

# JRC SCIENCE FOR POLICY REPORT

## Developing EU-wide end-of-waste criteria for plastic waste

*Draft Technical proposals*

PIERRI, E.  
EGLE, L.  
SAVEYN, H. G. M.

April 2023

This publication is a Science for Policy report by the Joint Research Centre (JRC), the European Commission's science and knowledge service. It aims to provide evidence-based scientific support to the European policymaking process. The contents of this publication do not necessarily reflect the position or opinion of the European Commission. Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use that might be made of this publication. For information on the methodology and quality underlying the data used in this publication for which the source is neither Eurostat nor other Commission services, users should contact the referenced source. The designations employed and the presentation of material on the maps do not imply the expression of any opinion whatsoever on the part of the European Union concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

#### Contact information

Name: European Commission – Joint Research Centre, Fair and Sustainable Economy, Circular Economy and Sustainable Industry

Address: Edificio EXPO, Calle Inca Garcilaso 3, 41092 Seville, Spain

Email: [JRC-END-OF-WASTE@ec.europa.eu](mailto:JRC-END-OF-WASTE@ec.europa.eu)

#### EU Science Hub

<https://joint-research-centre.ec.europa.eu>

JRCXXXXXX

EUR XXXX XX

PDF ISBN XXX-XX-XX-XXXXX-X ISSN XXXX-XXXX doi:XX.XXXX/XXXXXX XX-XX-XX-XXX-XX-N

doi: <https://doi.org/XXXXXX>

Luxembourg: Publications Office of the European Union, 2024

© European Union



The reuse policy of the European Commission documents is implemented by the Commission Decision 2011/833/EU of 12 December 2011 on the reuse of Commission documents (OJ L 330, 14.12.2011, p. 39). Unless otherwise noted, the reuse of this document is authorised under the Creative Commons Attribution 4.0 International (CC BY 4.0) licence (<https://creativecommons.org/licenses/by/4.0/>). This means that reuse is allowed provided appropriate credit is given and any changes are indicated.

For any use or reproduction of photos or other material that is not owned by the European Union/European Atomic Energy Community, permission must be sought directly from the copyright holders.

How to cite this report: Author(s), *Title*, Editors, Publisher, Publisher City, Year of Publication, doi:XX.XX/XXXXX (where available), JRCXXXXXX.

1	Introduction.....	3
1.1	Rationale and objectives.....	3
1.2	Policy context and background.....	3
1.3	Scoping exercise.....	4
2	Scope definition.....	6
2.1	Plastic waste destined for conversion into new plastic products.....	6
2.2	Recycling technologies.....	6
2.3	Point of end-of-waste.....	7
3	End-of-waste criteria.....	9
3.1	Requirements on input materials.....	9
3.2	Requirements on processes and techniques.....	11
3.3	Requirements on product quality.....	12
3.4	Requirements on quality assurance procedures.....	15
3.5	Requirements on provision of information.....	17
4	Next steps.....	19
	References.....	20
	List of abbreviations.....	21
	List of figures.....	22
	List of tables.....	23
	Annexes.....	24
	Annex 1. End-of-waste criteria proposed by the JRC in 2014.....	24
	Annex 2. End-of-waste criteria for plastic waste developed or under development in Member States.....	29
	Annex 3. List of substances in Annex IV of the POP regulation.....	30
	Annex 4. Existing standards and technical specifications for plastics.....	32
	Annex 5. Glossary.....	33

Stakeholders are invited to provide comments on this document **using the template provided** and to send one **consolidated document with feedback per organisation, at the latest by 20 June 2023** to JRC at [JRC-END-OF-WASTE@ec.europa.eu](mailto:JRC-END-OF-WASTE@ec.europa.eu) (please use ***“PLASTICS EOW – Feedback XX”*** as email subject, where XX is the name or acronym of your organisation).

DRAFT



# 1 Introduction

## 1.1 Rationale and objectives

One of the barriers to a European circular economy is the lack of harmonisation of End-of-Waste (EoW) criteria across Member States (MS), which creates legal uncertainty for waste operators as well as for entities trading or using secondary raw materials. Some MS are developing or have already implemented national EoW criteria for certain waste streams, including plastic waste. The implementation of EU-wide EoW criteria is expected to reduce administrative and economic burdens, especially when dealing with shipment. In addition, it can promote a well-functioning internal market for secondary raw materials.

In 2014, the Joint Research Centre (JRC) developed technical proposals for end-of-waste criteria for plastic waste for conversion (Villanueva & Eder, 2014). The proposals were not transposed into legislation at the time. In the current proposal, those criteria were used as a starting point.

Further to the commitment by the Commission<sup>1</sup> to assess the scope to develop further EU-wide end-of-waste criteria for certain waste streams, the Commission carried out a scoping exercise in 2021 to identify candidate streams for the development of EU-wide end-of-waste or by-product criteria (Orveillon et al., 2022). Different plastic polymers were ranked as priority streams. In line with the results from the scoping study, the Commission announced a new project for the development of technical proposals for EoW criteria for plastic waste. The project was launched on 31 May 2022 with a kick-off meeting hosted by JRC and the Directorate General for the Environment (DG ENV). The development of technical proposals is data driven and is supported by stakeholder consultations. A first stakeholder consultation was carried out between June and September 2022. The main goal of the first consultation was to gather feedback on the EoW criteria proposed by (Villanueva & Eder, 2014) and to gather new information and data (e.g. for different polymers to consolidate the scope definition, on use, market, existing standards and specifications as well as on environmental and health impacts). Information on existing national EoW criteria was also requested. The JRC has analysed thoroughly the feedback received and developed the first draft proposals in close cooperation with DG ENV.

The next stakeholder consultation phase will be opened on 20 April 2023 with an online workshop, where the proposals will be discussed with stakeholders. The consultation aims at gathering feedback on the technical proposals for EoW criteria for plastic waste presented in this document.

## 1.2 Policy context and background

End-of-waste criteria specify when certain waste ceases to be waste and becomes a product. The Waste Framework Directive (WFD) (2008/98/EC) as amended by Directive (2018/851/EU) defines in Article 6(1) the general conditions that a waste material has to fulfil to cease to be waste:

*"[...] waste which has undergone a recycling or other recovery operation is considered to have ceased to be waste if it complies with the following conditions:*

- a) the substance or object is to be used for specific purposes;*
- b) a market or demand exists for such a substance or object;*
- c) the substance or object fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products; and*
- d) the use of the substance or object will not lead to overall adverse environmental or human health impacts."*

In 2009, the JRC published a general methodology analysing the principles according to which the criteria should be set up and providing the related methodological and impact assessment frameworks required to determine end-of-waste criteria (Delgado et al., 2009).

This methodology was incorporated in the WFD (2018/851/EU) Article 6(2) in the following terms:

---

<sup>1</sup> COM/2020/98 final: <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN>

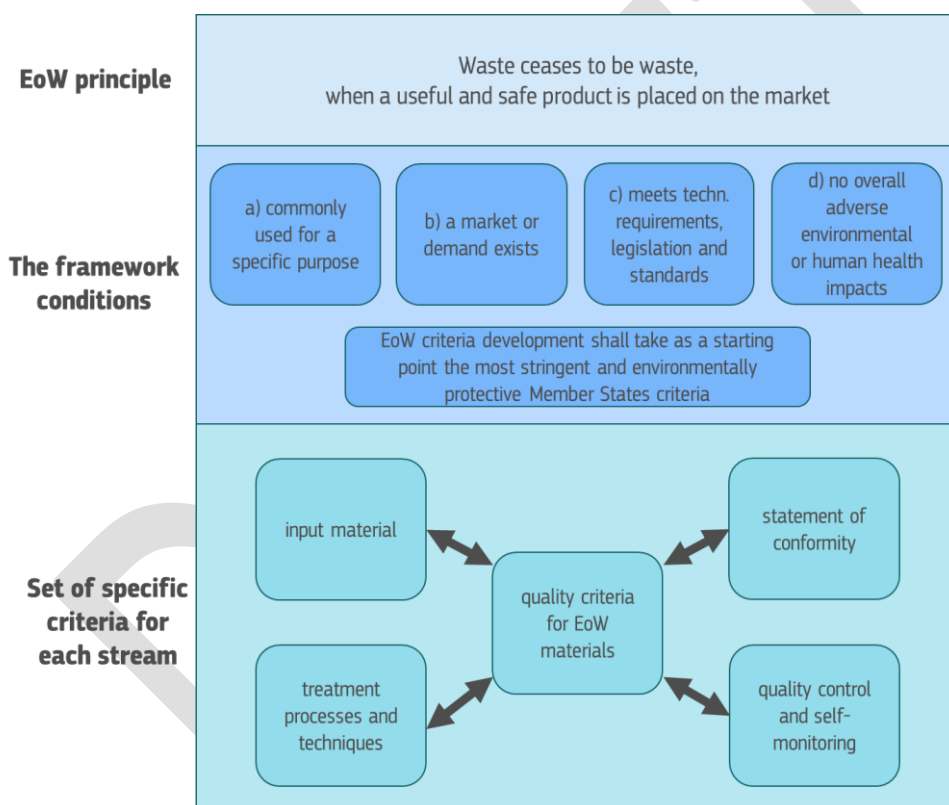
"The Commission shall monitor the development of national end-of-waste criteria in Member States, and assess the need to develop Union-wide criteria on this basis. To that end, and where appropriate, the Commission shall adopt implementing acts in order to establish detailed criteria on the uniform application of the conditions laid down in paragraph 1 to certain types of waste.

Those detailed criteria shall ensure a high level of protection of the environment and human health and facilitate the prudent and rational utilisation of natural resources. They shall include:

- a) permissible waste input material for the recovery operation;
- b) allowed treatment processes and techniques;
- c) quality criteria for end-of-waste materials resulting from the recovery operation in line with the applicable product standards, including limit values for pollutants where necessary;
- d) requirements for management systems to demonstrate compliance with the end-of-waste criteria, including for quality control and self-monitoring, and accreditation, where appropriate; and
- e) a requirement for a statement of conformity."

A relevant point introduced in the latest amendment of the WFD is that the Commission shall take as starting point the most stringent and environmentally protective EoW criteria established in Member States.

Figure 1: Conceptual approach of the EoW mechanism, framework conditions and elements of EoW criteria



EoW criteria have been already successfully laid down for:

- iron, steel and aluminium scrap (Commission Regulation 333/2011/EC)
- glass cullet (Commission Regulation 1179/2012/EU)
- copper scrap (Commission Regulation 715/2013/EU)

### 1.3 Scoping exercise

The scoping exercise (Orveillon et al., 2022), carried out by the JRC and DG ENV, aimed at supporting the Commission in the implementation of the Circular Economy Action Plan (CEAP) and the WFD by:

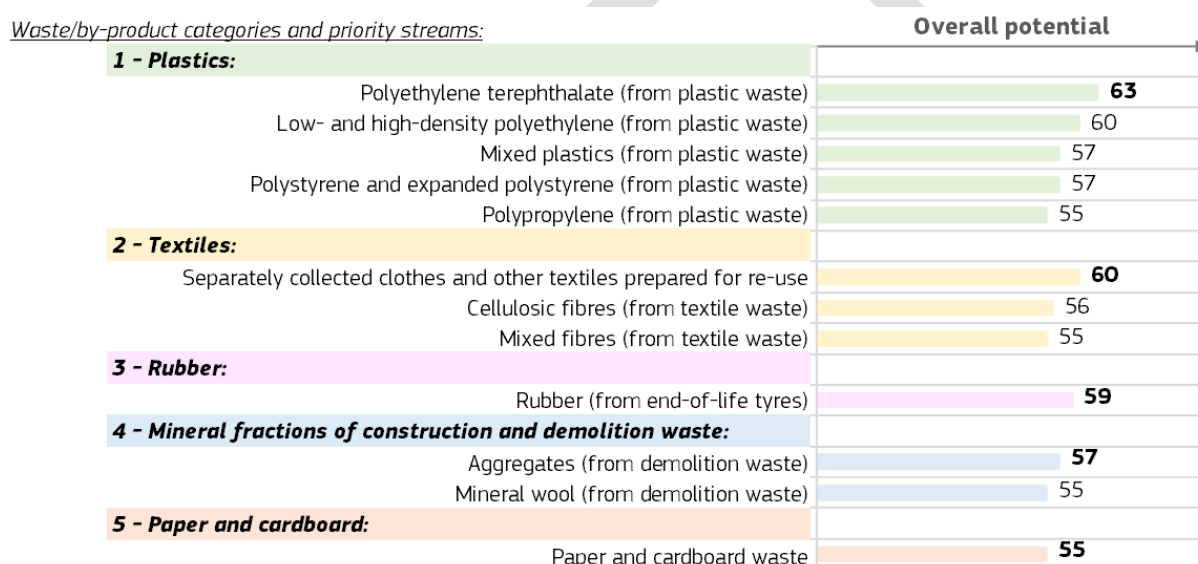
- 1) identifying a priority ranking of waste or by-product streams for which to develop further EU-wide end-of-waste or by-product criteria (scoping); and
- 2) deriving a shortlist of top-candidate streams for which to develop further EU-wide end-of-waste or by-product criteria.

