The role of slags and other by-products within circular economy in the steel industry

- Introduction to the InSGeP project
- David Algermissen

5.–6. MARCH 2025

ESTEP Focus Group Circular Economy & FEhS-Institute

ESTEP
European Steel Technology Platform

INSTITUT FÜR BAUSTOFF FORSCHUNG
FEhS

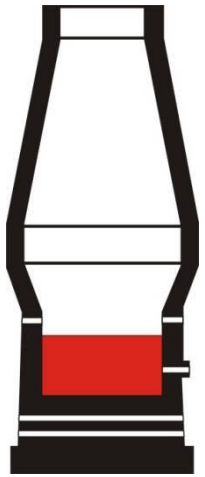
InSGeP
Investigations of Slags from Next Generation Steel Making Processes

European Commission

The research leading to these results has received funding from the European Union's Research Fund for Coal and Steel research programme under grant agreement number: 101112665

Iron and Steel Slags

Process route „Blast Furnace – BOF Converter“



Feedstocks
(Ore, Coke etc.)

Pig iron

Blast Furnace Slag

Crude Steel

BOF Slag

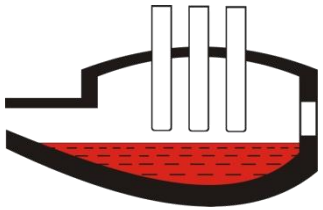
Secondary
Metallurgy

Steel

Ladle Furnace Slag

Process route „ Electric Arc Furnace“

Feedstocks
(scrap/DRI/HBI)



Crude Steel

EAF slag

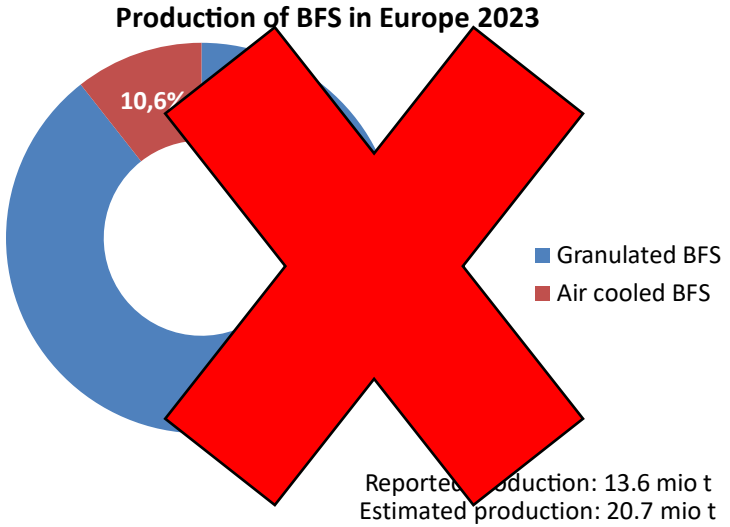
Iron and Steel Slags

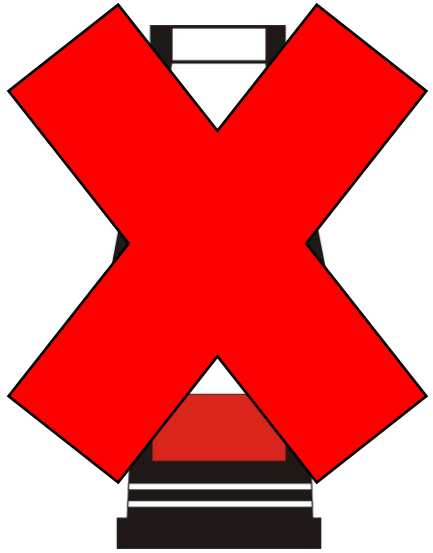
- Blast Furnace Slag
  - Granulated Blast Furnace Slag
  - Air cooled Blast Furnace Slag
- Steel Slags
  - BOF Slag
  - EAF(-C) Slag
  - Ladle Furnace Slag
  - EAF-S Slag
  - + Special Procedures

