June 2025

# Exchange & Capacity-building Group on Battery Materials *(ECaBaM)* 3rd Workshop

*Brussels, 7-8 April 2025*

Final Report



The third workshop of the Exchange & Capacity-building Group on Battery Materials (ECaBaM) was held in person on 07-08 April 2025 in the Eurometaux premises in Brussels. This workshop report covers the two days of discussions and should be read together with the slides provided for both days, since they provide more detailed information on the capacity-building sessions. The workshop was structured in two sections to foster expert discussion and capacity building. To ensure a balanced exchange of knowledge and perspectives, participants were divided into two breakout groups during the first day. Group 1 focused on "capacity building for substances in batteries and the elements needed for effective risk management", while Group 2 addressed "support for better understanding of manufacturing and recycling processes, associated emissions, and current and future risk management along the battery lifecycle". These targeted discussions enabled a thorough exploration of the specific challenges and opportunities in each area. The second day was dedicated to consolidating insights through a plenary orientation debate on lessons learnt from Phase 1 and identifying future capacity-building needs, including challenges related to circularity and remaining hurdles in the battery sector.

**James Watson (DG Eurometaux)** welcomed the participants and recalled that the important journey we are on, considering electrification and increasing use of batteries. Decarbonisation of our economy is key, and the EU still needs to stick to values. There is a need for a Net Zero by 2050 and hence the role of batteries is essential.

He stressed the importance of this dialogue and the appreciation for the work done together to achieve optimal regulatory outcomes, that will make the most of our systems and will ensure we have sustainable batteries produced and recycled in the EU. The sector is taking its environmental responsibility very seriously, keeping environmental protection and sustainability as overarching targets. He wished a successful workshop to the participants and a good field trip on Wednesday and concluded that this spirit of cooperation is what we need in the EU. We need to continue working together to solve the problems we face in a geopolitically unstable world for future generations.

**Hugo Waeterschoot (Eurometaux, chair Day 1)** welcomed the participants as well and recalled the housekeeping rules (antitrust policy).

The participants were divided in two breakouts.

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Eurometaux - European Association of Metals
Avenue de Tervueren 168, Box 13 | B-1150 Brussels | Tel: +32 (2) 775 63 11 | www.eurometaux.eu | eurometaux@eurometaux.be | @Eurometaux

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# Day 1

## Group 1: Capacity building for substances in batteries and elements needed for targeted risk management

**Augusto di Bastiano (ECHA)** introduced the discussion: The aim is to identify the information on "substances on batteries" needed to define appropriate risk management options. The expected output of the discussion is the identification of information needs and current information gaps.

He recalled that the Batteries Regulation requires to address Substances of Concern present in batteries or used in manufacturing and causing adverse effects on Human Health (HH) **or** Environment **or** affecting recycling. This requires to:

1) Identify/map the substances and

2) Identify the ones having adverse effects.

These 'adverse effects' were identified in the ESPR, which goes together with the Batteries Regulation, but also RoHS, Packaging.

Targeted substances include:

- Substances in the REACH Candidate List (a)
- Substances Classified for Chronic effects (b)
- POPs (c)
- Substances hampering recycling (d)

The Commission gave the mandate to ECHA to identify these SoC and define appropriate Risk Management Options (RMOs). The screening of the registration database for the use of substances in batteries generated a list of 600+ substances. Starting from the work done by JRC on waste batteries and the outcomes of the survey circulated to stakeholders in the ECABAM context aimed at understanding where these substances are used and how crucial they are, resulted in a list of about 300 substances. This latter list, which was circulated to the participants of the breakout, is still a provisional list, but the number of substances seems to be right.



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ECHA needs now to identify the elements to know to identify the appropriate RMOs. The Batteries Regulation proposes a restriction, which may appear frightening as it is often perceived as 'banning substances'. But a restriction can also target specific risk management measures, like e.g. define criteria to reduce emissions during the waste stage (apply appropriate control systems or some recycling technologies). The objective is to preserve substances we need and ensure that we can recycle them. Hence, we need to be very cautious with substances hampering recycling and need to understand what it means. An example in this context are PFAS: if they are present in the black mass there is a risk to create safety issues. In general, we are talking about substances that can be highly toxic for workers meaning that we need to know exactly what is in the batteries to be able to address these appropriately. An example regarding difficulties to recover was provided to them recently: it seems that when Li is bound, an alloy is produced making it impossible to recover the Li.



Regarding the RMO process, questions that can be discussed include: restriction is one of the RMOs can there be other types of RMOs? If it is a restriction, how to define the scope of the restriction?

Augusto invited industry to explain the concerns they may have in the production/recycling of batteries, whether recycled substances are used and whether work on alternatives is ongoing. All this information is needed by the Commission for its report, which is expected by 2027.

## 1. Background

By June 2025, ECHA has to provide the Commission with a study report (Phase 1 report) which will include a mapping of substances in batteries including substances used in manufacturing process and for recycling of waste batteries. The report aims at setting up the ground for further investigations (Phase 2 report) on substances of concern in batteries and identification of possible risk management options, the final report (phase 2) will be submitted to the Commission by December 2027. The study at the basis of the phase 1 report has been outsourced by ECHA to an external contractor in Q1 2024. The contractor has produced a draft report which contains a mapping of different type of batteries present in the EU market, with information on the substances present in them (in different parts) including the concentration ranges. Some information has been discussed by the contractor with industry stakeholders after initial presentation at ECaBaM 2 workshop to be validate and refined. The list of substances in batteries has been updated following the discussion with stakeholders. Information on quantities of substances is not available in the Phase 1 report. Information on concentration ranges is not complete, and available information requires further validation. Goals: Review the list o substances in batteries, define information gaps and identify strategies to gather information which is needed to fill these gaps.

Regarding the report prepared by Ramboll, a final version was provided to ECHA end of March. Unfortunately, ECHA still needs to work on it as a lot of non relevant information is included in it despite the iterations. The second phase of the project will start in June and will last until 2026. We need to make sure that relevant information is included in the report to Commission.

The background document included a list of questions to facilitate the discussions.

## 2. Question to direct discussion:

**Information review: mapping of batteries and substances**

1) Do list of batteries type reflect the EU market? To what extent?

2) Is information on substances used in different batteries and their concentrations in different parts, accurate and correct?
3) What is still missing?

**Identification of information needs for appropriate RM**



4) What additional information is needed to define risk from substances in batteries?
5) For what substances Restriction is considered an appropriate RM option?
6) What elements do you think should be taken into account, beyond risk for human health and the environment before proposing a certain substance for restriction?
7) What information would be needed to define substances hampering recycling?
8) What strategy would you propose to gather crucial information on substances to allow regulators to identify appropriate regulatory risk management options? How would you proceed in the case it would not be possible to achieve the information?

