STUDY TO ASSESS MEMBER STATES (MS) PRACTICES ON BY-PRODUCT (BP) AND END-OF WASTE (EoW)

Reference: N° 070201/2018/793241/ENV.B.3

Final Report, 2020

prepared by
Umweltbundesamt GmbH (EAA) and
ARCADIS Belgium NV

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1. Table of Contents

2. Abbreviations

BAT	Best Available Technology
BP	By-product(s)
CDW	Construction and demolition waste(s)
CPR	Construction Products Regulation (Regulation (EU) No 305/2011)
CJEU	Court of Justice of the European Union
EC	European Commission
EoW	End-of-waste(s)
EU	European Union
FPR	Fertilising Products Regulation (2019/1009/EC)
FS	Factsheet(s)
JRC	Joint Research Centre
MS	Member State(s)
NI	Northern Ireland
revised WFD	revised Waste Framework Directive (2008/98/EC, as amended by Directive (EU) 2018/851)
SVHCs	Substances of Very High Concern (see REACH Regulation)
TRIS	Technical Regulation Information System
WFD	Waste Framework Directive (2008/98/EC)

Country Initials

AT	Austria
BG	Bulgaria
BE	Belgium (covering Brussels region, Flemish region, Wallonia region)
CZ	Czech Republic
CY	Cyprus
DE	Germany
DK	Denmark
EE	Estonia
EL	Greece
ES	Spain
FI	Finland
FR	France
HR	Croatia
HU	Hungary
IE	Ireland
IT	Italy
LV	Latvia
LT	Lithuania
LU	Luxembourg
MT	Malta
NL	The Netherlands
PL	Poland
PT	Portugal
RO	Romania
SE	Sweden
SI	Slovenia
SK	Slovak Republic
UK	United Kingdom (covering England, Northern Ireland, Scotland, Wales)

3. Introduction

3.1 Background of the study

Aiming at redirecting waste and by-products (BP) from production processes back to industrial uses, the Waste Framework Directive (2008/98/EC, WFD)[1] has introduced for the first time the concept of end-of-waste (EoW) and has established rules to distinguish between wastes and BP.

Provided that certain specific conditions are met, facilitating and harmonising the recognition of BP and EoW status of substances and objects makes an important contribution to the concept of circular economies across Europe. For instance, it allows waste or BP of one industry to become inputs for another, thus promoting resource efficiency and industrial symbiosis. This is reflected in the Circular Economy Action Plan adopted by the European Commission in December 2015.

End-of-waste (EoW) criteria specify when certain waste ceases to be waste and obtains a status of a product respectively a secondary raw material. According to Article 6 of the WFD, certain specified waste may cease to be waste when it has undergone a recovery operation, including recycling, and complies with specific criteria to be developed in line with the following conditions:

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

Aiming at a harmonised implementation of the EoW concept across the EU, a methodology for developing specific criteria for individual waste streams has been designed by the Joint Research Centre[2] in 2010. In addition, a series of fact-finding studies for waste streams selected as suitable candidates for setting up EoW criteria[3] were conducted. In the framework of all these studies relevant standards and legislation, typical waste generation processes, quality standards, quantities, uses/applications and recovery processes of materials as well as markets for the secondary materials were investigated. Subsequently, the EU adopted Union-wide EoW criteria for certain waste streams: iron, steel, aluminium and copper scrap and glass cullet.

Where no Union-wide EoW criteria have been adopted, Member States (MS) may decide at national level whether certain waste has ceased to be waste, either by binding national criteria, which have to be notified to the European Commission - and will then be published under the EU's Technical Regulation Information System (TRIS)[4] - or by single case decisions. Ad-hoc decisions do not need to be notified to the European Commission.

[1] Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives
[2] http://ftp.jrc.es/EURdoc/JRC53238.pdf
[3] http://ftp.jrc.es/EURdoc/JRC58206.pdf
[4] https://ec.europa.eu/growth/tools-databases/tris/en/

Examples of legally binding national legislation are the criteria for waste wood, compost, secondary aggregates and refuse-derived fuels specified in the several by-laws made under the Austrian Waste Management Law[5] or criteria for compost produced from biodegradable waste, digestate resulting from biofuel production, sewage sludge resulting from sewage treatment established in Estonia[6].

Currently, approaches to recognise end-of waste status differ within MS. This is in particular the case in single-case decision-making. In some MS a designated institution such as the Environment Ministry or the Environment Agency is responsible for deciding whether EoW status is applicable or not. In other countries, as in Italy or Sweden, local or regional authorities take such decisions, or alternatively, the responsibility is with the industry to self-declare EoW, with random ex-post inspections carried out by the enforcement authorities.

Regarding **by-products (BP)**, there are no binding Union-wide criteria and MS are not required to provide information on any national criteria or on single-case decisions to the European Commission. Guidance on how to decide about waste or BP has been provided in the "Communication on the Interpretative Communication on waste and BP"[7] including a basic decision tree as shown below and some illustrative examples of specific material streams.

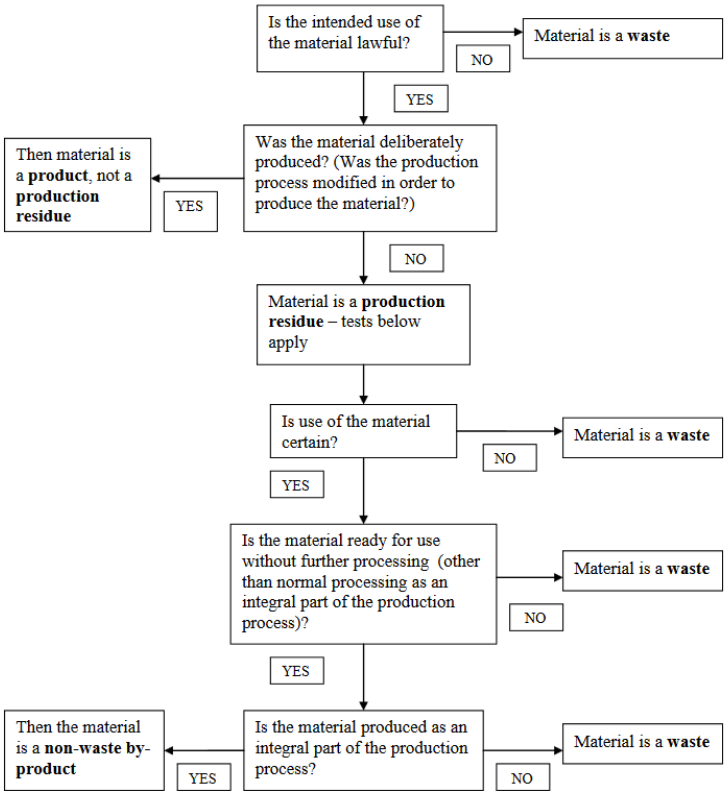


Figure 1 Decision tree on BP

[5] As summarised in the National Waste Management Plan, 2017. (https://www.bmnt.gv.at/umwelt/abfall-ressourcen/bundes-abfallwirtschaftsplan/BAWP2017-Final.html)
[6] https://www.riigiteataja.ee/dynaamilised_lingid.html?dyn=104072017043&id=110042013001; 104112015005;119052016009;128072017004
[7] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52007DC0059&from=EN

According to Article 5 of the WFD, a substance or object resulting from a production process whose primary aim is not the production of that substance or object is considered not to be waste, but to be a BP if the following conditions are met:

- further use of the substance or object is certain;
- the substance or object can be used directly without any further processing other than normal industrial practice;
- the substance or object is produced as an integral part of a production process; and
- further use is lawful, i.e. the substance or object fulfils all relevant product, environmental and health protection requirements for the specific use and will not lead to overall adverse environmental or human health impacts.

However, approaches with respect to deciding about BP status also differ across MS. There are more restrictive approaches which adhere more strictly to the precautionary principle and other more liberal approaches.

As stipulated in the revised WFD (Directive 2008/98/EC, and amended by Directive (EU) 2018/851), the European Commission may in terms of further harmonisation adopt implementing acts in order to establish detailed criteria on the uniform application of the conditions to specific substances or objects. 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. When adopting those implementing acts, the European Commission shall take as a starting point the most stringent and environmentally protective of any criteria adopted by MS and shall prioritise replicable practices of industrial symbiosis in their development.

The differences in **national approaches to EoW and BP status** may lead to real or assumed market distortions of the EU internal market for secondary raw materials, legal uncertainty for MS, recyclers and users of secondary raw materials as well as disputes over shipments of waste and non-waste. Furthermore, risks may arise for the environment and human health resulting from the application of inappropriate criteria and verification schemes (e.g. no pollutant limit values or limit values that are set too high, inappropriate waste analysis methods) for material streams which are not considered to be waste although they should be subject to environmental inspection under applicable waste legislation. Accordingly, materials with a BP or EoW status might escape from the level of environmental protection offered by waste legislation. However, these non-wastes are subject to all applicable product legislation, including REACH and CLP, which might set stricter and more complex requirements in terms of environmental and human health protection that the waste legislation does. For some recovered materials for which EoW criteria already have been established (such as compost) exemptions to registration under REACH already exist.

Furthermore, different approaches in MS to recognise EoW and BP status lead to waste statistics, which are hardly comparable for specific sectors.

Articles 5 and Article 6 of the revised WFD oblige the MS – in contrast to the former Directive where this was facultative – to take appropriate measures to ensure that EoW and BP status is assigned to substances and objects where the described conditions are met. With regard to the EoW status, the case-by-case decisions are given more emphasis in Article 6.Recital 17 of the revised WFD specifies in more detail that operators shall be provided with more certainty as to the waste or non- waste status of substances or objects in order to enable markets for secondary raw materials. In this term, greater transparency should be requested about Member State approaches to EoW status, in particular with regard to their case-by-case decisions and the result of verification by competent authorities, as well as to the specific concerns of MS and competent authorities about certain waste streams.

Union-wide criteria for the EoW status of particular waste streams, e.g. scraps and glass cullet, are of course a means to harmonise the different approaches in the MS. In the context of the Communication (COM(2018) 32 final) on the implementation of the circular economy package (options to address the interface between chemical, product and waste legislation)[8], following options have been identified in order to improve certainty in the implementation of EoW provisions:

- Take measures at EU-level to bring about more harmonisation in the interpretation and implementation by MS of EoW provisions laid down in the WFD. This may include:
    - *Radically stepping up work on the development of EU EoW criteria;*
    - *Removing the registration exemption for recovered substances provided in REACH thus requiring that all recovered substances should be registered under REACH and thereby achieving EoW status;*
    - *Where other specific product legislation provides different instruments laying down conditions that ensure the safe placing on the market of a substance or mixture, recognise these conditions as effective EoW criteria (see the fertilising products regulation or FPR (2019/1009/EC)) and, where justified, introduce a specific exemption from REACH registration.*
- Take measures to ensure more consistency of practices at Member State level. This may include:
    - *EoW status can only be achieved following an ex-ante decision by a Member State competent authority;*
    - *A recovery operator can make the assessment of whether EoW status is achieved (in combination with an ex-post checking regime by competent authorities); or*
    - *A combination of these approaches, e.g. distinguishing on the basis of the nature of specific waste streams.*

However, the process of establishing such criteria at EU-level has turned out to be a resource-intense and time-consuming procedure and there is evidence that the uptake by industry is low in individual MS.

A study analysing the impacts of the EU Regulation establishing EoW criteria for iron and steel and aluminium scrap[9] on scrap availability, trade flows, prices, administrative requirements, environment and human health was performed in 2014. The study revealed that in Italy more than 1,000 scrap companies generate EoW compliant scrap, whereas in the remaining EU a total of 100 scrap companies are generating such scrap.

To increase transparency about national approaches to implement the rules for EoW and BP status several activities have been undertaken at EU-level.

To overcome several critical issues in the authorisation processes and the lack of uniformity in deciding about EoW and BP status, in particular in single-case decisions, the IMPEL project "Landfill and Circular Economy"[10] was launched in 2018. It aims at examining the application of rules for BP and EoW status as laid down in the existing Articles 5 and 6 of the WFD, both from a permitting and inspection point of view and with a focus on handling single-case decisions linking to eco-innovation, REACH and the waste shipment legislation. A clear permitting process and a solid verification and

[8] Communication COM(2018) 32 final, and the accompanying Commission Staff Working Document (SWD(2018) 20 final)
[9] Regulation (EU) 333/2011
[10] https://www.impel.eu/wp-content/uploads/2018/02/Landfill-Circular-Economy-2018.pdf

inspection system is to be created to check compliance with the rules of the WFD. The material streams considered are residues from production processes. The results of a survey on the application of rules for EoW among the competent authorities from about 10 MS reveal that for nearly all of the waste streams selected as appropriate for EoW status by JRC in 2010[11], national criteria have been established in at least one of the MS. They further show that in some MS (Belgium, Netherlands, Croatia or UK) data bases of waste streams with a EoW status have been established, which are either publically or unofficially (e.g. databases of the competent authority) available; in other countries no such databases have been established.

Most recently, the guidance paper "Making the circular economy work: Guidance for regulators on enabling innovations for the circular economy"[12] has been published under the umbrella of IMPEL's "Landfill & Circular Economy" project and the "Make It Work" initiative[13]. Focusing on bringing waste and BP from production processes back to industrial uses, the guidance aims to help regulators to:

- understand the opportunities and barriers in EU environmental law;
- identify how they can organise themselves more effectively;
- determine the support they need from policy- and law-makers;
- become more sensitive to the needs and concerns of innovative businesses.

3.2 Objectives of the study

The main purpose of this study is to provide the European Commission with key information on the national implementation of provisions related to EoW and BP in the EU in order to support the European Commission with more insight into national practices.

This should in particular contribute to the establishment of a level playing field between MS and regions, the creation of a well-functioning internal market for secondary raw materials supporting the establishment of a circular economy, the improvement of legal certainty for MS, recyclers and users of secondary raw materials and avoiding illegal shipments and disputes over shipments of waste and non-waste.

More precisely, the objectives of this study are:

- to increase transparency about MS approaches to the regulation and implementation of BP and EoW status by identifying the legal framework and implementation practices regarding the existing Articles 5 and 6 of Directive 2008/98/EC in particular with regard to case-by-case decisions;
- to identify "best" and "suboptimal" practices with respect to the implementation and enforcement of the existing EU BP and EoW regulations; and
- to make recommendations on how to design national legal regimes on BP and EoW status that provide the best outcome from a circular economy perspective while ensuring that relevant chemical and product legislation is observed and adverse environmental and human health impacts are avoided.

The information and data compiled in this study will provide the European Commission with a basic idea of the type of information that could be stored in the Union-wide electronic register on national BP and EoW criteria, in accordance with Article 38 (1) of the revised WFD.

[11] http://ftp.jrc.es/EURdoc/JRC58206.pdf
[12] https://ieep.eu/news/making-the-circular-economy-work-guidance-for-regulators-launched-in-rome
[13] https://www.impel.eu/impels-landfill-project-make-it-work-initiative-join-to-promote-ecoinnovation-and-circular-economy/

3.3 Scope and tasks of the study

The scope of the study is determined by:

- the mandate provided by the "Communication on the interface between chemical, product and waste legislation" (COM/2018/032 final)[14] to launch a study to gain a better understanding of MS' practices in regard to the implementation and verification of provisions on EoW status as a basis for possible guidelines;
- the implementation in MS of the existing Article 5 and 6 of Directive 2008/98/EC on waste in MS and the need for MS to transpose the amended provisions of these Articles into their national legislation by early July 2020; and
- the mandate under the new Article 38 (1) of the revised WFD to organise a regular exchange of information and sharing of best practices among MS in relation to national BP and EoW policies and decisions facilitated by a Union-wide electronic register to be established by the European Commission.

In a fact-finding exercise, carried out via a written communication and a stakeholder consultation by telephone, up-to date information has been gathered covering practices and experiences gained in the national implementation (legislation, permitting, inspection, reporting) of the two concepts of EoW and BP. In addition to consultations with representatives from the competent authorities and industry, results of already available surveys investigating current practices in handling EoW and BP has been analysed (including the extensive data collection performed by JRC in the context of establishing EoW criteria) in the past.

In task 1, national legislation and guidance for all sector and waste/material streams were analysed according to information received from respondents. With regard to single-case decisions, the overall approach adopted by the respective Member State was investigated (i.e. who is the responsible authority, how are verifications/inspections performed, are there any national registers or studies where these cases are compiled, is information on the quantities of the waste streams concerned available, etc.). However, the scope does not cover a detailed analysis to be performed on single-case decisions for the whole range of possible waste/material streams and sectors (limit values, proof of evidence, justification etc.).

In task 2, a detailed analysis of specific waste/material streams and procedures established in the MS was performed in task 2 by means of case studies for selected waste/material streams/procedures.

In task 3, all the results gained from task 1 and task 2 will enable to identify main recommendations to be taken into consideration for framing future national legal / enforcement regimes for EoW status and BP.

[14] https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A52018DC0032

4. Identification of the current legal framework and practices in the MS

Requirements stipulated in Article 5 (BP) and Article 6 (EoW status) of the WFD were transposed and implemented in different ways by the MS. Chapter 4 describes data gathered by key experts of the MS and results gained from a subsequent assessment in order to identify and present the various practices applied in MS.

4.1 Identifying key experts/contacts for each Member State

The individual MS key experts were identified making use of the list of representatives nominated for the European Commission Working Group on Waste. The list is annexed to the report (see Annex to Chapter 4.1: Expert list MS authorities). Industry and NGO representatives were involved in an additional consultation described in Chapter 5.

4.2 Questionnaire and interviews

The key questions for the written questionnaire to MS authorities were summarised highlighting the main areas related to national BP and EoW status approaches:

- Transposition of the provisions of Article 5 & 6 of the WFD;
- National guidance/criteria established on BP;
- National guidance/criteria established on EoW;
- Policies related to materials which cease to be waste according to the criteria defined at EU-level;
- Take-up of case-by-case decisions;
- National enforcement actions;
- Information on the market situation;
- Identified drivers/barriers.

The questions were numbered and listed in a logical way (see Annex to Chapter 4.2: Template written questionnaire to the MS' authorities).

Telephone interviews in line with the template for the written questionnaire in case of remaining questions were carried out.

4.3 Conducting a written questionnaire survey and phone interviews

The consultation was initially scheduled to run until 21 March 2019. Due to the low response rate during the first three weeks, the deadline for submitting the questionnaire had to be extended specifically for several MS until the end of May. Finally, three MS did not return the filled-in questionnaire (DE, LV and MT).

4.4 Fact sheet documentation

Results gained from the questionnaire were summed up and documented in the MS country fact sheets thus contributing to comparable and structured information for those European MS which participated in the consultation process. The fact sheets are following the template format of the questionnaire. They cover data gained throughout desk-research and summarise the situation in the MS including information on references used. The final version of the fact sheet for 25 MS (not covering DE, LV and MT) is annexed to this report (see Annex to Chapter 4.4: MS factsheets). The drafted fact sheets have been sent for final approval to the MS experts. Out of 25 drafted fact sheets, only the Danish and the Polish fact sheets were not confirmed.

4.5 Analysing national approaches and state of play

Comprehensive information available at MS level enables a comparison of the uptake of BP/ EoW concepts between MS and an analysis of the situation for different material streams. For this analysis, information from the following data sources was used:

- MS fact sheets and feedback from the MS Consultation:
    - Transposition of the provisions of Article 5 (BP) and Article 6 (EoW status) of the WFD into national legislation (section A in the fact sheets)
        - the current situation regarding transposition
        - transposition of the amendments made by Directive (EU) 2018/851
    - National legislation establishing detailed criteria for BP or EoW for certain substances or objects / certain types of wastes (section C in the fact sheets)
        - general information on the relevant national provisions
        - key elements of the national provisions related to EoW
        - key elements of the national provisions related to BP status
        - consideration of the pre-cautionary principle for the specific national legislation
        - data on the operators
    - Policies related to materials which cease to be waste according to the criteria defined at the EU-level (particular types of scrap and glass cullet) (section C in the fact sheets)
    - Decisions regarding EoW and BP status made on a case-by-case basis (fact sheet section D)
    - Enforcement actions (fact sheet section E)
    - Drivers and barriers (in the fact sheet section F)
    - Market situation of materials already regulated under EoW or BP (in the fact sheet section G)
- Results from a project under the "Make It Work" initiative: Making the circular economy work: guidance for regulators on enabling innovations for the circular economy (prevention and recycling of waste)
- Technical Regulation Information System (TRIS)

4.5.1 Transposition of the provisions of Article 5 and Article 6 of the WFD

Table 1 provides an overview of the national legislation where Article 5 and Article 6 of the WFD have been transposed.

Table 1: Transposition of Article 5 and Article 6 of the WFD (analysed for 25 out of 28 MS)

No.	*Member State*	Article 5 word-by-word (full meaning)	Article 5 with identified explanations	Article 6 word-by-word (full meaning)	Article 6 with identified explanations	*Main legal document, transposing Article 5 and Article 6 of the European Commission Waste Framework Directive (possibly amended)*	English translation available? (Y-Yes / N-No)[1]
1	AT – Austria	X		X		Waste Management Act 2002	(Y)
2_1	BE – Walloon region	X[2]		X[2]		Decree on Waste 1996	N
2_2	BE – Flanders region	X[2]		X[2]		Materials Decree 2011	Y
2_3	BE – Brussels region	X[2]		X[2]		Ordinance on Waste 2012	N
3	BG – Bulgaria	X[2]		X[2]		Waste Management Act 2012	Y
4	CY – Cyprus	X		X		Law on Waste 2011	N
5	CZ – Czech Republic	X[2]		X[2]		Act on Waste 2001	Y
6	DE – Germany[3]						
7	DK – Denmark	X		X[2]		Order on Waste 2018	N
8	EE – Estonia	X[2]		X		Waste Act 2004	Y
9	ES – Spain	X		X		Act on waste and contaminated soils 2011	N
10	FI – Finland	X		X		Waste Act 2011	(Y)
11	FR – France	X		X		Environmental Code 2015	N
12	EL – Greece	X			X	Law on Waste 2012	N
13	HR – Croatia	X			X	Act on Sustainable Waste Management Act 2013	N
14	HU – Hungary	X		X		Act on Waste 2012	(Y)
15	IE – Ireland	X		X		European Communities (Waste Directive) Regulations 2011	Y
16	IT – Italy	X		X		Legislative Decree - Environmental regulations 2006	N
17	LT – Lithuania	X		X		Law on Waste Management 1998	Y
18	LU – Luxembourg	X		X		Law on Waste Management 2012	N
19	LV – Latvia[3]						
20	MT - Malta[3]						
21	NL - Netherlands[3]	X		X		Environmental Management Act (EMA) 2011	N
22	PL - Poland	X		X		Waste Act 2018	N
23	PT - Portugal	X		X		Decree on Waste 2006	N
24	RO - Romania	X		X		Law on waste 2011	N
25	SE - Sweden	X		X[2]		Environmental Code 1998	N
26	SI - Slovenia	X		X		Decree on Waste 2015	N
27	SK - Slovak Republic	X[2]		X[2]		Waste Act 2015	Y
28	UK - United Kingdom[3]	X		X		Waste Regulations 2011, each for England & Wales, Northern Ireland and Scotland Waste Management Licensing Regulations 2011 for Scotland	Y

1 (Y) means, English version available, but not official translated / published

2 Explanations on procedural obligations / responsibilities are given (possibly referring to additional legislation for specific waste/material streams)

3 Cells in GREY indicate that the Member State did not participate in the consultation process and no Country Factsheet is available

Most MS indicated that both Article 5 and Article 6 had been transposed word-by-word. In several cases (e.g. AT, EE, FI, ES) terms and definitions have been modified to follow national waste legislation but are still fully in line with the Articles.