12 candidate streams were ranked based on their overall potential for the further development of EU-wide end-of-waste or by-product criteria. The potential of candidate streams was appraised using the following ranking criteria:

- level of support from stakeholders to develop further EU-wide end-of-waste or by-product criteria
- current collection and material re-use/recycling rates
- identified uses, types of uses (recycling versus other recovery operations) and impacted economic sectors
- estimated EU market value
- intra- and extra EU shipments
- purity/composition of recovered materials and possibility to recover critical raw materials
- evidence of demand
- existence of relevant international or national product standards and
- existence of national or regional end-of-waste or by-product criteria
- expected environmental and human health impacts

Figure 2 presents the results of the scoping study, highlighting the five waste categories with the greatest overall potential. Therefore, DG ENV and the JRC commenced the work on the development of EoW criteria for the 5 presented plastic waste streams (initial scope).

*Figure 2: List of priority streams grouped per category and ranked based on their overall potential (Orveillon et al., 2022)*



## 2 Scope definition

### 2.1 Plastic waste destined for conversion into new plastic products

Based on the outcome of the scoping study, the work on EoW plastics commenced with the development of EoW criteria for the following selected polymers: PET, LD-/HDPE, PP, PS, EPS and mixed plastic from plastic waste. With the plastics selected at the initial stage, around 63 % of the plastics that are currently used by plastic converters were covered (Plastics Europe, 2022).

However, certain segments, as for example Electrical & Electronic Equipment, Automotive or Building & Construction with plastics recycling facilities in operation for polymer types like PVC, ABS, PMMA or PC would be excluded from the scope if only the shortlisted polymers would have been considered.

Besides mechanical recycling technologies that are already capable to remove e.g. unwanted hazardous substances, new recycling technologies are evolving and entering the market with the potential to remove unwanted substances that are bound or incorporated to the polymer matrix. This can lead to plastics that are currently non-recyclable or difficult to recycle to become recyclable in the future. This was communicated by several stakeholders after the initial stakeholder workshop held in May 2022. This was also confirmed by site visits performed by the JRC team in the course of the project. Based on the stakeholder feedback and the recent insights, the JRC proposes that all thermoplastic plastic waste shall be eligible for EoW status, regardless of the polymer type, as long as it complies with the proposed EoW criteria.

**JRC Proposal:** The scope includes **all thermoplastic plastic waste destined for conversion into new plastic products**.

#### QUESTION 1.

Do you agree with the proposal to extend the scope to all thermoplastics destined for conversion into new plastic products?

If NO, please explain the reason(s) and which limitations you would propose.

### 2.2 Recycling technologies

Besides mechanical recycling, new recycling approaches as e.g. dissolution, depolymerisation or feedstock recycling have the potential to increase the plastic recycling rate in the EU (Lase et al., 2023). An overview on the different plastic recycling approaches is given in Figure 3, Figure 4 and Figure 5. Some of these recycling technologies are able to remove unwanted components to a great extent, which is not always possible with mechanical approaches.

Therefore, it is proposed to extend the technological scope to include mechanical-, physical-, and chemical plastic recycling processes, including, but not limited to, dissolution, depolymerisation and feedstock recycling. This approach is technology neutral and allows for new innovations entering the market. The proposal only requires that the starting material is a thermoplastic plastic waste and that at the end of the treatment a thermoplastic output material is obtained that is suitable for conversion into new plastic products or objects made of plastic.

It is important to remark that intermediate materials such as e.g. pyrolysis oil, syngas, or monomers are out of scope in the current exercise, as the proposed EoW criteria are applicable only to plastics, i.e. synthesized polymers with or without additives. In mechanical- and physical recycling, the polymer remains a polymer throughout the process. This is different for depolymerisation and feedstock recycling, in which the polymers are transformed to oligomers, monomers or other chemical compounds. To apply the end-of-waste criteria, a re-polymerization step must be performed and the resulting polymer can be used as an input to the EoW compliance process.

**JRC Proposal:** The scope includes **mechanical, physical, and chemical recycling technologies**

## QUESTION 2.

Do you agree with the proposal to include in the scope mechanical, physical and chemical recycling technologies?  
If NO, please explain the reason(s) and which limitations you would propose.

### 2.3 Point of end-of-waste

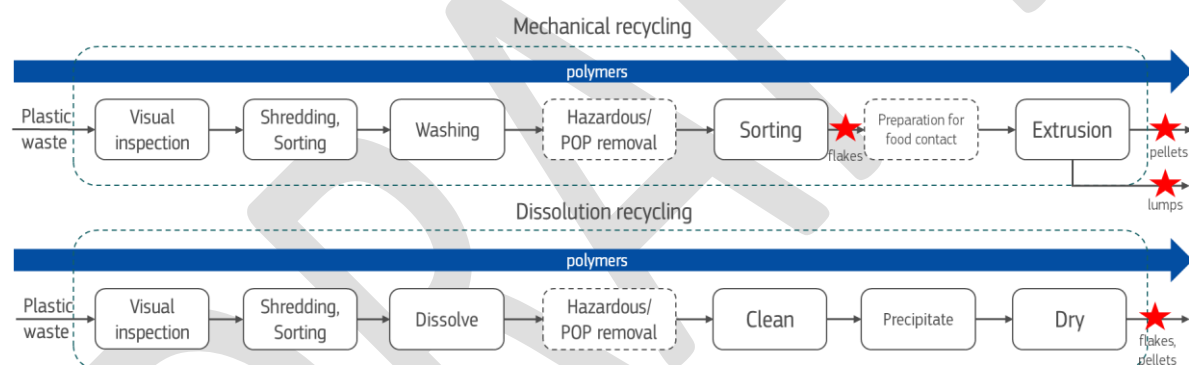
For mechanical and physical recycling processes, the end-of-waste status can be achieved at the point at which the output plastic complies with all requirements on product quality as well as all other end-of-waste criteria. Furthermore, the output plastic should be ready for re-melting and direct use in the production of plastic products or objects partly or fully made of plastic (e.g. polyesters in textile). As the size and form of the output plastic can vary significantly (e.g., flakes, pellets, and lumps), the criteria do not refer to a specific form or size of the output plastic.

The output of depolymerisation or feedstock recycling has to undergo a re-polymerisation step. In this case the end-of-waste status can be granted at the point at which the output plastic complies all requirements on product quality as well as all other end-of-waste criteria. Similarly to mechanical and physical recycling processes, as the size and form of the output plastic can vary significantly, the criteria do not refer to a specific form or size of the output plastic.

As stated in the previous section, outputs from depolymerisation or feedstock recycling processes without depolymerisation (e.g. pyrolysis oil, syngas) do not qualify for EoW within the current scope.

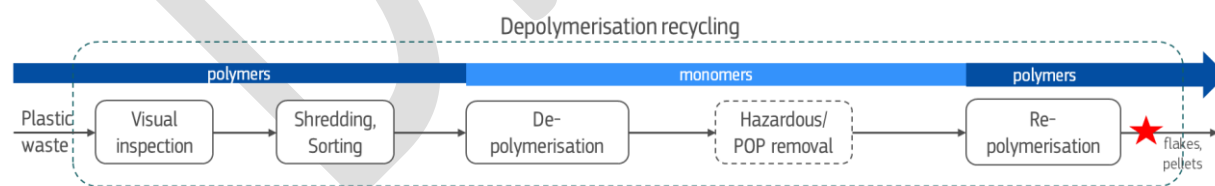
Exemplary schemes of different plastic recycling processes and the proposed points of end-of-waste are presented in Figure 3, Figure 4 and Figure 5.

Figure 3: Exemplary scheme of recycling of plastic waste by mechanical and dissolution technologies



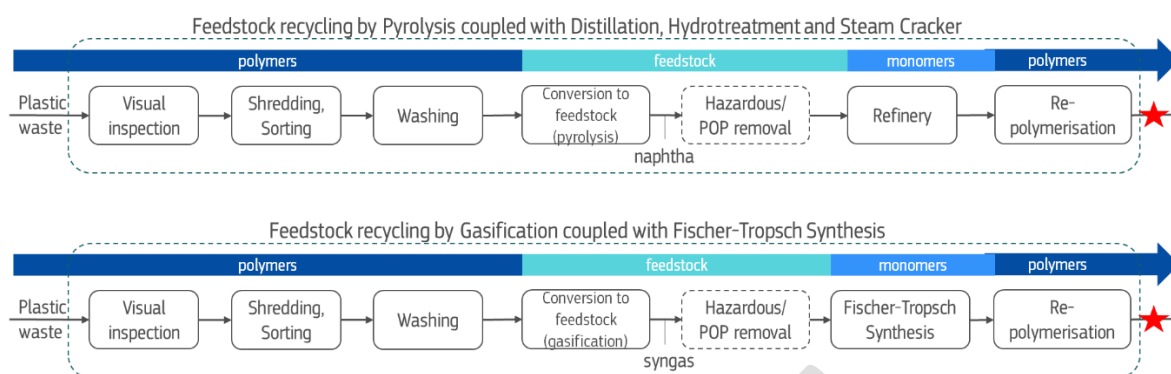
★ Proposal for point of end-of-waste for plastic waste

Figure 4: Exemplary scheme of recycling of plastic waste by depolymerisation



★ Proposal for point of end-of-waste for plastic waste

Figure 5: Exemplary scheme of feedstock recycling of plastic waste by pyrolysis and gasification



★ Proposal for point of end-of-waste for plastic waste

**JRC Proposal: End-of-waste criteria** are applicable to **plastics**, i.e. synthesized polymers with or without additives. **End-of-waste status** is granted at the moment at which the **output plastic is ready for re-melting** and **direct use in the production of plastic products or objects made of plastics**.

### QUESTION 3.

Do you agree with the proposal to grant end-of-waste status to plastics, i.e. synthesized polymers with or without additives, at the point at which the output plastic is ready for re-melting and direct use in the production of plastics products or objects made of plastics?

If NO, please explain the reason(s) and which changes you would propose.

### 3 End-of-waste criteria

In 2014 the JRC published technical proposals for end-of-waste criteria for plastic waste for conversion (Villanueva & Eder, 2014). The proposals were developed based on a comprehensive techno-economic analysis of the plastic waste production chain and an assessment of the economic, environmental and legal impacts when such plastic waste leaves the waste regime. The EoW criteria proposed by the JRC in 2014 (listed in Annex 1) were used as a starting point for the current exercise.

