Elaborated position on End-of-Waste criteria for chemical recycling

Executive summary

Chemical recycling technologies are essential complementary pathways to mechanical and solvent-based recycling in achieving the EU's circular economy objectives for plastics. While the Commission has already developed a draft Implementing Act establishing harmonised End-of-Waste (EoW) criteria for mechanical and solvent-based recycling, an equivalent dedicated framework for chemical recycling is still missing. To fully enable contribution of chemical recycling, the EU should urgently develop a dedicated and harmonised End-of-Waste framework that reflects the specific characteristics of chemical recycling technologies, value chains and outputs.

Cefic therefore calls on the Commission to act without delay to:

1. Base End-of-Waste criteria for chemical recycling on the conditions of Article 6(1) of the Waste Framework Directive, ensuring a consistent and technology-neutral application across all chemical recycling routes.
2. Ensure that, once waste ceases to be waste, the resulting materials are subject to applicable product and chemicals legislation, which inherently provide robust quality assurance and traceability systems, thereby maintaining a high level of protection for human health and the environment without the need for additional control mechanism.
3. Recognise that End-of-Waste may be achieved at different stages of the chemical recycling route, where specification-controlled secondary raw material intermediates meeting Article 6(1) conditions are produced.
4. Adopt an output- and intended use approach grounded in Article 6(1) of the Waste Framework Directive.
5. Establish harmonised EU-wide End-of-Waste criteria for chemical recycling technologies to ensure the functioning of the internal market and provide regulatory certainty for investment.

European Chemical Industry Council - Cefic aisbl
Rue Belliard 40 b.15 B-1040 Brussels Belgium
Tel. +32.2.436.93.00 mail@cefic.be **www.cefic.org**
EU Transparency Register n° 64879142323-90

Such an approach would provide legal certainty, support investment, strengthen the EU internal market for recycled chemical feedstocks and safeguard environmental and human health protection. Cefic remains committed to supporting the Commission in developing a robust, future-proof regulatory framework that enables all recycling technologies to contribute to the EU's circular economy and climate objectives.

Introduction

Chemical recycling requires dedicated, harmonised EU-wide End-of-Waste (EoW) criteria that reflect its specific technologies, value chains and outputs

The Commission's recent draft Implementing Regulation establishing EU-wide End-of-Waste criteria for plastics from mechanical and solvent-based recycling represents a welcome and important step towards harmonisation. However, its scope is explicitly limited to those recycling routes.

Why chemical recycling requires a dedicated End-of-Waste approach?

While mechanical, solvent-based and chemical recycling are complementary, they differ fundamentally in terms of technologies, value chains, and outputs. Any End-of-Waste criteria for chemical recycling should duly take these differences into account and be carefully designed. Further details are provided in Appendix 1.

Chemical recycling therefore requires dedicated, EU-wide End-of-Waste criteria that reflect its specific technologies, value chains and outputs. A separate End-of-Waste framework is essential to ensure legal clarity, regulatory coherence and simplification, as well as effective implementation across the Union, while avoiding regulatory barriers that could undermine its contribution to the EU's circular economy objectives

Cefic recommends that the Commission consider the following key elements in the development of End-of-Waste criteria for chemical recycling:

1. Anchoring End-of-Waste criteria for chemical recycling in the Waste Framework Directive

Article 6(1) of the Waste Framework Directive provides a robust and technology-neutral basis for End-of-Waste determinations. It establishes four cumulative conditions:

- The substance or object is to be used for specific purposes,
- A market or demand exists,
- It fulfils applicable technical and legal requirements, and
- Its use does not lead to overall adverse environmental or human health impacts.

These conditions are applicable to outputs of chemical recycling routes. It is therefore essential to operationalise Article 6(1) of the Waste Framework Directive in a manner that ensures its effective and harmonised application, as further explained in the following sections.

