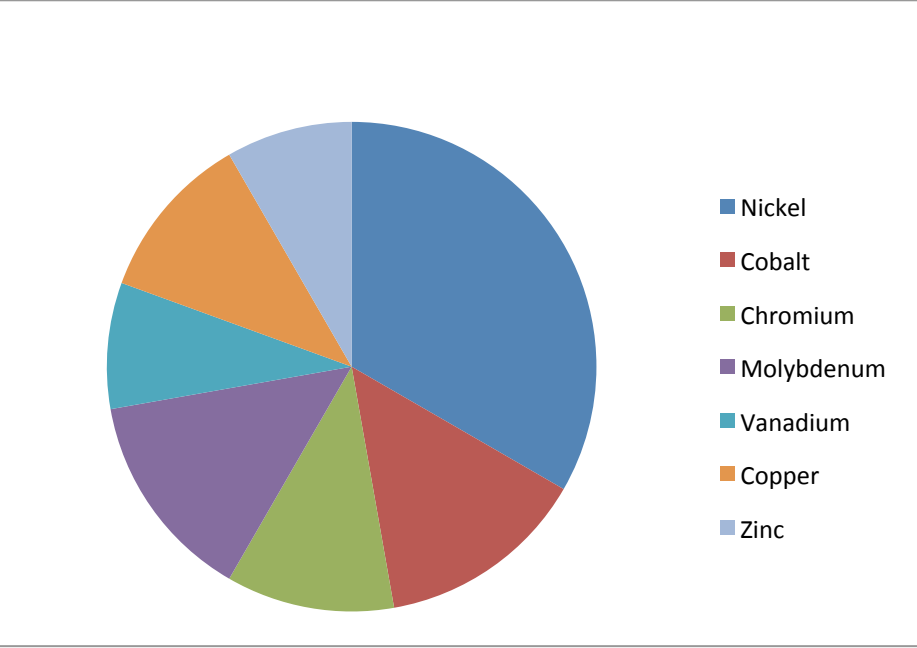


## SPERC Factsheet – *Manufacture of Metal-containing Catalysts*

| Section            | Content   |       |   |        |     |        |     |          |     |            |     |          |     |        |     |      |    |
|--------------------|---|-------|---|--------|-----|--------|-----|----------|-----|------------|-----|----------|-----|--------|-----|------|----|
| <b>SPERC Title</b> | <b>Manufacture of metal-containing catalysts</b>  |       |   |        |     |        |     |          |     |            |     |          |     |        |     |      |    |
| <b>SPERC code</b>  | ECMA 1.1a, v2.0   |       |   |        |     |        |     |          |     |            |     |          |     |        |     |      |    |
| <b>Scope</b>       | <p>Manufacture of catalysts comprising metals and metal compounds of nickel, cobalt, chromium, molybdenum, vanadium, copper and zinc.</p> <ul style="list-style-type: none"> <li>• Production of powdered or shaped catalysts or catalyst embedded in an organic matrix.</li> <li>• Regeneration of previously used catalysts</li> </ul> <p>Processes, tasks and activities include:</p> <ul style="list-style-type: none"> <li>- Raw material delivery and handling,</li> <li>- Catalyst manufacture: dissolving, precipitating, filtrating, drying, mixing, forming, impregnation, calcination, sulfiding, stripping, regeneration, reduction, stabilisation, coating and screening, loading of reactor (transfer from big bags/drums/containers).</li> <li>- Fresh catalyst packaging: filling operations, cleaning and maintenance and storage of final product.</li> </ul> <p>Release factors are derived from measured emission data. Metal representativeness of the compiled data is detailed below :</p>  <table border="1"> <caption>Metal Representativeness Data</caption> <thead> <tr> <th>Metal</th> <th>Relative Representativeness (Estimated)</th> </tr> </thead> <tbody> <tr> <td>Nickel</td> <td>35%</td> </tr> <tr> <td>Cobalt</td> <td>15%</td> </tr> <tr> <td>Chromium</td> <td>10%</td> </tr> <tr> <td>Molybdenum</td> <td>10%</td> </tr> <tr> <td>Vanadium</td> <td>10%</td> </tr> <tr> <td>Copper</td> <td>10%</td> </tr> <tr> <td>Zinc</td> <td>5%</td> </tr> </tbody> </table> | Metal | Relative Representativeness (Estimated) | Nickel | 35% | Cobalt | 15% | Chromium | 10% | Molybdenum | 10% | Vanadium | 10% | Copper | 10% | Zinc | 5% |
| Metal              | Relative Representativeness (Estimated)   |       |   |        |     |        |     |          |     |            |     |          |     |        |     |      |    |
| Nickel             | 35%   |       |   |        |     |        |     |          |     |            |     |          |     |        |     |      |    |
| Cobalt             | 15%   |       |   |        |     |        |     |          |     |            |     |          |     |        |     |      |    |
| Chromium           | 10%   |       |   |        |     |        |     |          |     |            |     |          |     |        |     |      |    |
| Molybdenum         | 10%   |       |   |        |     |        |     |          |     |            |     |          |     |        |     |      |    |
| Vanadium           | 10%   |       |   |        |     |        |     |          |     |            |     |          |     |        |     |      |    |
| Copper             | 10%   |       |   |        |     |        |     |          |     |            |     |          |     |        |     |      |    |
| Zinc               | 5%  |       |   |        |     |        |     |          |     |            |     |          |     |        |     |      |    |
|                    | The SPERCs are relevant to all operations that discharge their waste-water following processing in an on-site treatment plant.  |       |   |        |     |        |     |          |     |            |     |          |     |        |     |      |    |