As stated in (Villanueva & Eder, 2014), EoW criteria should take into account relevant legislation in force, avoiding possible duplications. EoW criteria should be clear and enforceable and should be robust to minimise non-compliance.

As defined in the WFD, the EU-wide EoW criteria shall be built upon existing national legislation, starting from the most stringent and environmentally protective EoW criteria established in Member States. A non-exhaustive overview of EoW criteria for plastic waste and case-by-case decisions on EoW status for specific polymers is given in Annex 2.

The main goal of EoW criteria is to ensure high quality of the output product resulting from the recovery operation. Hence the criteria should include direct product quality requirements as well as indirect requirements that help to ensure product quality, such as requirements on input materials and treatment processes. They should also include complementary requirements on provision of information and on quality assurance. Approaches used by some Member States also include requirements on intended use for the output product.

In the following sections, proposed EoW criteria are presented and discussed in detail.

#### 3.1 Requirements on input materials

The purpose of this category of criteria is to limit input materials that could compromise the output plastic and as a consequence the plastic product quality. An approach to restrict some sources of plastic waste was followed, meaning that specific materials cannot be used as input to the recovery operations. Conversely, all other plastic waste can be used as feedstock for recycling.

**Criterion 1.1** sets specific limitations with regard to input materials (restriction of sources). With regard to healthcare waste it should be pointed out that only about 15% of the waste generated in healthcare facilities has hazardous characteristics due to contact with chemicals, radioactive substances or infectious materials (Chartier et al., 2014). This was also argued by several stakeholders in the written consultation. Healthcare waste with hazardous properties shall not be used as input material to the recovery operation. (Chartier et al., 2014) also highlights that the majority of non-hazardous healthcare waste (e.g. packaging material that has not come in direct contact with infectious substances) is similar to municipal waste and should not pose any higher risk than waste produced in households. Therefore, it is proposed that non-hazardous plastic waste originated from healthcare facilities can be used as an input material for recycling. It shall be ensured that non-hazardous healthcare waste is segregated at source from hazardous healthcare waste<sup>2</sup>.

Several stakeholders highlighted that with the exclusion of used personal hygiene products also diaper recycling would be excluded, hampering technological innovation in diaper recycling. Diapers fall under the category of absorbent hygiene products (AHP), a broad category of products that includes baby nappies, sanitary protection pads, tampons and adult incontinence products. AHP waste can contain pathogens, pharmaceutical residues and degradation products of pharmaceuticals. At present, around three plants for the recycling of diapers are in operation or will enter industrial operation in the next few years. The technological approach to the treatment of diapers and recycling of the plastic differs among the three technologies.

Based on literature research and input provided by expert stakeholders, the JRC has concluded that AHP recycling is currently not a mature technology in the EU-27 and, as a consequence, products of personal

---

<sup>2</sup> Technical Guidelines on the Environmentally Sound Management of Biomedical and Healthcare Waste are provided by (UNEP, 2003; WHO, 2014).



208 hygiene should not be used as input for the recovery operation, as it is uncertain whether the recycling  
209 technologies are able to remove hazardous properties.

210 Some stakeholders suggested to include additional reference to POP containing waste in the requirements on  
211 input materials. **Criterion 1.2** refers to POP containing plastic waste that can contain substances that require  
212 a classification as hazardous waste or contain persistent organic pollutants (POPs) in concentrations above  
213 the defined concentration limits in Annex IV of the POP Regulation (EU 2019/1021<sup>3</sup>, including the last  
214 amendment of Annexes IV and V by EU 2022/2400 and its corrigendum of 22.12.2022 published in  
215 OJEU L 328/169) (see Annex 3). JRC proposes that hazardous plastic waste and plastic waste containing POP  
216 concentrations exceeding the limit values established in the POP Regulation are an allowed input if the  
217 treatment process and techniques are able to remove hazardous properties and remove POPs to the extent  
218 that the output plastic can be classified as non-hazardous waste and POP concentrations are below the  
219 applicable limit values that determine the possibility of placing them on the market (UTC limit values in  
220 Annex I of the POPs Regulation). The ultimate goal of end-of-waste criteria is product quality in line with the  
221 relevant product legislation, so that the output plastic has a comparable quality to virgin plastic. For this  
222 reason, a less restrictive approach on the eligible input plastic waste is proposed herein.

223 *Table 1: EoW criteria on input materials*

No.	Proposed EoW criteria on input materials	Self-monitoring requirements
1.1	The following materials shall not be used as input: <ul style="list-style-type: none"> <li>– healthcare waste with hazardous properties</li> <li>– used products of personal hygiene</li> </ul>	Acceptance control by visual inspection of all plastic-containing waste received and of the accompanying documentation shall be carried out by qualified staff which is trained on how to recognise plastic-containing input that does not fulfil the criteria set out in this section.
1.2	Hazardous plastic waste and plastic waste containing POP concentration above the limit values pursuant to Annex IV of Regulation (EU 2019/1021, including the last amendment of Annexes IV <sup>4</sup> and V <sup>5</sup> by EU 2022/2400) on persistent organic pollutants (POP) shall not be used as input, unless the treatment process and techniques used within the treatment facility are able to remove hazardous properties and POPs, to the extent that the output plastic can be classified as non-hazardous and have POP concentrations below the limit values defined in Annex I <sup>6</sup> of Regulation (EU 2019/1021).	Particular attention shall be placed to minimising the presence of hazardous components and POPs in plastic material input originated from electric and electronic equipment waste (WEEE), construction and demolition waste (C&D) and end-of-life vehicles (ELV).  The procedure of detecting and removing hazardous materials and POPs shall be documented under the management system.

<sup>3</sup> The POPs regulation aims at protecting human health and the environment with specific control measures and restrictions on POPs. POPs are chemical substances that persist in the environment, bio-accumulate through the food web, and pose a risk of causing adverse effects to human health and the environment.

<sup>4</sup> Annex IV of POP Regulation: List of substances subject to waste management provisions set out in Article 7

<sup>5</sup> Annex V of POP Regulation: Part 1: Disposal and recovery under Article 7(2)

<sup>6</sup> Annex I of POP Regulation: Part A: Substances listed in the Convention and in the Protocol as well as substances listed only in the Convention



**QUESTION 4.**

Do you agree with the proposed end-of-waste criteria on input materials?

If NO, please explain the reason(s) and which changes you would propose. Please provide evidence to support your arguments.

### 3.2 Requirements on processes and techniques

The purpose of introducing process requirements is to define minimum treatment conditions to reach an output plastic with quality suitable for EoW and comparable to virgin plastic. EoW status is reached only if the material is suitable to be used as direct input for the manufacturing of plastic products or objects made of plastic, without undergoing any further processing.

As mentioned in (Villanueva & Eder, 2014), no dilution of different qualities of plastic waste in the input should be allowed. The blending of waste to create a homogeneous feedstock prior to waste treatment may be appropriate in order to enable treatment or to optimize treatment efficiency (UNEP, 2022).

However, purposeful mixing of plastic wastes in order to dilute the pollutant content and to fall below certain limit values is in general prohibited by the Waste Framework Directive. The WEEE and ELV Directives do not allow the mixing of plastic waste containing brominated flame retardants with other plastic waste. As specified in the Technical Guidelines developed under the Basel Convention (UNEP, 2022) the blending of waste with POP concentrations above the limit values with other materials with the aim of reducing the POP content below the limits is not permitted.

**Criterion 2.1** refers to this principle by establishing a requirement to keep input material eligible for the production of EoW output plastic separated from other types of waste that are not eligible to be used as input material, following the requirements on input materials described in Section 3.1.

**Criterion 2.2** refers to the general requirement of completing all relevant treatment steps, regardless of the technology and sequence of treatments used. As the major objective of EoW criteria is the quality of the output material, the treatment process should include all the steps necessary to reach the targeted quality. Nonetheless, in order to leave room for innovation, it does not seem appropriate to prescribe specific treatment steps. It should also be noted that not all treatment steps are always necessary, as highlighted by the stakeholders. In addition, if the criteria are to be applicable to mechanical, physical and chemical recycling processes, the requirement to follow a prescribed sequence of steps is not feasible.

**Criterion 2.3** defines specific requirements for input materials that originate from waste electrical and electronic equipment (WEEE) and end-of-life vehicles (ELV).

*Table 2: EoW criteria on treatment processes and techniques*

No.	Proposed EoW criteria on processes and techniques	Self-monitoring requirements
2.1	Plastic waste eligible to be used as input material shall, once received by the producer or importer, be kept permanently separate from other types of waste that are not eligible to be used as input materials to avoid contamination.	Qualified staff shall carry out visual inspection of each consignment. The staff shall be trained to visually recognise waste that is eligible as input.
2.2	The process shall include all treatments needed to prepare the output plastic for direct input to manufacturing of plastic products or objects made of plastic.	The sequence of treatment steps shall be documented in the quality management system.
2.3	For waste containing hazardous substances or persistent organic pollutants (POPs) above the limit values pursuant to Annex IV of Regulation (EU 2019/1021), the following specific requirements shall apply:  (a) input materials that originate from waste electrical or electronic equipment shall have undergone all	Particular attention shall be placed to the processing of input plastic waste that may contain hazardous components, especially electric and electronic equipment waste (WEEE) and end-of-life vehicles (ELV).

	<p>treatments required by Article 8 and Annex VII<sup>7</sup> of Directive 2012/19/EU of the European Parliament (WEEE);</p> <p>(b) input materials that originate from end-of-life vehicles shall have undergone all treatments required by Article 6 and Annex I<sup>8</sup> of Directive 2000/53/EC of the European Parliament and of the Council (ELVs);</p>	
--	--	--

#### QUESTION 5.

Do you agree with the proposed end-of-waste criteria on processes and techniques?

If NO, please explain the reason(s) and which changes you would propose. Please provide evidence to support your arguments.

### 3.3 Requirements on product quality

Product quality is referred to as the quality of the output plastic that results from the recovery operation. This category of criteria aims at ensuring that the output plastic can be used to substitute primary raw materials, without posing any risk to human health and the environment. The output plastic shall also be ready for direct use in manufacturing new plastic products.

One of the requirements established in the WFD is that *“the substance or object fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products”*.

One of the major concerns expressed by stakeholders is the presence of hazardous substances.

**Criterion 3.1** refers to the requirement for the output plastic to comply with the same requirements applicable to virgin plastics and specifically with the product legislation:

- Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging of substances and mixtures (CLP)<sup>9</sup>
- Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)<sup>10</sup>
- Regulation (EU) 2019/1021 on Persistent Organic Pollutants (POPs)<sup>11</sup>

**Criterion 3.2** refers to the requirement for the output plastic to comply with customer or industry specifications and to be characterised using existing standards. However, if no standard is available for the characterisation of a specific plastic, this shall not prevent that plastic from reaching EoW status, provided it complies with customer or industry specifications and with the existing legislation. Relevant standards and technical specifications for plastics are listed in Annex 4.

**Criterion 3.3** aims at limiting the content of non-plastic components. The limit should on the one hand be sufficiently strict to avoid shipment of material with a high level of non-plastic components and to ensure high quality of the output plastic; on the other hand it should not be too strict to avoid making EoW status impossible to reach. Besides, the limit value should be applicable to all plastics. Limits between 0.5 and 5% were suggested by stakeholders during the written consultation. The proposed threshold for non-plastic

<sup>7</sup> Annex VII of WEEE Directive: Selective treatment for materials and components of waste electrical and electronic equipment referred to in Article 8(2).

<sup>8</sup> Annex I of ELV Directive: Minimum technical requirements for treatment in accordance with Article 6(1) and (3).

<sup>9</sup> The CLP Regulation establishes the requirement to classify, label and package hazardous chemicals appropriately before placing them on the market. The requirements apply to manufacturers and importers.