The report below groups the comments by theme.

**On the list of substances:**

*Information review*

1. Does the list of batteries type reflect the EU market? To what extent?

There is a discrepancy between the two lists of substances that have been generated, i.e. the 600+ coming from the screening of the Registration database and the 300 substances list based on the JRC report and the survey carried out in the context of ECABAM. It was commented that the discrepancy may result from the way the value chain is organised in practice and how the REACH Registration works. The producer/importer of a substance (registrant) will sell its substance on the market and then traders will intervene. It is not always easy to identify all the uses of a substance and keep the list up to date. The identification of a batteries use in the registration dossier could be an estimation.

The information available on a certain use is not always well documented, hence checking its validity is also challenging (a substance may not be used anymore, or the battery using the substance is not produced anymore). Based on this, it seems that the information provided in the survey (300 list) is most probably more accurate. Further work could be done with registrants to ensure an update of the dossiers. ECHA says that they are considering sending letters via REACH IT to ask registrants to update the dossiers and the parts on uses in particular. Cefic added that some of their manufacturers stated in their dossiers that some of substances mapped are actually "not used in batteries". A bilateral communication with registrants will help to clarify. A substance could be used in plastics to wrap batteries and then batteries is identified as "use".

2. Is information on substances used in different batteries and their concentrations in different parts, accurate, and correct?

ECHA proposes to provide the relevant parts of the report generated by Ramboll in March and reworked by ECHA. ECHA is supposed to finalise Phase 1 of the project in June, hence in theory there is not a lot of time for iterations. However, the tables could be circulated and an estimated time for assessing their correctness could be defined by the ECABAM team. Depending on this required time, the check of the tables would still be part of Phase 1 or be part of Phase 2. It was recommended to go back to the lay-out reporting by technical function and technology, as this facilitated the



Eurometaux - European Association of Metals
Avenue de Tervueren 168, Box 13 | B-1150 Brussels | Tel: +32 (2) 775 63 11 | www.eurometaux.eu | eurometaux@eurometaux.be | @Eurometaux

review. ECHA indicated that the current display was adopted due to confidentiality issues, but they will check. A confidentiality agreement could be signed.

3. What is still missing?



Gaps include types of substance and concentrations. There is also limited information on volumes, uses, existing regulatory and voluntary actions. The Ramboll report is mainly a list of substances but as it was not very clear how Phase 2 would be held, there is not a lot of information related on risk management measures. It is important to do a last effort to improve the information to avoid working with defaults (or calls for evidence where other parties may reply as well).

**On uses and market shares:**

- ECHA would need ranges rather than precise quantities or volumes as they realise the dynamic environment. For example: if it is known that 90% goes to the car industry and the rest to other uses. There could be a possibility to prioritise 90% as if there is an estimated 0.01 % release from that substance, addressing 90% of the uses will still be a significant reduction. Authorisation does not discriminate between 3 tons and 3000 tons, but restrictions allow to do so.
- We need to know what is going on in household waste statistics.
- At the end ECHA will need to have a table structured according to the categories of batteries to match the Batteries Regulation (for now, ECHA looked at batteries according to chemistry). Question to be considered: is the categorisation of the Batteries in the Batteries Regulation covering all types of batteries or is something missing? Eurostat does not match this categorisation.
- Market shares are an important missing part in the existing report. ECHA looked at Eurostat hoping that the amounts provided by Eurostat could be used to calculate volumes using the concentration ranges. However, it is really generic: Eurostat reports only numbers and 4-5 types of chemistry and does not seem to make a difference between, portable and industrial batteries. The Commission also asked to investigate Cd, Pb, CrVI, Hg to identify if further restrictions are needed. For Hg for example, ECHA has found that there is still a very small market but that it is not used in batteries anymore. It could be military/policy uses but those do not fall under the Batteries Regulation. It will be much more efficient to get directly market data (production, exported, imported). This need for market data could be addressed by an additional survey limited to 4,5 simple questions. The objective is to understand what is 'more' or 'less' relevant based on market shares. It does not mean that the restriction will come. If no tonnages can be provided but only number of pieces of batteries, estimations could be made based on weight.
- The question was posed how to address the imported batteries? ECHA said that currently no they do not have a clear view of what is the real issue. If batteries are imported and recycled in the EU, then the volumes will add to the volumes targeted by the Regulation. If we want to keep some materials in the EU, we need to consider imported batteries.
- There is need also to have an idea about the representativeness of the collected info (e.g. if a company has 20% of the market shares, there is a question mark regarding the remaining 80%. If this 20% is known, then the information can be used).
- It is acknowledged that the more granular the asked information is, the more difficult it is to collect. The example of Ni was given to illustrate the difficulties: there are different batteries technologies using different Ni compounds: we would need several values to know the total amount of Ni used in a type of batteries. Would the total mount be sufficient? NiOH for example is sold without knowing to which type of batteries it goes. If you have different types of chemistry, you can quantify but if is not the case, the situation becomes more difficult to estimate and competitors may not be keen to reveal the numbers.



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**On existing legislation (in place):**

- The existing legislation is covered in the report but there is a need to understand the scope of the legislation.

**On concentration ranges:**



- This could also be addressed by the survey.
- It was asked whether these ranges address only the batteries or also the casings? This needs to be framed and checked (the Ramboll report at the start also includes casings).
- Do these ranges address the substance in the input material or within the battery? The example of Pb and Pb compounds was given. We know what volumes of which compounds go in but some Pb compounds transform in the battery. What is the most appropriate information? ECHA indicated that a substance will be restricted in different manners (e.g. risk management measures for the waste stage, or concentrations or...), which can apply to Pb and Pb compounds. For some substances, we have group entries while for others we have individual substances classifications (with also individual entries on the Candidate List).
- They would need to know how much Pb is used. It seems easier to say total weight of Pb or Li. If the concentration range is very large we would need a typical value and explain why the range is so big. ECHA would rather prefer to have high-level tonnages than specific compounds at the different stages of the lifecycle.
- Should we consider substances at discharged or charged state? The purchase takes place at discharged state, that seems to be the most relevant. There may be an issue at the end of life of the battery (other compound?). The current list of substances identified assumes all these to be the raw materials.
- Should we address new substances created in the battery and present at end of life? The Batteries Regulation does not give a common definition of 'what is used during the manufacturing process'. But precursors are different from process chemicals (used in manufacturing but not ending in the battery). For example, one purchases liquid LiOH in 200 L drums entering into the batteries manufacturing process. You will need other substances like solvents, processing aids you won't find back in the battery but there will be potential exposure during manufacturing and possible releases into the environment. The restriction will also target those substances (meaning that the list of substances can be long).
- It was asked whether downstream users reports are also used. ECHA looks as SCIP.

