

# European environmental policy and its influence on the use of slag products

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# European Environment policy - Targets

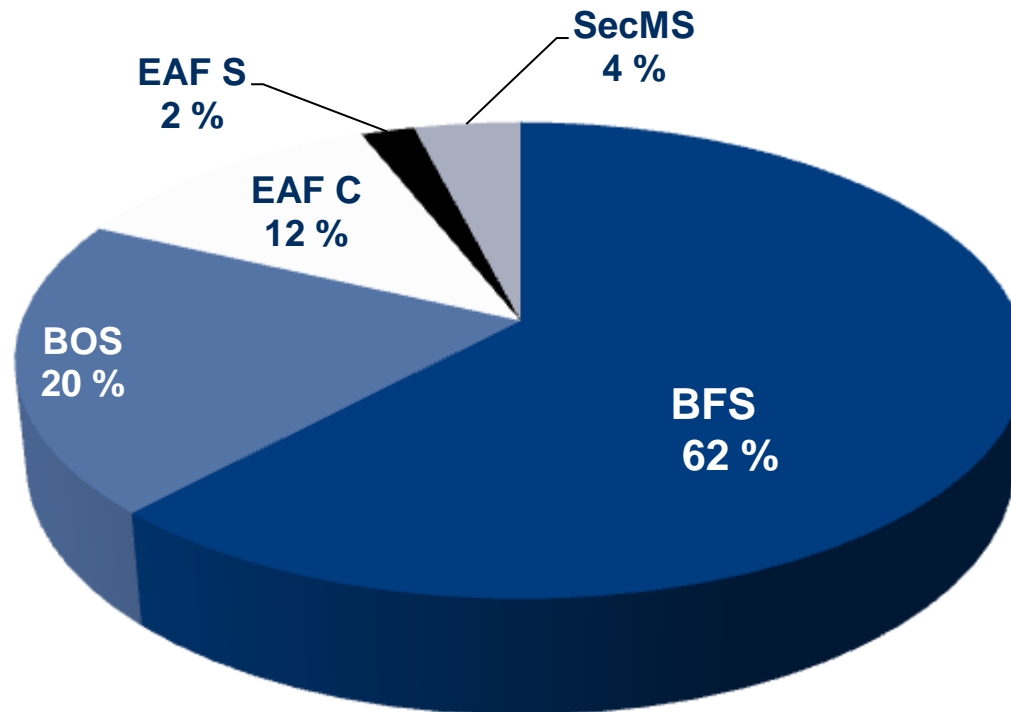
- Preservation and protection of the environment as well as improvement of the quality
- Protection of human health
- Careful and efficient use of natural resources
- Funding of measures on international level for coping with environmental problems on global or regional level

