

*Stepwise approach for
Generic Exposure Scenarios
for metals:
main principles and workflow*

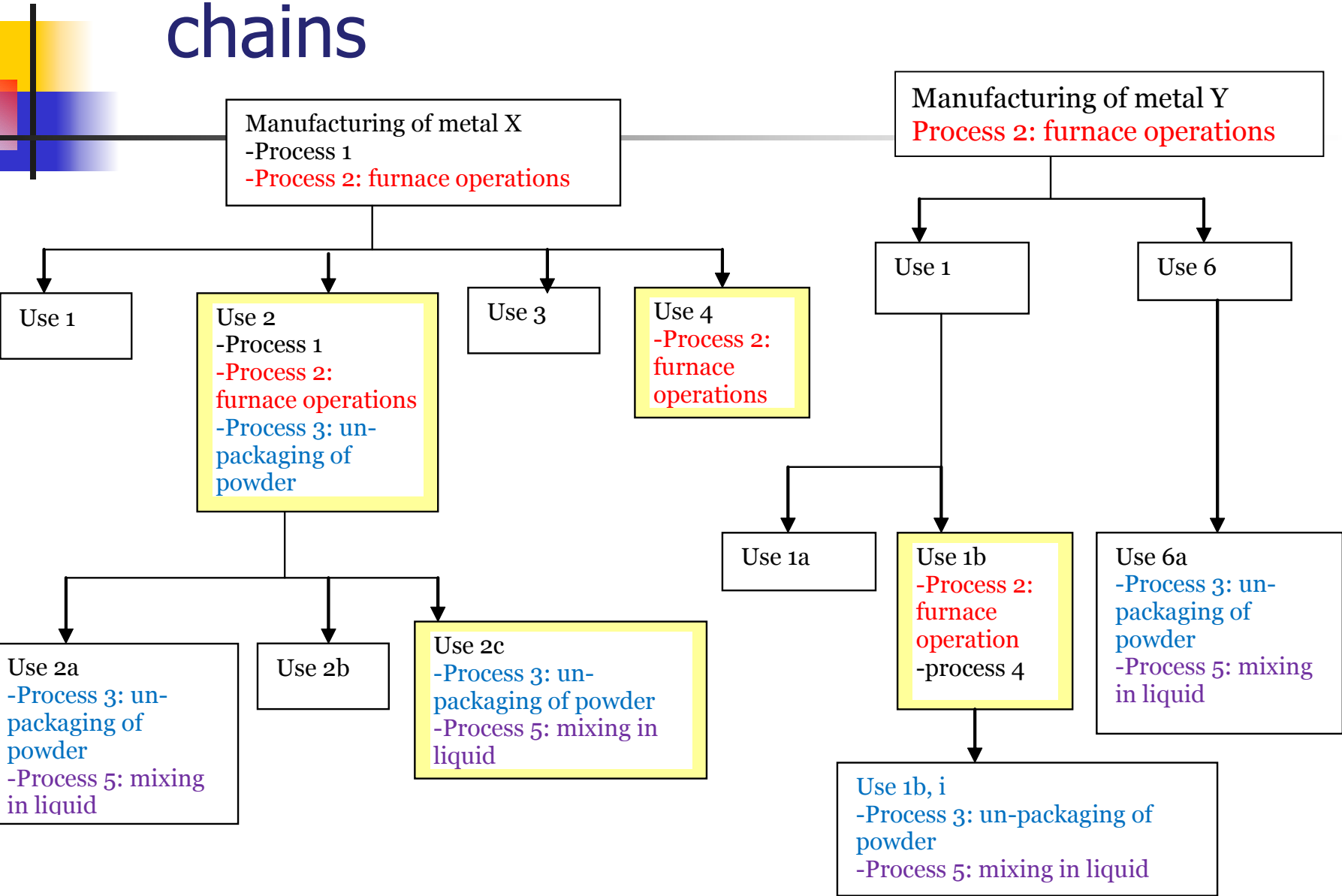


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Getting to generic exposure scenario basics

- Exposure scenarios (ES) under REACH are focused on **exposure and how to control it**
- All uses of the substance throughout the supply chain need to be covered by an ES
- Metal supply chains are
 - Complex, many uses, but
 - Characterized by similar processes