Regarding the survey, it was concluded that we need to have the right questions to get the right answers, go straight to the point to be more specific to get numbers. The estimates will be for SoC, not for all substances.

*Risk management: information needs and related discussions*

**On 'hampering recycling':**

- The question was posed how to deal with the "hindering recycling" aspect considering that a substance may hinder 1 process but not another?
- Any recycling process requires some creativity so there is always some 'hampering'. But what is the border to conclude to 'hampering? Is it a high level of burden? Is it a qualitative statement to be dealt with in a quantitative way? We should realise that the more substances you put in an application, the more complex the recycling becomes. It was also commented that 'hampering recycling' is a moving target as batteries manufacturers and recyclers continuously develop technologies. There may be a solution further down the timeline.
- We should also clarify the recycling of 'what': only of the 4 metals in scope of the recycling targets of Batteries Regulation or the critical/ strategic materials or even more broadly? It was also questioned whether the



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objective to keep critical substances in the EU also includes substances already on the EU market and already in use (e.g. Pb)?

- ECHA highlighted the relevance and importance of being specific when discussing the hampering recycling criterion. Everything is in theory technically recyclable, but there are considerations of costs, or e.g. capacity in the EU that come at play. Also, the global context should be looked at: either there is an incentive, or the recycling won't happen in the EU, and this in contradiction with EU's objective to keep the materials in the EU. On which materials precisely: this is a discussion they need to have with Commission as the definition is very generic for now.
- They do understand that it is a dynamic environment: they have visited one recycling facility and realised that when the company experiences issues with some substances, they actively looked for solutions. Industry is continuously searching for solutions. Hence hampering should not be considered as 'absolute'. But as ECHA they need to find out the level of feasibility and they propose to develop questions for the discussions at the next meeting on these aspects specifically: e.g., how much does it cost (if e.g. costs are 3 times higher than the purchasing from China, economic feasibility won't be met), what are the hurdles (market?), etc.
- ECHA also stressed that it is the recyclers' responsibility to ensure safe recycling but also batteries producers should ensure the recycling can work. There are clear trends to make batteries fast charging and long-lasting but how much effort is put in the recyclability? What would be the way to make it recyclable? ECHA referred to a study on a mix between hydrometallurgy and pyro processes and it seems that there is lot of effort on how to make processes more efficient, but it is important as well to consider better mechanical separation. The stability of raw material is critical. Hydrometallurgical processes require stability in the black mass. This is typically knowhow of the recyclers. Article 6 of the Batteries Regulation may be a driver for recycling but there also other a lot of other drivers. The collection/separation may be the hampering element in some sectors. We could build more in chemistry or in sorting. In the real world, industry will produce the best possible products, the most performant to meet the market needs. Industry can make it more modular but going beyond that is difficult. The question is whether we can staple innovation and regulation? Regarding innovation, the question was posed how much emphasis there is in the project regarding the future? Do we want to survey the innovation as well?
- The question was also posed how much the existence of a market influences recycling. The example of graphite was given. It is possible to recycle it but there does not seem to be a 'batteries market'. The quality of the recycled material is key here and will define the possible markets of the recycled graphite: recyclers will make a trade-off between the purity of the materials they will achieve and possible customers (high purity graphite for battery materials or lower purity for other sectors). The example of Li was given as well: although there are processes that allow to recycle the Li, the economic driver is not there as long as there is not enough material to recycle as concentrations are low. What is the 'boundary' of the discussion here: are we referring only to recycling for batteries or closing the loop (knowing that volumes in total remain the same). Taking zinc as an example: recycling produces the oxide form while the metallic form is the one in use. There may be a lot of demand on the market for the oxide form: you could either directly use recycled oxide or generate the oxide by reoxidising zinc, which is more expensive. A recycler will look at its margin as will naturally try to get most out of products. This to say that the economics of recycling are to be known as they play an important role. As it was agreed to prepare a survey to finalise phase 1 and prepare phase 2 (see below), it was proposed to include the question: what are the drivers for recycling? Costs, quality of material, regulatory support (cost of not recycling is also to be considered if you must discharge it in a landfill).

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**On SoC**

- What are the boundaries regarding the substances targeted by the mapping? Are substances part of the insulation layers in- between cells also to be mapped?
- Do we have now an agreed definition of SoC? Will we keep the one from ESPR as Ramboll had presented it at the last workshop as being a proposal? ECHA indicated that they discuss with Commission how to use the definition. The preamble of the Batteries Regulation could not make a reference to ESPR and needs to adopt that definition. The definition in the Ramboll report is larger than the one in ESPR. There is a need to be practical and harmonise definitions (to avoid conflicts between legislations). They are almost there.



**On Risk Management Option and Risk Management Options (RMO)**

- ECHA explained that the identification of the risk management needs and appropriate RMOs is an important part of their work: if a substance is already well controlled by existing legislation, there may be no need to address it. There is a kind of division between the harming environment or human health and the "hampering recycling" elements in the definition. For example, if the substance is a CMR (and it can be demonstrated that OSH is in place), it may be sufficient to focus on the hampering recycling part. A bit less than 50 among the 300 substances listed meet these criteria. The question is how to prioritise the substances among the 300 substances in the list? How to focus on what matters? And what about substitution: are efforts ongoing, should ECHA look at substitution plans (between 0 and 12 years)?
- We need to identify the information to support the conclusion that the existing risk management measures are sufficient or well-controlled. ECHA indicated that in the context of REACH restrictions, ECHA relies on the information included in the registration dossiers first source. If information is missing (e.g. how much is used specifically in batteries) they would need to make assumptions. A wrong assumption may lead to precautionary conclusions. Although it is acknowledged that precautionary approaches may be wrong, sometimes it is the only way the institution can use. Sending letters to registrants via REACH IT to ask registrants to update the registration dossiers regarding the uses in batteries may help, as well to address the discrepancies between the list generated by the screening of the Registration database (600 substances) and the list of 300 substances based on the JRC report and the survey carried out in the context of ECABAM).
- It was commented that prioritisation should focus on what matters most, addressing not only substances but also technologies and markets (e.g., for the twin transition or e.g. only used in military applications), size of batteries etc. If a substance is meeting the 2 types of criteria (harm + hamper recycling), will it be of a higher priority than if it meets only 1 criterion? ECHA explained that the responsibility of the prioritisation is with the Commission. The prioritisation criteria could follow a similar route to the one followed by the SVHC criteria: criteria proposed by ECHA, going for discussion at Commission followed by a discussion in CARACAL. The outcomes will be used to form a scoring system. There is a group formed on DG GROW to work on the different tasks to be done still.
- Key would be the possibility to downgrade visibly the priority if information becomes available (not possible under authorisation and that creates issues in other legislations).
- The safety management regarding Li batteries may be linked to reactivity of Li but it is also because to that reactivity that Li is used. Safety management needs always to be in place. More and more people are now on the market and need knowledge. Newcomers need to be aware of risk management measures.
- In terms of risk, should we look at everything that is covered by lifecycle or limit to specific lifecycle stages? ECHA will analyse the different steps of the lifecycle, starting with industrial uses, then professional/consumer uses, end of life waste and recycling. They will analyse all possible regulatory risk management already in place (e.g. in CMRD or other contexts as there is no need to regulate what is already regulated or where exposure is