**These targets have to be basis  
of slag use!!**



# Production of Iron and Steel Slag in Europe

2008: 45.6 million tonnes



**BFS:** Blast Furnace Slag

**BOS:** Basic Oxygen Furnace Slag

**EAF C:** Electric Arc Furnace Slag - Carbon Steel

**EAF S:** Electric Arc Furnace Slag - Stainless Steel

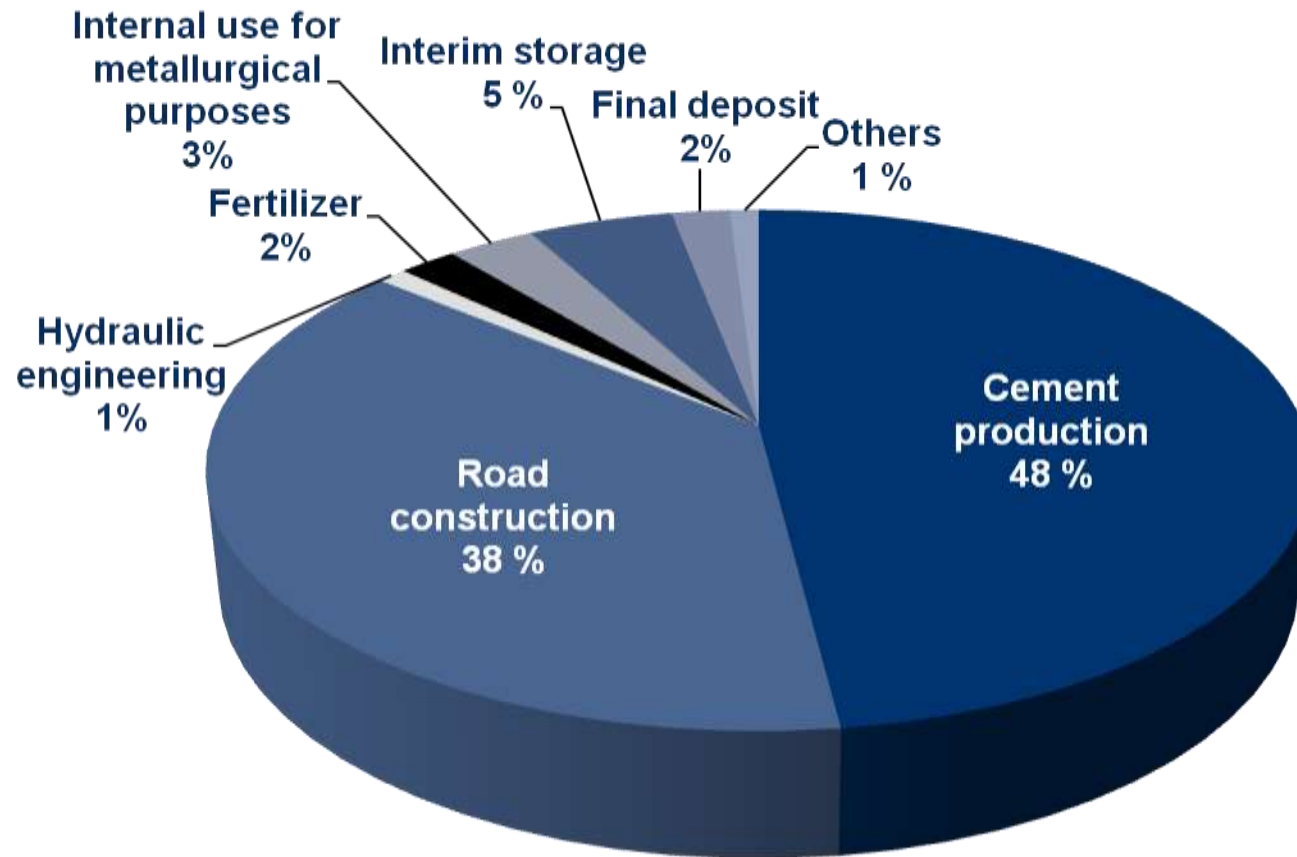
**SecMS:** Secondary Steelmaking Slag

EUROSLAG Questionnaire 2009



# Use of Iron and Steel Slag in Europe

2008: 46.9 million tonnes



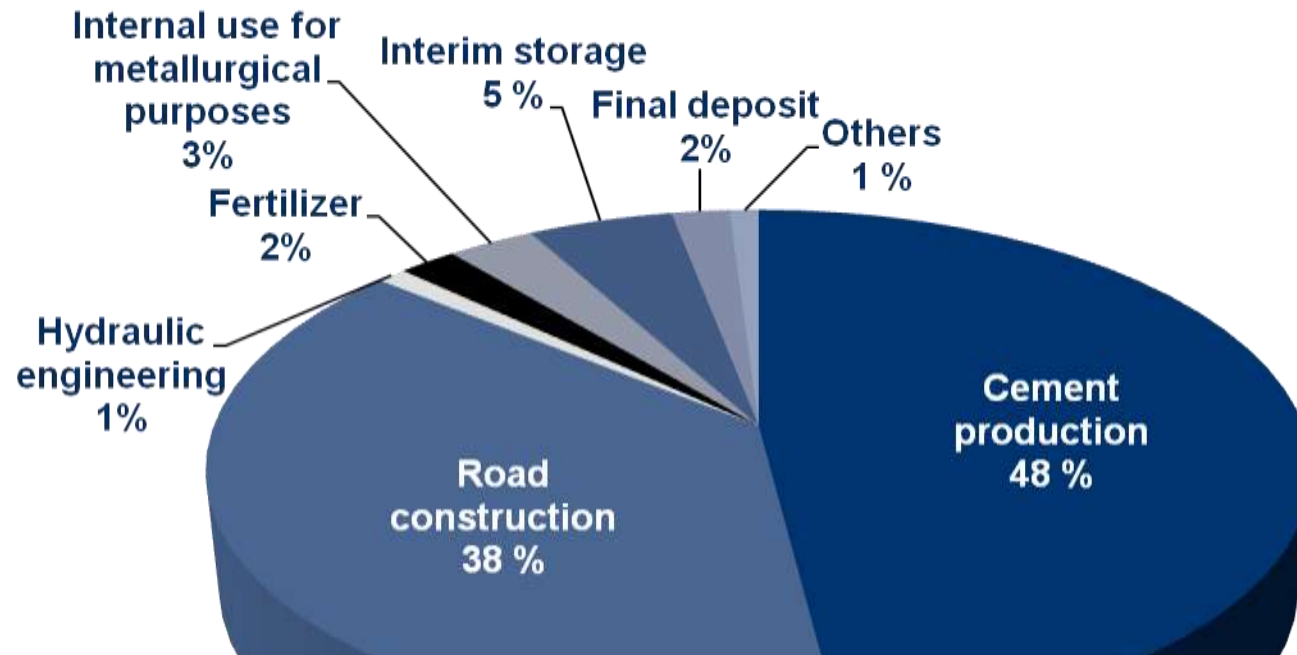
EUROSLAG Questionnaire 2009





# Use of Iron and Steel Slag in Europe

2008: 46.9 million tonnes



**87% of the slag produced in Europe is used for building purposes**

EUROSLAG Questionnaire 2009

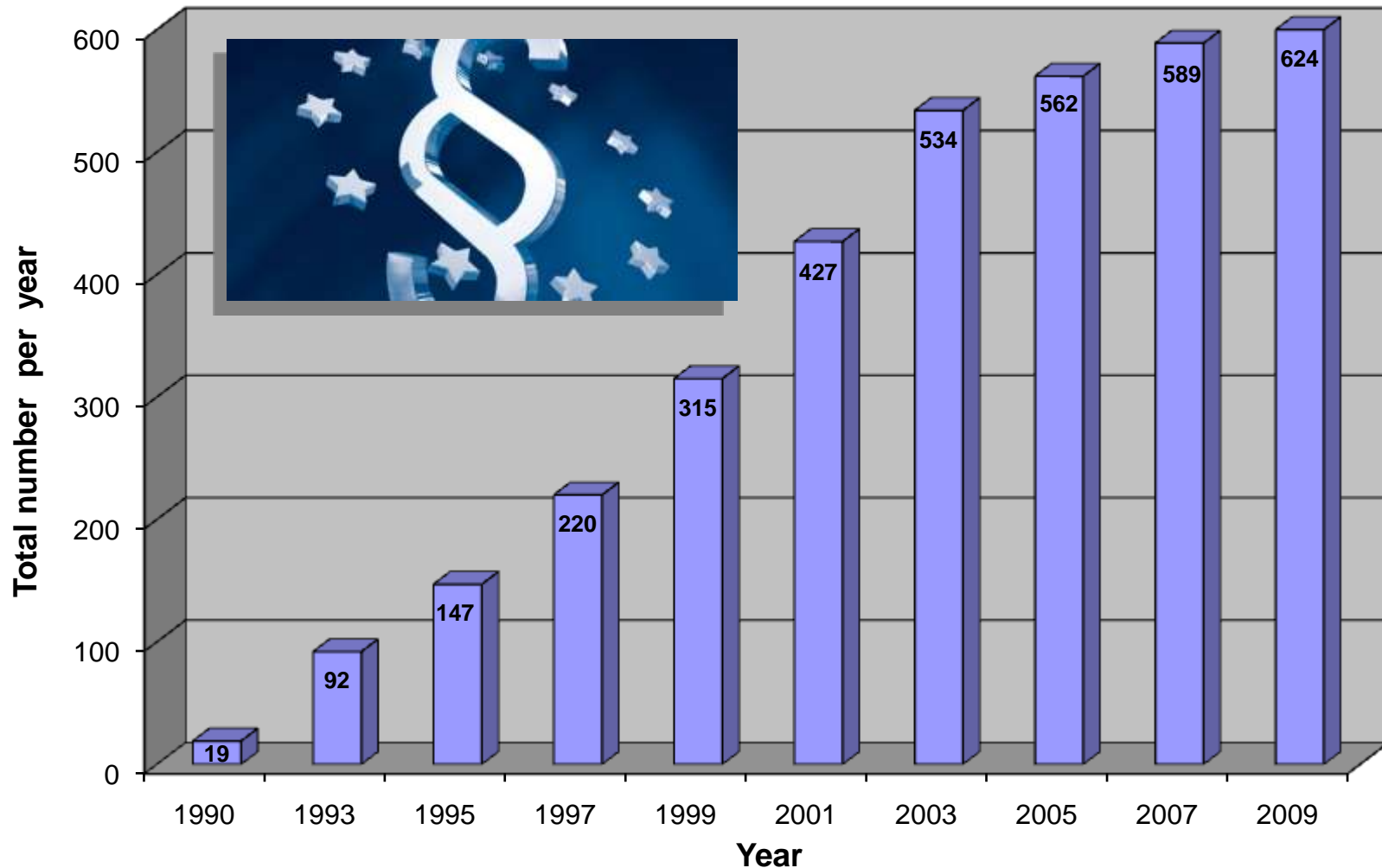


# Issues of Concern concerning Environment

- What is slag - Waste or Product?
- Effects on human beings (ecotoxicity and toxicity)
- Effects on air (emissions)
- Effects on water (surface and groundwater) and
- Effects on soil (retention, enrichment of substances)

