December 2024

Exchange & Capacity-building Group on Battery Materials *(ECaBaM)*, 2nd workshop

Helsinki, 28-29 October 2024

Final Report

The second workshop of the Exchange & Capacity-building Group on Battery Materials (ECaBaM) was held in person and online on 28-29 October 2024 in the European Chemicals Agency (ECHA) in Helsinki. 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 meeting was conducted according to the antitrust rules of Eurometaux, to which all participants were reminded to fully comply.

ECHA's Executive Director, Sharon McGuiness, welcomed in person and online participants and opened the discussions for day one by setting the scene. She recalled ECHA's Strategy Statement, which notes the need for attention for collaboration and knowledge exchange with stakeholders. The subject of this workshop is quite relevant for ECHA, since its tasks under the new Batteries Regulation mark the shift ECHA's in thinking from substances to products. As a result, there is also some refocus work to be done towards stakeholders as ECHA will need to think in a different way as before: there is a need to look at new ways of working, new dynamics. With every new piece of legislation, synergies with existing tasks will need to be explored and new challenges will pop up, both for regulators and stakeholders. Delivering on the tasks under the Batteries Regulation are significant. The new regulations are also a challenge for Member States. Therefore, it will be very important to build capacity and advance science and knowledge around batteries for all parties involved. ECHA further understands the need to explore appropriate support towards industry, in particular SMEs, by having the tools and approaches to implement future requirements. Engagements such as today's through ECaBaM has a value for the agency and exchanging knowledge in this context is important. Today's meeting is an opportunity for learning and interchange on technology, substances and chemicals management practices. Today is also a key step in a collaborative exercise to successfully implement the Batteries Regulation. She closed her address by wishing all participants good discussions and engagement. It is a collaborative effort to be jointly ready.

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Day 1

Chaired by Violaine Verougstraete (Eurometaux)

The Chair reminded participants that ECaBaM is a platform created by Eurometaux to facilitate exchanges with ECHA on its tasks for the implementation of the EU Batteries Regulation and substance restrictions, being the first task the identification and prioritisation of substances of concern to support COM to prepare the list of substances (study outsourced to Ramboll), and the second the set-up of the restriction process of substances in batteries. A first workshop took place on 16-17 April 2024 to set the scene and for key actors to get familiarised, with very relevant presentations on batteries technologies and markets, as well as trends. In April, participants helped refine the questions for the initial questionnaire prepared by Ramboll, that helped gather key information over the summer and of which the preliminary results will be presented today.

This second workshop is therefore Beginning of a cooperation for exchange of information, today's workshop a follow-up for these activities, with the following aims:

1. Informing stakeholders about the outcome of the data-gathering survey that will be the basis for ECHA's mapping and list of substances.
2. Discussing upcoming key issues for the continuation of ECHA's work: prioritisation, waste and recycling, and SEA.
3. Gaining a better understanding of key issues, such as those regarding battery producers and OEMs, the role played by in/organics, etc.
4. Fostering and facilitating cooperation in the expertise development and early submission of relevant information

The agenda of the 2nd ECaBaM meeting was approved, with items focusing on the outcome of the survey, further capacity building and discuss aspects to facilitate the implementation.

1. Introduction on the drivers of prioritization

Magdalini Topouzidou (European Comission, DG ENV) set the scene by providing some background on the BR. Its recent update was justified given the sharp increase in production volumes that is expected for the next years, estimated to increase **by a factor of ~14** compared to the current situation due to their role in the decarbonisation and energy transition. The Batteries Regulation therefore aims for their safe use, recycling of materials and promoting strategic autonomy in the EU. Unlike the previous Directive, the scope of the Batteries Regulation now covers the entire lifecycle and cover batteries whether or not incorporated in or added to products. The life cycle of batteries covered and references to key sections of the BR is provided in the scheme below.

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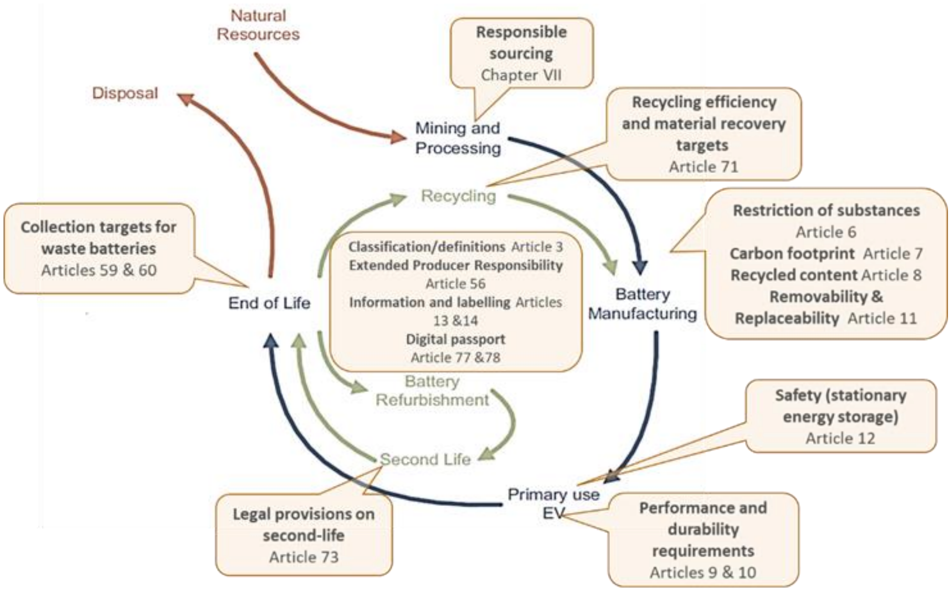
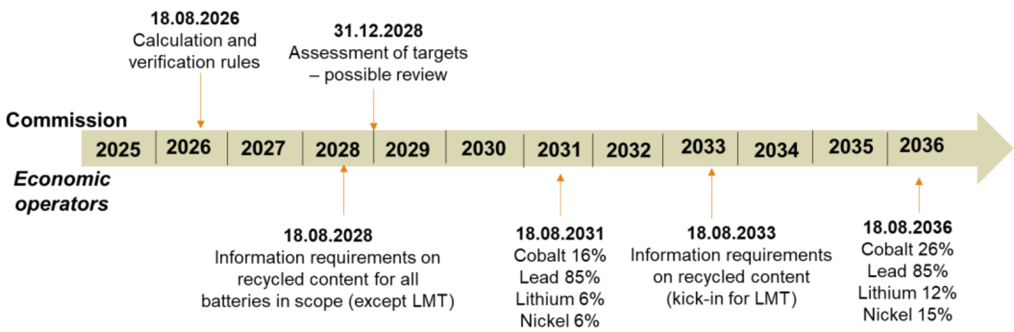


In addition, there is a long list of different battery types all covered by the new BR (Portable batteries (including portable battery of general use), Starting, Light, Ignition (SLI) batteries, Light Means of Transport (LMT) batteries, Electric Vehicle (EV) batteries, and Industrial batteries (including stationary battery energy storage systems (SBESS)).

A key task for the Commission (COM) is to adopt restrictions of substances in case of an unacceptable risk to human health or the environment, arising from the use of a substance in the manufacture of batteries, or from the presence of a substance in the batteries when they are placed on the market, or during their subsequent life cycle stages (including waste). The procedure to adopt a restriction in general follows the REACH approach whereby ECHA committees are involved (covering also socio-economic assessment, including an analysis of alternatives). It is expected that COM will wait to propose restrictions until the process is in place, except for an urgency, but Member States are also allowed to initiate a restriction dossier if they wish to do so.

By the end of 2027, the Commission, assisted by the European Chemicals Agency, is required to prepare a report on substances of concern, meaning substances having adverse effect on human health or the environment or hampering recycling for safe and high quality secondary raw materials, contained in batteries or used in their manufacturing.

The BR includes in article 8, also key elements to promote a circular economy of battery materials, in particular art. 8 on recycled content. It is a staged approach to introduce this according to the scheme:



Delegated acts will help implementing this and reaching the targets listed, including recycling efficiencies and recovery for materials for different timepoints as defined in art 71.

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RECYCLING EFFICIENCIES BY 2025 (AND 2030)	RECOVERY of MATERIALS BY 2027 (AND 2031)		
75 % for **lead-acid** batteries (80% in 2030)	90 %	for **cobalt**	95 % in 2031
65% for **lithium-based** batteries (70% in 2030)	90 %	for **copper**	95 % in 2031
80% for **nickel-cadmium** batteries	90 %	for **lead**	95 % in 2031
50% for **other waste batteries**	90 %	for **nickel**	95 % in 2031
	50 %	for **lithium**	80% in 2031

These values resulted from a JRC study and are presently forwarded to the WTO for consultation by 3 December. These values can be amended depending technical progress.

A key issue in respect to battery materials recovery is the black mass that can be considered as an intermediate in the battery material recycling cycle. The Commission defined this material having waste status.

Finally, she introduced the status of activities to cover the battery manufacturing and recycling for the List of Waste (LoW). Recital 116 requests to update the LoW to reflect all battery chemistries, in particular the codes for lithium-based waste batteries, in order to enable proper sorting and reporting of such waste batteries. There is a consultation ongoing. The final adoption is envisaged for Q1 2025.

Augusto di Bastiano (ECHA) took over from the Commission to explain more in detail the ECHA tasks under the new Batteries Regulation and the next steps.

He stressed that ECaBaM 1 was an important and first step, among others, to understand/collect the information needs on substances in batteries, but also the technology trend/critical materials, the issues and development strategy (among others via stakeholders' questionnaire but also workshop).

For ECaBaM 2 he noted as important objectives:

- To brief on the outcome of the Ramboll survey
- To explore aspects relevant to the prioritisation of substances for restrictions
- Increase understanding of the issues and challenges for industry
- How to improve the assessment of risks from waste and recycling activities.
- How to provide recognition for strategic autonomy and availability of the battery technologies in the EU
- What would be relevant SEA considerations for the implementation of the BR

From the survey, ECHA noted a response rate lower than expected and that substances registered for use in batteries are not aligned with information received in the survey, i.e., not all was covered/reported. Therefore, an update of registration dossiers for substances registered for use in batteries would be required. Moreover, they have also observed that updated information on releases/exposure is needed to improve risk assessment for waste handling and recycling.

As a reminder, the goal of ECHA is to provide a report with a list of SoC and an indication on Risk Management and prioritisation to the COM by end of 2026. The internal milestone for that is having an initial report (Phase 1) by June 2025 (including the mapping of substances and processes and the investigation on use in batteries of Hg, Cr (VI), Cd, Pb and indication for further actions). The final report is phase 2. There is also internal work ongoing to set up the restriction process within the agency.

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Phase 1 – mapping	Phase 2 - identification and prioritisation	Restriction process under BR - implementation
• Understanding of technologies and processes (current and under development) for manufacturing of batteries, handling, disposal and recycling of waste batteries • Identification of substances present in batteries and/or used in different processes • Definition of properties, specific uses, technical function, quantities • Identification of key drivers for substances selection and possibility for substitution	• Identification of SoC (criteria to be used) • Restriction for substances in batteries justified if risks for Human Health or Env are not adequately controlled and need to be addressed EU wide (Article 6(2)) • Principles for assessment of risks • Prioritisation: Adaptation/integration of SVHC criteria & Development of new criteria • Possible additional elements to be considered in the prioritisation other than hazard properties and exposure	Process set up: • ECHA's team set up and capacity • building • RAC-SEAC set up and training • Restriction templates and internal • procedures • IT tools, website and info sharing • Communication and external support

This workshop is crucial to learn from the first phase of the Ramboll study: the mapping step, especially on the handling and recycling of batteries, the identification of substances of concern (SoCs) in batteries (some being technically essential or strategic, while others are not), what are relevant key drivers for prioritisation and which substances can be substituted.

For phase 2, the definition for handling a restriction is identical as under REACH (EU-wide risk). The SoCs definition used in their work comes from the one codified under the Ecodesign for Sustainable Products Regulation (ESPR). SoCs as defined in the BR also include an additional criterion on *substances that could hamper recycling*. Principles for Risk Assessmemt in this respect are under discussion at ECHA. Further key is the prioritisation of substances that could be based on existing classic criteria. SoCs are also an issue in the context of other legislation like ESPR, ELV, RoHS and IED, to name the most relevant ones. This means that ECHA will have to manage this well in the future under the new upcoming tasks.

He referred further to the COM comment that *the EU political levels will most probably not propose a restriction until the list and reports of ECHA are available by the end of 2026*. However, MSs may prepare a restriction as well, hence the need to be ahead of time with guidance and interpretation.

ECHA's restriction process under the BR will be consistent with the REACH process, including the consultation of scientific committees and the opportunity for stakeholders to provide relevant information during the Public Consultations and participation in the Committees. Stakeholders are vital for ECHA, hence the need for mutual understanding on roles and responsibilities, aiming for increasing the relevancy of the outcome, improving the feedback and communication and building trust in processes and the outcome.

ECHA therefore invites all stakeholders to engage with them through the different tools they have available for that (ECHA news, public consultation, guidance development, etc.) and in respect to the BR, the "have your say" during the Public Consultations on restriction proposals.

He further clarified that ECHA assures that confidential information will be protected and not communicated.

The next steps for ECHA's battery team are:

- Finalisation of Phase 1 report by June 2025
- outsource of Phase 2 report (list of SoC and prioritization) by Q3 2025
- Final report to COM by Q4-2026

- Implementation of the restriction process: policies and procedures, guidance/training communication, IT tools, internal capacity building

During his presentation he emphasised in particular that the recycling of battery materials will be critical. However, we note that this is not the primary driver in the design of new batteries and battery types.