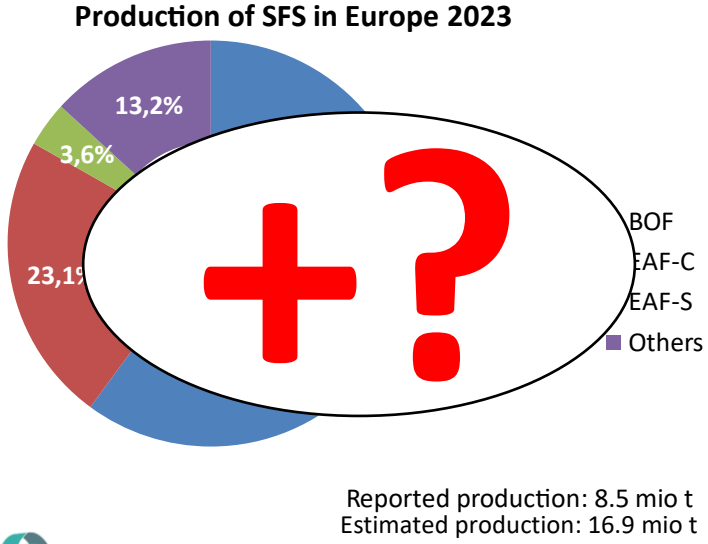
Non-ferrous Slags

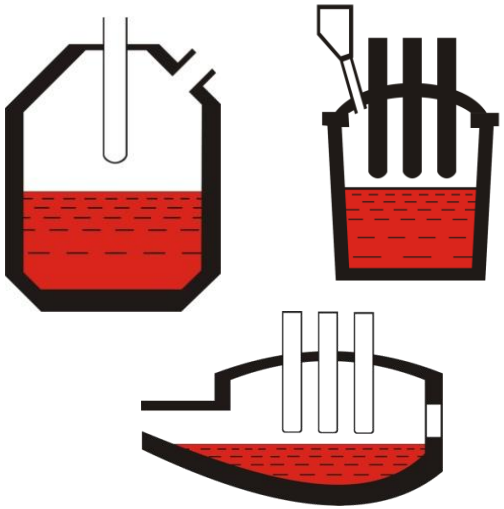
- Lead smelter Slag
- Ferrochrome Slag
- Copper Smelter Slag
- Waelz Kiln Slag
- + Other

Production and Use of Iron and Steel Slags in Europe (EU27+UK)