## Evaluation based on

- European legislation
- European harmonised standards
- Requirements on the place of use



Source: CEMBUREAU

# Examples of environmental Directives and regulations in Europe which concern slag use

- EU-Waste catalogue [2000]
- EU-Council Decision on the Landfill of Waste [2002]
- EU-Waste Shipment Regulation [2006]
- EU-REACH Regulation [2006]
- EU-Waste Framework Directive [2008]
- EU-Water Framework Directive [2008]
- EU-Construction Products Directive [1988]  
under revision as Regulation [2011?]  
(Basis for European standardisation of building materials)

[year of publication]





**The European Waste Catalogue (EWC) established by the Commission Decision 2000/532/ECC of 3 May 2000 contains two entries regarding slag:**

- **10 02 01 waste from the processing of slag**
- **10 02 02 unprocessed slag**

**Conclusion:  
Processed slag is a (By)-Product**

**Question:  
What is meant by processing?**

In 2002 the EU Commission agreed that

- granulation
- pelletisation
- foaming
- proper solidification connected with a specified heat treatment
- separation, crushing, sieving, milling

**are examples of slag processing.**

**Nearly 90% of slag generated in Europe  
is running through these processing steps and  
are marketed as (By)-Product!**

## Issues to be discussed by the Consortium:

- lack of data, examination of literature
- classification (decision of the Consortium: slags are registered as UVCB substances)
- definition of generation processes
- substance identity (contents)
- leaching concentrations
- evaluation of studies
- uses
- relevance of fines and fibres
- test methods
- election of test laboratories
- development of test protocols
- inhalation tests
- performance of eco-toxicological and toxicological tests

## Tests which were carried out or are still running:

### Eco-toxicological tests, e.g.

- Growth inhibition of algae
- Short-term and long-term toxicity to invertebrates
- Effects on soil micro-organisms
- Short-term toxicity to plants



### Toxicological tests, e.g.

- Cytogenicity studies in mammalian cells
- Gene mutation studies in mammalian cells
- Skin irritation tests
- Eye irritation tests
- Inhalation studies



## Tests which were carried out or are still running:

### Eco-toxicological tests, e.g.

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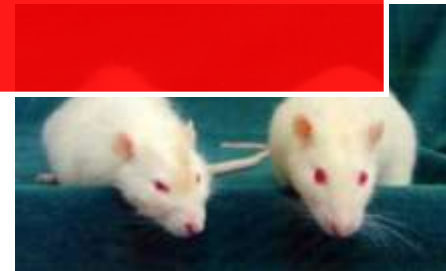
### Evaluation of toxicity of slags:

**Slags are non hazardous substances**

### Toxicological Basis for the registration before

**1<sup>st</sup> December 2010**

- Cytogenicity studies in the
- Gene mutation studies in mammalian cells
- Skin irritation tests
- Eye irritation tests
- Inhalation studies



# EU-Waste Shipment Regulation 2005

## Entries before Revision WSR - Version 2005

- **GREEN List**

Wastes included may not be subject to the general information requirements laid down in Article 18

### **GC070:**

Slags arising from the manufacture of iron and steel (including low alloy steel) **excluding** those slags which have been specifically produced to meet both national and relevant international requirements and standards.





# EU-Waste Shipment Regulation 2005

## Entries after Revision WSR - Version 2005

### • GREEN List

Wastes included may not be subject to the general information requirements laid down in Article 18

#### **B1200:**

Granulated slag arising from the manufacture of iron and steel

#### **B1210:**

Slag arising from the manufacture of iron and steel including slags as a source of  $\text{TiO}_2$  and Vanadium



# EU-Waste Shipment Regulation 2005

## Entries after Revision WSR - Version 2005

### • Amber List

Wastes included will be subject to the procedure of written notification and consent

#### AA010:

Dross, scalings and other wastes from the manufacture of iron and steel <sup>1)</sup>

- <sup>1)</sup> This listing includes wastes in the form of ash, residue, slag, dross, skimming, scaling, dust, powder, sludge and cake, unless a material is expressly listed elsewhere.



## Relevance of WSR

The Waste Shipment Regulation is applicable only to wastes - without regulating the differentiation between wastes and products in general.

What concerns the term "waste" in Article 2, the Waste Shipment Regulation refers only to Article 1 of the Waste Framework Directive. (Prof. Versteijl 2005)



# **Question!**

## **Are Slags Wastes or (By-)Products?**

**Relevant for many other substances generated  
parallel to the main product!**



# Classification as Waste or By-Product



## COMMUNICATION FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT on the Interpretative Communication on waste and by-products 21<sup>st</sup> February 2007

### Annex 1 – examples of wastes and non-wastes

#### 1. SLAGS AND DUSTS FROM IRON AND STEEL PRODUCTION

Blast furnace slag can be used directly at the end of the production process, without further processing that is not an integral part of this production process (such as crushing to get the appropriate particle size).