Discussion

- *ECHA further clarified what confidential information is or not: information is not confidential (COB) unless explicitly requested by industry. In addition to this formal COB flag, there is always a generic data review before ECHA discloses specific information types like market data for example.*

- *Will there be a list of SoC for each legislation? We need to think about downstream industries that must assemble and combine all lists and components in e.g. one passport. Will consolidation of these lists also be part of the job?*
    - *ECHA replied that they look at cross-connexion, particularly because they are also in charge of RoHS, packaging waste, and other legislation with similar requirements. ECHA centralises the responsibilities of legislations in different units. They referred to the OSOA principle: when assessing a substance, they in general will take outcomes with them.*

- *If the existing exemptions on Cd, Hg and Pb have to be extended, how would that be done under the BR given the timeframe is short?*
- *ECHA referred to section 2 of the Ramboll survey on implementation. It is COM that will need to define whether to proceed with a restriction (extend/modify current ones). Substances listed in Annex I are about gathering information on these substances, including on releases. Why are these substances used for? Functional role or impurity?*

- *On SoCs: On which definition and criteria should we focus?* Preferably all the stakeholders should understand in the same way what is behind.
    - *ECHA confirmed that this is a main objective of phase 2 of the project and that there will be more concrete information provided at that stage.*

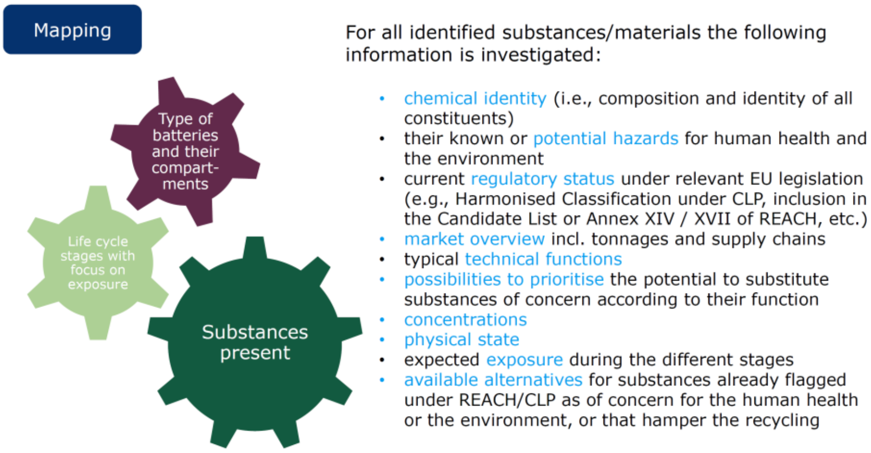
- *'Hampering recycling' is a new requirement and a different type of criterion. Recycling processes for batteries are equivalent to those for other materials (like electronic materials) and often handled in the same installations. Hence the criteria and guidance will also have an impact on ELV/RoHS. Batteries are part of what lands in the recycling streams. We thus need to keep in mind that the scope of recycling will be broader.*

2. Outcome of the Ramboll survey

Alexander Porykus, Maren Krause and Klaudija Obajdin (Ramboll)

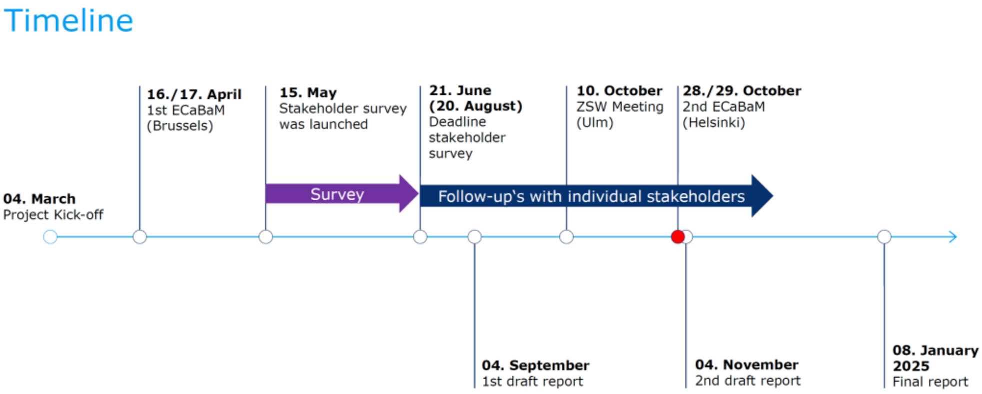
The presenters outlined the work done by their team **during the phase one** of the study outsourced to Ramboll by ECHA. Ramboll has leaded the survey activity and presented the interim report finished in September based on the information collected from stakeholders and internal research. Ramboll recognised persisting information gaps and COB, which require to be superficial on certain aspects.

The scheme below provides an overview of the information searched for in the **mapping, the first part** of their work:



The team recalled the challenge with market data not necessary directly related to uses. Ramboll has also been asked by ECHA to reflect about the potential to substitute substances of concern according to their function with additional criteria. This will be a topic for reflexion in the breakout session. They explained that they prepopulated their report with substances identified from the JRC list. Some examples were presented on which comments were made and which are available in the slides.

The scheme below provides the timeline of the data collection up to the delivery on the first report early 2025:



The number of reactions on the survey was not very extensive (41) and different for the different steps of the battery supply chain and the different battery type chemistries. Most comments were received from the substance manufacturers.

Some shortcomings of the survey were highlighted like e.g., that the categorization does not distinguish between primary and secondary batteries; does not specify whether the categories' name e.g., "lithium-based" refers to the materials used in anode, cathode, or electrolyte etc. The uses of these substances could be subdivided in substances used in: the manufacturing processes, substances present in the batteries, those formed during the electrochemical processes in the

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battery when functional, during the recycling processes and others (like plastics).

Lead-based	•PbA: Lead Acid batteries
Lithium-based	•LCO: Lithium-Cobalt-Oxide rechargeable batteries •LMO: Lithium- Manganese-Oxide rechargeable batteries •NMC: Lithium-Nickel-Manganese-Cobalt-oxide rechargeable batteries •NCA: Lithium-Nickel-Cobalt-Aluminium-Oxide rechargeable batteries •LFP: Lithium-Iron-Phosphate rechargeable batteries •LTO: Lithium-Titanium-Oxide anode rechargeable batteries •$LiSOCl_2$: Lithium-Thionyl-Chloride primary batteries •$LiSO_2$: Lithium-Sulfur Dioxide primary batteries •$Li\text{-}MnO_2$: Lithium Manganese Dioxide primary batteries
Nickel-based	•NiMH: Nickel-Metal-Hydride batteries •$Na\text{-}NiCl_2$: Sodium-Nickel-Chloride batteries
Alkaline-based	•Alkaline based batteries
Zinc-based	•Zn-C: Zinc-Carbon batteries •Zn-Cl: Zinc-Chloride batteries •Zn-air: Zinc air batteries •Ag-Zn: Silver-Zinc batteries •Ag-O: Silver-Oxide batteries
Sodium-based	•Na-S: Sodium-Sulphur batteries •Na-ion (cathode made with prussian white, layered oxide or polyanion) batteries

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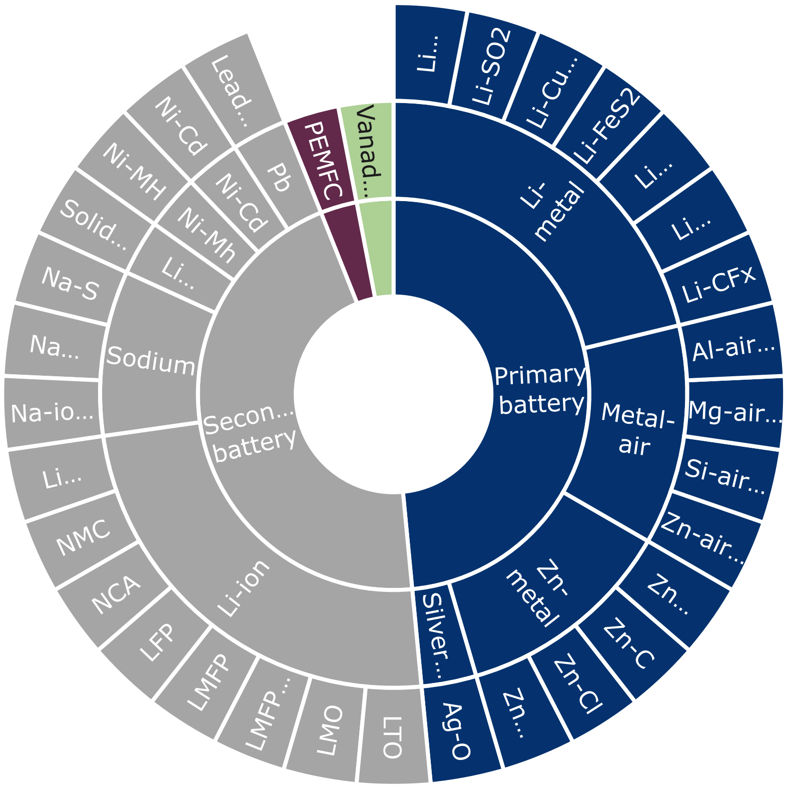
Ramboll summarized the different battery technologies as follows:



329 substances could be identified, with 157 substances not previously accounted for by the JRC report. 250 of those substances could be identified by a CAS/EC number as a unique identifier. The remaining could not.

For the substances with a CAS number, they started an initial SoCs assessment based on the ESPR criteria, being: SVHC substances (candidate list for authorisation), specific hazard classes or hazard categories (triggered by ESPR), POPs. In addition, they will need to identify substances that are negatively affecting recycling.

One of the problems they encountered relates to the fact that in the ESPR the criteria are based on harmonized classifications. New hazard classes are not mandatory yet, so CLH does not include categories like ED and PMT. A second problem was that for a series of substances there in no harmonised classification, but only hazard notification classification was available from the registration files. The graphs below define the different numbers for each of those groups:

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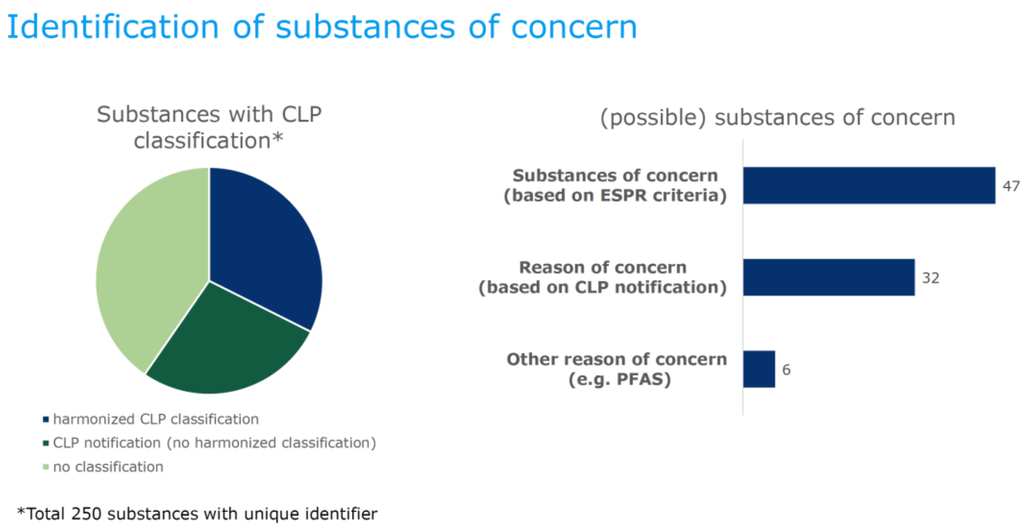
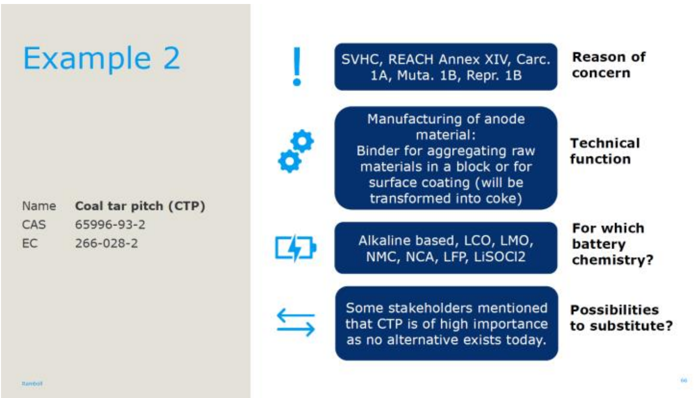
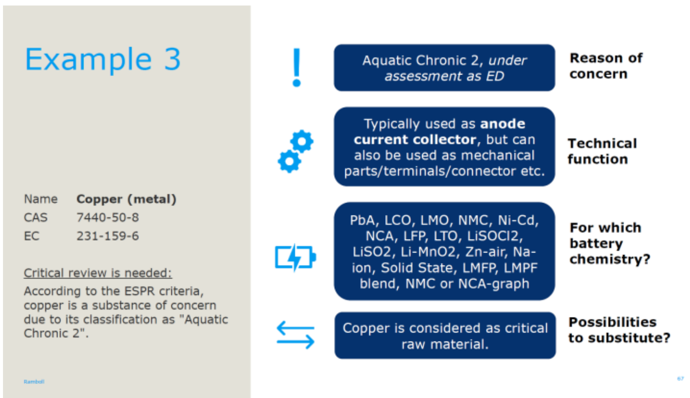


Ramboll then presented four different examples on how they would like to assess the substances in respect to their potential concern, their technical function, which battery chemistry they are used in and potential risk management (including substitution). Two such examples one on an organic (CTP) and a metal (Cu) are provided hereunder:





The Ramboll researchers still have several open questions from the assessment so far: Market data for substances of concern used in batteries, identification of SoCs (not the one with unique identifier or CLH), or what is the specific technical importance in batteries of all the listed substances.

Specifically in the context of substitution/prioritisation they questioned if the function could be used to differentiate the 'difficult-to substitute/critical/essential substances' (e.g., key metallic ions) from the 'more-easily-substitutable' ones (e.g., additives).

Furthermore, they identified information gaps for specific battery chemistries such as Li-metal, sodium batteries (NaS, $NaNiCl_2$) and metal air (Zn-air). Open questions include what are their production processes, exposure risks and mitigation measures and if there are established End of Life (EoL) processes for such less common battery chemistries.

The **second part of the project** focussed on an **investigation on Cd, Pb, CrVI and Hg,** on which Ramboll presented some preliminary results at ECaBaM 2 encouraging participants to share further information on outstanding data gaps or identifying mistakes.