Common elements in metal supply chains



Similar elements of process and exposure

- In the (Metals) industry supply chains, **common processes** can be identified
 - Between different metals
 - Between different uses
- It is anticipated that when processes are similar, the exposure pattern and the way to control exposure will also be similar
- Similar process = similar exposure pattern = similar RMMs

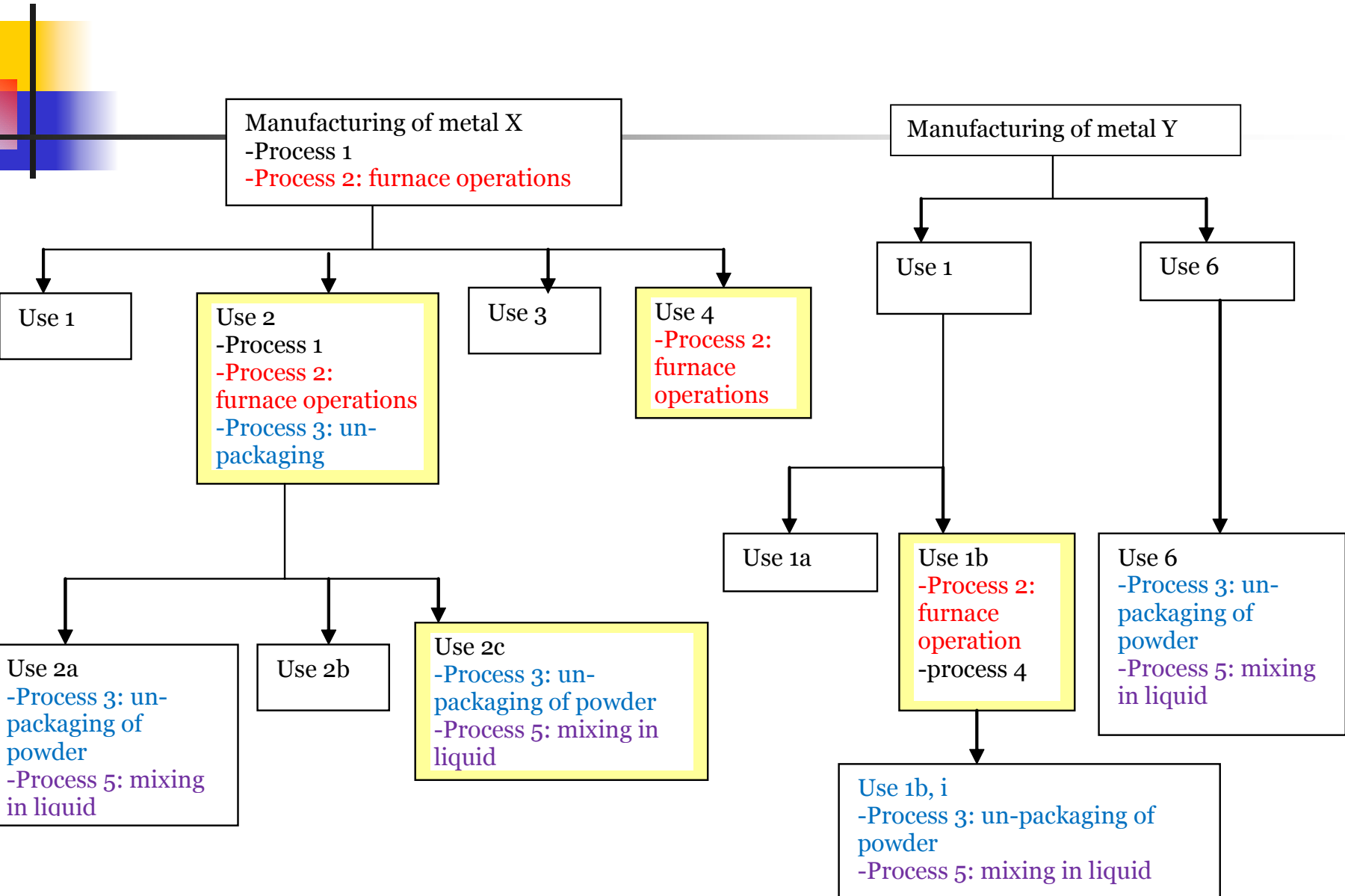
Generic exposure scenarios (GES) to facilitate covering (many) different uses