2. Alignment with product and chemicals legislations (Application of Article 6(1)(d) of Waste Framework Directive)

The draft Commission Implementing Regulation[1] on End-of-Waste criteria for mechanical and solvent-based recycling explicitly requires, in Annex I, Section 2.3(a), that the output plastic must not be classified as hazardous under CLP in order to obtain End-of-Waste status.

I. Hazard classification and the inappropriateness of a blanket non-hazardous requirement

Such a blanket requirement is not appropriate for chemical recycling and should not be introduced in any future framework for these technologies. Many virgin chemical substances, monomers and intermediates are legitimately classified as hazardous while being safely manufactured, placed on the market and used within the EU under existing regulatory frameworks.

Hazard classification under REACH and CLP does not imply that a substance or mixture is unsafe or unsuitable for use. On the contrary, where a substance or mixture is classified as hazardous under the CLP regulation, REACH requires that it be accompanied by a safety data sheet (SDS), setting out clearly defined conditions for safe handling, storage, transport, use and risk management. These obligations ensure that potential risks to human health and the environment are identified, communicated and effectively controlled throughout the value chain.

II. Ensuring compliance through existing regulatory frameworks and quality assurance

Compliance with applicable chemicals legislation, in particular the REACH Regulation, provides a robust and comprehensive framework to ensure that chemical recycling outputs meet the conditions set out in Article 6(1)(a–d) of the Waste Framework Directive. REACH ensures that substances are adequately characterized, their hazards and risks are assessed, and appropriate risk management measures are implemented across the value chain.

In this context, the Guidance on waste and recovered substances issued by the European Chemicals Agency (May 2010, version 2) clarifies that recovered substances may be considered equivalent to already registered substances where “sameness” is demonstrated, including with regard to their impurity profile. This ensures that any differences arising from the recycling process are assessed and do not adversely affect the substance’s hazard profile or safe use.

On this basis, compliance with REACH — together with applicable permitting conditions under Industrial Emissions Directive (2010/75/EU, amended by 2024/1785) — should be considered sufficient to demonstrate that chemical recycling outputs do not lead to overall adverse environmental or human health impacts, are fit for specific purposes, and meet applicable technical and legal requirements. It should therefore enable these materials to cease to be waste, and to be placed on the market as secondary raw materials or products, without the need for additional or duplicative End-of-Waste criteria.

[1] COMMISSION IMPLEMENTING REGULATION (EU), laying down rules for the application of Directive 2008/98/EC of the European Parliament and of the Council as regards criteria to determine when plastic waste ceases to be waste, Brussels (2025).

To support credibility and enforceability, operators should implement robust yet proportionate quality assurance systems, covering input control, process monitoring, output verification and the management of non-conformities, supported by appropriate record-keeping and auditability.

3. The point of End-of-Waste: recognising secondary raw materials from chemical recycling

For chemical recycling, End-of-Waste must, at the latest, be achievable at the output of the chemical recycling unit (see the star marker in Figure 1), once plastic waste has been converted into specification-controlled secondary raw materials that fulfil the criteria set out in Article 6(1) of the Waste Framework Directive. The same conditions apply to outputs generated at different stages of the chemical recycling route, including at the preconditioning stage (e.g. agglomerates or pellets) and at the output of the chemical recycling unit (e.g. oils, waxes, gases, oligomers or monomers) (see the red circles in Figure 1).

In line with Article 3(17) of the Waste Framework Directive, which recognises that recycling can result in products, materials or substances, such specification-controlled secondary raw materials can constitute the point at which waste ceases to be waste in a chemical recycling route, provided that the conditions set out in Article 6(1) are fulfilled. These materials are placed on the market to be used for specific purposes, have market demands and comply with applicable product and chemicals legislation including the REACH regulation under which they are recognized as a substance or mixture.