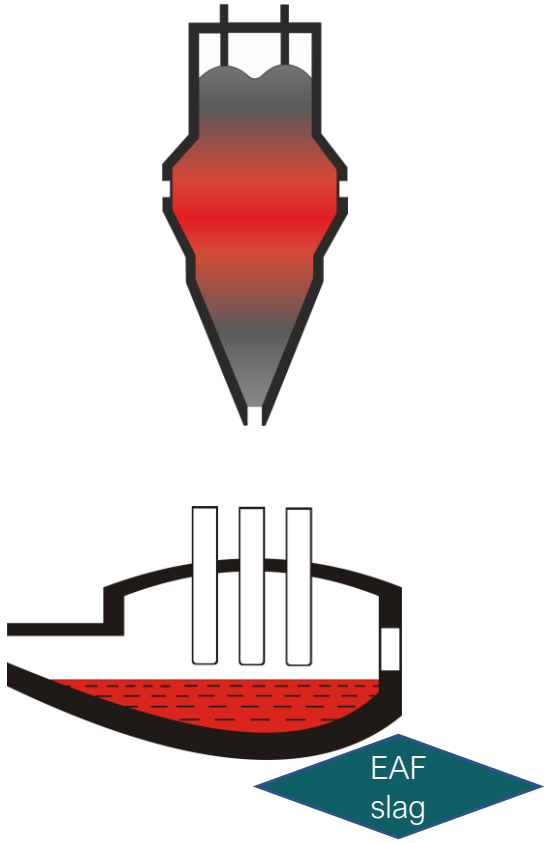




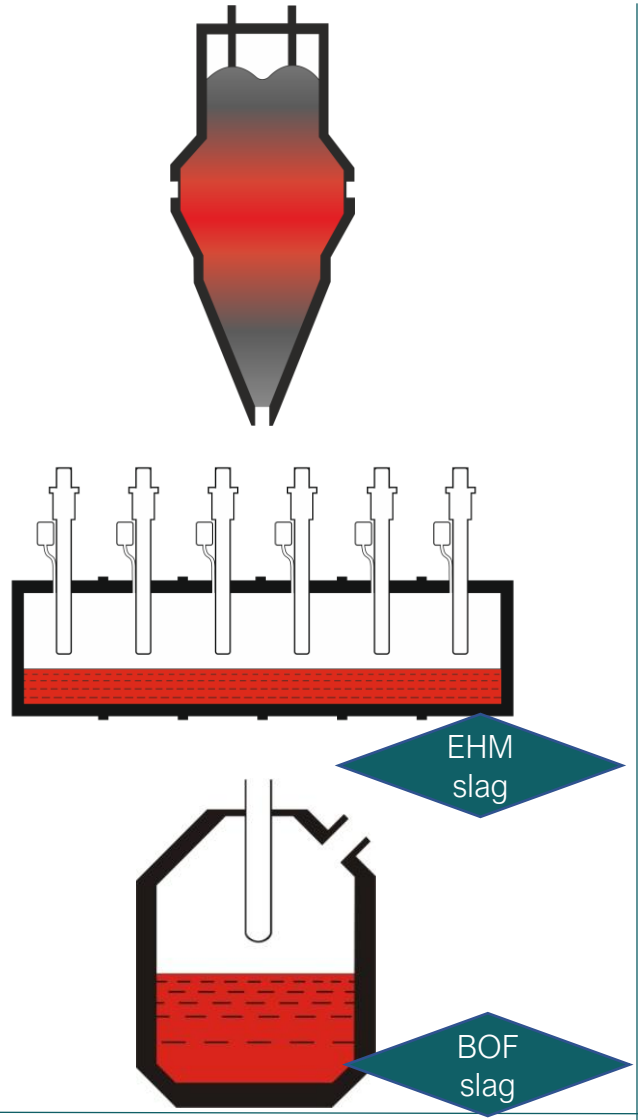
Effect on usage?

Ref.: EUROSLAG, 2024

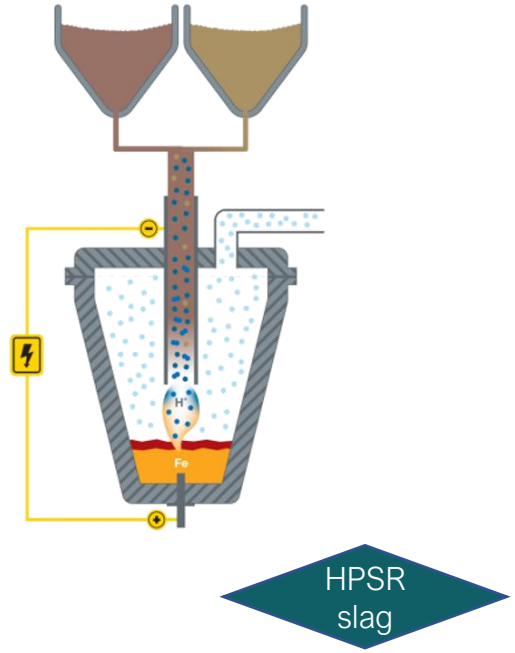
New production routes in Europe – New type of by-products