- GES describes the Operational Conditions, related RMMs and exposure associated with the use of a substance/product in a given, similar process
- By definition, they cover a broad range of conditions of use
 - Within one given metal (more specific)
 - Between different metal substances
- They can provide a starting basis for developing the specific ES covering specific uses
 - they should enable to integrate input from DU
 - They should enable communication of good industry practice

A stepwise approach for developing GES for metals: 1. Data collection

- By registrant, with help from user
 - Compilation of an inventory of applications of the metal, together with a determination of the uses
 - Mapping of the supply chain, identification of the processes involved
- Information sources
 - Product stewardship, technical and commercial activities
 - Dialogue with customers
 - Existing RAs
 - DU associations
 - ...

Common elements in Supply chains



A stepwise approach for developing GES for metals: 2. characterisation

- **Characterise** processes with respect to
 - how they are supported by operational conditions (OCs)
 - What type of exposures routes are possible/relevant = qualitative exposure information
 - What risk management measures (RMMs) are taken
- Use a matrix to get overview
- Check similarities of OC, RMMs, and exposure routes
- ⇒ Group common processes

Quantitative characterisation

Process	User group	Task description	OC, physical form	RMMs	Relevant exposure
Smelting / hot metal production	industrial	Loading, melting	Large volume Full day shift Elevated T° Molten metal	(semi-) enclosed system LEV	Inhalation of fumes
Smelting / hot metal production	industrial	casting	Large volume Full day shift Elevated T° Molten metal	Open or semi-closed system LEV	Inhalation of fumes
Smelting / hot metal production	industrial	Loading etc	Large volume Full day shift Elevated T° Molten metal	Open system LEV	Inhalation of fumes
Welding	professional	welding	Small volume Massive metal,	Open system Ventilated area	Inhalation of fumes

Grouping

Process	User group	Task description	OC, physical form	RMMs	Relevant exposure
Furnace / hot operation					
production	industrial	Loading, melting	Large volume Full day shift Elevated T° Molten metal	(semi-) enclosed system LEV	Inhalation of fumes
		casting	Large volume Full day shift Elevated T° Molten metal	Open system LEV	Inhalation of fumes
by production	industrial	Loading etc	Large volume Full day shift Elevated T° Molten metal	Open system LEV	Inhalation of fumes
lding	professional	welding	Small volume Massive metal,	Open system Ventilated area	Inhalation of fumes

A stepwise approach for developing GES for metals: 3. Draft GES

- the registrant will draft the GES, using the information collected and will also include a **risk characterisation step**, i.e.
 - the comparison of quantitative exposures based on available data or modelling estimates with DNELs and/or PNECs.
 - For quantitative assessment, exposure tools or measurement data are needed

Quantitative exposure estimation for the GES

- Exposure information may be available, but is usually quite sparse, especially with the users
 - Databases, RAs, Biological monitoring, Emission data...
- The further down the supply chain, the more difficult to get precise exposure information
- Measured data \Rightarrow exposure modeling
 - Exposure models are always (very) conservative
 - Measurements will often be needed

Risk characterisation in the (G)ES

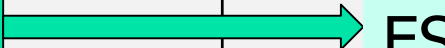
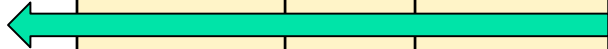
- ⇒ Consider hazard profile of the substance
- Assess risk ratios
- here, GES becomes metal-(hazard profile)-specific: ES
 - RMMs have to be specified considering the hazard profile
- “no risk” situation has to be described

Hazard profile

Areas of use	Task description	Operational conditions / Physical form	RMM	Exposure endpoint	Predicted exposures		Predicted risk RCR	Additional RMMs that would be recommended
					Value	Tool used to estimate exposure (measured/model)		
Conservative estimates								
<i>Furnace operations</i>								
Production				Soil		EUSES	Yes	To be discussed further
				Water		e.g. measured	No	
				Air		EUSES		
				Inhalation		EASE or equivalent		
				Dermal		EASE		

