# Study on Data Inventory for a Raw Material System Analysis

## Meeting Report – Fifth Expert Workshop

<table>
<thead>
<tr>
<th>Project</th>
<th>Study on Data Inventory for a Raw Material System Analysis: Roadmap and Test of the Fully Operational MSA for Raw Materials (Contract no.: 30-CE-0612154/00-04)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event</td>
<td>Fifth Expert Workshop – Materials Borates, Chromium, Cobalt, Gallium, Tungsten.</td>
</tr>
<tr>
<td>Date</td>
<td>27 May 2015</td>
</tr>
<tr>
<td>Location</td>
<td>DG GROW, Avenue d'Auderghem 45, 1040 Brussels, Belgium</td>
</tr>
</tbody>
</table>

### European Commission
- Flor DÍAZ-PULIDO – DG GROW
- Slavko SOLAR – DG GROW
- Claudia WULZ – DG GROW
- Andrea BLENGINI - DG JRC
- Darina BLAGOEOVA – DG JRC

### Project team
- Charlotte PETIOT - BIO by Deloitte (BIO)
- Alvaro DE PRADO TRIGO (BIO)
- Mariane PLANCHON (BIO)
- Chloé DEVAUZE (BIO)
- Jürgen GIEGRICH (IFEU)
- Axel LIEBICH (IFEU)
- Tomas HAK - Charles University Environment Center (CUEC)

### Experts
- Mirona COROPCIIUC (Euromines)
- Julien SCHIETTECATTE (Atlantic Strategy Group)
- Roger DOOME (European Borates Association EBA, member of IMA-Europe)
- Lara CARRIER (IMA-Europe – Boron Consortium)
- Hakan KANLI (Etimine S.A.)
- Philippe LIEBAERT (DCX Chrome)
- Sheraz NEFFATI (International Chromium Development Association)
- Brigitte AMUROSO (The Cobalt Development Institute)
- Casper GOVAERT (Umicore)
- Rohit MISTRY (Economics For The Environment Consultancy Ltd (eftec))
- Carol PETIT (Cobalt REACH Consortium Ltd. CoRC - Cobalt Development Institute)
- Nelly KERNEVEZ (Soitec)
- Thomas REINHOLD (Freiberger Compound Materials GmbH)
Agenda

- General presentation of the project: context, objectives, tasks, timeline
- General presentation of the methodology for the Material System Analysis (MSA): list of parameters and main calculation steps
- Parallel working sessions: Discussion on data gathered on material flows and stocks for five materials (Borates, Chromium, Cobalt, Gallium, Tungsten): description, preliminary results, method of calculation, data sources, data gaps, etc.
- Conclusions and next steps

Main points and comments that emerged from the plenary sessions

\textit{a) Remark about data, parameters and methodology}

- Regarding data used to calculate MSA parameters, the project team underlined that they are looking for various types of data: formal data (from Eurostat for example) and non-formal data provided by industrial stakeholders and experts to cross-check sources and try to have the most consistent and reliable data. The stakeholders expertise is thus of utmost importance to have a critical review of the results.

- The project team specified that the functional recycling step calculated in the MSA aims to give the current quantity of material that is effectively recycled, and not the potential quantity that could be recycled (if the recovery was technically and economically feasible and viable).

- It has been pointed out that the growth rate of product consumption at the worldwide level can be very different from the growth rate at the EU level, so the extrapolation between both data can be difficult.

- Some experts insisted on the fact that the assessment of the future demand is tricky and highly uncertain due to unforeseen changes, risk of economic crisis and technology disruption. The project team is aware of such limitations and will only provide qualitative information that already exists (no internal forecast).

- Regarding the management of confidentiality issues, it has been explained that the public part of the outcomes will only display EU-aggregated data and results for the whole application of a material, not for a specific product. Raw data will not be publicly disclosed.

\textit{b) Outcomes and deliverables of the project}

- In response to questions regarding the outcomes of the project, the project team clarified that the deliverables of the project will be a report presenting the methodology and the results (2 Sankey diagrams per material + 1 page of information explaining the value chain, the main flows and the sources and assumptions used to perform the MSA for each material) along with 1 Excel file and 1 background document per material. After the project, the European Commission will publish the report and will build a public database gathering the aggregated results for each MSA. The database will include quantitative results for flow and stock parameters and Sankey diagrams.

- Regarding the level of details of the information provided in the database, the project team underlined that the database will be very transparent regarding the sources used and the limits of the results (comments, data quality score…). However, all the calculation steps will only be detailed in the Excel files and in the background documents delivered to the European Commission but will not be published in the database. These documents are considered to be too complicated and they may raise some confidentiality issues.