DR-EAF



DR-Smelter-BOF



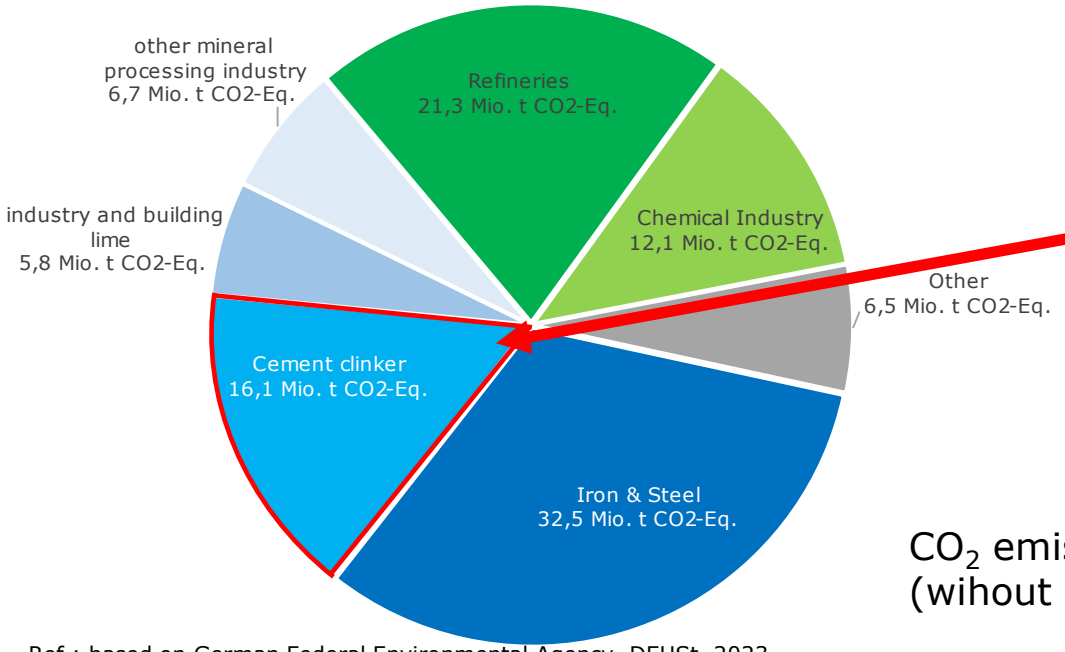
HPSR

InSGeP

Granulated Slag – A beneficary material for cement industry

Emmitting approx. 800 kg CO_2 per ton of clinker (60 % of this is due to raw materials)

Using granulated blast furnace slag decreases carbon footprint by more than 10 Mio. t/a and saves 25 Mio. t/a of natural ressources in Europe *