- On Hg:
    - Hg is used to prevent internal gases that could cause leakage as well used as an electrode.
    - Their current use seems phased out and concentrations are very low if still occurring

    - The substance is extensively regulated, and the survey seems to indicate that Hg is not used in battery manufacturing anymore in the EU
- On Cd:
    - Most Cd in batteries is used for the production of NiCd batteries
    - Those batteries are used for their (very) technical functionalities like resistance to corrosion, and varying temperatures
    - In these batteries, Cd Cd OH act as the active material in the anode in concentration ranges of 6-18%
    - The use of Cd, including in batteries, is well regulated
- On Pb:
    - SLI batteries are the main use of Pb in the EU with up to 53% used in automotive applications and 31% in industrial batteries
    - Some uses or traces of Pb in other battery types (like in Zn air batteries) could not be confirmed from the responses on the survey
    - Pb is also well regulated at different levels including in portable batteries under BR.
- On CrVI:
    - NOT intentionally used in batteries for a specific functionality
    - Most passivation uses are already phased out but CrVI is still used for the passivation of Cu foil to prevent oxidation before being used in Li-ion batteries and other applications. (see also ongoing REACH authorisation)
    - Important is that there are no residues in the final battery product
    - CrVI: is no longer used and certainly on the phase out

Finally, RAMBOLL ended its presentation by reminding some key open questions that could so far not be resolved from the questionnaire:

- Market data of SoCs used in batteries
- Some outstanding identifications when no CAS number could be identified
- How to deal with SoCs for which only non-harmonised classifications are available
- In respect to substitution and prioritisation: does it makes sense to use "the specific functionality" to differentiate between the "difficult to substitute / critical / essential substances, from the more "easily substitutable ones"?
- Information on production processes, exposures, risks and risk mitigation for specific battery chemistries (for series of type of batteries: Li-metal, sodium-based batteries ad Zn-air batteries)
- Information gaps on EoL processes for the less common battery types indicated in the point above

DISCUSSION:

- *How to handle production processes not in the EU, optimised elsewhere? Some of the Occupational Exposure Limits (OELs) required for NMP in the EU would not be met elsewhere (e.g. Annex XVII for NMP) outside EU jurisdictions. One thing ECHA can impose is that if a substance is present in the batteries, restrictions possible on imports.*

- *There was a remark that NMP is not present in the battery, it has to be removed during manufacturing process to allow proper functioning.*
    - *Ramboll replied that the information is compiled based on stakeholder input. They have reasons to believe that NMP is completely removed in the final battery, but this was input received from the survey. Moreover, there is information that NMP or other apriotic solvents may be used in the recycling process for some batteries.*

- *There seems to be a clear need for a process to collect further information on outstanding questions, to include comments/corrections to the collected info to avoid ad hoc discussions. One option suggested by ECHA is to include this objective in phase 2 of the study, going again through the listed materials aiming to update lacking information or making corrections were relevant.*

- *Compliance with article 33 is more than SVHC substances. The question is whether Ramboll has only looked at CAS number of SVHC candidate list or beyond. ACEA checked for lacking substances and identified many. We need to agree on what substances and identifiers (CAS numbers) to consider. The ones on ECHA SVHC website or beyond?*
    - *Ramboll replied that they needed to start from something. ECHA confirmed that we need to go beyond but for resource reasons, this was difficult to do it already now. They invited ACEA to share the list publicly.*

- *NMP is a good example to demonstrate that Asian players are not aware that NMP cannot be in the battery. Was this issue analysed? Moreover, when such players completed the questionnaire, were they aware about the criticality of the exercise?*
    - *Ramboll replied that indeed biased information can occur, the question is how to check for this. As indicated above we may collectively aim at improving this during phase 2.*

- *Is there a real issue with imported batteries containing unwanted impurities?*
    - *Ramboll confirmed that they do not expect this given the strict standards. The question is how to deal with the manufacturing processes outside the EU were substances like NMP may still be widely used while forbidden in the EU. ECHA noted that this is outside the jurisdiction of the EU.*

- *How will the existing risk management measures be documented/covered in the report?*
    - *Ramboll clarified that the question on RMMs was part of the survey. Some stakeholders provided this information for each substance in the battery, others did not. At this stage they have not further embarked into the exposure question. Suggestions for input are most welcome. Clear exceptions are Pb and Cd for which extensive monitoring and risk management information was provided. For the other substances, this information will be considered in the next phase.*

- *The Batteries Regulation targets substances having an ENV/HH effect, or hampering recycling? This looks like a mix between hazards and risks, not just a listing based on hazard categorisation alone.*
    - *ECHA recalled that the starting point for a restriction is that the risk is inadequately controlled on an EU wide basis. Subsequently the Restriction dossier is the place to substantiate and assess this potential risk. It may conclude that the substance has an effect for a number of reasons or not. In the latter case a restriction is not needed. Before preparing a restriction dossier, an investigation takes place (light restriction, reports are on the ECHA website). It is clear that there is no possibility to do restriction/risk assessments of all substances in two years' time since ECHA has no resources for it. It will be a stepwise process: listing the substances present in batteries, identification of SoCs, providing suggestions for priorities, etc. In the end it will be the COM the one to decide to move forward on a substance or battery technology to investigate the relevance for a restriction.*

- *For existing substances in Annex I, how will it work? Would the existing restriction on CrVI, Hg and Cd, for given battery types be extended to other battery types? Don't we need to prove first that risks are there? E.g. exposure at the workplace.*
    - *At this stage this is an investigation, not an assessment of risks. Once that has been done and confirmed and if exposure does indeed occur that would create a risk at EU-wide level, the COM can follow-up if they feel relevant.*

- *There is a difference between the investigation and the mapping. In the investigation, there is a requirement to assess exposure and RMMs. Outcomes could be "no risk as phased out" or e.g. "risk because some releases have been identified and may need to be addressed". COM may propose to check: CFE, PC = conclusion need or not.*

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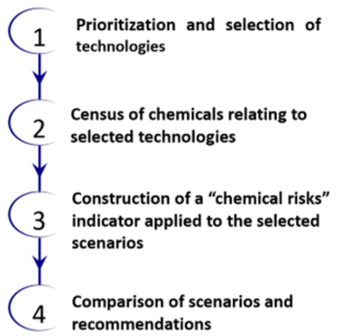
3. The French TEMA project on the Environmental Risk of the Energy Transition

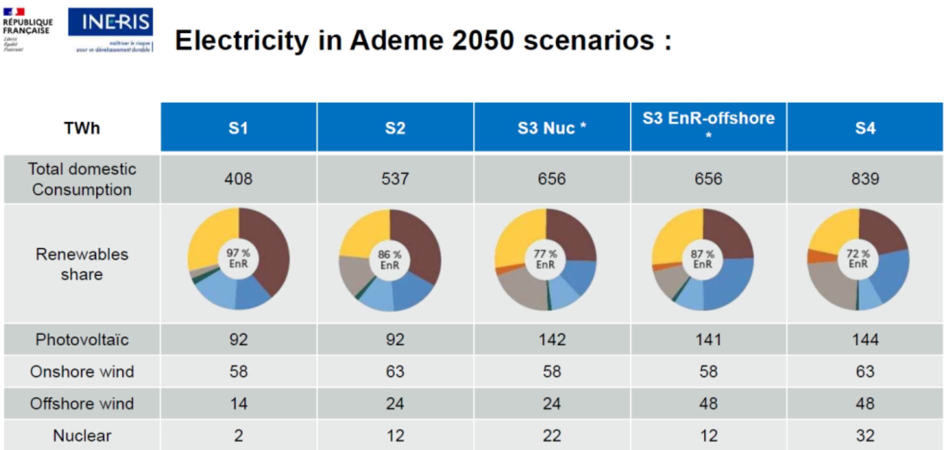
Jean Marc Brignon (INERIS).

Jean Marc Brignon, from the French National Institute for Industrial Environment and Risks (Ineris), presented the ongoing research-oriented project funded by ADEME, the French Agency for Ecological Transition, that aims mainly at creating a knowledge basis on several energy technologies, including batteries, and runs from 2024 to 2026. The project follows a stepwise approach as indicated in the graph.



The initial data collection on chemicals and materials is done by Ineris (like Ramboll did for ECHA) based on existing scientific literature, grey literature, websites, in-house experts, and external experts (including industry). This is then followed by prioritization of processes/technologies and focus on key batteries components, with a workshop and one-to-one discussions with experts expected to refine the findings. A last step is envisaged for further data collection and validation on selected priorities. The completion is expected for September 2025.

For this study France will work with four scenarios depending on the energy generation/source combination used (different types of renewables, nuclear, …):



Electricity in Ademe 2050 scenarios :

TWh	S1	S2	S3 Nuc *	S3 EnR-offshore *	S4
Total domestic Consumption	408	537	656	656	839
Renewables share	97 % EnR	86 % EnR	77 % EnR	87 % EnR	72 % EnR
Photovoltaïc	92	92	142	141	144
Onshore wind	58	63	58	58	63
Offshore wind	14	24	24	48	48
Nuclear	2	12	22	12	32

For batteries in particular the study will (for resources reasons) have to focus on specific types (stationary or portable or automotive). A potential risk indicator is defined depending on the chemicals used, their quantities, uses, hazards and exposures for the different energy scenarios.

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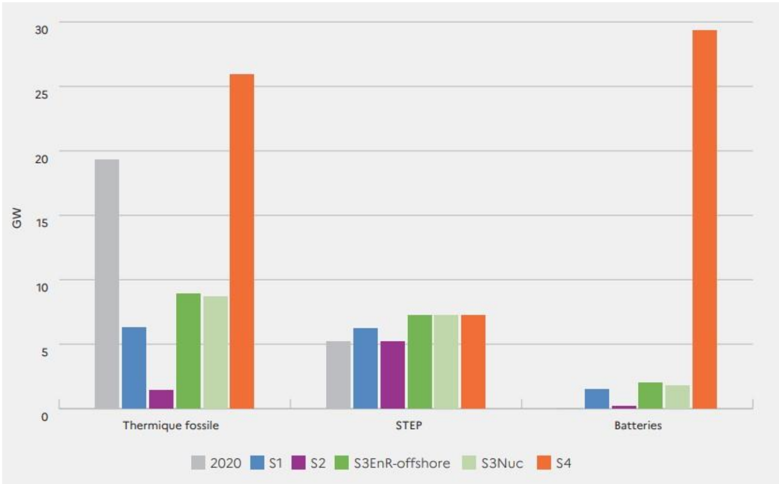
RÉPUBLIQUE FRANÇAISE INERIS

Batteries in Ademe 2050 scenarios :



INERIS / UGE / IFPEN / ENPC 90

DISCUSSION:

- *What are the final aims of the research? Is it to inform the legislator?*
    - *Ineris stated that at this stage the study is mainly for research purposes and that there was no direct aim to inform authorities. This research comes from the finding that so far the Environmental Footprint impact assessment is mainly focusing on CO2, GHG... and less on other environmental impacts like toxicity, which may be as important or at least complementary.*
- *Would it not be relevant to schedule for an Exchange of information with ECHA in phase 2?*
    - *Absolutey.*

4. Vehicle manufacturer's issues with Hazardous Substances in batteries

Timo Unger (ACEA).

Timo presented the challenges and needs of end-users, taking the participants on a journey from vehicle manufacturing and use, to battery end of life. He stated that most car manufacturers source and do not produce the battery components themselves, whereby the original equipment manufacturer (OEM) battery sourcing is mainly driven by cost and performance targets. Hence this aligns rather with the supplier's available technologies, rather than the OEMs being specific about the battery technology itself. Moreover, most OEMs (except TESLA) are not directly involved in the battery material development. The specifications from OEMs can however include requirements on the use of hazardous substances on the procured materials (not on how they are manufactured), information that the supplier has to provide in the Global Automotive Declarable Substance List (GADSL).

Vehicle manufacturers do not identify problems related to the assembling of batteries at OEM sites given there is no exposure at all to the hazardous battery components during the assemble process, nor during the use phase in the car. The reason is that the batteries are sealed by design when delivered to the OEMs.

Regarding the end-of-life phase, for circularity reasons, recycling is for the car manufacturers a "last resort" measure. They first promote their reuse, then refurbishment and remanufacturing, and only as a last option, recycling for materials recovery or disposal. Contrary to the SCIP database or the physical label foreseen in art. 13 of the BR, the Battery Passport and the IDIS (International Dismantling Information System) are seen by the sector as good data transfer and

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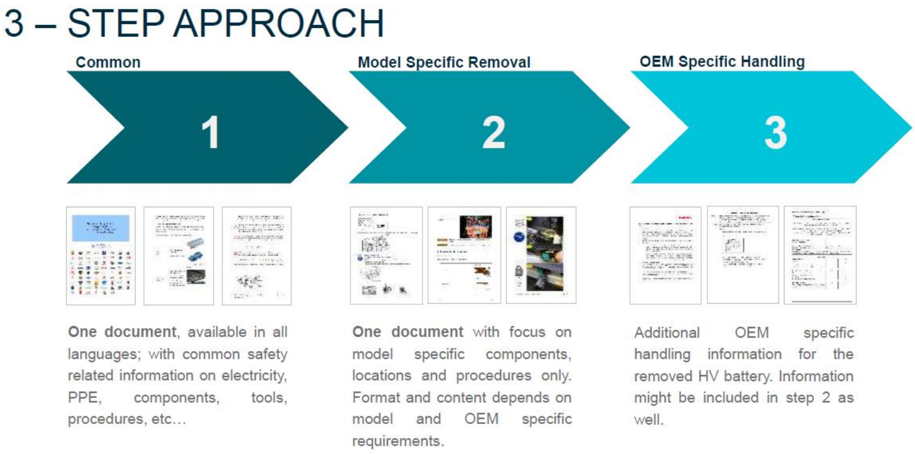
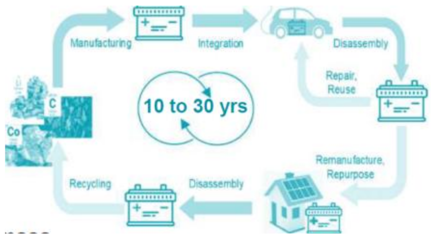
communication tools to promote and perform efficient and safe end of life. For materials, EoL management in the sector, the right type and amount of information is needed. The 3-step approach example of High Voltage batteries in IDIS was provided as an example to support this.



Regarding recycled content, the is so far limited experience with EV batteries, hence the role of hazardous substances in hampering recycling is at this stage unclear to the sector. Key issues include the challenge of legacy materials and testing for materials compliance of secondary materials (compared to the purity of primary materials).

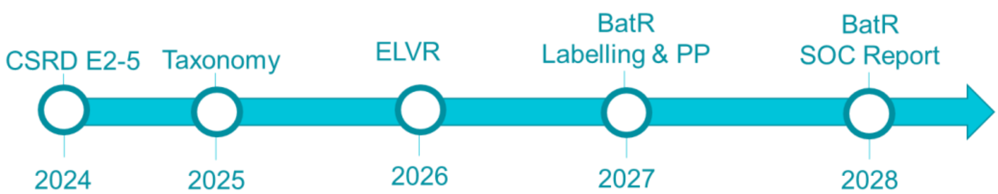
Moreover, there is an extensive time gap between manufacturing and final material recycling (see picture) that causes questions on what we know about battery technologies in 30 years and how do we know if materials will hamper recycling or not.



A key issue already identified by the sector is to prevent the export of Black Mass for recovery outside the EU, which makes it more difficult for EU companies to meet their recycling obligations. It was suggested/questioned if a classification as hazardous waste could be of help.