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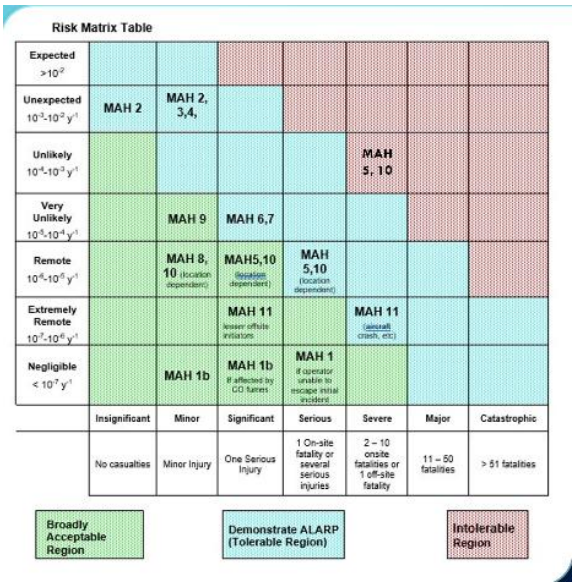
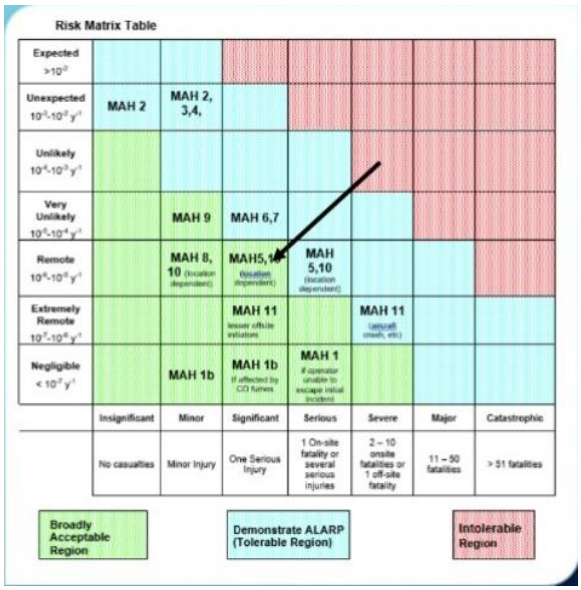
negligible. If there are parts of the lifecycle that are not regulated, e.g. consumer articles and evidence there is a risk, they will need to address that. The RMOA could also list and identify voluntary initiatives.

- It was proposed to look at the risk assessment approach for Seveso distinguishing what is broadly acceptable, ALARA etc. and residual risks.
- On grouping: while some metal compounds have group classification entries (based on metal ion concept), the difference in bioavailability may still be important to consider.
- What would be the approach if the substance is considered well controlled and there is an issue at the waste stage? ECHA: the question: is there any technology or other substance to substitute ..it is not lifecycle driven. Lifecycle is more from a RA perspective: does it create problems during any lifecycle stage. Is there any substance that could be used to substitute and not creating an issue at that lifecycle stage? If you cannot recycle it either change technology to enable recycling or you substitute your substance. If different technologies and a substance creates only a problem for one technology then restriction may not be the best RMO. BAT is addressing the problem.






Reporting on Group 1 (by ECHA): the group discussed the substances ECHA is interested to work on as required by the Batteries Regulation. We need to conclude the Phase 1 of the project (mapping of substances in batteries including substances used in manufacturing process and for recycling of waste batteries) to move to Phase 2 (further investigation of SoC concern in batteries and identification of possible risk management options). The list of substances in batteries has been updated following the discussion with stakeholders but information on quantities of substances is not available in the Phase 1 report. Information on concentration ranges is not complete, and available information requires further validation. A survey will be designed to collect the missing information with simple questions to be reviewed by volunteers. It was also realised that for a given chemistry, there could be 10-15 different manufacturers. Hence there won't be a set of unique substances, but variations and industry won't be keen to explain the details. We need to know at least what the standard making of that industry is but there is no need to have the small pepper and salt details.

The discussions touched about hampering recycling but also the drivers of recycling, without going too much in detail as this was addressed in Group 2. The group discussed about different RMOs as part of the project is also to identify which kind of risks need to be addressed and what kind of risk management measures already exist? You will have to consider different lifecycle stages: you may have the situation that at the manufacturing, the CMRD is already implemented (no need for a restriction), that there is no release/no exposure at the consumer stage but there may be issues with environmental/workers exposure at the recycling stage. The restriction could be tailored to address this. But there could be other RMOs to address the issue, e.g. OSH, BAT etc.



*Agreed Actions:*

1. ECHA to provide the list of substances to check for the information on technical function, type and part of the batteries, concentration ranges (typical concentration at discharged state). ECHA will check if there CBI issues (from the previous survey as the JRC report is public). In terms of lay-out, ECHA will reflect if they can go back to the previous lay-out to facilitate the check.
2. Eurometaux to define with ECABAM participants the time needed to check these tables and report to ECHA
3. Design a short survey to address information gaps: 4-5 simple questions (have these reviewed by a small group of volunteers before they are sent out)- timing to be agreed.

## Group 2: Support to further understanding manufacturing and recycling processes, associated emissions and existing and future risk management along the lifecycle

Hugo introduced the discussion looking back at the aim of the group 2: Review and discuss existing manufacturing, waste and recycling process, available knowledge on releases/exposures, current and potentially future risk management practices along the lifecycle. Identify key data gaps and information needs and how to address there, and to discuss key factors that can hamper recycling processes and future trends.