<sup>10</sup> The REACH Regulation has been adopted with the aim of reducing the risks posed by chemicals on human health and on the environment, by restricting the use of certain substances (e.g. substances of very high concern (SVHC)) in products placed on the market.

<sup>11</sup> The POPs regulation aims at protecting human health and the environment with specific control measures and restrictions on POPs. POPs are chemical substances that persist in the environment, bio-accumulate through the food web, and pose a risk of causing adverse effects to human health and the environment.

components is 2%, in line with the approach from (Villanueva & Eder, 2014) and with the current state of technologies for sorting and recycling, as confirmed by several plant operators during the site visits.

Table 3: EoW criteria on product quality

No.	Proposed EoW criteria on product quality	Self-monitoring requirements
3.1	<p>The output plastic of the treatment facility shall comply with existing legislation and in particular:</p> <ul style="list-style-type: none"> <li>– shall not be classified as hazardous pursuant to Article 3 and Annex I<sup>12</sup> of Regulation EC/1272/2008 (CLP).</li> <li>– shall meet the conditions for the placing on the market or use of substances of very high concern (SVHC) listed in Annex XIV<sup>13</sup> of Regulation EC/1907/2006 (REACH) pursuant to Article 56 and those for the manufacturing, placing on the market and use of restricted substances pursuant to Article 67 and Annex XVII<sup>14</sup> of REACH.</li> <li>– shall meet the provisions limiting the manufacturing, placing on the market and use of persistent organic pollutants (POPs) pursuant to Article 3 and Annex I<sup>15</sup> of Regulation (EU) 2019/1021.</li> </ul>	<p>The assessment of REACH compliance, and in particular determination of hazardousness has to be concluded from a qualitative and quantitative characterisation of the plastic material in the consignment.</p> <p>At appropriate intervals subject to review if significant changes in the operating process are made, representative samples of plastic waste shall be analysed to measure the content and nature of hazardous substances.</p> <p>The appropriate frequencies of monitoring by sampling shall be established taking into account the following factors:</p> <ul style="list-style-type: none"> <li>– (1) the expected pattern of variability (for example as shown by historical results);</li> <li>– (2) the inherent risk of variability in the quality of the waste used as input for the recovery operation and any subsequent processing, for instance the higher average content of plastics containing hazardous substances;</li> <li>– (3) the inherent precision of the monitoring method; and</li> <li>– (4) the proximity of results to the concentration thresholds that render the material hazardous or restrict their commercialisation.</li> </ul> <p>The procedure of recognising hazardous materials shall be documented under the management system, and shall be available for auditing.</p> <p>In addition to quantitative characterisation, qualified staff shall carry out a visual inspection of each batch in the consignment.</p> <p>The staff shall be trained on potential hazardous properties that may be associated with plastic waste and on material components or features that allow recognising the hazardous properties</p>

<sup>12</sup> Annex I of CLP Regulation: Classification and labelling requirements for hazardous substances and mixtures.

<sup>13</sup> Annex XIV of REACH Regulation: List of substances subject to authorisation.

<sup>14</sup> Annex XVII of REACH Regulation: Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles.

<sup>15</sup> Annex I of POPs Regulation: Substances listed in the Convention and in the Protocol as well as substances listed only in the Convention.

		visually.
3.2	<p>The output plastic of the treatment operation shall comply with a customer specification, or an industry specification for direct use in the production of plastics or objects made of plastic by re-melting in plastic manufacturing facilities.</p> <p>Standards on characterisation of the output plastic shall be used if available.</p> <p>The output plastic shall have adequate mechanical-physical properties to partially or completely substitute virgin plastics.</p>	<p>Qualified staff shall verify that each batch in the consignment complies with the appropriate specification.</p>
3.3	<p>The non-plastic component content shall be <math>\leq 2\%</math> of moisture-free output plastic weight.</p>	<p>Qualified staff shall carry out visual inspection of each batch in the consignment.</p> <p>At appropriate intervals subject to review if significant changes in the operating process are made, representative samples of the moisture-free plastic waste shall be analysed gravimetrically to measure the content and nature of non-plastic components. The non-plastic components content shall be analysed by weighing in moisture-free condition after mechanical or manual (as appropriate) separation of materials under careful visual inspection.</p> <p>When the material has undergone thermal treatment to agglomerate or pelletise it, the determination of the content of non-plastic components has to be carried out at the latest stage of reprocessing before thermal treatment is applied to the plastic to agglomerate or pelletise it. Complementary analytical techniques may be used in the determination of the non-plastic component content, such as chromatography or infrared spectroscopy, especially for the purpose of inspection.</p> <p>The appropriate frequencies of monitoring by sampling shall be established taking into account the following factors:</p> <ol style="list-style-type: none"> <li>(1) the expected pattern of variability (for example as shown by historical results);</li> <li>(2) the inherent risk of variability in the quality of the waste used as input for the recovery operation and any subsequent processing, for instance the higher average content of metals or glass in plastic waste from multi-material collection systems;</li> <li>(3) the inherent precision of the monitoring method; and</li> <li>(4) the proximity of results to the limitation of the non-plastic component content to a maximum of 2% of moisture-free weight.</li> </ol>

		The process of determining monitoring frequencies shall be documented as part of the management system and shall be available for auditing.
--	--	---

#### QUESTION 6.

Do you agree with the proposed end-of-waste criteria on product quality?

If NO, please explain the reason(s) and which changes you would propose. Please provide evidence to support your arguments.

### 3.4 Requirements on quality assurance procedures

A very relevant element of EoW criteria is to assure reliability of EoW criteria and verify compliance. The owner of the output plastic with EoW status has to demonstrate compliance with all the EoW criteria and should hence implement a quality management system. A quality management system shall include documented procedures to monitor the input materials, the quality of the output plastic and the treatment process. It shall also serve to record the results of the mentioned monitoring requirements and feedback from customers on the quality of output plastic (Villanueva & Eder, 2014). **Criterion 4.1** refers to these requirements.

In the written consultation, several stakeholders highlighted the relevance of the ISO 9001 in this context and suggested to make clear reference to this standard. The JRC supports this and proposes the implementation of a quality management system based on EN ISO 9001:2015. It was also proposed to establish a third-party certification, supporting the thorough verification of each criterion, e.g. a verification of the testing methods used to generate data for monitoring or a characterisation of the quality of the output plastic as part of an audit.

Stakeholders referred to EuCertPlast<sup>16</sup>, the European certification scheme for plastics recycling, which is becoming a common reference for quality management amongst recyclers. It also holds relevance in relation to the statement of conformity. However, in order to maintain a neutral and independent approach, no mandatory participation in third-party certification schemes is proposed.

Table 4: EoW criteria on quality assurance procedures

No.	Proposed EoW criteria on quality assurance procedures	Self-monitoring requirements
4.1	<p>The recycler shall implement a management system based on EN ISO 9001:2015 suitable to demonstrate compliance with the end-of-waste criteria.</p> <p>The management system shall include a set of documented procedures concerning each of the following aspects:</p> <ul style="list-style-type: none"> <li>(a) monitoring of the quality of output plastic resulting from the recovery operation (including sampling and analysis);</li> <li>(b) monitoring of the treatment processes and techniques;</li> <li>(c) acceptance control of waste used as input for the recovery operation;</li> <li>(d) feedback from customers concerning the quality of the output plastic;</li> </ul>	None

<sup>16</sup> <https://www.eucertplast.eu/>

<p>(e) record keeping of the results of monitoring conducted under points (a) to (d);</p> <p>(f) review and improvement of the management system;</p> <p>(g) training of staff.</p> <p>The management system shall also prescribe the specific monitoring requirements set out for each criterion.</p> <p>The management system of the supplier of output plastic eligible for end-of-waste shall be certified by a conformity assessment body which is accredited by an accreditation body successfully peer evaluated for this activity by the body recognised in Article 14 of Regulation (EC) 765/2008; or by an environmental verifier which is accredited or licensed by an accreditation or licensing body according to Regulation (EC) No 1221/2009 which is also subject to peer evaluation according to Article 31 of that Regulation, respectively.</p> <p>Verifiers who want to operate in third countries must obtain a specific accreditation or license, in accordance with the specifications laid down in Regulation (EC) No 765/2008 or Regulation (EC) No 1221/2009, the latter together with Commission Decision 2011/832/EU.</p> <p>The importer of plastic material resulting as output of treatment facilities based in third countries shall require his third countries suppliers to implement a management system which complies with these requirements and which has been verified by an independent external verifier.</p> <p>A conformity assessment body, as defined in Regulation (EC) No 765/2008, which has obtained accreditation in accordance with that Regulation, or an environmental verifier, as defined in Art 2 (20) (b) of Regulation (EC) No 1221/2009, which is accredited or licensed in accordance with that Regulation, shall verify that the management system complies with the requirements of this Article 2(20)(b). The verification shall be carried out every year. Only verifiers with the following scopes of accreditation or licence based on the NACE Codes as specified in Regulation (EC) No 1893/2006 are regarded to have sufficient specific experience to perform the verification mentioned in this Regulation:</p> <ul style="list-style-type: none"> <li>– * NACE Code 38 (Waste collection, treatment and disposal activities; material recovery); or</li> <li>– * NACE Code 20 (Manufacture of chemicals and chemical products); or</li> <li>– * NACE Code 22 (Manufacture of rubber and plastic products)</li> </ul> <p>The producer shall give competent authorities access to the management system upon request.</p>	
--	--

**QUESTION 7.**

Do you agree with the proposed end-of-waste criteria on quality assurance procedures?

If NO, please explain the reason(s) and which changes you would propose. Please provide evidence to support your arguments.

### 3.5 Requirements on provision of information

The requirements on provision of information are complementary to quality criteria. The criteria have to minimise any onerous administrative load, recognising when current practice is competent in providing a valuable material for recycling, respecting existing legislation, and protecting human health and the environment. In order to minimise the risk that EoW plastics are diverted to uses different from conversion, additional requirements are needed, specifically on the statement of conformity. **Criterion 5.1** refers to the requirement to include a statement on the use for conversion into plastic products (no other application allowed) and on the compliance with the relevant legislation (CLP, REACH and POPs).

As mentioned above, the EUCertPlast certification scheme has also been suggested as being relevant in this context and it was indicated as a valid alternative for a harmonised statement of conformity. However, it is not appropriate to mandate the use of third-party schemes such as EUCertPlast within EoW criteria. Hence, adherence to any third-party scheme remains voluntary.

The manufacturer shall ensure compliance with relevant product legislation for specific uses. For example, for applications as food-contact material, the output plastic has to comply with Regulation (EC) No 1935/2004 on materials and articles intended to come into contact with food - referred to as Food Contact Material (FCM) Regulation, and on Regulation (EC) No 2022/1616 on recycled plastic materials and articles intended to come into contact with foods. This goes however beyond the scope of end-of-waste legislation. Hence no specific reference to this legislation is given in the criteria.

*Table 5: EoW criteria on provision of information*

No.	Proposed EoW criteria on provision of information	Self-monitoring requirements
5.1	<p>The output plastic of the treatment facility is only intended for use in the manufacture of plastic products or objects made of plastic through conversion processes. Consignments of output plastic with end-of-waste status shall be accompanied by the following statement to be included in the statement of conformity:</p> <p><i>"The material in this consignment must only be used for the manufacture of plastic products or objects made of plastic. It must not be converted directly or indirectly to energy or non-plastic materials".</i></p> <p>In this regard, the statement of conformity of the consignment shall include a section with the statement:</p> <p><i>"The material in this consignment is not classified as a hazardous substance or mixture, pursuant to Article 3 and Annex I of Regulation EC/1272/2008 (CLP), and meets provisions, as appropriate, on manufacturing, placing on the market and use of substances pursuant to Article 56 and Annex XIV of Regulation EC/1907/2006 (REACH), Article 67 and Annex XVII to Regulation EC/1907/2006 (REACH), Article 3 and Annex I of Regulation (EU) 2019/1021 (POPs)".</i></p>	<p>The producer of the output plastic shall provide supplementary information concerning the limitation of use to plastic manufacturing.</p>

334  
335  
336  
337

**QUESTION 8.**

Do you agree with the proposed end-of-waste criteria on provision of information?  
If NO, please explain the reason(s) and which changes you would propose.