On the challenge of CBI, ACEA managed to find a CBI protection mechanism in the GADSL (Material Manufacturers are allowed to "hide" up to 10% of their recipe). But if a substance is listed on GADSL as prohibited or declarable due to its hazards for example, then it must be reported.

They did a systematic assessment of SoC categories by legislation, concluding that the issue on hazardous substances in batteries is unclear, complex and going beyond (only) SoC's. Moreover, the timing between the different legislation using hazardous substance information in respect to batteries is not aligned, as shown in the table.



Legal Reference	SOC / hazard definition
Article 6 of the Battery Regulation	ESPR SOC Definition
Article 13, Annex VI & Annex XIII of the Battery Regulation	Hazardous substances acc. to Art 3, CLP
Article 2(28) of the ESPR	ESPR SOC Definition
Article 5(1) of the ELVR	ESPR SOC Definition
Article 5 of the PPWR	ESPR SOC Definition
Annex C of the EU Taxonomy	All criteria of CLP and Art 57. REACH
Article 32 – 35 of the CSRD	ESPR SOC Definition without POPs
Guiding criteria and principles for the essential use concept in EU legislation dealing with chemicals	Most harmful substances
Green Claims Directive	To be analysed

ACEA stated that their systematic assessment of SoC categories by legislation as well as a systematic assessment of SOC categories by hazard classes that can be shared for the purpose of the Ramboll survey.

Finally, he concluded indicating a series of open questions that needed further monitoring:

- Harmonised- vs. self-classifications: ACEA only considers substances with a harmonised classification, not those with only self-classifications.
- Are classified mixtures in scope? We do not consider classified mixtures but only the substances.
- Substances with a classification where the hazard depends on the exposure route / use / composition / impurities/ dimension / etc. ACEA only lists those substances where the hazard in hard parts can be clearly identified.
- How to interpret and consider 2(28)d: "*substances that negatively affects the re-use and recycling of materials in the product in which it is present*"? They are not proactively considering substances that may fulfil this requirement.
- Thresholds? They facilitate the standard threshold of 0.1% w/w of the homogenous material (or lower if already otherwise required). There is a challenge due to different reporting thresholds in SDS.

Discussion

- *Given that almost all batteries for EV use are imported into the EU it seems relevant that the main (non-EU) battery manufacturers (CATL / BYD / PANASONIC) contribute to the survey and if not (which was confirmed by Ramboll) should there not be an effort done to have them included in the survey?*
    - *ECHA and Ramboll concurred on the relevance of this concern and information need.*

5. The case of Ni-Cd batteries

Patrick de Metz (ICdA)

The industrial Li-ion market grows fast but is presently still small in tonnage compared to the industrial Pb-acid battery market which can be considered as the workhorse. In between are the Ni-Cd batteries in tonnage and applications, designed and used for specific technical niche applications.

A series of criteria, mainly the specific energy storage and power a battery can provide, defines what type of batteries you (can) use.

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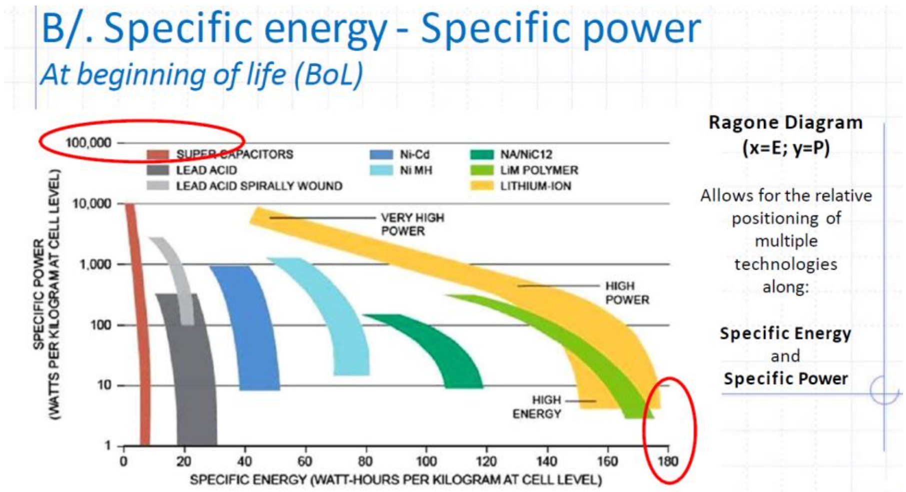
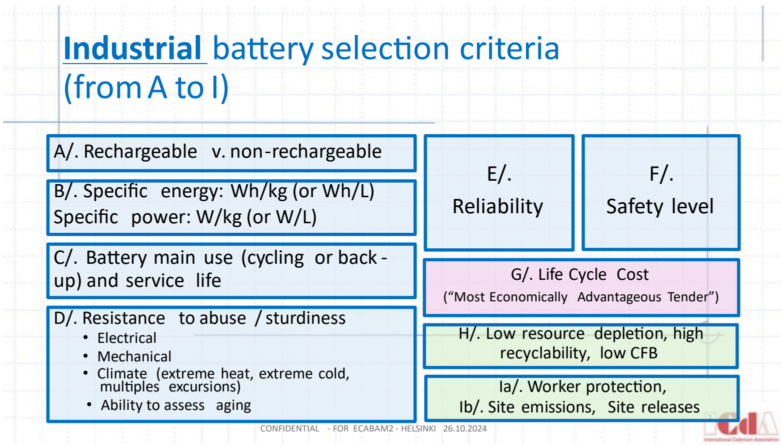
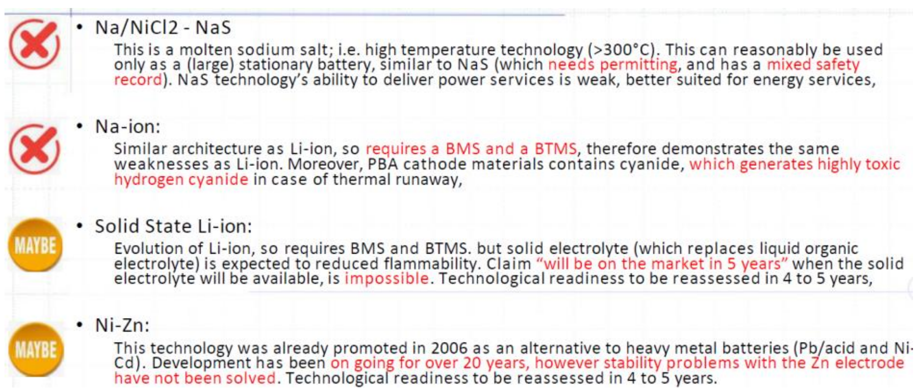


Those define in essence the generic battery selection criteria relevant for different uses. Three of them (D, E and F) are typical for the Ni-Cd batteries: resistance to abuse, extreme reliability and safety levels resulting in their use in mission critical industrial assets (like power plants or heavy industries), trains, Tram and Metro rolling stock and civil aviation.



Finally, the presenter provided an overview of the current availability of technically feasible strong candidates to substitute for industrial Ni-Cd batteries as provided in the overview hereunder, concluding that at this stage they are not available but that for the future, solid-state Li-ion batteries and Ni-Zn batteries may be feasible options.

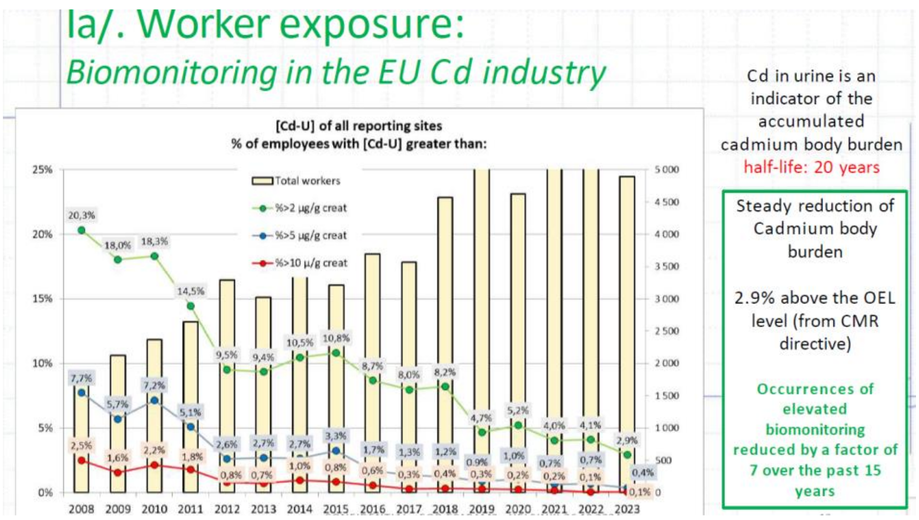


Given the hazard properties of the materials used in Ni-Cd batteries, the sector provides extensive attention to its EHS approach covering aspects like manufacturing of batteries, used battery collection and recycling, worker protections, plant air and water releases, etc.

As stated by the previous speaker too, there is no exposure during the use phase of the batteries under conditions of normal and reasonably foreseeable conditions of use.

In order to control and minimize exposure during the raw material production, battery manufacturing, battery recycling, they have put in place an ICdA Guidance on the management of the Risks Related to Chronic Occupational Exposure and its Compounds.

In follow-up of the adopted EU-OEL on Cd (2019) he noted that the EU Ni-Cd battery sector for its monitoring programs, shifted from respirable towards inhalable monitoring, concluding that the share of workers not compliant with 4µg/m3 respirable fraction is decreasing, reaching full compliance. This is complemented by the biomonitoring programme showing that 2.9% of the Cd exposed workforce (predominantly male and aged between 20 and 60) have a CdU > 2.05% (corresponding to the French general population. This demonstrates (see also other slides) that health and environmental risks are well controlled.



Moreover, the water and air releases are well controlled whereby the contribution from the battery sector is declining both in total amounts as well as comparable to other Cd emitters (e.g. Zn sector)

In summary, he concluded that NiCd batteries at this moment are used in specific niche applications (mainly industrial) where reliability and resistance is of ultimate importance. Potential alternatives for Ni-Cd batteries are at this moment not yet technically feasible and the Health and Environmental risks are well controlled.

Conclusions by the chair

Violaine Verougstraete (Eurometaux)

On the drivers of prioritisation:

ECHA recalled that restrictions for substances in batteries are justified if risks for Human Health or Environment are not adequately controlled and need to be addressed at EU wide level (Article 6(2)), this follows the principles for assessment of risks. With regards to prioritisation, a possibility would be to adapt/integrate SVHC criteria together with the development

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of new criteria (i.e., possible additional elements to be considered in the prioritisation other than hazard properties and exposure). The functional properties of the substance in the battery (critical vs not specific) could be discussed as a potential improvement (see item for the breakout on day 2). Jean Marc Brignon also invited stakeholders to participate in the discussion on the possible risk indicator developed by Ineris.

On the outcomes of the data-gathering exercise:

There are some data gaps on which further interaction and input would be welcomed. For some technologies/batteries, a lot of input was received, but far less for others. The absence of information from key non-EU battery manufacturers was noted as a point of further attention. The discussion showed the importance of distinguishing between the mapping part and the investigation parts of the project but also of having more refinements in phase 2. An exchange with Ineris in phase 2 would also recommended.

On the key issues for OEMs:

Data, data and data. We need to provide the right information to the right audience, in the right time, right format, tailored to the specific needs of the different waste operators. ACEA presented the IMDS database and the mechanism in place and explained that when it comes to hazardous substances, one needs to go beyond the ESPR SoCs. Moreover, there are clear outstanding questions on what should be considered as relevant substances under the BR. The CSRD for example looks at hazardous substances with labelling, starting already in 2027. The BR seems to be the most demanding because it refers to hazardous substances. It is urgent though to increase the understanding and digestion of the requirements.

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Day 2

Chaired by Pamela Campbell (ECHA)

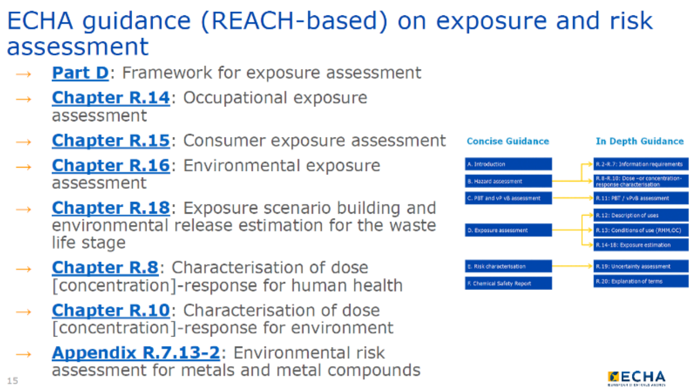
Pamela Campbell (ECHA) recalled that on Day 1 the participants received a general overview, and initial results from the Ramboll survey, which showed the need for further input. Input can also be provided in other formats. Ineris, ACEA and Industrial batteries shared interesting perspectives. Today is about exposure, SEA, organics, future trends.

1. Assessing risks from waste and recycling activities

Celia Tanarro and Stefano Frattini (ECHA) opened the second day with a presentation on the role of risk assessment in restriction processes with a focus on assessing risks from waste and recycling activities. Stefano started from Article 6 of the Batteries Regulation and explained that the scope is really triggered by the hazard profile of a substance. The type of risk assessment required is very different depending on whether we have a PBT/PMT vs chronic hazard or threshold vs non threshold.

The scope of the risk assessment will follow the provisions set in REACH for restriction dossiers; in particular, it should be clarified upfront on which hazard to focus on and what uses. In general, in REACH hazards need to be confirmed via CLH or inclusion in the candidate list (SVHC). The risk assessment shall cover all uses including use and manufacturing. Here we focus on recycling/waste stage because volumes are expected to increase.

Regarding the **methodology and guidance**, Stefano presented the available ECHA guidance, but it is not excluded to set up a specific guidance for exposure and risk assessment of batteries:



- Part D is setting up the framework for exposure assessment, including the assessment needs of transformation products.
- Chapter R14: for example methodology to assess exposure to workers in industrial setting (such as in recycling centres), collect measured to characterize exposure, etc.
- Chapter R15: consumer exposure might be relevant in certain cases on use of batteries by general population
- Chapter R16: relevant to assess environmental releases and exposure, not covering specifically the waste stage while
- Chapter R18: most relevant one, unfortunately not covering specifically recycling of batteries and lacking accurate and reliable information on release from waste. Need of measure data on releases to refine release factors proposed in R18
- Chapter R8-10: mostly related to hazard assessment and characterisation; to be used in case dose response (or DNEL, PNEC) not already set by authorities
- Chapter R7 (appendix): specific assessment criteria for metals

However specific technical guide on risk assessment for batteries might be needed to complement the REACH one.