**This material can therefore be considered to fall outside of the definition of waste.**

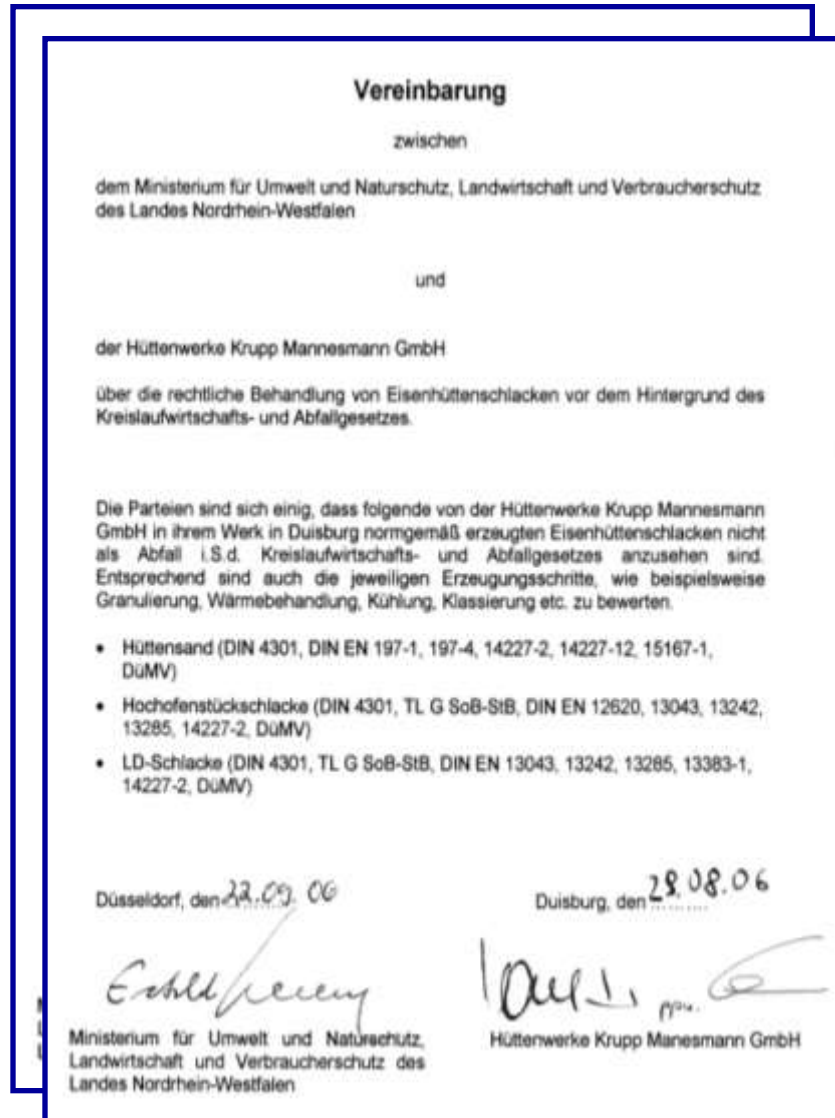
# Classification as Waste or By-Product

## Further examples for the classification of Slags

• Austria 1991:	GBS	non waste
• EWC 1993:	10 02 01 waste from slag processing 10 02 02 unprocessed slag	
	conclusion: processed slag	non waste
• Germany 1997:	EAF-slag produced by BSW	non waste
• Austria 1999:	GBS	product
• EPA, 2000:	GGBS	by-product
• EU 2002:	Slag from the steel industry	waste
• Finland 2005:	Ferrochromium slag	non waste
• Belgium 2007:	GBS	non waste
• EU 2007:	GBS/ABS	by-product
• UK 2007:	GBS/ABS	by-product

GBS: Granulated Blast Furnace Slag, GGBS: Ground GBS, ABS: Air cooled Blast Furnace Slag





**Agreement**

**Ministry of Environment  
(North Rhine-Westphalia)**

**and**

**Hüttenwerke  
KruppMannesman**

**respectively**

**ThyssenKrupp Steel  
Europe**

**Iron and steel slags are  
by-products**

# Classification as Waste or By-Product

## Conclusion 1

Concerning the classification of slag there are three cases possible:

- Slags are considered being by-products already in the liquid state directly after manufacture with or without processing steps.



# Classification as Waste or By-Product

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- Slags are first considered being wastes but cease to be wastes after a number of recovery measures.



# Classification as Waste or By-Product

## Conclusion 1

Concerning the classification of slag there are three cases possible:

- Slags are considered being by-products already in the liquid state directly after manufacture with or without processing steps.
- Slags are first considered being wastes but cease to be wastes after a number of recovery measures.
- Slags remain waste



## Conclusion 2

### Need of

- **Criteria for by-products**
- **End of waste criteria**



## Waste Framework Directive - WFD

entered into force on 12 December 2008

### Article 5 "By-products"

A substance ..., may be regarded **as not being waste ... but as being a by-product** only if the following conditions are met:

- (a) further use is certain;
- (b) direct use without any further processing other than normal industrial practice;
- (c) production is an integral part of a production process;
- (d) further use is lawful, i.e. with regard to all relevant product, environmental and health protection requirements.





## Waste Framework Directive - WFD

entered into force on 12 December 2008

### Article 6 "End of Waste Status"

Certain specified waste shall cease to be waste ... when it has undergone a recovery, including recycling, operation and complies with **specific criteria to be developed** in accordance with the following conditions:

The substance or object

- (a) is commonly used;
- (b) is marketed or demanded;
- (c) fulfils the existing legislation and standards;
- (d) will not lead to adverse environmental or human health impacts.



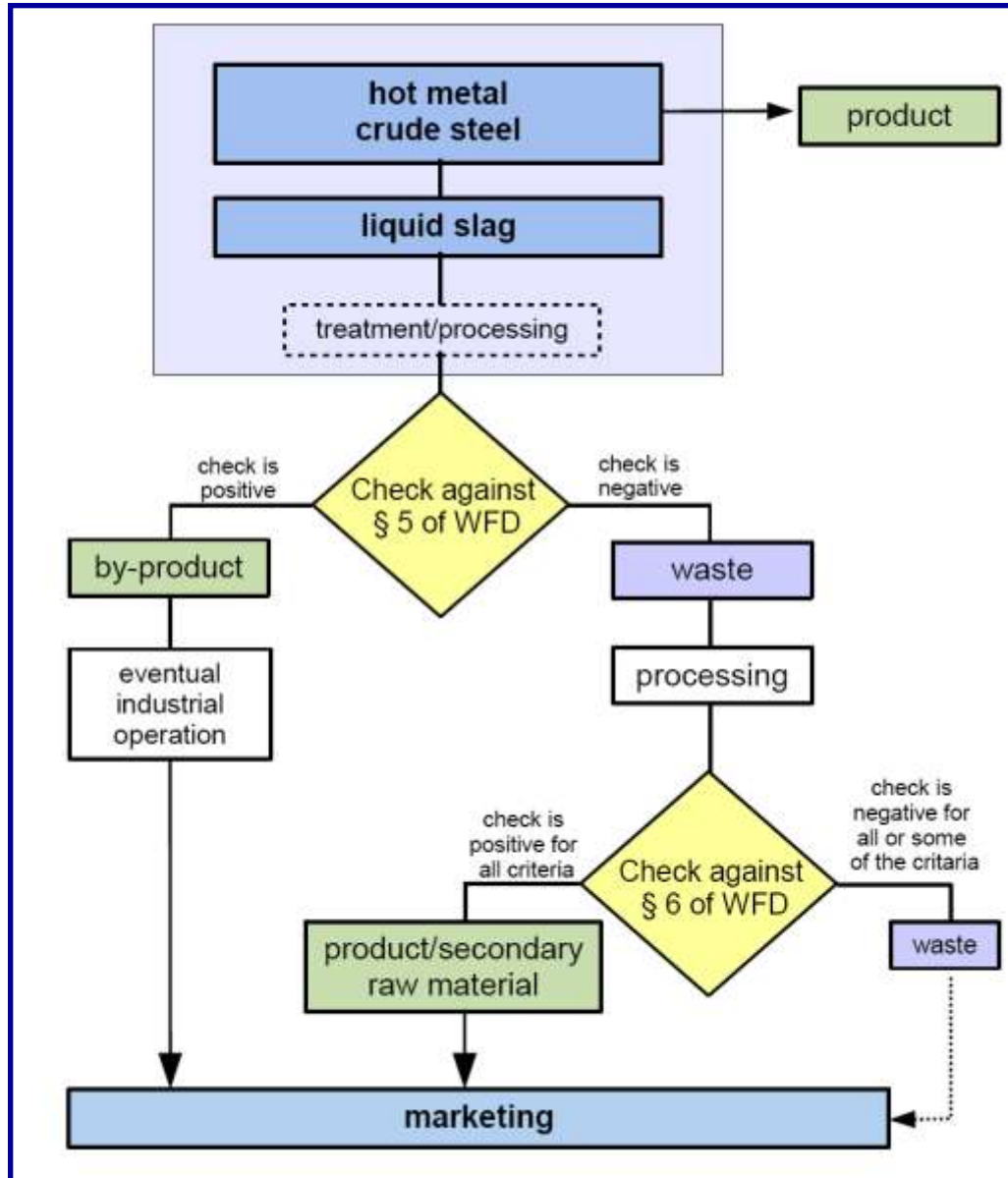
## Evaluation of slag

### Decision tree

### § 5 By-products

and

### § 6 End of waste status



**Position Paper  
on Ferrous Slag**

Respecting §§ 5 and 6 of the  
Waste Framework Directive

April 2011



**The European Slag Association**

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- 2.4 EWC
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  - 3.1 Ferrous slag types and their registration under REACH
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  - 3.3 Statistics – production and use
  - 3.4 Standardization of ferrous slag and quality control
- 4. Ferrous slag and environment
- 5. Slag in the light of the WFD requirements
  - 5.1 The relevance of the criteria of Article 5 regarding slag
  - 5.2 The relevance of the criteria of Article 6 regarding slag
- 6. Conclusion

## Consequences for slag

### EU-Waste Framework Directive



Evaluation of slags as by-products or  
via EoW-criteria

Discussion and decision on

- which slag is a by-product
- which slag enters EoW criteria

by Comitology Procedure

Foundation of an expert group headed by the  
EU-Commission



## Activities of the Commission in 2010 to define EoW criteria

Invitation to tender

IPTS-2010-J06-41-OC

*Institute for Prospective Technological Studies*

Technical Specifications

Study on methodological aspects regarding limit values for pollutants in aggregates in the context of the development of end-of-waste criteria under the EU Waste Framework Directive

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### Materials

for aggregates to be considered:

- Blast furnace (BF) slag
- Basic oxygen furnace (BOF) slag
- Electric arc furnace (EAF) slag
- Argon oxygen decarburization (AOD) slags
- Blast furnace (BF), basic oxygen furnace (BOF), electric arc furnace (EAF) dust
- Fly ash (from coal combustion)
- Bottom ash (from coal combustion)
- Boiler slag (from coal combustion)
- FBC ash (from coal combustion)
- Fly ash, bottom ash, boiler ash (from household waste incineration)

## Activities of the Commission to define EoW criteria

### Tasks of the study

Invitation to tender	
IPTS-2010-206-41-OC	
Technical Specifications	
Study on methodological aspects regarding limit values for pollutants in aggregates in the context of the development of end-of-waste criteria under the EU Waste Framework Directive	
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- 1: Identify the potential pollutants from aggregates
- 2: Identify the most suitable testing approaches and methods, including simplified modes of compliance
- 3: Describe the legislation and regulatory practice for controlling pollution from aggregates
- 4: Assess the need for including limit values for pollutants in end-of-waste criteria
- 5: Identify and assess the different methodological approaches for deriving pollutant limit values



## Consequences for slag

EU-Water Framework Directive



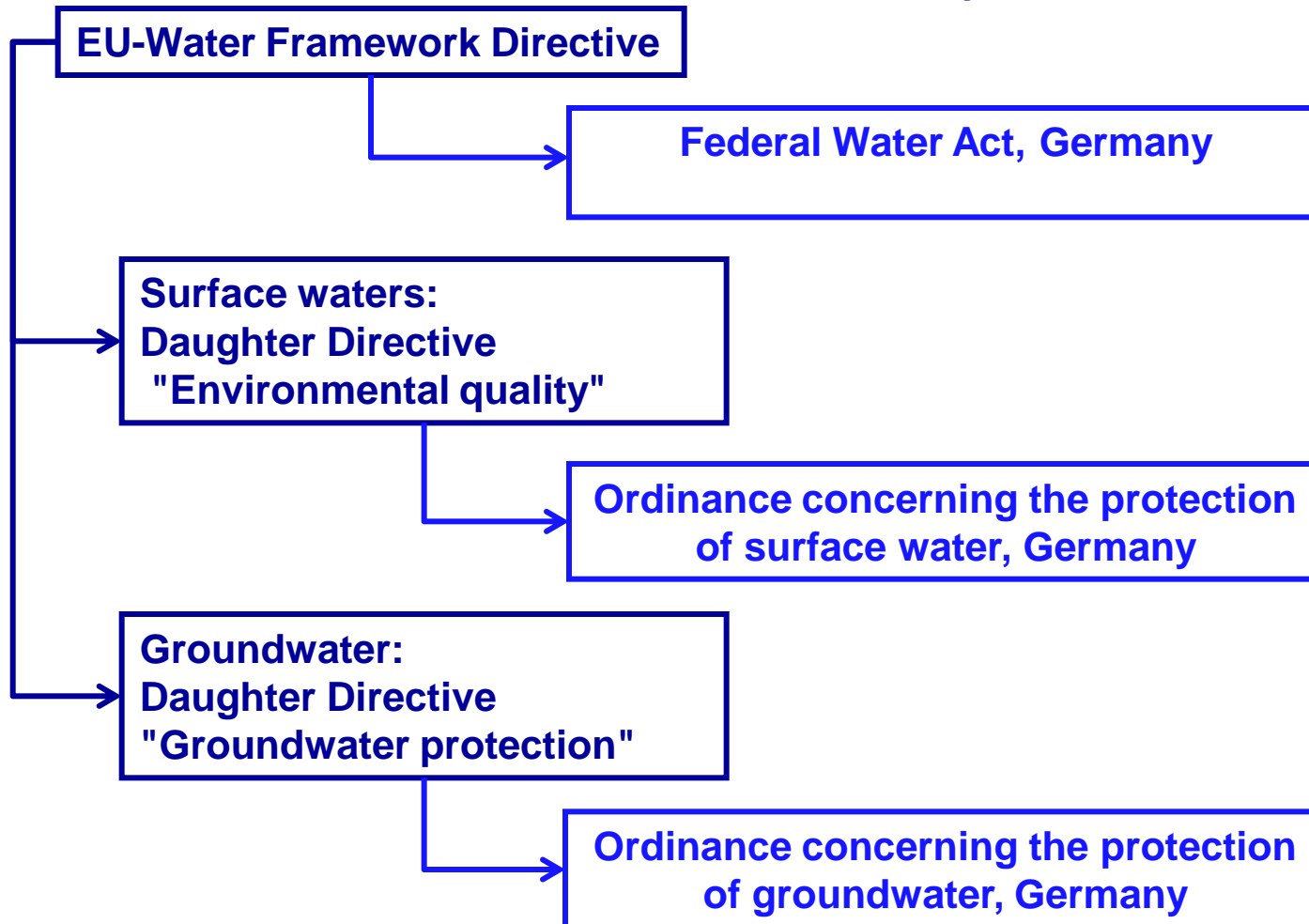
Evaluation of by-products e.g. slags

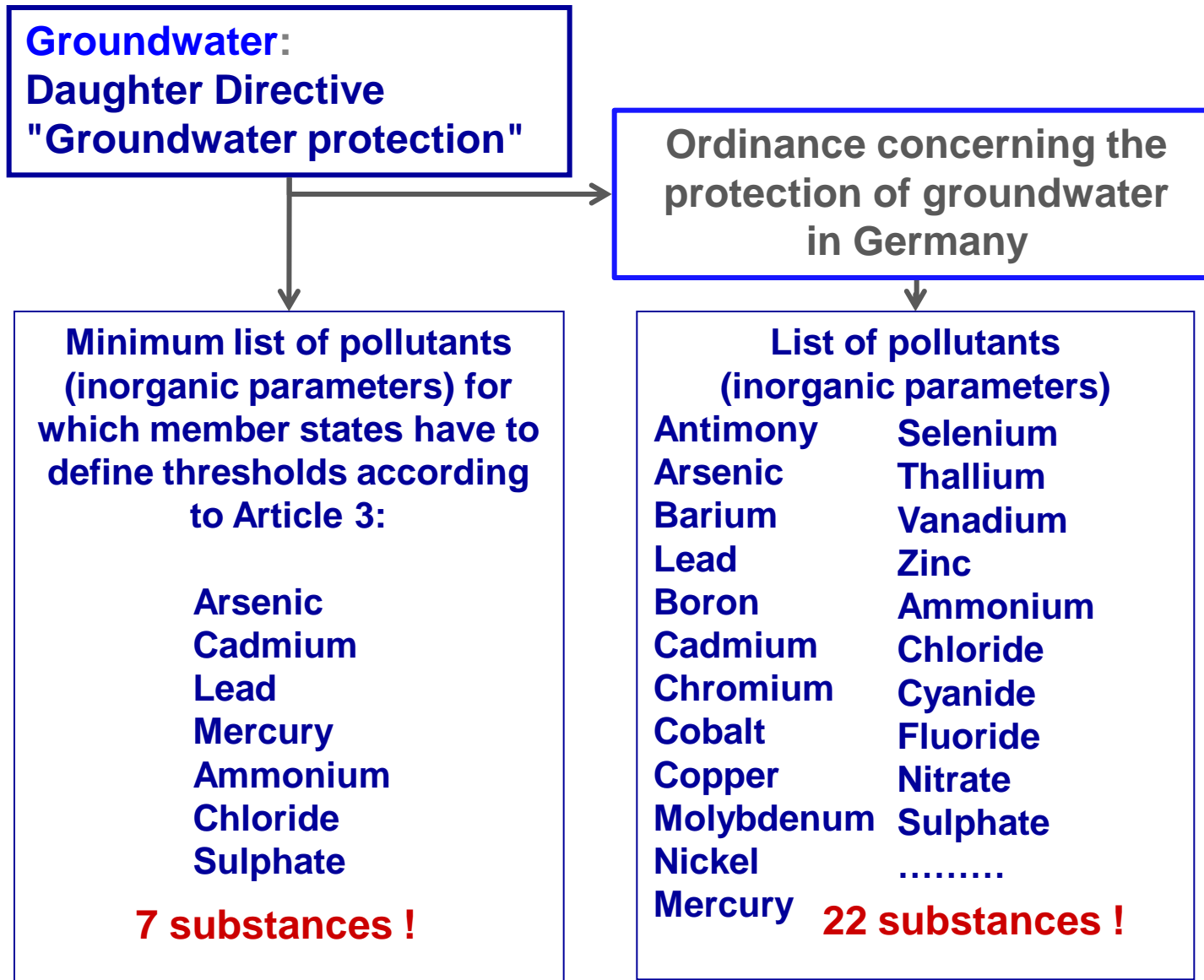
Discussion on

- typical potential pollutants
- limiting values for pollutants
- controlling of typical pollutants
- fields of application

# EU-Water Framework Directive 2008

## Implementation EU Water Framework Directive into law in Germany





## **Essential requirements (ER) of construction products to be respected by European harmonised Standards (CPD)**

- 1. Mechanical resistance and stability**
- 2. Safety in case of fire**
- 3. Hygiene, health and the environment**
- 4. Safety in use**
- 5. Protection against noise**
- 6. Energy economy and heat retention**

