

SAPOTEC

Soluções Ambientais LTDA.

Part of Zech Group

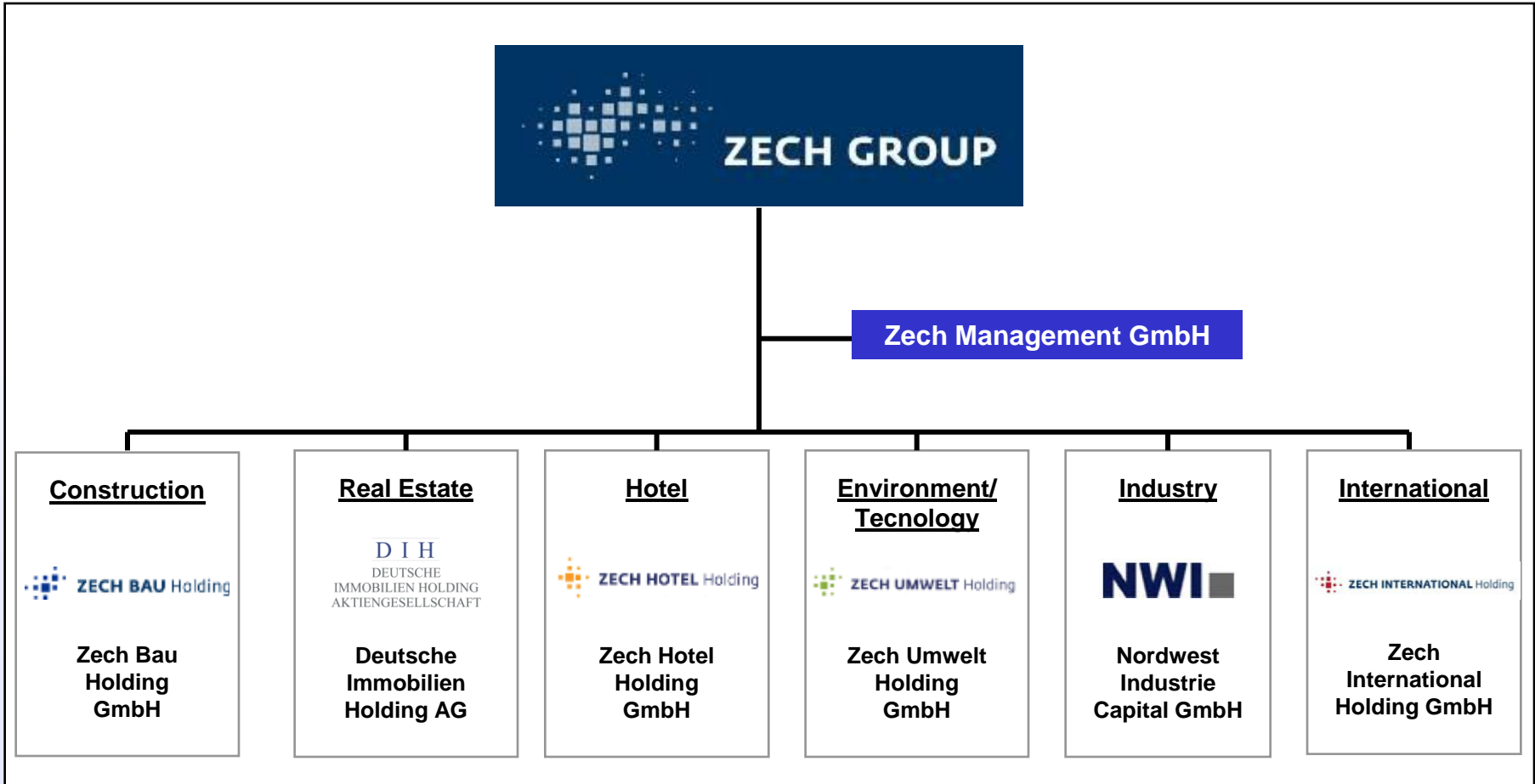


Bioremediation in Brazil - Technology Transfer

Overview

- Zech Group - Sapotec Ltda.
- Concept of Bioremediation
- Market for Bioremediation in Germany
- Market for Bioremediation in Brazil
- Technology Transfer
- Case Study
- Conclusion

SAPOTEC - A Zech Group Company



Field of Action: ZECH Umwelt

Soil



Water



Air



Services:

- Remediation technologies
- Revitalization of degraded areas
- Waste water treatment technologies
- Reduction of gas emissions
- Mobile und stationary treatment facilities
- Waste management

SAPOTEC LTDA.

