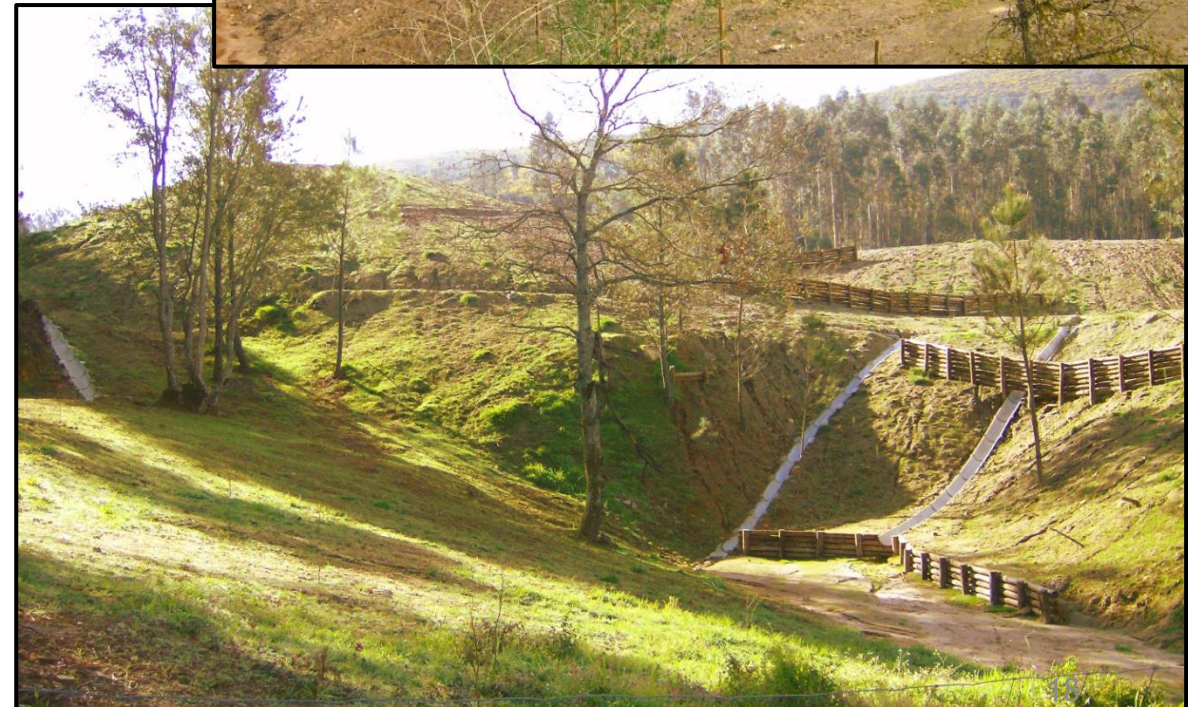
→ Royalties from Portuguese mining companies