In several cases, additional covering procedural obligations / responsibilities (referring to national legislation for specific waste/material streams) have been provided in the national transposition of Article 5 and 6 of the WFD. Five MS (BE, BG, CZ, EE, SK) reported that amendments have been made regarding Article 5 on BP and six MS (BE, BG, CZ, DK, SE, SK) indicated that for Article 6 on EoW.

Explanation regarding the transposition of Article 6 (EoW) in the main piece of legislation which is not related to procedural obligations / responsibilities only could be identified for two MS only, addressing the following aspects:

- An obligation is added, specifying that EoW status for hazardous waste cannot be achieved through dilution or mixing of waste (EL).
- A demand for an additional obligations (HR):
    - A certificate of a management system, of the EMAS system register or a system compliance certificate applied under the special regulation;
    - The certificate of accreditation issued by the competent accreditation body;
    - Evidence of fulfilment of special criteria for the EoW status.

Based on Article 175(1) of the Treaty on the European Union, MS can add supplementary provisions or implement stricter provisions when implementing a Directive.

Generally, MS can use their own approach when setting up an administrative framework for the implementation of Articles 5 and 6. As an example, in the Flemish region of Belgium no distinction has been made between EoW and BP.

Concerning the future transposition of the amendments to the WFD as stipulated by Directive (EU) 2018/851, only one MS out of 25 MS analysed (NL), provided information on related drafted national provisions. The provided draft set of national criteria as laid down in Article 5(3) and 6(3) of the WFD were taken up at national level in a word by word citation.

4.5.2 National guidance / criteria established on BP

At EU-level, the Communication on the Interpretative Communication on waste and BP (COM (2007) 59 final) and the Guidance[15] on the interpretation of key provisions of the WFD provide guidance on how to determine BP status including specific examples such as slags and dusts from iron and steel production, BP from the food and drink industry (animal feed), BP from combustion (flue gas desulphurisation gypsum), off-cuts and other similar material. The latter also provides guidance on how to interpret the criteria of Article 5 & 6 referring to specific rulings and CJEU case law.

In addition, the Regulation (EC) No 1069/2009 lays down health rules in regard to animal BP. Animal BP including processed products covered by this regulation are generally excluded from the scope of the WFD (see Article 2), except for those which are destined for incineration, landfilling or use in a biogas or composting plants. Accordingly, the question on waste / non-waste status for specific animal BP still has to be addressed.

[15] https://ec.europa.eu/environment/waste/framework/pdf/guidance_doc.pdf

At national level the decision on determining BP status is taken at different administrative levels across the European MS. Guidance is provided for specific waste/materials as shown in Table 2. There are two different forms of implementation, non-binding guidance or criteria stipulated in legislation.

Table 2: Identified national or regional guidance / criteria on BP status established in the MS (analysed for 25 out of 28 MS)

Material streams covered	*MS having established guidance / criteria*	*Relevant document*
• **Biogas slurries** (umbrella term for liquid and solid fermentation residues from separation) from biogas plants that only use renewable raw materials and not waste (renewable raw materials plants) • **Iron scale** (mill scaling arising from the manufacture of iron and steel) • **FGD gypsum is gypsum** which is obtained from exhaust from flue gas desulphurisation systems (abbreviation "FGD") • **Sawdust or wood chips** from clean, non-chemically treated wood from the processing (sawmill) are considered BP • **Fly ash** from coal-fired power plants	AT	**AT** – Federal Waste Management Plan 2017 - Part 2 - Guidelines for the shipment of waste
• **Sunflower husks** • **Wood**	BG	**BG** – Waste Management Act 2012 – Article 4
• **Excavated soil** • **Stones**	IT, IE	**IT** – National Decree No 120 / 2017 **IE** - Guidance Note (not published yet)
• **Wood fuel ash**	LT	**LT** – National Order No D1-14 / 2011
• **Wood residues** from wood processing and the production of panels and furniture • **Residues of biomass** of plant origin from the production and processing of pulp, paper and cardboard and from the production of food and beverages	SI	**SI** – Decree on the emission of substances into the atmosphere from small and medium combustion plants 2013
• **Residues of production of polymeric material used in the production of agricultural silage film and residues from agri-food industries** • **Polyurethane foam scrap**	ES	**ES** – Order APM/852/2019, Order APM/189/2018 and Order APM/397/2018
• **Food BP**	BE[16]	**BE** (Walloon) – Decree on Waste 1996
• **Crude glycerine** • **Construction and demolition materials**	NL	**NL** – Regulation on BP criteria

The following MS indicated to have established national guidance on the classification of a material as waste or non-waste (BP):

- **Denmark:** Guidance from Danish EPA[17]
- **Sweden:** Guidance from Swedish EPA[18]
- **Portugal:** General criteria for classification of BP (PT MoE 2015)
- **Croatia:** Ordinance on BP and EoW status (OG No 117/14)

4.5.3 National guidance / criteria established on EoW

As for BP, the decision when waste ceases to be waste is taken at different administrative levels across the European MS. Guidance is given for specific

[16] In the Flemish part of Belgium no procedural distinction is made between end-of-waste and by-product and criteria and guidance are established covering both categories.

[17] https://mst.dk/media/89958/Vejledendeudtalelseomklassificeringafstoffermvfraindustriensomaffaldellerikkeaffaldbi.pdf

[18] http://www.naturvardsverket.se/Kalendarium/Dokumentation-fran-seminarier/Dokumentation-fran-Avfallsdag-i-Stockholm/

waste/materials as shown in Table 3. Implementation usually takes the form of criteria stipulated in national/regional legislation.

Table 3: Identified national guidance / criteria on EoW status established in the MS (analysed for 25 out of 28 MS)

End-of waste status foreseen on following waste/material streams	*Examples of waste types serving as input material for the process (possibly limited to specific qualities)*	*MS having established guidance / criteria*	*Relevant document / Link*
• **Construction materials, aggregates, building materials**	Electric furnace slag (except stainless steel slag); Blast furnace slag (including blast furnace lump slag); Converter slag; Building waste (not site waste); Roadway rubble; Excavation; Concrete rubble; Track gravel; Bitumen and Asphalt; Street cleaning waste (only stone chipping input); bricks; tiles, tiles, faience and ceramics; inert waste	AT, BG, HR, BE, UK, NL	**AT** – Recycled Construction Materials Regulation (BGBl II Nr. 181/2015) **BG** – Ordinance for management of construction waste and recovery of recycled building materials (Decree No 267/2017) **HR** – Ordinance on BP and EoW status (OG No 117/14) **BE** (Walloon) – Decree **BE** (Flanders) – Order adopting regulation on the sustainable management of material cycles and waste (2012) **NL** – Regulation determining EoW status of recycling granulate (2015) **UK** (England, Wales, NI) – End of waste criteria for the production of aggregates from inert waste (2013)
• **Waste wood**	Bark from machining and processing; Slabs; wood chips from untreated, clean, uncoated wood; Sawdust and wood shavings from untreated, clean, uncoated wood; Wood swarf and slurry; Chipboard waste; Wooden packaging and waste wood, uncontaminated; Building and demolition wood; Wood shavings, uncontaminated; Wood waste, organically treated (e. g. cured varnishes, organic coatings); Wood for recycling, quality assured; Wood packaging	AT, FR	**AT** – Wood for Recycling Ordinance, (BGBl II Nr.160/2012) **FR** – Order on EoW for wood packaging shreds (2014)
• **Substitute fuels, solid recovered fuels** • **Processed used oils for use as fuel**	Not specified in detail (often indicated by negative list); Used oils, waste lubricating oils; Used cooking oil *(By the Spanish Order APM/206/2018, waste which falls under the MARPOL scope, is issued (waste included in the International Agreement to prevent pollution from ships).*	AT, IT, CZ, HR, FR, ES	**AT** – Waste Incineration Ordinance (BGBl II Nr. 389/2002) **IT** – Ministerial Decree (No 22/2013) **CZ** – Regulation under legislative procedure **ES** – Order (APM/205/2018) on processed used oil **HR** – Ordinance on BP and EoW status (OG No 117/14) **FR** – Order on EoW for waste grease and used cooking oil for use as fuel in a combustion installation (2016) **UK** (England, Wales, NI) – End of waste criteria for the production and use of processed fuel oil from waste lubricating oils (2011) ***ES** – Order APM/206/2018, type C MARPOL waste*
• **Compost** • **Fermentation products, biogas digestate** • **Fertiliser and soil improver**	Source separated bio-waste, bark and wood, uncontaminated, vegetable food residues, eggshells, fermentation residues from anaerobic treatment, Organic vegetable waste from garden & parks and other greens; Vegetable waste, from the preparation and consumption of food, Sewage sludge from municipal wastewater treatment	AT, BG, EE, CZ, SI, PT, HR, BE, UK	**AT** – Ordinance on compost (BGBl II Nr. 292/2001) **BG** - Ordinance on separate collection of bio-waste and treatment of biodegradable waste (Decree No 20/2017) **EE** – Regulation on requirements for production of compost from biodegradable waste (No 7/2013)

End-of waste status foreseen on following waste/material streams	*Examples of waste types serving as input material for the process (possibly limited to specific qualities)*	*MS having established guidance / criteria*	*Relevant document / Link*
	plants		**EE** – Regulation on requirements for biogas digestate generated from biodegradable waste (No 12/2016) **CZ** – Decree in management of biodegradable waste (No 341/2008) **PT** – Legislation (No 103/2015) **HR** – Ordinance on BP and EoW status (OG No 117/14) **BE** (Flanders) – Order adopting regulation on the sustainable management of material cycles and waste (2012) **SI** – Decree on the treatment of biodegradable waste and the use of compost or digestate **UK** (England, Wales, NI) – End of waste criteria for the production and use of quality compost from source-segregated biodegradable waste (2012) **UK** (England, Wales, NI) – End of waste criteria for the production and use of quality outputs from anaerobic digestion of source-segregated biodegradable waste (2014)
• **Biochar, drying products or ashes**	Sewage sludge from municipal waste water treatment plants; treated ash from the incineration of poultry litter, feathers and straw	EE, UK	**EE** – Regulation on requirements for manufacturing of products from sewage sludge (No 24/2017) **UK** (England, Wales, NI) – End of waste criteria for the production and use of treated ash from the incineration of poultry litter, feathers and straw (2012)
• **Fuel additive from oil shale mining waste and tailings**	Oil shale and the stone material accompanying oil shale	EE	**EE** – Regulation on requirements for the production of a Fuel Additive from Oil Shale Mining Wastes and Tailings (No 60/2015)
• **Tyre chips added to the shale oil production process** • **Tyre-derived rubber materials**	Scrap tyres	EE, PT, UK	**EE** – Regulation on requirements for tyre chips added to the shale oil production process (No 40/2018) **PT** – Legislation (No 20/2018) **UK** (England, Wales, NI) – End of waste criteria for the production and use of tyre-derived rubber materials (2014)
• **Reclaimed asphalt pavement**	Bitumen, Asphalt	IT, CZ	**IT** – Ministerial Decree (No 69/2018) **CZ** – Regulation under legislative procedure
• **Dredging materials**	Dredging materials	IT	**IT** – Legislative Decree (No 152/2006)
• **Used absorbent products for personal care**	Used absorbent products for personal care (nappies)	IT	**IT** – Regulation laying down standards governing EoW status of absorbent hygiene products (PAPs) pursuant to Article 184-ter, subparagraph 2 of Legislative Decree No 152 of 3 April 2006.
• **Recovered plastics, namely flakes, agglomerates and granules**	Waste plastics	PT	**PT** – Legislation (No 245/2017)
• **Paper**	Waste paper, cardboard	BE	**BE** (Walloon) – Decree
• **Soil**	Not specified in detail (often indicated by negative list)	BE	**BE** (Flanders) – Order adopting regulation on the sustainable management of material cycles and waste (2012)

End-of waste status foreseen on following waste/material streams	*Examples of waste types serving as input material for the process (possibly limited to specific qualities)*	*MS having established guidance / criteria*	*Relevant document / Link*
• **Biomethane** from waste	Biomethane from landfill gas and anaerobic digestion (AD)	UK	**UK** (England, Wales, NI) – End of waste criteria for the production and use of Biomethane from landfill gas and anaerobic digestion (AD) biogases (2014)
• **Flat glass**	Waste glass	UK	**UK** (England, Wales, NI) – End of waste criteria for the production of processed cullet from waste flat glass (2014)
• **Aggregate from waste steel slag**	Waste steel slag	UK	**UK** (England, Wales, NI) – Aggregate from waste steel slag: quality protocol (2016)
• **Biodiesel**	Not specified in detail	UK	**UK** (England, Wales, NI) – Biodiesel: quality protocol (2015)
• **Gypsum**	Waste plasterboard	UK	**UK** (England, Wales, NI) – Recycled gypsum from waste plasterboard: quality protocol (2015)
• **Non-packaging plastics**	Non-packaging plastics	UK	**UK** (England, Wales, NI) – Non-packaging plastics: quality protocol (2016)
• **Pulverised fuel ash (PFA)** and **furnace bottom ash (FBA)**	Non-packaging plastics	UK	**UK** (England, Wales, NI) – End of waste criteria for the production of pulverised fuel ash (PFA) and furnace bottom ash (FBA) for use in bound and grout applications in specified construction and manufacturing uses (2010)
• **Distillation residues of used oils**	Used oils	FR	**FR** – Order on EoW for distillation residues of used oils for use as a plasticizer for bitumen in the manufacture of roof waterproofing membranes (2017)
• **Re-used objects**	Cartridges, packaging, vacuum pressure containers, tyres, waste electrical and electronic equipment, textiles, waste furniture components	FR	**FR** – Order on EoW for objects and chemicals that have been prepared for reuse (2018)
• **Cut wiping cloths**	Used textiles	FR	**FR** – Order on EoW for cut wiping cloths made from used textiles for use as rags (2019)
• **Specific chemicals**	Used chemicals	FR	**FR** – Order on EoW for chemicals or objects that have been regenerated (2019)

The following MS indicated plans to introduce additional national EoW criteria for specific waste streams in the future:

- **Italy:** Lead paste from waste batteries, Inert construction and demolition waste, Waste Paper, Mixed Plastics from packaging waste, Heterogeneous Plastics from pulper waste
- **Lithuania:** Biodegradable waste and sewage sludge, tyres
- **Greece:** Rubber material derived from used tyres
- **Finland:** Crushed concrete used for construction purposes
- **France:** Excavated soils and sediments, hydrochloric acid from chloric waste incineration, collected papers and cardboards, and reusable ELV parts

The general impression is that currently there is a broad spectrum of different waste types that are classified as EoW. This could lead to considerable material streams withdrawn from the environmental protection context of waste legislation[19]. However, these non-wastes are subject to all applicable product legislation, including REACH and

[19] Flemish statistics indicate that 46% of the industrial waste is classified as end-of-waste or by-product (source: Bedrijfsafvalstoffen productiejaar 2004-2016, OVAM 2018)

CLP which might set stricter and more complex requirements in terms of environmental and human health protection that the waste legislation does. For some recovered materials for which EoW criteria already have been established (such as compost) exemptions to registration under REACH are existing. For other cases, the restriction requirements would apply as the substances will not be considered as waste and subject to specific provisions under the REACH restriction procedure

It should be investigated whether the application of EoW is done in line with the precautionary principle. Also, the driving forces behind deserve examination. The differences between MS are remarkable, with some MS including hazardous wastes while others indicate not to establish national or regional EoW criteria at all. The balance between the precautionary principle and the liberal market is kept differently in the different MS.

The following MS have explicitly stated that currently no national/regional EoW criteria are existing nor applied and that they do not intend to establish any of those criteria in the near future:

- **Denmark**
- **Sweden**
- **Poland**
- **Slovak Republic**
- **Cyprus**
- **Luxembourg**
- **Romania**

4.5.4 National policies related to materials which cease to be waste according to the criteria defined at EU level

The possibility to define EoW criteria was introduced by the revised WFD adopted by the European Parliament and the Council of the EU in 2008 with the objective to facilitate the reintroduction of materials into use cycles by removing administrative burdens of waste legislation. Thus, the EoW criteria shall contribute to resource efficiency and to the transition to a circular economy, in accordance with the objectives of the WFD.

According to Article 6 (1) and (2) of the WFD, certain specified waste shall[20] cease to be waste when it has undergone a recovery (including recycling) operation and complies with specific criteria. In accordance with the WFD, such criteria should be set for specific materials by the European Commission.

Before the latest amendment to the WFD in 2018, EU-level criteria for EoW were enacted in the so-called comitology procedure. For this purpose the revised WFD foresees a committee procedure (Article 39 of the WFD). In practice, the JRC drafts the technical proposals for regulations regarding the EoW criteria at EU-level. The European Commission is assisted by a committee, whose members vote on the proposals.

So far, the following EoW regulations have entered into force through the comitology procedure:

- Iron, steel and aluminium scrap: Council Regulation (EU) No 333/2011
- Copper scrap: European Commission Regulation (EU) No 715/2013

[20] Before the latest amendment this was not obligatory, and wastes "may" cease to be waste, when MS have established specific rules. Now, MS are obliged to develop such specific rules: "MS shall take appropriate measures to ensure…"

- Glass cullet: European Commission Regulation (EU) No 1179/2012

In accordance with the revised WFD, the European Commission shall monitor the development of national EoW criteria in MS and assess the need to develop Union-wide criteria on this basis. To that end, and where appropriate, the European Commission may adopt implementing acts in order to establish detailed criteria on the uniform application of the conditions laid down the revised WFD. The 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.

The criteria shall include:

a) permissible waste input material for the recovery operation;
b) allowed treatment processes and techniques;
c) quality criteria for EoW 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 EoW criteria, including for quality control and self-monitoring, and accreditation, where appropriate; and
e) a requirement for a statement of conformity.

The questionnaire to examine MS current legal framework and practices on BP and EoW included the following questions regarding the policies related to materials which cease to be waste according to the criteria defined at the EU-level (particular types of metal scrap and glass cullet):

- Is (comprehensive) information available on the number and type of economic operators (sectors) who produce or import/export iron and steel, aluminium and copper scrap or glass cullet obtaining an EoW status according to the criteria defined at the EU-level?
- Is (comprehensive) information available on the quantities of iron and steel, aluminium and copper scrap or glass cullet obtaining an EoW according to the criteria defined at the EU-level?
- Do you see a need for additional EU guidance for specific waste / material streams or processes related to EoW / BP?

Availability of information on the number and type of economic operators and on quantities ceasing to be waste (analysed for 25 out of 28 MS)

The survey revealed that MS authorities do not have (comprehensive) information available on the number and type of economic operators who produce or import/export iron and steel, aluminium and copper scrap or glass cullet obtaining an EoW status according to the criteria defined at the EU-level. Consequently, information on the quantities of iron and steel, aluminium and copper scrap or glass cullet obtaining an EoW is not available either. This is due to the fact that there is no legal requirement to collect these data. However, some MS have established systems for the collection of data on the economic operators who produce EoW materials according to the criteria defined at the EU-level and/or on the quantities ceasing to be waste according to these criteria (see Table 4).

As stated above under the section describing the background to this study (section 3.1), a survey was carried out by the JRC-IPTS in 2014[21] and came to the conclusion that most Member State authorities do not collect comprehensive information on EoW

[21] http://publications.jrc.ec.europa.eu/repository/bitstream/JRC91591/lf-na-26884-en-n.pdf

producers. The Study also concluded that there is no urgent need for further monitoring in the near future, due to the relatively modest rate of uptake of these EoW criteria, more than 1,100 scrap industry companies were using the EU-level EoW criteria across Europe in 2014, most established in Italy. According to the JRC-IPTS, surveys covering the relevant industry seem to be the most appropriate way to monitor EoW for scrap metal, and copper scrap.

The uptake of the EoW criteria for glass cullet seems to be higher. According to FERVER[22], the European glass recyclers are recycling more than 90% of the collected packaging glass as materials that fulfill the EoW quality criteria and can directly be used in the production of new glass products.

Several authorities (CZ, SE, DK, FI) stated in their answers that the EU-level criteria for EoW steel, aluminium and copper are only rarely used in their countries. As a possible reason for this, one Member State mentions that recycling practices within the metal sector have been established already a very long time ago and smelters proceed with materials having waste status. There has not been any real need to change these practices, even if the criteria have been introduced. Furthermore, the Member State mentions that the EoW criteria might not be strict enough when it comes to the requirements related to the quality of the EoW material.

Table 4: Examples of data collection on the information related to iron and steel, aluminium and copper scrap and glass cullet obtaining an EoW status according to the criteria defined at the EU-level

Member State	Type of information	Type of data collection and dissemination
Austria	Types and quantities of the materials ceasing to be waste.	Annual waste balances reported annually in an electronic form. http://edm.gv.at
Bulgaria	List of businesses that have successfully conducted EoW accreditation procedures.	Lists publicly available on the web page of the EEA. http://eea.government.bg/bg/nsmos/waste/registri-spravki
Portugal	Information on the receivers/users of the materials ceasing to be waste.	Data on receivers/users of the EoW materials have to be reported by the producers of these materials.
Belgium (Flanders)	Information on the number and type of economic operators who produce EoW materials. Types and materials of materials ceasing to be waste.	EoW materials registry publicly available on OVAM's website: https://services.ovam.be/registratie/pages/publicOrganisatieList.xhtml?dossierType=GRONDSTOF_EU&showGeschorste=false Materials ceasing to be waste are included in the data collection on waste generation and treatment in Flanders under a category called "new resources". The data collection is based on the data reported by businesses in their annual integrated environment report and on PRTR-reports.

[22] FERVER (2019): Glass, the End of Waste success story in Europe.

Needs for additional EU guidance related to EoW and BP (analysed for 25 out of 28 MS)

Most MS authorities (CY, EL ES, HR, LU, AT, DK, EE, FI, FR, RO, PT, IT, SK, LT, SE) see a need for additional EU guidance for specific waste / materials streams or processes related to EoW / BP. Guidance on the uniform application of the conditions for EoW and BP laid down in the WFD could for example help avoid disagreements between MS when materials claimed to be EoW or BP are shipped across the borders.

In their responses to the survey, MS authorities mentioned the following waste/material streams for which further guidance or EU-level criteria could be particularly useful:

- rubber material derived from used tyres
- slag from iron and steel production processes
- solid recovered fuel / refuse derived fuel
- construction and demolition waste
- plastic wastes used in mechanical recycling and chemical recycling (especially "complex plastic wastes" other than PE, PET, PVC PP and PS)
- anaerobic digestate and compost
- processed fuel oil / fuel from waste oil
- solid biomass fuels
- tyre pyrolysis oil
- biodiesel
- animal fat
- olive pomace
- paper
- textiles

Furthermore, in their answers to the survey, the MS authorities have expressed the following ideas, wishes and proposals regarding further guidance:

- guidance regarding operations addressed to preparing for reuse for different types of materials;
- exchange of information on best practices e.g. in the form of a sharing platform dedicated to EoW and BP with the criteria established;
- update of the available general guidance on EoW;
- clarifications whether some applications should be prohibited for EoW materials or BP (e.g. combustion);
- broader guidelines for BP;
- more examples, especially related to the furniture industry.

4.5.5 Uptake of case-by-case decisions on EoW and BP

Where detailed criteria have not been established neither at EU nor at national level decisions regarding EoW or BP can be taken on a case-by-case basis. In these cases decisions are made based on the general conditions and by considering applicable case law.