- 2000: Foundation of Sapotec in Brazil;
- 2002: Inauguration of the first bioremediation plant in Paulínia - São Paulo;
- 2006: Inauguration of the second bioremediation plant in Nova St. Rita - Rio Grande do Sul;
- 2009: Operating in all Federal States of Brazil, with a focus on the South and Southeast of Brazil (SC/PR/SP/MG/RIO);
- Fields of action: Soil and waste treatment, environmental engineering services.

Concept of Bioremediation

Contaminated soil/waste + Microorganisms  **CO₂ + H₂O + Biomass**



**Reduction of
pollutant concentration**

Restrictions of Bioremediation

**Achievement of a
high degradation**



**Increase of the
microbial population**



- Type of microorganism (bacteria, fungi, yeasts)**
- O₂, pH-value, temperature, humidity**
- Nutrients (N₂, K, P)**
- Contamination (concentration and toxicity)**

Treatable Contaminants with Bioremediation

Contaminants	Not applicable	In parts	Applicable	Unkown
Hydrocarbons/ Mineral oil products			X	
Polychlorinated aromatic hydrocarbons (PAC)			X	
Volatile chlorinated hydrocarbons		X		
Aromatic hydrocarbons (BTEX)			X	
Polychlorinated biphenyles (PCB)		X		
Other organic halogen compounds		X		
Cyanates (also with complex compounds)		X		
Organic nitrogen compounds		X		
Agrarian pollutants/pesticides		X		
Heavy metals	X			
Dioxines and furanes	X			

Flow diagram TERRAFERM® process

Biological test and optimization



Delivery of soil at the plant

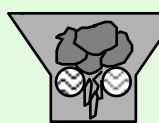


Separation

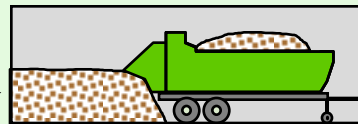
Residuals etc. ...