DRAFT



## 4 Next steps

Stakeholders are invited to provide comments on this document **using the template provided** and to send **one consolidated feedback per organisation**, at the latest by **20 June 2023** to JRC at [JRC-END-OF-WASTE@ec.europa.eu](mailto:JRC-END-OF-WASTE@ec.europa.eu) (please use "*PLASTICS EOW – Feedback XX*" as email subject, where XX is the name or acronym of your organisation).

The JRC will collect and analyse the feedback received. Building upon the feedback, the JRC will develop the final proposals in close cooperation with DG ENV.

The work will be finalised by the first quarter of 2024 (tentative timeline). It should be stressed that the technical proposals produced by the JRC do not bind the Commission in any way to proceed with the legal adoption of EoW criteria for plastic waste and that changes may be made during the legal adoption process.

DRAFT

## References

- Chartier, Y., Emmanuel, J., Pieper, U., Pruess, A., Rushbrook, P., Stringer, R., Townend, W., Wilburn, S., & Zghondi, R. (2014). Safe Management of Wastes from Health-Care Activities. In *World Health Organization Press* (Issue Geneva).
- Delgado, L., Catarino, A. S., Eder, P., Litten, D., Luo, Z., & Villanueva, A. (2009). End of waste criteria, final report. In *JRC Scientific and Technical Reports* (Vol. 14, Issue 3). <https://doi.org/10.2791/28650>
- Lase, I. S., Tonini, D., Caro, D., Albizzati, P. F., Cristóbal, J., Roosen, M., Kusenber, M., Ragaert, K., Van Geem, K. M., Dewulf, J., & De Meester, S. (2023). How much can chemical recycling contribute to plastic waste recycling in Europe? An assessment using material flow analysis modeling. *Resources, Conservation and Recycling*, 192(March). <https://doi.org/10.1016/j.resconrec.2023.106916>
- Orveillon, G., Pierri, E., Egle, L., Gerbendahl, A., Wessman, P., Garcia John, E., & Saveyn, H. G. M. (2022). *Scoping possible further EU-wide end-of-waste and by-product criteria* (Issue March). <https://doi.org/10.2760/067213>
- Plastics Europe. (2022). *Plastics – the Facts 2022*. October, 81. <https://plasticseurope.org/knowledge-hub/plastics-the-facts-2022/>
- UNEP. (2003). *Technical Guidelines on the Environmentally Sound Management of Biomedical and Healthcare Waste*. Basel (Y1; Y3). *Convention series/SBC No. 2003/3*. Secretariat of the Basel Convention.
- UNEP. (2022). *Technical Guidelines - General technical guidelines on the environmentally sound management of wastes consisting of, containing or contaminated with persistent organic pollutants*. <http://www.basel.int/TheConvention/ConferenceoftheParties/Meetings/COP15/tabid/8392/Default.aspx>
- Villanueva, A., & Eder, P. (2014). End-of-waste criteria for waste plastic for conversion. In *Luxemburg*. <https://doi.org/10.2791/13033>
- WHO. (2014). Safe management of wastes from healthcare activities. *World Health Organization Press*. <https://www.who.int/publications/i/item/9789241548564>

## 373 **List of abbreviations**

ABS	Acrylonitrile Butadiene Styrene
AHP	Absorbent Hygiene Products
CEAP	Circular Economy Action Plan
C&D	Construction and Demolition
CLP	Classification, Labelling and Packaging
DDT	1,1,1-trichloro-2,2-bis (4-chlorophenyl)ethane
DG ENV	Directorate General for the Environment
EC	European Commission
ELV	End-of-Life Vehicles
EoW	End-of-Waste
EPS	Expanded Polystyrene
EU	European Union
FCM	Food Contact Material
HDPE	High Density Polyethylene
(DG) JRC	(Directorate General of the) Joint Research Centre
LDPE	Low Density Polyethylene
MRF	Materials Recovery Facility
MS	Member States
MSW	Municipal solid waste
NACE	Nomenclature statistique des activités économiques dans la Communauté européenne (statistical classification of economic activities in the European Community)
PC	PolyCarbonate
PCB	Polychlorinated Biphenyls
PCDD/PCDF	Polychlorinated dibenzo-p-dioxins and dibenzofurans
PET	Polyethylene Terephthalate
PFOS	Perfluorooctane sulfonic acid and its derivatives
PMMA	Polymethyl Methacrylate
POP	Persistent Organic Pollutants
PP	Polypropylene
PPWD	Packaging and Packaging Waste Directive
PS	Polystyrene
PVC	Polyvinyl Chloride
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RoHS	Restriction of Hazardous Substances
SCCP	Short-chain chlorinated paraffins
SUP	Single-Use Plastic
SVHC	Substances of Very High Concern
WEEE	Waste Electrical and Electronic Equipment
WFD	Waste Framework Directive
WSR	Waste Shipment Regulation

374	<b>List of figures</b>	
375	Figure 1: Conceptual approach of the EoW mechanism, framework conditions and elements of EoW criteria....	4
376	Figure 2: List of priority streams grouped per category and ranked based on their overall potential (Orveillon	
377	et al., 2022).....	5
378	Figure 3: Exemplary scheme of recycling of plastic waste by mechanical and dissolution technologies.....	7
379	Figure 4: Exemplary scheme of recycling of plastic waste by depolymerisation.....	7
380	Figure 5: Exemplary scheme of feedstock recycling of plastic waste by pyrolysis and gasification.....	8
381		

DRAFT

382 **List of tables**

383	Table 1: EoW criteria on input materials .....	10
384	Table 2: EoW criteria on treatment processes and techniques .....	11
385	Table 3: EoW criteria on product quality.....	13
386	Table 4: EoW criteria on quality assurance procedures.....	15
387	Table 5: EoW criteria on provision of information .....	17
388	Table 6: EoW criteria for plastic waste for conversion proposed by (Villanueva & Eder, 2014).....	24
389	Table 7: EoW criteria for plastic waste and case-by-case decisions on EoW status for specific polymers in	
390	Member States (non-exhaustive list).....	29
391	Table 8: List of substances (Annex IV) subject to waste management provisions set out in Article 7 of the POP	
392	Regulation.....	30
393	Table 9: Overview of existing standards and technical specifications (non-exhaustive list).....	32
394		

## Annexes

### Annex 1. End-of-waste criteria proposed by the JRC in 2014

Table 6: EoW criteria for plastic waste for conversion proposed by (Villanueva & Eder, 2014)

No.	Category	End-of-waste criteria		Self-monitoring requirements
1	Product quality	1.1	<p>The waste plastic shall comply with a customer specification, or an industry specification for direct use in the production of plastic substances or objects by re-melting in plastic manufacturing facilities.</p> <p>When applicable, the following standards on characterisation of plastic recyclates shall be used:</p> <ul style="list-style-type: none"> <li>For polystyrene: EN 15342 Plastics. Recycled plastics. Characterization of polystyrene (PS) recyclates</li> <li>For polyethylene: EN 15344 Plastics. Recycled plastics. Characterization of polyethylene (PE) recyclates</li> <li>For polypropylene: EN 15345 Plastics. Recycled plastics. Characterization of polypropylene (PP) recyclates</li> <li>For poly(vinyl chloride): EN 15346 Plastics. Recycled plastics. Characterization of poly(vinyl chloride) (PVC) recyclates</li> <li>For poly(ethylene terephthalate): EN 15348 Plastics. Recycled plastics. Characterization of poly(ethylene terephthalate) (PET) recyclates</li> </ul>	Qualified staff shall verify that each batch in the consignment complies with the appropriate specification.
		1.2	<p>The non-plastic component content shall be ≤ 2 % of moisture-free weight.</p> <p>A non-plastic component is any material different from plastic, which is present in waste plastic for recycling. Examples of non-plastic components are metals, paper, glass, natural textiles, earth, sand, ash, dust, wax, bitumen, ceramics, rubber, organic matter and wood, except when these materials are integral constituents of the plastic structure before it is re-melt, such as talc, limestone, glassfibre or wood fibres used as fillers and structural or mechanical reinforcements.</p>	<p>Qualified staff shall carry out visual inspection of each batch in the consignment.</p> <p>At appropriate intervals subject to review if significant changes in the operating process are made, representative samples of the moisture-free waste plastic shall be analysed gravimetrically to measure the content and nature of non-plastic components. The non-plastic components content shall be analysed by weighing in moisture-free condition after mechanical or manual (as appropriate) separation of materials under careful visual inspection.</p> <p>When the material has undergone thermal treatment to agglomerate or pelletise it, the determination of the content of non-plastic components has to be carried out at the latest stage of reprocessing before thermal treatment is applied to the plastic to agglomerate or pelletise it. Complementary analytical techniques may be used in the determination of the non-plastic component content, such as chromatography or infrared</p>

				<p>spectroscopy, especially for the purpose of inspection.</p> <p>The appropriate frequencies of monitoring by sampling shall be established taking into account the following factors:</p> <ul style="list-style-type: none"> <li>(1) the expected pattern of variability (for example as shown by historical results);</li> <li>(2) the inherent risk of variability in the quality of the waste used as input for the recovery operation and any subsequent processing, for instance the higher average content of metals or glass in waste plastic from multi-material collection systems;</li> <li>(3) the inherent precision of the monitoring method; and</li> <li>(4) the proximity of results to the limitation of the non-plastic components content to a maximum of 2 % of moisture-free weight.</li> </ul> <p>The process of determining monitoring frequencies shall be documented as part of the management system and shall be available for auditing.</p>
		1.3	<p>The waste plastic</p> <ul style="list-style-type: none"> <li>– shall not be classified as hazardous following the definitions in Article 3 and Annex I of Regulation EC/1272/2008 (CLP).</li> <li>– shall meet the conditions of commercialisation of substances of very high concern (SVHC) laid out in Article 56 of Regulation EC/1907/2006 (REACH).</li> <li>– shall meet the prescriptions about the restriction of the commercialisation of persistent organic pollutants laid out in Article 3 of Regulation 850/2004/EC (POPs).</li> </ul>	<p>The assessment of REACH compliance, and in particular determination of hazardousness has to be concluded from a qualitative and quantitative characterisation of the plastic material in the consignment.</p> <p>At appropriate intervals subject to review if significant changes in the operating process are made, representative samples of waste plastic shall be analysed to measure the content and nature of hazardous substances, and the extent to which users of the waste plastic or the environment are exposed to contact with these substances.</p> <p>The appropriate frequencies of monitoring by sampling shall be established taking into account the following factors:</p> <ul style="list-style-type: none"> <li>(1) the expected pattern of variability (for example as shown by historical results);</li> <li>(2) the inherent risk of variability in the quality of the waste used as input for the recovery operation and any subsequent processing, for instance the higher average content of plastics containing</li> </ul>

