



Overview of mercury stabilisation processes

13 October 2009

- Current status -

BiPRO

Beratungsgesellschaft für integrierte Problemlösungen



Background

Regulation (EC) N° 1102/2008

bans of exports of metallic mercury and certain mercury compounds and mixtures from 15 March 2011

+

metallic mercury from certain applications (e.g. Chlor-alkali-plants) has to be considered as waste from 15 March 2011

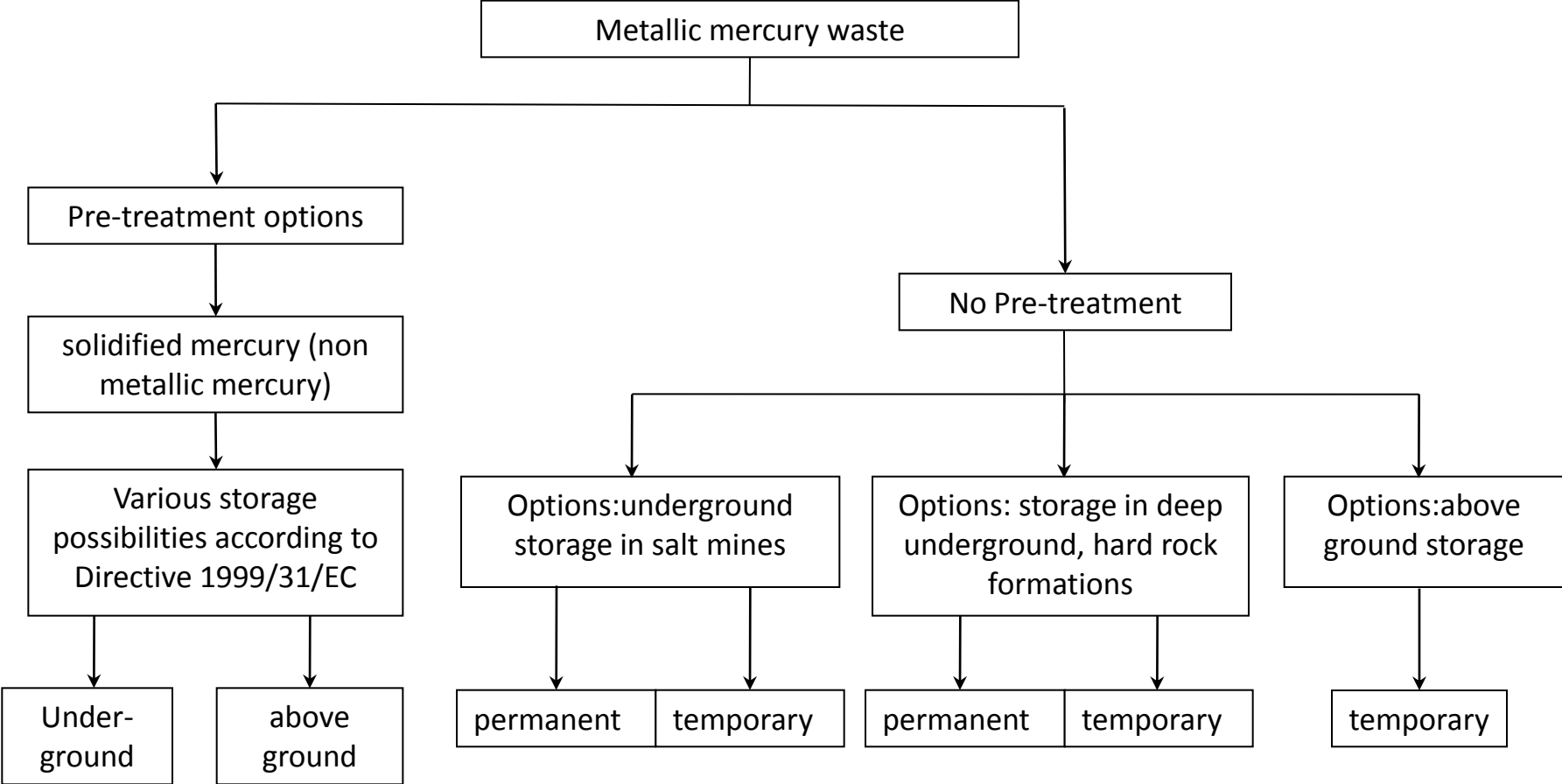
considerable amounts of surplus mercury, which should be prevented from re-entering the market

