

Sound Recycling and Transboundary Movements of WEEE Containing Critical Raw Materials - CEWASTE Requirements

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Abstract

Recycling rates of most critical raw materials (CRMs) are close to zero. To close this gap, the Horizon 2020 CEWASTE project elaborates sustainability, managerial, technical and traceability requirements as part of a certification scheme for sound CRM recycling and transboundary movements of WEEE containing critical raw materials. The CEWASTE requirements were developed by taking the European Standards on Collection, Logistics and Treatment Requirements for WEEE (EN 50625-1 approved in 2017 by CENELEC (European Committee for Electrotechnical Standardization) as starting point as these provide most comprehensive guidance relevant for the purpose of the CEWASTE project [1]. Only where they were not sufficient to meet all CEWASTE objectives, new requirements were developed. These include technical requirements for final treatment of waste li-ion and lead-acid batteries, waste magnets and fluorescent powders; requirements for addressing health and environmental competences development, communication aspects as well as traceability requirements. Considering the international nature of the value chains and transboundary movements of wastes concerned, the Basel Convention was highlighted where required. CEWASTE requirements follow the principles of being technologically and economically feasible; focusing on optimal sorting and removal before treatment; promoting continuous improvement of CRM recycling practices supported by a management system; being auditable; and allowing traceability for WEEE with high environmental and social risks in value chains outside of Europe.

A strong stakeholder consultation resulted in about 300 comments received. A validation process through a pilot testing in about 20 companies from Europe, Turkey, Colombia and Rwanda supports the requirements development and their acceptance. A second online consultation will take place in early 2021 and the final version will serve the CEWASTE Certification and Verification Scheme [2].

The project's ambition is to provide a set of requirements that help improving the recycling of critical raw materials under sustainable conditions in international value chains.

1. Introduction

The 2017 EU-list of critical raw materials (CRMs) includes 27 materials [4]. Their recycling rates from waste products are, however, low. Since recycling is one approach to mitigate the criticality of CRMs, the CEWASTE project aspires setting up and establishing requirements for a standard and an assurance and verification system for the collection, transport and treatment of products containing CRMs to enable their recycling and to create a level-playing field for the operators along the end-of-life (EoL) chain. At the same time, the requirements shall – besides the recycling of materials listed as CRM – also improve the recycling of other valuable materials.

In order to increase the CRM and valuable materials recovery, relevant components (key CRM Components - KCC) from key equipment (key CRM equipment - KCE) are determined [5]. For the KCC, CEWASTE requirements were defined (or simply referred to) based on the European Standards on Collection, Logistics and Treatment Requirements for WEEE (EN 50625-1 approved in 2017 by CENELEC (European Committee for Electrotechnical Standardization), which is the most comprehensive set of standards available and relevant for the purpose of the CEWASTE project. Henceforth this set will be named CENELEC standards. The requirements development process followed a multi-stakeholder consultative based approach (see chapter 2). In the case of the following KCC no sufficient requirements were identified or there is none existing at all; hence, new

guidance was developed: waste batteries, magnets, printed circuit boards and fluorescent powders. Chapter 3 summarizes the sustainability, traceability, managerial and technical requirements.

2. The process and principles

2.1 Multi-stakeholder consultative process

The following events support the consultative process towards the CEWASTE requirements development in line with the ISEAL Code of Good Practice for sustainability standards development [3]:

- Two rounds of public online consultation. The first one from December 2019 to January 2020 and the second round in early 2021 for a duration of one month. 300 comments were received during the first consultation.
- A physical stakeholder meeting at the WRF 2019 Conference in Geneva (Oct, 2019).
- Pilot testing in about 20 companies from Europe, Turkey and Rwanda, Colombia between September and October 2020.

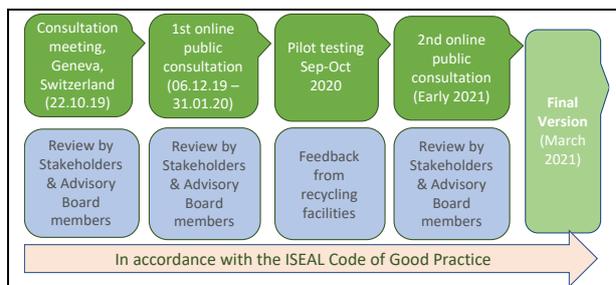


Figure 1: Stakeholder consultation process compliant with ISEAL

2.2 Principles

The CEWASTE requirements were developed based on the following principles:

- Technological and economic feasibility;
- Focus on optimal sorting and removal before pre- and final treatment
- Continuous improvement of CRM recycling practices through a management system
- Auditability
- Traceability for WEEE with high environmental and social risks in value chains outside of Europe such as waste batteries and printed circuit boards.