				<p>hazardous substances;</p> <p>(3) the inherent precision of the monitoring method; and</p> <p>(4) the proximity of results to the concentration thresholds that render the material hazardous or restrict their commercialisation.</p> <p>The procedure of recognising hazardous materials shall be documented under the management system, and shall be available for auditing.</p> <p>In addition to quantitative characterisation, qualified staff shall carry out visual inspection of each batch in the consignment.</p> <p>The staff shall be trained on potential hazardous properties that may be associated with waste plastic and on material components or features that allow recognising the hazardous properties visually.</p>
		1.4	Waste plastic shall not contain leachable fluids such as oil, solvents, glues, paint, aqueous and/or fatty foodstuffs, that can be detected by visual inspection and olfactory test, except for negligible amounts that will not lead to any dripping.	<p>Qualified staff shall carry out a visual inspection of each consignment. Where visual inspection reveals the presence of signs of fluids except water, that may result in e.g. mould growth or odours, and these signs are non-negligible, the consignment shall remain waste.</p> <p>The staff shall be trained on potential types of contamination that may be associated with waste plastic and on material components or features that allow recognising the contaminants.</p> <p>The procedure of recognising contamination shall be documented under the management system.</p>
2	Input materials	2.1	Bio-waste, healthcare waste, and used products of personal hygiene shall not be used as input.	<p>Acceptance control of all plastic-containing waste received by visual inspection and of the accompanying documentation shall be carried out by qualified staff which is trained on how to recognise plastic-containing input that does not fulfil the criteria set out in this section.</p> <p>Particular attention shall be placed to the absence of hazardous components in plastic material input originated from electric and electronic equipment waste (WEEE), construction and demolition waste, and end-of-life vehicles (ELV).</p> <p>The procedure of recognising hazardous materials shall be documented under the management system.</p>
		2.2	Hazardous waste shall not be used as an input except where proof is provided that appropriate processes and techniques to remove all hazardous properties have been applied.	
3	Processes and	3.1	Waste plastic streams used as input shall, once received by the producer or importer, be	Particular attention shall be placed to the processing of input materials that



	techniques		kept permanently separate from the contact with any other waste, including other waste plastic grades.	may contain hazardous components in plastic, especially electric and electronic equipment waste (WEEE), construction and demolition waste, and end-of-life vehicles (ELV). Treatment techniques resulting in the mixing of these materials, such as shredding before removal of hazardous substances, shall be avoided.
		3.2	All treatments needed to prepare the waste plastic for direct input in a free flowing form to manufacturing of plastic products, such as de-baling, sorting, separating, size-reducing, cleaning, melting, filtering, regranulating, or grading, shall have been completed.	
		3.3	For waste containing hazardous substances, the following specific requirements shall apply:  (a) input materials that originate from waste electrical or electronic equipment or from end-of-life vehicles shall have undergone all treatments required by Article 8 of Directive 2012/19/EU of the European Parliament and of the Council (WEEE) and by Article 6 of Directive 2000/53/EC of the European Parliament and of the Council (ELVs);  (b) hazardous waste that is not mentioned in point (a) shall have been efficiently removed in a process which is approved by the competent authority.	
4	Provision of information	4.1	<p>Waste plastic that has ceased to be waste is only intended for use in the manufacture of plastic through conversion processes. Waste plastic consignments shall be specifically labelled with a statement on this intended use.</p> <p>The statement of conformity of the consignment shall include a section with the statement:</p> <p><i>'The material in this consignment is intended exclusively for the manufacture of plastic products'.</i></p> <p>Waste plastic that has ceased to be waste is within the scope of Regulations (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), and (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures (CLP). A prominent role is given to the procedures laid out in these Regulations for the determination of hazardousness, completed with a reference to Regulation (EC) No 850/2004 on persistent organic pollutants (POPs).</p> <p>In this regard, the statement of conformity of the consignment shall include a section with the statement:</p> <p><i>'The material in this consignment is not classified as hazardous, following the definitions in Article 3 and Annex I of Regulation EC/1272/2008 (CLP), and meets the prescriptions on commercialisation of substances of very high concern (SVHC) laid out in Article 56 of Regulation EC/1907/2006</i></p>	None

			<i>REACH, and the restriction of the commercialisation of persistent organic pollutants laid out in Article 3 of Regulation 850/2004/EC (POPs)</i> .	
5	Quality assurance procedures	5.1	<p>The producer shall implement a management system suitable to demonstrate compliance with the EoW criteria.</p> <p>The management system shall include a set of documented procedures concerning each of the following aspects:</p> <ul style="list-style-type: none"> <li>(a) monitoring of the quality of waste plastic resulting from the recovery operation (including sampling and analysis);</li> <li>(b) monitoring of the treatment processes and techniques;</li> <li>(c) acceptance control of waste used as input for the recovery operation;</li> <li>(d) feedback from customers concerning the product quality;</li> <li>(e) record keeping of the results of monitoring conducted under points (a) to (d);</li> <li>(f) review and improvement of the management system;</li> <li>(g) training of staff.</li> </ul> <p>The management system shall also prescribe the specific monitoring requirements set out for each criterion.</p> <p>The management system of the supplier shall be certified by a conformity assessment body which is accredited by an accreditation body successfully peer evaluated for this activity by the body recognised in Article 14 of Regulation (EC) 765/2008; or by an environmental verifier which is accredited or licensed by an accreditation or licensing body according to Regulation (EC) No 1221/2009 which is also subject to peer evaluation according to Article 31 of that Regulation, respectively.</p> <p>Verifiers who want to operate in third countries must obtain a specific accreditation or licence, in accordance with the specifications laid down in Regulation (EC) No 765/2008 or Regulation (EC) No 1221/2009, the latter together with Commission Decision 2011/832/EU.</p> <p>The importer shall require his suppliers to implement a management system which complies with these requirements and has been verified by an independent external verifier.</p> <p>A conformity assessment body, as defined in Regulation (EC) No 765/2008, which has obtained accreditation in accordance with that Regulation, or an environmental verifier, as defined in Art 2 (20) (b) of Regulation (EC) No 1221/2009, which is accredited or licensed in</p>	None

		<p>accordance with that Regulation, shall verify that the management system complies with the requirements of this Article (2(20)(b)). The verification shall be carried out every three years. Only verifiers with the following scopes of accreditation or licence based on the NACE Codes as specified in Regulation (EC) No 1893/2006 are regarded to have sufficient specific experience to perform the verification mentioned in this Regulation:</p> <ul style="list-style-type: none"> <li>– * NACE Code 38 (Waste collection, treatment and disposal activities; material recovery); or</li> <li>– * NACE Code 20 (Manufacture of chemicals and chemical products); or</li> <li>– * NACE Code 22 (Manufacture of rubber and plastic products)</li> </ul> <p>The producer shall give competent authorities access to the management system upon request.</p>	
--	--	--	--

398

## 399 **Annex 2. End-of-waste criteria for plastic waste developed or under development in Member** 400 **States**

401 *Table 7: EoW criteria for plastic waste and case-by-case decisions on EoW status for specific polymers in Member States*  
402 *(non-exhaustive list)*

Member State	Scope	Available documents	Status
<b>BE</b> (Flanders)	All plastic waste	<b>Manual to support self-assessment</b> of fulfilment of end-of-waste and by-product criteria: <a href="https://ovam.vlaanderen.be/zelfbeoordeling">https://ovam.vlaanderen.be/zelfbeoordeling</a>	<b>Implemented:</b> EoW status when complying with REACH/CLP and use in production processes without further treatment
<b>ES</b>	Selected plastic waste <sup>17</sup>	<b>Draft Ministerial Order</b> establishing the criteria for determining when plastic waste undergoing mechanical treatment and destined for the manufacture of plastic products ceases to be waste pursuant to Law 7/2022 of 8 April on contaminated waste and soils for a circular economy.	<b>Work in progress:</b> Draft for a Plastic EoW decree notified to EC.
<b>FI</b>	Selected plastic waste	Under development	<b>Work in progress</b>
<b>FR</b>	All waste types, with certain exceptions	<b>JORF n° 0052 du 02/03/2019</b> <a href="https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000038190409">https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000038190409</a> <b>Decree No. 2021-380 of April 1, 2021</b> <a href="https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000043327059">https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000043327059</a>	<b>Implemented by</b> national Decree and order
<b>IE</b>	<ul style="list-style-type: none"> <li>– Recycled LDPE pellets</li> <li>– PET recyclate</li> <li>– PE and PP recyclate pellet</li> <li>– Plastic flakes from plastic packaging</li> </ul>	<b>Case-by-case decisions</b> <a href="https://www.epa.ie/our-services/licensing/waste/end-of-waste-art-28/">https://www.epa.ie/our-services/licensing/waste/end-of-waste-art-28/</a>	<b>Implemented:</b> Case by case EoW decisions by the EPA

<sup>17</sup> a) pre-consumer: 07 02 13, 12 01 05; b) post-consumer: 02 01 04, 15 01, 15 01 10\*, 16 01 19, 17 02 03 19 12 04, 20 01 39; c) With regard to chapters 18 01 and 18 02, it should be clarified that plastic wastes with codes 18 01 03\* and 18 02 03\* as well as 18 01 02, 18 01 04, and 18 01 03\* could also be considered as admissible waste.

<b>IT</b>	<ul style="list-style-type: none"> <li>Absorbent hygiene products (AHP)</li> <li>Mixed plastics from packaging waste</li> <li>Heterogeneous plastics from pulper waste</li> </ul>	<b>Decree on EoW status for AHP recycling:</b> The regulation establishes the specific criteria under which the heterogeneous polyolefin-based plastics, superabsorbent polymer and cellulose from the recycling of AHP no longer qualify as waste (DECRETO 15 maggio 2019, n. 62). <a href="https://www.gazzettaufficiale.it/eli/id/2019/07/08/19G00071/sq">https://www.gazzettaufficiale.it/eli/id/2019/07/08/19G00071/sq</a>	<b>EoW for AHP recycling implemented</b> by national decree.  <b>Planning:</b> indicated plans to develop EoW criteria for mixed plastics from packaging and heterogeneous plastics from pulper waste.
<b>NL</b>	PVC granulate	<b>Decision on EoW status for PVC:</b> Rechtsoordeel status einde-afval PVC-granulaat, 31 januari 2018	<b>Implemented:</b> case by case EoW decision
<b>PT</b>	Recovered plastics (flakes, agglomerates and granules)	<b>Portuguese Decree No. 245/2017</b> of 2nd August <a href="https://interplast.pt/Artigos/301498-Fim-do-estatuto-de-Residuo-(FER).html">https://interplast.pt/Artigos/301498-Fim-do-estatuto-de-Residuo-(FER).html</a>	<b>Implemented:</b> Portuguese Decree No. 245/2017 (incl. criteria for EoW)

### Annex 3. List of substances in Annex IV of the POP regulation

Table 8: List of substances (Annex IV) subject to waste management provisions set out in Article 7 of the POP Regulation