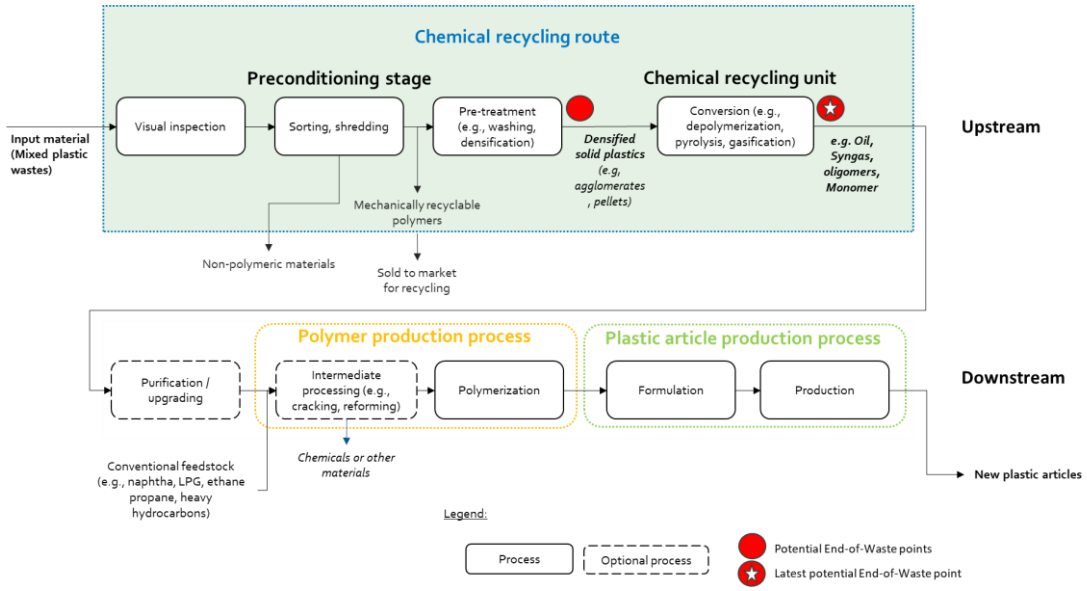

Figure 1: schematic illustration of chemical recycling supply chain converting mixed waste plastics to new plastic articles

In line with Article 6(1) of the Waste Framework Directive and the Commission's guidance on recovery operations[2], End-of-Waste should be achievable at the earliest appropriate point in the value chain where materials no longer present waste-specific risks and are placed on the market as specification-controlled secondary raw materials to be used in other processes[3]. This principle is further reinforced by guidance

[2] Guidance on the interpretation of key provisions of Directive 2008/98/EC on waste.

[3] Section 1.3.5 under the Guidance on the interpretation of key provisions of Directive 2008/98/EC on waste.

from the European Chemicals Agency[4], which clarifies that materials resulting from recovery operations, once they are ready for use as substances, mixtures or articles, should be considered as products for a manufacturing process rather than as waste. Furthermore, pursuant to Article 2(2) of the REACH Regulation (EC) No 1907/2006, waste is excluded from the scope of REACH, implying that materials placed on the market as REACH-compliant substances or mixtures should not be regarded as waste.

Chemical recycling plants operating at today's scale often rely on multiple feedstock sources from different countries before being combined in a common conversion process. This requires harmonised EU-wide End-of-Waste criteria to enable effective shipment of plastic feedstocks, investment planning, plant design and permitting procedures.

Some practical examples illustrating potential points for End-of-Waste in chemical recycling are presented in Appendix 2."

4. Designing input and output and intended use criteria for chemical recycling

Chemical recycling technologies exhibit varying tolerance to contaminants and rely on different chemical conversion mechanisms. They are designed around their input, output and intended uses. For example, a depolymerisation process may require relatively homogeneous input streams of target polymer, whereas a pyrolysis process or gasification process may accept broader mixed fractions provided that downstream upgrading / cleaning and output specifications are met.

This technological diversity means that EU-wide harmonised End-of-Waste criteria should not impose fixed, polymer-specific purity thresholds as a general rule.