The revised WFD explicitly mentions in Article 6 the case-by-case decision on EoW,. It should be noted that such case-by-case evaluation is not foreseen in Article 5 on BP: *"Where criteria have not been set at either Union or national level under paragraph 2 or 3, respectively, a Member State may decide on a case-by-case basis,*

or take appropriate measures to verify, that certain waste has ceased to be waste on the basis of the conditions laid down in paragraph 1 and, where necessary, reflecting the requirements laid down in points (a) to (e) of paragraph 2, and taking into account limit values for pollutants and any possible adverse environmental and human health impacts."

The revised WFD does not require a notification of case-by-case decisions to the European Commission but gives the MS the opportunity to make information about case-by-case decisions and about the results of verification by competent authorities publicly available by electronic means.

The revised WFD does not specify the possible forms of case-by-case decisions. Depending on the MS legislation, the case-by-case decision may take different forms, for instance:

- a separate decision by the competent authority;
- a decision as part of a waste permit or IED-permit;
- self-assessment combined with a verification or non-binding opinion of the competent authority.

Depending on the MS legislation, wastes may cease to be waste only on the basis of national EoW criteria or on the basis of case-by-case decisions. MS make use of a mix of national EoW criteria and case-by-case decisions. If legally binding criteria are established at national level for specific waste/material streams in a country those criteria are taken up in permits and no single case-by-case decisions are needed. In the same country, the approach on single case-by-case decisions might be taken for other waste/material streams where no national criteria have been established for the respective waste/material stream.

The questionnaire to MS authorities conducted within this study included the following questions regarding case-by-case decisions:

- Possibilities of taking case-by-case decisions on EoW (or BP) status provided for in national legislation.
- Information on specific case-by-case decisions taken for EoW or BP status including information on cases where the procedure of decision-making was challenging and on decisions that have led to a refusal of an application for EoW or BP status.
- The authority level (national, regional, local) that is responsible for taking case-by-case decisions regarding EoW and BP status.
- Availability of information on case-by-case decisions (including the number and type of economic operators) on where waste ceases to be waste (or is classified as a BP).
- Specific guidance documents stipulating rules for defining EoW or BP on a case-by-case basis.

Table 5: Case-by-case decisions in the MS (analysed for 25 out of 28 MS)

No.	*Member State*	Types of case-by-case decisions on EoW	Form of case-by-case decision on BP	Authority level	Availability of information on the case-by-case decisions
1	AT – Austria	Separate decision	Separate decision	Regional	No systematic compilation
2_1	BE – Walloon region	Separate decision	Separate decision	Regional	No decisions taken
2_2	BE – Flanders region	Separate decision	Separate decision	Regional	Publicly available
2_3	BE – Brussels region	As part of permit	As part of permit	Regional	Register, but not

No.	*Member State*	**Types of case-by-case decisions on EoW**	**Form of case-by-case decision on BP**	**Authority level**	**Availability of information on the case-by-case decisions**
					published
3	BG – Bulgaria	Does not exist	Separate decision	National	Publicly available
4	CY – Cyprus	Under development, type not decided up to now	Under development, type not decided up to now	National	No decisions taken
5	CZ – Czech Republic	As part of permit	Self-assessment	Regional	Database on permits (EoW)
6	DE – Germany[1]				
7	DK – Denmark	Separate decision	Separate decision	Local	No systematic compilation
8	EE – Estonia	Does not exist	As part of permit	National	No systematic compilation
9	ES – Spain	Does not exist	Does not exist	-	No decisions taken
10	FI – Finland	As part of permit / self-assessment	As part of permit / self-assessment	Local/Regional	No systematic compilation
11	FR – France	Separate decision	Separate decision	Regional	No systematic compilation
12	EL – Greece	Does not exist	As part of permit	Regional / National	No systematic compilation
13	HR – Croatia	Does not exist	Does not exist	-	No decisions taken
14	HU – Hungary	As part of permit	As part of permit	Regional/National	No systematic compilation
15	IE – Ireland	Separate decision	Separate decision, Notification by the operator	National	Publicly available
16	IT – Italy	As part of permit - currently not made	As part of permit - currently not made	Regional*	No systematic compilation
17	LT – Lithuania	Does not exist	Self-assessment + supervision	National	No systematic compilation
18	LU - Luxembourg	Separate decisions based on self-assessment	Separate decisions based on self-assessment	National	No systematic compilation
19	LV – Latvia[1]				
20	MT – Malta[1]				
21	NL – Netherlands	As part of permit + Non-binding declaratory opinions	As part of permit + Non-binding declaratory opinions	Local/Regional /National	Register on the non-binding declaratory opinions
22	PL – Poland	Separate decision	Separate decision	Regional	No decisions taken
23	PT – Portugal	Under development type not decided up to now	Separate decision	National	Systematic compilation
24	RO – Romania	As part of permit	As part of permit	Local/National	Register, but not published
25	SE – Sweden	Self-assessment + supervision	Self-assessment + supervision	Local/Regional	No systematic compilation
26	SI – Slovenia	Does not exist	Self-assessment + supervision	Local/Regional	No systematic compilation
27	SK – Slovak Republic	As part of permit	As part of permit	Regional/National	Register on the permits issued on national level
28	UK – United Kingdom	Separate decisions in Northern Ireland, Wales and Scotland Self-assessment & opinion in England	Separate decisions in Northern Ireland, Wales and Scotland Self-assessment & opinion in England	Regional	Records hold, but no accessible database

1… Cells in GREY indicate that the Member State did not participate in the consultation process and no Country Factsheet is available
*… The possibility to take case-by-case decisions is provided for. Case-by-case decisions have been made as part of permits on the regional level. However, the current national case law indicates that EoW / BP decisions should not be made on the regional level but can be issued only by the Ministry of the Environment.

It is remarkable in this analysis that the number of case-by-case procedures set up for BP by MS is that high while the WFD does not provide for the possibility of case-by-case decisions for BP. Contrary, even having the possibility of case-by-case decisions stipulated for EoW in the WFD, the uptake has been significantly low.

In the following, selected examples on different practices are described in detail:

- **Case-by-case decision as part of permit (FI):** Case-by-case decisions on EoW or BP status can be made as part of the environmental permit procedure for a specific facility. Licensing and supervision of industrial operations are divided between the regional state authorities and local state authorities, depending on the type and size of the operations. The decision is only applicable to the facility in question, and not to all operators that produce/handle similar materials. For operations that do not require an environmental permit, the operator can request a statement from the supervisory authority on the status of the material. In that case, the final decision as whether the material fulfils EoW or BP criteria is made as a self-assessment by the operator.
- **Self-assessment (SE):** The operators themselves are responsible for assessing whether a waste has ceased to be a waste after a recycling process. The Swedish Environmental Protection Agency recommends that the operators consult with the enforcement authority in this matter. Within the framework of the supervision, the operator's assessment is examined, and if the authority does not agree with the decision that the waste has ceased to be waste, the authority may order the operator to continue handling the substance or object as waste. The same procedure is applied for BP assessments performed by the operators. The system of compliance with the Environmental Code Miljöbalk (1998:808) is based on self-monitoring carried out by the operators. Under the Environmental Code, the Ordinance on Operators' Self-monitoring (1998:901) has been issued. According to this Ordinance, operators have to apply a self-monitoring management system and have to monitor the operation of the activity continuously in order to mitigate or prevent detrimental impacts on human health or the environment.
- **Separate decisions (IE):** All applications for EoW decisions and notifications of BP decisions are assessed on a case-by-case basis, using a risk assessment approach. The EPA, which is a national level authority, is responsible for EoW and BP decisions. A single case-decision was taken for LDPE plastics in 2018. A number of applications for EoW decisions on recycled aggregates are currently being assessed and the challenge is to determine, based on the risk assessment provided, whether compliance with Article 6(1)(d) has been demonstrated. An application for EoW status for tyre-derived rubber materials (rough chip tyre-derived rubber from the recycling of waste tyres) was refused on the basis that compliance with Article 6(a) could not be demonstrated.

The following table includes examples of waste streams /residues for which case-by-case decisions have been made in different MS.

The data collection conducted on the MS authorities revealed that single case by-case decisions are hardly available and accessible throughout the information provided by the authorities. Permits and decisions could only be provided for a few cases for countries such as Finland and Portugal providing examples on the approach taken by the single MS. There is a huge lack of transparency, decisions are often not entering electronic data bases and more importantly not accessible by the public.

Table 6: Examples of waste streams / residues for which case-by-case decisions have been made

Member State	**Examples of waste streams for which EoW decisions have been made**	**Examples of residues for which BP decisions have been made**
BE – Flanders region	Treated sewage sludge, fly ash and bottom ash, dredging spoils, contents of sand traps, anode sludge, and aggregates.	
BG - Bulgaria		Sunflower husk, wood chips and cutting, sawdust, malt bran and yeast from breweries.
CZ - Czech Republic	Aggregates, textile cord, shredded paper, polystyrene, waste wood brickets, shredded sorted plastics, plastic re-granulate, waste gypsum from flue gas cleaning, CDW and excavated asphalt.	Excavated soils, residues from metal smelting, residues from mineral wool production, mirror scrap, plastic cuttings, leather cuttings, soil from potatoes cleaning.
EE - Estonia		Sawdust.
FI - Finland	Wooden chips for the production of "wooden bricks", processed gypsum from phosphorous chemical processes for use as fertiliser, iron powder, coal and lime produced out of iron slag and blast furnace soot, aluminium chloride recovered from acids containing aluminium chloride, fuel oil regenerated out of waste oils and oil emulsions.	
IE - Ireland	LDPE plastics. A number of applications for EoW decisions on recycled aggregates are currently under assessment.	
LU - Luxembourg	Coarse fraction of railway ballast and wood chips produced from bio-waste.	
RO – Romania		Wine yeast and grape marc (production of alcoholic beverages); sawdust, shavings, cuttings, wood chips, chipboard scraps (wood processing and the production of panels and furniture, pulp, paper and cardboard); processed textile fibres; mixture of vegetable powder, barley, chaff, malt root; unprocessed slag and blast furnace slag (iron and steel industry); the coffee resulting from the coffee machine verification process.
PT - Portugal		Metal BP, paper and cardboard, polyurethane foam, mix plastic waste (PVC/PP), sodium hydroxide solutions saturated with sodium aluminate, waste of cereals and soybeans, calamine from hydrometallurgical processing, slags from ferrous and non-ferrous smelting processes, ceramic waste, fluidized bed biomass, animal BP, animal feed aluminium leftovers.
SK - Slovak Republic		Sawdust and metal dust.

Examples of cases where case-by-case decisions have led to a refusal in different MS:

- **BE – Belgium (Flanders region):** Specific case-by-case decisions on **EoW** have led to the refusal of an application for EoW status for a variety of reasons: 1) higher emissions of the EoW material compared to a primary resource, 2) the intended recovery method of the EoW material is at a lower level of the waste hierarchy (e.g. difficult to obtain EoW status for a material that is to be used as a fuel, when there are still recycling options available).
- **FI – Finland:** An example of waste for which a **BP** case-by-case decision led to the refusal is sand from fluidised beds (waste code 10 01 24). An example of waste for which an **EoW** case-by-case decision led to a refusal is carbon black (solid) from inorganic chemical process (waste code 06 13 03). In both cases, the reasoning was that the material does not fulfil the EoW / BP criteria.
- **IT – Italy:** In a Ruling of the Council of the State of 28th February 2018 (case no. 1229 on the recycling plant Contarina) it was stated that regional

authorities are not able to issue authorisations concerning the recycling and recovery of **EoW** products for any waste stream beyond those already indicated in the national legislation. In the relevant case, a recycling facility for diapers could not receive EoW status for its recycling materials from the regional authorities (this changed in terms of introducing the national regulation laying down standards governing EoW status of absorbent hygiene products (PAPs) pursuant to Article 184-ter, subparagraph 2 of Legislative Decree No 152 of 3 April 2006).

- **PL - Poland**: An example of waste for which a **BP** case-by-case decision led to the refusal of an application as BP is broken asphalt which than had to be considered as waste (waste code 17 03 02). The reason for the refusal was the fact that the product was not generated by a production process.
- **SE – Sweden**: Two companies have marketed rubber granulate / granulates from tyres as an **EoW** material. However, during an inspection by the enforcement authorities their marketing strategy was questioned and the operators could not demonstrate that the processed granulate had ceased to be waste.
- **SK - Slovak Republic**: An example of waste for which **BP** case-by-case decision led to the refusal of the relevant application is asphalt removed from the road surface by special equipment. The question here is, whether the material is a result of a production process (the primary aim of which is not the production of that material) and whether the material is produced as an integral part of a production process or not.

4.5.6 National enforcement actions

The recital 17 of the revised WFD states that those appropriate measures to ensure that waste that has undergone a recovery operation is considered to have ceased to be waste (i.e. to ensure that the waste complies with all the conditions laid down in Article 6(1) of the WFD) should include enforcement provisions.

Those enforcement provisions shall enable verification that waste that is considered to have ceased to be waste as a result of a recovery operation complies with the law of the European Union on waste, chemicals and products.

In this context particular priority shall be given to waste streams that pose a higher risk to human health and the environment due to their nature and volume, to waste that is subject to innovative recovery processes or waste that is recovered for subsequent further use in other MS.

The questionnaire conducted within this study included the following questions on enforcement actions:

- The authority level (national, regional, local) that is responsible for the enforcement of the provisions of legislation laying down criteria for EoW status of specific waste streams / for BP
- The authority level (national, regional, local) that is responsible for the enforcement of the EU-provisions establishing criteria for the EoW status of certain waste types

Table 7: National authorities responsible for enforcement related to the application of detailed criteria established in the MS (analysed for 25 out of 28 MS)

No.	*Member State*	**Authority level responsible for the enforcement of national provisions**	**Authority level responsible for the enforcement of the EU-provision**
1	AT - Austria	**Regional**: District administrative authority	**National**: Federal Minister for Sustainability and Tourism.
2_1	BE – Walloon region	**Regional**: Service Public de Wallonie / Agriculture, Ressources naturelles et Environnement (In case of an appeal: the Walloon Ministry for the Environment)	**Regional**: Service Public de Wallonie / Agriculture, Ressources naturelles et Environnement (In case of an appeal: the Walloon Ministry for the Environment)
2_2	BE – Flanders region	**Regional:** Division Enforcement of the Department Environment	**Regional:** Division Enforcement of the Department Environment
2_3	BE – Brussels region	**Local**: Brussels Environment	**Local**: Brussels Environment
3	BG - Bulgaria	**Regional:** Regional inspectorates	**Regional**: Regional inspectorates
4	CY - Cyprus	**National:** Minister of Agriculture, Rural Development and Environment via Department of Environment	**National:** Minister of Agriculture, Rural Development and Environment via Department of Environment
5	CZ - Czech Republic	**National:** Czech Environmental Inspectorate.	**National**: Czech Environmental Inspectorate.
6	DE - Germany[1]		
7	DK - Denmark	**Local**	**National**
8	EE - Estonia	**National:** Environmental Inspectorate	**National:** Environmental Inspectorate
9	ES - Spain	**Regional**: Autonomous Communities in Spain	**Regional**: Autonomous Communities in Spain
10	FI - Finland	**Local / Regional**	**Local / Regional**
11	FR - France	**Regional:** Regional authorities of the ministry in charge of environment	**Regional:** Regional authorities of the ministry in charge of environment
12	EL- Greece	**National /Regional:** Directorates of the Ministry of Economy and Development, Directorates of Development at regional level, General Chemical State Laboratory	**National /Regional:** Directorates of the Ministry of Economy and Development, Directorates of Development at regional level, General Chemical State Laboratory
13	HR - Croatia	**National:** The Ministry of environment and energy	**National:** The Ministry of environment and energy
14	HU - Hungary	**National:** Ministry for Innovation and Technology.	**National:** Ministry for Innovation and Technology.
15	IE - Ireland	**National / Local:** the EPA / local authorities	**National / Local:** the EPA / local authorities
16	IT – Italy	**National:** Ministry of the Environment	**National:** Ministry of the Environment
17	LT - Lithuania	**National:** The Ministry of Environment and the Ministry of Economic and innovation	**National:** The Ministry of Environment and the Ministry of Economic and innovation
18	LU - Luxembourg	**National:** Environmental Agency and the Ministry for the Environment, Climate and Sustainable Development	**National:** Environmental Agency and the Ministry for the Environment, Climate and Sustainable Development
19	LV – Latvia[1]		
20	MT - Malta[1]		
21	NL - Netherlands	**Local / Regional / National**	**Local / Regional / National**
22	PL - Poland	**Regional:** The Marshals of the provinces and the Regional Inspectors for Environmental Protection	**Regional:** The Marshals of the "voivodship", and the Regional Inspectors for Environmental Protection
23	PT - Portugal	**National / Regional**: Portuguese Environmental Agency, Portuguese Environmental Enforcement Agency, Portuguese Economic Enforcement Agency, Environmental police authority, the regional environmental authorities.	**National / Regional:** Portuguese Environmental Agency, Portuguese Environmental Enforcement Agency, Portuguese Economic Enforcement Agency, Environmental police authority, the regional environmental authorities.
24	RO - Romania	**National:** National Environmental Guard	**National:** Romanian Accreditation Association
25	SE - Sweden	**Local / Regional:** The county administrative boards at the regional level and The Environmental and Public Health Committee in each municipality	**Local / Regional:** The county administrative boards at the regional level and The Environmental and Public Health Committee in each municipality
26	SI - Slovenia	**National:** Ministry of Environment and Spatial Planning, the Environmental Agency, the Inspectorate of the Republic of Slovenia for the Environment and Spatial Planning	**National:** Ministry of Environment and Spatial Planning, the Environmental Agency, the Inspectorate of the Republic of Slovenia for the Environment and Spatial Planning
27	SK - Slovak Republic	**National/Regional/Local**: The Environmental Inspectorate, district offices in the regional capital, local district offices and the Slovak	**National/Regional/Local**: The Environmental Inspectorate, district offices in the regional capital, local district offices and the Slovak Trade

No.	*Member State*	**Authority level responsible for the enforcement of national provisions**	**Authority level responsible for the enforcement of the EU-provision**
		Trade Inspection	Inspection
28	UK - United Kingdom	**Regional:** Environment Agency (England), NRW (Wales) , SEPA (Scotland), NIEA (Northern Ireland)	**Regional:** Environment Agency (England), NRW (Wales) , SEPA (Scotland), NIEA (Northern Ireland)

1… Cells in GREY indicate that the Member State did not participate in the consultation process and no Country Factsheet is available

Further information, such as on the enforcement of actions/procedures that are envisaged in cases where a particular industry determines the EoW/BP status and other enforcement actions on its own are provided in the MS fact sheets (see Chapter 7.4).

4.5.7 Information on the market situation

The MS interview partners were interviewed on the market situation of materials which have reached EoW and BP status. Only a few respondents could provide some information in this regard.

Availability of information on the market situation for EoW materials or BP, specifically on the market prices for secondary and primary materials, including competitiveness issues and cross-border movements

Generally it seems that currently no markets for EoW or BP are existing and that when waste ceases to be waste, it enters the general market and follows the rules of the market for commodities. Alternative treatment options, manifold fields of application as well as raw material prices in the market have significant impact on the EoW/BP uptake.

For instance, Sweden highlights that specific information on the market situation for EoW materials or BP does not exist. If waste or a BP has reached non-waste status it is regarded as a recovered product by the market, possibly having different market prices compared to primary products.

Hungary reports that information on the market situation is available for secondary raw materials from an impact assessment of 2014. Accordingly, the average price for PET was 66 HUF/kg (approx. 0.2 euros), glass 5 HUF/kg (approx. 0.015 euros) and for aluminium 275 HUF/kg (approx. 0.86 euros).

Austria points out that some information might be available from associations, such as the association for composting and biogas, or the recycling associations.

Bulgaria reports that industry associations promoting specified waste or material streams that can be considered for EoW and BP do not exist, therefore no official information on market prices is available.

Croatia indicates that a national register of BP exists where selling and purchasing entities have to be registered during the selling process. Furthermore, the entity listed in the Register of BP should submit by 1st March of each year a report on BP (as set out in national legislation) for the previous calendar year that contains the name of the company that has taken over the BP or notified it for export. However, information on the prices of specific EoW materials and BP is not included.

Availability of information on eco-innovation or research initiatives that are drivers for secondary raw materials

Respondents were in general not able to identify eco-innovation or research initiatives that are drivers for secondary raw materials.

There are few exceptions: in the Czech Republic, the Ministry is aware of work related to excavated asphalt and aggregates by a research group at the Czech Technical University in Prague, and activities at Brno University of Technology related to the development of standards and new ways of utilisation of CDW.

The Irish EPA is currently working on projects including those on the use of bauxite residue, the substitution of virgin materials in cement manufacture with suitable wastes, and identification of legacy substances (POPs) in waste. On specific materials, the EPA is funding recently commissioned research to develop a national EoW standard for quality compost & digestate, which may form part of EoW criteria for this material in the future. The research is due for completion in January 2020.

In Portugal, issues related to secondary raw materials may be driven by the public research agency (LNEG). The public research agency (LNEG)[23] established projects providing and distributing knowledge and innovation including exchange between administrative authority level and industrial sectors.

4.5.8 Identified drivers/barriers

In total, 19 respondents provided information about drivers and barriers identified in the context of the application of EoW / BP regimes on specific material streams. The analysis of the responses can be summarised as follows.

4.5.8.1 Barriers identified by MS authorities

Barriers related to appropriate institutional set-up to enable the establishment of rules for EoW and BPs

1) Waste management legislation cease to be applicable when the status of "waste" is lost

When a certain material gets the "EoW status", it automatically loses its connotation as waste, hence the waste legislation ceases to be applicable. Therefore, no track about the further use of the material can be provided and uncertainties for the users of EoW materials about the quality and the traceability of its embedded material may occur (e.g. lower quality compared to primary products). One Member State mentions that applying EoW can be perceived by the public as deregulation of waste.

2) Lack of quality criteria

Respondents report that not many EU criteria for EoW and BPs exist. Such lack of criteria and knowledge of best practices might make it difficult for the competent authority to make a decision as to whether a material is waste or a BP, or to define all relevant product requirements.

[23] http://www.lneg.pt/IeDT/areas/

Also, waste streams with more than one possible application might need quality criteria that are suitable to different applications, although this leads to a high administrative workload. In other words, if for a material there are several possible applications which require different quality criteria, then the EoW should apply the least stringent of the criteria.

Alternatively, multiple EoW could be designed for different product uses, although this might be achieved more efficiently via standards and product legislation

Finally, the criteria set at the EU level tend to differ slightly from what may be gathered from EU case law, as the point at which EoW is reached may be viewed more leniently than case law. An example for that was the Mayer Parry (MPR) case in the UK[24], which was one of the largest scrap metal merchants in the UK, and its dispute with the Environment Agency regarding the scope of the definition of "waste" as in the Waste Management Regulations 1994.

In particular, the dispute concerned whether material handled by MPR at various stages was "waste" and hence to what extent it required a waste management license under the Environment Protection Act 1990. In its decision, the UK Court analysed the statutory regime, the European regulations as well as European court decisions related to the term "waste", and concluded that as long as the materials continued to be subject to any process falling under "recycling or reclamation of metals and metal compounds" (core business of MPR), they had to be defined as waste. Also, the fact that some operations did not in themselves have environmental implications was not a reason for excluding them from the definition of waste. Conversely, once MPR had restored the material to a form which was suitable for sale as a secondary raw material to steelworks or other manufacturers, the task of recovery was complete, and the material ceased to be waste.

