Experiences from the non-ferrous metal industry in establishing substance sameness

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Inorganic UVCBs: background

- UVCBs defined according to ECHA guidance, variability is driver
- Complex materials that contain varying concentrations of metals, metal compounds and/or minerals (often composed of 10 or more constituents)
- Intermediates: substances transformed into another substance(s)
- Restricted life cycle, including manufacturing, transformation into other substance (=use)
- Often complex, interlinked material flows, e.g.
  - ❑ metal matte converted into blister/anode
  - ❑ slimes from copper production used as raw material to produce precious metals
  - ❑ bleeds, dust, etc., recycled and reverted back to various metal productions

→ Who can register together?

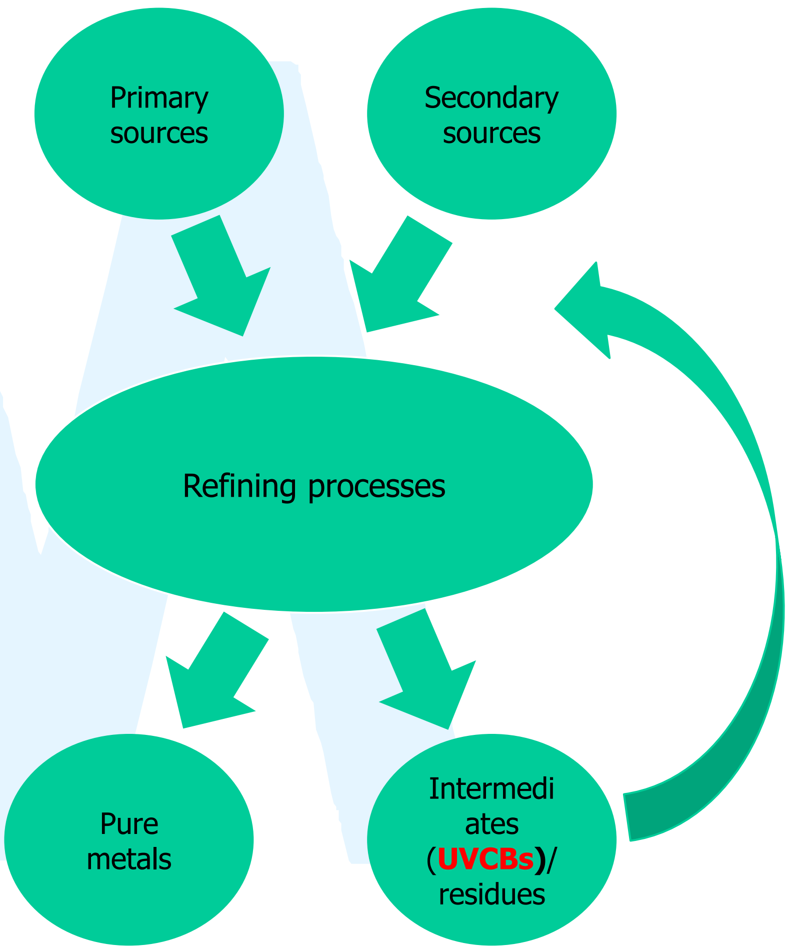
Metal refining sources: complex materials

Primary sources

- Metal ore
- Metal concentrate

Secondary sources

- Dusts
- Secondary Metal material
- Metal Slags
- Metal Residues
- End-of-life materials (recyclables like e.g. catalysts, piping, metal containing substrates, …)
- …..