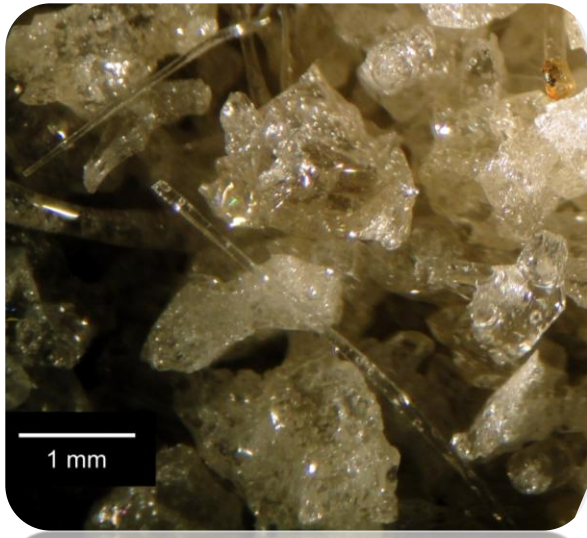


Ref.: based on German Federal Environmental Agency, DEHSt, 2023

Germany

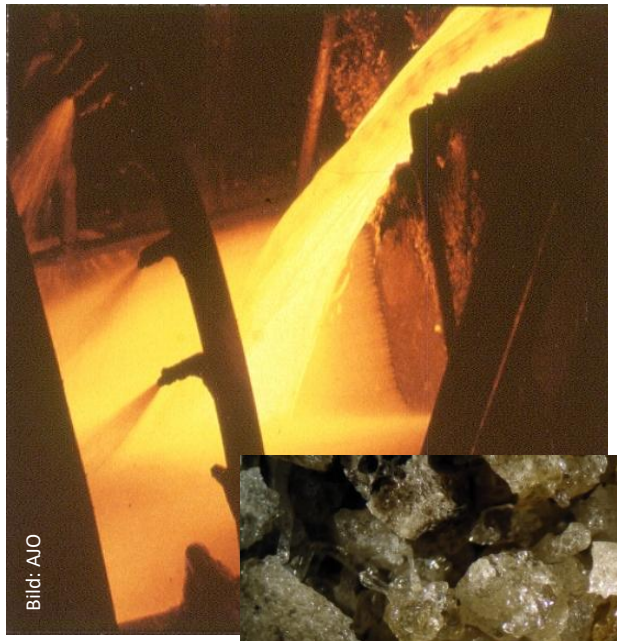
4.5 Mio. t/a CO_2