3) Segregated responsibilities and institutional set-up slowing down the decision process

In some MS such as Denmark, the institutional set-up regarding decisions on waste is seen as a barrier to classification of EoW and BPs since each municipality can make different decisions, and a decision is legally effective only in the local municipality. In Portugal, EoW legislation and BP analysis within the responsibility of the Environment Agency (Waste Authority), but the quality criteria are developed by another institution, hence cooperation and communication might be a challenge. In some other countries such as Greece, the national authority is appointed to take decisions on waste and waste status and hence there is a need for a ministerial decision to obtain EoW status. Whether an amendment of this legislative framework should take place in order to speed up the process is being considered. Other respondents report that when the responsibility for issuing criteria is divided between regional authorities, this might result in differences across the national territory, e.g. regarding the interpretation of the waste status.

4) Administrative burdens

Administrative burdens were also indicated as potential barriers. Some MS such as Estonia reports that the proceedings for granting a waste permit and the coordination of permits might be very complicated and time-consuming. Spain indicates that the evaluation procedure for EoW can take up to two years, France indicates time periods of one year without certainty of success. Cyprus indicates that a lack of personnel and

[24] https://www.informea.org/en/court-decision/mayer-parry-recycling-ltd-plaintiff-%C2%96-and-%C2%96-environment-agency-defendant

expertise and a complicated legal framework act as barriers to managing material streams under EoW and BP regimes.

Barriers related to existing strategies on resources, products policy, and chemicals legislation

1) The interaction of EoW with product and chemical regulations can be controversial

While the resources and product policies aim mainly to increase the uptake of secondary raw materials/resources and hence to reduce the use of primary resources, the chemical legislation aim mainly to ensure a high level of protection for human health and the environment as well as free circulation on the internal market, while enhancing competitiveness and innovation. This can sometimes diverge from the precautionary principle. In some cases it was reported that the lack of quality assurance schemes might make it challenging for materials under EoW or BP regimes to compete with primary materials.

In the case of recovered materials, information as required under REACH is often missing, as highlighted by Austria. Sometimes this is caused by the exemption of registration for recovered substances (e.g. art. 2.7 (d)), although theoretically the information should be the same that was uploaded for the primary raw material in the first place. The main issue is that the competent authorities are, in some cases, not aware of the use of this exemption. This is an enforcement issue: all non-waste substances and mixtures placed on the marker above 1 ton have to be REACH registered, unless exempted by any of the exemptions for Title II mentioned in the different points of Article 2 REACH. Exemptions for recovered materials are conditional to, among other requirements, demonstrating similarity with a (primary) registered substance. This issue should be verified and enforced by MS.

A possible way forward is to introduce a notification obligation once the exemption has been used, that might overcome this information gap (in principle, info on the requirements should be fulfilled as a *condition sine qua non* to apply this exemption).

Similarly, in the case of BPs, information on (possible) contaminants is often missing. This might happen for instance when BPs are consumed by the same legal entity that produced them, which is then exempted from registration. But if BPs are imported or placed on the market, they should fulfil the same registration and information requirements than any other substances under REACH.

However, it is considered to be a challenge to pass legislation that allows waste to cease to be waste without running the risk of the diffuse spread of harmful substances. For instance, the Swedish EPA and the Swedish chemicals agency are continuously working on guidance documents regarding non-toxic and resource efficient material cycles. Spain reports that in the light of a circular economy, it might happen that more and more EoW materials find their way onto the secondary raw material market without the necessary precautions for the environment and human health. In order to limit controversial effects, both article 5 and 6 of the WFD require an assessment on the overall adverse impacts on environment and human health.

2) Complying with chemicals legislation and documentation can be challenging for the industrial sector

Compliance with REACH and the costs involved are seen as barriers by the industrial sector, especially when it comes to the technical and economic feasibility to handle

material streams under EoW regimes. But it would not be environmentally sound nor feasible to allow after-waste materials not to be subject to chemicals and product legislation. EoW criteria should always include compliance with REACH as a condition.

Denmark mentioned that only a few Danish companies apply the EoW criteria for metal scrap (if any at all). National stakeholders have explained that the obligations under REACH are not favourable to their business and that they mostly consider metal scraps as waste and, since usually exports of metal scraps are in line with the waste law.

The documentation requirements of the REACH regulation related to iron/aluminium scrap were also named as a barrier to using material streams under EoW and BPs rules.

Barriers to the economic feasibility of handling material streams under EoW or BP regimes

1) Competition of EoW and BPs with raw materials and lack of demand by the market

Low prices of primary raw materials, lack of demand for EoW products or BPs as well as high costs of recycling and producing high-quality material were often mentioned as economic barriers to managing material streams under EoW and BP regulations.

2) Lack of markets for EoW and BPs

Lack of proper markets and a lack of information about the existence of markets were also mentioned as a problem. In particular, it has been mentioned that if there is no market, the conditions for BPs and EoW are not applied and taken-up to high extend.

3) Taxes

The Czech Republic mentions that particularly low landfilling taxes create competition with the marketing of EoW and BP. Portugal mentioned a tax on BPs as a barrier: in order to obtain the classification of the BP, the requesting entity has to submit a request to the Portuguese EPA through a form, according to term 3, Article 44 of legislation 178/2006 and its revised version 73/2011 on waste legislation. (diploma RGGR). This request is subject to a fee of 5000 Euros. [25]

4) Costs for permitting

In some cases, investments needed to meet the requirements might be a barrier. There are also producers who probably do not feel the need to certify the product as they will find a use for their material under the waste regime as well.

Barriers providing and distributing knowledge and innovation including exchange

1) Lack of standards and data

There might not always be enough data to allow for comparisons to be made between a product that is made of waste and a product that is made of raw materials, for instance on certain technical properties or performance.

[25] https://apambiente.pt/index.php?ref=16&subref=84&sub2ref=957&sub3ref=958

Standards for a product are helpful, but often standards do not allow and are not intended for comparing materials and products made out of primary and secondary resources. This often leads to different interpretations by different parties involved.

Barriers to public perception and consumer acceptance of material streams

1) Lack of awareness about BPs or EoW products and low public perception

Low public perception and stakeholder awareness about BPs or EoW materials is often mentioned as a barrier affecting the acceptance of and the demand for these materials. Often there are fears that recycled materials might affect production quality and the demand for products (e.g. farmers might be afraid of using treated sewage sludge because the demand for their products might decrease even if the sewage sludge fulfils the relevant quality criteria). In some other cases, uncertainties about new waste streams and BPs are mentioned. In general, although the public´s perception of sorting and recycling issues is improving (as highlighted by Italy), the general public is still suspicious in terms of use and applying of recycled materials. Awareness campaigns, quality assurance systems and the sharing of success stories about EoW materials and their uses can help increase their acceptance.

Barriers to the trans-frontier shipment of EoW materials or BPs between MS and to third countries

1) Approaches, criteria, and standards might differ substantially across the MS and outside the EU

Lack of coherence among MS and their different approaches on established criteria, and the classification as waste or non-waste were mentioned by many as a major barrier to the trans-frontier shipment of EoW materials or BPs. Article 28 of Regulation (EC) No 1013/2006 on shipments of waste states that in case of disagreements between MS on the status of waste or non-waste, the material shipped between them should be considered as waste and thus the strictest controls apply.

The criteria established at the national level by a MS are only applicable within that particular country, which tends to confuse companies trading with raw materials across country borders. Companies must be aware of the distinction between a BP or EOW and waste in the country of the shipment´s destination and possible transit countries. It is mentioned for instance that in some cases, a product which is an EoW product in one country does not fulfil the criteria of another country. Austria provided the example of filter dust (waste code: 10 02 07*) which has been considered EoW in Austria but was not accepted as such in the receiving Member State due to possible emissions of organic pollutants when used in the cement industry. Similar or harmonised approaches to EoW and BPs in the EU MS or on an EU level would ease trans-frontier shipments.

The different regulations among the MS can also pose competitive disadvantages for companies located in MS applying higher environmental standards, especially if materials with lower quality requirements are introduced as a BP or EoW.

Moreover, the notion of 'BPs' does not seem to be well defined outside the EU. When exporting EoW materials or BPs to countries outside the EU, exporting companies need to be aware that the material in question may be considered a waste in the country of destination. For trans-frontier shipments outside the EU, the requirements of Article 28 of the Waste Shipment Regulation also apply. It has been mentioned that there is

no clear process of how national or case-by-case decisions on EoW or BPs could be mutually recognised/accepted by other EU or non-EU MS. Therefore, operators are often not sure if the procedures of the Waste Shipment Regulation should be followed when EoW/BP material is shipped abroad. The operator has to take into account that multiple procedures may have to be followed when shipping a certain material: material can be shipped as a product to one Member State or country, but when shipped to another Member State or country the Waste Shipment Regulation might apply. This may cause unequal competition between different countries and companies. Furthermore, these discrepancies lead to shipments being stopped (e.g. at borders), sometimes for longer periods, before eventually being accepted or refused. This has been often reported as a barrier to trade and free movement of materials that could be recycled.

Potential solutions should be assessed to solve disputes more rapidly or to facilitate the different applicable procedures.

2) Traceability of material

Since the Waste Shipment Regulation and international agreements (e.g. Basel Convention, OECD Decision) for trans-frontier shipments of waste are not applicable in case of transports of BPs or EOW, there may be uncertainties regarding the traceability of the materials. It has been mentioned that as soon as these materials lose the status of waste, their traceability is lost (see also Chapter on Case 4: EoW and BP to facilitate trans-frontier shipment).

4.5.8.2 Drivers identified by MS authorities

Not many respondents were able to identify drivers. The following aspects were mentioned as potential drivers. In addition, the guidance paper "Making the circular economy work: Guidance for regulators on enabling innovations for the circular economy" was screened in order to derive main drivers/barriers.

Drivers related to appropriate institutional set-up to enable the establishment of rules for EoW and BPs (see also guidance paper "Making the circular economy work: Guidance for regulators")

1. Appropriate legislative framework

An appropriate legislative framework is required to provide for appropriate procedures for assessing and deciding on EoW and BP status. The Czech Republic has identified adapting new legislation in general as a potential driver, whereas other respondents mention recently adopted national legislation/guidance as a driver, such as Greece has done for the recently adopted National Action Plan on Circular Economy.

2. Clearly defined criteria on EoW and BPs

Establishing appropriate criteria for EoW and BPs is often mentioned as a driver. Estonia for instance reports that the planned new national EoW criteria for oil-containing wastes might create a legal basis for producing a substance or mixture which could be used as a fuel, a process which has until now posed difficulties in terms of obtaining permits under current legislation. For this specific examples it must be however highlighted that this does not promote regeneration of waste oils, but rather conversion into fuel (energy recovery or incineration), which is lower in the waste hierarchy than recycling. Hence, the contribution of EoW and BPs criteria to circularity

should be also carefully considered when developing them and different national efforts in developing such criteria might not be as efficient and effective in safeguarding respect for the concept of the waste management hierarchy as initiatives and agreements on an EU level on such criteria.

Other respondents have reported that it might be easier to bring non-waste materials back to the market since there are fewer legislative constraints. There are, however, the barriers already mentioned in context with the requirements under REACH and other relevant product and chemicals legislation (see Chapter on barriers).

3. Appropriate distribution of competences among the different institutions

An appropriate distribution of competences among the relevant institutions was mentioned as a driver, although opinions differ when it comes to what the best option might be (centralised or decentralised competences, regional versus national). Some respondents regarded a distribution of competencies among multiple institutions as a barrier, whereas others considered it a driver (see also Chapter on barriers). For instance, Italy reports that regional competences for issuing criteria can speed up enforcement of the provisions of Articles 5 and 6 of the WFD.

4. Cooperation between regulators

Beyond an appropriate distribution of competencies, cooperation between all environmental and other regulators is extremely important, especially when developing circular innovations (i.e. mutually aligned inspection plans).

5. Proactively working with businesses

Regulators can work proactively with businesses to help examine possible new markets for secondary new materials, to identify and match suppliers and users, support the development of new circular economy ideas and business models, and to encourage businesses to develop new ways of thinking for their own contexts.

In Croatia, industry is involved in establishing criteria and in the final consultations on drafted legislation. Industry associations send their representatives to working groups responsible for establishing an ordinance where national criteria are defined.

Ireland In Northern, Invest NI (Northern Ireland's regional development agency) provides governmental support through an Industrial Symbiosis service to match industries offering and demanding industrial BPs.

6. Boost the role of environmental management systems

A further instrument that regulators can use to encourage circular thinking in businesses is applying an environmental management system (whether EMAS, ISO 14001 or others). Environmental management systems encourage businesses to adopt a holistic approach to thinking about the environmental performance of a business and regulators could encourage businesses to carry out analyses of the materials they use and produce (waste/secondary raw materials) to stimulate change and improvements in the future.

Drivers related to existing strategies on resources, products policy, and chemicals legislation

Existing strategies on resources, products policy, and chemicals legislation (e.g. the EU Circular Economy Package, the Roadmap to a Resource-Efficient Europe under the Europe 2020 Strategy, the REACH Regulation, etc.) were mentioned by some respondents as drivers for using material streams under EoW and BPs rules. It was also highlighted that the use of EoW with a known and consistent composition might be easier. Also, less administration for materials falls under product legislation is seen as a driver in the management of material streams considered as EoW and BPs.

In the UK, the development of "Quality Protocols"[26] is an example of various agencies and departments coming together in innovative ways, with a consistent system in place that includes engagement with industry and other sectors. In Northern Ireland, the Waste Management Strategy 'Delivering Resource Efficiency` includes a section on 'EoW' and the development of 'Quality Protocols'. The Department for the Economy in Northern Ireland has recently conducted a consultation on its proposed Industrial Strategy 'Economy 2030'. Finally, another driver is a legislative framework that is fit for the intended and based on feedback from the regulators.

Another option consists of developing EoW and BP strategies as part of Waste Management Plans and Waste Prevention Programmes, although no concrete examples in MS could be found.

Drivers related to the economic feasibility of handling material streams under EoW or BP regulations

1. Higher revenues from the sale of a product than from the sale of a waste

Turning waste and BPs into resources can increase revenues and therefore the attractiveness of the business. For example, Bulgaria reports that consumers perceive BPs used for pellets and briquettes obtained from sunflower husks or wood waste as economically more competitive on the market.

2. Creation of a dedicated market-place for EoW and BPs

In many cases, a lack of markets or even of information on existing markets for EoW and BPs were regarded as a barrier. The creation of dedicated markets can make it easier for industries to turn waste into a valuable resource for other purposes, as in the example of the Spanish region of Catalonia, where initiatives such as the "Bolsa de Subproductos" ("Stock market of by-products") have been established for years[27]. Other respondents have mentioned that the handling of EoW materials gives access to the free market and leverages prices. Developing databases on other circular economy issues, such as digital market places bringing together demand and supply of secondary raw materials, might also act as a driver.

[26] http://www.wrap.org.uk/content/quality-protocols

[27] https://www.residuosprofesional.com/tag/bolsa-de-subproductos-de-cataluna/

Drivers related to the providing and distribution of knowledge and innovation, including exchange (see also guidance paper "Making the circular economy work: Guidance for regulators")

1. Sharing best practices between MS or between different institutions

Sharing knowledge was mentioned as a potential driver. Sharing knowledge among different responsible institutions in the same country was also regarded as particularly important, as well as establishing collaboration between different authorities, stakeholders and universities. Collaboration between different stakeholders can managed though advisory bodies: the Waste Committee in Estonia for instance, which involves members of different authorities and waste experts, is an example of such an advisory body. Workshops and capacity-building events with Regional Inspectorates (RIEWs) and businesses are regularly held on the subject of waste management to exchange views and hold debates on issues regarding waste management at a national level, including end-of-life and BPs issues. Another useful instrument is a voluntary database for secondary raw materials or EoW decisions. Similarly, creating platforms or forums for sharing ideas or feedback (for example on regulatory barriers) can also act as a driver.

2. Research and innovation for new EoW streams and BPs

Some respondents mention that research and innovation can act as a driver. Some MS have already taken action. In Portugal, the public research agency (LNEG) has launched projects to provide and disseminate knowledge and innovation including an exchange between the administrative authority level and the industrial sector. Support for university research, e.g. on producing low-pollutant materials or on how virgin materials can be substituted, can also act as a driver.

3. Improve the provision of information in permitting processes

The amount and level of detail of the information to be provided in order to obtain a permit is often unclear, which slows down the permitting process. This is particularly relevant in the process of acquiring or updating new permits. Collaboration with business operators to clarify the type and detail of information to be provided; proof or substantiation or even an exchange of information which the operator has already provided for another region or Member State might act as a driver.

Drivers related to public perception and consumer acceptance of material streams

1. Use of EoW and BPs which have been used for some time

Public perception is mentioned as an important factor which can act either as a barrier or as a driver. For waste material which is known to have been used for some time as input material for other activities (e.g. glass cullet, metal scrap, used paper, used tyres, plastic flakes) consumer acceptance, typically in B2B, is highly satisfactory.

2. Ensuring high quality EoW and BPs

Ensuring high quality "new" EoW products and BPs might act as a strong driver. One example is for instance the new EoW criteria for diapers developed in Italy, which should ensure that the complexity of materials embedded in the product find their way in the recycling route.

Drivers related to the trans-frontier shipment of EoW or BP between the MS and to third countries

Harmonised national, or agreed EoW criteria on an EU level would drive a more efficient transport of the concerned EoW materials, as the sometimes burdensome procedures and obligations in waste shipment legislation would not be applicable.

4.5.9 Case decisions at the Court of Justice of the European Union (CJEU)

Specific case law decisions by the European Court of Justice taken on end-of-waste / by-product issues may provide guidance and insight in order to establish proceedings at national level. The following Court cases are listed as examples:

- Judgment of the Court (Second Chamber) of 28 March 2019 on involved parties **AS Tallinna Vesi versus Keskkonnaamet**: The topic covers **specific end-of-waste criteria for sewage sludge which has undergone recovery treatment** for which no criteria at European Union or national level were defined (**Case C-60/18**)

- *Ruling: Article 6(4) of Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives must be interpreted as meaning that:*
  - *it does not preclude national legislation, such as that at issue in the main proceedings, under which, where criteria have not been set at European Union level for determining end-of-waste status as regards a specific type of waste, such end status depends on the existence of criteria laid down in a generally applicable national legal act concerning that type of waste, and*
  - *it does not allow a waste holder, in circumstances such as those in the main proceedings, to demand the recognition of end of waste status by the competent authority of the Member State or by a court of that Member State.*

- Judgment of the Court (Eighth Chamber) of 2 May 2019 on involved parties **European Commission versus Republic of Croatia**: The topic covers a failure of a Member State to fulfil obligations under Directive 2008/98/EC (Article 13 - Obligation of MS to ensure protection of human health and of the environment - Article 15(1) - Obligation to have waste treated by the holder or other designated persons) declaring **stone aggregates as by-products which does not fall within the concept of a 'by-product'** - (**Case C-250/18**):

- *Declaration: The Court declares that, by failing to consider that the stone aggregate deposited in Biljane Donje (Croatia) is waste, rather than a by-product, and must be treated as waste, the Republic of Croatia has failed to fulfil its obligations under Article 5(1) of Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives; by failing to take all the measures necessary to ensure that management of the waste deposited in Biljane Donje is carried out without endangering human health or harming the environment, the Republic of Croatia has failed to fulfil its obligations under Article 13 of Directive 2008/98; by failing to take the measures necessary to ensure that the holder of the*

waste deposited in Biljane Donje treats the waste himself or has the treatment handled by a dealer or an establishment or undertaking that carries out waste treatment operations or by a private or public waste collector, the Republic of Croatia has failed to fulfil its obligations under Article 15(1) of Directive 2008/98.

- Judgment of the Court (Fourth Chamber) of 3 October 2013 on involved parties **Donal Brady versus Environmental Protection Agency (Ireland)**: The topic covers **slurry produced in a piggery and stored there pending its transfer to farmers who use it as fertiliser on their land aiming the question classification as 'waste' or 'by-product'** (**Case C- 113/12**).

- *Ruling:*
    - *The first subparagraph of Article 1(a) of Council Directive 75/442/EEC of 15 July 1975 on waste, as amended by the European Commission Decision 96/350/EC of 24 May 1996, must be interpreted as meaning that slurry produced in an intensive pig farm and stored pending delivery to farmers in order to be used by them as fertiliser on their land constitutes not 'waste' within the meaning of that provision but a by-product when that producer intends to market the slurry on terms economically advantageous to himself in a subsequent process, provided that such reuse is not a mere possibility but a certainty, without any further processing prior to reuse and as part of the continuing process of production. It is for the national courts to determine, taking account of all the relevant circumstances obtaining in the situations before them, whether those various criteria are satisfied.*
    - *European Union law does not preclude the burden of proving that the criteria for finding that a substance such as the slurry produced, stored and transferred in circumstances such as those of the main proceedings constitutes a by-product are met from resting on the producer of that slurry, provided that this does not result in the effectiveness of European Union law, and in particular of Directive 75/442, as amended by Decision 96/350, being undermined and that compliance with the obligations flowing from European Union law is ensured, in particular the obligation not to make subject to the provisions of that directive substances which, on application of those criteria, must, under the Court's case-law, be regarded as by-products to which the directive does not apply.*
    - *Article 2(1)(b)(iii) of Directive 75/442, as amended by Decision 96/350, must be interpreted as meaning that, where Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources has not been transposed into the law of a Member State, livestock effluent produced while operating a pig farm located in that Member State cannot be considered to be, by virtue of the existence of the latter directive, 'covered by other legislation' within the meaning of that provision.*
    - *In a situation where slurry produced and held by a pig farm is to be classified as 'waste' within the meaning of the first subparagraph of Article 1(a) of Directive 75/442, as amended by Decision 96/350:*
        - *Article 8 of that directive must be interpreted as precluding the holder from being authorised, under any conditions, to transfer that waste to a farmer who uses it as fertiliser on his land if it transpires that that farmer neither possesses the permit referred to in Article 10 of the directive nor is exempted from the requirement to possess such a permit and registered in accordance with Article 11 of the directive; and*

- *Articles 8, 10 and 11 of the directive, read together, must be interpreted as precluding the transfer of that waste by the holder to a farmer who uses it as fertiliser on his land, and who possesses a permit as referred to in Article 10 or is exempted from the requirement to possess such a permit and is registered in accordance with Article 11, from being subject to the condition that the holder assumes liability for compliance by that other farmer with the rules that are to apply to the recovery operations carried out by the latter by virtue of European Union law concerning the management of waste and fertilisers.*

- Judgment of the Court (Second Chamber) of 7 March 2013 on involved parties **Lapin elinkeino-, liikenne- ja ympäristökeskuksen liikenne ja infrastruktuuri –vastuualue versus Lapin luonnonsuojelupiiri ry**: The topic covers old telecommunications poles treated with CCA (copper-chromium-arsenic) solutions — Registration, evaluation and authorisation of chemicals — Regulation (EC) No 1907/2006 (REACH Regulation) — List of uses for treated wood in Annex XVII to the REACH Regulation — Old telecommunications poles used as underlay for duckboards) **(Case C-358/11)**

- *Judgement:*
  - *1) This request for a preliminary ruling concerns the interpretation of Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (OJ 2008 L 312, p. 3) and of Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC (OJ 2006 L 396, p. 1 and corrigendum OJ 2007 L 136, p. 3), in its version resulting from Commission Regulation (EC) No 552/2009 of 22 June 2009 (OJ 2009 L 164, p. 7) ('the REACH Regulation').*
  - *2) The request has been made in proceedings between Lapin elinkeino-, liikenne- ja ympäristökeskuksen liikenne ja infrastruktuuri –vastuualue ('transport and infrastructure section' of the Lapland Centre for Economic Development, Transport and Environmental Responsibility; the 'liikenne ja infrasruktuuri – vastuualue') and the Lapin luonnonsuojelupiiri ry (Lapland Nature Protection Association) concerning repair works to a track made up of duckboards whose infrastructure consists of old wooden telecommunications poles treated with a solution known as 'CCA' (copper-chromium-arsenic) ('CCA solution').*
- *Ruling:*
  - *European Union law does not, as a matter of principle, exclude the possibility that waste regarded as hazardous may cease to be waste within the meaning of Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives if a recovery operation enables it to be made usable without endangering human health and without harming the environment and, also, if it is not found that the holder of the object at issue discards it or intends or is required to discard it within the meaning of Article 3(1) of that directive, this being a matter for the referring court to ascertain.*

- *Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC, in the version resulting from Commission Regulation (EC) No 552/2009 of 22 June 2009, in particular Annex XVII thereto, in so far as it authorises the use, subject to certain conditions, of wood treated with a 'CCA' (copper-chromium-arsenic) solution, must be interpreted as meaning that, in circumstances such as those in the main proceedings, it is relevant for the purpose of determining whether such wood may cease to be waste because, if those conditions were fulfilled, its holder would not be required to discard it within the meaning of Article 3(1) of Directive 2008/98.*
- *Articles 67 and 128 of Regulation No 1907/2006, in the version resulting from Regulation No 552/2009, must be interpreted as meaning that European Union law harmonises the requirements relating to the manufacture, placing on the market or use of a substance such as that relating to arsenic compounds which is the subject of a restriction under Annex XVII to that regulation.*
- *Annex XVII, point 19(4)(b), to Regulation No 1907/2006, in the version resulting from Regulation No 552/2009, which lists the applications for which, by way of derogation, wood treated with a 'CCA' (copper-chromium-arsenic) solution may be used, must be interpreted as meaning that the list in that provision is exhaustive in character and that, therefore, that derogation cannot be applied to cases other than those referred to therein. It is for the referring court to determine whether, in circumstances such as those at issue in the main proceedings, the use of the telecommunications poles concerned as an underlay for duckboards does in fact come within the scope of the applications listed in that provision.*
- *The provisions of Annex XVII, point 19(4)(d), second indent, to Regulation No 1907/2006, in the version resulting from Regulation No 552/2009, according to which wood treated with a 'CCA' (copper-chromium-arsenic) solution must not be used in any application where there is a risk of repeated skin contact, must be interpreted as meaning that the prohibition at issue must apply in any situation which, in all likelihood, will involve repeated skin contact with the treated wood, such likelihood having to be inferred from the specific conditions of normal use of the application to which that wood has been put, this being a matter for the referring court to ascertain.*

5. Case studies on BPs and EoW applications

5.1 Identifying case studies and stakeholder consultation

In this subtask, industrial actors and European and national federations have been asked on what they perceive as optimal, functional cases and as suboptimal cases on EoW and BPs. A total number of 41 stakeholders (38 industry associations, 2 NGOs and 1 company, list see Annex to Chapter 5.1: List of industry/NGOs contacted) have been contacted (on prior agreement with the European Commission) for completing a specific industry/NGOs questionnaire (see Annex to Chapter 5.1: Template written questionnaire to industry/NGOs representatives). The international industry associations and federations have distributed the questionnaires among their national members, who in turn shared them among their partners. Some federations opted to compile all info from individual members into the questionnaire prior to sending back, whereas others chose to complete the questionnaire themselves and directly send back the completed questionnaire. As few industry associations did take the effort to compile their member's info into the questionnaire, the latter approach has mostly been followed.