I. Input material criteria: tailored to technology and risk

Management of input materials typically relies on documented and auditable acceptance procedures, such as application-specific input specifications relevant to the respective chemical recycling technology and intended output quality.

Chemical recycling processes are designed to ensure that substances present in waste stream, including hazardous constituents and contaminants, are appropriately managed, so as to prevent adverse impacts on human health and the environment. Where necessary, such substances are removed or concentrated into controlled side streams (e.g. residues, ashes, or process water) that remain subject to applicable waste management requirements, while outputs placed on the market remain compliant with applicable legislation.

In this context, End-of-Waste criteria for chemical recycling should primarily focus on the compliance and specification-controlled nature of outputs, rather than prescribing overly restrictive definitions of input streams. This is particularly important as chemical recycling technologies complement mechanical and solvent-based recycling by enabling the treatment of more heterogeneous, complex or low-quality waste streams that may otherwise be difficult to recycle. Feedstock acceptance criteria should therefore remain

[4] Guidance on waste and recovered substances, ECHA, version 2, May 2010

linked to the operational and technical requirements of individual recycling processes and installations, which may vary across technologies, provided that the resulting outputs comply with applicable environmental, product and chemicals legislation.

II. Output quality and intended use as the main basis for End-of-Waste determination

For chemical recycling, outputs are typically specification-controlled secondary raw materials intended for further industrial processing. This is the most meaningful and enforceable control point for End-of-Waste purposes. The quality requirements of these materials will vary depending on the recycling route and is inherently defined by their intended application and corresponding market requirements, as reflected in downstream industrial specifications and acceptance criteria. In this context, compliance with the REACH Regulation (EC) No 1907/2006 confirms that such materials are placed on the market as substances or mixtures and therefore should not be regarded as waste.

5. Legal fragmentation undermines the internal market and investment

In the absence of harmonised EU-wide End-of-Waste criteria for chemical recycling, determinations are currently made at Member State — and sometimes regional — level. This has led to divergent interpretations regarding whether chemical recycling outputs are considered waste or products, at which stage End-of-Waste may be achieved, and how installations across the value chain should be permitted and regulated.

These regulatory divergences create legal uncertainty and avoidable risks for project developers and investors, delaying or deterring investment in chemical recycling capacity in the EU without delivering additional environmental or health protection.

Cefic therefore calls for the urgent establishment of harmonised EU-wide End-of-Waste criteria for chemical recycling, based on Article 6(1) of the Waste Framework Directive. Pending such harmonisation, a robust mutual recognition mechanism should be put in place to ensure that End-of-Waste status granted by one Member State is recognised across the Union.

I. Regulatory uncertainty, permitting regimes and investment impacts

Regulatory fragmentation is reflected in differing permitting approaches across Member States. Some chemical recycling facilities operate as stand-alone waste treatment plants, while others are integrated into petrochemical or refinery installations and operate under manufacturing permits. In certain cases, chemical recycling facilities operate under both waste treatment and production permits.

In integrated installations, plastic feedstocks are often expected to have product status upon entry, which in practice requires that End-of-Waste has been achieved upstream. However, such expectations vary across Member States and depend on case-specific regulatory interpretations.

This legal uncertainty at the waste–product interface also affects investment decisions and operational planning. Where the regulatory status of chemical recycling outputs is unclear, operators may face inconsistent permitting requirements or risk that downstream chemical installations are treated as waste treatment facilities. In some cases, conflicting national interpretations may even call into question previously recognised End-of-Waste status, particularly in the absence of effective mutual recognition across Member States.

As a result, regulatory fragmentation may slow the scale-up of chemical recycling capacities and feedstock supply chains in the EU, thereby constraining the availability of circular raw materials needed to meet the Union's circularity objectives, including recycled content targets under Union legislations.

