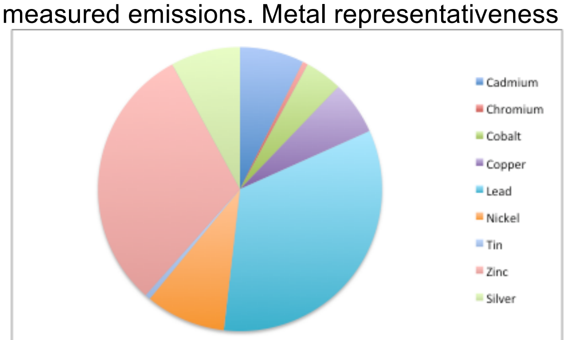
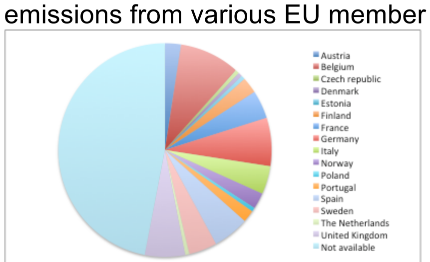
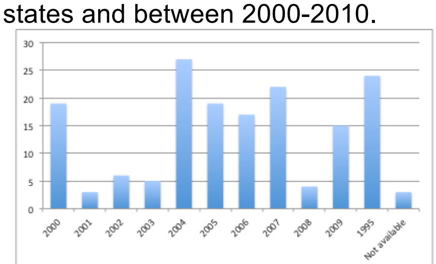
Section	Content
Title of spERC	Manufacture and recycling of massive metal and metal powder
spERC code	Eurometaux 1.1.v2.1
Scope	Limitations of coverage compared to ERC relate to: **User groups:** Manufacture and recycling of massive metal or metal powder from both primary (derived from ores) and secondary raw materials (from indigenous scrap and residues). This SPERC does not cover production of organic or metallo-organic substances and mining and ore treatment at the mine site and producers of metal compounds. **Substance groups or functions**: Release defaults are derived from measured emissions. Metal representativeness of background data:  Metal (compound) is defined here in a broad sense. The definition includes alkali metals, alkaline earth metals, transition metals, post-transition metals, metalloids and their compounds but excludes non-metals, halogens, noble gases and metallo-organic compounds. SPERC valid for metals with solid water partition coefficient for suspended matter between 10,000 L/kg and 400,000 L/kg. **Types of products**: The product of the industry is either refined metal (powder) or semis/semi manufactures, i.e. metal cast ingots or wrought shapes, extruded shapes, foil, sheet, strip, rod, etc. **Geographical and Time:** Release defaults are derived from measured emissions from various EU member states and between 2000-2010.  
Related use descriptors	PROC 22, PROC 23, PROC 26, PROC 27a, PROC 27b SU 14, ERC1
Operational conditions	Since metal SPERCs are based on measured data at end-of-pipe on-site, all processes are integrated in the release fractions from raw materials handling to cleaning and maintenance. **Size of installations:** Amount used can vary between 1 and 320,000 Tonnes/year. **Processing conditions:** Open and closed systems, wet and dry processes.

	Emission to Air: Emissions to air arise from storage, handling, pre-treatment, pyro-metallurgical and hydrometallurgical stages. Transfer of material is particularly important. **Emission to Water:** The main sources of the most important effluent streams are wet off-gas cleaning, slag granulation, cooling water, surface run-off and other process waters from hydro-metallurgy. Process integrated measures such as recycling and/or reuse of water are already successfully used in one or more processes of the non-ferrous metal industry.