Metal refining processes - examples

Primary mix:
Copper ores conc.
Fluxes
Secondary Cu materials
Dusts, etc

Secondary mix:
Slags
Different residues
Copper iron
Dusts, etc

Matte Smelting

Secondary Smelting

Additional inputs materials

Additional inputs materials

Converting

Additional inputs materials

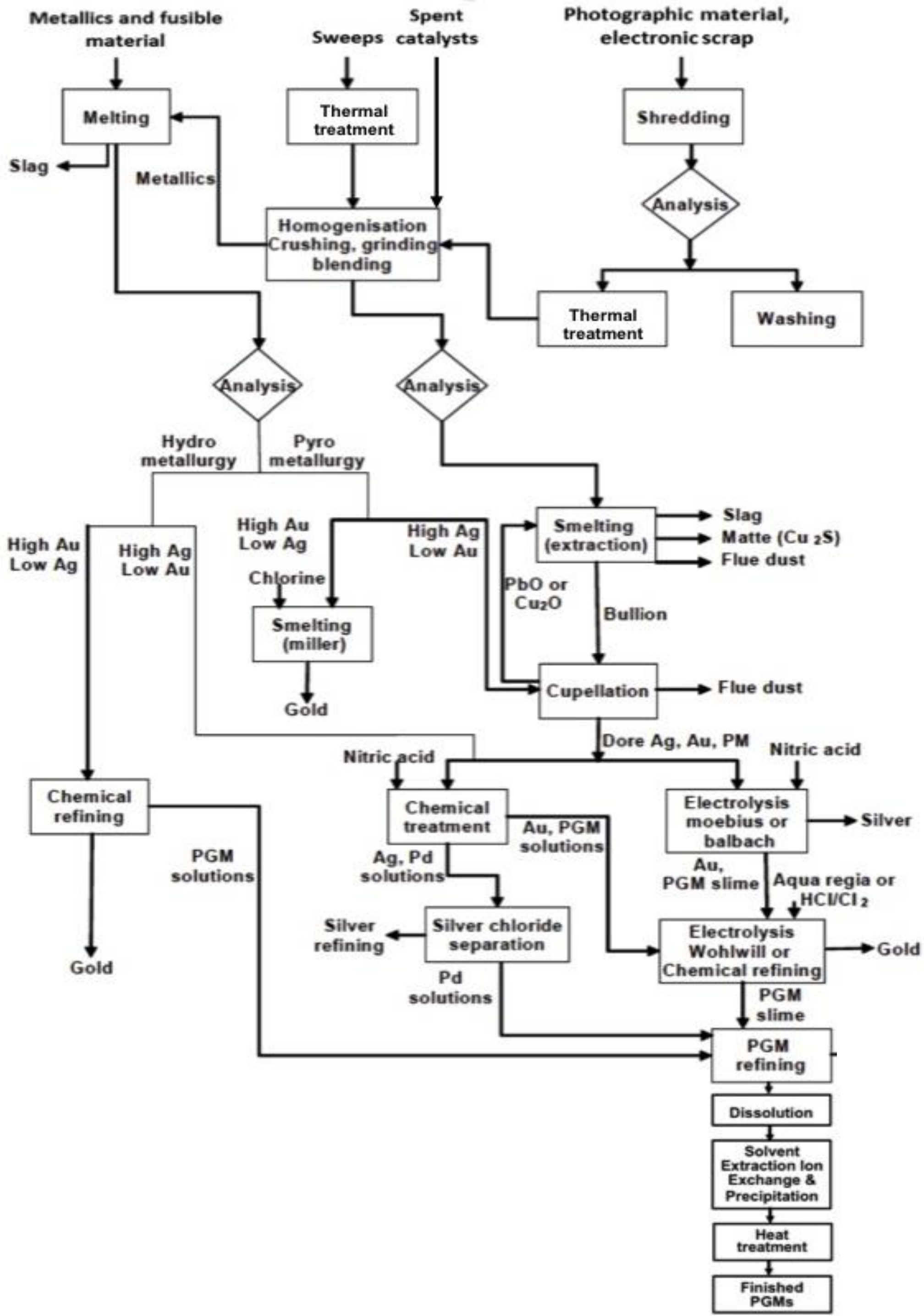
Additional inputs materials

Fire-refining & anode casting

Electrolytic Refining

Example: Copper production

Example: Precious metal production



SIEFs formation: start

- Started approximately 3 years before registration deadline

- Working Groups:
  - ❑ Regrouped major metal manufacturers around the table
  - ❑ Technical people, rather than marketing
  - ❑ History in cooperation under NFM BREF & ESR exercises

- Tools: questionnaires, flow sheets, decision trees, existing inventories

Example of early stage decision criteria

Is the material resulting from the copper production?

E.g. Copper cement

Does the material contain copper?

E.g. Gypsum

Is the material a Copper compound?

E.g. Copper sulphate

Is the material a copper intermediate?

As appropriate:

Contact other consortium. Discuss best home

Further decision steps for complex substances (1)

- Starting point were always the commonalities:

Reaction/vessel producing the substance?

- Align to NFM BREF description and terminologies
- E.g. smelting, electro refining, ….

Name of the substance?

- Marketing name
- EINECS name and number

Life cycle of the substance?

- Company material streams
- Input materials (transfer, handling), production (chemical reaction), storage and transfer until transformation process (into other substance)

Further decision steps for complex substances (2)

- Refinement of the initial clustering:
  - Based on expert considerations:
    - — E.g. matte and slag, slag and scale
  - Based on additional testing
    - — E.g. flue dust from primary smelter and flue dust from secondary smelter, flue dust from smelting and flue dust from converting

- Setting rules for further cooperation work
    - — Agree on common terminology
    - — Agree on a generic production and life cycle of the substance
    - — Agree on common EC name and description (eventually improved)

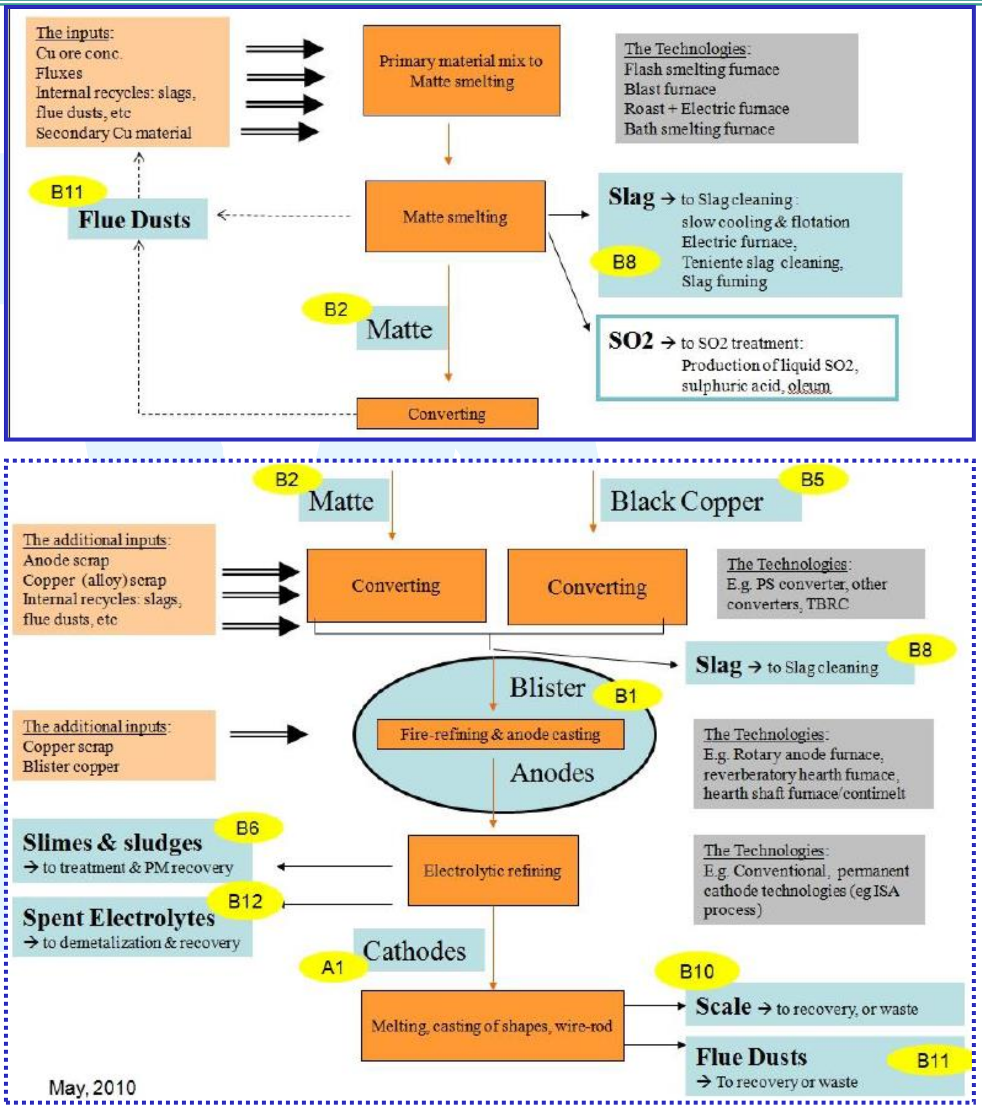
SIEFs formation

- Steps
  - Exchange of (non-confidential) information on company process flows (source, process)
  - Exchange information on company specific compositions (elemental + speciation) – with secretariat, on confidentiality basis
  - Establish list of existing EINECS entries and other existing substances/product definitions (e.g. LME)
  - Development of Generic process flows to identify occurrence of different UVCBs – focus on commonalities!
  - Overlap with other consortia’s scopes identified and discussed

Generic process flow: example

As from existing reference handbooks, etc.

- e.g. NFM BREF - Best Available Technologies



Challenges & solutions

1. Avoid overlap with other (metal) consortia

a. <u>Case of non-precise EINECS descriptions</u>

E.g. Doré

Original EINECS description: Gold and silver bullion

Description proposed by PMC: Metallic bars/ingots, grains or anodes and their residues (spent anodes) resulting from pyro-metallurgy processes applied on primary and secondary feeds with high precious metal content. Doré mainly contains silver and/or gold and copper, lower quantities of platinum group metals (iridium, osmium, palladium, platinum, rhodium, and ruthenium) and other non-ferrous metals in varying concentrations.