II. Cross-border trade and waste shipment risks

In the absence of harmonised EU-wide criteria and consistent mutual recognition across jurisdictions, specification-controlled secondary raw materials are recognised as End-of-Waste in one Member State or region but still classified as waste in another applying divergent criteria. Consequently, when such materials are transported across borders, enforcement authorities may assess shipments differently under the Waste Shipment Regulation. Where authorities face legal or administrative uncertainty regarding the status of a consignment, shipments may be stopped for further assessment or verification.

In practice, this can lead to transport delays, supply uncertainty, operational disruptions, increased administrative burden and legal uncertainty for operators — even where the material is technically equivalent, fully specification-controlled and destined for compliant manufacturing use. While ongoing initiatives aim to facilitate the shipment of certain waste streams within the EU, divergence interpretation and application of End-of-Waste criteria across Member States continue to create significant uncertainty for cross-border value chains.

Appendix 1

Main technological and value chain differences between chemical, mechanical recycling and solvent-based recycling processes

I. Structural differences in value chains

Chemical recycling involves the controlled transformation of the chemical structure of polymers, converting plastic waste into specification-controlled secondary raw material intermediates such as oils, waxes, gases, oligomers and monomers. Depending on the configuration of the installation, the overall recycling operation generally also includes a preconditioning stage, in which plastic waste is prepared (e.g. through sorting, size reduction or densification) to ensure process stability and feedstock consistency (see Figure 1). This may result in materials such as agglomerates or pellets, which themselves typically constitute specification-controlled mixtures of substances that could be safely handled, transported and stored.

The resulting secondary raw materials are typically substances, mixtures or, where relevant, chemical intermediates with risk and hazard profiles comparable to conventional raw materials.They are subject to compliance with the REACH Regulation and typically re-enter industrial chemical value chains where they are further processed in refineries, steam crackers or polymerisation units before final products are manufactured and placed on the consumer market. These operations are carried out under strictly regulated conditions, including under the Industrial Emissions Directive (2010/75/EU, as amended by 2024/1785).

In line with Article 3(17) of the Waste Framework Directive, which recognises that recycling can result in products, materials or substances, such specification-controlled secondary raw materials can constitute the point at which waste ceases to be waste in chemical recycling route provided that the conditions set out in Article 6(1) are fulfilled.

Mechanical recycling is a process in which plastic waste is processed without intentionally altering the chemical structure of the polymers—typically through sorting, cleaning, shredding, and remelting—to produce recycled plastic materials. The polymer's chemical structure remains largely unchanged and the additives present (such as antioxidants, fillers, flame retardants and pigments) are largely retained. While non-target substances and contaminants may be reduced during processing, they are not always fully removed, depending on the quality of the input stream and the efficiency of the process. The resulting materials can typically be directly reprocessed through remelting and be placed directly on the market.

In solvent-based recycling processes, plastic waste is treated without significantly altering the chemical structure of the polymers. These processes generally require relatively well-defined and sorted feedstock streams, often involving pre-treatment steps such as sorting, cleaning and size reduction to ensure efficient separation and purification. During the process, selected polymers are dissolved in a solvent, enabling the removal of additives, contaminants, pigments or other unwanted substances, while preserving the polymer structure. The purified polymer is subsequently recovered from the solvent and further processed, for example through drying and extrusion, into materials suitable for the manufacture of new plastic products.

II. Role in treating complex waste streams

Chemical recycling technologies are specifically designed to address plastic waste streams that are difficult or impossible to recycle mechanically into secondary raw materials for production of higher quality and technical performance requirements, such as packaging for contact sensitive applications. These waste streams include mixed plastic fractions, degraded polymers, thermoset materials, residues of mechanical recycling operations and composite or certain multilayer structures. In such cases, chemical recycling provides a route to maintain materials within the circular economy by recovering material value that would otherwise be lost to incineration or landfill.

For example, mixed polyolefin waste containing fillers, additives or residues may be challenging to meet mechanical recycling and solvent-based recycling quality requirements yet can be converted into secondary raw materials such as hydrocarbon feedstocks that meet defined specifications after appropriate processing. Similarly, certain multilayer packaging structures may be unsuitable for mechanical and solvent based recycling but can be chemically converted into secondary raw materials.