|                                     |   |  |
|-------------------------------------|---|--|
| <b>Related use descriptors</b>      |   |  |
|                                     | <p>Process Categories:<br/>PROC 1, PROC 2, PROC 3, PROC 4, PROC 5, PROC 8a, PROC 8b, PROC 9, PROC 14, PROC26, PROC0</p> <p>Main User Groups: SU 8, SU9</p> <p>Environmental Release Classes:<br/>ERC 1, ERC 3, ERC 6A, ERC 6B</p>   |  |
| <b>Operational conditions</b>       | <b>Operational conditions - Phrases</b>   |  |
|                                     | <p>Indoor Use (EUPHRACS 06.1400000)</p> <p>Water-based Process ((EUPHRACS 06.1403000)</p> <p>Product applied in aqueous process solution with negligible volatilization (EUPHRACS 06.1414000).</p> <p>Spent process fluid discharged to wastewater (EUPHRACS 06.1410000)</p> <p>Assumes a good basic standard of occupational hygiene is implemented (EUPHRACS 06.1114000)</p> <p><b>Air</b><br/>Emissions to air may arise from delivery, handling, drying, forming, impregnation, calcinations, reduction, screening and filling.</p> <p><b>Water</b><br/>The important sources of wastewater during catalyst production are filtration, maintenance and cleaning.</p> <p><b>Operational conditions – Free text background</b></p> <p>The bulk of waste-water arises from filtration and washing of the precipitated material. All waste-water is treated in an effluent treatment plant and the resulting filter cake is generally sent for recycling to recover metals. Particulate material captured from airborne emissions is also sent for recycling.</p> |  |
| <b>Other operational conditions</b> | The manufacture of metal-containing catalysts includes open and closed systems and both wet and dry processes.  |  |
| <b>Obligatory onsite RMMs</b>       | <b>RMM Phrase</b>   | <b>RMM-Efficiency (RE<sub>sperc</sub>)</b>   |
|                                     | <p><b>Air</b></p> <p>Direct emissions to air should be mitigated by application of one or more of the following RMMs:</p> <ul style="list-style-type: none"> <li>• HEPA filtration (EUPHRACS 06.1520003),</li> </ul>  | <p>One or more of these RMMs (of which HEPA/bag filtration and wet scrubbers are the most common) were reported to be present in more than 88% of sites. <b>RMM efficiency (RE<sub>sperc</sub>) was reported to be ≥99%.</b></p> |