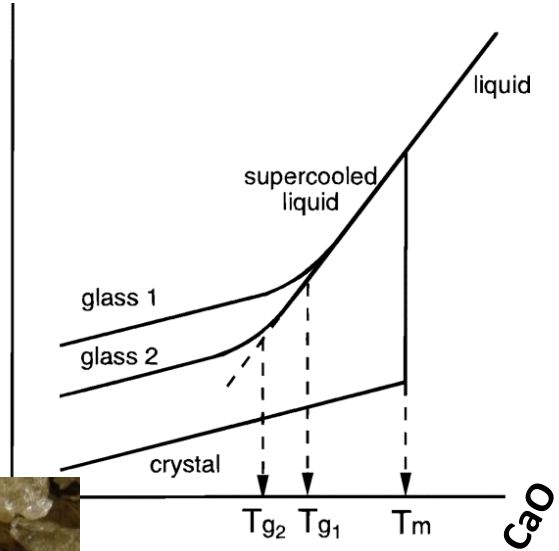
CO_2 emissions of german industry 2023 (wihout electrical energy producer)



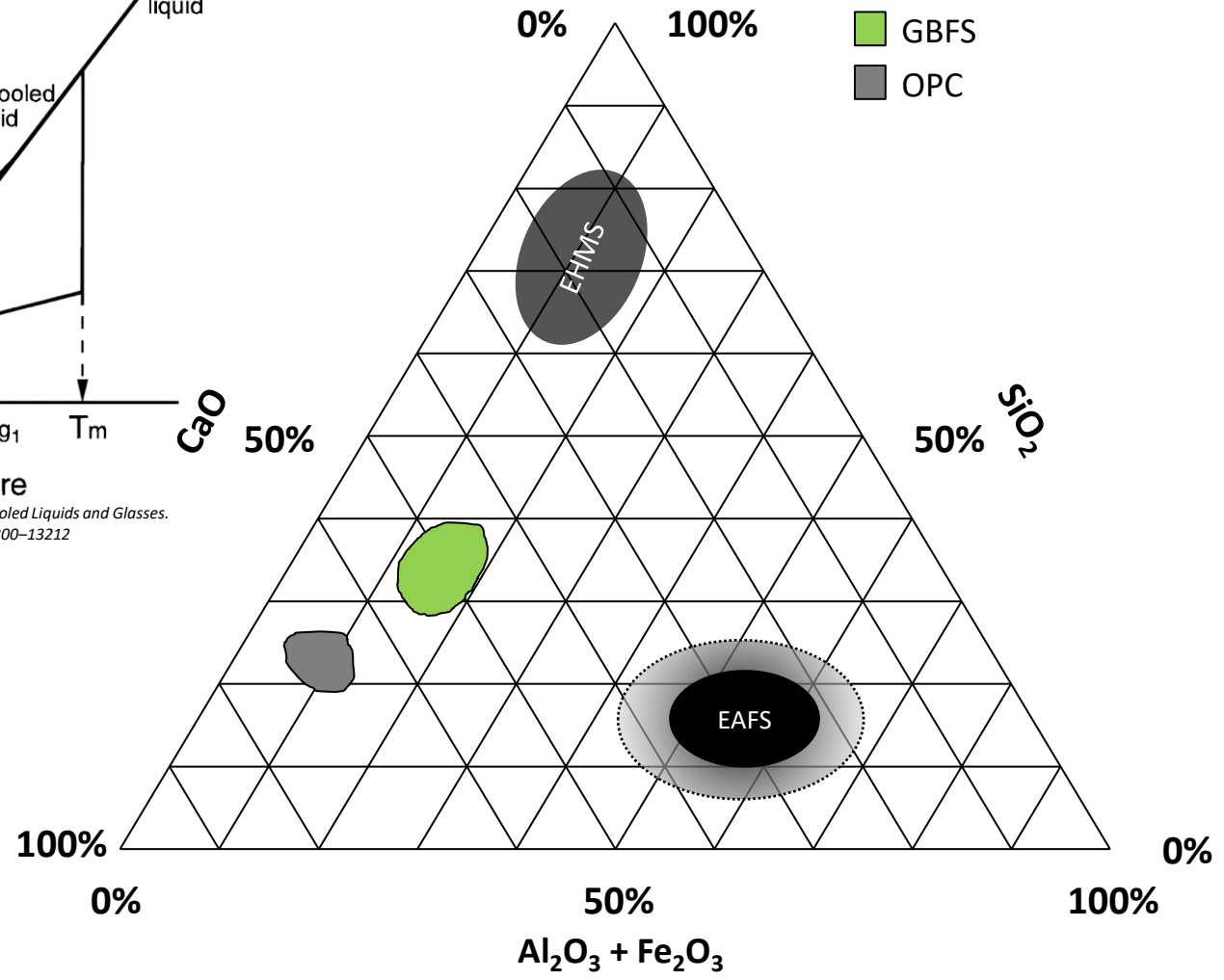
* estimated, based on German data and EUROSLAG statistic