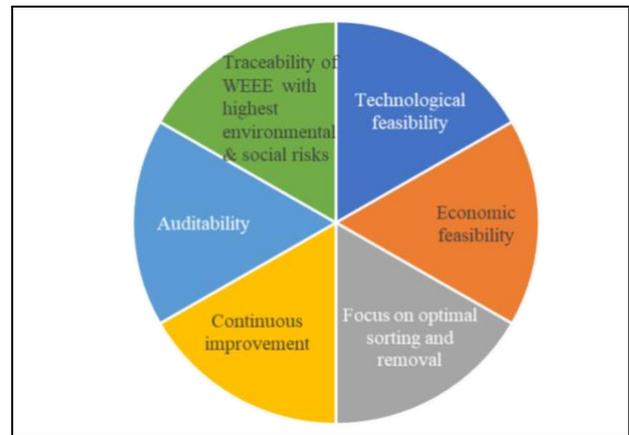


Figure 2: CEWASTE requirements principles

3. Managerial, sustainability and traceability requirements

The structure of the CEWASTE requirements document follows the structure of the CENELEC standards (see Figure 3).

The definitions clause makes reference to existing definitions and provides new ones in case needed (e.g. due diligence). The managerial, sustainability and traceability requirements are in clause 4 and technical requirements are presented in clause 5.

Complementary information is provided in the Annexes. In Annex I the list of KCE and CRM contained as well as main toxics in wastes is presented. Annex II introduces an example of a monitoring and evaluation plan in support of the management system. Annexes III to VI refer to technological options for treating waste batteries, magnets and fluorescent powders.

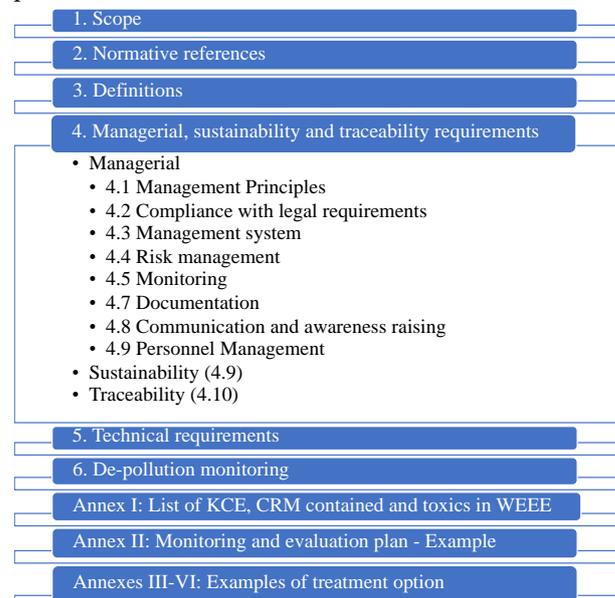


Figure 3: CEWASTE requirements – Structure

Main gaps identified include technical requirements for increasing the recovery of CRM from fluorescent

powders, printed circuit boards (PCBs), batteries and magnets.

It is worthwhile to note that the re-use phase is not part of the CEWASTE scope.

3.1 Managerial aspects

Aiming at developing and continuously improving the management system of operating facilities, collection and logistics facilities, treatment and final treatment operators shall comply with clauses 4.1 to 4.5 and 4.7 to 4.9 related to ‘managerial requirements’ (Figure 3). An example of a monitoring and evaluation plan is in Figure 4 (parts 1 and 2).