Material appropriate for treatment

Comminution



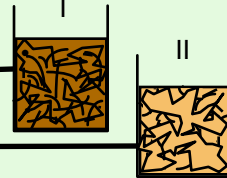
Homogenization



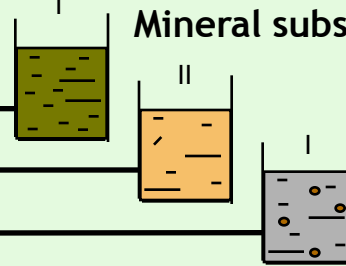
Landfill

Structured materials

Substrates



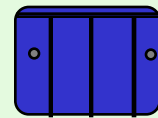
Mineral substances



Quality control



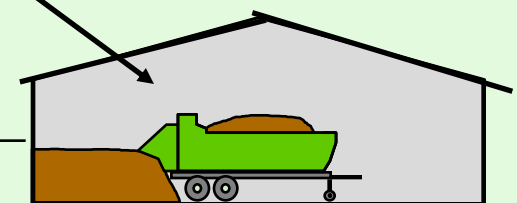
Air purification



Recycling



Treated soil



Biological treatment on-site/off-site

Landfill

Soil Treatment *Off-site*

Steps of Treatment



Soil Treatment *On-site*



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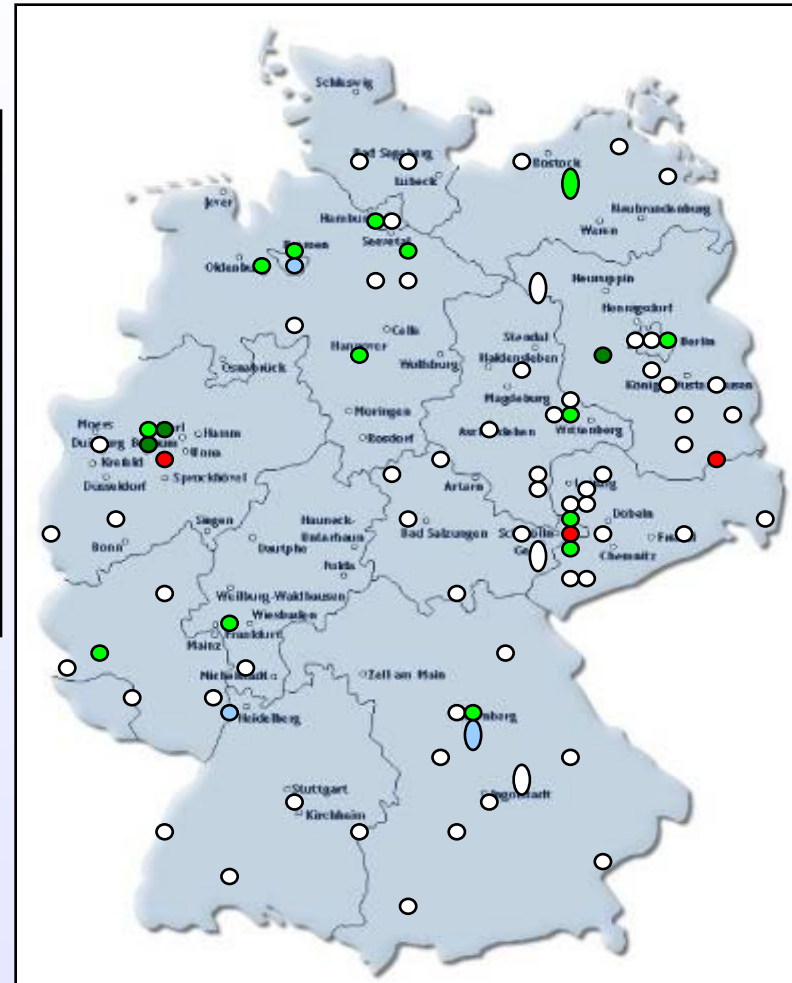
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Bioremediation in Brazil

Ecogerma 2009
São Paulo

The Market in Germany

93 plants for bioremediation *off-site* with:

- Capacity > 6.5 Mio. ton per year (2007);
- 76% capacity utilization.



Waste Treatment in Germany

Example: Bioremediation plant in Ganderkesee (of ZECH Umwelt)

Waste Code ¹	Waste type
13 05 01*	Solid waste from sand traps and oil-/water separators
13 05 08*	Waste mixtures from sand traps and oil-/water separators
17 05 03*	Soil and stones containing hazardous materials
17 05 04	Soil and stones except of those under 17 05 03
17 05 05*	Dredged material containing hazardous materials
17 05 07*	Track ballast containing hazardous materials
17 05 08	Track ballast except those under 17 05 07
19 12 09	Minerals (e.g. sand, stones)
19 13 01*	Solid waste from soil remediation containing hazardous materials
19 13 02	Solid waste from soil remediation except those under 19 13 01
19 13 03*	Sludges from soil remediation containing hazardous materials
19 13 05*	Sludges from ground water remediation containing hazardous materials
20 03 03	Street cleaning waste
20 03 06	Waste from sewer cleaning

*Hazardous waste

¹European Waste Catalogue

Final Disposal of Treated Soil Material in Germany

- Return transport of treated soil to place of origin;
- Cover layer for landfills;
- Selling of treated soil for horticultures and anti-noise-barriers;
- Recultivation of degraded areas.