Appendix 2

Practical examples Illustrating End-of-Waste at intermediate stages

The following practical examples illustrate potential points for End-of-Waste as marked in Figure 1:

- Example 1: Output of the pre-conditioning stage as End-of-Waste materials

One example concerns prepared plastic feedstocks used as inputs to chemical recycling (pre-conditioning stage). Mixed plastic waste may be sorted and converted into specification-controlled agglomerates, pellets or similar densified formats that are supplied under contract to a chemical recycling facility. This principle applies equally to specification-controlled material fractions sorted from end-of-life products, such as polymer components from automotive, appliance, electronics or construction applications, where defined quality parameters, contractual supply relationships and intended recycling use are established. At this stage, the material has a clear and lawful use, a market exists, and the technical requirements defined by the receiving recycling facility are met. Compliance with applicable chemicals and environmental legislation is ensured, for example through compliance with the Industrial Emissions Directive (2010/75/EU, amended by 2024/1785) and associated BREF BATCs as well as compliance with relevant chemical legislation such as REACH[5], under which risks to human health and the environment are identified, assessed, and adequately controlled for the intended uses[6].

- Example 2: Output of the chemical recycling unit as End-of-Waste materials

A second example concerns the output of a chemical recycling unit (see Figure 1). For instance, a pyrolysis installation converts mixed plastic waste into a hydrocarbon oil (pyrolysis oil) that meets defined technical specifications and is sold under contract as secondary raw material to the next operator downstream (purification/upgrading facility or other intermediate processing). At this stage, the output likewise has a clear and lawful use, a market exists, and technical requirements are met. Compliance with chemicals and environmental legislation is ensured, for example through registration of hydrocarbon oil under applicable product legislation such as REACH, where risks to human health and the environment are identified, assessed, and adequately controlled for the intended uses[7]. The same reasoning applies to outputs from other chemical recycling technologies, such as depolymerization or gasification. For example, depolymerisation of polyesters via methanolysis results in monomers (ethylene glycol and dimethyl terephthalate) which are identical in composition of virgin monomers, hence substance sameness applies under REACH. Therefore, de facto these are products and End-of-Waste point has been reached.

- Example 3: Multiple output fractions with different characteristics and end-uses

Certain chemical recycling processes yield multiple material fractions with different characteristics and intended uses. For instance, chemolysis processes may produce: (i) recovered monomers, diamines, polyols or oligomers meeting specifications for repolymerization or synthesis; (ii) separated polymer components suitable for further purification; and (iii) residual fractions (fillers, additives, degraded

[5] Some Member States allow registration of Densified plastics such as agglomerates under REACH as “mixtures”

[6] Following the End-of-Waste criteria under Article 6(1) of the Waste Framework Directive

[7] Following the End-of-Waste criteria under Article 6(1) of the Waste Framework Directive

materials) for energy recovery or alternative recycling. End-of-Waste criteria should allow differentiated classification of such output streams based on their respective characteristics and intended uses, avoiding any requirement to classify all output fractions uniformly. Materials meeting quality specifications and destined for defined industrial applications may achieve End-of-Waste status when Article 6(1) conditions are fulfilled for each specific fraction."

In above examples, continuing to classify such materials as waste provides no additional environmental or health protection, while significantly complicating permitting procedures, cross-border transportation and the integration of chemical recycling into established value chains.

For more information please contact:
Masoud Zabeti
Senior Innovation Manager
mza@cefic.be

About Cefic

Cefic, the European Chemical Industry Council, is the forum of large, medium and small chemical companies across Europe, accounting for 1.2 million jobs and 13% of world chemicals production.
On behalf of its members, Cefic's experts share industry insights and trends, and offer views and input to the EU agenda. Cefic also provides members with services, like guidance and trainings on regulatory and technical matters, while also contributing to the advancement of scientific knowledge.