Key performance Indicator	Definition	Actions / Responsibilities
Objective 2.1 Increasing CRM recovery		
% of CRM streams monitored of the total	Portion of streams with CRM content monitored in accordance to the CEWASTE requirements	-Provision of training to workers concerned / H6S department manager - Provision of required measurements devices / H6S department manager
% of recyclable units collected of the total	Portion of key CRM equipment collected which fulfils the quality goal established	-Training about quality risks and the quality goals of the operator -establishment of a system for records management of quality of inputs and outputs of key CRM component or equipment produced

Figure 4: Monitoring & evaluation plan – An example – Part 1

Key performance Indicator	Resources needed	Base-line in year 0	Threshold or target for years 1 to 5	Results /date of measurement
Objective 2.1 Increasing CRM recovery				
% of CRM streams monitored of the total	- Measurement devices - Visuals for training	30 %	Year 1: 50 % Year 2: 80 % Year 3: 100 %	60% / 31 Dec year 1
% of recyclable units collected of the total	- Measurement devices - Visuals for training	20 %	Year 1: 50 % Year 2: 80 % Year 3: 100 %	60% / 31 Dec year 1

Figure 4: Monitoring & evaluation plan – An example – Part 2

3.2 Sustainability aspects

Sustainability requirements include:

- Environmental protection from emissions of (pre-)treatment processes (clause 4.10.1)
- Local communities well-being (clause 4.10.2)
- Society related aspects (4.10.3)

It is well understood that employees’ concerns such as those about ‘training’, ‘occupational health’ and ‘contractual aspects’ are often considered sustainability issues. However, in order to facilitate the reading from the ‘employee’ perspective, these topics are placed in the personnel management part (clause 4.9) together with other general employee-related topics.

3.3 Due diligence for traceability

Traceability requirements are placed in clause 4.6 and apply to lead-acid waste batteries and PCBs.

The due diligence approach is elaborated for monitoring and demonstrating compliance upstream the value chain. Due diligence results are useful for external communication purposes e.g. to customers.

Under this approach, each party of the value chain is required to conduct a second-party verification process to trace and document compliance with the CEWASTE requirements of the processing of CRM-containing materials such as waste batteries and their streams.

Note: For printed circuit boards guidance on traceability is given in the CENELEC TS 50625-5 document by means of contractual obligations in the first tier of suppliers and by downstream monitoring requirements.

3.4 Technical requirements focusing on gaps identified

The requirements that operators and facilities shall follow to recycle key CRM equipment and key CRM component shall follow are presented in clause 5.

Technical requirements developed for the KCC base on the sufficient availability of evidences, experiences and national and European recommendations which contribute to advance in this area.

Overall, the sequence of activities follow the one applied by the CENELEC standards. Users of the CENELEC standards. will recognize main new developments in the following clauses:

Clause 5.6 Shipping. For movements within a country or for transboundary movements, considerations from the Basel Convention [6] and other international conventions related to shipping need to be taken into account.

Clause 5.7 Sorting. For optimal sorting, as starting point, the following received at collection points, collection facilities and logistics facilities shall be collected separately:

- Fluorescent lamps (containing fluorescent powders)

- CRT monitors and TVs (containing fluorescent powders)
- Temperature exchange equipment (TEE) (containing magnets)
- Household appliances other than TEE (motors/drives containing magnets)
- Laptops (hard disk drive - HDD), desktop Computers (HDD), mobile phones, tablets and similar devices containing printed circuit boards and magnets
- External CDDs, ODDs, devices with internal CDDs/ODDs
- Magnets from WEEE and electrical engines from all types of electrical vehicles
- Batteries from electric vehicle (BEV) and (plug-in) hybrid electric vehicle (P)HEV
- Li-ion batteries
- Lead-acid batteries

Clause 5.10 Removal of KCC. Specific requirements for the removal of components containing CRM are further elaborated in this clause and concern:

- Waste batteries
- Fluorescent powders
- Waste magnets
- Printed circuit boards

Clause 5.11 Final treatment. It is required that the separated fractions/components containing CRM are treated in facilities that are designed for the recycling of the concerned CRM and that self-declare having implemented

5. Technical requirements	
• 5.1 General technical requirements	
• 5.2 Technical and infrastructural pre-conditions	
• 5.3 Handling	
• 5.4 Acceptance and receiving	
• 5.5 Storage at collection	
• 5.6 Shipping	News
• 5.7 Sorting	
• 5.8 De-pollution at treatment facilities	
• 5.9 Treatment of non-depolluted WEEE and fractions	
• 5.10 Removal of CRM-containing components	
• 5.11 Final treatment for recovering CRM fractions and final disposal of waste fractions	News
• Waste batteries	
• Fluorescent powders	
• Waste magnets	
• Printed circuit boards	

Figure 5: Technical requirements - Main new developments

CEWASTE requirements. Technological options for treatment are presented in the Annexes III to VI, except for the PCB.

An example with the steps followed for lead-acid and li-ion waste batteries is presented in Figure 6. In this diagram flow, concerned sub-clauses within the CEWASTE are given on the sides of the graphic and cover the removal, delivery, acceptance, sorting and

final treatment. Recovered CRM would include antimonial lead and cobalt.

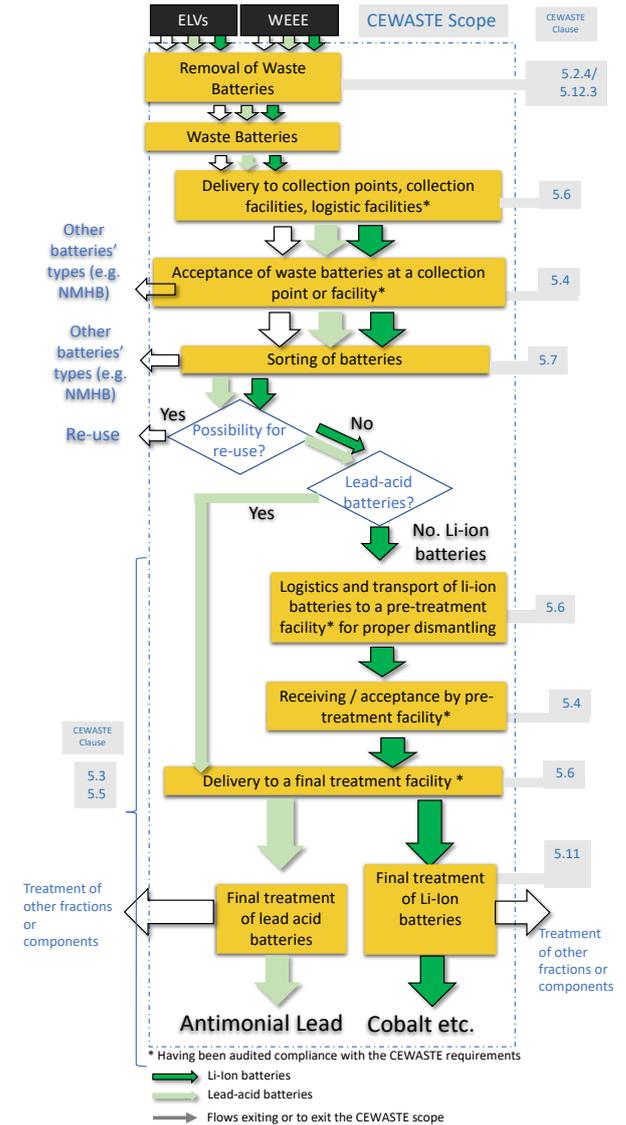


Figure 6: Flow process for implementing technical CEWASTE requirements in waste batteries

In the case of waste batteries, requirements and recommendations are provided for lead-acid and lithium-ion batteries and not NiMH batteries. Lead-acid batteries are key WEEE according to the Basel Convention and is subject to strict controls when part of transboundary movements. Lithium-ion batteries is a growing waste stream not yet under the Basel Convention list subject to control. NiMH batteries are decreasing their market relevance, hence, the project consortium decided not to consider this as critical WEEE for the purpose of the project.

4. Outlook

A framework for certification of the compliance of various actors with the CEWASTE requirements is developed under the CEWASTE project [2]. This includes an assurance and verification scheme.

The CEWASTE requirements fill the gap and fundamentally complement the CENELEC series of standards. This is applicable worldwide to any facility dealing with the recycling of WEEE focusing on waste batteries, printed circuit boards, magnets and fluorescent lamps. Through their use recovery of critical and valuable raw materials will be increased and recycling improved. Notably, compliance with CEWASTE requirements of waste batteries and PCBs management will be demonstrated via due diligence. The CEWASTE requirements are conceptualized as public good and the final version will be published in 2021.

Literature

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