GES

ES

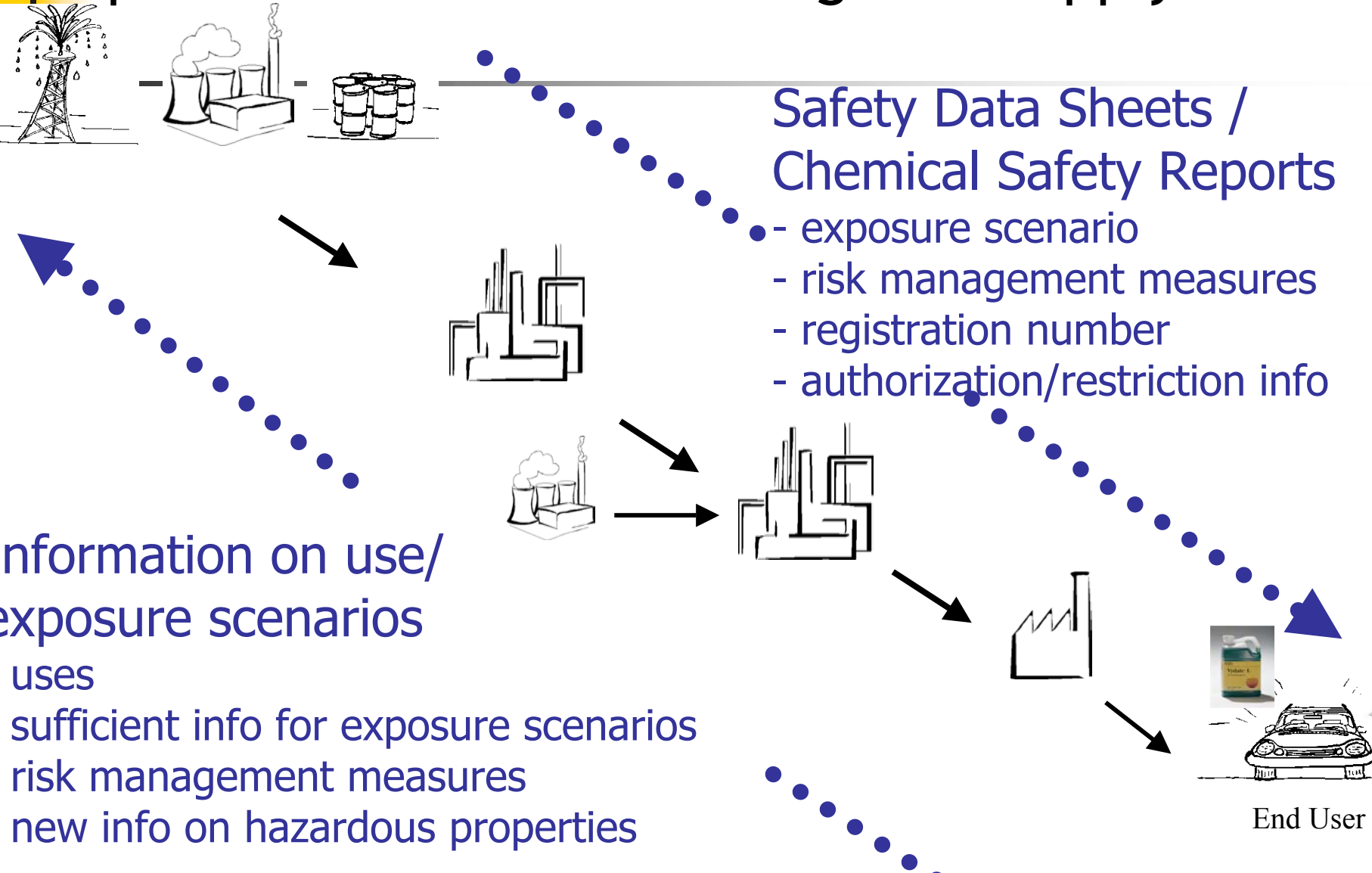


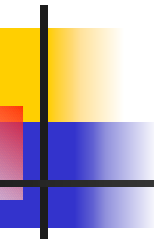
Conservative estimates



Developing and concluding the ES for metals:

Step 4: Communication through the supply chain





Refinement of the ES through Interaction with the supply chain

The user will consider the default GES in the light of his conditions and check whether the GES covers his conditions

In particular, the DU will check the operational conditions and the Risk Management Measures as proposed in the GES