Substance	CAS No	EC No	Concentration limit referred to in Article 7(4)(a)
Endosulfan	115-29-7 959-98-8 33213-65-9	204-079-4	50 mg/kg
Hexachlorobutadiene	87-68-3	201-765-5	100 mg/kg
Polychlorinated naphthalenes			10 mg/kg
Alkanes C <sub>10</sub> -C <sub>13</sub> , chloro (short-chain chlorinated paraffins) (SCCPs)	85535-84-8	287-476-5	1 500 mg/kg The Commission shall review that concentration limit and shall, where appropriate, adopt a legislative proposal to lower that value no later than 30 December 2027
Tetrabromodiphenyl ether C <sub>12</sub> H <sub>6</sub> Br <sub>4</sub> O	40088-47-9 and others	254-787-2 and others	Sum of the concentrations of tetrabromodiphenyl ether C <sub>12</sub> H <sub>6</sub> Br <sub>4</sub> O, pentabromodiphenyl ether C <sub>12</sub> H <sub>5</sub> Br <sub>5</sub> O, hexabromodiphenyl ether C <sub>12</sub> H <sub>4</sub> Br <sub>6</sub> O, heptabromodiphenyl ether C <sub>12</sub> H <sub>3</sub> Br <sub>7</sub> O and decabromodiphenyl ether C <sub>12</sub> HBr <sub>10</sub> O: (a) until 29 December 2027, 500 mg/kg; (b) from 30 December 2025 until 28 December 2027, 350 mg/kg, or, if higher, the sum of the concentration of those substances where they are present in mixtures or articles, as set out in the fourth column, point 2, of Annex I for the substances tetrabromodiphenyl ether, pentabromodiphenyl ether, hexabromodiphenyl ether, heptabromodiphenyl ether and decabromodiphenyl ether; (c) from 30 December 2027, 200 mg/kg or, if higher, the sum of the concentration of those substances where they are present in mixtures or articles, as set out in the fourth column, point 2, of Annex I for the substances tetrabromodiphenyl ether, pentabromodiphenyl ether, hexabromodiphenyl ether, heptabromodiphenyl ether and decabromodiphenyl ether.
Pentabromodiphenyl ether C <sub>12</sub> H <sub>5</sub> Br <sub>5</sub> O	32534-81-9 and others	251-084-2 and others	
Hexabromodiphenyl ether C <sub>12</sub> H <sub>4</sub> Br <sub>6</sub> O	36483-60-0 and others	253-058-6 and others	
Heptabromodiphenyl ether C <sub>12</sub> H <sub>3</sub> Br <sub>7</sub> O	68928-80-3 and others	273-031-2 and others	
Decabromodiphenyl ether C <sub>12</sub> HBr <sub>10</sub> O	1163-19-5 and others	214-604-9 and others	
Perfluorooctane sulfonic acid and its derivatives (PFOS) C <sub>8</sub> F <sub>17</sub> SO <sub>2</sub> X  (X = OH, Metal salt (O-M <sup>+</sup> ), halide, amide, and other derivatives including polymers)	1763-23-1 2795-39-3 29457-72-5 29081-56-9 70225-14-8 56773-42-3 251099-16-8 4151-50-2 31506-32-8	217-179-8 220-527-1 249-644-6 249-415-0 274-460-8 260-375-3 223-980-3 250-665-8 216-887-4	50 mg/kg

	1691-99-2 24448-09-7 307-35-7 and others	246-262-1 206-200-6 and others	
Polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/PCDF) and dioxin-like polychlorinated biphenyls (dl-PCBs)			5 µg/kg <sup>18</sup>  The Commission shall review that concentration limit and shall, where appropriate, adopt a legislative proposal to lower that value, where such lowering is feasible in accordance with scientific and technical progress, no later than 30 December 2027.
DDT (1,1,1-trichloro-2,2-bis (4-chlorophenyl)ethane)	50-29-3	200-024-3	50 mg/kg
Chlordane	57-74-9	200-349-0	50 mg/kg
Hexachlorocyclohexanes, including lindane	58-89-9 319-84-6 319-85-7 608-73-1	210-168-9 200-401-2 206-270-8 206-271-3	50 mg/kg
Dieldrin	60-57-1	200-484-5	50 mg/kg
Endrin	72-20-8	200-775-7	50 mg/kg
Heptachlor	76-44-8	200-962-3	50 mg/kg
Hexachlorobenzene	118-74-1	204-273-9	50 mg/kg
Chlordecone	143-50-0	205-601-3	50 mg/kg
Aldrin	309-00-2	206-215-8	50 mg/kg
Pentachlorobenzene	608-93-5	210-172-0	50 mg/kg
Polychlorinated Biphenyls (PCB)	1336-36-3 and others	215-648-1	50 mg/kg
Mirex	2385-85-5	219-196-6	50 mg/kg
Toxaphene	8001-35-2	232-283-3	50 mg/kg
Hexabromobiphenyl	36355-01-8	252-994-2	50 mg/kg
Hexabromocyclododecane <sup>19</sup>	25637-99-4, 3194-55-6, 134237-50-6, 134237-51-7, 134237-52-8	247-148- 4221-695-9	500 mg/kg The Commission shall review that concentration limit and shall, where appropriate, adopt a legislative proposal to lower that value to not higher than 200 mg/kg no later than 30 December 2027.
Pentachlorophenol, its salts and esters	87-86-5 and others	201-778-6 and others	100 mg/kg
Dicofol	115-32-2	204-082-0	50 mg/kg
Perfluorooctanoic acid (PFOA), its salts and PFOA-related compounds, as set out in Annex I	335-67-1 and others	335-67-1 and others	1 mg/kg (PFOA and its salts),  40 mg/kg (sum of PFOA-related compounds) The Commission shall review that concentration limit

<sup>18</sup> The limit is calculated as the sum of PCDD, PCDF and dl-PCBs according to the toxic equivalency factors (TEFs) set out in Part 2, in the third paragraph, in the table, of Annex V.

<sup>19</sup> "Hexabromocyclododecane" means hexabromocyclododecane, 1,2,5,6,9,10-hexabromocyclododecane and its main diastereoisomers: alpha-hexabromocyclododecane, beta-hexabromocyclododecane and gamma-hexabromocyclododecane.

			and shall, where appropriate, adopt a legislative proposal to lower that value, where such lowering is feasible in accordance with scientific and technical progress, no later than 30 December 2027.
Perfluorohexane sulfonic acid (PFHxS), its salts and PFHxS- related compounds	355-46-4 and others	355-46-4 and others	1 mg/kg (PFHxS and its salts),  40 mg/kg (sum of PFHxS-related compounds). The Commission shall review that concentration limit and shall, where appropriate, adopt a legislative proposal to lower that value, where such lowering is feasible in accordance with scientific and technical progress, no later than 30 December 2027.

406

407 **Annex 4. Existing standards and technical specifications for plastics**408 *Table 9: Overview of existing standards and technical specifications (non-exhaustive list)*

Number	Type	Title	Year
EN 15347	Standard	Plastics - Recycled plastics - Characterisation of sorted plastics wastes	2022
EN 15342	Standard	Plastics - Recycled Plastics - Characterisation of PS recyclates	2007
EN 15344	Standard	Plastics - Recycled Plastics - Characterisation of PE recyclates	2020
EN 15345	Standard	Plastics - Recycled Plastics - Characterisation of PP recyclates	2007
EN 15346	Standard	Plastics - Recycled Plastics - Characterisation of PVC recyclates	2007
EN 15348	Standard	Plastics - Recycled Plastics - Characterisation of PET recyclates	2013
CEN/TR 15353	Tech. report	Plastics - Recycled plastics - Guidelines for the development of standards for recycled plastics	2007
CEN/TS 16010	Tech. specification	Plastics - Recycled plastics - Sampling procedures for testing plastics waste and recyclates	2022
CEN/TS 16011	Tech. specification	Plastics - Recycled plastics - Sample preparation	2013
EN 15343	Standard	Plastics - Recycled Plastics - Plastics recycling traceability and assessment of conformity and recycled content	2007
EN 13430	Standard	Packaging - Requirements for packaging recoverable by material recycling	2004
EN 13437	Standard	Packaging and material recycling - Criteria for recycling methods. Description of recycling processes and flow chat	2003
CEN/TR 13688	Tech. report	Packaging – Material recycling – Report on requirements for substances and materials to prevent a sustained impediment to recycling	2008
CEN/TR 13695	Tech. report	Packaging – Requirements for measuring and verifying the four heavy metals and other dangerous substances present in packaging and their release into the environment	2000
		Part 1: Requirements for measuring and verifying the four heavy metals present in packaging	2000
		Part 2: Requirements for measuring and verifying dangerous substances present in packaging, and their release into the environment	2019
DIN EN 17410:2020-06	Standard	Controlled loop recycling of PVC profiles from windows and doors	2020

UNI 10667-18:2022	Standard	Materie plastiche prime secondarie – Parte 18: Miscele di materie plastiche eterogenee a base di poliolefine provenienti da residui industriali e/o da materiali da post-consumo	2022
DIN SPEC 91446	Standard	Classification of recycled plastics based on Data Quality Levels for use and (digital) trading	2021
ISO/TC 308	Standard	Chain of custody	Under devel.
ISO/IEC 17025	Standard	Testing and calibration laboratories	2017
CEN	Standard	European standardisation deliverable(s) on quality grades for sorted plastics wastes: HPDE, LDPE, PP, PET, PVC, PS, EPS	Requested by CPA
CEN	Standard	European standard(s) on characterisation of Acrylonitrile butadiene styrene (ABS) recyclates	Requested by CPA
CEN	Standard	European standardisation deliverable(s) on quality requirements for application of plastic recyclates in products: rHDPE, rLDPE, rPP, rPET, rPVC, rPS, rEPS, rABS	Requested by CPA
Ecoembes	Tech. specification	<a href="https://www.ecoembes.com/sites/default/files/inline-files/recicladores/municipal/ETMR-DEF-v12-ETMR-monomaterial.pdf">https://www.ecoembes.com/sites/default/files/inline-files/recicladores/municipal/ETMR-DEF-v12-ETMR-monomaterial.pdf</a>	
IVH	Technical specification	EPS-Leitfaden für Weiterverwertung & Recycling <a href="https://www.ivh.de/wp-content/uploads/EPS-Leitfaden-Weiterverwertung-Recycling-12-2021_IVH_VDPM.pdf">https://www.ivh.de/wp-content/uploads/EPS-Leitfaden-Weiterverwertung-Recycling-12-2021_IVH_VDPM.pdf</a>	2021
Plastic Recyclers Europe	Tech. specification	Characterisation of recycling inputs and recyclates <a href="https://www.plasticsrecyclers.eu/recyclates-characterisation">https://www.plasticsrecyclers.eu/recyclates-characterisation</a>	2022

## Annex 5. Glossary

**Additives and fillers:** substances added to a polymer in the manufacturing of plastics to improve specific properties of the end product (e.g. hardness, softness, UV resistance, flame formation resistance) or improve their behaviour during manufacturing (e.g. lubricants, catalysts, stabilisers, solvents, polymerisation aids, recycling aids). Examples of additives are flame retardants or softeners. Examples of fillers are powders (e.g. talc) or fibres (e.g. glass fibres). However, in plastic waste, and for the purpose of recycling, the presence of certain additives and fillers may be undesired. Some of them are associated to environmental and/or health risks (e.g. PFOS, some halogenated flame-retardants, and toxic heavy metals). These materials and substances are bound to or incorporated into the polymer matrix, making their removal challenging. Actually, the presence of additives and fillers in plastics can alter significantly some of the properties used for separation (e.g. fillers or brominated flame retardants can significantly change the density of polymers).

**Bale:** balers are used to compact waste into dense, easier to transport bales. Bales can be produced from (plastic) waste collected separately or commingled with other streams but also from sorted plastic waste (e.g. PET-bottle bale, Polyolefin mix bale).

**Chemical recycling**<sup>20</sup> refers to different technologies, that mainly include:

- **Pyrolysis and gasification:** These technologies are capable of breaking down plastic polymers into a feedstock of various chemical compounds (naphtha, syngas), by treatment at high temperatures in a low-oxygen environment. Following refining (naphtha) or Fischer-Tropsch synthesis (syngas) monomers and basic chemicals are produced, which in turn can be used for different petrochemical and chemical applications, including the production of new polymers.

<sup>20</sup> Processes where the input material is used for energy recovery or the reprocessing into materials that are to be used as fuels are not considered recycling according to Article 3(17) of the Waste Framework Directive 2008/98/EC.

430 - Solvent based **depolymerisation** is a process using chemical substances, solvents and heat to  
 431 break down polymers into oligomers, monomers or a mixture of monomers and other chemical  
 432 compounds.

433 **Collection:** (follows the WFD (2008/98/EC) definition): the gathering of waste, including the preliminary  
 434 sorting and preliminary storage of waste for the purposes of transport to a waste treatment facility.

435 **Collection rate:** percentage of plastic waste collection compared to the total plastic waste generation.  
 436 Plastic waste collected in a country but exported for recycling to another country is included. Plastic waste  
 437 imported from other countries and recycled in the country in question is not included.

438 **Commingled collection:** a multi-material collection system where two or more (dry) recyclable waste  
 439 streams are deliberately collected together, for later sorting into mono-materials at a sorting plant (e.g.  
 440 Materials Recovery Facility).