-> *New description added to dossier as description in the EINECS inventory does not fulfil the ECHA guidance for identification and naming of substances under REACH and CLP (UVCB description should mention starting materials, production process step(s) and known main constituents)*

Challenges & solutions

b. Case of multi purpose EINECS

E.g. Copper, dross

ESIS (European chemical Substances Information System). Page 1 of 1

Result for EC#: 305-408-5

Expand All (+) Collapse All (-)

EC# found in EINECS (European INventory of Existing Commercial chemical Substances).

General Information:

EC#	:	305-408-5
CAS#	:	94551-59-4
Substance Name	:	Copper, dross
De	:	Kupfer, Schlacke
Es	:	Cobre, escoria
Fr	:	Cuivre, crasses
Molecular Formula	:	Not available
Description	:	Not available

Structural Formula:

Not available

Biocidal Products Directive (Directive 98/8/EC) Information:

There is no information in ESIS for this substance with respect to the BPD.

Classification and Labelling Information:

This substance is not classified in the Annex I of Directive 67/548/EEC.

Export and Import of Dangerous Chemicals (Regulation (EEC) No 304/2003) Information:

This substance is not listed in the Annex I of Council Regulation No (EC) 304/2003.

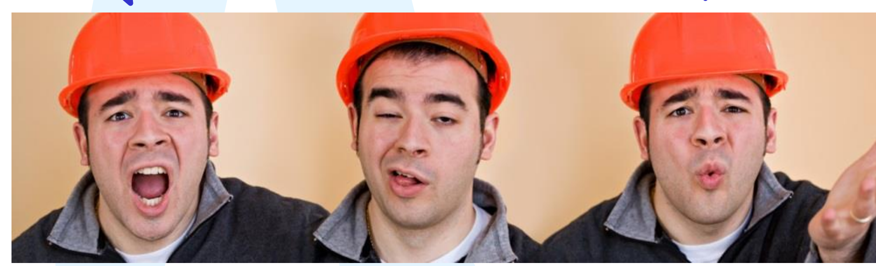
HPV-LPV (High and Low Production Volume) Information:

HPV Chemical : - List of Producers/Importers

Produced during copper manufacturing?

Produced during lead manufacturing?

A dross mainly containing Copper?



→ Term "copper dross" no longer used:
- lead drosses
- Refined descriptions for copper slags (from smelting and from refining) and for copper scales (from melting)

Challenges & solutions

c. <u>Case of "orphan" UVCBs – e.g. former waste</u>

E.g. black copper, copper smelting

Material was waste, no entry in EINECs inventory

Description proposed by Copper Consortium:

EC number:	918-452-0
EC name:	Black copper, copper smelting
Description:	Metallic substance produced by melting and/or processing of metallic (scrap) and/or oxidic copper bearing materials (slag, oxides, ashes). Black copper is composed primarily of copper, contains other residual ferrous and non-ferrous metals and may contain metal oxides and metal sulphides. Black copper will gradually be transformed into "blister copper" or "anode copper" with higher copper content, during further metallurgical processes

Challenges & solutions

2. Confidentiality of composition – handled by secretariat who developed “generic” composition (= across industry)

- Boundaries: generic elemental composition lists all known constituents and describes elemental composition across industry, derived as follows for each elemental constituent:
  - Typical concentration = average of Legal Entity typical concentrations;
  - Minimum concentration = minimum of Legal Entity typical concentrations;
  - Maximum concentration = maximum of Legal Entity typical concentrations.
- UVCB substance: number of constituents is relatively large and/or variability of composition is relatively large or poorly predictable -> concentration ranges outside the ones given in the generic composition do not necessarily exclude sameness.
- Metal species were determined based on information available to registrants and/or mineralogical analysis.

Challenges & solutions

- ID card developed by secretariat including:
  - Identification of the UVCB: name, EC nr, CAS nr, description
  - Usual elemental composition and speciation of the UVCB
  - Information on appearance, physical state and properties of the substance
  - Analytical methods for identification of the substance
  - Lead Registrant
  - REACH strategy
  - Classification
  - Reported uses

Challenges & solutions

- ID card example - composition

Table 2. Usual composition

Type	Name of the element	Symbol	Species present	Typical concentration (%)	Concentration range (%)
Precious metals	Silver	Ag	Metallic	6,7	0 - 20
	Gold	Au	Metallic	0,83	0 - 2,5
	Iridium	Ir	Metallic	4,2	0 - 10
	Palladium	Pd	Metallic	12	0 - 25
	Platinum	Pt	Metallic	12	0 - 25
	Rhodium	Rh	Metallic	4,7	0 - 10
	Ruthenium	Ru	Metallic	5	0 - 10
Other metals/ constituents	Aluminium	Al	Al2O3, biotite	0,73	0 - 1,2
	Arsenic	As	As2O3	2,3	2 - 2,6
	Barium	Ba	BaO	0,33	0 - 1
	Bismuth	Bi		0,33	0 - 1
	Calcium	Ca	CaO	2,5	0 - 7,5
	Cobalt	Co	Metallic	0,15	0 - 0,5
	Chromium	Cr	Cr2O3, FeCr2O4	0,39	0 - 1,1
	Copper	Cu	Cu2O, CuSO4, CuS-Cu9S5, CuFeS2	17	6 - 28
	Iron	Fe	Fe3O4, NiFe2O4, Fe3S5O21, FeCr2O4, FeS-FeS2,	16	7,8 - 22

SID refinement process

Site 1: Typical material
% various metals: typical
Form/granulometry: typical

Site 2: Typical material
% various metals: typical
Form/granulometry: typical

.....
......

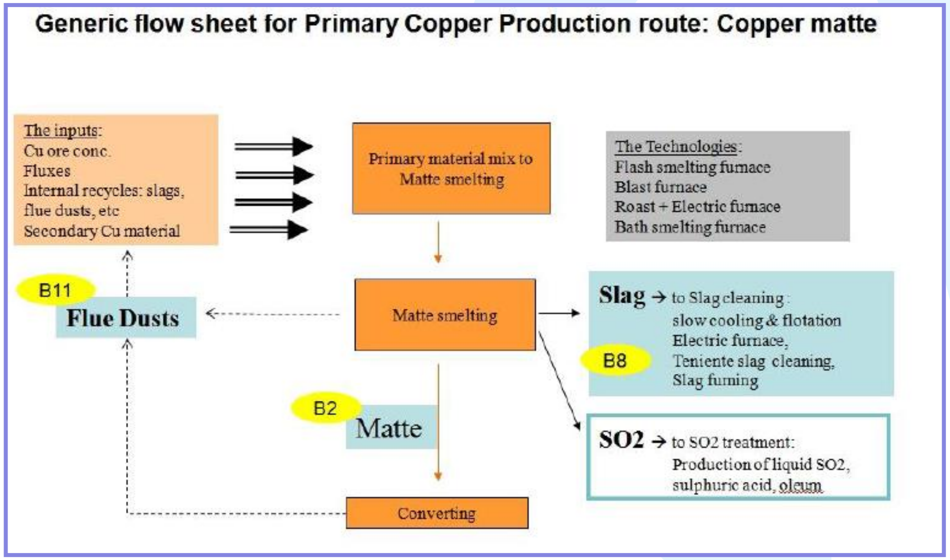
Site n: Typical material
% various metals: typical
Form/granulometry: typical