Obligatory onsite RMMs	**Air** Direct air emissions should be reduced by implementing one or more of the following RMMs: • Electrostatic precipitators using wide electrode spacing: 5 – 15 mg/Nm^3 • Wet electrostatic precipitators: < 5 mg/Nm^3 • Cyclones, but as primary collector: < 50 mg/Nm^3 • Fabric or bag filters: high efficiency in controlling fine particulate (melting): achieve emission values < 5mg/Nm^3. Membrane filtration techniques can achieve < 1 mg/Nm^3 • Ceramic and metal mesh filters. PM10 particles are removed: 0.1 mg/Nm^3 • Wet scrubbers: < 4 mg/Nm One or more of these RMMs (of which fabric or bag filters and wet scrubbers are more common) were reported to be present in more than 90% of the sites. Overall range of reported RMM efficiencies ranged between 90% and 99.98%. Fugitive emissions should be reduced from material storage and handling, reactors or furnaces and from material transfer points by following hierarchical measures: process optimization and minimization of emissions, sealed reactors and furnaces, targeted fume collection. **Water** Following IPPC-BAT document, the treatment methods are very much dependent on the specific processes and the metals involved. Direct water emissions should be reduced by implementing one or more of the following RMMs: • Chemical precipitation: used primarily to remove the metal ions (e.g. $Ca(OH)2$, pH 11 precipitation: >99% removal efficiency; $Fe(OH)3$, pH 11: 96% removal efficiency) • Sedimentation (e.g. $Na2S$, pH 11, >99% removal efficiency) • Filtration: used as final clarification step (e.g. ultrafiltration, pH 5.1: 93% removal efficiency, nanofiltration: 97% removal efficiency, reverse osmosis, pH 4-11: 99% removal efficiency) • Electrolysis: for low metal concentration (e.g. electrodialysis: 13% removal efficiency within 2 hours at 2g/L, membrane electrolysis, electrochemical precipitation, pH 4-10, >99% removal efficiency) • Reverse osmosis: extensively used for the removal of dissolved metals • Ion exchange: final cleaning step in the removal of heavy metal from process wastewater (e.g. 90% removal efficiency for clinoptinolite and 100% removal efficiency for synthetic zeolite) One or more of these RMMs were reported to be present in >90% of the sites for massive metal production. The 50^{th} percentile of reported site-specific removal efficiency for 40 sites is 99% (range between 90% and 99.98%). More information can be found in EC (2001), Integrated Pollution Prevention and Control (IPCC): reference document on Best Available Techniques in the Non Ferrous Metals Industries.

<table>
<tr><td></td><td>Waste
Releases to the floor, water and soil are to be prevented. If the metal content of the waste is elevated enough, internal or external recovery/recycling might be considered.</td></tr>
<tr><td>Substance use rate</td><td>Assessment defaults as set by ERC 1. It is recommended to use a realistic substance use rate.</td></tr>
<tr><td>Days emitting</td><td>Default number of emission days are derived from a multi-metal background database of measured site-specific release factors collected under the former Directive of New and Existing Substances and REACH 2010 registration dossiers.
<table><tr><td>218 days/year</td><td>This is the 10th percentile of reported site-specific number of emission days for 121 sites from production of massive metal and metal powder.</td></tr></table></td></tr>
<tr><td>Integrated release factors (air, water, soil)</td><td>Default release factors are derived from a multi-metal background database of measured site-specific release factors collected from peer-reviewed EU Risk Assessment Reports under the former Directive of New and Existing Substances and REACH 2010 registration dossiers.