5.2 Selecting cases for in-depth analysis

In the end, we received a total of 42 duly filled out questionnaires and 4 responses in the text body part of e-mails for identifying case studies. Out of the information gathered in the Member States consultation and in combination with info on LIFE projects provided by the Commission, we were able to make a list of 57 cases, hence implying that every response may contain several cases, covering both waste stream and procedural cases. Every single case has been framed based upon several highlighted topics which were used for internal use. A full compilation of all cases (long list) can be found in Annex to Chapter 5.2: Long list of cases for in-depth analysis.

5.2.1 Scoping

Using the headings and main topics, the 57 cases have been analysed in an overview table, taking into account its geographical distribution, the material stream covered, the distribution over EoW and BPs, the spread over EU regulations, national legal provisions or case-by-case decisions, the (scarce) availability of market information, the evaluation on whether the case is well or poorly organised, the focus on the precautionary principle or on a liberal market approach. This overview table is included in Annex to Chapter 5.2: Long list of cases for in-depth analysis.

The selection was made by means of searching for a balance between the following aspects:

- Spread over BP and EoW cases.
- Geographical distribution over the whole EU market.
- Focus on implementation of EU regulations, national regulations, case-by-case decisions.
- Share of precautionary and liberal cases.
- Focus on priority material streams.
- Size of the sector or market covered.
- Needs for harmonisation.

The aim was to select 10 cases out of a list of 57 which, as a whole, would fulfil all mentioned aspects in a balanced way.

5.2.2 Analysing step

Spread over BP and EoW cases:

42 cases refer to existing or desired EoW solutions, whereas 12 refer to BPs and 3 cases cover both EoW and BPs.

Geographical spread over the whole EU market:

- 14 cases have a Union-wide span
- 8 cases cover a selection of more than one MS
- 7 cases refer to northern MS, either because it is the case in one specific Scandinavian Member State, or because the case is spread over MS among which some northern MS.
- 13 cases refer to southern MS, either on its own or grouped
- 6 cases refer to eastern MS , out of this only one case refers to one MS (the Czech Republic), all others are grouped
- A large group of 29 cases refers to western MS, either on its own or grouped

Particularly western MS show more concern about EoW and BP issues. In any case, the aim is to achieve a balance between Union-wide, grouped, and western, eastern, southern and northern cases.

Focus on implementation of EU regulations, national regulations, case-by-case decisions:

From the case descriptions it is not always apparent whether the respondents aim at or refer to case-by-case decisions, national implementation rules or (desired) EU regulations. We identified, however, the following distribution: 7 referrals to EU regulations, 26 to national or needed national, provisions and 24 to case-by-case decisions, often based on self-assessment. We respected this spread when selecting the short list.

Spread over precautionary and liberal cases:

A large majority of 45 cases refers to, or requests, a more liberal approach of the EoW of BP status attribution. This also reflects the nature of the industry respondents. Only 12 cases refer in one way or another to the precautionary principle, often referring to existing examples. This focus on liberal principles is also reflected by 12 cases that can be interpreted as material streams placed on the wish list to obtain actually not yet existing applications as EoW of BP. We included both liberal and precautionary cases in the short list.

Focus on priority material streams - the following material streams are mentioned:

- slags (mentioned 8 times)
- plastics (mentioned 6 times)
- CDW (mentioned 6 times)
- fly ash and filter dust (mentioned 3 times)
- bottom ashes (mentioned 3 times)
- metal scrap (mentioned 3 times)

- incinerable wastes (mentioned 2 times)
- soil and stone (mentioned 2 times)
- paper and cardboard (mentioned 2 times)
- tyres (mentioned 2 times)
- mentioned once: whey and colostrum, asphalt, biodegradable wastes, mixed municipal waste, wood, food sludges, digestate, chemicals, glass, wastewater sludge, roadside grass, diapers and the like.

Size of the sector or market covered:

Nearly no data on market size or market impact could be collected with the questionnaires. The size of the sector or the market is often related to the nature of the material. The following markets are included: metallurgy, construction and demolition market, plastic industry, metal treatment industry, waste incineration.

Market impact:

Not all cases are fit for statistical analysis covering data on the Waste Statistics Regulation published by EUROSTAT. Nevertheless for some cases the market size is assessed using following query in the EUROSTAT [env_wasgen] database:

Generation of waste by waste category, hazardousness and NACE Rev. 2 activity [env_wasgen]		
Last update	23.05.19	
Extracted on	31.05.19	
Source of data	Eurostat	
UNIT	Tonne	
HAZARD	Hazardous and non-hazardous - Total	
NACE_R2	All NACE activities plus households	
WASTE	TIME/GEO	European Union - 28 countries
Total waste	2016	2 537 770 000
Plastic wastes	2016	17 590 000
Animal and vegetal wastes (subtotal, W091+	2016	95 280 000
Household and similar wastes	2016	167 100 000
Mineral waste from construction and demoliti	2016	344 720 000
Combustion wastes	2016	117 720 000
Metallic wastes (W061+W062+W063)	2016	98 580 000

Figure 2 Example of analysing EUROSTAT data

Needs for harmonisation:

Six cases mention explicitly the need of Union-wide harmonisation for EoW or BP decisions actually taken at a national or case-by-case level. The short list reflects this need for harmonisation.

5.2.3 Selection of the short list

The selection of 10 short list cases bundles 29 of the 57 long list cases. It contains 4 mixed cases and 6 EoW cases. It guarantees a spread over eastern, western, northern and southern MS while also covering 5 Union-wide cases. It focusses mainly on national provisions. 7 cases deal with case-by-case decisions and in 2 cases EU regulations are discussed. Although most cases are of a liberal nature, in 4 cases precautionary aspects are covered as well. Priority material streams like slags, CDW, RDF, bottom ashes, metal scrap are covered. Large sectors and markets like metallurgy, construction and demolition, waste incineration and metal treatment are covered. Needs for harmonisation are well addressed by the selected cases. The 10 selected cases are presented in the following Table.

Table 8: Short list with 10 selected cases (agreed upon with the EC)

No.	Short title of the selected case	Key data on the case
1	Metal bearing slags used as raw material under an EoW status	• EoW and BP cases • Covers Union-wide cases, southern, western, northern MS cases • Covers national provisions and case-by-case decisions • All presented cases have a liberal, non-precautionary scope • Slags appear in 8 long-listed cases • Covers the metallurgy sector (slags are a part of combustion waste, which represent a yearly market of 117 million tonnes or 3.2 % of total waste generation) • Implicit reference to harmonisation needs
2	Mineral construction and demolition wastes broken into granulates and used as a building material under EoW status	• EoW case • Covers Union-wide and grouped cases as well as individual cases including western, eastern MS • Covers mainly national provisions as well as the need for case-by-case decisions • Contains both precautionary and liberal cases • CDW appears in 6 longlisted cases excluding asphalt, 5 of these are possibly referring to use as a building material • Covers the construction and demolition sector (but not tunnels, excavated materials, road construction, mineral wastes from construction represent a yearly market of 335 million tonnes or 13.6 % of total waste generation) • Strong need for harmonization and clarity
3	Refuse derived fuel and solid recovered fuel as EoW material	• EoW case • Covers Union-wide and grouped cases including western, eastern, southern MS • Covers mainly national provisions • Contains one precautionary and one liberal case • RDF appears in 2 longlisted cases • Covers the waste incineration sector, no data on RDF or wastes fit for RDF in the EUROSTAT database, as RDF can be retrieved from all incinerable wastes (household waste, an important source of RDF, represents 167 million tonnes or 6.6 %) • Need for harmonization
4	EoW and BP to facilitate trans-frontier movement	• Both EoW and BP cases • Covers Union-wide and grouped cases as well as individual cases including western, northern, eastern, southern MS • Covers national provisions, case-by-case decisions and a request for EU regulation • Contains mainly liberal cases • Trans-frontier shipment is mentioned in 6 longlisted cases, wastes mentioned are bottom ashes, plastics and filter dust • Covers the waste incineration sector, the plastics sector and many others (Eurostat does not contain data on EoWs or BPs fit for trans-frontier movement, the market for trans-frontier movement of some non-hazardous wastes can be assessed based on COMEXT statistics: plastic waste contains 2.4 million tonnes for intra EU shipment and 2 million tonnes for extra EU shipment, rubber waste contains 0.3 million tonnes for intra EU shipment and 0.9 million tonnes for extra EU shipment, glass waste contains 2.4 million tonnes for intra EU shipment and 0.1 million tonnes for extra EU shipment, iron scrap contains 29.4 million tonnes for intra EU shipment and 21.5 million tonnes for extra EU shipment) • Need for harmonization to facilitate trans-frontier trade
5	Metal scraps and residues, other than slags and ashes	• Mainly EoW, one suggestion for BP • Covers western and southern MS

No.	Short title of the selected case	Key data on the case
		• Covers EU regulations and one suggestion for national provisions • Contains only liberal cases • Metal scrap is mentioned in 3 longlisted cases • Covers the metal treatment industry (metal wastes excluding slag and ashes which are classified as combustion wastes represent a yearly market of 99 million tonnes or 3.9 %) • No need for harmonization as the EU regulation apparently functions well
6	EoW criteria for rubber from tyres	• Due to recent debates • EoW case • Covers a grouped case as well as an individual case including western, northern, southern MS • Covers the need for national provisions and case-by-case decisions • Contains both liberal and precautionary cases • Tyres are mentioned in 2 longlisted cases (rubber wastes represent a yearly market of 3.4 million tonnes or 0.13%. This represents however 19 % of all separately collected plastic wastes) • Covers the rubber and car manufacture and maintenance industry • Need for harmonization
7	Digestate from anaerobic digestion	• Pure BP case • Covers a western Member State • Covers the need for national provisions • A liberal case • Mentioned in 1 longlisted case • Covers only a limited sector on anaerobic digesters (Eurostat does not contain figures on digestate from anaerobic digestion; the market is small although it can have a large potential; animal and vegetal wastes, possibly fit for digestion, represent 95 million tonnes or 3.8 %) • Need for harmonization
8	Non treated wood in natural form	• Pure BP case • Covers a western Member State • Covers the need for case-by-case decisions • A liberal case • Mentioned in 1 longlisted case • Eurostat does not contain figures on non-treated wood in natural form (source markets can be forestry, park management, gardening, households) • Need for harmonization
9	Registers and reporting obligations on case by case decisions	• EoW and BP case • Covers eastern, western and southern MS • Covers case-by-case decisions • A precautionary case • Mentioned in 1 longlisted case • No figures on market size can be retrieved for this more procedural case • Good and poor examples of harmonized approach at Member State level
10	EoW status of ashes from biomass combustion	• Based on a LIFE case • EoW case • Covers a southern MS • Covers the need for case-by-case decisions • A liberal case • Mentioned in 1 longlisted case • Covers a limited sector on forestry (Eurostat does not contain detailed figures on biomass ashes from forestry origin. It shows a yearly market of 30,000 tonnes or incineration wastes generated by agriculture, forestry and fishing) • Need for a harmonised approach

5.3 Case analysis

5.3.1 Case 1: Metal bearing slags used as raw material under an EoW status

5.3.1.1 Introduction and market situation

Slag is a generic name for a non-metallic rock-like material produced together with metallic products. It is generated when a desired metal is separated from raw ore and through primary and secondary metallurgical processes. We can distinguish ferrous and non-ferrous slag, depending on the type of metal production. Different categorisation is possible. In this study, we are using the following categories:

- Ferrous slag:
  - Using iron ore as raw material:
    - Blast Furnace slag (BF) from iron making, granulated or air-cooled;
    - Basic Oxygen Furnace slag (BOF) from steel converting (also called LD slag from "Linz–Donawitz-steelmaking");
    - Secondary Metallurgical Slag (SMS) from steel refining;
  - Using scrap-based material:
    - Electric Arc Furnace slag (EAF) from steel making (from carbon and from stainless and high alloy steel production);
    - Secondary Metallurgical Slag (SMS) from steel refining;
- Non-ferrous slag:
  - Copper slag;
  - Lead- and zinc containing slag;
  - Phosphorus slag;
  - Aluminosilicate slag;
  - Etc.
- Ferro alloys slags

There are no EUROSTAT data on the generation of slags. EUROSLAG holds statistics on ferrous slags based on a bi-annual survey within the sector. But for non-ferrous slag, no systematic information is available. Based on available data, IDEA (European Union, 2015)[28] calculated that about 46 million tonnes of ferrous slag are produced. Blast furnace slag accounts for the largest part (50-60%), basic oxygen furnace slag for about 20-25% and electric arc furnace slag accounts for about 10-20% of total slag[29]. The US National Slag association estimates that in the US the ratio of non-ferrous metal slags to total slag production is approximately 12%[30], which for the EU would mean a yearly production of about 6 million tonnes of non-ferrous slag.

The ferrous and non-ferrous slags differ in value chain, volume, composition as well as value. Non-ferrous slags very often have a medium to high economic value due to their residual content in other metals. Important drivers for using and valorising slags are cost efficiency and return on investment. Markets opportunities are impacted by the prices of recyclates and BPs of other industries, such as CDW, incineration ashes,

28 European Union (2015) Analysis of certain waste streams and the potential of Industrial Symbiosis to promote waste as a resource for EU Industry
29 EUROSLAG statistics (https://www.euroslag.com/research-library-downloads/downloads/)
30 NSA (2015) see http://www.nationalslag.org/common-uses-slag

etc., and on the presence of steel plants. A relatively well developed market for non-ferrous non-scrap metal waste exists within the EU, mainly concentrated in areas where the iron and steel and non-ferrous metal industries are located.[28] Most of slags are traded intra-EU. The extra EU28 trade for slags is relatively small. Import of ferrous slags represents less than 1% of the total amount produced in the EU28. Exports are slightly bigger but still less than 1%. The main reason for this is the bulk nature of slags and the transport costs in relation to the price of slags.[31]

The legal status of ferrous slag, i.e. their classification as waste, product or BP has been discussed worldwide for many decades. In the view of the sector, slags are either intentionally generated BP that should not be classified as waste, or EoW products losing their waste status (EoW). The sector sees thus two possibilities[32]:

1. Slag is considered as a BP already in the liquid state, directly after its manufacture, with or without processing steps within the normal industrial practices;
2. Slag is first considered as waste, but ceases to be waste to become EoW after a number of recovery measures.

In its Interpretative Communication on waste and BPs (COM(2007) 59 final of 21.2.2007), the European Commission assessed blast furnace slag (BF) as a material which can be considered to fall outside the definition of waste. In practice, BF slag is indeed more generally considered as product than the other types of ferrous slag. In the Guidance on the interpretation of key provisions of Directive 2008/98/EC on waste (EC, 2012), examples and clarification on when a slag can be considered a BP are provided. The status of slags differs between MS.[32] For instance, in Austria the use of steel mill slag as aggregates for construction is regulated in the Recycled Construction Materials Regulation. In Flanders (Belgium), a Ministerial Decree[33] defines which materials related to the metallurgical industry are considered to be raw materials (Flanders does not differentiate between EoW and BP[34]). In Portugal, slags from ferrous and non-ferrous melting processes, have been accepted as BP.

Slags that are classified as a product, BP or EoW need to be registered under REACH. The different ferrous slag families have been registered in 2009.[32] Also ferro-alloys slags and non-ferrous slag like copper, lead-zinc and ferro-chromium slag and phosphorus slag have been registered[35].

Other relevant legislation is the Water Framework Directive (2000/60/EC) and the Groundwater Directive (2006/118/EC), which impact the conditions that slags must meet to be used in for instance road construction. The environmental issue targeted is

31 Handley P, Basuyau (2019) Legal and environmental bottlenecks and opportunities for slag-based products valorisation, Proceedings of the 6th International Slag Valorisation Symposium, retrieved from https://www.academia.edu/38774637/LEGAL_AND_ENVIRONMENTAL_BOTTLENECKS_AND_OPPORTUNITIES_FOR_SLAG-BASED_PRODUCTS_VALORISATION

32 EUROSLAG (2012) Position Paper on the Status of Ferrous Slag complying with the Waste Framework Directive (Articles 5 / 6) and the REACH Regulation, April 2012, retrieved from https://www.euroslag.com/wp-content/uploads/2019/01/Position_Paper_April_2012.pdf

33 Ministerieel Besluit van 4 september 2012 houdende de lijst met materialen, afkomstig van en bestemd voor metallurgische productieprocessen voor non-ferrometalen, en de lijst met materialen, afkomstig van metallurgische productieprocessen voor ferrometalen, die als grondstoffen worden gebruikt, consulted via https://www.ovam.be/sites/default/files/MB%20metallurgie%20BS%2024%2010%202012.pdf

34 In Flanders, the terms "BP" and "EoW" have been transposed as defined in the WFD. In practice, however, the same criteria and conditions apply. A material is considered a raw material or a waste, regardless of whether it has once been waste or not. The reasoning of the Flemish Waste Agency is that the same material should not be meeting different criteria and conditions just because of a juridical definition (waste or BP).

35 https://echa.europa.eu

the potential leaching of hazardous substances from the used slag. Also the Construction Products Regulation (CPR, 305/2011/EU) and national product standards impose conditions the BP or EoW slag need to meet when used in construction products.

5.3.1.1 Treatment options

Non-ferrous metal slags are often[36] reused and reprocessed to extract in each step additional and/or other metals as far as technically and economically feasible. The final stage slag, with the amount of non-ferrous metal reduced to the lowest extent that can economically and technologically be extracted, is put on the market for the construction of roadways, infrastructure and buildings, or are landfilled. Landfilling options differ across MS, e.g. with regard to prices, prohibition rules and pre-treatment standards.[28]

Ferrous slags can undergo different types of treatment, depending on the intended utilisation. Slags are cooled (soft or rapid), physically modified (crushed, sieved, milled) and specific substances could be added (e.g. sand, oxygen). The aim of the treatment is to influence the properties of slags to make them comply with relevant requirements of European or national product standards, such as volume stability or glassy content.[32]

Following EUROSLAG statistics (2016)[37], about 80% of Blast Furnace slag is used in cement or as concrete addition, and about 20% is used in road construction. A small fraction is used as glass raw material, mineral wool, lime fertiliser or soil stabilization[38]. Most countries have an utilisation rate of 100% [32]

Steelmaking slags are also used in transportation construction, e.g. road, railway, waterway and earthworks (46%), metallurgical use (15%), in cement / concrete (4%) and as fertiliser in agriculture. Only a small part of the steelmaking slag is landfilled (14% in 2016). Reasons for landfilling can be the fine grained properties of the slag or in specific cases the environmentally related leaching behaviour.[37] Some general bottlenecks are the absence of a harmonised regulatory framework that allows access to the market and a general poor knowledge of the properties of metallurgical slags.

Non-ferrous slags and ferro-alloys slags are also used in different applications and mainly in road applications, or in precast concrete as secondary aggregates to substitute for natural aggregates (gravels) that are becoming scarce. The uses/applications of those slags are described in the Non-Ferrous Metal BREF[39]. Like the slags from steel productions, the non-ferrous slags and ferro-alloys slags are subject to compliance with a series of official standardised specifications.

[36] Ferro-alloy slags are usually used directly in further applications without an additional extraction stage. The preliminary physical treatments, like crushing and screening to achieve the required size according to the specifications of the customers, are often similar to those applied to classical raw materials (like aggregates).

[37] https://www.euroslag.com/wp-content/uploads/2019/01/Statistics-2016.pdf

[38] Reuter M, Xiao Y, Boin U (2004) Recycling and environmental issues of metallurgical slags and salt fluxes. VII International Conference on Molten Slags Fluxes and Salts, The South African Institute of Mining and Metallurgy, 2004.

[39] Best Available Techniques (BAT) Reference Document for the Non-Ferrous Metals Industries 2017, JRC 107041, Publication Office of the European Union, ISBN 978-92-79-69655-8.

5.3.1.2 Problems / Examples / Solutions

Different legal status, regulations and standards in MS for the same type of slag

Slags can be classified as a BP, an EoW, a waste or a product, not only depending on the type of slag, but also on the MS. For instance, in Germany, Spain and Belgium, ferrous slags are classified as a BP if they meet certain requirements. In some East-European countries[40] they are considered to be waste, while in Greece they are considered waste until slag undergoes mechanical treatment and then they gain EoW status. There are also recent developments for giving the BP status to certain types of ferrous slag in France and Italy.