With regards to assessing **Environmental Exposure and Risk**, the scope of the assessment is triggered by the hazard. For PBT-vPvB/PMT-vPvM substances the emissions should be minimised. In case of PBT only emission estimation is needed, but for environmental threshold substances exposure assessment is needed to demonstrate the control of risk. For environmental threshold substances, the risk characterisation ratio (RCR) should be lower than 1 (PEC/PNEC <1). For threshold substances for Human Health, the RCR for humans exposed via the environment (HvE) should be lower than 1 (exposure/DNEL <1). For non threshold substances for Human Health the risk of HvE should be minimised and impact assessment performed. For HH hazard triggering HvE assessment, the exposure assessment is always required, but is treated differently if you have threshold substances (risk < 1) in respect of non threshold (e.g. cancerogenic), where impact assessment (e.g. population exposed)_ is needed.

The DNELs, PNECs or dose response curve (for carcinogenic substances) are normally already agreed at Risk Assessment Committee (RAC) level and hence available (in general).

Emission estimation is the start: it is a key element for environmental risk assessment. It is the basis for the exposure estimation (PEC derivation). Per se, is "the" assessment criteria for PBT/PMT substances.

The emission estimation is based on:

- Literature data (e.g. OECD-Emission Scenarios Documents - ESD)

- Measured emission campaigns

- Both, literature and measured data can be used to derive Sector Specific Environmental Release Categories (SpERC) (can be very relevant!)

Exposure estimation is always required, except the case of PBT/PMT or ED (where threshold cannot be identified).

Predicted Environmental Concentrations (PECs) can be obtained by fate and transport modelling (EUSES, now embedded in Chesar tool, preferably used). In some cases adaptation of the model is needed to suit the case of metals. For the Human via the Environment assessment of metals specific Biotransfer Factors (BTF) to estimate vegetables and meat concentrations are required. Measured environmental concentrations in the vicinity of the recycling sites can also be used to estimate PECs

What do they see as current data gaps/needs:

- Scarce information on releases from recycling and waste stage:
    a. R18 Guidance not accurate on releases from waste (landfill, shredding)
    b. OECD ESDs do not cover emissions from waste
- BREFs on batteries do exist:
    a. NMF: Lead battery recycling processes (BATs) and associated emission limits
    b. Battery giga factories: more appropriate but not before 2025 and focus seems on manufacturing
- Measured emission campaigns is needed
    a. To estimate releases from battery dismantling and recycling sites
    b. To derive SpERCs for different processes and use conditions
    c. More in general, to characterise releases from waste stage

He explained that in the absence of data, ECHA can only rely on conservative assumptions as contained in the guidance.

He provided some **examples of relevant REACH restriction proposals**:

- Restriction of MCCP: PBT, releases from waste stage (landfill, incineration)

- PVC investigation report: PBT like assessment, releases from waste stage. Additives from PVC need to use default in guidance. This is a pre-restriction study (covering several substances) that might be replicated in the context of restriction of substances in batteries

- CrVI: Carcinogenic (non-threshold). Work in progress. Can be interesting as can be an impurity in batteries, is non-threshold. HvE: distribution of releases and correlated risk from industrial sites. Relevant source of exposure. The restriction will end with different options: one may include with the definition of "acceptable" releases and related RMM (not a ban). This is very interesting as a thought starter in the context of batteries.

Celia took over from Stefano to present the **Human Health exposure and risk** part and its scope:

- For threshold substances for Human Health, the RCR for human health exposure should be lower than 1 (exposure/DNEL <1)

- For non threshold substances the exposure should be minimised and impact assessment performed

- Similarly to Environmental endpoints, threshold or exposure reference values (e.g. DNELs or dose response curve*) are typically discussed and adopted by RAC

There are two considerations to take into account, consumers and workers.

For consumers, their exposure to substances in batteries is expected to be unlikely in foreseeable use conditions. Exposure to consumers may occur due to misuse or malfunction of the battery (e.g. in case of fire). Consumers' exposure during waste handling/recycling is assumed to be unlikely, but exposure for general population can occur via the environment.

Exposure to professional and industrial workers can occur during production, use and maintenance of batteries, as well as in the waste and recycling stage. The exposure during waste handling and recycling may come from the recycling of the batteries themselves but also from handling and recycling of electronic devices containing batteries (WEEE). Workers' exposure depends on work practices, controls and technologies in place and can be relevant during waste handling and recycling.

Based on this, ECHA expects that in terms of **exposure estimation** the same principles will apply as for general Restrictions on substances: exposure estimation can be done using modelling tools, measured and biomonitoring data. Metals are components of batteries but there are only a (few) studies available that address the exposure at the recycling stages. ECHA's feeling is that based on current reference values, target concentrations for metals will be low. And this will most probably result in making air monitoring/biomonitoring a requirement for exposure assessment. Measurement techniques and biomarkers can be more likely available for metals/more rarely for other types of substances. There is information on biomonitoring for metals, values based on health effects, background values for general population, correlation BM and air value. Most metals have OELs and are measured in air, and you have biomarkers.

In terms of **current data gaps and needs**, looking at the publicly available data there are some studies available from Waste from Electrical and Electronic Equipment (WEEE) recycling and on battery recycling. Studies are available to address exposures during battery recycling, but most of them concern exposure to Pb (few studies cover other metals), there is therefore no coverage of all substances/all metals.

There are studies available on waste and recycling of electronic equipment that report presence of metals in air (and biomonitoring data) but you will have a mix, not only batteries. Few studies are available for other type of substances used in batteries. Probably more data may become available when facing a potential restriction.

Further Information on uses/tasks and actual conditions of use in the recycling/ waste stages will be useful to do a proper exposure assessment

To conclude:

- Recycling and handling of waste batteries are likely to represent a significant source of releases and exposure due to high increase of batteries' consumption and recycling
- Data gaps and need for new information have been identified for the estimation of releases from waste stage and recycling

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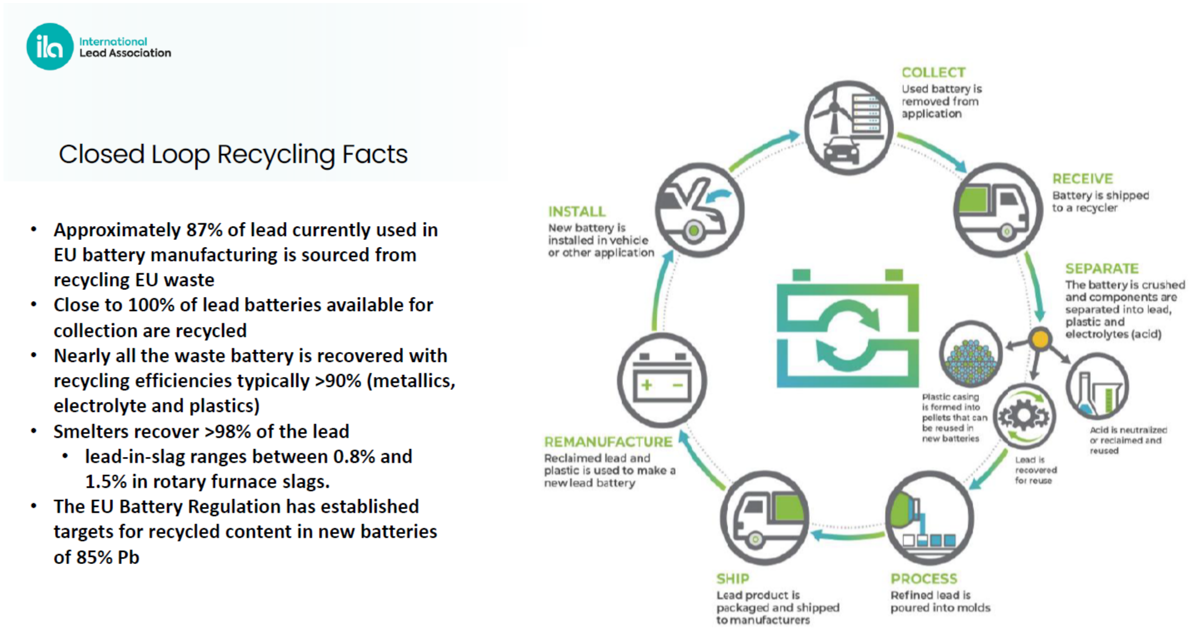
- Need to deal with uncertainty but in case of lack of data, the precautionary principle is applied/is considered when taking actions
- Support from industry and updated information from registration dossiers are of high importance for and accurate decision on exposure assessment
- Here the focus is on waste and recycling but regulatory actions under the Batteries Regulation may target all life cycle stages (use, production etc.)

DISCUSSION

- *Regarding environmental exposure: does ECHA look at local or regional/continental exposure?*
  - *ECHA replied that both. When assessing local, there is a need to consider also the background – so it is a case by case approach.*

Steve Binks (ILA) provided an update on lead battery recycling as a follow-up to his first presentation during the first ECaBaM workshop.

Pb batteries are the best studied batteries. The Pb batteries are the more common, are numerous and there for years. This allowed also to develop recycling.



Regarding slags, Pb ranges between 0.8 and 1.5% in the most common process and goes to hazardous waste. All in all, it is a success story for closed loop recycling.

Often the presumption is that Pb batteries have no market anymore and hence not a priority to focus on. But the reality is different. There are indeed some declines in SLI batteries because of EV (auxiliary batteries will have half of the weight). But most of the demand comes from replacement batteries. The EU demand is about 14% of global demand. The EU is an exporter (2 billions a year for EU businesses). There will also be growth due to increased demand for storage batteries.

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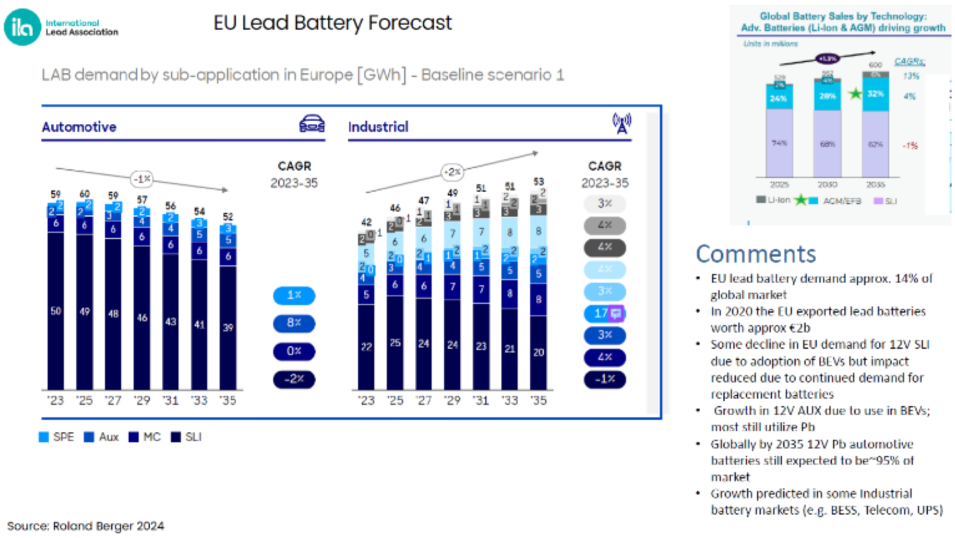

What does it mean in terms of Pb demand?

International Lead Association

Lead Demand Forecast For EU Battery Manufacturing *(automotive and Industrial)*

Year, Type	2023	2025	2027	2029	2031	2033	2035
Auto, Mte	1.23	1.23	1.24	1.25	1.26	1.26	1.27
Ind, Mte	0.85	0.90	1.00	1.12	1.23	1.33	1.47
Total, Mte	2.08	2.13	2.24	2.37	2.49	2.59	2.74

Note: there is some discrepancy in figures reported and forecasts (e.g for 2023- ILZSG reports total of 1.35 Mte)

By 2035: the industry battery market is expected to be the biggest demand.

Therefore, the question is whether there is additional information on Pb emissions from battery manufacturing. Steve referred to the study done in 2022 by VITO using water, air, soil data from 50 sites to refine EUSES (this was presented in ECaBaM 1).

The slide below shows outcomes of a study in 2021 on contributions to the environmental emissions across EU. Pb batteries contribute 95-96% of the Pb on the market.

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International Lead Association

Further Information on Lead Emissions From Battery Manufacturing

- Study Undertaken by ARCHE Consulting in 2021
- Site Pb emissions data (water & air) was obtained from questionnaires delivered to EU lead battery manufacturers and recyclers and compared to published PRTR data
- Pb emissions from EU battery production and recycling facilities appox 0.00061% of total used

AIR

Release activities	Pb emission (t/y) from PRTR (2017)	Pb emission (t/y) from industry questionnaires (2017)
1.3.1 - battery producers	2.32	4.54
1.3.1 - battery recycler	4.10	7.08
TOTAL	6.42	11.61

2.2%

WATER

Release activities	Pb emission (t/y) from PRTR (2017)
1.3.1 - battery producers	0.33
1.3.1 - battery recycler	0.26
TOTAL	0.59

0.59%

Table 1: Yearly lead emission estimates to air in the EU-27

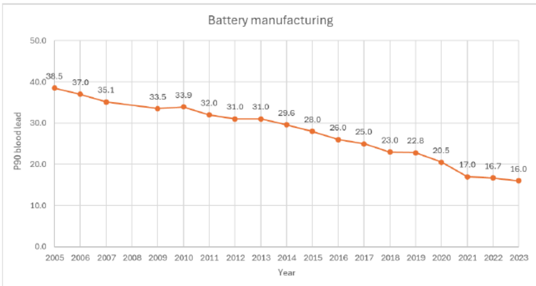
Release activities	Pb emission (t/y)	Contribution (%)	Reference
1 Production and processing of metals	**216.0**	**40.3**	
1.1 Production of pig iron or steel including continuous casting	138	25.8	PRTR, 2017
1.2 Metal ore (including sulphide ore) roasting or sintering installations	40.5	7.6	PRTR, 2017
1.3 Production of non-ferrous crude metals from ore, concentrates or secondary raw materials	27.7	5.2	PRTR, 2017 + Industry questionnaires (2017)
1.3.1 Battery sector	*11.61*	2.2	*Industry questionnaires (2017)*
1.3.2 Primary lead production	*7.21*	*1.3*	*PRTR, 2017*
1.3.3 Other	*8.87*	*1.7*	*PRTR, 2017*
1.4 Processing of ferrous metals	8.72	1.6	PRTR, 2017
1.5 Surface treatment of metals and plastics using electrolytic or chemical processes	0.71	0.1	PRTR, 2017
1.6 Ferrous metal foundries	0.35	0.1	PRTR, 2017
2 Energy sector	**56.1**	**10.5**	
2.1 Thermal power stations and other combustion installations	55.0	10.3	PRTR, 2017
2.2 Mineral oil and gas refineries	1.10	0.2	PRTR, 2017
3 Mineral industry	**7.51**	**1.4**	PRTR, 2017
4 Paper and wood production processing	**7.05**	**1.3**	PRTR, 2017
5 Waste management	**156.5**	**29.2**	
5.1 Waste incineration	25.5	4.8	Vangheluwe et al, 2013
5.2 Shredding	131	24.5	Vangheluwe et al, 2013
6 Traffic	**92.3**	**17.2**	2020 Update
Total	**535.5**	**100**	

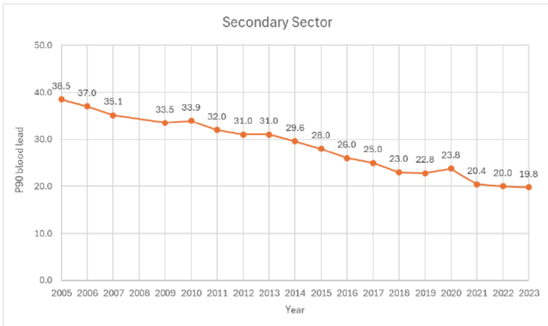
With regards to workplace exposure, they have now a binding value in CMRD (15 µg/dl and 4 µg/dl for women of childbearing age). There is still some work to be done. Pb is very data rich as biomonitoring is a requirement since decades. They have a very extensive database:

International Lead Association

Workplace Exposures: *Employee biological monitoring*

- **All companies conduct regular biological monitoring of employees through routine blood lead testing**
- **The sector has made significant efforts to reduce employee lead exposures through Asssociation driven voluntary programs and targets**
- **Adoption of DIRECTIVE (EU) 2024/869 in March 2024, now establishes an EU BLV of 15µg/dL and will provide additional stimulus to reduce employee Pb exposure in the battery sector.**





All data are reported as µg Pb/dL blood

Pb-B halved since 2005 meaning that Pb exposure decreased significantly as Pb-B also reflects historical exposure. Most of the companies are on target.