|                           |  |  |
|---------------------------|--|--|
|                           | <p>Fabric filters (EUPHRACS 06.1520001) and Bag or Ceramic Filters</p> <ul style="list-style-type: none"> <li>Wet Scrubbers (EUPHRACS 06.1520014 &amp; 1520015) (second most common reported)</li> <li>Dry or semi-dry Scrubbers</li> <li>Metallic Grids (not common)</li> </ul> <p><b>Water</b></p> <p>Direct emissions to water should be mitigated by application of one or more of the following RMMs:</p> <ul style="list-style-type: none"> <li>Precipitation (EUPHRACS 06.1522000)</li> <li>Sedimentation (EUPHRACS 06.1526000)</li> <li>Filtration (EUPHRACS 06.622000)</li> <li>Distillation</li> <li>Ion Exchange (EUPHRACS 06.1524001)</li> </ul> | <p>One or more of these RMMs (of which chemical precipitation is the most common) were reported to be present in more than 70% of sites. RMM efficiency was reported as 95-99.9%. <b>RE<sub>sperc</sub> is taken to be 99% (50<sup>th</sup> percentile of reported site-specific RE)</b></p> |
| <b>Substance use rate</b> | <b>Phrase</b>  | <b>Value</b>   |
|                           | Indicative substance use rate in a typical operation   | <b>M<sub>sperc</sub> = 5,400 kg/d (as metal equivalent)</b>  |
|                           | <b>Justification</b>   |  |
|                           | M <sub>sperc</sub> is calculated as an indicative realistic worst case value based on the highest 90 <sup>th</sup> percentile daily production volume for any of the individual metals used in catalyst production.  |  |
| <b>Days emitting</b>      | <b>Phrase</b>  | <b>Value</b>   |
|                           | Emission days/year (EUPHRACS 06.1397000)   | 280  |
|                           | Intermittent Release (EUPHRACS 06.1394000)   |  |
|                           | Continuous Release (EUPHRACS 06.1395000)   |  |
| <b>Release factors</b>    | <b>Values (per pathway)</b>  |  |

|                              |   |                   |
|------------------------------|---|-------------------|
|                              | <p>Air: 0.025% (Release after on-site RMM)</p> <p>Water: 0.067% (Release after on-site RMM)</p> <p>There are no emissions to soil,</p> <p>Releases to waste: The sludge from on-site treatment plants is processed for metal reclamation (recycling).</p>   |                   |
|                              | <p><b>Justification</b></p> <p>Information on RMMs and emissions for the non-ferrous metals industry are detailed in <i>EC (2001), Integrated Pollution Prevention and Control (IPCC): Reference Document on Best Available Techniques in the Non Ferrous Metals Industries (December 2001)</i>.</p> <p>Release defaults detailed in this factsheet are derived from measured emissions data from catalyst manufacturers in various EU member states between 2008-2010. RFs are calculated as realistic worst case values based on metal-specific 90<sup>th</sup> percentile site-specific release factors from 19 sites for production of metal-containing catalysts.</p> <p>Since RFs 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 processing and cleaning and maintenance.</p> |                   |
| <b>Optional RMMs</b>         | <b>Type of RMM</b>  | <b>Efficiency</b> |
|                              | <p>Alternative RMMs are suitable is they achieve a similar removal efficiency to that reported for onsite RMMs currently used in this sector.</p>   |                   |
| <b>Narrative description</b> | <b>Manufacture of metal-containing catalysts</b>  |                   |
|                              | <p>This SPERC describes SPERC parameters relevant to the production of metal containing catalysts via processes based on impregnation or precipitation, filtration, drying (optional heating/calcination or reduction) and forming of final product</p>   |                   |
| <b>Scaling</b>               |   |                   |
|                              | <p>If a site does not comply with the conditions specified in the SPERC, it is recommended to apply the Metals DU Scaling Tool developed by ARCHE in order to perform a site specific assessment. The scaling tool is available at <a href="http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool">http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool</a></p>  |                   |

|  | Site-specific parameters  | Parameter description  | Values - Site                     |
|--|---|--|-----------------------------------|
|  | $M_{\text{site}}$<br><br>Emission days $_{\text{site}}$<br><br>$RF_{\text{site}}$ | Amount which is used on site per year<br><br>Emission days per year from the site<br><br>Release factors measured on site after RMMs | To be determined by site operator |