Moreover, if a slag has a similar legal status, different transposition of the EU Waste Framework Directive and the EU Water Framework Directive may lead to different regulations and standards. Examples are different specifications and tests for the use of slag and requirements for slag transport. When there is no mutual recognition between MS, the slag industry needs to perform several tests when the slag is to be exported to several countries. Some MS (e.g. Germany) are also more stringent, requiring for instance testing more elements than required in the Water Framework Directive, leading to higher costs and thus less profitability and potential use.[31]

This lack of harmonised criteria hampers trans-boundary shipments of these materials significantly in Europe.

An obvious solution would therefore be to have a full harmonisation and the same application of European EoW or BP criteria among MS. More clearly technical requirements can ensure a level playing field between primary and secondary raw materials.

But having harmonised criteria or clear technical requirements may pose a conflict with the case-by-case approach that may be required depending on material and application. The industry notes that they are not in favour of too rigid guidelines or handbooks: "limits, testing procedures and other aspects might not be pertinent to the case, unjustifiably blocking any use of EoW, BPs and more in general secondary raw materials."

Problems with procedures in getting the BP or EoW status

The industry complains that procedures are often non-existing, unclear, too demanding or even not compliant with the WFD. They advocate for a clear EU guidance for operators, public authorities and final users could be very helpful in removing hurdles and bottlenecks.

In Sweden, the transposition of Article 5 on BPs implements only three BP criteria, and criteria 1 (a) and 1(c) until now have not been included in the Swedish law (Miljöbalken 15 kap 1 §). The four criteria of the WFD have been included in a preamble of the Miljöbalken, but as it is 'grey law', it does not take away uncertainty for the operators, as claimed by the sector.

In Spain, for getting the BP status the industry complains of a very long administrative procedure in which exhaustive documentation is requested, Furthermore, it is required to have the application to be signed by the final users of the BP. But in many cases it

40 Velzeboer I, van Zomeren A (2017) EoW criteria for inert aggregates in MS, study in commission of the Dutch ministry of Infrastructure and Environment, ECN: Petten

is complicated if not impossible to know in advance who will be the final users. Even knowing all of them, usually the final or intermediate users of industrial BPs are many. Finally, the BP status is approved on a case-by-case basis, so a new request is required for each use and each material.

In Germany, one of the possible uses of ferrous slag is as aggregate in road construction. It is used as if it is a product or marketed as BP, i.e. fulfilling all harmonised standards such as those for aggregates and aggregate mix. But there is no official procedure.

The administrative and technical work behind a dossier or process initiated by an industry for classifying their co-generated streams as BPs requires extensive knowledge of different EU laws and technical aspects, both with the companies involved as well as with the public officers. Crucial is a good communication between companies and public authorities.

Problems with waste classification

Some companies experience difficulties with classification of waste. It requires extensive knowledge of waste legislation as well as the CLP Regulation. This knowledge is not only required within companies but also with public officers.

Next, the industry asserts that the hazardous properties of substances contained by EoW and BP slags should be assessed in terms of bio-availability. Their form and relevant properties should be assessed and not only their content. The sector claims that national strategies based on reducing the content of hazardous substances (according to chemicals law) for ensuring resource efficiency or/and circular economy is a short-sighted option, because it will lead to an unjustified landfilling.

It should be considered, however, that if the content of hazardous substances is not reduced and tackled before it gets to waste stage, the subsequent recycled material might be not allowed to be placed on the market according to EU legislation. Then it would really lead to landfill/incineration. Hazardous substances should not in principle be landfilled, they need to go through other processes (energy recovery).

REACH registration

For a slag to be approved as BP or EoW it needs to be registered under REACH (unless exempted by any of the exemptions in Annexes IV or V of REACH). The effort and costs to require a REACH registration are relatively high. But beforehand, it is not certain that the application as BP or EoW will be approved. Moreover, in some MS the slag is accepted as a BP, in other MS it is not. This means that recyclers need to comply with both waste and product legislation requirements.

According to the industry, the European Commission can greatly improve the interface between chemicals and waste legislation by establishing Union-level harmonised conditions for BPs. This would prevent double regulation and facilitate a circular economy. A material, which has a well-established market, fulfils standards and is not negatively affecting environmental or human health should be considered as a (by-) product.

Public opinion

The public opinion can be sceptical about the use of secondary raw materials, especially when it concerns materials that may be hazardous. Natural materials are considered by public as safer by definition, while they can cause problems as well.

According to the industry, more focus on risk control and reduction than on hazard control and reduction can create a more supportive environment.

More information on the EoW or BP material and how it compares to natural materials might help for better acceptance by the public. The use of ferrous slag and its derived products may serve as an example for circular economy and the preservation of natural resources.

Public procurement

Public administrations can help in promoting the use of secondary raw materials, for instance in public procurement. Germany, for example, is currently amending its national act on circular economy, prioritising the use of secondary raw materials in public procurement. The development of a technical guidance for users can further stimulate their use.

5.3.1.3 Evaluation

In order to establish a better exchange of slags for recycling or processing, the industry argues for harmonisation of criteria throughout the European Union. This could be established by an EoW regulation as done for glass and different scrap types. The disadvantage of such an approach is that it impedes a case-by-case approach depending on the nature of the slag, its origin and its intended use. This could also be established by a first European implementing act on BPs, but until now no examples exist.

The four general criteria on BP are(as stipulated in Article 5 of the WFD):

(a) further use of the substance or object is certain;
(b) the substance or object can be used directly without any further processing other than normal industrial practice;
(c) the substance or object is produced as an integral part of a production process; and
(d) further use is lawful, i.e. the substance or object fulfils all relevant product, environmental and health protection requirements for the specific use and will not lead to overall adverse environmental or human health impacts.

Evaluation of these criteria:

- Further use is certain insofar a viable market for the slags, e.g. as a construction material, exists, which is not guaranteed in all contexts due to competition with other primary and secondary construction materials.
- Direct use of the product is not guaranteed when in the liquid form. The industry mentions cooling (soft or rapid), physically modification (crushing, sieving, and milling) and addition of specific substances (e.g. sand, oxygen) as further processing. It deserves further analysis and interpretation to assess whether this is normal industrial practice.
- Slags are in all cases produced as an inevitable and integral part of melting ore or scrap. For metal quality reasons (which is the main product), the process is designed in a way that all unwanted substances are finally bound in the slag.

- The biggest issue with some non-ferrous slags lays in their lawful use, related to their hazard properties. Effects as mentioned in this provision may be connected to the level of bio-availability or the risk, although also the precautionary principle may be applied when the final destination of the product and its possible long second lifecycle is not always fully known.

Based on this analysis, BP status of slags is possible only for a limited section of non-hazardous slags that do not need another treatment apart from what is normal industrial practice. Re-entering products with hazardous properties in new use cycles might also be contradictory to the principles of circular economy as this requires sanitation or removal of hazardous substances from the recovery cycles.

The four general criteria on EoW are (as stipulated in Article 6 of the WFD):

(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.

Evaluation of these criteria:

- Use for specific purposes is defined by the industry as secondary construction material in different applications, such as road construction, granulates, foundations, or as a secondary ore for further extraction.
- Closely connected to use for specific purposes is the availability of a functioning market. As described above for BPs a viable market for the slags, e.g. as a construction material, is not guaranteed in all contexts due to competition with other primary and secondary construction materials.
- The technical requirements may be present ab ovo or may be created through pre-treatment operations like cooling, crushing, sieving, milling or addition of specific substances. The end of the pre-treatment phase defined the point where the material may enter the EoW phase.
- For some non-ferrous slags, adverse environmental or human health impacts may be generated through their content of hazardous substances and/or their hazardous properties. Impacts as mentioned in this provision may be connected to the level of bio-availability or the risk, although also the precautionary principle may be applied when the final destination of the product and its possible long second lifecycle is not always fully known. The risk management as included in the REACH dossier can be an element in the discussion.

Large material flows, e.g. granulated blast furnace slag or special treated steel slags could have a BP status from the beginning. Some ferrous slags which need more processing could get an EoW status after treatment. Nevertheless, the environmental and health impacts resulting from content of hazardous substances remain an issue to be taken into consideration. In summarising the assessment the following advice can be given:

- Develop Union-wide standards on conditions of the slag and conditions or its use under which the slag can be classified as EoW.
- Define these standards for each type of slag.

- Create a level playing field by imposing these conditions on all MS via a Regulation. Make sure that also requirements for testing / analysis of samples is consistent among MS.
- Foresee in the conditions stringent provisions on both content of hazardous substances and impact on health and environment, considering the precautionary principle.

5.3.2 Case 2: Mineral construction and demolition wastes broken into granulates and used as a building material under EoW status

5.3.2.1 Introduction and market situation

The category 'Construction and Demolition Waste' (CDW) includes any waste generated within activities of companies belonging to the construction sector and which is included in category 17 of the European List of Wastes. The category 17 provides codes for several individual materials that can be collected separately from a construction or demolition site. It includes waste streams [hazardous and non-hazardous; inert, organic and inorganic] that originate from sites where construction, renovation or demolition activities take place. Construction waste contains several materials, often related to cut-offs or packaging waste. Demolition waste comprises all materials found in constructions. Renovation waste can contain both construction-related materials and demolition-related materials.[41]

Activities that generate CDW are mostly the construction of buildings and civil infrastructure, total or partial demolition of buildings and civil infrastructure, road planning and maintenance. A smaller fraction is generated by households as DIY waste.

The status of CDW is well-defined, sources and categories are known and when it comes to re-use and recycling of these materials EoW status is a real opportunity.

However, it should be mentioned that throughout the EU different national definitions are applied which makes cross-country comparisons complicated. In some countries even materials from land levelling (which may include excavated soil) are regarded as construction and demolition waste.

From a value chain perspective CDW generally has a high potential for recycling, since some of its components have a high resource value. Particularly for this case on aggregates, it should be highlighted that there is an existing recycling market for aggregates derived from CDW waste in roads, drainage and other construction projects. Technology for the separation and recycling of CDW is well established, readily accessible and in general cheap.

This is one of the reasons why CDW has been identified as a priority waste stream by the European Union. Article 11.2 of the Waste Framework Directive (2008/98/EC) stipulates that "MS shall take the necessary measures designed to achieve that by 2020 a minimum of 70% (by weight) of non-hazardous construction and demolition waste excluding naturally occurring material defined in category 17 05 04 in the List of Wastes shall be prepared for re-use, recycled or undergo other material recovery" (including backfilling operations using waste to substitute other materials).

[41] https://ec.europa.eu/growth/content/eu-construction-and-demolition-waste-protocol-0_en

Despite its potential, the level of recycling of CDW varies greatly (between less than 10% and over 90%) across the European Union.

It has to be highlighted, however, that CDW can contain considerable amounts of hazardous substances / fractions which can pose particular risks to the environment and to human health. Separation at site is crucial.

Being aware of the barriers to recycling and re-using CDW, the European Commission has published an 'EU Construction and Demolition Waste Management Protocol' in September 2016.[42] This Protocol matches the Construction 2020 strategy[43], the Communication on Resource Efficiency Opportunities in the Building Sector[44] and the Circular Economy Package[45]. Its overall aim is to increase confidence in the CDW management process and the trust in the quality of recycled materials.

The Protocol provides for guidance in the following five areas:

(a) Improved waste identification, source separation and collection;
(b) Improved waste logistics;
(c) Improved waste processing;
(d) Quality management;
(e) Appropriate policy and framework conditions.
(f) Furthermore, it includes good practices from across the EU as inspiration for both policy makers and practitioners. It also includes an overview of definitions and a checklist for practitioners.

Construction and demolition waste (CDW) is one of the heaviest and most voluminous waste streams generated in the EU. In 2016 it accounted for more than 36% of all waste generated in the EU and consists of numerous materials, many of which can be recycled. [46]

CDW is a complex category. List of waste established by the European Commission Decision 2000/532/EC includes eight main categories under its code 17 Construction and demolition wastes (including excavated soil from contaminated sites). These are the following:

- 17 01 concrete, bricks, tiles and ceramics
- 17 02 wood, glass and plastic
- 17 03 bituminous mixtures, coal tar and tarred products
- 17 04 metals (including their alloys)
- 17 05 soil (including excavated soil from contaminated sites), stones and dredging spoil
- 17 06 insulation materials and asbestos-containing construction materials
- 17 08 gypsum-based construction material
- 17 09 other construction and demolition wastes

Most valuable recyclable materials like metals, glass and wood are generally sorted out and recycled in order to be sold to other industries as a secondary raw material.

[42] https://ec.europa.eu/growth/content/eu-construction-and-demolition-waste-protocol-0_en
[43] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2012:0433:FIN:EN:PDF
[44] http://ec.europa.eu/environment/eussd/pdf/SustainableBuildingsCommunication.pdf
[45] http://ec.europa.eu/environment/circular-economy/index_en.htm
[46] EUROSTAT, data for reference year 2016.

Other categories can end-up in energy recovery, e.g. plastics, wood, paper etc. [47] CDW containing hazardous elements (such as asbestos containing waste, PAK contaminated soil, etc.) undergo specific treatments for hazardous waste. Inert materials not proper for recycling are ending up at landfills.

To achieve EoW status the category 17 01 (concrete, bricks, tiles and ceramics), 17 03 (bituminous mixtures) and 17 05 (soil (including excavated soil from contaminated sites), stones and dredging spoil) are the most relevant ones, but in some cases glass and insulation materials are also included.

This case study focuses on CDW broken into aggregates and used as a building material under EoW status.

5.3.2.2 Treatment options

Aggregates are used most commonly for road construction, for bound surfaces and base layers, for concrete and for asphalt mix. From a value chain point of view the production of recycled materials can take place immediately through mobile breaking and sieving at the construction or demolition site or at a different place. Sometimes the recycled aggregates can be even utilised at the same site. From an economic point of view the best way is to recycle and utilise the CDW at site also having in mind that CDW is heavy weighted and bulky and transportation is not economic, meaning that it should be limited as much as possible.

From the moment CDW ceases to be waste it becomes a product and other regulations apply.

The most important regulation on this is REACH. However, in the specific case of recycled aggregates REACH registration obligations do not apply because within REACH recycled aggregates are regarded as an article. Articles are exempted from the obligation to register. Due to articles 7(1), 7(2) and 33 of the REACH Regulation substances of very high concern (SVHC) in articles must be notified if their concentration exceeds e.g. 0.1% w/w. Such substances are typically not identified in recycled aggregates.[48]

Construction Products Regulation (CPR, 305/2011/EU) and national product standards impose conditions that CDW has to meet EoW status when used in construction products.

Other relevant legislation is the Water Framework Directive (2000/60/EC) and the Groundwater Directive (2006/118/EC), which impact the conditions that recycled CDW must meet to be used for instance for road construction. A crucial issue is the potential leaching of hazardous substances from the used CDW as there is a risk that waste aggregates with EoW status can contain substances that can cause

[47] V. Bilsen et al.: Development and implementation of initiatives fostering investment and innovation in construction and demolition waste recycling infrastructure, 2018; https://publications.europa.eu/en/publication-detail/-/publication/3637d9db-1c3e-11e8-ac73-01aa75ed71a1/language-en

[48] ECHA guidance on waste and recovered substances, 2010 http://echa.europa.eu/documents/10162/13632/waste_recovered_en.pdf

unacceptable impacts on soil, surface water or groundwater and/or on human health. This concern is expressed in condition (d) in Article 6 (1) of the WFD.[49]

Harmonised European product standards on aggregates have been developed by the Technical Committee CEN/TC 154 on Aggregates and are being used.

General standards:

- EN 932-1:1996 – EN 932-6:1999 Tests for general properties of aggregates
- EN 933-1:2012 – EN 933-11: 2009 Tests for geometrical properties of aggregates
- EN 1097-1:2011 – EN 1097-11:2013 Tests for mechanical and physical properties of aggregates
- EN 1367-1:2007 – EN 1367-8:2014 Tests for thermal and weathering properties of aggregates
- EN 1744-1:2009 – EN 1744-8:2012 Tests for chemical properties of aggregates
- EN 16236:2018 Assessment and Verification of the Constancy of Performance (AVCP) of aggregates - Type testing and Factory Production Control

Product specific standards:

- EN 12620:2002+A1:2008 Aggregates for concrete
- EN 13043:2002/AC:2004 Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas
- EN 13055:2016 Lightweight aggregates
- EN 13139:2002 Aggregates for mortar
- EN 13242:2002+A1:2007 Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction
- EN 13383-1:2002 - EN 13383-2:2019 Armour stone
- EN 13450:2002 Aggregates for railway ballast

EUROSTAT data can be found on EWC category 12.1 Mineral waste from construction and demolition. This covers the following List of Waste categories, all selected from chapter 17 of the List of Waste:

- 17 01 01 concrete
- 17 01 02 bricks
- 17 01 03 tiles and ceramics
- 17 01 06* mixtures of, or separate fractions of concrete, bricks, tiles and ceramics containing dangerous substances
- 17 01 07 mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06
- 17 02 04* glass, plastic and wood containing or contaminated with dangerous substances
- 17 03 02 bituminous mixtures other than those mentioned in 17 03 01
- 17 03 01* bituminous mixtures containing coal tar
- 17 03 03* coal tar and tarred products
- 17 05 07* track ballast containing dangerous substances
- 17 05 08 track ballast other than those mentioned in 17 05 07
- 17 06 03* other insulation materials consisting of or containing dangerous substances

[49] Ole Hjelmar, Jette Bjerre Hansen, Margareta Wahlström, Ola Wik: EoW Criteria for Construction & Demolition Waste, 2016; http://www.diva-portal.org/smash/get/diva2:1044870/FULLTEXT03

- 17 06 04 insulation materials other than those mentioned in 17 06 01 and 17 06 03
- 17 08 01* gypsum-based construction materials contaminated with dangerous substances EN 28.9.2010 Official Journal of the European Union L 253/33
- 17 08 02 gypsum-based construction materials other than those mentioned in 17 08 01
- 17 09 01* construction and demolition wastes containing mercury
- 17 09 03* other construction and demolition wastes (including mixed wastes) containing dangerous substances
- 17 09 04 mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03

This statistical category (EWC 12.1) covers more or less waste materials that are feasible for producing aggregates after applying EoW status. According to EUROSTAT in 2016 a total of 344 million tons of mineral CDW were generated in EU28. Out of this amount approximately 10 million tons were classified as hazardous waste and the remaining 334 million tons as non-hazardous.

5.3.2.3 Problems / examples / solutions

In the EU MS CDW management is regulated to a varying extent: in several MS there are regulations specifically targeting CDW. Several examples are elaborated in the above-mentioned EU CDW Management Protocol.[50] Well-developed regulations can be found in the Netherlands, Denmark, Germany, Belgium, France, Austria, UK and Italy. According to a recent study the legislative framework of the leading countries is characterised by a variety of legislation combined with other tools promoting recycling of CDW. The most advanced legislations targeting CDW management comprise for example specifications on separation and requirements regarding the pre-treatment of CDW in Germany, mandatory pre-audits on demolition sites and mandatory departmental CDW management plans in France, as well as quota of percentage for recycled materials (including construction materials) and products in public procurement in Italy. High landfill taxes (for example in Denmark) or a landfill ban on CDW (like in the Netherlands, Belgium) naturally promote CDW recycling.[51]

Specific EoW criteria for CDW have been established in the Netherlands, Austria, Belgium (Flanders), France, Italy and Denmark. In the UK, Germany guidelines and protocols foster the promotion of recycling of CDW.

By comparing the different national regulations and approaches on EoW status of CDW, differences can be identified in two ways:

- Definition of types and qualities of waste materials that can be used as input materials for producing recycled materials, and
- Definition of possible use and applications of the recycled product (aggregate).

The *Italian* EoW criteria lays down specific criteria according to which bituminous concrete ceases to be categorised as waste. Here the input material should be under

[50] https://ec.europa.eu/growth/content/eu-construction-and-demolition-waste-protocol-0_en

[51] V. Bilsen et al.: Development and implementation of initiatives fostering investment and innovation in construction and demolition waste recycling infrastructure, 2018; https://publications.europa.eu/en/publication-detail/-/publication/3637d9db-1c3e-11e8-ac73-01aa75ed71a1/language-en

List of Waste 17 03 02, and the output material is bituminous concrete granulate to be used in bituminous mixtures or for the production of aggregates for materials which are unbound or are hydraulically bound to be used in road construction, in accordance with harmonised standard UNI EN 13242, excluding environmental remediation.

The *French* criteria (*Order setting EoW criteria for aggregates produced from waste from construction and public works, to be used in road building*) is regulating aggregates produced from waste from construction and public works for use in road construction exclusively. Input materials can be the following:

- waste covered by Section 17 01 "Concrete, bricks, tiles and ceramics" with the exception of waste covered by Section 17 01 06* "Mixtures of, or separate fractions of concrete, bricks, tiles, and ceramics containing dangerous substances"
- waste of similar type to that mentioned in the previous point, covered by Section 16 03 04 and generated by a production facility;
- waste covered by Section 17 02 02 "Glass"
- waste covered by Section 17 03 02 "Bituminous mixtures other than those mentioned in 17 03 01" as well as waste generated by a production facility of the same type as those covered by Section 17 03 02;
- waste covered by Sections 17 05 04 and 20 02 02 "Soil and stones", with the exception of soil;
- mixed waste containing only the waste mentioned in the five previous points.

The output materials could fall under the 'concrete', the 'asphalt' or the 'mixed' categories and can be used in road construction.

The *Austrian Recycled Construction Materials Regulation* covers mixtures of selected waste from construction and demolition measures, excavation waste, concrete rubble, track gravel and bitumen and asphalt. The regulation includes electric furnace slag, blast furnace slag and converter slag as potential input materials as well (see also case 1). Annex 2 lists the possible use of output materials. Aggregates can be used for bound surface, base layer, asphalt mix and also for concrete of strength class C12/15.

The *Danish* regulation (*Order on the use of residual products, soil and sorted building and construction waste*) has the widest CDW input material coverage:

- Natural stone, e.g. granite and flint.
- Unglazed tile (bricks and roof tiles).
- Concrete.
- Mixtures of materials from natural stone, unglazed tile and concrete.
- Iron and metal.
- Plaster.
- Stone wool.

Beside these classic CDW categories the order covers soil, slag from waste incineration as well as bottom ash and fly ash from coal-fired power stations.

The output materials can be used for building and construction works, mostly as solid layer for roads, pipeline trenches, pathways, ramps, noise barriers and foundations. The order emphasises that sorted, uncontaminated building and construction waste can be reused for the same or related purpose for which the waste material was previously used, including the reuse of bricks, tiles or plasterboard in construction, etc. without authorisation and may be used without authorisation and after pre-

processing, including crushing, as a replacement for primary raw materials in building and construction works.

Beside the national approaches taken in the Member States the revision of the Construction Products Regulation (CPR, 305/2011/EU) may be a driver to foster recycling of CDW and act as a driver to establish minimum conditions for CDW when used in construction products.

5.3.2.4 Evaluation

From the examples above it is obvious that EoW status for CDW is already established as a common practice in several MS. However, the regulations differ in both defining input and output materials and applications for intended uses.

A possible way forward would be to have a full harmonisation and same application of European EoW or BP criteria among MS. This could create more clear technical requirements that can ensure a level playing field between primary and secondary raw materials. However, where a functional market for a certain EoW product is already in place on a national scale, imposing harmonised criteria or common technical requirements may pose a conflict with the existing national criteria and the possible case-by-case decisions that may be required depending on material and application and therefore might be disadvantageous for the functioning of the market and to the companies operating on the market. Adaptations to new administrative and/or technology related requirements could require to provide resources and efforts by the companies. Case-by-case decisions could be still important for CDW as it represents a complex category with specific input materials, or special use of the recycled product. No case-by-case decisions on CDW were provided by MS authorities during the consultation within this study.