Air
<table><tr><td>0.03% (release after RMM)</td><td>The 90th percentile of reported site-specific release factors to air for 111 sites from the production of massive metal and metal powder</td></tr></table>
Water
<table>
<tr><td>Kd* (L/kg)</td><td>Release factor</td><td>Justification</td></tr>
<tr><td>< 10,000</td><td>6% (before on-site STP)</td><td>Assessment default as set by ERC 1</td></tr>
<tr><td>10,000 – 400,000</td><td><table><tr><td>Kd</td><td>Release factor**</td></tr><tr><td>10,000 – 25,000</td><td>0.03%</td></tr><tr><td>25,000 – 60,000</td><td>0.01%</td></tr><tr><td>60,000 – 190,000</td><td>0.005%</td></tr><tr><td>190,000 – 400,000</td><td>0.002%</td></tr></table>** after on-site STP</td><td>Realistic worst-case regression line (RF = 10^(0.043 – 0.915 x log(Kd)) of the metal-specific 90th percentile reported site-specific release factors to wastewater for 142 sites from the production of massive metal and metal powder</td></tr>
<tr><td>> 400,000</td><td>6% (before on-site STP)</td><td>Assessment default as set by ERC 1</td></tr>
</table>* Kd = solid water partition coefficient for suspended matter

A relationship between solid-water partitioning coefficient for suspended matter Kd and the release factor to water can be justified because the Kd expresses the distribution between aqueous phase and suspended matter. Kd is an important parameter impacting the removal efficiency especially in sedimentation and precipitation RMMs but also in on-site runoff, cleaning operations, wet processes, etc… The four upper outlying data points around Kd of 125,000 L/kg are caused by two sites with multiple year data.</td></tr>
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	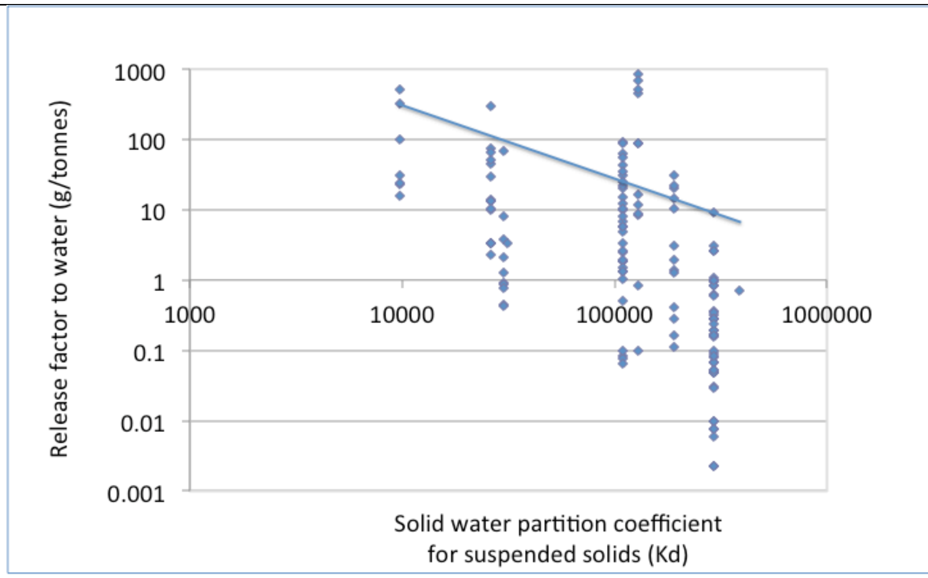 **Soil** Not applicable to local scale **Waste** 2.3% — The 90th percentile of reported site-specific release factors to solid waste for 62 manufacturing sites covering zinc, nickel, lead, cobalt, cadmium, antimony
Optional risk management measures for iteration	For iteration purposes (if SPERC default release factors do not demonstrate safe use), it is recommended to measure/monitor the air and/or water releases as a first refinement step. In case further iterations are required, a combination of multiple obligatroy on-site measures can be considered.
Narrative description	Since metal SPERCs are based on measured data at end-of-pipe on-site, all indicated PROCs are integrated in the release fractions from raw materials handling to cleaning and maintenance. The range of raw materials available to the various installations is wide and this means that a variety of metallurgical production processes is used: hydrometallurgical and pyrometallurgical processes. The hydrometallurgical winning process with acids and alkalis involves roasting, leaching, purification and electrolysis. The pyrometallurgical winning process involves roasting, sintering, blast furnacing, condensing and refining/casting. Loading of anodes in tank. Deposition of powder on cathodes. Discharge of powder, washing and drying. Removal of spent anodes. Raw materials handling, cleaning of equipment and storing of produced massive metal and metal powders are also included in the scope. Hazardous wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately to hazardous waste incineration plants or hazardous waste landfills as hazardous waste.
Scaling	If a site does not comply with the conditions stipulated in the SPERC, it is recommended to monitor the air and water releases and apply the Metals DU scaling tool in order to perform a site-specific assessment. Each site can evaluate whether he works inside the boundaries set by the ES through scaling. The Metal EUSES calculator for DUs is freely available to metal industry DUs and can be downloaded from http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool.