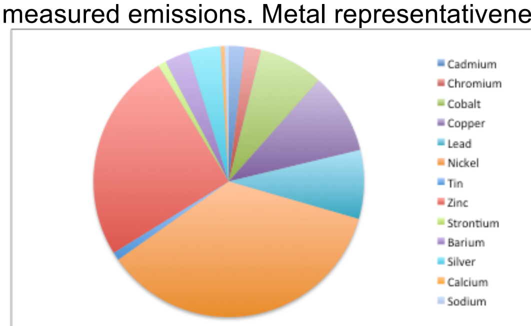
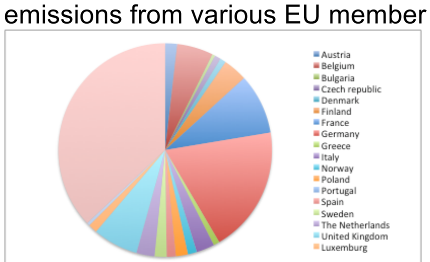
<table>
<tr><th>Section</th><th>Content</th></tr>
<tr><td>Title of spERC</td><td>Manufacture of metal compounds</td></tr>
<tr><td>spERC code</td><td>Eurometaux 1.2.v2.1</td></tr>
<tr><td>Scope</td><td>Limitations of coverage compared to ERC relate to:

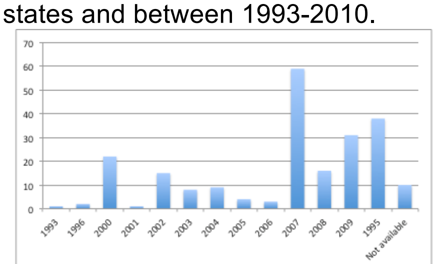
User groups: Manufacture of metal compounds. This SPERC does not cover production of organic or metallo-organic substances and mining and ore treatment at the mine site and producers of massive metal.

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 1,000 L/kg and 400,000 L/kg.

Types of products: Metal compound

Geographical and Time: Release defaults are derived from measured emissions from various EU member states and between 1993-2010.




</td></tr>
<tr><td>Related use descriptors</td><td>PROC1, PROC2, PROC3, PROC4, PROC8b, PROC9, PROC 22, PROC 23, PROC 26, PROC 27a, PROC 27b
SU 14, ERC1</td></tr>
<tr><td>Operational conditions</td><td>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 1,300,000 Tonnes/year.
Processing conditions: Open and closed systems, wet and dry processes.</td></tr>
<tr><td>Obligatory onsite</td><td>**Air**</td></tr>
</table>

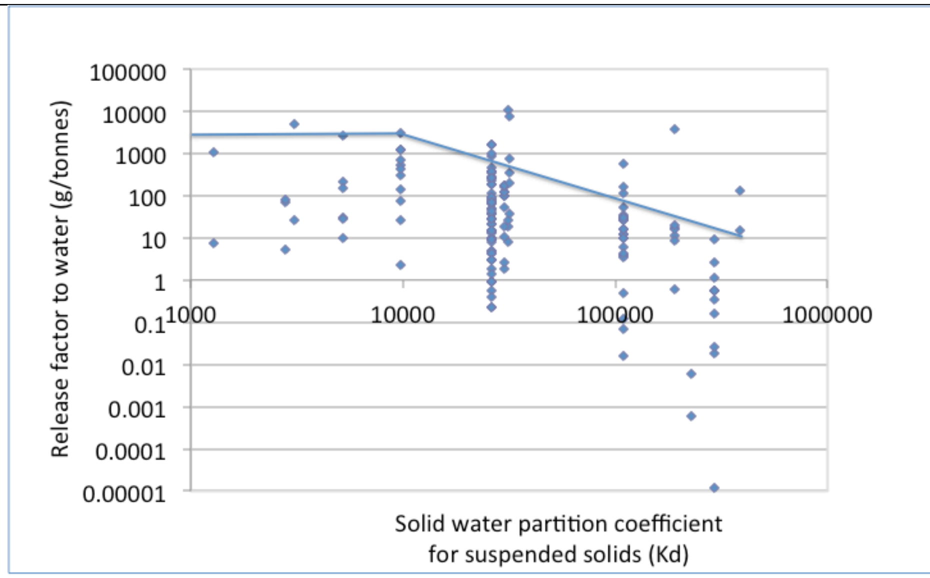
RMMs	Direct air emissions should be reduced by implementing one or more of the following RMMs: • Electrostatic precipitators using wide electrode spacing: 5 – 15 mg/Nm³ • Wet electrostatic precipitators: < 5 mg/Nm³ • Cyclones, but as primary collector: < 50 mg/Nm³ • Fabric or bag filters: high efficiency in controlling fine particulate (melting): achieve emission values < 5mg/Nm³. Membrane filtration techniques can achieve < 1 mg/Nm³ • Ceramic and metal mesh filters. PM10 particles are removed: 0.1 mg/Nm³ • 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 >50% of the sites for production. The 50th 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. **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.
Substance use rate	Assessment defaults as set by ERC 1. It is recommended to use a realistic substance use rate.