Discussion

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- *Regarding exports from the EU, it was stated that batteries that go to the UK and other regions, will be recycled elsewhere.*

- *The studies provide a good benchmark. Emission values are much lower than default guidance values. As processes are rather similar across batteries recycling, can similar values be expected for other processes?*
    - *Steve explained that the VITO study gave a 2-3 order of magnitude vs EUSES. It requires an effort to refine EUSES with real data but worth it.*

- *Was there variation between 50 sites?*
    - *Steve confirmed it: due to technologies and also because of the regulatory patchwork in terms of emission values (different depending on the MS). This is further explained in the paper and ILA has raw data.*

- *A comment was made on the fate of Pb in case of a ban of use of Pb in batteries. Pb is a byproduct of Ag, Zn refining so it will anyway remain. If end of the batteries use, how to address amount of Pb and how to deal with existing batteries? Pb will not disappear. Steve agreed that this is the elephant in the room. For now, closed loop-if you break it (drivers is purely economic): raw materials will be exported elsewhere where there is still recycling (drain outside EU) even in worse conditions, Pb cannot go to municipal sites – so will be dumped and there will be an impact on production of other metals. Pb is not mined for itself. Pb value chain often keeps these mines with head above water as not hazardous waste -Pb in battery safest option*

- *When collecting data, what is very important is the contextual information -which may differ from one site to another. This is also needed to evaluate risks. Steve explained the existing regulation that applies: NFM BREF, all Seveso sites, permitting, HvE triggers monitoring requirements and volumes of batteries going to recycling are known*

- *A Swedish program led to batteries fund*

2. Ongoing work on the environmentally sound management of waste batteries under the Basel Convention

Chiel Berends (European Commission, DG ENV) provided an overview of the technical guidelines on batteries under the Basel Convention. He started with a short recap on the Basel convention, which was adopted in 1989 and entered into force in 1992. There are 191 parties, which include 188 UN member states, the Cook Islands, the European Union, and the State of Palestine. The five UN member states that are not party to the treaty are East Timor, Fiji, Haiti, South Sudan, and United States. It is the only international treaty setting out legally binding provisions on global trade in waste.

Its aim is to protect human health and the environment against the adverse effects of hazardous waste and to promote sustainable management of waste. The main tool to achieve this is a regulatory system for the transboundary movement of hazardous and “other” waste which requires “Prior Informed Consent”- a procedure with 4 steps, and Basel Ban amendment that entered into force in December 2019 prohibiting export of hazardous waste from OECD countries to developing countries. Examples of wastes regulated by the Basel Convention include (recently) E-waste and Plastic waste but since longer time used lead acid batteries as well.

They are also issuing Technical Guidelines (TG), which are not legally-binding, but more policy-orienting showing best practices and recommendations on how to manage waste. They are specifying all practicable steps to ensure that these wastes are managed in an environmentally sound way. TG are adopted on a wide range of topics, including landfilling, E-waste, POPs, and plastic waste.

More specifically regarding batteries, the Conference of the Parties to the Basel Convention in 2003 adopted the Technical Guidelines for the ESM of Waste Lead-acid Batteries (WLAB). There is new work ongoing following BC-15/11UNEA Resolution 3/9 where it was requested to update the TG on the ESM of WLAB but also develop TG on the ESM of waste batteries other than waste lead-acid batteries (OWB). A small intersessional working group (SIWG) on the technical guidelines on the environmentally sound management of waste batteries was set up. The SIWG is open in nature and consists of members nominated by Parties from the five regional groups of the United Nations and is open to observers

More details on the TGs:

- Technical Guidelines on Waste Lead-Acid Batteries: Co-leads are Uruguay and China and are in charge of updating existing guidelines, works progress and adoption is scheduled tentatively at COP17 in April-May 2025.
- Technical Guidelines on Other Waste Batteries: Co-leads are the EU and China. It is a new TG with a large scope where there are no previous TG. A lot of work is being done to define the batteries covered and categorisation etc. The draft under discussion now is not yet mature.

More information (e.g. draft and comments) can be found on the website of Basel Convention (under 'implementation' and 'waste batteries')

Next meetings: SIWG Batteries: 18 – 22 November 2024 in Geneva /17th meeting of the Conference of the Parties: 28 April – 9 May 2025 in Geneva.

Discussion

- *Li being classified will have an impact on Basel Convention annexes?*
  - *DG ENV replied that the EU can adopt stricter legislation, the question is more for the batteries team.*
- *We see a big gap in requirements between EU waste legislation and other regions - is that also reflected in TG?*
  - *Yes but the TG aim at harmonising.*

3. SEA considerations for the Batteries Regulation implementation

Kalle Kivela (ECHA) introduced some SEA considerations for the Batteries Regulation implementation, starting by comparing the Batteries Regulation and REACH. We will have the same assessment criteria under both legislations for Dossier Submitters and ECHA, i.e. risk reduction capacity and proportionality, practicability and enforceability. SEAC will focus on proportionality (comparison of costs and benefits). Hampering recycling as a concern may impact the restriction options, and consequently impact assessment. Batteries as the subject of restriction makes the scope narrower in comparison to REACH, but may introduce challenges e.g. due to EU environmental policies (green transition) and global competition. The same ECHA Committees will be involved.

The main differences between REACH and Batteries Regulation are that:

- Substances of concern definition covers "hampering of recycling"
- Batteries Regulation includes the waste/recycling stage
- Batteries as a subject of restriction brings specific aspects to assessment

There are different risk management options:

- A restriction (REACH or BR) may be a ban, but also **conditions** can be imposed for the use of the substance/group of substances, e.g. reference exposure values, technical risk management measures to reduce releases or exposure
- Careful planning and assessment are needed on the best measures to tackle the concern. If the concern is on waste stage, technical measures to reduce releases or exposure are a potential tool to tackle the concern
- No current experience on restrictions under Batteries Regulations including how they may look like
- All life cycle stages (including waste) are a target
- The type of restriction has significant impact on the information needed to justify a restriction. Restriction does not automatically mean a need to substitute the substance of concern

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What is the available guidance?

Impact assessments for restrictions under BR follow to large extent similar methodologies as under REACH and the available guidance documents are applicable.

General guidance documents and other support material are available on **ECHA webpage**, e.g.

- SEA guidance for restrictions
- How to evaluate PBTs and vPvBs (SEAC note)
- Guiding principles on uncertainty analysis

ECHA is currently investigating possible gaps on restriction guidance for BR and they plan to integrate possible additional instructions to existing restriction documents (or prepare separate support material) by the end of 2025.

ECHA has identifed some shortcomings from available guidance and current practise and methodologies applied in REACH restrictions.

Regarding cost of **technical risk management measures,** generic (not substance specific) estimates could support the preparation of restriction proposals. Possible upcoming work on the cost estimates depends on what type of restrictions will be in focus. There is only limited information available on cost of technical measures to reduce releases and exposure, and better information is needed. This information gap may become more relevant when focus is on the waste and recycling stage.

Regarding the **life-cycle approach**, ECHA is investigating the possibility of life-cycle thinking to enhance impact assessment (also for restrictions under REACH). The main objective of using LCA methodology is to find potential conflicts with other goals (e.g. greenhouse gas reduction goals, and also other trade-off situations) and to further increase overall benefits of proposed regulation. Ongoing work consists of a review of existing frameworks (e.g. COM's ILCD - international reference life cycle data system- handbook) to identify relevant best practices for LCA and a careful consideration of what is feasible (also resource-wise) and clearly improves the impact assessment methodology. This is still work in progress and we will see how useful these aspects could be in restrictions.

Additional key topics for SEA include:

- critical materials: EU strategic autonomy on materials is and interesting and possibliy challenging topic
- other EU environmental policies: Carbon emission objectives were already mentioned under the life-cycle thinking
- global competition: need to have the tools to consider this

Prioritisation is a very important step in the restriction process since it gives the starting point for the up-coming work. The proposal is to start from SVHC criteria, but to what extent we need to adapt them? Are there additional elements to consider beyond hazard and exposure? Could prioritisation under the Batteries Regulation consider also SEA aspects?

One challenge is that as the relevant aspects depend on the concern (and the restriction options to tackle it), these wider considerations are challenging to be taken into account during the prioritisation step.

To summarise:

- Impact assessments for restrictions under the Batteries Regulation follow to large extent similar methodologies as under REACH
- Some differences have been identified that may require adjustments in the methodologies used and topics covered
- ECHA is investigating needs for methodology development
- Prioritisation of substances is an important step in overall restriction process
- It is unclear currently if and how SEA aspects could be considered in the prioritisation

Discussion

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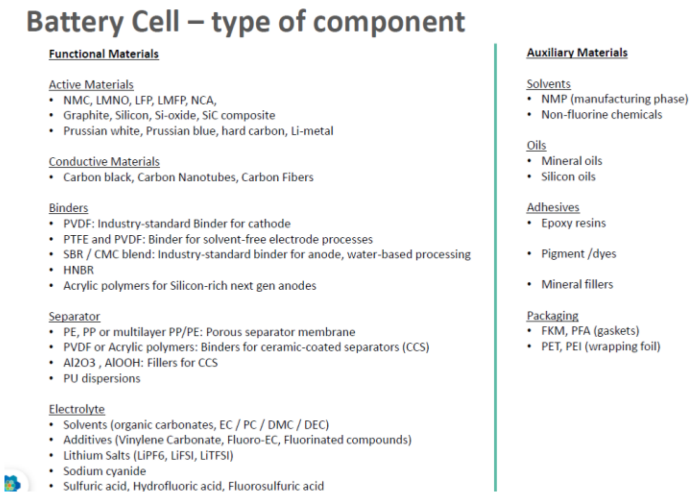
- *There are some existing examples of estimating costs to address exposures: there have been SEA study for Co and for Cd.*
- *Cobalt has a cost of compliance model adapted from Ni and that can be potentially adapted to other metals. They also did a survey at global level that can be shared.*

4. The role of organics and non-metal inorganics in batteries

Riccardo Pieri and Cis Herwyin (Cefic) presented the role of organic and non-metal inorganic chemicals in battery materials. The presentation focuses on Li batteries, but the considerations apply to all types of battery chemicals, primary or secondary.

A battery is a closed system, and it is unlikely that there is exposure or release. This is due to the case/pack. The use of plastics reduces the total weight and improves energy performance. Flexibility, durability, stability are all assets provided by organics for the casing. Organics are also used in the gasket, insulator, battery lid/module protection. Organics are also important to guarantee the integrity. At the level of the cell also, organic components are needed to ensure e.g. adhesive strength, support conductivity etc.

Going in the detail of the components:



And the functions:

- Manufacturing, Not present in final product.
- Battery encapsulation
- Mechanical/thermal requirement - Cooling
- Electrical protection coating – signal color high voltage
- Fire protection – thermal barrier sheets – flame retardant - Fire/blast coating
- Binder within coating
- Solvent (increase conductivity) – additive (increase lifetime or colour signal)
- Electrolyte
- Gaskets
- Graphite purification
- Recycling phase: Hydrometallurgical process

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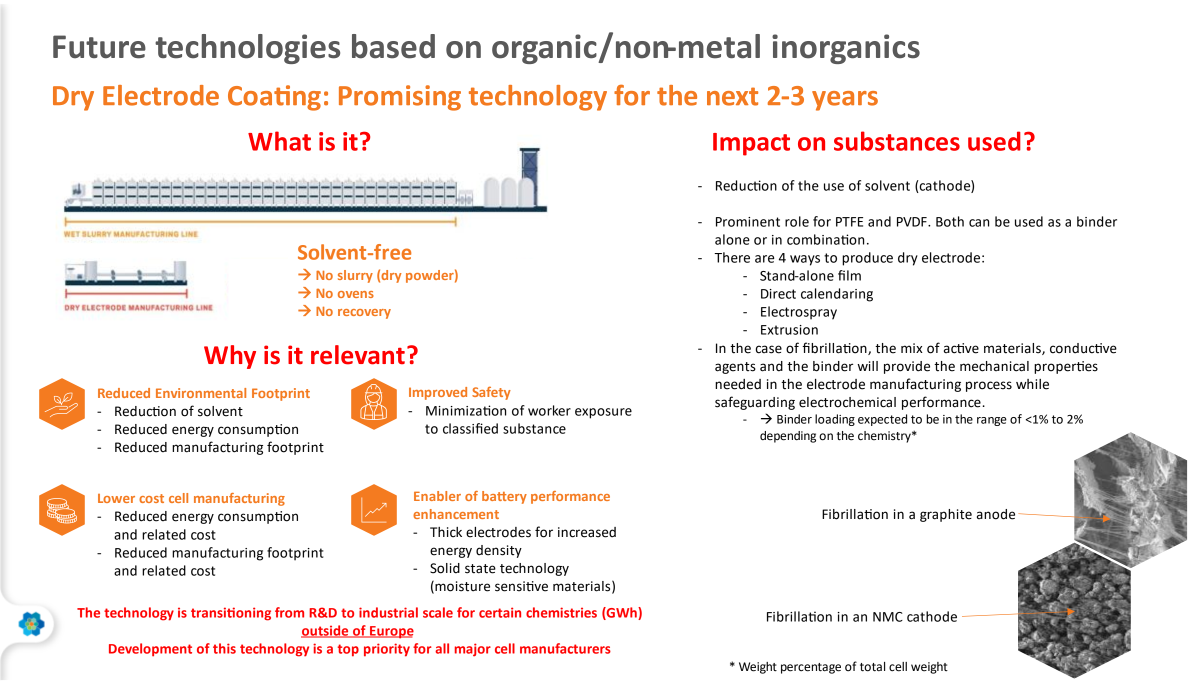
The **quantities are challenging to evaluate** and are normally based on assumptions as it depends on evolving technology and designed applied. Cell design is established with a narrow window of components, but it is more complex for pack/modules to evaluate organics/non-metal inorganics. They still play a role and are present.