- In response to questions regarding the two different possible approaches to develop the MSA (bottom-up or top-down), the project team said that approaches implemented within
the framework of the project will be described in the report, with details on the advantages and limits of such approaches. However, comparison of different approaches will not be carried out during the project.

- Some experts indicated that it could be very interesting to have a dynamic view of the flows and stocks in the database. The project team clarified that the outcome of this project is a static picture of the flows and stocks for a given representative year. However the database is intended to be updated on a regular basis; which will allow for a dynamic picture in the future.

- Several experts warned about the possibility of a misuse of the database results by common users in the absence of a proper guidance on ‘how to use or not the database’. The project team answered that the final report will include: a general description of the methodology used to develop the MSA, a clear definition of the different parameters calculated and a caveat in order to remind the limitations of the results. The caveat and the definition of the parameters will also be included in the database, with in addition a data quality score for all the parameters.

c) Future methodology for criticality assessment

- It has been reminded that this project is focused on the development of the MSA of the studied materials and on making recommendations on how to improve and update the MSA. The project is not intended to perform any assessment of the criticality of the materials or develop any policy recommendations. The database will be used in the future as a source, among others, to assess the criticality of materials following the new methodology that is currently developed by the JRC; but this will not be part of the study.

- In the future, the MSA database will be extended to other materials (not only the critical ones), but this will not be part of the study.

d) Similar projects

- It was noticed that this project is the first study at the EU level to be so complete in terms of materials and life cycle steps. There are other on-going projects on MSA in EU, US or Japan but they are in general focused on one material or on a few life cycle steps.

e) Timeline of the project and robustness of the results

- Some experts warned about the difficulties to finish the work in the 3 following months and about the risk of great uncertainties in the results. The project team answered that they are aware that a lot of work remains to be done by the end of the project in September. They will deliver the most reliable results which are possible to provide within the framework of this project, while remaining transparent regarding the limitations of the results.

Main points and comments that emerged from the working sessions

a) Tungsten

- 1 expert attended the meeting to assist with the MSA of Tungsten, gathering the comments from several Euromines members involved in the EU Tungsten market.

- The working session was efficient in terms of quality check of preliminary results regarding the first life cycle steps (exploration and extraction), and especially EU resources and reserves.

- It was underlined that some additional information can be obtained in the Roskill report.

- It has been validated that Tungsten is solely extracted as a main product. However, the quantity of W in tailings is not known.
• Inputs regarding quantities of waste generated at the processing and manufacture steps were provided.

• Due to lack of data or confidentiality issues, the expert could not provide inputs regarding parameters of group 2 and 3 (e.g. investment in exploration, industry structure, future demand, etc.).

• To fill the data gaps, it has been suggested to contact HC Stark and ELG Haniels for the secondary materials and the recycling of HSS applications, CEFIC for Tungsten chemical compounds, and to look at results of platinum MSA for the W catalysts.

• From the Use step, no new data or quality check has been possible to obtain.

• It has been suggested to use the Roskill to obtain data regarding: resources & reserves in EU, share of US extraction, country concentration and governance risk supply at the processing step, industry structure and future demand at the processing step, imports and exports of W metal powders, imports & exports of tools (all categories).

b) Cobalt

• Four experts attended the sessions on Cobalt, covering all life cycles of the material.

• The data on the extraction and processing steps were reviewed or validated. Some of the estimations should be revised (e.g. imports and exports of cobalt compounds), since the categories used by Eurostat include cobalt mixed with other materials and it is difficult to estimate the part of cobalt content.

• When there are different sources for some of the parameters, it would be good to explain the choice of selecting one source rather than other ones. Although differences may not be very big, it would be good for the reader to know that there are some different figures.

• The sectors in which cobalt is used should be revised - the shares of use of cobalt in each sector are different in the EU than worldwide: few batteries are produced in the EU, whereas chemicals represent one of the biggest shares of cobalt use in the EU. The economic value of chemicals is higher than other uses of cobalt, but some of the uses of these chemicals represent a small amount of cobalt, compared to other flows. It should be however noted in the economic importance.

• The recycled content of cobalt used worldwide and in the EU is not clear: there are a number of sources that report different rates of recycled content and rates of recycling at end-of-life. It was recommended to look in detail to some of the works by Graedel, UNEP, Oakdene Hollins or Roskill.

• Most of the end uses of cobalt are industrial applications: hard tools, catalysts, magnets, biogas... these products rarely end up as waste collected, but they are recovered or remanufactured within the industry. There may be some losses that are recovered and used in other industrial sectors.