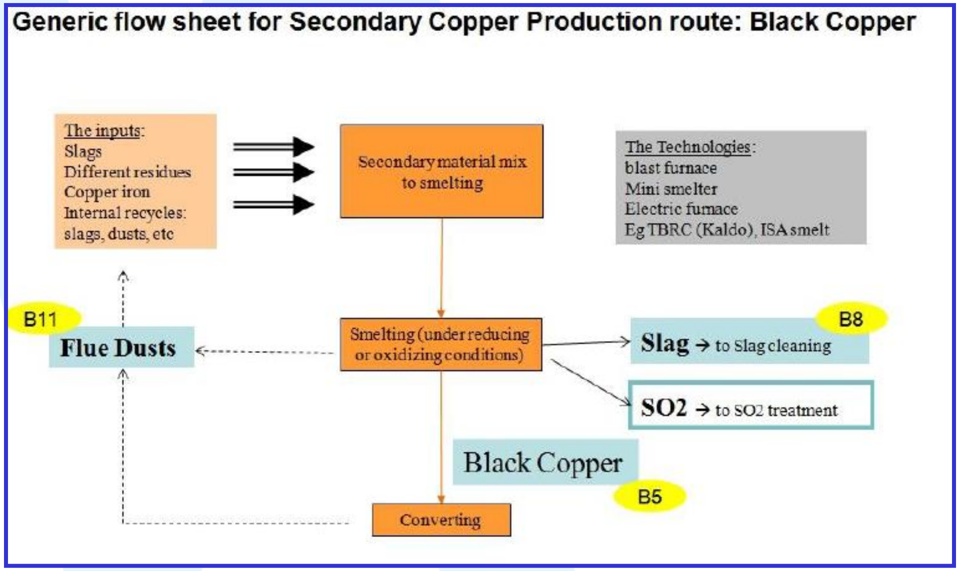
Generic Substance Identity: representing the complex substance produced
Generic process description & origin of the material (eg NFM BREF)
Chemical composition % Cu, Zn, Pb, As, Ni, ….: typicals and ranges across manufacturers
Chemical species: generic, eg oxidic, sulphidic, sulphates, …
Form/granulometry: typical and ranges

Challenges & solutions

3. Metal specific: Input information on sameness is mainly based on processes and "precursors":

Example of similar processes





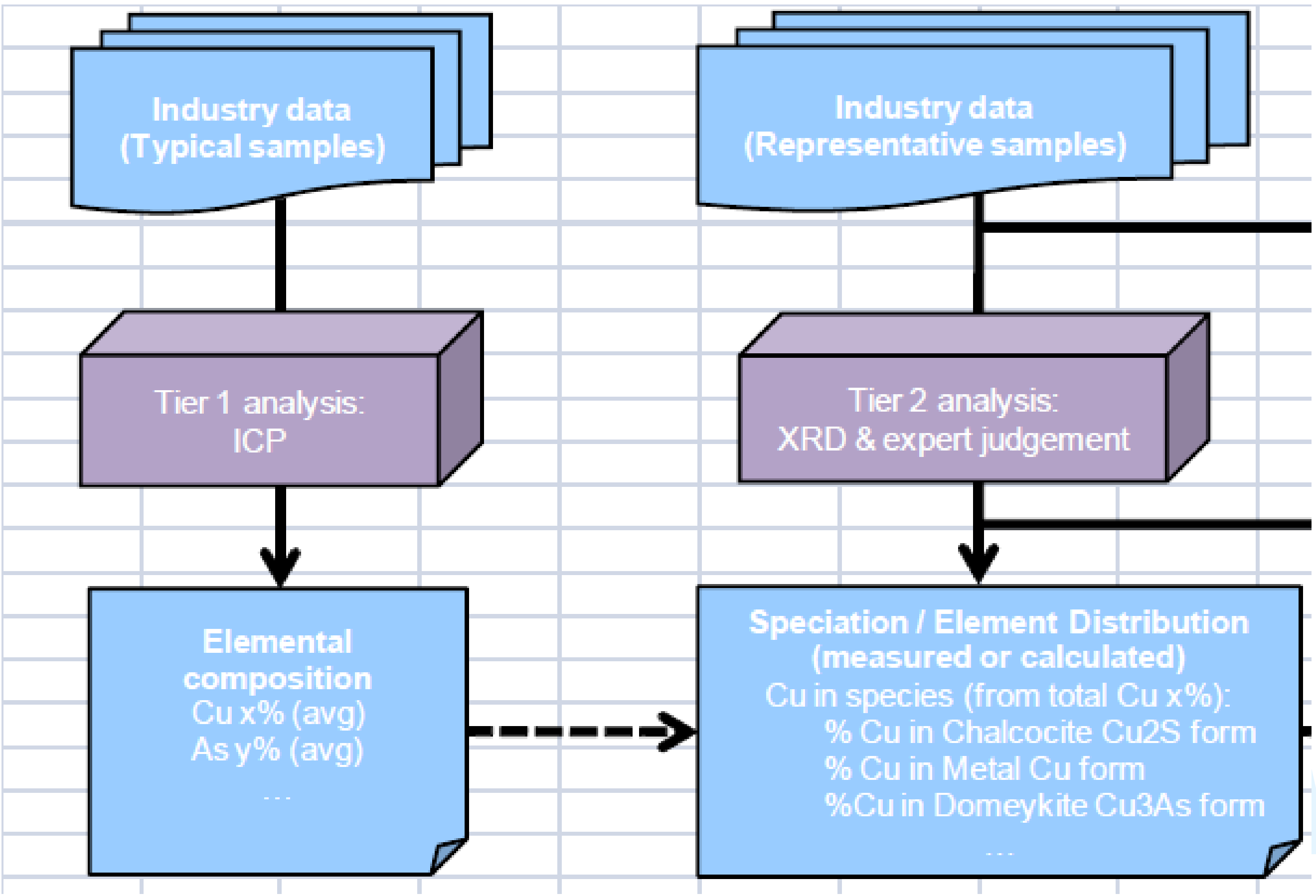
Challenges & solutions

4. Testing and verification of sameness claims:

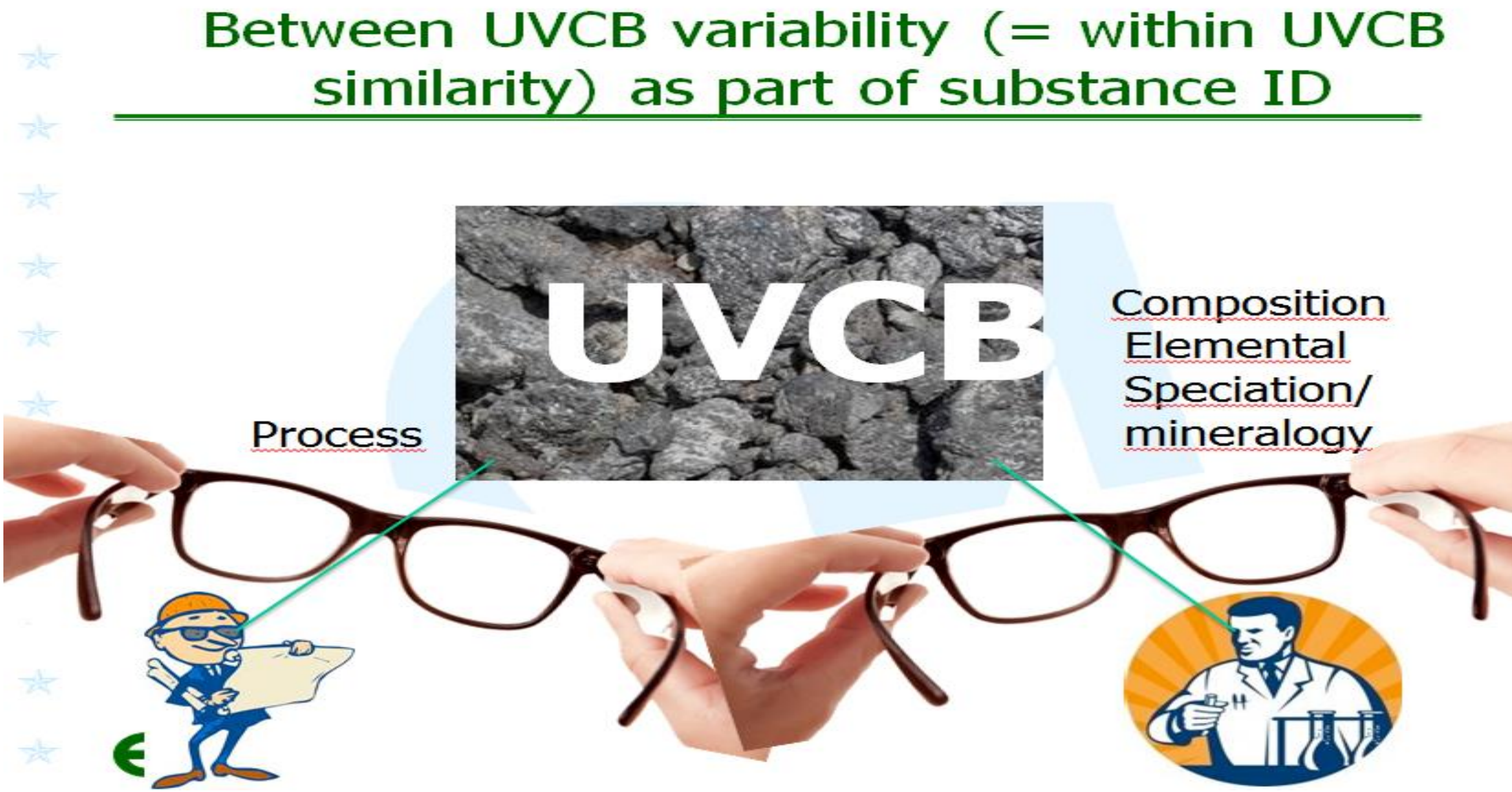
1) Development of standard sampling protocols –for composite samples
2) Identification of uncertainties and selection of representative samples (e.g. flue dusts from secondary & primary smelters) –tiered approach!
3) Determination of (elemental) compositions and mineralogy/speciations, granulometry
4) Evaluation of results and documentation in registrant dossiers

Role of expert judgment to assess uncertainties -example

Typical and representative samples



How was variability addressed?



Variability and the challenge for classification

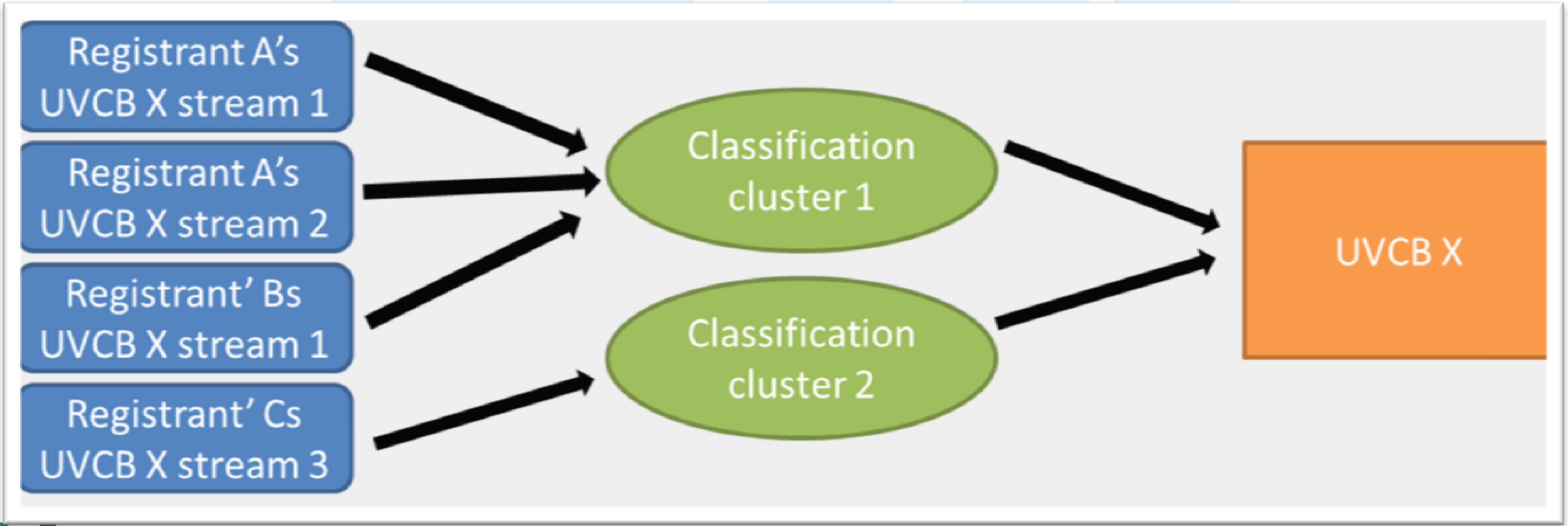
	UVCB: unknown	UVCB: variable	Analytical testing
Elemental composition	Known	Low to large variability	By each registrant
Speciation/ mineralogical composition	Largely known, some unknown	No variability for enriched UVCBs and sometimes large variability for side-product UVCBs	By consortium (representative sample)
Physical appearance	Known	Constant	
Process	Known	Constant/specific for enriched UVCBs, can potentially come from different furnaces/reactors but always "removed" in the same way for side-product UVCBs (e.g. tapping, exhausting leaching, etc…)	