<table>
<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>182 days/year</td><td>This is the 10th percentile of reported site-specific number of emission days for 168 sites from production of metal compounds.</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 145 sites from the production of massive metal and metal powder</td></tr>
</table>

Water
<table>
<tr><th>Kd* (L/kg)</th><th>Release factor</th><th>Justification</th></tr>
<tr><td>< 1,000</td><td>6% (before on-site STP)</td><td>Assessment default as set by ERC 1</td></tr>
<tr><td>1,000 – 10,000</td><td>0.2% (after on-site STP)</td><td>Reasonable worst-case (90th percentile) (available data too limited to develop robust regression)</td></tr>
<tr><td>10,000 – 400,000</td><td>
<table>
<tr><th>Kd</th><th>Release factor**</th></tr>
<tr><td>10,000 – 25,000</td><td>0.2%</td></tr>
<tr><td>25,000 – 60,000</td><td>0.04%</td></tr>
<tr><td>60,000 – 100,000</td><td>0.01%</td></tr>
<tr><td>100,000 - 190,000</td><td>0.005%</td></tr>
<tr><td>190,000 – 250,000</td><td>0.002%</td></tr>
<tr><td>250,000 - 400,000</td><td>0.001%</td></tr>
</table>
** after on-site STP</td><td>Realistic worst-case regression line (RF = 10^(1.59 – 1.14 x log(Kd)) of the metal-specific 90th percentile reported site-specific release factors to wastewater for 201 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</td>
</tr>
</table>

<table>
<tr><td></td><td>


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…

Soil
Not applicable to local scale

Waste

<table>
<tr><td>2.3%</td><td>The 90th percentile of reported site-specific release factors to solid waste for 62 manufacturing sites covering zinc, nickel, lead, cobalt, cadmium, antimony</td></tr>
</table>
</td></tr>
<tr><td>Optional risk management measures for iteration</td><td>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 obligatory on-site measures can be considered.</td></tr>
<tr><td>Narrative description</td><td>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.
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.</td></tr>
<tr><td>Scaling</td><td>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.</td></tr>
</table>

Determinant Label[1]	Quali-/ Quanti-tative[2]	Value[3]	Description of Value[4]
On site treatment of wastewater	Qual	Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange	Following IPPC-BREF note 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) 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.
On site treatment of off-air	Qual	Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber	Direct air emissions should be reduced by implementing one or more of the following RMMs: · Electrostatic precipitators using wide electrode spacing: 5 – 15 mg/Nm³ · Wet electrostatic precipitators: < 5 mg/Nm³ · Cyclones, but as primary collector: < 50 mg/Nm³ · Fabric or bag filters: high efficiency in controlling fine particulate (melting): achieve emission values < 5mg/Nm³. Membrane filtration techniques can achieve < 1 mg/Nm³ · Ceramic and metal mesh filters. PM10 particles are removed: 0.1 mg/Nm³ Wet scrubbers: < 4 mg/Nm 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.