• Cobalt in batteries, pigments and semiconductors in electronic products are consumer applications that will likely end in waste collection and treatment flows.

• Cobalt is recycled from rechargeable batteries - however, it is not clear whether this is done in the EU or outside the EU. Cobalt is not recovered from pigments in glasses or ceramics.

• There are few dissipative uses of cobalt: some pharmaceuticals and animal feed applications. In the rest of applications, cobalt is incorporated into the products.

c) Borates

• The borates session was attended by 3 experts – 2 representatives of the European Borates Association (EBA) and 1 representative of the borates industry (a major European producer).
EBA has been issuing its own reports covering mostly extraction and production; the latest one was published in 2013 with the data of 2012.

It was agreed that the reference substance would be B (boron element whose amount can be calculated by stoichiometric principles) reported in mass weight (kg).

Firstly, the borates life chain was reviewed and completed by adding a few processed materials important for the manufacturing phase (e.g. diboron trioxide etc.).

Most of the time was spent on verification of the parameters of group 1 where some mistakes were identified in the parameters of the manufacturing phase – EBA will provide its own data broken down by main product categories and main processed materials.

Thus, some data based on the Prodcmod and Comex databases will be replaced by the data directly reported by the producers. Still, some data, mostly on the use flows and collecting/recycling flows will be based on common hypotheses and assumptions and they will be modelled/calculated since do data are available.

In general, the meeting was very useful.

d) Chromium

Two experts provided useful information on chromium flows in the EU.

The experts represented the whole value chain of chromium with a focus on mining activities, ferrochrome production and chromium metal manufacturing.

It was agreed that the first figure of the background document, showing the value chain of chromium, should be extended for some intermediates and applications. So, the relevance of chromium for the EU economy becomes clearer for non-experts.

A discussion came up about the definition of criticality. According to the experts chromium in general with its main uses in stainless and alloy steel applications is not critical, as the supply of ferrochrome is not problematic. Although chromium metal has only a share of less than 2% of the chromium use in the EU, its supply is assessed as more critical for the EU economy by the experts.

The average chromium content of the semi-finished products of stainless steel, alloy steel and chromium chemicals and their uses in final products were discussed. Uncertainties will be double-checked with other experts from the sector processing and reported back to the consultants.

A missing flow in the MSA structure was identified; at every life cycle stage secondary material for non-functional recycling can occur (e.g. slags from steel production), not only at the ‘recycling’ step.

The life span of products, collection and recycling quotas were discussed at the end of the session. They will be double-checked by experts from these sectors.

e) Gallium

Three experts attended the meeting to assist in the MSA of Gallium.

Discussions led to changes in the value chain, particularly regarding the intermediate products to focus on, such as Gallium arsenide epitaxial wafers and Gallium nitride.

The experts provided useful information on the processing step. They confirmed the EU production of primary Gallium and that all Gallium is obtained as by product of alumina. Yields of Gallium for the various processes were also discussed.

The experts agreed on saying that there are European manufacturers in all sectors using Gallium, though the volumes produced are quite low in the EU. However no quantitative information could be provided on the volumes of processed material (primary and refined
Gallium) consumed in EU. Qualitative comments confirmed that the manufacture of Gallium arsenide (for instance in wafers) represents most of the Gallium used in the EU.

- In a similar way, it appeared that estimations on the volumes of Gallium contained in end products (at the use step) would be difficult to identify. However the experts agreed that the ranges of distribution between end applications (i.e. on the consumer market) was consistent for the EU market. More precise distribution is expected from contacting with other experts.

- The experts confirmed that there is no secondary material from recycling of end of life products. They agreed on saying that almost half of the refined Gallium is produced in the EU from new scrap (from manufacturing waste generated in EU), and considered the volumes calculated in the MSA to be in a consistent range.

- The experts also provided several inputs regarding parameters of group 2 and 3 (e.g. typical time required for production of Gallium, industry structure, etc.).

- The experts provided the names of other companies that would be able to assist in the further development of the MSA of Gallium. It was suggested by one expert that the Yole Development study on Gallium nitride could be of interest to the project.

- The confidentiality issue remains an important limit to finding precise data for the MSA of Gallium in the EU. However it was agreed that further contact would be made with the experts after the workshop, in order to get more consistent quantitative information.

Next steps

- The project should be completed by September 2015.

- Interactions between the project team and the experts will continue in order to complete and improve the MSA of the five materials discussed during this workshop.

- At the end of the project, a final task will be to make recommendations for the European Commission to establish and maintain the MSA database.