Can lead to different classifications

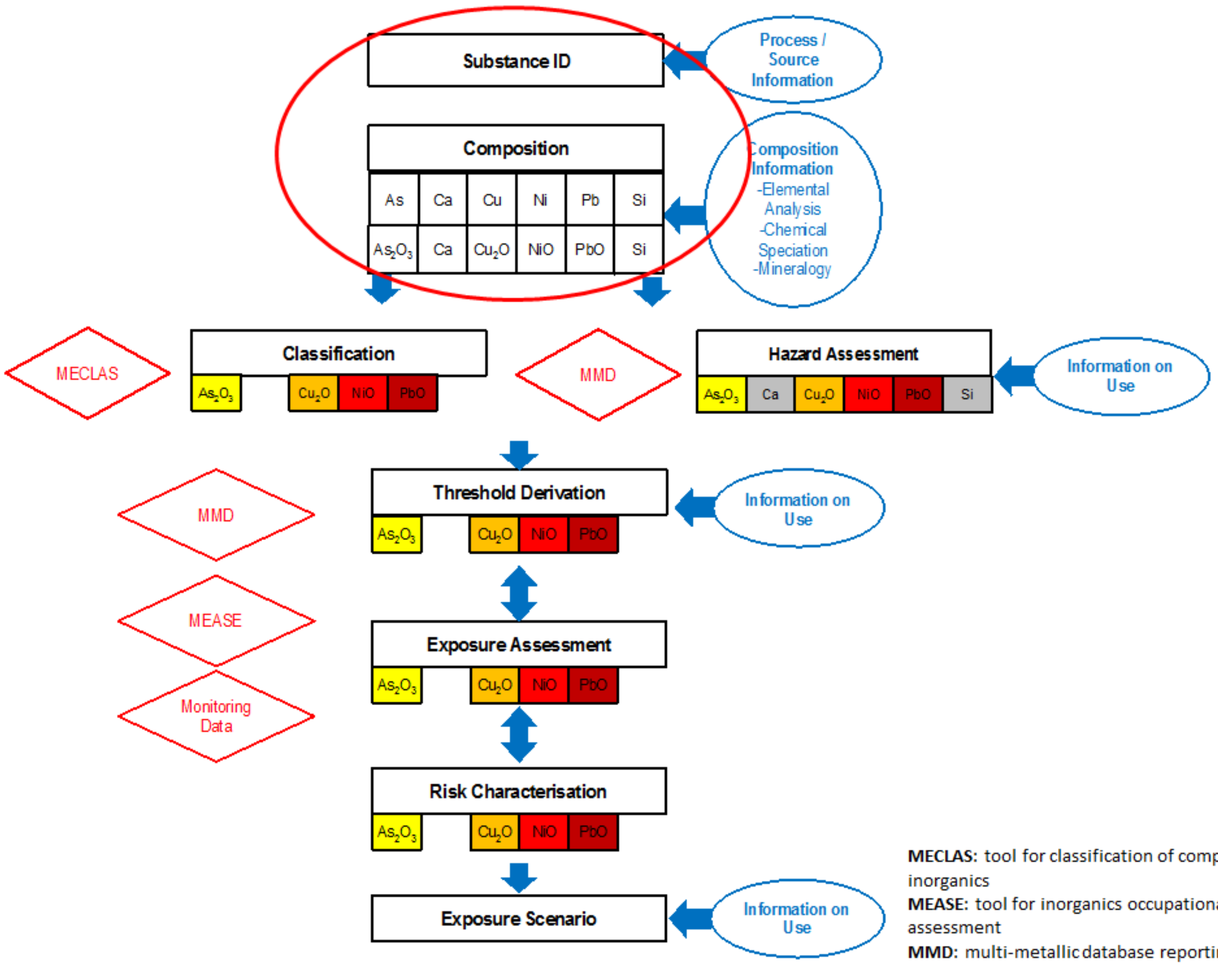
Within UVCB variability and grouping

Objectives:

- to increase understanding of the variability within UVCB (i.e. “capturing” site specific variability and (to a large extend) also variability over time)
- to allow companies to easily derive a worst-case classification for possible new streams (practical feasibility for SDS generation and labelling)



SID approach should be considered in perspective of UVCB assessment



MECLAS: tool for classification of complex inorganics
MEASE: tool for inorganics occupational assessment
MMD: multi-metallic database reporting hazard data, as shared under EM umbrella

Concluding remarks

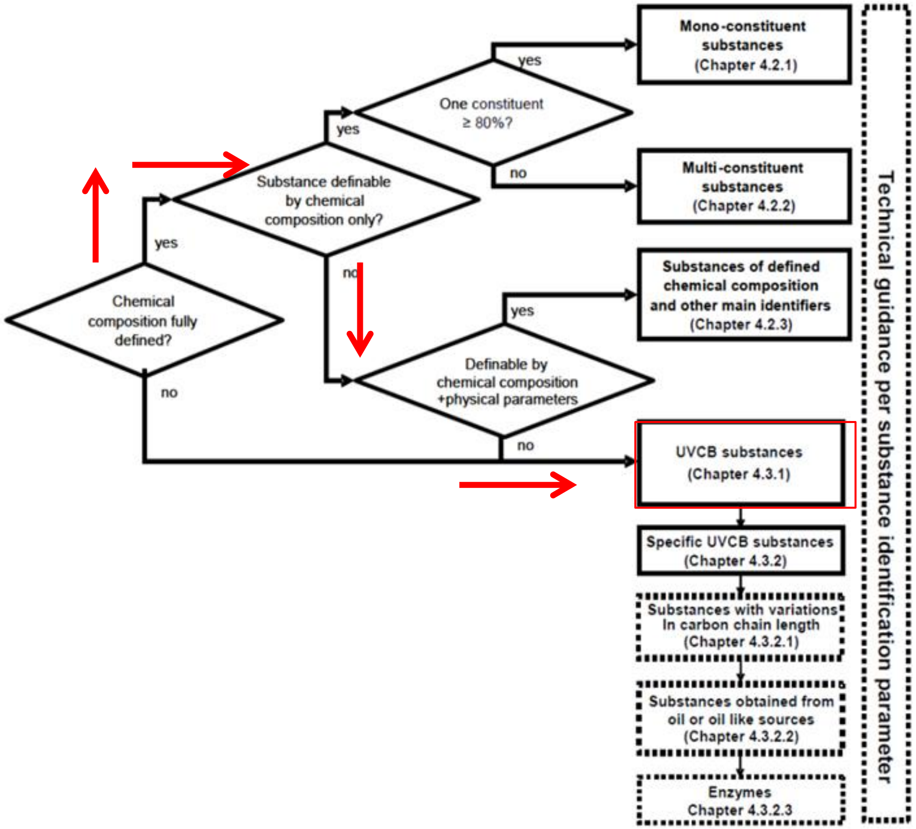
- SID profiles: establishment and maintenance –determinant role of source, process (e.g. NFM BREF notes) and main constituent(s)
- Hazard profiles – 1 (UVCB) substance but eventually several (classification) grades
- Progress in technologies – e.g. late joiner: SID profile and common testing protocol are basis for evaluation (”reasonable” level of details to be agreed upfront)
- Impact from progress in analytical techniques periodic re-assessment of classifications/hazard profiles necessary