441 **Consignment:** a batch of output plastic which is intended for delivery from a producer to another holder and  
 442 may be contained in either one or several transport units, such as containers.

443 **Contaminants:** substances or materials present in plastic waste that are not targeted for its further recycling  
 444 and which pose a risk for human health and the environment (e.g. hazardous substances, persistent organic  
 445 pollutants).

446 **Converter:** manufacturer of semi-finished or finished products by a number of operations involving pressure,  
 447 heat and/or chemical addition, converting output plastic, usually in the form of powder, flakes, regrind, pellets  
 448 (regranulates), agglomerates or profiles. The process involves the re-melting of the plastic, and often involves  
 449 extrusion and filtering.

450 **Dissolution:** Dissolution process uses heat and solvents to dissolve plastic waste into a solution of the  
 451 polymers and additives that it originally contains. In the following step the additives are separated from the  
 452 polymers before recovering the polymers from the solution. Compared to chemical recycling, during the  
 453 dissolution process the structure of the polymer is not altered.

454 **Disposal** (follows the WFD (2008/98/EC) definition): any operation which is not recovery even where the  
 455 operation has as a secondary consequence the reclamation of substances or energy. Annex I of the Directive  
 456 sets out a non-exhaustive list of disposal operations.

457 **Energy recovery:** it refers to the use of waste principally as a fuel (e.g. refused-derived fuel (RDF)) or other  
 458 means to generate energy.

459 **Hazardous waste** (follows the WFD (2008/98/EC) definition): waste which displays one or more of the  
 460 hazardous properties listed in Annex III of the WDF (e.g. explosive, acute toxic).

461 **Healthcare waste:** waste from human or animal healthcare and/or related research (except kitchen and  
 462 restaurant wastes not arising from immediate healthcare), including all its subcategories as detailed in code  
 463 18 of Commission Decision 2000/352/EC (List of Wastes).

464 **Holder:** means the natural or legal person who is in possession of the plastic material.

465 **Importer** (follows the REACH Regulation (1907/2006/EC) definition): means any natural or legal person  
 466 established within the Community who is responsible for import.

467 **Input material:** plastic waste used as input to the treatment facility.

468 **Lump:** Plastic fraction separated by the extruder screen, containing small particles of non-plastic components.

469 **Material recovery** (follows the WFD (2008/98/EC) definition): material recovery' means any recovery  
 470 operation, other than energy recovery and the reprocessing into materials that are to be used as fuels or  
 471 other means to generate energy. It includes, inter alia, preparing for re-use, recycling and backfilling.

472 **Materials recovery facility (MRF):** specialized plants that receive, separate and prepare recyclable  
 473 materials for further processing (e.g. mechanical recycling). MRF are either designed to accept dry recyclable  
 474 materials that have already been separated at source from municipal solid waste or to accept mixed  
 475 municipal solid waste to separate out designated recyclable materials (e.g. plastics) through a combination of  
 476 mechanical sorting steps.



477 **Mechanical recycling:** for plastics, it refers to processes for recovering pre-sorted plastic waste by  
 478 mechanical processes such as sorting, grinding, washing, drying, re-granulating and compounding. Mechanical  
 479 recycling does not change the chemical structure of the polymer.

480 **Mono-material collection:** a system for the deliberate collection of a single recyclable material, such as  
 481 paper, plastics, metals, or glass.

482 **Monomer** (follows the REACH Regulation (1907/2006/EC) definition): means a substance which is capable of  
 483 forming covalent bonds with a sequence of additional like or unlike molecules under the conditions of the  
 484 relevant polymer-forming reaction used for the particular process.

485 **Municipal solid waste (MSW):** non-sorted, mixed waste from households and commerce, collected together.  
 486 This waste flow excludes the flows of recyclables collected and kept separately, be it one-material flows or  
 487 multi-material (commingled) flows.

488 **Non-plastic component:** Materials and substances that are not bound or incorporated to the polymer  
 489 matrix, but are part of the products where plastic is present (e.g. metals, paper, glass, natural textiles, earth,  
 490 sand, ash, dust, wax, bitumen, ceramics, rubber, organic matter and wood).

491 **Non-targeted plastic:** A polymer present in plastic waste, but the presence of which is detrimental to the  
 492 direct use of the plastic waste in the production of plastic substances or objects by re-melting in plastic  
 493 manufacturing facilities. Examples of non-targeted plastics in the manufacturing of PE recyclates are PET and  
 494 PVC. A separation is normally possible for most polymers with physical methods due to the different  
 495 properties.

496 **Output plastic:**

497       - plastic obtained in the form of a polymer from a mechanical or physical plastic waste recycling  
 498       plant.

499       - plastic obtained in the form of a polymer after chemical recycling and repolymerisation.

500 **Physical recycling** (also called solvent-based separation): plastic waste is dissolved with solvents, but no  
 501 chemical degradation reaction takes place and the polymer chains remain undamaged. This approach allows  
 502 the removal of different contaminants such as e.g. flame retardants.

503 **Plastic:** (follows the SUP Directive (2019/904/EC) definition) means a material consisting of a polymer (as  
 504 defined in the REACH Regulation), to which additives or other substances may have been added, and which  
 505 can function as a main structural component of final products, with the exception of natural polymers that  
 506 have not been chemically modified.

507 **Plastic waste:** refers to waste, which the holder discards, intends to discard or is required to discard, and  
 508 consists mainly of plastic polymers with additives and fillers. Plastic waste for recycling can originate from  
 509 the following sectors: packaging, building and construction, automotive, electrical & electronic equipment,  
 510 households, and agriculture, farming and gardening. The plastic waste can be derived from separate collection  
 511 systems (e.g. separate collection of plastic packaging from households from households) but also from more  
 512 complex waste mixtures (e.g. mixed household waste) after a sorting step.

513 **Pre-consumer waste:** also known as post-industrial waste, or industrial scrap. Refers to waste generated  
 514 during conversion or manufacturing processes.

515 **Polymer:** (follows the REACH Regulation (1907/2006/EC) definition) means a substance consisting of  
 516 molecules characterised by the sequence of one or more types of monomer units. Such molecules must be  
 517 distributed over a range of molecular weights wherein differences in the molecular weight are primarily  
 518 attributable to differences in the number of monomer units.

519 **Post-consumer waste:** waste products generated by a business or consumer that have served their  
 520 intended end use, not involving the production of another product.

521 **Primary raw material (virgin material):** material which has never been processed into any form of end  
 522 use product.

523 **Producer:** means the holder who transfers plastic waste to another holder for the first time as former plastic  
 524 waste that has ceased to be waste. Waste holder means the waste producer or the natural or legal person  
 525 who is in possession of the waste.

526 **Qualified staff:** means the staff which is qualified by experience or training to monitor and assess the  
527 properties of output plastic.

528 **Restricted materials:** any material in plastic waste which represents a risk for health, safety and  
529 environment, such as e.g. healthcare waste, used products of personal hygiene, hazardous waste and POP  
530 waste.

531 **Recovery** (follows the WFD (2008/98/EC) definition): any operation generating waste serving a useful  
532 purpose by replacing other materials which would have been otherwise used to fulfil a particular function, or  
533 waste being prepared to fulfil that function, in the plant or in the wider economy. Annex II of the Directive sets  
534 out a non-exhaustive list of recovery operations.

535 **Recycled plastic:** a broad term, generally applied to any sort of plastic product containing to some degree  
536 polymers originating from plastic waste, and not only virgin polymer. Plastic can currently be labelled recycled  
537 if even only a small percentage of it is made from plastic waste. The term does not currently imply or  
538 guarantee that it is manufactured with any additional environmental consideration. Case-by case labelling will  
539 indicate the type and percentage of recycled plastic content.

540 **Recycling** (follows the WFD (2008/98/EC) definition): any recovery operation by which waste materials are  
541 reprocessed into products, materials or substances whether for the original or other purposes. It includes the  
542 reprocessing of the material but does not include energy recovery and the reprocessing into materials that  
543 are to be used as fuels or for backfilling operations.

544 **Recycling Rate:** percentage of plastic waste which is reused for making new plastic, compared to the total  
545 plastic consumption.

546 **Repolymerisation:** is the process of converting a monomer recovered from plastic waste back into a  
547 polymer.

548 **Separate collection:** (follows the WFD (2008/98/EC) definition): collection where a waste stream is kept  
549 separated by type and nature so as to facilitate a specific treatment.

550 **Targeted plastic:** a polymer or resin present in plastic waste, which is collected and treated for recycling, i.e.  
551 the direct use of the plastic waste in the production of plastic substances or objects by re-melting in plastic  
552 manufacturing facilities.

553 **Thermoplastic polymer:** a polymer that becomes pliable or mouldable at a certain elevated temperature  
554 and hardens when cooled. Thermoplastics are therefore recyclable and include PET, PE, PP and PS.

555 **Treatment** (follows the WFD (2008/98/EC) definition): recovery or disposal operations, including preparation  
556 prior to recovery or disposal.

557 **Used products of personal hygiene:** hygiene products such as for example toothbrush, razors, and  
558 absorbent products (e.g. diapers) that have been discarded.

559 **Virgin plastic:** a new polymer, directly produced from the petrochemical feedstock (e.g. natural gas or crude  
560 oil) which has never been used or processed before. This type of plastic is produced in order to create brand  
561 new plastic products for the very first time.

562 **Visual inspection:** means inspection of consignments using either one or several human senses such as  
563 vision, touch and smell and any non-specialised equipment. Visual inspection shall be carried out in such a  
564 way that all representative parts of a consignment are covered. This may often best be achieved in the  
565 delivery area during loading or unloading and before packing. It may involve manual manipulations such as  
566 the opening of containers, other sensorial controls (feel, smell) or the use of appropriate portable sensors.

567

## GETTING IN TOUCH WITH THE EU

### In person

All over the European Union there are hundreds of Europe Direct centres. You can find the address of the centre nearest you online ([european-union.europa.eu/contact-eu/meet-us\\_en](http://european-union.europa.eu/contact-eu/meet-us_en)).

### On the phone or in writing

Europe Direct is a service that answers your questions about the European Union. You can contact this service:

- by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),
- at the following standard number: +32 22999696,
- via the following form: [european-union.europa.eu/contact-eu/write-us\\_en](http://european-union.europa.eu/contact-eu/write-us_en).

## FINDING INFORMATION ABOUT THE EU

### Online

Information about the European Union in all the official languages of the EU is available on the Europa website ([european-union.europa.eu](http://european-union.europa.eu)).

### EU publications

You can view or order EU publications at [op.europa.eu/en/publications](http://op.europa.eu/en/publications). Multiple copies of free publications can be obtained by contacting Europe Direct or your local documentation centre ([european-union.europa.eu/contact-eu/meet-us\\_en](http://european-union.europa.eu/contact-eu/meet-us_en)).

### EU law and related documents

For access to legal information from the EU, including all EU law since 1951 in all the official language versions, go to EUR-Lex ([eur-lex.europa.eu](http://eur-lex.europa.eu)).

### Open data from the EU

The portal [data.europa.eu](http://data.europa.eu) provides access to open datasets from the EU institutions, bodies and agencies. These can be downloaded and reused for free, for both commercial and non-commercial purposes. The portal also provides access to a wealth of datasets from European countries.

## The European Commission's science and knowledge service

Joint Research Centre

### JRC Mission

As the science and knowledge service of the European Commission, the Joint Research Centre's mission is to support EU policies with independent evidence throughout the whole policy cycle.



**EU Science Hub**  
[joint-research-centre.ec.europa.eu](https://joint-research-centre.ec.europa.eu)



@EU\_ScienceHub



EU Science Hub - Joint Research Centre



EU Science, Research and Innovation



EU Science Hub



EU Science



Publications Office  
of the European Union