# European Standards relevant for slag

## 1<sup>st</sup>/2<sup>nd</sup> Generation

EN 197: Cement

EN 206: Concrete

EN 13139, 12620 etc.: Aggregates

EN 13383: Armourstones

EN 12945: Fertiliser

EN 13285: Unbound mixtures

EN 14227: Slag bound mixtures

EN 15167: GGBS in Concrete



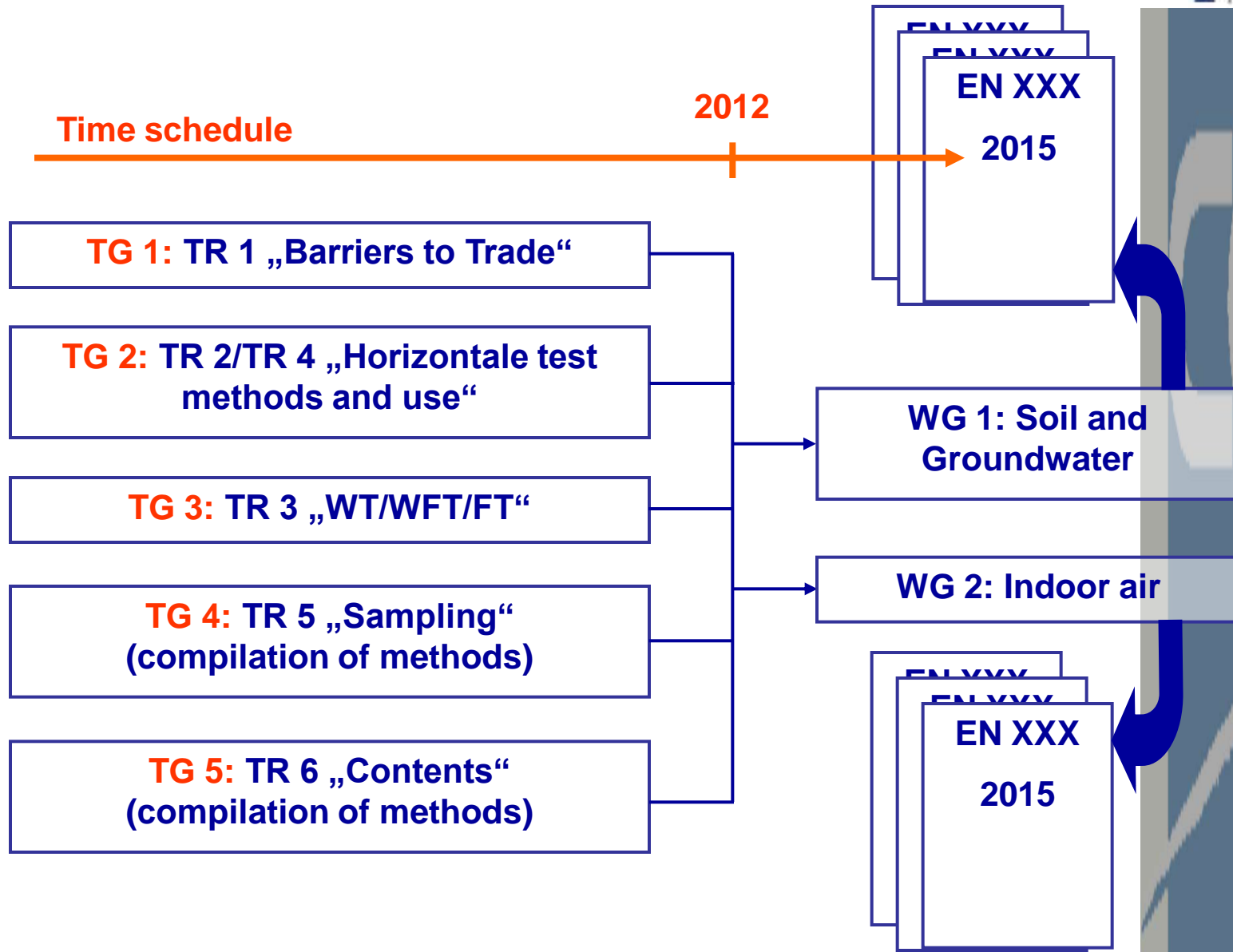
## Essential requirements (ER) of construction products to be respected by European harmonised Standards

1. Mechanical resistance and stability
2. Safety in case of fire
3. Hygiene, health and the environment
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5. Protection against noise  
6. Energy economy and heat retention

**will not be respected by the  
1<sup>st</sup>/2<sup>nd</sup> Generation of European Standards**

# CEN/TC 351 "Dangerous Substances"





## WG 1 Tasks:

- Regulated Dangerous Substances (RDS) to be respected
- Assessment of the release performance of RDS from construction products during use based on the

## WT- / WFT- / FT- Classification Procedures

- Development of test methods e.g. to assess leaching behaviour

# CEN/TC 351 "Dangerous Substances" - List of RDS

Metals and their compounds			
Heavy metals	Chromium (VI)	18540-29-9	<p>Directive 2003/53/EC, 2004-71-D</p> <p>Chromium (VI) compounds are classified carcinogenic (Cat. 2) and as dangerous for the environment (Directive 67/548/EEC).</p>
	Chromium	7440-47-3	Directive 80/68/EEC,
	Copper	7440-50-8	<p>2005-283-NL, 2006-90-D, 1999-263-A,</p> <p>2005-735-FIN, 2004-71-D,</p> <p>2006223-E</p>
	Cobalt	7440-48-4	<p>Directive 80/68/EEC,</p> <p>2005-283-NL, 2006-90-D</p> <p>Classified dangerous for the environment (Directive 67/548/EEC).</p>
	Molybdenum	7439-98-7	<p>Directive 80/68/EEC,</p> <p>2005-283-NL, 2005-735-FIN,</p> <p>2006223-E, 2006-90-D,</p>

In many mineral raw materials as well as in secondary materials (e.g. recycled aggregates, road construction products) and in industrial by-products (e.g. fly ash)

## List of RDS

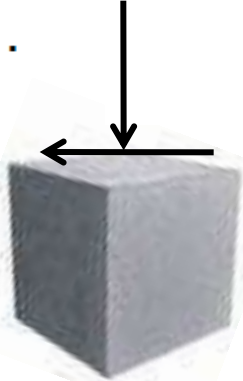
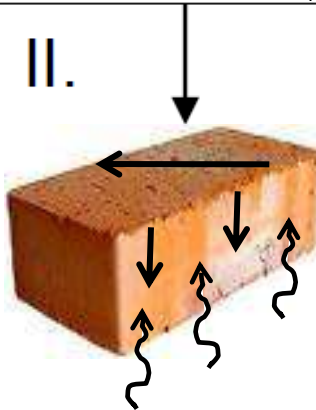