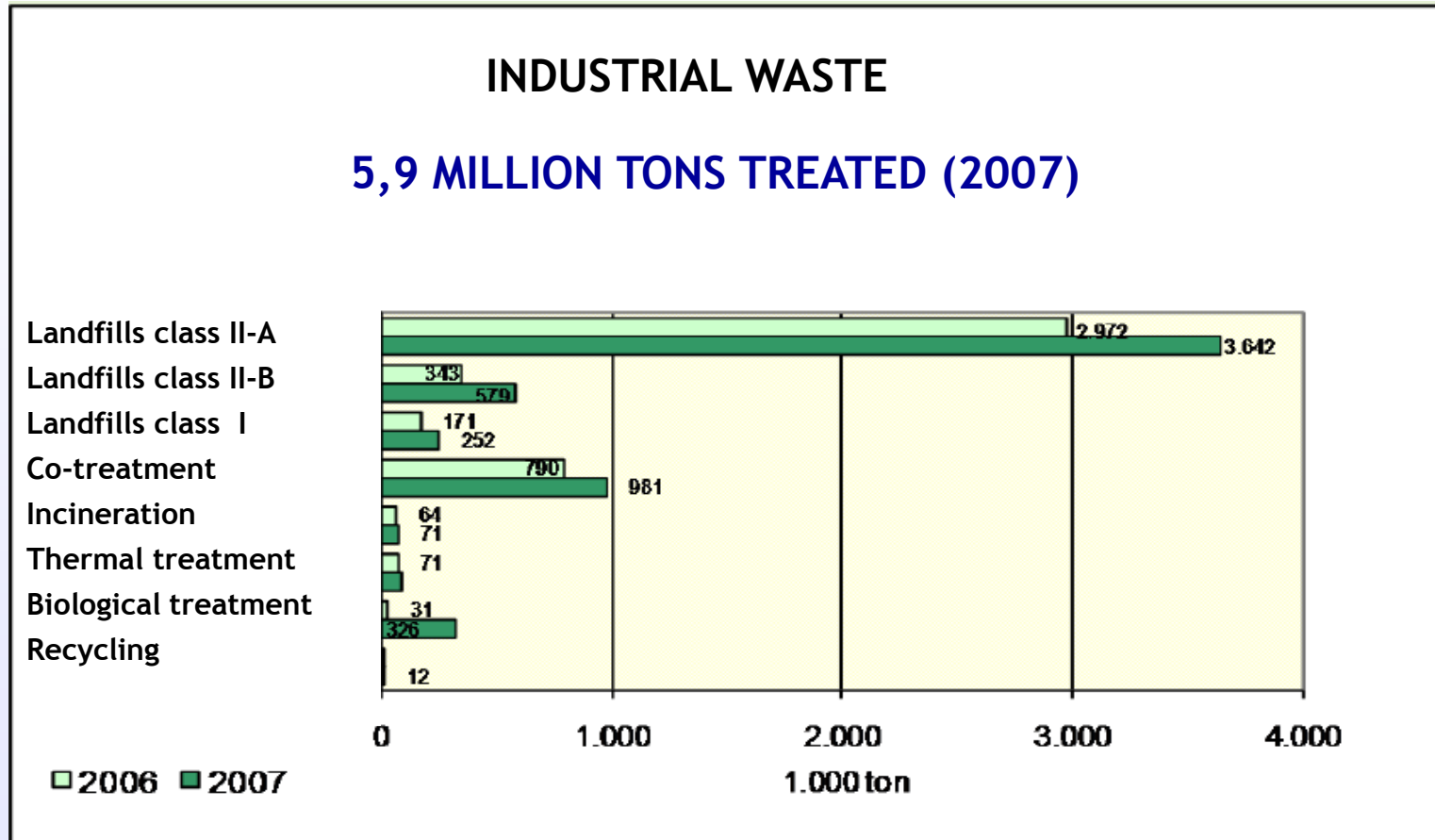
Bioremediation in BRAZIL

General Information:

- Until the year 2000 there were no registered remediation plans for *ex situ*-technologies in Brazil
- First soil remediation project of the Sapotec:
 - *REPLAN*: 2002/03



Bioremediation in BRAZIL



Source: ABETRE (Ass.Bras.de Empresas de Tratamento de Resíduos)

Final Disposal of Treated Soil

- ❑ Return transport of treated soil material to place of origin;
- ❑ Transfer to landfills class II.



TECHNOLOGY TRANSFER

- Technology adaption to climatic conditions;
- Problems with licensing;
- Lack of legal and technical regulations (no classification into emplacement classes as Z0 to Z2 of the technical rule TR Boden);
- Problems with the importation of equipment.

Case Study

History:

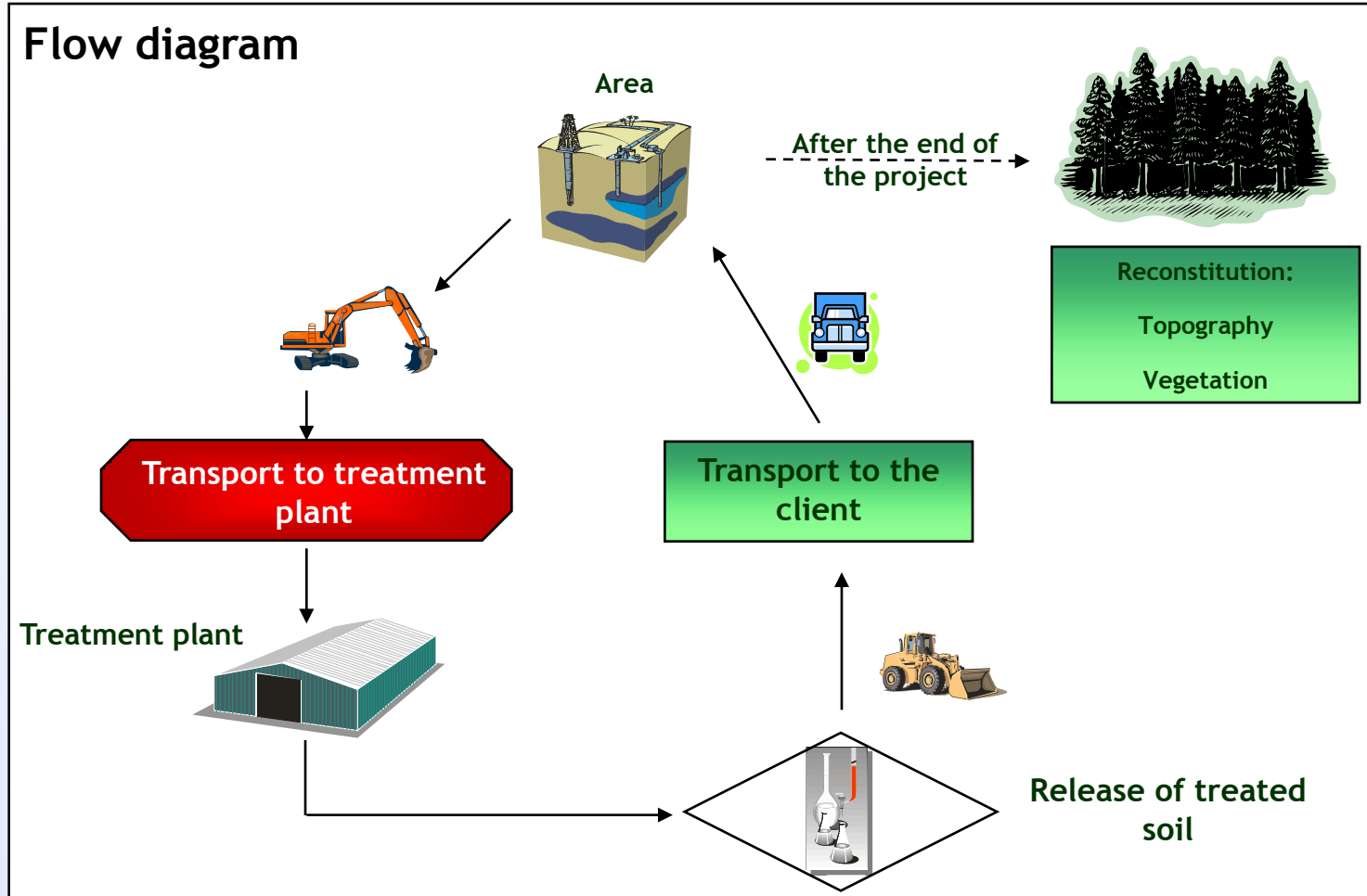
Soil utilization over a time period of about 18 years (1970/80) as unsecured landfills for:

- Solid waste and liquid, oleaginous sludges;
- Construction waste;
- Insetted landfill layers (soil).

Total volume is estimated to be of approx. 30.000 tons of contaminated soil with mineral oil hydrocarbons.

Area utilization was stopped about 20 years ago leaving the substances exposed to natural mechanisms.

Case Study



After Removal of Vegetation



Topographic Investigation



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Surface Excavation



Separation of Oil Sludges



Monitoring of Gas Emissions



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Sampling



Loading of Materials and Transport to Treatment Plant



Return of Treated Soil onto the Before Excavated Surface



Conclusion

- Bioremediation is a technology with a high application potential in Brazil.
- Bioremediation is a technology sparsely utilized when compared to Germany.
- Legislation/Standardization for this area should be enhanced.



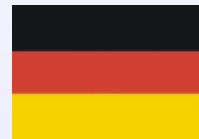
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