### 1. Background

The Commission has requested ECHA to prepare a report identifying substances of concern in batteries. This includes collecting detailed information on all battery lifecycle stages (including manufacturing, use, waste stage collection and recycling) for different battery types. A review of existing processes and practices used in the EU to process/recycle different battery types (including dismantling, pre-treatment, hydrometallurgical and pyrometallurgical processes, current risk management practices etc.) is required. This information is needed to identify during what waste/recycling stages releases of substances of concern (SoC) could occur, and if these could be expected to result in exposure of humans and the environment. It is noted that currently most recycling activity for certain battery types currently occurs outside the EU (e.g. Lithium-ion batteries (LIBs)) and when recycling occurs in the EU it is often only up to the intermediate stage (e.g. black mass) which is then exported for further processing for recovery of battery-grade materials. However, recycling of these batteries in the EU is projected to increase significantly in the future. For other battery types (e.g. lead acid batteries (LABs)) extensive recycling occurs in the EU.

To assess whether the risks are currently adequately controlled for all battery types a key priority is to assess the potential for releases of SoC during all waste/recycling stages that occur in the EU. Projected future trends for battery recycling in the EU, and factors that hamper recycling activities also need to be considered in the analysis. The need to



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significantly scale-up the recovery of critical battery raw materials within the EU is recognised as well as the need to do this whilst also adequately controlling risks associated with SoC. Identifying the key steps/processes used in the waste/recycling stage that we should focus on will help us to develop pragmatic solutions for controlling the risks associated with SoC. This work should help to facilitate the sustainable scale-up of the battery recycling sector in the EU. This break-out group will offer an opportunity for stakeholders in the battery waste/recycling sector to provide current and valuable input into this analysis.



## 2. Questions

Three questions were posed to the participants regarding the review of the existing waste/recycling processes and the available information on potential release/exposure:

1. **In the previous workshop (October 2024) we discussed shortly the main processes used in the EU for recycling batteries, by type e.g. LIBs, Nickel-based (e.g. Ni-Cd), LABs, and other batteries. Are there any further nuances to be considered that were not covered before? This is to review our current understanding and get stakeholder input on the representativeness of the publicly available schematics (e.g. see attachment), and potential variation between facilities – particularly variations which could impact potential for releases.**
    a. Within the EU is there a range of processes used to process the same battery types?
    b. When waste batteries are exported is the same mix of recycling processes used? Or what are the key differences?
    c. When EU recycling rates are high (e.g. LABs) they vary by EU country and are not 100% - what typically happens to waste batteries not going into recycling facilities in the EU?
    d. What impact will the revision of the EU LoW (to include waste LIBs and intermediates e.g. black mass) have on global flows of waste batteries and intermediates? How is this expected to impact the waste/recycling sector in the EU?
    e. Projections for the EU industry indicate significant increase in the generation of waste batteries and ramping up of recycling in the EU (e.g. see attachment) Are these predictions considered realistic? What factors could impact this scale up? What issues could accompany such a rapid scale-up? If the lithium battery market scales up as predicted what would be the key steps/processes, we should focus on in terms of limiting SoC releases and exposures – to ensure this scale-up is done whilst also ensuring risks are adequately controlled?
2. **What processes, and what stages of the process, have greatest potential for releases and exposure?**
    a. What monitoring data are available? (e.g. worker exposure monitoring, wastewater / air monitoring data etc.).
    b. What limits the ability of the waste/recycling industry to gather release/exposure information?
    c. Are there existing emission release factors currently in use? What modelling/estimation approaches are March 2025 currently used?
    d. How accessible is existing release/exposure information?
    e. What are the main data gaps in terms of releases/exposures during the waste stage/recycling?
    f. How does the potential release/exposure profile differ between EU-based and the main recycling facilities outside the EU?
    g. What are the key steps/processes associated with the greatest potential for releases/ exposures for SoCs? What are the key risk management measures that are currently used? Are there additional process-specific



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options to further reduce releases/ exposures that could be applied? Why are these not currently being used? (e.g. no regulatory requirement, cost/availability, practical/technical issues etc.)

h. Which will be the most relevant SoCs on which to focus, in terms of emissions, during the recycling stage? Operators may have already some idea of what to focus on (beyond lead, cadmium, nickel, etc).

3. **How could we get this key information?**
   a. Which actors should be in charge of data collection and data provision? How could this be set up? Should REACH move to a cradle-to-cradle approach to be able to collect information on the end-of-life phase?
4. **What risk management measures are currently used and how effective are these at limiting releases and exposures for manufacturing and recycling?**
5. **What factors currently limit recycling of batteries?**
   a. Are there certain substances / materials that restrict recycling operations? E.g. making recycling either technically and/or economically difficult?
   b. Are there future trends expected in battery chemistry/design that could improve or worsen the current situation?

## 3. Discussion

The discussion started with a tour de table with all participants expressing their assessment and knowledge on the five questions proposed:

- The discussion highlighted significant challenges across the lithium-ion battery (LIB) recycling process. Main areas of concern include the collection phase, which presents risks such as fire hazards. During shredding, recyclers face significant issues with metal emissions and organic compounds. During the manufacturing process and recycling, the reactors deal with high temperature enhancing the risk with the organic compounds. The resulting waste, a filter cake containing phosphorus, aluminium, fluoride, and other compounds, currently poses analytical difficulties and is typically neutralized before landfill disposal. Additional challenges include managing dust, addressing water use during the black mass (BM) stage and hydrometallurgy, handling unknown or new battery chemistries, and developing effective recycling methods for graphite.
- Participants discussed significant challenges concerning administrative procedures and definitions in battery recycling and refining processes. Key difficulties include handling various battery types through separate recycling lines. Critical administrative questions involve determining when the recycling process officially concludes, assessing end-of-waste (EoW) status versus European List of Waste (EU LoW) classifications, and verifying material recovery sufficiency alongside financial stability.
- The discussion addressed the initial phase of battery recycling, focusing on collection, transportation, and early-stage processing. Have been noted significant administrative burdens and costs associated with transporting hazardous waste, including regulatory notifications and involvement of competent authorities. The recycling process typically begins with mechanical shredding followed by pyro-metallurgical treatment, although some processes skip shredding and directly utilize pyro methods, retrieving metals like cobalt, nickel, and copper. Key risk management efforts focus on controlling dust and small particle emissions, with organics typically burned off, leaving primarily $CO_2$ emissions.
- Some participants deal with only one kind of waste (Sodium Sulphate) and they have the technology to recycle it for their own process.
- Comments from the automotive sector raised the implications of the upcoming Battery Regulation (BR), emphasizing sustainability and emissions-related challenges, specifically Articles 7 and 8. The group also