CDW is generally a bulky waste stream with relatively low value. Prices of primary materials are low and therefore competitiveness in the market is challenging. Therefore, transport over long distances is economically not attractive; this is confirmed by the very low amounts shipped across borders and might be an argument for keeping it regulated at national level. Further investigation is proposed to assess what are the lost potentials caused by the lack of EU wide criteria, that would enable the development of cross-border markets in densely populated bordering regions or in the case of small countries.

From the stakeholder consultation conducted herein, the same feedback from the industry has been received. The industrial sector is working on relatively well-operating regional and national markets following national criteria and therefore do not require EU level action.

However, new technologies could change the status quo in the field. If a CDW waste fraction becomes valuable enough for cross-border shipment an EU level EoW criteria will be desirable.

Current CDW recycling comprises in many cases low-grade recycling and even down-cycling (e.g. glass fractions in aggregates). The study on assessing business models for C&D recycling highlighted that CDW recycling technology includes two types, conventional and advanced technologies for granulate as well as high-grade recycling, respectively. For example, stone fractions, are currently mostly processed into aggregates for foundation material. New emerging technologies are able to produce

aggregates that are suitable for the production of high-grade concrete. But as the demand for foundation aggregates is at present high enough and the emerging technologies are often more expensive than the currently used technologies, most of the materials end up as base layers for buildings and road construction. These examples demonstrate that national EoW criteria already include the possibility of using aggregates for concrete production.

Another example for this is the glass fraction of CDW. Separation is crucial and the EU promotes this, for example in the EU CDW Management Protocol. Many national regulations are following this practice. Still, when it comes to the glass fraction that has suitable recycling technologies, separation sometimes still occurs as a barrier. Demolition companies would need to install another container for this collection and provide transport. These extra costs are currently mostly not compensated by the money that is received for the glass fraction. In particular, from the examples above we can see that aggregate standards set limit values for glass (e.g. <2% in Flanders) that allows the complete fraction to be integrated in the stony fraction and also presents a missed business opportunity for glass and down-cycling of glass if used to produce secondary aggregates instead of recycled glass.[52]

We can conclude that EoW criteria exist in several EU MS which regulate well the naturally local/regional markets of aggregates from recycled CDW. Where local/regional application of established EoW criteria are functional there is no need for EU level harmonisation of the criteria. However, when a certain fraction becomes valuable enough for cross-border shipment EU level EoW criteria will be desirable. At that moment EU level standards will be needed and under this condition possible existing case-by-case decisions should be investigated and analysed. Such harmonised standards could enhance CDW recycling in MS that are currently less advanced in the field. Again it should be highlighted that assessments on unexploited potentials caused by the lack of EU level criteria enabling the development of cross-border markets would be desirable.

In the meantime, the EU CDW Management Protocol should be further promoted, incentives and support to new and emerging technologies should be developed and moving to higher-grade recycling for all CDW fractions should be a direction for the future.

Although re-use (when demounted materials are used for the same purpose in new buildings) is not fully an EoW issue, it should be highlighted here that according to the waste hierarchy it should be preferred to recycling.

As with all CDW related policies it should be emphasised that separation at source is the first and crucial step for both re-use and recycling.

Furthermore, it is recommended that existing good practices from leading MS should be promoted for MS lagging behind in order to re-use and recycle as much as possible of these most voluminous waste streams within the EU. A thorough collection of best practices is available in the EU CDW Management Protocol. Furthermore, there are EU funded projects in the field of research and technology development (HORIZON2020) and in experience exchange (various INTERREG programmes) which have best practice collections that could be used for capitalisation and dissemination activities.

[52] V. Bilsen et al.: Development and implementation of initiatives fostering investment and innovation in construction and demolition waste recycling infrastructure, 2018; https://publications.europa.eu/en/publication-detail/-/publication/3637d9db-1c3e-11e8-ac73-01aa75ed71a1/language-en

5.3.3 Case 3: Refuse derived fuel and solid recovered fuel as EoW material

5.3.3.1 Introduction

Producing waste-derived fuels for energy recovery is a quite common waste management option for those waste fractions which have a high caloric value but are difficult to prepare for reuse and recycle. These are commonly known under the name of Refused Derived Fuel (RDF) and Solid Recovered Fuel (SRF).

RDF is a substitute fuel which is produced from domestic and business waste, which includes biodegradable material as well as plastics. Non-combustible materials such as glass and metals are removed, and the residual material is then shredded. SRF is a higher-quality alternative of RDF. It is produced mainly from commercial waste including paper, card, wood, textiles and plastic and is additionally processed to improve its quality and value. SRF has a higher calorific value than RDF.

There is no exact Union-wide classification for such materials. Even national authorities have not yet established any exact guidelines on the composition of alternative fuels.RDF and SRF are typically used to generate energy and can be used for specific applications such as in cement kilns, CHP plants and power plants.

It can be argued that RDF and SRF co-exist for the cement industry in the EU and that they might equally contribute to a Circular Economy, in particular to valorise fractions of residual waste which would otherwise not be recovered or recycled and thus would need to be landfilled. More specifically, co-processing SRF in the cement industry can avoid the landfill of waste, especially in markets where incineration might still be too expensive, such as in Poland.

5.3.3.2 EU regulations for SRF

The production of SRF from non-hazardous combustible waste for the substitution of primary fuels for heat and/or power generation and for the production of material products such as clinker for cement, is part of a complex business environment, which is subject to a broad legal framework:

- The Waste Framework Directive (2008/98/EC and its amended version 2018/851): The Directive gives a wide definition of waste.
- The Landfill Directive (1999/31/EC): in particular regarding the diversion of biodegradable waste from landfill and waste disposal
- The Industrial Emissions Directive, IED (Directive 2010/75/EU), especially concerning the prevention and control of emissions of pollutants in the air due to industrial activities including waste incineration activities. With this regard, BAT reference documents (BREF) for incineration and waste management were developed by the IPPC Bureau of the Joint Research Centre. BREF on waste treatment includes installations preparing fuel from non-hazardous waste. The Industrial Emissions Directive sets strict environmental requirements that have

to be applied by dedicated Waste-to-Energy incineration plants and industrial plants (e.g. cement kilns) that co-incinerate waste.

- The revised Renewable Energy Directive (RES Directive, Directive 2018/2001/EC), which defines biomass, including biodegradable fraction of industrial and municipal waste, and supports the market development of substitute fuels and SRF [53]

EU legislation does not specifically regulate the SRF but only their use when they are employed in incineration plants regarding their emissions, not their composition. The regulations on emissions are applicable if SRF are intended as waste (the IED Directive 2010/75/EU regulates the incineration of waste), and sets strict standards for their incineration. If not intended as waste, the emission standards of the BREF of the respective industry sector have to be applied.

Existing standards and classification of SRF

Standards have been developed for SRF by the European Committee for Standardisation, namely the CEN/TC 343.

The standard defines the SRF as a fuel produced from non-hazardous waste in compliance with the European standard EN 15359. The main requirement is that a producer specifies and classifies its SRF by detailing its net calorific value, the chlorine and the mercury content of the fuel. Other specifications include (as mandatory) several other properties, such as the content of all heavy metals mentioned in the Industrial Emissions Directive. The class and the origin of the SRF must be specified, for this producers are obliged to use the prescribed form of EN 15359. Furthermore, a declaration of conformity has to be issued.

This standard is important since it sets a common quality definition of SRF, but EN 15359 and its underlying standards do not require any quality level and do not regulate the conditions under which SRF is used in incineration or co-incineration plants. In other words, the standard does not set limit values for contaminants in SRF and does not differ between "good quality" SRF and "poor quality SRF", but it rather sets the specifications of a range of parameters. Hence, the CEN norm asks to document the presence of e.g. heavy metals but does not impose a maximum threshold value. It is then up to the competent authority to decide which levels of contaminants will be accepted. In deciding so, the competent authority will take account of the emission limit values set in the Waste Incineration Directive and of best available technologies described in BREF documents. The required quality of SRF is therefore defined by the client, consequently SRF quality can vary. Moreover, the standard is not obligatory.

In conclusion, EN 15359 cannot exclusively specify the EoW status for SRF, but can be a useful tool to determine qualities of RDF.[54]

At the EU level no criteria for EoW for SRF exist.

[53] https://standards.cen.eu/bp/407430.pdf

[54] https://www.zkg.de/en/artikel/zkg_Solid_Recovered_Fuels_Specifications_and_classes_2067874.html

Nevertheless, a few MS (e.g. Italy and Austria) have already developed criteria at national level, which will be explained in the next section.

5.3.3.3 Treatment options

Treatment

In order to produce SRF, mixed municipal solid waste is sent to pre-treatment. Non-combustible materials and inert materials (such as glass, ceramics, stones) and easy recoverable materials (such as ferrous and non-ferrous metals) are removed during the treatment by means of magnets and mechanical screening and separation. After that, the material is shredded in order to produce high calorific material in appropriate grain size.

Incineration

RDF is burned in dedicated RDF incinerators or is co-incinerated with coal or oil in multi-fuel boilers or cement kilns, a practice which has been approved by some countries and which has made cement kilns a major market for RDF. Discordant opinions regarding the environmental appropriateness of this practice exist. Some argue that cement kilns and industrial boilers have poor pollution control mechanisms that are not capable of capturing pollution caused by a more heterogeneous fuel such as RDF/SRF [55].

5.3.3.4 Problems / Examples / Solutions

Problems

There are several concerns around SRF and especially around the options to develop EoW criteria for SRF.

A first concern about SRF is the lack of a definition due to a lack of homogeneity in the waste composition. Many calorific wastes can be referred to as SRF but there is no official definition of SRF and the content and quality may vary considerably.

Due to the heterogeneous nature of the waste, composition and quality regarding the environmental parameters of SRF might be uncertain or difficult to describe. In other words, while an SRF might have a good calorific value and low chlorine and mercury content, clients cannot be sure of its composition if it is not tested and evaluated in an appropriate and standardised way.

This poses certain risks for producers and users of these fuels. As environmental impacts may not be fully known, public acceptance and acceptance of SRF by competent authorities might be lower.

[55] https://www.no-burn.org/wp-content/uploads/RDF-Final.pdf

Concerning the opportunity to develop EoW criteria, several Union-wide working groups – including groups representing industries – have expressed their concerns.

In a joint letter to the European Commission on 19.02.2014[56], the CEWEP – Confederation of European Waste-to-Energy Plants, the CEMBUREAU - The European Cement Association, the ESWET – European Suppliers of Waste-to-Energy Technology and the MWE - Municipal Waste Europe, explicitly asked not to lift the SRF/RDF from the status of waste, mostly due to issues related to waste traceability, shipment, and issues linked to the incineration of these substances (as highlighted in detail in this section).

This position was also remarked in the survey carried out within this study, where the interview partner and managing director of CEWEP asserted that for RDF "No EoW solution is necessary, since the waste legislation provides the greatest certainty to ensure that environmental criteria are respected. Otherwise RDF (or SRF) could be burned in any poorly designed boiler not complying with the strict regulations for waste incineration".

Hence, the following issues can be evidenced:

1. Transboundary shipment and differences in regulating SRF as EoW:

The Waste Shipment Regulation provides for transboundary shipments of certain waste to be notified and controlled by the competent authorities. There are concerns about the impact that national initiatives classifying SRF or RDF as EoW may have on the traceability and control of transboundary shipments of such material. Unclarities as regards the procedures to comply with for transboundary shipments would also make tracking and control of this material more difficult and could potentially be exploited by unscrupulous operators.

2. Ceasing the status of waste and problems with incineration:

A major highlighted problem is that if EoW criteria for SRF were developed, incineration and co-incineration of SRF/RDF as EoW (i.e. as a "product"), would not fall under the scope of the Industrial Emissions Directive's provisions for waste incineration and waste co-incineration plants anymore. Therefore operators of other facilities would not have to meet the same strict emission limit values and monitoring requirements set for this sector.

If SRF cease to be considered waste, its combustion in EU industrial installations would be mainly controlled by the obligations on Large Combustion Plants under the Industrial Emissions Directive (IED), with much higher emission limits for certain substances have to be fulfilled[57].

[56] Joint letter waste derived fuels 19.02.2014 - CEWEP

[57] https://www.researchgate.net/publication/287799243_Sustainable_waste_management_through_EoW_criteria_development

Laboratory analyses by the Austrian Environment Agency indicated that "sufficiently good qualities [of waste derived fuels] cannot be produced from mixed non-hazardous waste that is able to fulfil standards and specifications for EoW. If incinerated as non-waste [i.e. EoW] in plants outside the Waste Incineration Directive scope, higher air emissions have to be expected"[58].

The CEWEP underlined the enormous importance that waste status is not lifted for SRF/RDF and that SRF/RDF remains in the waste regime. Only a treatment in installations conforming to Best Available Techniques set for waste incineration and waste co-incineration can ensure that pollutant emissions are controlled and minimised for safeguarding an environmentally safe recovery process.

Examples

So far, Italy and Austria have developed criteria for determining when refuse derived fuels can be qualified as a product and therefore are no longer subject to waste treatment legislation and standards. The examples of Italy and Austria are presented as follows.

Austria: EoW criteria for solid recovered fuel (SRF)

The Regulation of the Environmental Minister, amending the Waste Incineration Ordinance (AVV Amendment 2009), and in particular Article 18a [59] set the criteria for EoW for Substitute Fuels by establishing:

- The typologies of waste which might be suitable for Substitute Fuels, namely it restricts the usage of hazardous waste and waste from the medical sector in accordance with the Austrian standard OENORM S 2104.
- The need for the waste owner having the waste characteristics of a substitute fuel ended, to continuously maintain records on the receivers of the specified substitute fuel products (names, addresses, quantities, dates) and store those records for five years.
- The need for records documenting the end of the waste characteristics, e.g. via an assessment report prepared by the waste producer or the waste collector meeting the specifications of Annex 9(2.8) of the Waste Incineration Ordinance.
- The requirement to submit the records upon request to the Federal Environmental Minister.
- The requirement to include a quality management system with external quality assurance in the production of substitute fuels for which the waste owner intends to end the waste characteristics, and namely by taking into account the

[58] Umweltbundesamt (2008) Aggregates case study. Final report referring to contract 150787–2007 F1SC-AT, Vienna. Institute for Prospective Technological Studies (one of the seven scientific institutes of the European Commission's Joint Research Centre, http://www. umweltbundesamt.at/; Weber T, Gehrmann H-J, Horn J, et al. Thermische Verwertung von Ersatzbrennstoffen auf einem MARTIN Rückschub-Rost; Untersuchungen zum Abbrandverhalten im Festbettreaktor und Übertragung der Ergebnisse auf den industriellen Prozess [Thermal utilization of alternative fuels]. In: Flammentag Berlin, 12–13 September 2007. Dusseldorf: VPI Verlag

[59] Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft und des Bundesministers für Wirtschaft, Familie und Jugend über die Verbrennung von Abfällen (Abfallverbrennungsverordnung – AVV) StF. BGBl. II Nr. 389/2002 idgF

OENORM CEN/TS 15358 'Solid Secondary Fuels – Quality Management Systems – Special Requirements for Application in the Production of Solid Secondary Fuels', issued on 1 July 2006.

- The limit values for certain parameters (heavy metals, cadmium, lead, arsenic, etc.), as well as the sampling methods.

Italy: EoW criteria for solid recovered fuel (SRF)

Italy is among the MS which already adopted EoW criteria for SRF, granting certain categories of solid recovered fuel (SRF) the EoW status in Decree No 22/2013 of 14 February 2013.

The Decree, as published on the Official Gazette of the Italian Republic, aims at regulating the production and employment of SRF in all its aspects in order to promote their use contributing to lower greenhouse gas emissions from burning traditional fuels and waste landfilling by ensuring that high environmental standards are met.

The EoW criteria regulate in particular the following aspects:

- The characteristics of the SRF production plants as well as the standards these must fulfil, such as the UNI EN15358.
- The waste typologies which are approved for the production of SRF. According to the Italian Standard EN 15353:2012 B Solid Recovered Fuel, SRF is made and produced from non-hazardous waste from MSW, commercial sources, and special waste streams. The initial waste can originate from several wastes like the following: (a) industrial, (b) municipal (c), sewage sludge (d) construction and demolition waste as well as (e) commercial waste[60]. A dedicated Annex lists the waste products which are suitable for the production of SRF.
- The production process for SRF, the declaration of conformity, the quality management system and the storage and transport of the SRF. The quality management need to be compliant with the UNI EN ISO 9001 e UNI EN ISO 14001.
- The framework conditions for the use and incineration of the SRF.

In addition, a committee for quality control has been established with the role of ensuring the monitoring of the production process and subsequent phases and the application of the legislation.

Nevertheless, there Italian EoW criteria are criticised, concerning the risks that burning certain substances might pose for the environment and the health.

Already at the beginning of the endorsement process of the EoW criteria for SRF in Italy, GAIA (the Global Anti Incineration Alliance), expressed its concerns relating to the production and condition for use of solid recovered waste.

60 https://www.researchgate.net/publication/287799243_Sustainable_waste_management_through_EoW_criteria_development

In an official letter of notification it was highlighted that "Italy is classifying solid recovered fuel (SRF) as non-waste in order to be able to incinerate or co-incinerate it outside of the EU regulatory framework for waste and industrial emissions (incineration and co-incineration), arguing that SRF that is prepared and classified/specified according to Italian standard UNI EN 15353:2012 standard "Solid Recovered Fuel" ceases to be classified as waste. We strongly disagree with the EoW criteria (EoW) proposed by Italy giving SRF a product/fuel status that does not take into account the negative environmental impacts as required by the WFD Article 6.d"[61]

Furthermore, scientific publications examining the issue highlighted that the Italian EoW criteria are based on classes 1 to 3 of the Standard EN15353:2012 "Solid Recovered Fuel", which sets the mercury content too high to receive environmental permits for combustion in any type of large combustion or cement plant[62].

EU parliamentary questions have also been raised questioning the compliance of the Decree on EoW with the EU Legislation. In the question n. E-003423-17 to the European Commission in May 2017, Rule 130, exponent of the EFDD (Europe of Freedom and Direct Democracy), raised the issue that "burning SRF in plants, such as cement factories that are not technologically designed for this purpose, produces more heavy metal emissions than when SRF is burnt in traditional incinerators, and more than when cement factories burn just fossil fuels". This breaches Article 6(1)(d) of Directive 2008/98/EC according to which waste ceases to be waste when no overall adverse environmental or human health impacts result from its use. What is more, burning SRF infringes the precautionary principle laid down in Article 191 of the Treaty on the Functioning of the European Union. In its answer to a parliamentary question the European Commission maintained that "such practice would not lead, in principle, to an overall adverse environmental or human health impacts.' Legally, this answer is not admissible since the point at issue is the possible infringement of an article in a directive".

In the answer provided by the European Commission (Question reference: E-003423/2017) it was highlighted that "the cement kilns permitted in the EU must comply with Directive 2010/75/EU (1) on industrial emissions (IED) and operate applying the Best Available Techniques (BAT) set out for this industrial sector in Decision 2013/163/EU (2). In addition, where cement kilns incinerate waste, that activity is specifically covered by the waste co-incineration provisions of Chapter IV and Annex VI to the IED. Pursuant to Article 8 and Article 23 of the IED, it is the responsibility of MS to take the necessary measures to ensure that the permit conditions — including the emission limit values — are complied with; and that environmental inspections of installations are duly carried out in order to detect non-compliances and shortcomings, respectively. In the absence of Union-wide 'EoW' criteria for solid recovered fuel (3) (SRF), it is for the Italian competent authorities to take decisions based on the national criteria adopted in accordance with the four

61 http://www.gaialibrary.org/content/letter-notification-italian-draft-legislation-establishing-end-waste-criteria-solid

62 https://www.researchgate.net/publication/287799243_Sustainable_waste_management_through_EoW_criteria_development

cumulate conditions set out in Article 6(1) of Directive 2008/98/EC (4) on waste, notably that the SRF will be used in cement kilns as a fuel under the relevant product legislation and will not lead to higher environmental or health impacts as compared to if it were treated via other methods under the waste regime.[63]

5.3.3.5 Evaluation

The use of SRF (and RDF) is an established waste management practice.

SRF with a waste status are normally regulated under the WFD and the EU Incineration Directive, which ensure that the non-homogeneity of the SRF does not bring hazardous substances to be incinerated and release them into the environment. EU standards are available for the classification of the SRF based on the content of some substances such as mercury; nevertheless, the standard does not distinguish between "good" and "poor" SRF and does not constitute an EoW criteria.

When the question about the need to develop Union-wide EoW criteria is raised, the following pros and cons shall be taken into account:

Having SRF with non-waste status raises concerns regarding traceability and environmental impact of those secondary fuels, and might as well hamper the transition to a circular economy. The aim of EoW should be to ensure that the waste that still arises, even after all preventing measures have been exhausted, is collected and treated in a way that ensures recycling. EoW criteria should not encourage suboptimal sorting processes aimed at processing waste into fuels rather than recycling. Hence, the development of EoW criteria would not be beneficial to a circular economy.[64]

Although setting EoW criteria might boost waste diversion from landfilling and towards energy recovery from waste, the production of SRF/RDF might discourage the separate collection of waste at source, or sorting out recyclable fractions and thus hinder transition towards circular economy.

The examples of Italy showed that EoW criteria still raised concerns about the environmental impact of incinerating SRF if there is no more obligation to comply with the waste and incineration regulations in place. The point was raised that each MS might apply different parameters to define the acceptability of waste for SRF, causing imbalances in the playing field and making the market condition more uncertain.

Most importantly, many Union-wide working groups raised severe concerns about the possibility of regulating EU EoW criteria for SRF. They strongly demanded to retain SRF under the waste status in order to keep it under the regime of the waste and waste incineration legislation.

[63] http://www.europarl.europa.eu/doceo/document/E-8-2017-003423-ASW_EN.html
[64] https://www.erfo.info/images/PDF/Jan_Theulen_2.pdf

However, the need to develop a set of rules which would ensure that waste derived fuel is of a good and constant quality seems apparent, particularly to create confidence in the market and to establish standardisation for all relevant supervision.

5.3.4 Case 4: EoW and BP to facilitate trans-frontier shipment

5.3.4.1 Introduction

Trans-frontier shipments of waste and goods between EU MS and third countries play an essential role in the European economy. If classified as non-waste, provisions at EU level related to the trans-frontier shipment of those materials are different compared to materials classified as waste. Accordingly, a harmonised classification system plays an important role to enable a fair competitive market.

The feedback received from MS and industry stakeholders demonstrates that there are cases where materials are classified differently by the authority / operator of dispatch and the authority / operator of destination: there might be disagreement on the character of the waste to be shipped.

As indicated and exemplified in the European Commission study on waste markets[65], different EoW criteria set at national or regional level can result in market distortion and can lead to difficulties in trans-frontier shipment of those materials.

5.3.4.2 Guidance and relevant provisions on the shipment of waste

The Waste Shipment Regulation (WSR, Regulation (EC) No 1013/2006) lays down rules and control procedures for the transboundary shipments (i.e. transport) of waste (MiW 2019). The WSR only applies to waste; it does not apply to BPs and EoW materials. Wastes on the 'green lists' are non-hazardous, and are subject to general information requirements when shipments between EU MS take place for recovery. Wastes on the 'amber lists' are deemed to be hazardous[66], and are therefore subject to more stringent control regimes within the EU, with notification and prior consent, as are certain mixtures of waste. Waste destined for disposal, either hazardous or non-hazardous, also has to comply with the prior notification and consent procedure.