Back-up slides

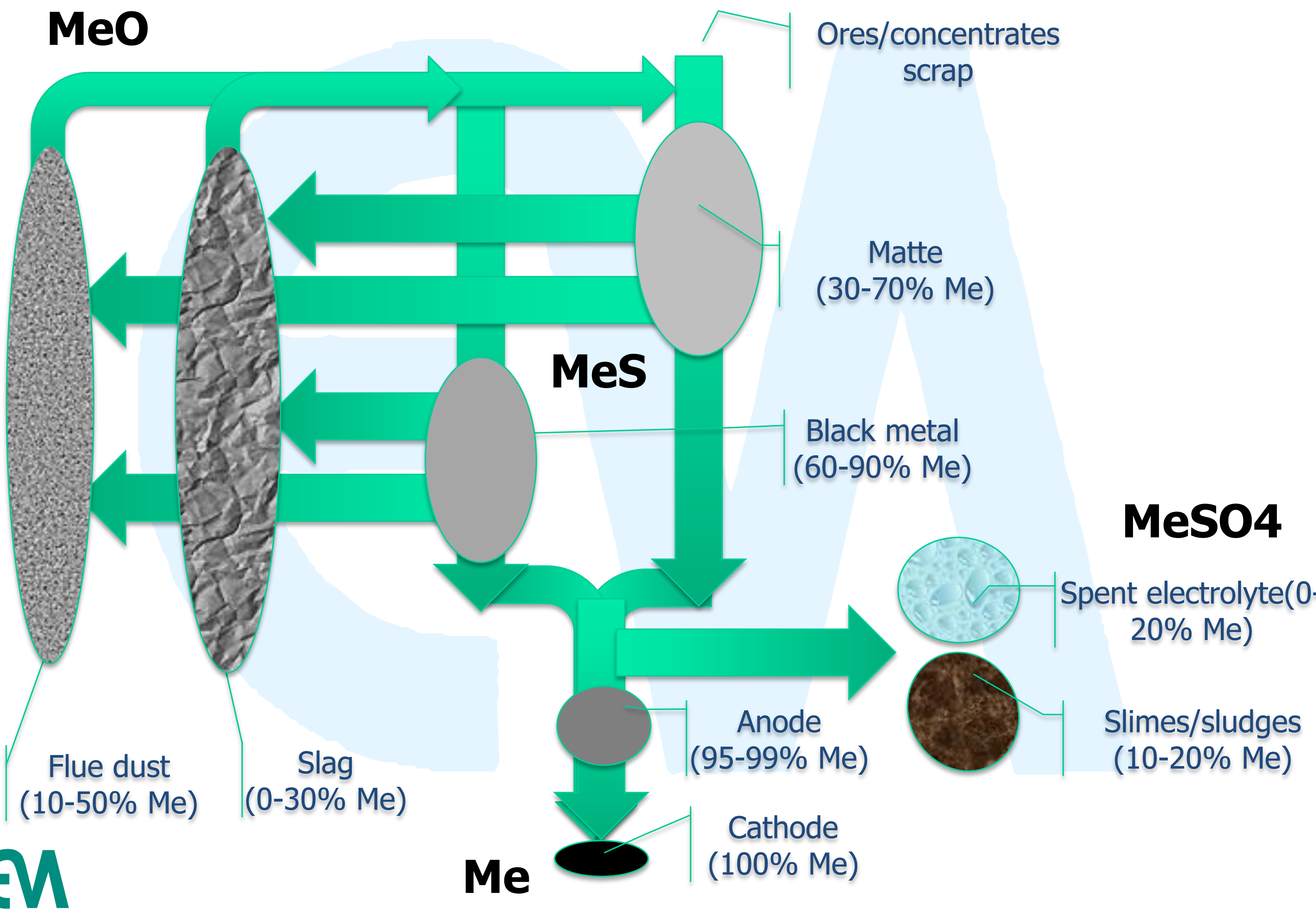
Back-up : UVCBs, why?

- Variability is the driver
- UVCBs defined according to ECHA guidance

Figure 4.1:Key to guidance document chapters and appendices for appropriate guidance for various types of substances