→ EDM revenue



Rehabilitation works: Covas Mine (Sn, W): 0,6M€ on 2007



Photos: EDM

Rehabilitation works: Fonte Santa Mine (W): 0,5M€ on 2007



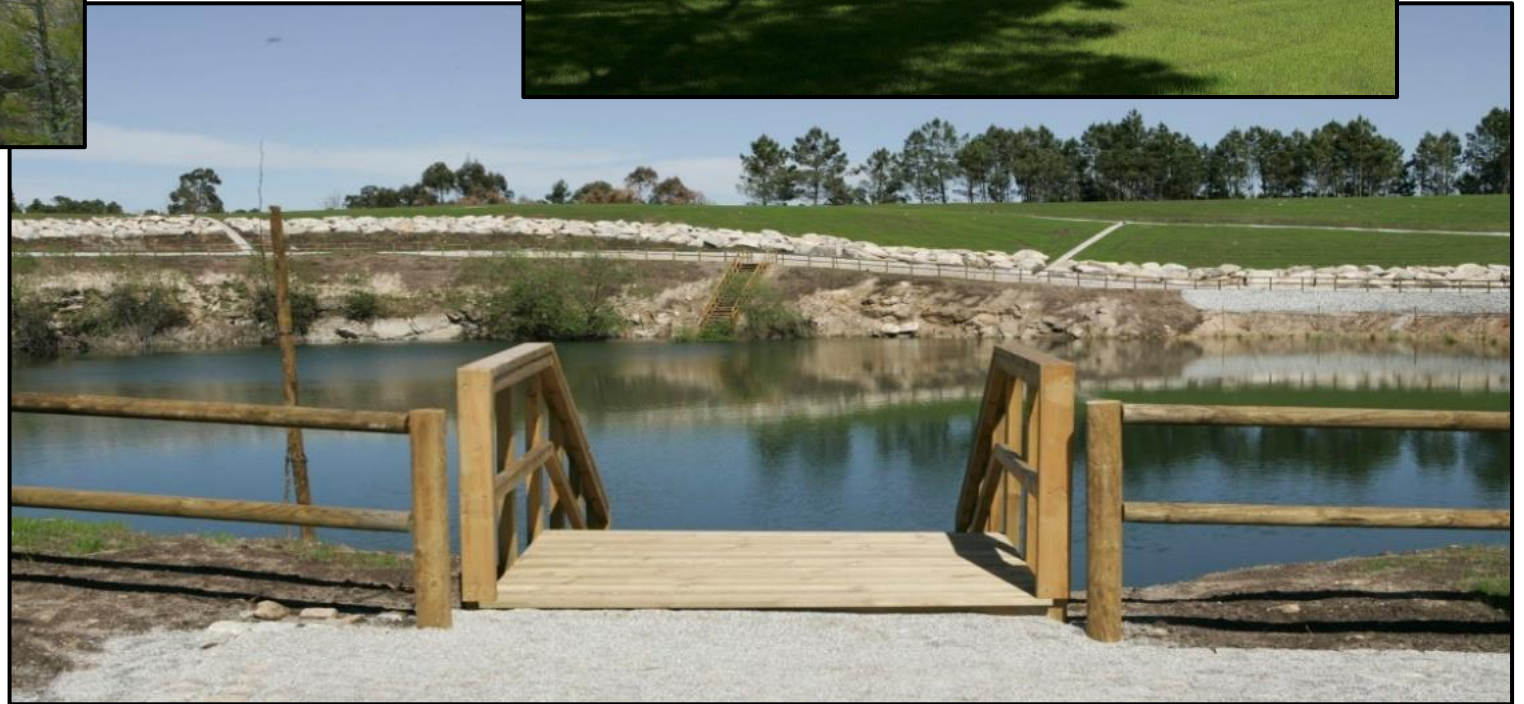
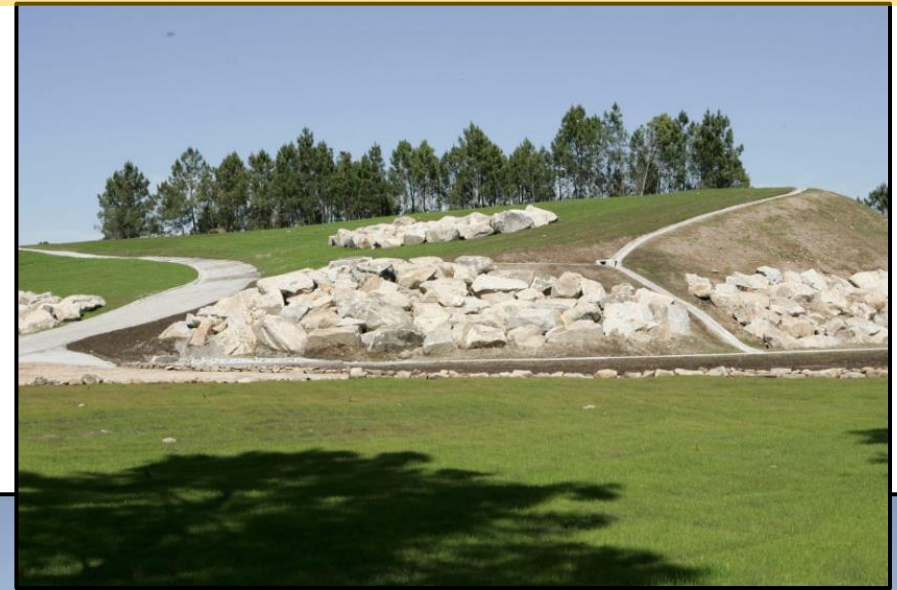
Photos: EDM

Rehabilitation works: Terramonte Mine (Pb, Zn): 1,2M€ on 2007-2008



Photos: EDM

Rehabilitation works: Espinho Mine (U): 0,35M€ on 2010-2011



Rehabilitation works: Lousal Mine (Cu, S, Au, Ag): 4,8M€ on 2010-2011



Rehabilitation work: Old dam Urgeiriça Mine (U): 7,8M€ on 2005-2008



Photos: EDM

On going rehabilitation work: São Domingos Mine (polimetallic sulphides)

Estimated 2,8 M€ on 2016-2017



Photos: EDM

Conclusion

- Portugal is committed to correct environmental liabilities and impacts of centuries of mining activity (passive until 1990). Since 1990 every mining company is responsible to ensure the environmental rehabilitation.
- The Government defined a policy and created conditions for the execution of an Environmental Remediation of Old Mining Areas Plan.
- There are strong improvements in safety issues, soil, water and air quality, mining heritage preservation and reclamation of these degraded areas for further uses.
- Challenges for the future: Mining wastes should be seen as potential secondary sources of mineral resources.

Thank you for your attention



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