**The list is completed.**

**Now an adjustment of the mandates will be necessary.**

**Associations shall prepare dossiers, e.g. for slag via EUROSLAG**

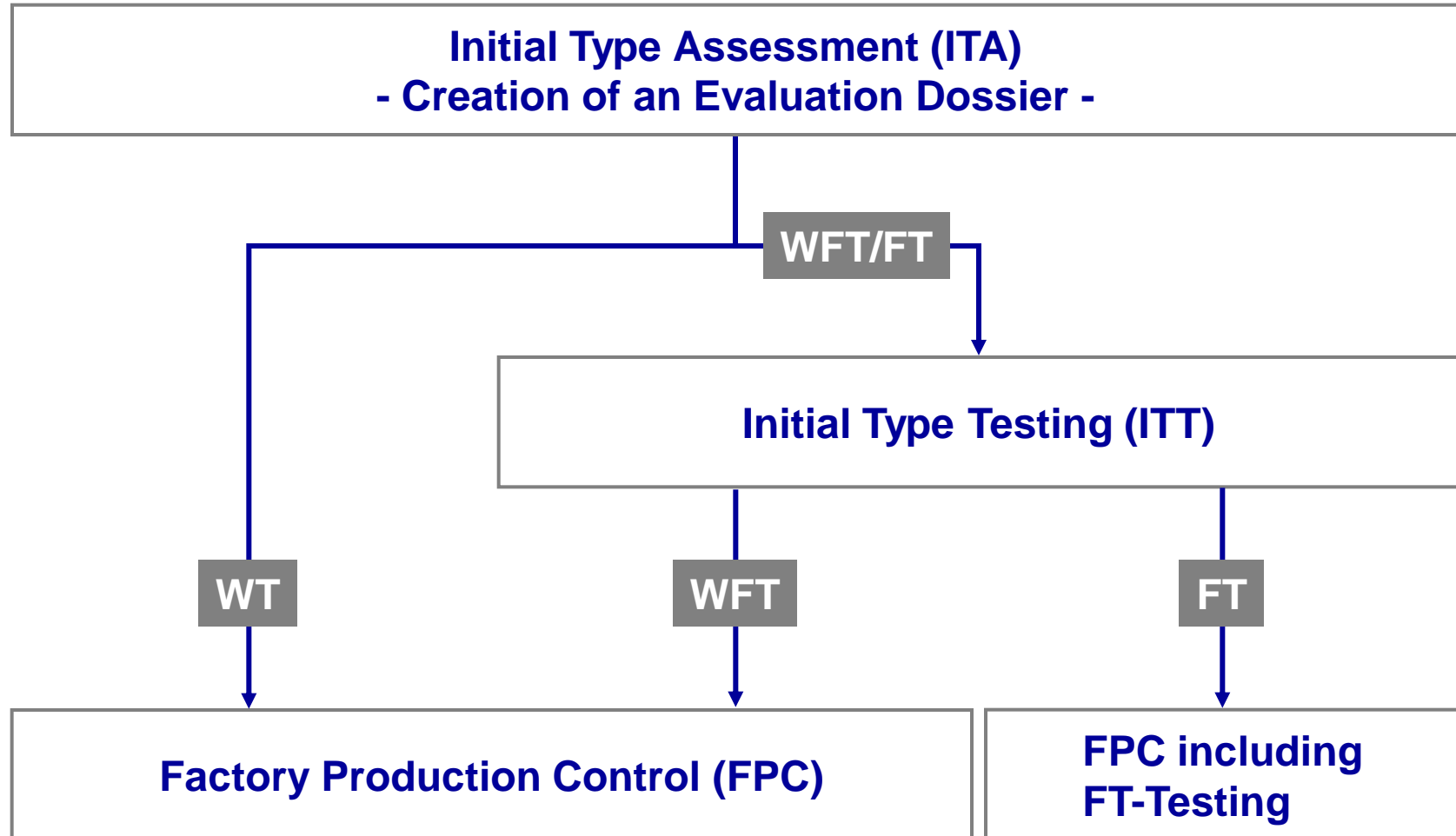
## Guidance standard for CEN Product TC's for selection of leaching tests appropriate for their product(s) – General principles

### Leaching scenarios for horizontal tests

<p>I.</p> 	<p>Non permeable product. Water is flowing over the surface of the product</p>	<p>Leaching scenarios for horizontal tests</p>
<p>II.</p> 	<p>Low permeable product. Water is transported into the matrix by capillary forces; contribution of core to surface</p>	
<p>III.</p> 	<p>Permeable product. Water may infiltrate into the matrix driven by gravity</p>	

**Based on the identified leaching scenarios appropriate leaching tests will be developed e.g. tank test, percolation test**

# Principal of the WT/ WFT/ FT-Classification



EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

EN 13242

**Aggregates for unbound and hydraulically  
bound materials for use in  
civil engineering work and  
road construction**

This draft European Standard is submitted to CEN members for formal vote. It has been drawn up by the Technical Committee CEN/TC 154.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CEN in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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COMITÉ EUROPÉEN DE NORMALISATION  
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Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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ref. No. prEN 13242:2001 E

## Procedures for:

- WT/ WFT/ FT - classification
- Initial Type Assessment - ITA
- Initial Type Testing - ITT
- Evaluation and description of results
- Factory Production Control - FPC (including test frequency)

# CEN/TC 351 "Dangerous Substances" - Standards

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## Possible Classification of RDSs

- **NPD:** No Performance Determined
- **Class A, B, C..:** threshold values (e.g.  
Cr: 0.5, 0.1, 0.01 mg/l  
V: 0.1, 0.05, 0.01 mg/l)
- **DV:** Manufacturer's declared value

# Dangerous Substances in Aggregates

## 2. Generation of European Aggregates standards

### 1 Scope

This European Standard...

... incorporates a general requirement that **aggregates shall not release any dangerous substances** in excess of the maximum permitted levels specified in a relevant European Standard for the material ...

NOTE 1 ... Additional characteristics and requirements may be specified on a case by case basis .... In the case of new and unfamiliar source materials this may be particularly relevant **to release of regulated dangerous substances. ...**

NOTE 4 Requirements for the declaration of the potential of aggregates **to release regulated dangerous substances are currently under development.** Until such time as these are finalised attention should be paid to requirements **at the place of use.**



# Conclusions

**Long time successful application of iron and steel slags as building materials and fertilizer including saving of resources and CO<sub>2</sub> emissions**

**but**

- **overrating environmental issues by e.g. baseless tightening of limiting values and non reality based modelling of percolation processes**
- **missing acceptance concerning the use of by-products of the steel industry**
- **protracted permission procedures**

**may hinder the successful use of ferrous slags in future.**



# Thank you for your attention