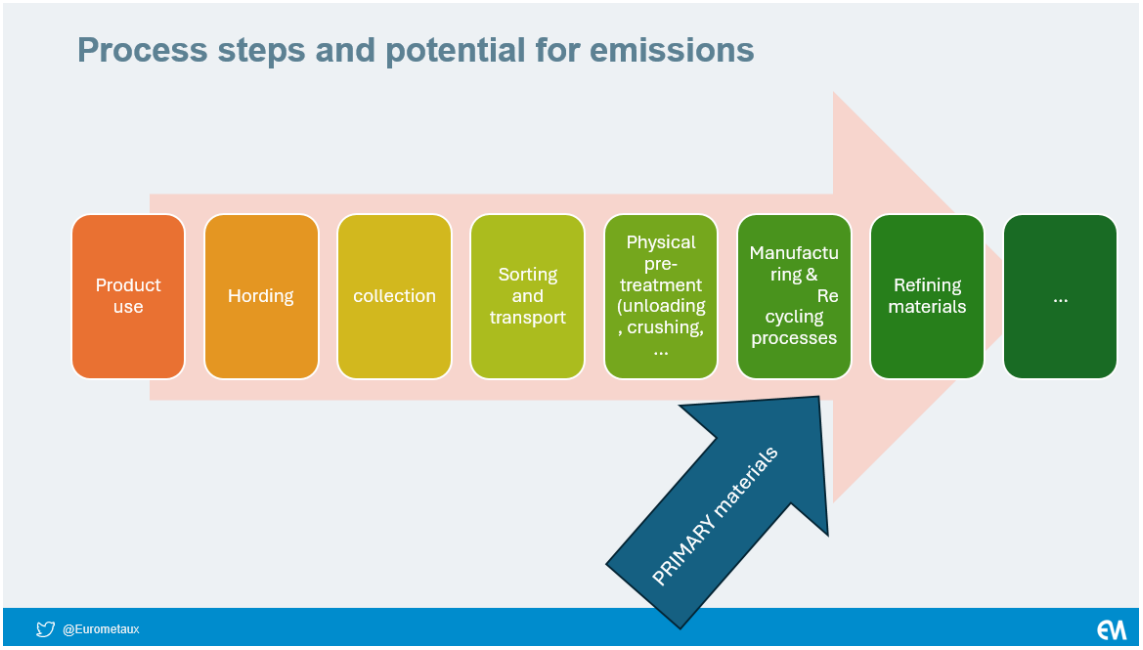
discussed the challenges related to the increasingly long lifetimes of batteries and their second-life applications. Concerns were raised about ensuring the profitability of recycling businesses, especially given differing economic viability among recyclers. The importance of proactively designing batteries for safe use and easier recycling was emphasized, particularly given the long development cycles, with manufacturers already preparing to meet recycling regulations anticipated for 2031.

- The discussion addressed risks and emissions primarily associated with battery production and recycling, with particular attention to nickel (Ni). Numerous risk management measures, including existing legislative controls and emission limits protecting workers and the environment, are already in place. Nickel-specific restrictions also exist, especially for products involving skin contact. Additionally, further regulatory limits for nickel are anticipated, particularly affecting the mining sector.
- During the tour de table was emphasized the importance of emission control in BREFs particularly concerning battery production and recycling. Given the expected increase in battery volumes, ensuring sufficient recycling and landfill capacity is essential. It was noted that BREFs provide valuable guidance on managing emissions and adopting environmentally sound techniques, helping to address potential capacity challenges and promote controlled environmental management.
- Have been highlighted the importance of balanced standards and alignment between battery recycling processes and upcoming regulatory frameworks such as the Industrial Emissions Directive (IED 2.0) and BREFs. Gigafactories, representing a significant share of battery production, will fall under these regulations. Ensuring compatibility with ongoing initiatives like ECaBaM was emphasized. Safety management was underlined as a critical priority, regardless of the specific battery chemistry—whether LFP today or potentially non-ferrous metals (NFM) in the future.
- Harmonization across Member States is essential to avoid fragmented regulation and ensure efficient, scalable battery recycling at the EU level.
- Clear and consistent End-of-Waste (EoW) criteria are needed, particularly for Black Mass, which is currently debated as either a product or an intermediate requiring further treatment.
- Economic feasibility and competitiveness must be safeguarded; recyclers should be supported rather than overregulated, especially since they must recycle what is available, even if they didn't introduce hazardous substances like POPs.
- Import-related challenges, including materials from China and plastics, further complicate safe recycling and must be addressed uniformly.
- Batteries rarely go to landfill when they contain valuable materials, making the claim misleading; proper regulation should reflect this reality.
- Fire risks pose a significant challenge for recyclers, particularly regarding insurance coverage. Ensuring a profitable recycling business model is critical, as recycling activity will decline without a strong market. Battery design should facilitate material recovery, yet some materials used extensively (e.g., due to low cost) may lack recycling value. It is also essential to ensure that black mass remains within the EU to support regional processing and value retention.
- NiCd batteries, particularly portable ones, have limited market relevance today, and are generally not hoarded. Industrial batteries are often repurposed rather than stockpiled. Recycling processes for NiCd batteries are well-established and consistent globally, relying on dismantling and cadmium distillation rather than shredding. Exposure risks are well-documented, supported by 20 years of anonymized data collection through a dedicated observatory established by the cadmium association, involving producers, recyclers, and manufacturers. All NiCd batteries are recycled within the EU, with no exports, and the sector operates with a strong, shared knowledge base and robust database on exposure.

- Cobalt: Emissions and exposure mainly arise during production. Thanks to REACH, significant data is now available, and a cobalt-specific OEL (Occupational Exposure Limit) process is underway, alongside efforts to establish a Cobalt Observatory.
- REACH vs BR: While REACH focuses on manufacturing and use, the Battery Regulation (BR) allows more flexibility. For example, where risks are not adequately controlled at the waste/recycling stage, risk management measures can be targeted to that stage under the BR. The aim is to encourage sustainable industry scale-up. ECHA is contributing through BREF development and promoting pragmatic, life-cycle-based approaches.
- Graphite: Recycling of graphite is at an early stage with very limited data, especially regarding contaminants. For materials like graphite and lithium, poor-quality feedstock raises doubts about their suitability for battery-grade applications.

## 4. Outcome of the discussion

The outcome was presented following the proposed scheme, extracting from the discussion the issue for each step of the recycling (and manufacturing) of a battery:




Product use: Use is not hazard-free.

Hoarding: Hoarding was identified as a challenge primarily linked to consumer behaviour, especially in the case of alkaline batteries. Julie-Ann highlighted issues with vapes and other single-use batteries. Unlike consumer batteries, industrial batteries are not significantly affected by hoarding.

Collection, sorting and transportation: Risks related to battery collection arise primarily in the handling of consumer batteries, such as those in e-bikes and phones, rather than industrial or professional batteries, whose collection

systems are functioning well. The main concerns emerge during the stages of sorting, transport, and especially storage. The movement of lithium-based batteries is highly regulated under the EDR, requiring notifications and creating delays. Additionally, inconsistent definitions of hazardous versus non-hazardous waste across countries cause logistical challenges, leading to increased storage times and volumes—heightening fire and safety risks. This situation is exacerbated by regulatory fragmentation at the national and regional levels, which results in dis-harmonization and hinders timely recycling access.