The second part of the presentation focused on future technologies based on organic/non-metal inorganics, which include:

1. **Dry electrode coating and impact on uses of organic/non-metal inorganics**: a process technology. Illustration of a solvent based process using a slurry to mix the components. The solvent needs to be dried off before use and there is a recovery system. The dry electrode line does not use a solvent anymore: no slurry, no solvent and reduces footprint drastically. By removing the use of the solvent you reduce environmental footprint, you don't need ovens, recovery systems, improved safety, resulting in EF reduction and costs reduction. On top, this is an enabler of future technologies. It is not a solid state battery, but dry coating is an enabler for solid state for the short to midterm future. The expected impact on materials used in cell manufacturing is the following: no use of NMP. Impact on binder system: current use of PVDF won't disappear – will be further used. Concept of fibrillation: binder forms fibres making a web keeping all materials together. PTFE will get a more prominent role.



2. **Solid state and impact on use of organics/non-metal inorganics**: this is seen as the holy grail in battery research - no liquid electrolyte, no risk of leakage, possibility to improve performance. Nevertheless, it is still under development. The best-performing solid-state batteries incorporate polymers to solve issues in preparing the layers, enhance interfaces, cohesion, manufacturing, and mechanical properties, including flexibility. The organics content won't change drastically as the content of the binder targeted is the same than what is used today for the wet process. The dry process could help making thicker electrodes reducing slightly the quantity of metallic collectors/KWh.

To conclude, the role of the organic and non-metal compounds is crucial for performance, safety and durability. There is an important role in lithium and other Batteries although often overshadowed by the active material. The impacts are as numerous as the chemistries, and properties are varied ranging from the battery pack / module to protect the battery and ensure an optimal functioning over a long-life span. They are up to playing an essential role as components in electrodes and separator / electrolyte systems of high-performance lithium-ion batteries.

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Moreover, the development of new advanced battery systems rely on organic and non-metal compounds for successful implementation. The design of new materials is addressing recyclability, safety, cost, etc. These conclusions are also valid for other battery chemistries, emerging and consolidated.

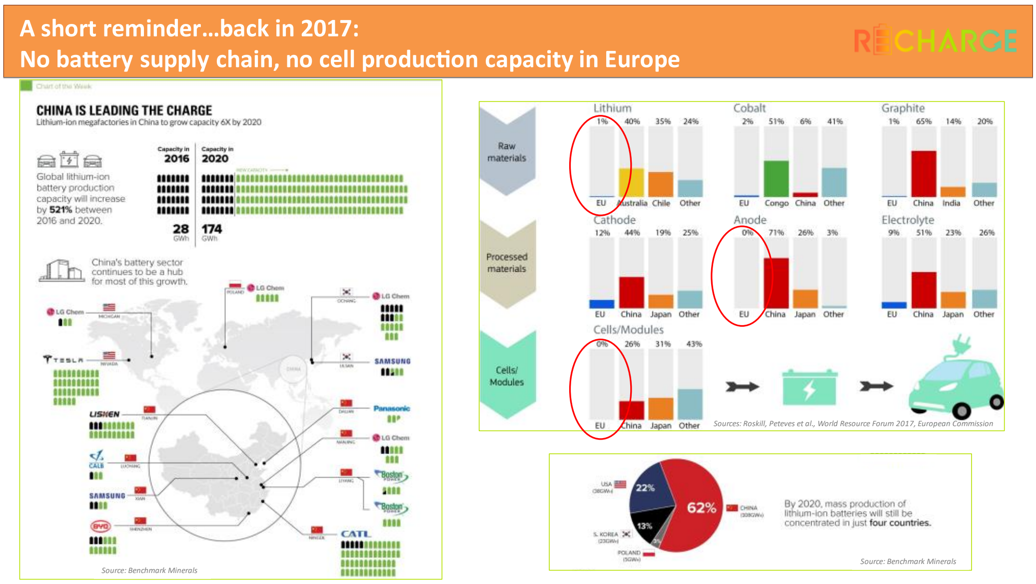
DISCUSSION

- *A question was posed on the timeline of the solid-state ion battery*
  - *It is now around the corner after a decade of efforts.*
- *How much efforts are going into investigating new substances vs management of existing ones?*
  - *There is no specific percentage estimated, but recycling is definitely a priority when designing new materials.*

5. Future trends in the EU

Ilka von Dalwigk (RECHARGE) presented new projects and trends that are key to understand what will be in the market in the next decade.

We need batteries for society and ambition to achieve Green Deal objectives. Batteries are used in series of applications including powering industry, powering mobility solutions and general public applications, and remain one of the key enablers for sustainable development, green mobility etc. A lot has changed since 2017: there was a growing demand for battery factories being built in the EU, having the whole supply chain in the EU to safeguard the knowledge and ensure resilience. She showed a slide in projects in operation/ under construction/announced. However it is not a done deal that these projects will be realised.



Ramping up remains difficult in the EU: upscaling is very difficult from lab to plant also because e.g. materials will change properties during production. This is quite visible in EU projects e.g. Northvolt, first EU player at larger scale. A lot of expansions are still needed and are quite CAPEX intensive.

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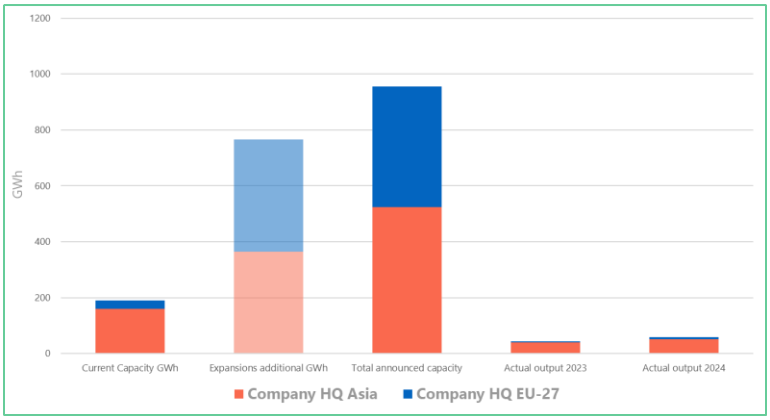
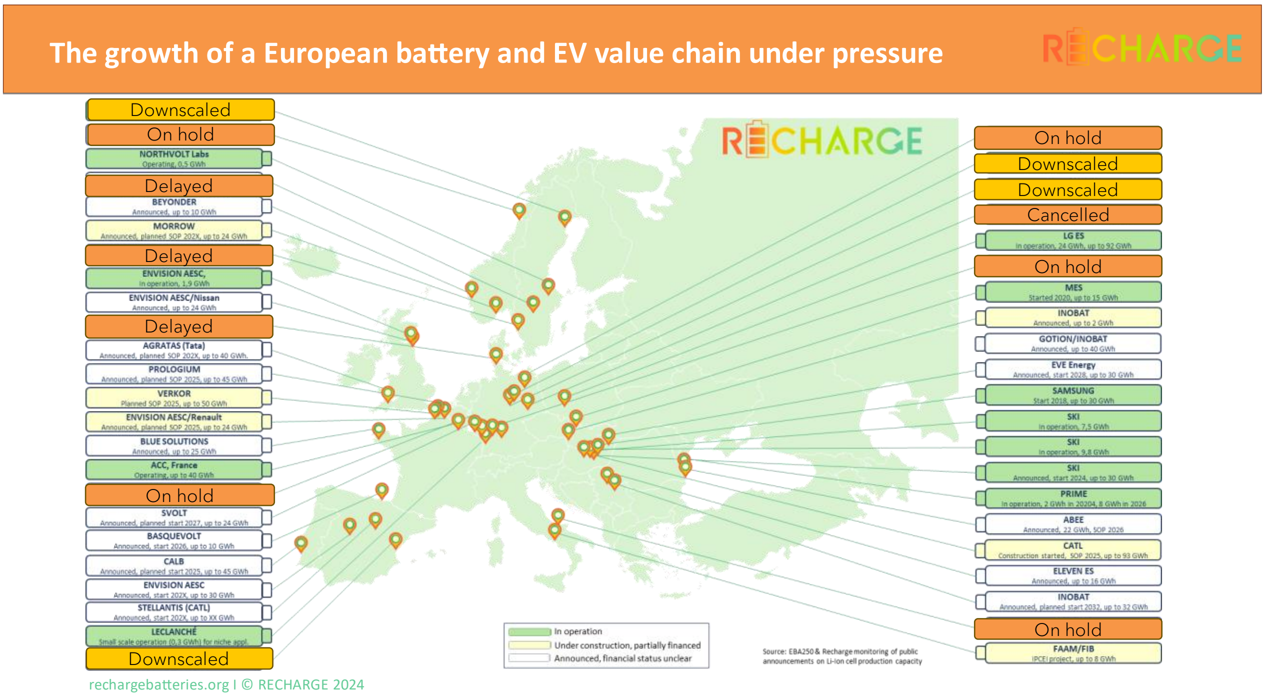
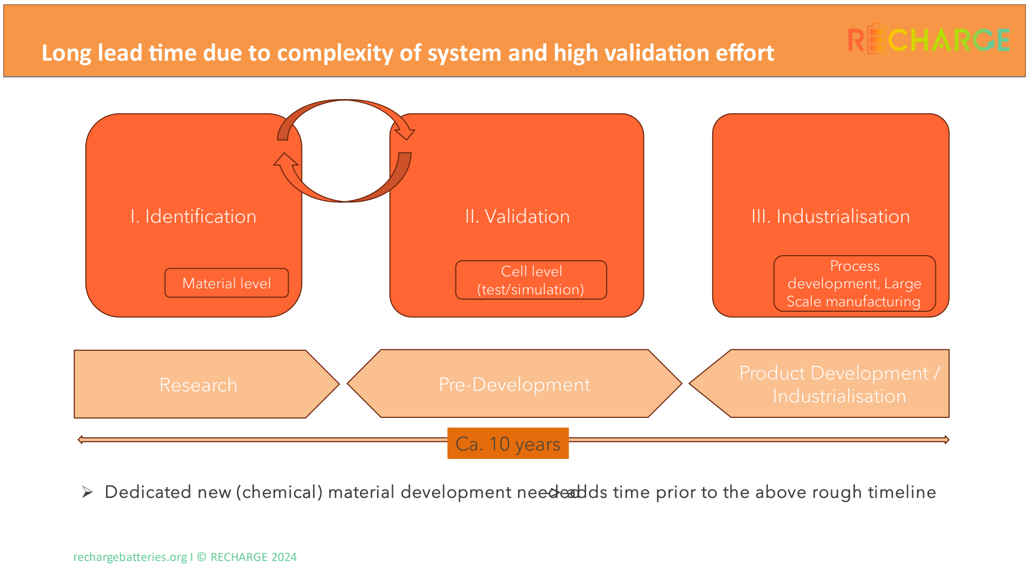


There are a lot of **external factors** impacting the growth of an EU battery and EV value chain: EV uptake in the EU is lagging (even if the EV market is still growing), while the EU is increasingly importing EVs and batteries from China. Production costs in the EU are not competitive compared to US and China and there is massive subsidising of industry in China/US. SVolt announced this morning that the project is abandoned. Many projects are downscaled and delayed:

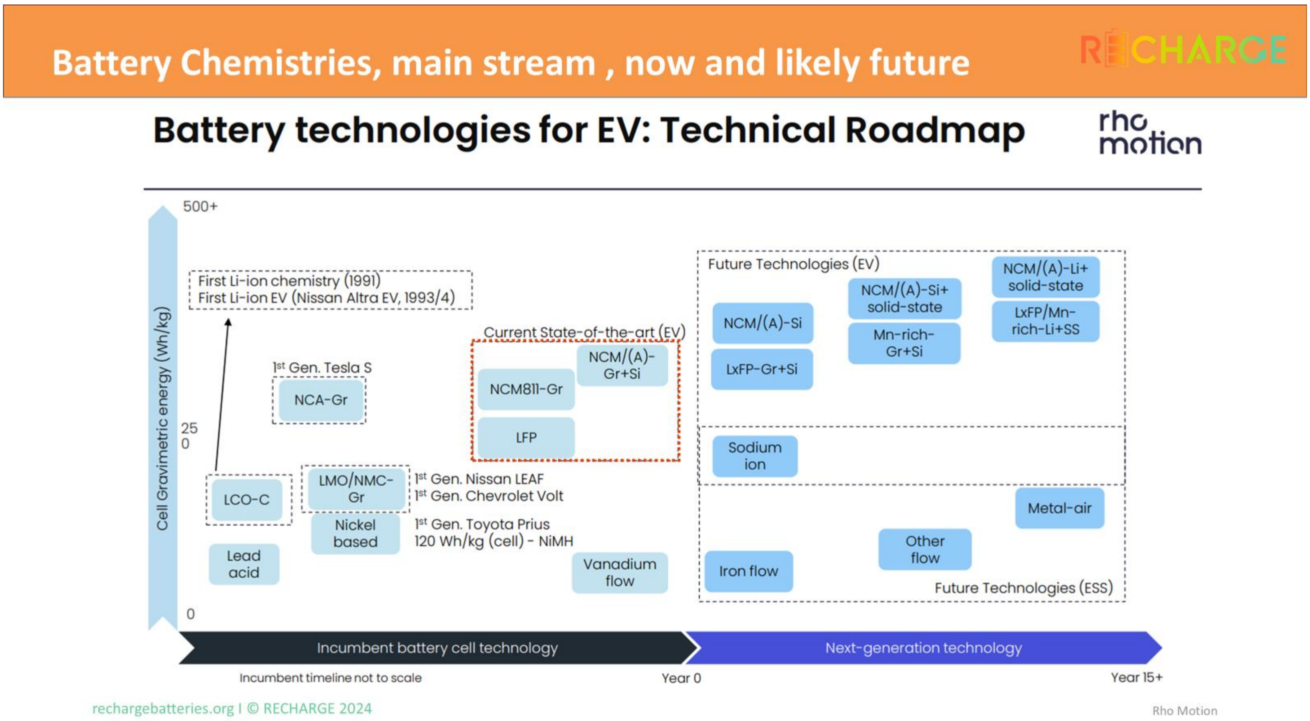


She explained that **regarding technology choices** in the EU, circa 10 years is needed to go from research (identification material level) to validation (cell level research lab/pilot line) with possible iterative loops before going to industrialisation. Every time you change the chemistry you need to redo the loop on testing and validation. Also to note is that KPIs (depending on what you put inside and parameters) in many cases are conflicting and there is a need to find best compromises by application (e.g. safety, energy density, charge time, cost, lifetime, sustainability). In all categories requirements are increasing due to consumer expectations and/or regulation (e.g. Batteries Regulation).