The exposure tools will allow the DU to check his exposure. If still too high exposure, additional RMMs need be integrated

Further communication between supplier and user will refine the ES until all operations are covered

Interactions with the supply chain

- Preferred: interaction with European/national users organisations
 - e.g.: EU general galvanisers
 - Cover whole sector
 - Can communicate directly with their members
- If no organisation: representative companies
 - Coverage?
 - Multi-metallic questionnaire for data generation

Exposure (calculation) tools



Workers: exposure estimates, preferably based on measured (metal) data

- Exposure estimates have been made for a number of typical metal processes

Environment: Exposure Calculator Tool (based on EUSES)

- DU have option to include local conditions

Generic exposure scenarios for workers prepared by the EM ES WG (e.g.):

- Handling of ores, concentrates, raw metal oxides and scrap
- Activities at smelters, furnaces, refineries, coke ovens including oxides production
- Sand and die casting, tapping and casting of melted solids, drossing of melted solids, hot dip galvanising
- Metal powder production by hot (atomisation, dry dispersion) and wet (electrolysis, wet dispersion) metallurgical processes, spinning (fibres)
- Leaching processes, use in closed, continuous process with occasional controlled exposure (including solvent extraction)
- Packaging, unpacking, mixing/blending and weighing of metal powder/inorganics
- Mixing of powdery material into batch processes (mixing with liquid)
- **Electrolysis at low temperature sulphuric acid**

GES catalogue for typical metal processes (EM ES WG)

Processes	Industrial Category	PROC	Operational conditions (OC)	Temperature of the process	Physical form of material	Physical form of exposure	Fugacity*	Relevant exposure routes for workers	inhalation ECETOC
Example: Activities filters, es, refineries, vens ing oxides ction	Please specify if industrial and/or professional activity	Please indicate here PROC from current PROC list (see PROCs sheet)	Please specify volume (large or small) and give an estimation of duration of activity (>4 hours (default), 1-4 hours, 15 min-1 hour, <15 min)	Please estimate if process takes place at high or low (ambient) temperature	Please specify form of handled material: powders, massive, liquid	Please specify form to which workers are exposed to	for PROCs 21-25, defined according to melting points, for other PROCs defined on the basis of e.g. dustiness	Please specify relevant exposure routes for workers: inhalation and or dermal	Please pr estimates ECETOC-T relevant l or other modell estimates may have from EBR
ng of ores, ntrates, raw oxides and	Industrial	4-8b	large volume, >4 hours/day	ambient temperature	powders, massive	dust	massive: low, powders: high	inhalation, dermal	high fugacit 25 mg/ low fugacit 0.1 mg/

Example: Electrolysis at low temperature (sulphuric acid)

ROC code	2 (Continuous process but where the design philosophy is not specifically aimed at minimizing emissions. It is not high integrity and occasional expose will arise e.g. through maintenance, sampling and equipment break-ins)
Operational conditions	large volume, > 4 hours/day
Process temperature	moderate (between room temperature and 100°C)
Physical form of material	liquid
Physical form of exposure	Mist, liquid
Volatility/dustiness	moderate because of low temperature
Relevant exposure routes	Inhalation (and dermal)

Example: Electrolysis at low temperature (sulphuric acid)

exposure assessment

Inhalation tier 1 (ECETOC TRA or other source)	moderate fugacity: 0.5 mg/m³
Inhalation: measured	0.02-0.05 mg/m³
Dermal tier 1 ECETOC TRA or other source	LEV present: 2 µg/cm²/day (480 cm²) No LEV present: 200 µg/cm²/day (480 cm²)
Dermal: measured	/
Generic risk management measures	Covered system, Local ventilation, Protective clothing (acid protection category ?)



remarks

- (G)ES need always be checked for relevancy
 - Also if “no risk” is described by default in tier 1
- EM GES catalogue to be further developed and refined with more metal-specific exposure data
- Default exposure estimates are usually very high
 - refinement or measured data is often required



Conclusions

- Generic exposure scenarios may facilitate the task of covering many different ES for different uses
- Focus on common processes with common OCs and common RMMs
- May be used as a starting point for further refinement with specific users to be developed into specific ES
- Metal specific exposure assessment tools are critical for development of realistic scenarios
- EM GES catalogue is under development