Physical pre-treatment: There is a potential need for risk management in battery shredding operations, especially with the increasing presence of unknown battery types. Dust emissions during shredding pose exposure risks from both metals and organics. Although the existing Waste Treatment BREF (2018) covers shredding, its data is based on older processes (from 2013) and it primarily applies to large-volume operators, leaving small-scale recyclers and new technologies insufficiently addressed. Additionally, pre-treated materials entering the EU often have unknown compositions, further complicating safe and effective treatment.

Primary material: Primary materials, which enter the EU for battery manufacturing, are currently not fully integrated into the regulatory framework that bridges physical processing and recycling stages. While the Mining BREF provides some coverage on exposure risks, it remains unclear whether it sufficiently addresses all relevant aspects, particularly for newer materials. A major concern is the lack of robust data on exposure and environmental monitoring for these new substances, which poses challenges for effective risk management and regulatory oversight.

Manufacturing and recycling process: Battery recycling presents complex challenges due to the formation of unknown impurities, particularly organic compounds, which may arise during high-temperature processes. While metals are well understood and regulated, organics, including substances like PFAS and potentially persistent organic pollutants (POPs), pose emerging risks. The material being recycled often differs significantly from the original, leading to variability and unpredictability in composition. Although recycled material may contain fewer impurities than raw material, the nature of these impurities is often unclear. There is cautious optimism about tools like the Battery Passport, but doubts remain regarding its effectiveness in capturing relevant information for risk management. The upcoming BREF may offer some guidance, though it may not fully address the evolving complexity.

Refining materials: The main challenge in battery recycling lies in cost. While recycled materials can technically reach the quality of primary materials, achieving this level of purity is expensive. Materials with high gate fees, such as LFP batteries, are often more likely to be sent outside Europe due to limited domestic capacity and profitability concerns. Additionally, for some metals, recycling cannot match the cleanliness of primary refining. The current economic model for EV battery recycling is imbalanced, and many business-to-business actors are stockpiling materials like LFP while awaiting more favourable conditions. Ultimately, environmental and cost efficiency must be weighed to support sustainable recycling within the EU.



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Avenue de Tervueren 168, Box 13 | B-1150 Brussels | Tel: +32 (2) 775 63 11 | www.eurometaux.eu | eurometaux@eurometaux.be | @Eurometaux

June 2025

# Day 2

## 1. Lessons learnt from Phase 1 and orientation debate on Phase 2



**Augusto di Bastiano (ECHA)** presented the status and future plans under ECHA's mandate to identify Substances of Concern (SoCs) in batteries, a task mandated by the European Commission in December 2023. This work is part of a two-phase investigation aiming to support regulatory decisions under the Batteries Regulation and in alignment with REACH Restriction procedures.
Phase 1 focused on mapping battery substances, processes, and existing uses of mercury (Hg), cadmium (Cd), lead (Pb), and chromium (Cr VI). Over 300 substances have been identified, but key challenges emerged:

- Low response rate to the stakeholders' questionnaire due to unclear or overly complex questions.
- Mismatch between ECHA's data and the contractor's substance list.
- Missing information, especially on substance concentrations, emissions, exposures, and market data.

To address these issues, ECHA is reviewing Ramboll's report, refining the list of substances, and finalising investigations on Hg, Cd, and Pb. A pragmatic approach, relying on conservative assumptions when data is lacking, was adopted.
ECHA acknowledged that battery waste falls outside the usual scope of REACH, which focuses on substances rather than waste. The battery sector was identified as a new and under-explored regulatory area. Direct engagement with recyclers and waste operators, beyond questionnaires, proved vital. Coordination with Commission and JRC is also key for success.

The second phase, set to begin mid-2025, will address remaining information gaps and culminate in a final report to the Commission by Q4 2026. This report will:

- Provide a harmonized and refined list of SoCs in batteries.
- Define SoCs using the ESPR framework (covering hazardous substances, POPs, and those that hinder recycling), with possible additions such as substances for which RAC has expressed a positive opinion on harmonized classification
- Incorporate lifecycle and waste-stage exposure data.
- Set criteria for prioritising substances for regulatory action based on information such as hazard, exposure, volume, and existing lifecycle measures.

ECHA aims to apply REACH-like restriction processes to batteries, with adjustments for waste-related risks. This involves updated templates, IT tools, internal training, and stakeholder consultation. A special focus is on how SoCs will be defined and managed across the product lifecycle, including during recycling.

**Next Steps:**

- June 2025: Completion of Phase 1 report.
- Q3 2025: Start of Phase 2 final report drafting.
- Q4 2026: Submission of the final report to Commission.



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ECHA is also establishing internal coordination groups and will continue engagement through the ECaBaM platform. The overall approach emphasises practical risk management, better questionnaire design, and improved data collection for future policymaking.

## 2. Q&A



1. Are we expecting the comments submitted on the draft report in November to be implemented before the final report is released in June?

ECHA: The aim is to provide this kind of feedback, but we will assess what can be shared at the end of the process. There is concern that sharing it earlier could cause turbulence, so the final report will be adjusted accordingly to mitigate this risk.

2. We have received several requests regarding the list of substances, including requests to double-check and complete it, but some say it doesn't make sense. Should we aim for full completion to move forward?

ECHA: A pragmatic approach is preferred. The goal is not just to review the list, but to help identify the key questions and gather input on what industry considers relevant. The definition of Substances of Concern (SoCs) is still under discussion, as the Basic Regulation (BR) does not directly reference ESPR and institutions will need to define this. It's important to distinguish between substances that are of concern and those that are not. As the process moves forward, the focus will narrow to those substances that genuinely pose a concern. Industry is not being asked to add substances, but rather to review what has been done and correct inaccuracies. Ultimately, what matters is identifying a small, meaningful list of substances truly relevant for risk management.

3. Are we currently checking for substances like mercury and cadmium in recycling processes? Have these metals been found in workers at such facilities? More broadly, is there clear evidence of a problem, such as lead poisoning, that justifies expanding testing? While adding tests isn't technically difficult, each new requirement adds cost, especially for small or family-run businesses. With varying recycling volumes across Europe, additional burdens could threaten the viability of the sector. Shouldn't we ensure there is a real issue to address before introducing further obligations?

ECHA: To justify a restriction, there must be evidence of an unacceptable risk that needs to be addressed at the EU level. If the risk is localised, such as at a single plant, then a restriction would not be appropriate. We need concrete data on certain substances to rule out potential risks. Identifying whether a real problem exists is the next step. Importantly, if the European Commission asks ECHA for a report, it does not automatically mean that a restriction will follow. The process can stop if it's shown that the risk is controlled.