Safe storage within the Community has to be ensured

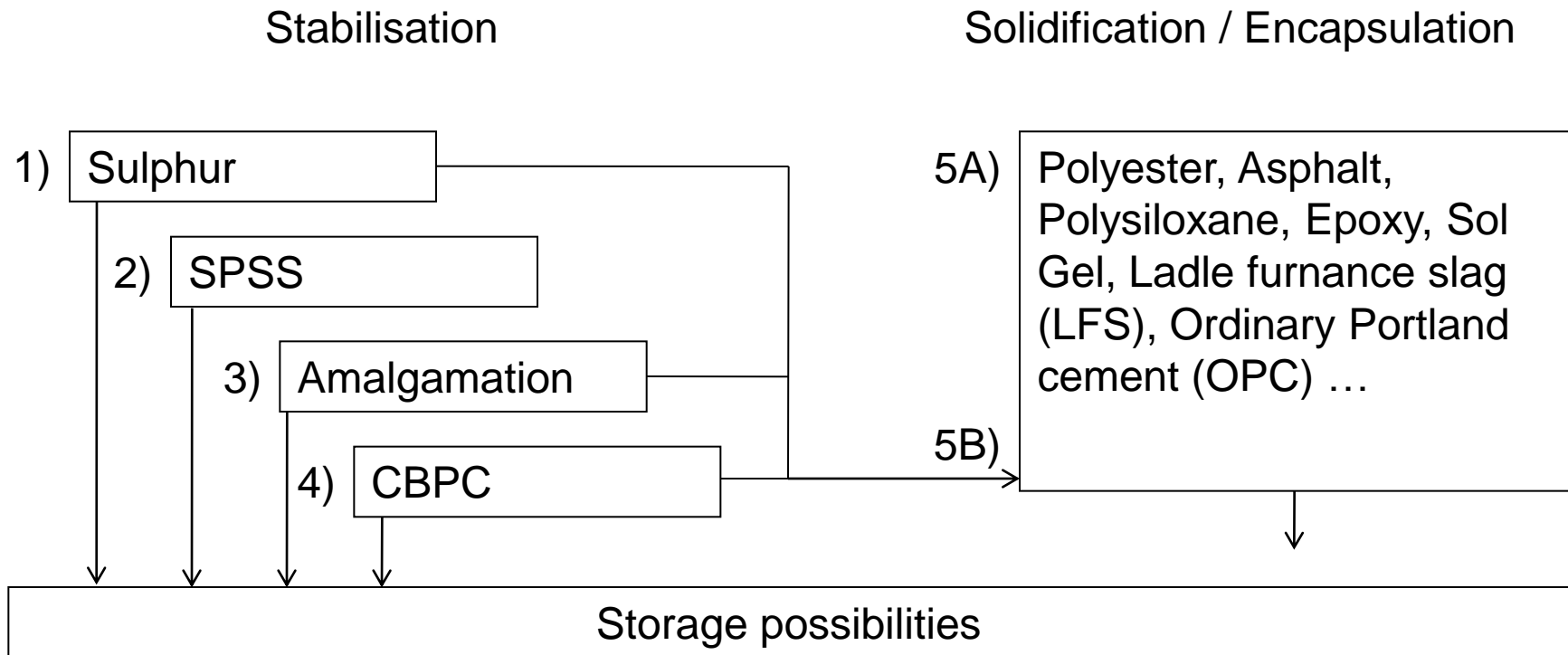
→ Project launched by the EU COM DG Env to identify solutions in compliance with Regulation (EC) N° 1102/2008



Overview of possible options



Overview on immobilization techniques of elemental mercury



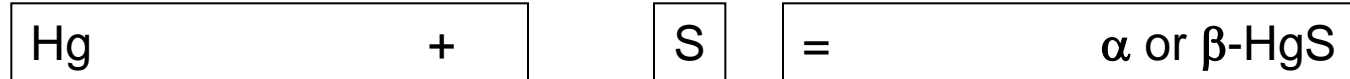
SPSS: Sulphur Polymer Stabilisation/Solidification

CBPC: Chemical Bonded Phosphate Ceramic

1) Sulphur Stabilisation / 2) SPSS

1) Sulphur Stabilisation

1 part mercury + 0.16 part Sulphur → 1.16 part HgS



Liquid mercury + solid sulphur → solid powder
 +blending crystals

Pilot plant + large scale planning

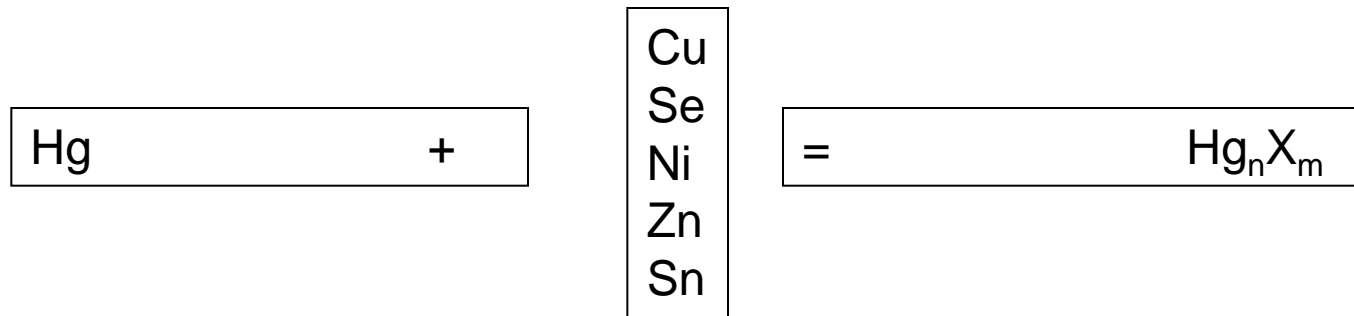
2) SPSS Stabilisation

The same process as in 1) Sulphur Stabilisation, but with additives
 e.g. < 5 % sulphur polymer cement (SPC) a monolithic products can be
 obtained => SPSS

Commercially available

3) Amalgamation

1 part mercury + ~ 3 part metal → 4 part Amalgam



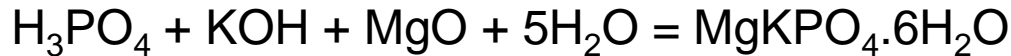
Liquid mercury + solid fine powder → solid Amalgam
+blending

Commercially not available, testing ongoing

4) Chemical bonded Phosphate Ceramic CBPC

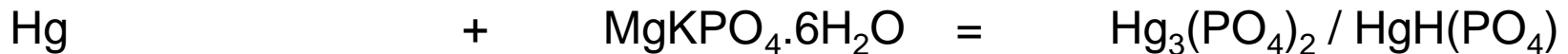
1. Step:

Example: Magnesium – Potassium – Phosphate (MKP)



Alternatives: Mg; Mg-NH₄; Mg-Na; Al; Zr –Phosphate (hazardous metal waste)

2. Step:



Liquid mercury + liquid phosphate solution → solid phosphate ceramic

The product can be stabilised by adding Na₂S, NaHS and K₂S into the process

Commercially not available, testing ongoing

5A) / 5B) Encapsulation techniques

5A) Encapsulation without pre-treatment stabilisation

Encapsulation of elemental mercury in: Ordinary Portland cement (OPC)

Commercially not available

Encapsulation of mercury containing waste in: Polyester, Asphalt, Polysiloxane, Sol-Gel, Dolocrete™, Epoxy, Ladle furnace slag (LFS),
The matrix can also have a stabilisation effect (e.g. LFS)

5B) Encapsulation with pre-treatment stabilisation

Encapsulation of β - HgS in: concrete to

- reduce the surface (lower leaching values) and
- increase physical stability and bearing capacity

Commercially not yet available but expected soon

Assessment of pre-treatment options I

Immobilisation Techniques					
Process		Technical aspects	Environmental aspects	Economic aspects	Additional comments
Encapsulation techniques	Poly-ethylene	Low	(Low)	(Medium)	Stabilisation needed
	Asphalt		(Low)	(Medium)	
	Polyester / Epoxy resin		(Low)	(Medium)	
	Synthetic Elastomers		(Low)	(Medium)	
	Poly-siloxane		(Low)	(Medium)	
	Sol Gel		(Low)	(Medium)	
	Dolocrete TM		(Low)	(Medium)	
	CaCO ₃ -MgO		(Low)	(Medium)	
	Ladle furnace slag		(Low)	(Medium)	
	Cement		(Low)	(Medium)	

↑
excluded

Assessment of pre-treatment options II

Immobilisation Techniques				
Process		Technical aspects	Environmental aspects	Economic aspects
Encapsulation of pre-treated (stabilised) mercury	Poly-ethylene	Low	(High)	(Medium)
	Asphalt		(High)	(Medium)
	Polyester / Epoxy resin		(High)	(Medium)
	Synthetic Elastomers		(High)	(Medium)
	Poly-siloxane		(High)	(Medium)
	Sol Gel		(High)	(Medium)
	Dolocrete TM		(High)	(Medium)
	CaCO ₃ -MgO		(High)	(Medium)
	Ladle furnace slag		(High)	(Medium)

↑
excluded

Assessment of pre-treatment options III

Immobilisation Techniques			
Process	Technical aspects	Environmental aspects	Economic aspects
OPC-Encapsulation	Medium	(Low)	(Low)
CBPC	Medium	(Low)	(Medium)
CBPC Na ₂ S/K ₂ S	Medium	(High)	(Medium)
Amalgamation	Medium	(Medium)	(Medium)
Amalgamation / OPC	Medium	(High)	(Medium)
Encapsulation HgS / concrete	Medium	(High)	(Medium)
SPSS	High	High	High
Sulphur stabilisation	High	High	High

Excluded

Further investigations



Thank you for your attention

Sonja Bauer

Sonja.Bauer@bipro.de

www.bipro.de

www.bipro.de/mercury/index.html