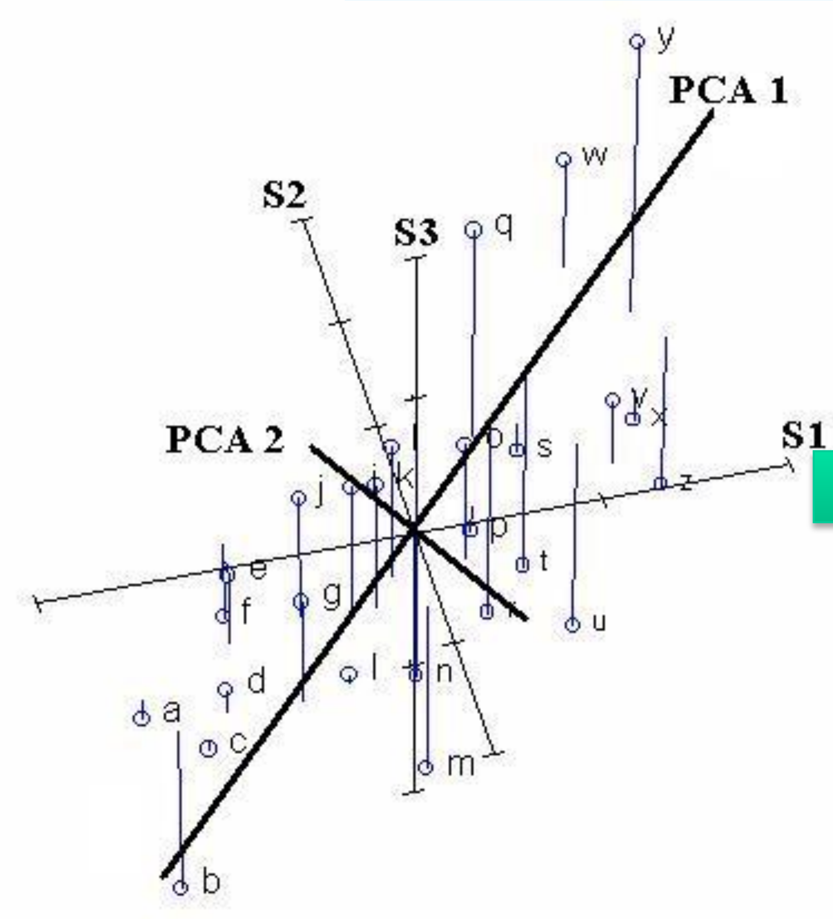


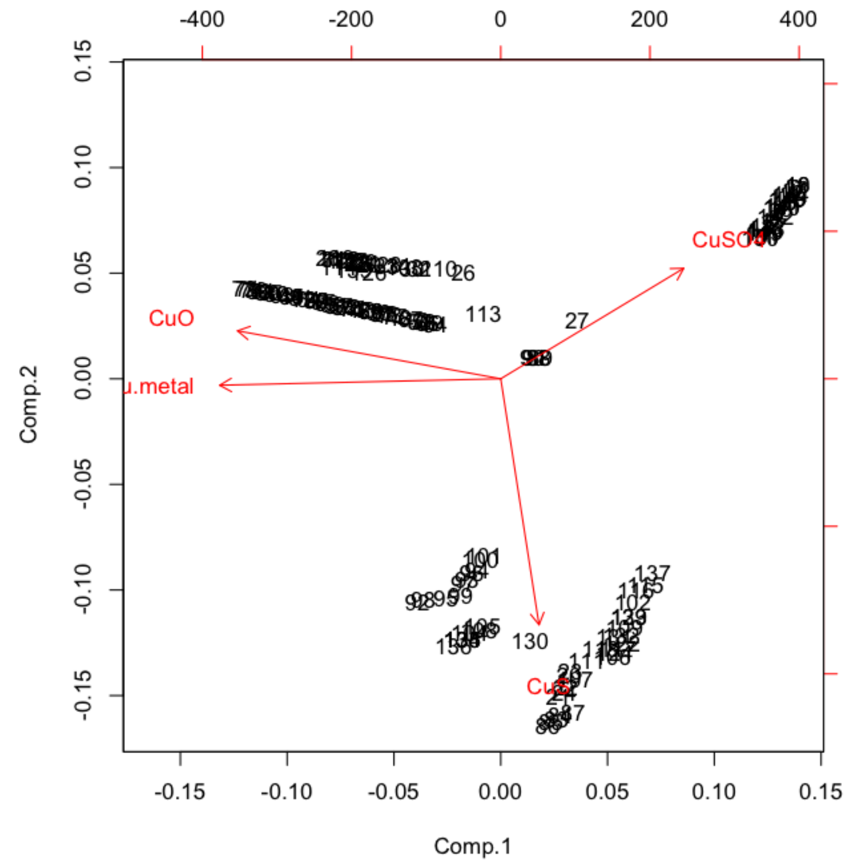
Process driven perspective: example



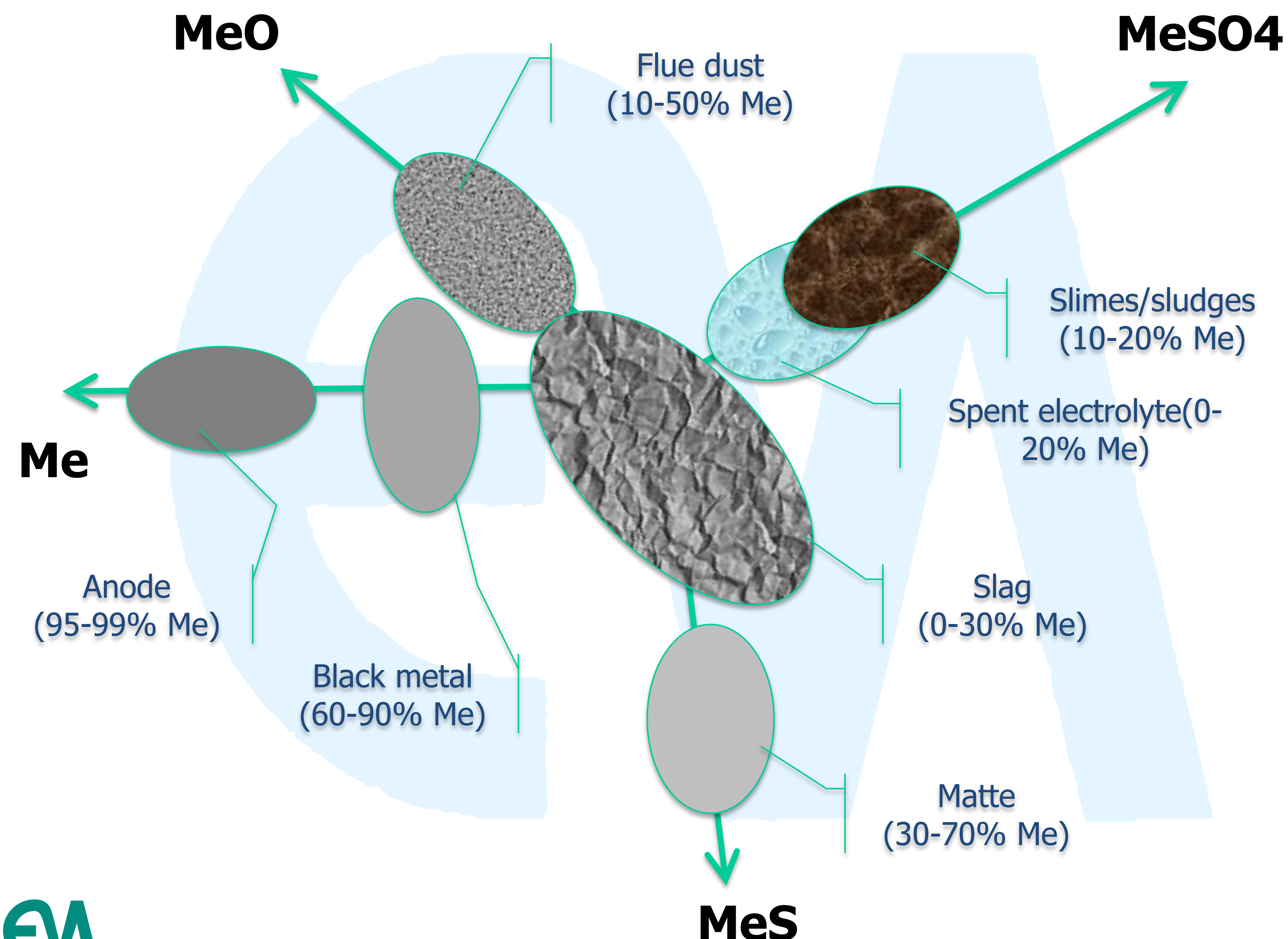
Composition driven perspective

Principal component analysis:
Multidimensional speciation data set reduced to 2 dimensions





Composition driven perspective: example



Composition driven perspective