Current trends with batteries industry include:

- Reduction of Co: very costly material with supply chain concerns
- Mixing of technologies can be done
- Na ion batteries: LFP batteries have been proven to be cost competitive- so expected uptake of Na ion batteries is limited.



Looking through a crystal ball: no big changes are expected, we remain still with a production of NMC but some projects may be turned into LFP. On LFP, a lot of technologies will come from China, she referred to a small project in Greece at the pilot scale.

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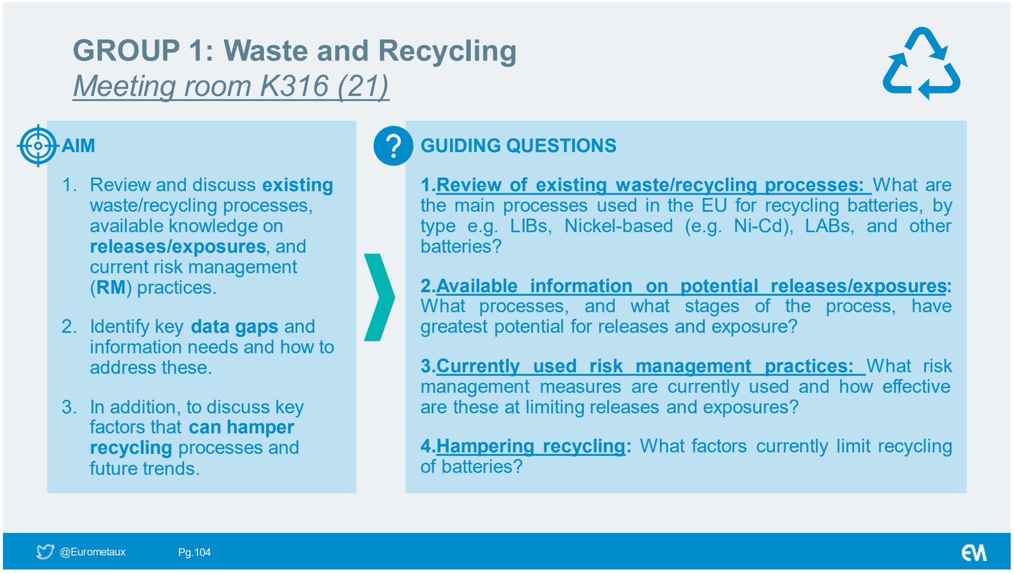
6. Breakout sessions

Group 1: waste and recycling



- There are many commonalities in preparation, emissions and release treatment for existing recycling processes, but the processes in facilities are different from one another, this is why they need to be considered separately. Moreover, there is not too much variation in the processes used within the EU for recycling of batteries by main type. For example, all sites recycling LABs use essentially the same main processes and any variations are more due to furnace or facility size.
- At facilities there are Risk Management measures to control releases.
- There is a lot of monitoring data available for the main battery types (Pb, Ni Cd).
- There is very limited amount of Li ion batteries being recycled in the EU. There are high CAPEX requirements to be profitable, reason why there are not many recyclers in the EU and why most of it takes place outside. 90% of the black mass is exported, therefore emissions associated with Li ion battery recycling currently take place out of the EU. There is interest to get hold of black mass in EU to comply with recycled content requirements.
- On substances that could impede recycling, POPs were mentioned (legacy issue) as well as some specific plastics that are needed to meet strict technical standards for OEMs (flammability) that need to be segregated not to impact recycling.

Group 2: Initial discussion-brainstorming on criteria for SoC and then how to prioritise them

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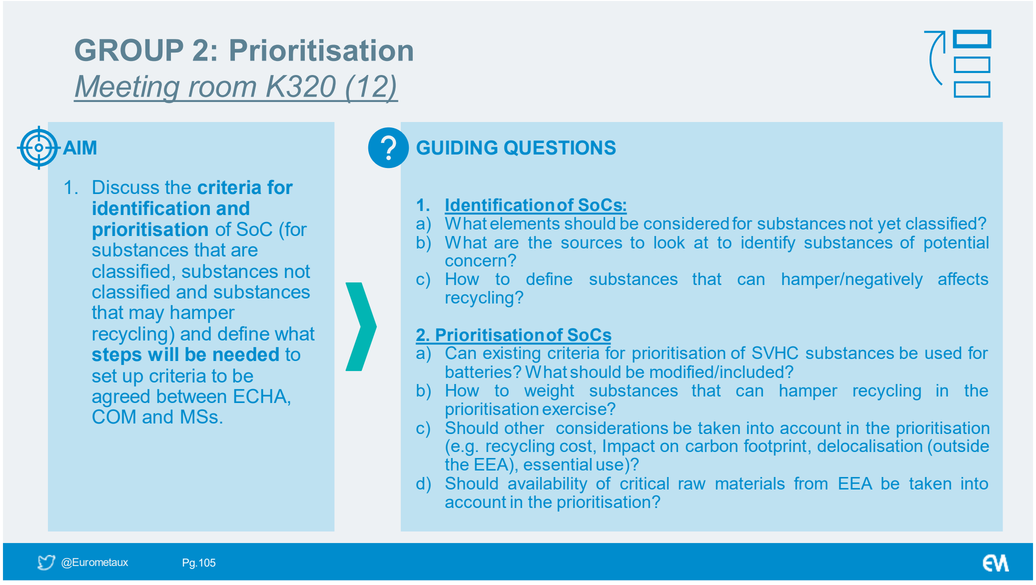


What elements should be considered for substances not yet classified?

The advice of the breakout group is to work stepwise:

Step 1: start from the ESPR criteria:

- Harmonised classification
- + SVHC lists
- + Restriction Annex XVII
- + existing restrictions POPs..

Step 2: substances in the regulatory pipeline

Question: what about groups of substances and regrettable substitution?

What are the sources to look at to identify substances of potential concern?

- Official lists + Annex XV substances (list of ECHA with CAS identifiers + go to compliance with article 33, Annex XVII)
- Need to make the formal ECHA list more comprehensive to have one point of truth? Not to leave the tasks of checking members of the group to industry.

How to define substances that can hamper/negatively affects recycling?

There are different levels of complexity:

- Knowledge: the recycling of batteries will take place in 20-30 years, so to understand what the problems will be at that time, we need to know which technologies will be used by then. In order to overcome that shortcoming, we need to start from current knowledge/current technologies and for the future the three R technologies list, which is a joint effort of dismantlers, waste operators and addresses work on proven recycling technologies (at industrial and lab scale). The list is consolidated/updated frequently, and regulators can have access to information on new recycling processes under development.
- Need to have common understanding/alignment about what recycling covers: secondary recovery of critical raw materials, from dismantling… up to the metal recycling?
- Criterion “Hampering recycling” cannot become more important than the function of substances.

- It is not only about BR, so what about other legislations? Need to check coherence.
- We should not forget that industrial processes can be adapted.

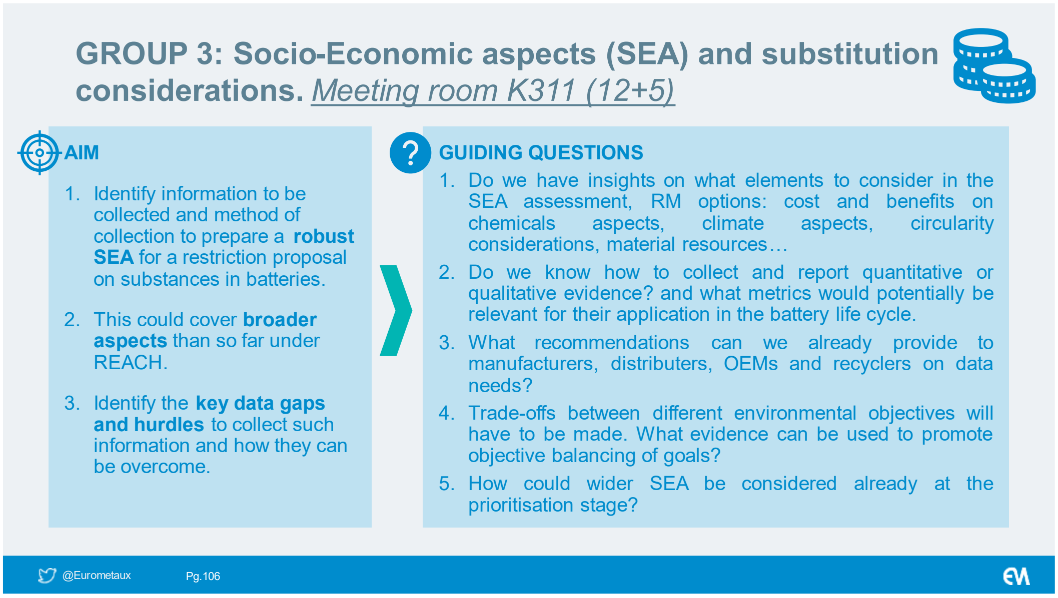
Prioritisation of SoCs:

- Start from SVHC prioritization criteria. But discussion is needed to introduce risk. How will "wide dispersive use" be considered while exposure to batteries may be limited to e.g., workplace. The REACH review is coming so a possible change of the criteria could be considered.
- We need a good definition of recycling and better knowledge before adding a point on "hampering recycling".
- Other considerations should be taken into account: we need to add additional criteria to the SVHC starting point, SEA elements to avoid hampering the EU industry for example, but we need to make a distinction between high-level screening on SEA aspects vs. SEA in a restriction considering resources. Other criteria could include: critical functionality, substitution and alternatives, "sustainable fate of material". This point needs further discussion, also considering developments in other legislations. The problem of where to find the relevant information should be discussed as well.
- Need to consider de-listing if e.g., new technology reaches the market, or risk management measures are actually implemented.

Steps to consider:

- All agree on definitions : e.g. hampering recycling
- Identification: need for a process, working group (to be defined)
- Have clear criteria for prioritization
- Work on listing and de-listing

Group 3 on SEA considerations:



Do we have insights on what elements to consider in the SEA assessment for substances in batteries restriction, risk management options: cost and benefits on chemicals aspects, climate aspects, circularity considerations, material resources, others?

- Time and speed are very fast in the batteries domain due to the large number of innovations. So we best need to learn from "trends". Unfortunately, most trends are driven by innovations taking place outside the EU.

Technical and cost aspects/information (including outside the EU) are drivers in SEAC, so relevant to consider them.

- Some information can be quantified: missed investments, missed recycling opportunities. Other impacts cannot. It was suggested to describe these impacts qualitatively either as part of the proportionality assessment or separately depending on the topic.
- BR foresees a carbon footprint declaration and environmental footprint: this information will become available and will be most useful for the purpose of SEA when relevant for the case. Costs and benefits of climate to be considered as well. Hampering recycling can be addressed by materials loss cost. Some aspects can be addressed, some others not. Carbon footprint looks at manufacturing and recycling but not the use phase, which is the one taking place in the EU.
- Functional requirements: drive the assessment of alternatives. Need to look at impact on products.
- New batteries can be used for at least 10 years and often reach 1.000.000 km meaning recycling can only happen after a long period of time

Do we know how to collect and report quantitative or qualitative evidence on these aspects and what metrics would potentially be relevant for their application in the battery life cycle? What recommendations can we already provide to manufacturers, distributers, OEMs and recyclers on data needs, hence, to stimulate them to get organised to collect relevant data and evidence?

- Lifetime of batteries is now over >10 years, and recycling can only happen later. This long period make it different to predict what evidence on recycling to use for SEA assessments knowing thsi will only happen in 15 years time. Cleaning technologies in recycling facilities will often be the same regardless of the substance or product, so there is the possibility to make fair predictions.

Trade-offs between different environmental objectives will have to be made. What evidence can be used to promote objective balancing of goals?

- The BR will provide a unique situation in that we will have chemicals information but also climate and environmental footprint information given as part of the battery passport reporting obligation),
- Given this is new, the question will be on how to judge and evaluate these aspects in a holistic and comprehensive way.

How could wider socio-economic aspects be considered already at the prioritisation stage (prioritisation of substances for restrictions)? Would it benefit from assessing battery chemistries/technologies (instead or in parallel of single substances) and what information is needed to do this?

- Criteria that could be taken into account for prioritisation are: substances hampering recycling – criticality of the material for the EU market, easiness to recover and recycle key materials.
- Some battery types can hardly be recycled a property that could be considered during the prioritisation process.

Conclusions of the workshop

Simone Doyle (ECHA) explained that ECHA has been focusing some resources on ECHA's new tasks. They are in close contact with COM and committed to finalise the work on SoC. They are not expecting to get Commission mandates for such restrictions in the coming two years, so it seems wise to focus now on the scoping study and capacity building for this changing environment. But even if there is no mandate from COM, it is still possible to get a request from Member States, hence they need to further adapt processes in ECHA to that. The onboarding for Batteries will also have to be followed and applied to other new restriction processes to be developed: packaging and packaging waste, or RoHS are examples of new tasks that will be under ECHA's remit. They need to continue to build capacity and onboard. They appreciate the efforts initiated under ECaBaM and thanked the participants for their inputs and openness to share. She thanked the ECHA batteries team and exposure unit and conference centre, consultants from Ramboll, as well as Eurometaux. She hopes for a win-win stemming from exchanging information and understanding. She finally thanked the speakers. ECHA hopes to foster relationships to ensure the work is meaningful and allows to better understand the regulatory environment.