Requirements to produce a material for the cement industry

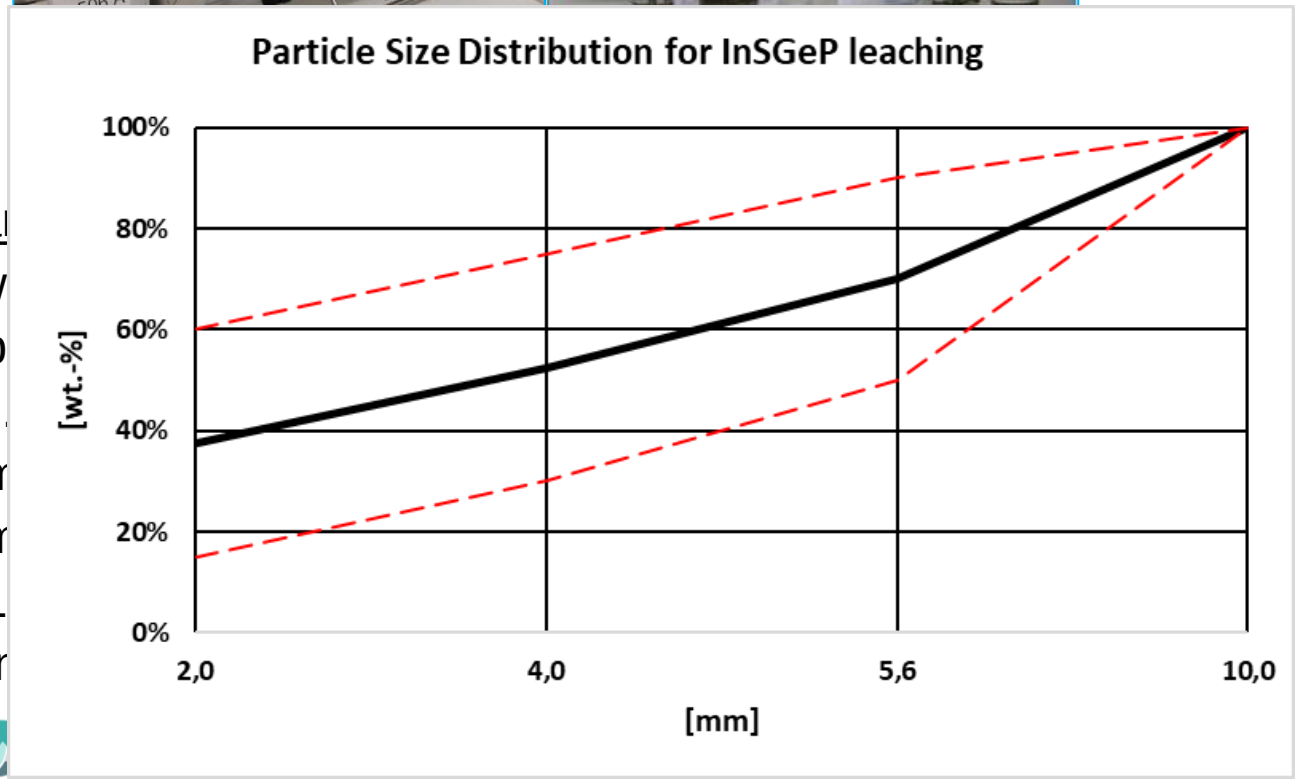




Ref.: M.D. Edinger et al.: Supercooled Liquids and Glasses. J. Phys. Chem. 1996, 100, 31, 13200–13212



Road construction – limiting values for leaching

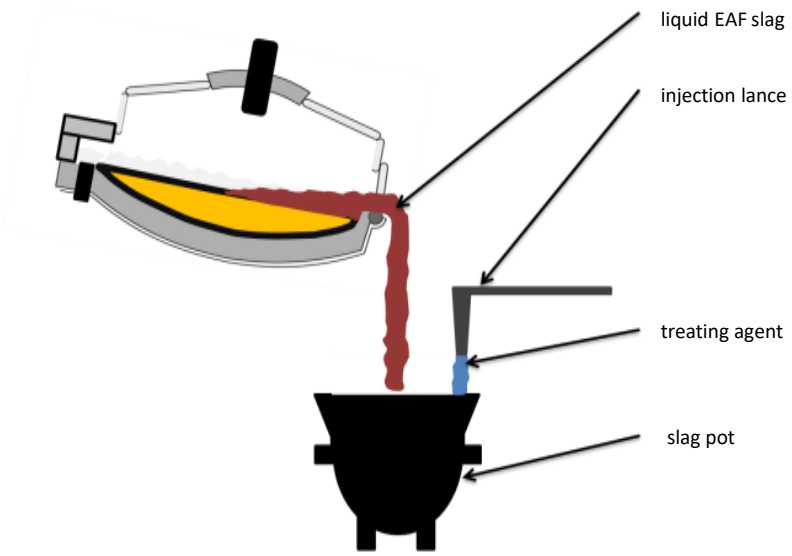


Exa
Low
Dep
(e.g
Dem
→ m
→ L
→ Ir

France	Germany	Italy	Basque (Spain)
As	pH	pH	As
Ba	EC	COD	Ba
Cd	$Cr_{(total)}$	As	Cd
$Cr_{(total)}$	Mo	Ba	Cr
Cr (VI)	V	Be	Cr (VI)
Cu	F^-	Cd	Cu
Hg		Co	Hg
Mo		$Cr_{(total)}$	Mo
Ni		Cu	Ni
Pb		Hg	Pb
Sb		Mo	Sb
Se		Ni	Se
Zn		Pb	V
Cl^-		Sb	Zn
F^-		Se	Cl^-
SO_4^{-2}		V	F^-
		Zn	SO_4^{-2}
		Cl^-	
		CN^-	
		F^-	
		NO^{3-}	
		SO_4^{-2}	

Slag treatment necessary?

Take care about boundary conditions!