## 3. New trends and further capacity-building needs – Ilka Von Dalwigk

Ilka Von Dalwigk is the Director General of RECHARGE, the advanced rechargeable and lithium batteries industry association in Europe. In the context of ECaBaM, she gave an extensive overview of the new trends regarding the world of batteries. On the regulatory front, several important legislative initiatives are now in force, notably the Critical Raw Materials Act and the EU Battery Regulation. These measures reflect the European Union's commitment to boosting strategic autonomy, securing critical supply chains, and enhancing the sustainability of battery production and end-of-life management. The Critical Raw Materials Act sets ambitious targets for domestic capacity, such as achieving 10% extraction, 40% processing, and 25% recycling of critical raw materials within the EU, while also limiting dependency



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on any single non-EU country to a maximum of 65%. The EU Battery Regulation complements this by introducing mandatory requirements for due diligence, carbon footprint declarations, and recycling efficiency, by progressively increasing targets. These regulations are being actively implemented by stakeholders such as Recharge and other industry actors along the battery value chain.

The European Commission is also rolling out a wider set of industrial measures designed to strengthen Europe's competitiveness and technological leadership in the battery sector. This includes the Clean Industrial Deal, the Automotive Action Plan, and a dedicated battery booster package that will mobilise up to €1.8 billion in funding over the next two years. These initiatives aim to support battery manufacturing, improve coordination across supply chains, and ensure compliance with EU environmental and safety standards. Additional steps such as the reclassification of black mass as hazardous waste and restrictions on its export are part of the broader effort to enhance circularity and keep valuable materials within the European economy.

From a technology and market perspective, significant developments are underway. Recent projects have demonstrated that end-of-life batteries can be successfully refurbished and repurposed for grid-related applications, thereby extending their useful life. However, the long-term market preference, whether toward refurbishment or direct material recovery, remains uncertain and will likely depend on the evolving economic value of recovered materials and second-life applications. Industry stakeholders emphasise the need to allow market forces to determine the most viable paths forward, given the diversity of use cases and battery chemistries.

Research continues to explore alternative recycling pathways, particularly for materials such as Silicon, and more broadly, across cathode, anode, and electrolyte technologies. There is growing interest in reducing dependency on critical raw materials like Cobalt, Nickel, and Lithium, with innovations focusing on lithium iron phosphate (LFP) chemistries and emerging solutions such as lithium manganese iron phosphate (LMFP) and sodium-ion batteries. These alternatives promise to improve cost efficiency, thermal stability, and sustainability, though some, especially sodium-ion, are not yet commercially competitive at current lithium prices.

In parallel, efforts are being made to improve battery manufacturing processes, including the use of solid and semi-solid electrolytes, dry coating techniques, and encapsulated or pre-lithiated anode materials. These technological trends reflect a broader ambition to align industrial innovation with evolving regulatory and customer expectations, including safety, performance, and lifecycle impact. Overall, the European battery ecosystem is transitioning towards more diversified, circular, and strategically secure supply and production models, supported by both policy and innovation.

## 4. Circularity of batteries – current (and future) hurdles – Kenneth Ekman

Dr. Kenneth Ekman is the Head of R&D and Concept Development in Fortum Battery Recycling Oy. The session on circularity in battery recycling highlighted both the urgency and complexity of establishing a functioning circular economy for electric vehicle (EV) batteries in Europe. By 2030, over 1.5 million EV batteries are expected to reach end-of-life, yet the ecosystem to manage them sustainably remains under-developed. While efforts are underway to make operations as safe and environmentally sound as possible, the absence of mature business models is a significant barrier. Many actors in this emerging market, particularly smaller players, lack the resources to properly monitor and control environmental and social impacts. There is growing interest from multiple stakeholders, including organics, but the sector needs structural support.

Material flows are increasingly circular in theory, but in practice, the lack of well-defined "circular business models" leads to considerable leakage of valuable resources, such as black mass, from regional European supply chains. Most of this black mass is currently exported to Asia, undermining the goal of domestic value retention. Ensuring that value is shared among all actors, manufacturers, recyclers, and users alike, is key to building a resilient system.



Design for recycling also remains a major bottleneck. Many batteries are not constructed with disassembly or recovery in mind, making recycling highly labour-intensive in the absence of automation. Collection and sorting are further complicated by the variety of battery chemistries and inconsistent permitting processes, which can take years. Economically, the viability of recycling is constrained by high capital expenditure requirements, particularly for advanced hydrometallurgical and pyrometallurgical facilities. Without stronger regulatory alignment across EU Member States, progress toward a circular economy will remain fragmented.

Looking ahead, a number of systemic hurdles must be addressed. These include advancing recycling technologies that recover high-value materials efficiently (rather than simply using cheaper chemistries), integrating circularity into a global supply chain still optimised for linear production, and raising consumer awareness about proper battery disposal. Sustainable sourcing of new materials and the development of a skilled workforce are also essential to the transition.

To overcome these challenges, a set of policy and market-based measures is needed. These include government incentives to de-risk early investments, creating clear demand signals for recycled materials, and fostering cross-border collaboration and data sharing. Regional value chains must be supported through partnerships and knowledge exchange, ensuring that the costs and benefits of end-of-life battery management are fairly distributed. Ultimately, enabling a sustainable battery ecosystem requires coordinated action across the regulatory, economic, and technological spheres.

## Conclusion of the workshop

The third ECaBaM workshop, held on 7–8 April 2025 in Brussels, brought together experts to discuss critical aspects of battery materials, regulatory challenges, and future capacity-building needs. The discussions were structured in two breakout groups: Group 1 focused on mapping substances of concern (SoCs) in batteries, addressing information gaps related to substances used in battery manufacturing and recycling, and identifying potential risk management options; Group 2 examined manufacturing and recycling processes, associated emissions, exposures, and existing and future risk management practices across the battery lifecycle. Key topics included recycling challenges, data gaps on substance concentrations, difficulties in collecting exposure data, regulatory fragmentation, and the evolving role of new battery chemistries. The workshop also reviewed broader trends such as the EU Critical Raw Materials Act, Battery Regulation implementation, and the need for clearer circular economy business models. The next steps will include finalising Phase 1 of ECHA's study and moving into Phase 2, with a final report due to the European Commission by Q4 2026. Upcoming ECaBaM will focus on substances hampering recycling and battery market developments.



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Avenue de Tervueren 168, Box 13 | B-1150 Brussels | Tel: +32 (2) 775 63 11 | www.eurometaux.eu | eurometaux@eurometaux.be | @Eurometaux