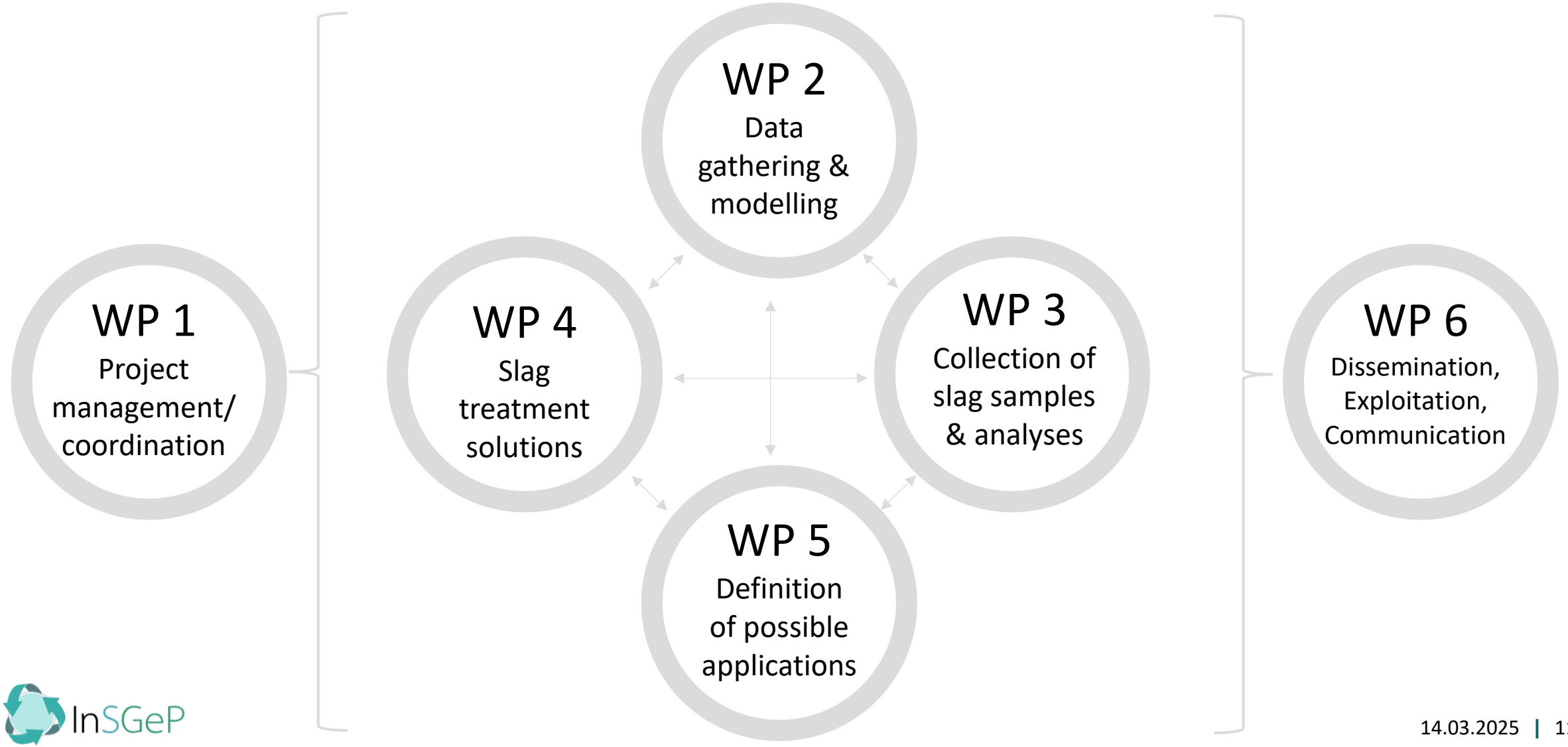


Treating
during tapping

InSGeP Partners

5 RTO
5 steel works
2 plant manufacturers
+ ESTEP

InSGeP Workplan (07/2023 – 06/2027)



InSGeP

- Simulation of effects on slag and process of DRI or HBI charge in electric arc furnace
- Collection and laboratory development of slag samples using DRI and HBI in industrial and pilot scales
- Valorization of EAF slags from DRI melting with dry granulation process
- Market analysis and stakeholder consultation

David Algermissen

European Commission

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