In principal the logic of EoW regimes is that waste that has ceased to be waste is no longer under the waste shipment regime.

The definitions on waste, BPs and EoW materials as stipulated in the WFD (Directive EU 851/2018) to which the WSR refers, are a key element in terms of classification.

EU Guidance has been established i.a. on the classification of specific waste streams in order enable harmonisation throughout the EU MS (Correspondents' Guidelines). Some of them are relevant for material streams that sometimes are shipped as second hand or non-waste:

[65] European Commission (2016): The efficient functioning of waste markets in the European Union: legislative and policy options, final report.

[66] E.g. mixed municipal waste is non-hazardous but falls under amber list procedure according to annex IV part 1 second sentence and footnote referring to annex II of the Basel Convention.

- Correspondents' Guidelines No 1 on Shipments of Waste Electrical and Electronic Equipment (WEEE) and of used Electrical and Electronic Equipment (EEE) suspected to be WEEE
- Correspondents' Guidelines No 5 on classification of wood waste under entries B3050 or AC170
- Correspondents' Guidelines No 6 on classification of slags from processing of copper alloys under entries GB040 and B1100
- Correspondents' Guidelines No 7 on classification of glass waste originating from cathode ray tubes (CRT) under entries B2020 or A2010
- Correspondents' Guidelines No 9 on shipment of waste vehicles

In addition, several MS published national guidance also covering the aspect on waste classification in the context of transboundary movement (e.g. Handbook on Waste Shipment as part of the Austrian Federal Waste Management Plan 2017[67]; Shipping green-listed waste by the Nordic Council of Ministers 2018[68]).

Article 28 of the WSR lays down provisions in case of disagreement on classification issues. Paragraph 1 stipulates that "*if the competent authorities of dispatch and of destination cannot agree on the classification as regards the distinction between waste and non-waste, the subject matter shall be treated as if it were waste*."

Beside administrative burdens, provisions e.g. on financial guarantees (Article 6) only apply to materials classified as waste, to cover costs in cases where a shipment or the recovery or disposal cannot be completed as intended (costs for transport, costs of recovery or disposal, including any necessary interim operation; and costs of storage for 90 days). The MS receiving the material in question may take the decision to classify the materials in question as waste in order to prohibit future problems in case of incomplete shipment or recovery / disposal, or to be in line with the precautionary principle.

5.3.4.3 Problems / Examples / Solutions

Some MS indicated examples of specific waste streams (e.g. filter dust from exhaust gas cleaning of thermal processes; mill scales) where disagreement between MS` authorities on the classification of waste / non-waste occurred in terms of transboundary shipment of that material. This could lead to market distortions because, depending on the opinion of the competent authorities of dispatch and reception, the same material might be shipped with or without the administrative efforts of a notification (amber list) or with or without a contract and an identification form (green list for recovery).

In addition, cases were highlighted where shipment of claimed EoW material to a country where no EoW regulation had been established resulted in disagreement between the company receiving the material and the competent authority in the MS of destination. This situation for example occurred for tyre chips and for slags from metal industry. Sometimes, different decisions for the same type of material were made, based on a case-by-case assessment. In such cases, the EoW regulation of the country of dispatch proved to be useful for the competent authority of destination in assessing whether the material should be classified as BP, EoW or waste, although

[67] https://www.bmnt.gv.at/umwelt/abfall-ressourcen/bundes-abfallwirtschaftsplan/BAWP2017-Final.html
[68] https://norden.diva-portal.org/smash/get/diva2:1209854/FULLTEXT01.pdf

there is no mechanism of mutual acceptance of decisions made in another MS on EoW in place.

In France, national criteria for used tyres are in place and applied by the industry. The national competent authority contacted third countries which commonly import used tyres from France in order to discuss whether the shipment should in their view take place as waste or not. Different responses were received: some countries accepted the import as non-waste (Panama), some insisted on application of the waste shipment legislation (notification procedure for Libya). Libya did not recognize the EoW waste status, so the shipment of end-of-life tyres from France to Libya had to be done with a notification procedure in accordance with the Basel Convention. Hence, end-of-life tyres may be classified as EoW in France, but are exported as waste to Libya.

An arbitration system at EU level could help competent authorities to come to an agreement, instead of applying Article 28 of the WSR and declaring a material 'de jure' to be waste.

EU-harmonised criteria on EoW throughout MS may tackle the challenge on disagreement on waste classification in terms of bringing guidance and harmonisation. When additional EU-harmonised EoW criteria are in place, MS should be committed to put these criteria in practice. As revealed by monitoring activities conducted by the EC[69], the take up of existing EU EoW criteria needs to be improved also to facilitate transboundary movement of those materials.

Disagreements may not always occur only on the level of waste and non-waste, even different qualities of waste might be a challenge. On 10th of May 2019, the United Nations Environment Programme (UNEP) issued an Amendment to Annexes in the Basel Convention from 1 January 2021 which will affect the classification of plastic waste for export (based on the Norwegian proposal). The Amendment creates a new entry in Annex II - Y48 - that places all plastic waste subject to notification procedures unless they fall within one of the exceptions in Y48. With special emphasis on the exemption 'mixed shipments of PET, PE and PP provided that all the wastes in the shipment are destined for separate recycling in environmentally sound manner and almost free from contamination and other types of wastes. The question will be how sharp the line in terms of classification can be drawn.

Relevance

Following the growing global trade, the dimension of shipments of materials within EU-28 as well as from and to other regions in the world is illustrated via examples from COMTRADE database and provided in the following table:

Table 9: Data on specific material streams reported by EU-28 (data are not reported from all countries, so data gaps exist)

		EU-28 Extra			EU28 Intra	
FLOW		IMPORT	EXPORT		IMPORT	EXPORT
PRODUCT/PERIOD		Jan.-Dec. 2018	Jan.-Dec. 2018		Jan.-Dec. 2018	Jan.-Dec. 2018
2619	slag, dross scaling and other waste from the manufacture of iron and steel (exl granulated slags)	365 589	171 572		1 774 510	2 134 803
3825	Residual products of the chemical or allied industries, not elsewhere specified or included; municipal waste; sewage sludge; other wastes specified	1 379 169	433 016		830 478	733 544
3915	Waste, parings and scrap, of plastics	359 214	1 927 518		2 862 548	2 487 432
7001	Cullet and other waste and scrap of glass; glass in the mass	377 073	117 732		2 729 795	2 428 883
7204	Ferrous waste and scrap; remelting scrap ingots of iron or steel	2 828 697	21 806 287		30 504 750	29 373 230

[69] European Commission study (2014): Monitoring impacts from Council Regulation (EU) No 333/2011: EoW criteria for Al/Fe scrap

Source: EUROSTAT EU trade since 1988 by HS2-HS4 [DS-016894]

Metal bearing slags and metal scrap were analysed within this study regarding their potential to acquire EoW and BP status. As shown by the table, significant amounts of those materials are already traded between EU-28 and exported to third countries. Figure 1[70] shows the total amount of transboundary shipments of waste for Germany. Also other materials like plastics, glass, and other wastes are shipped frequently across borders, both between MS and to non-EU MS. Figure 3[71] gives an overview of transboundary shipments in EU-28 taking place under notification procedure.

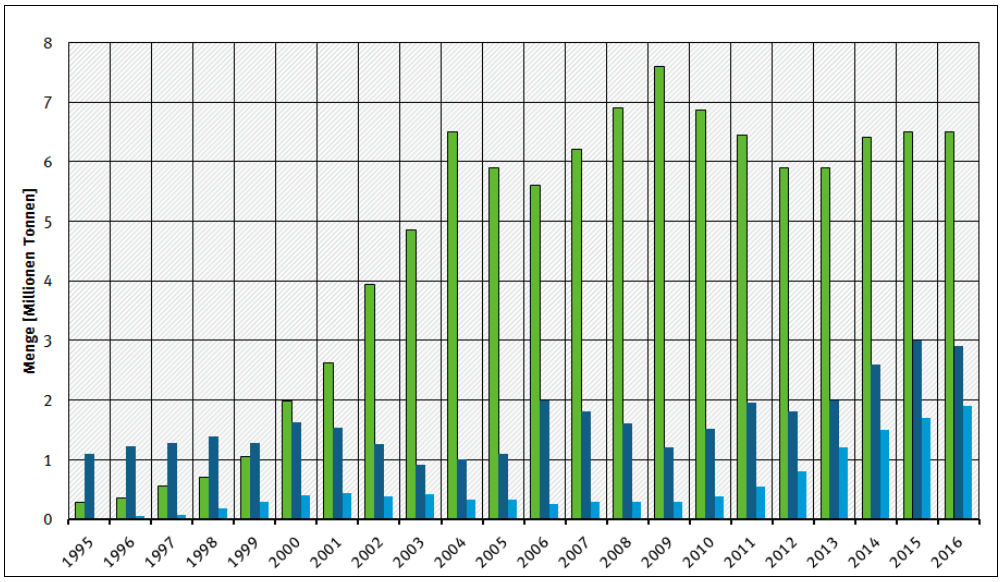
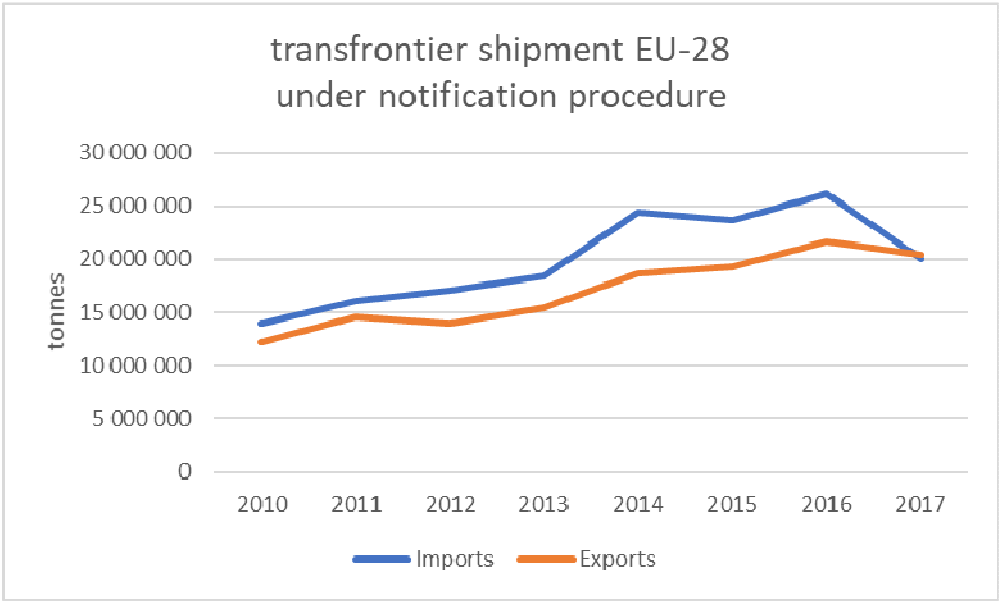


Figure 3: Total waste shipment reported for Germany (green: import; dark blue: export; blue: transit)



[70] https://www.umweltbundesamt.de/themen/abfall-ressourcen/grenzueberschreitende-abfallverbringung / grenz ueberschreitende-abfallstatistik/

[71] EUROSTAT, Transboundary shipments of notified waste by partner, hazardousness and waste management operations [env_wasship]

Figure 2: Total waste shipment for EU-28 (shipments with notification procedure)

5.3.4.4 Evaluation

In order to prevent different views and decisions on waste / non-waste status between MS which may hamper the smooth proceeding of transboundary shipments of waste / EoW / BP materials the following aspects are of main importance:

- To **increase the information exchange** on applied national BP and EoW criteria between the different MS in order to spread knowledge on regulations / decisions established in the MS, and to support MS in harmonising their national decisions;
- To **foster the uptake of the European Commission regulations** on EoW criteria **in practice**: European Commission regulation on EoW of glass cullet (see Commission Regulation (EU) N° 1179/2012); European Commission regulation on EoW of iron, steel, aluminium scrap and copper scrap (see Commission Regulation (EU) N° 715/2013); EU Regulation on animal BPs (see Regulation (EU) N° 1069/2009);
- To **establish additional Union-wide criteria on specific waste streams** in order to harmonise the classification of waste / material streams of high concern for trans-frontier movement;
- To make an in-depth assessment whether additional **European Commission support or arbitration in case of disagreement** should be given in order to analyse and harmonise specific decisions taken by the MS authorities (e.g. by an European Commission body with the function of a 'clearing house');
- When the financial guarantee in accordance with Article 7 of the WSR plays a role in decisions on waste / non-waste status taken by MS authorities it shall be analysed whether in specific cases the **introduction of a Union-wide guarantee**, even in combination with the supporting / clearing function mentioned in the previous point, might be an instrument to solve accompanying constraints.
- To develop additional **correspondents' guidance** on EoW discussion points, in application of Article 28 of the WSR.

5.3.5 Case 5: Metal scraps and residues, other than slags and ashes

5.3.5.1 Introduction and market situation

There are two main categories of metals: ferrous and non-ferrous. Metals which contain iron (or an alloy like steel) are ferrous metals, those without iron are non-ferrous. Commonly, non-ferrous metals are copper, brass (alloy of copper and zinc), aluminium, zinc, magnesium, tin, nickel, and lead. Precious metals such as gold, silver and platinum and exotic or rare metals are also non-ferrous.

Ferrous metals include mild steel, carbon steel, alloy steel, stainless steel, cast iron, and wrought iron. These metals are primarily used for their tensile strength and durability, especially mild steel which helps hold up the tallest skyscrapers and the longest bridges in the world. They can also be found in housing construction, industrial containers, large-scale piping, automobiles, rails for railroad and transportation, and in a high number of equipment at home. According to EUROFER, construction has the

largest sector share. Ferrous metals have a high carbon content which generally makes them vulnerable to rust when exposed to moisture. There are two exceptions to this rule: wrought iron resists rust due to its purity and stainless steel is protected from rust by the presence of chromium. Most ferrous metals are magnetic which makes them very useful for motor and electrical applications. In Europe, steel is by far the most frequently used industrial base material. The steel industry has long held a strategic place in the EU economy, fostering innovation, growth, and employment. Steel is closely linked to numerous industrial sectors such as automotive, construction, electronics and renewable industries. The EU is the second largest producer of steel in the world after China. The output of crude steel amounted over 167 million tonnes in 2018 (EUROFER). Its annual turnover is approximately € 150 billion and the steel sector employs approximately 350 000 people (SETIS).

The main advantage of non-ferrous materials is their malleability. They also have no iron content, giving them a higher resistance to rust and corrosion, and making them ideal for gutters, liquid pipes, roofing and outdoor signs. Lastly, they are non-magnetic, which is important for many electronic and wiring applications. Their unique properties are low weight (aluminium), high conductivity (copper), or resistance to corrosion and non-magnetic property (zinc). Non-ferrous metals are essential for mechanical engineering, transport, aerospace, construction, packaging, electricity and energy, electronics, and medical devices. According to Eurometaux's 2017 key industry data, the sector's turnover now reaches € 120 billion. The sector directly employs more than 500 000 people, mostly in downstream industries. The EU is one of the biggest consumers of non-ferrous metals worldwide. For many non-ferrous metals (except aluminium), the EU is very dependent on the import of such raw materials, hereby clearly indicating the importance of recycling in general and circular economy in particular, representing a huge opportunity for the EU.

Metals are valuable materials that can be recycled again and again without degrading their properties. Metal scrap is bits and pieces of metal parts (e.g., bars, turnings, rods, sheets, wire) or metal pieces that may be combined together with bolts or soldering (e.g., radiators, automobiles, railroad box cars), which, when worn or superfluous, can be recycled. Metal scrap is essentially a product made of metal that has become worn out or is off-specification and is recycled to recover its metal content, or metal pieces generated from machining operations and recycled to recover their metal content. Materials not covered by this term include residues generated from melting and refining operations (i.e., drosses, slags, and sludges), liquid wastes containing metals (i.e., spent acids, spent caustics, or other liquid wastes with metals in solution), liquid metal wastes (i.e. liquid mercury), or metal-containing wastes with a significant liquid component, such as spent batteries. As such, metal scrap comes from two different sources. First, there is the metal arising during the primary production or at any of the processes leading to final fabrication (new scrap). Then there is the scrap recovered from products containing metals that have reached the end of their service life (old scrap). New scrap generated during primary manufacturing is fully recycled either onsite or can be forwarded directly to a re-melter/refiner or to steel works. As its composition is known, it may not need pre-treatment before re-melting. Old scrap is collected after a consumer cycle, separately or mixed, often contaminated, depending on its origin and type of collection. Sources of old scrap are aluminium scrap, vehicles, construction and building, packaging material, cables and wires, and electrical and electronic equipment. Old scrap may also be called post-consumer scrap, whereas new scrap is pre-consumer scrap.

5.3.5.2 Treatment options

Recycling of metal scrap is very appealing because of the environmental issues regarding resource (primary ore) exploration and high energy intensity of primary metal production.

The metal scrap recycling process involves several steps. The main stages are collection, sorting, processing, melting, purification, and solidification.

Modern recycling technologies can effectively identify many different kinds of metals, though there is still the need for even more effective recycling technologies to separate non-ferrous metals.

Sorting involves separating metals from the mixed scrap metal stream or the mixed multi-material waste stream. Separating ferrous metals from non-ferrous metals is one of the most important steps in the sorting process. As ferrous metals contain iron, they are attracted by magnets and easily pulled out of the mixed waste stream. In scrap yards, cranes fitted with an electromagnet can remove larger pieces of ferrous scrap. When sorting metals from a mixed stream of recyclable material, paper is removed first, leaving only plastics and metals. Then, electric currents are induced across the stream where only metals get affected (Eddy Current Separation). Although aluminium is not magnetic, this technology can levitate it and allow plastics to drop out of the process. Recovering precious metals from electronic waste becomes economically viable only if enough scrap is collected. Such separation takes more technologically advanced and sophisticated recycling equipment. In large recycling facilities, the use of sensors to identify metals through infra-red scanning and x-ray fluorescence has become common practice.

To allow further processing, metals are shredded. Shredding is done to promote the melting process as small shredded metals have a large surface to volume ratio. As a result, they can be melted using comparatively less energy. Normally, aluminium is converted into small sheets, and steel is changed into steel blocks.

Scrap metal is melted in a large furnace. Each metal is taken to a specific furnace designed to melt that particular metal. A considerable amount of energy is used in this step, though much less than the energy needed to produce metals using virgin raw materials.

Purification is done to ensure the final product is of high quality and free of contaminants. One of the most common methods used for purification is electrolysis.

After purification, melted metals are carried by the conveyor belt to cool and solidify the metals. In this stage, scrap metals are formed into specific shapes such as bars that can be easily used for the production of various metal products. Iron and Steel (ferrous metals), are the most recycled metals globally due to their usage in leading industrial and construction industries. Aluminium, due to its excellent scrap value and lower energy needs, is the most recycled non-ferrous metal respectively the most recycled consumer product worldwide. Metal recycling of Silver, Gold, and Platinum is also done, albeit in lower quantities as the recycling processes involved are expensive.

Important regulation and legislation concerning management of metals scrap is the WFD and EU WSR. Scrap pre-treatment plants may generally operate under a permit for waste treatment, though permit details do vary among MS. Production of secondary metal at refineries and re-melters and the associated treatment of scrap metal on site are subject to the IE Directive on industrial emissions. Shipments of

metal which is classified as waste needs to comply with requirements in the WSR. Most metal scrap types belong to the list B of Annex V, containing wastes not covered by Article 1(1)(a) of the Basel Convention, and therefore not covered by the export prohibition, when exported to non-OECD countries.

Specific European Commission Directives regulate metal containing material streams: Directive on Waste from Electric and Electronic equipment, End-of-Life Vehicles Directive and Packaging Directive. Those Directives have addressed to different extent also specific requirements beginning from separation to recycling targets.

In April 2011, The European Union adopted its first EoW regulation covering iron, steel and aluminium scrap, aiming to stimulate recycling markets by defining more clearly when recovered material ceases to be waste.

- COUNCIL REGULATION (EU) No 333/2011[72] of 31 March 2011 establishes criteria determining when certain types of scrap metal cease to be waste under Directive 2008/98/EC of the European Parliament and of the Council. Article 3 established criteria for iron and steel scrap, Article 4 for aluminium. Any kind of treatment, such as cutting, shredding, cleaning and removal of pollutants needed to prepare the scrap for the final use in steel or aluminium works or foundries, must be completed before the metal scrap can be released from waste status. For example, ELV have to be dismantled, fluids and hazardous compounds removed and the metal fraction treated in order to recover clean metal scrap that meets the EoW criteria.
- In July 2013, the same occurred for copper through Article 3 of the European Commission Regulation (EU) No 715/2013[73] of 25 July 2013 establishing criteria determining when copper scrap ceases to be waste under Directive 2008/98/EC.

The analysis elaborated below covers all types of metal scrap, including the scrap which is not covered by the European Commission Regulations.

An evaluation by the Commission[74] of several waste streams resulted in the conclusion that recycling markets for scrap metal (steel, aluminium, copper) would benefit from the development of specific criteria determining when scrap metal obtains the status from waste ceases to be waste. Those criteria should ensure a high level of environmental protection. They should be without prejudice to the classification of scrap metal as waste by third countries. Metal scrap is used as feedstock in steel works, foundries, aluminium refiners and re-melters for the production of metals, non-ferrous metal producing industry. Iron, steel, aluminium scrap and copper scrap should therefore be sufficiently pure and meet the relevant scrap standards or specifications required by the metal producing industry. Key in the regulations are, next to a quality management system and statements of conformity, a set of criteria on the quality of the scrap resulting from the recovery operation, waste used as input for the recovery operation, treatment processes and techniques.

[72] COUNCIL REGULATION (EU) No 333/2011 of 31 March 2011 establishing criteria determining when certain types of scrap metal cease to be waste under Directive 2008/98/EC of the European Parliament and of the Council: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:094:0002:0011:EN:PDF

[73] COMMISSION REGULATION (EU) No 715/2013 of 25 July 2013 establishing criteria determining when copper scrap ceases to be waste under Directive 2008/98/EC of the European Parliament and of the Council: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013R0715&from=EN

[74] https://susproc.jrc.ec.europa.eu/documents/Endofwastecriteriafinal.pdf

5.3.5.3 Problems / Examples / Solutions

Different application across the European Union

Apart from the EU Regulations, the legal and administrative procedures on deciding EoW / BP status for scrap vary to high extend across European MS. Many MS decided to take different routes or procedures regarding the status of metal scrap. It occurs that MS set their own national criteria, leading to non-harmonised national EoW criteria. When criteria are set low, there might be a risk of export under non-waste status to lower recyclers. The collected information during stakeholder consultation revealed that differences were generated through a divergent implementation of the WFD or even the lack of implementation/use of certain parts of it. As such, stakeholders report that the Regulation is not homogeneously applied across EU countries due to different implementations of the Environmental and Waste legislation at national level on the one hand but also due to different technical specifications applied by the steel industries and scrap industry across Europe on the other hand, although CEN standards on e.g. grading exist (EN 10020:2000) to set up harmonisation.

There are regions (e.g. Italy) in which the EoW Regulations are fully applied providing some benefits to the local scrap market as, e.g., setting the legal framework for buying and managing scrap. On the other hand, there are other EU regions in which the EoW Regulations are not applied at all but where the scrap market depends on local provisions and habits and is functioning in terms of scrap availability and quality independent of its waste status. These differences derive from diversified pre-existing situations on which EoW criteria chanced upon during its entering into force as Regulation. In such a situation, the scrap market has adapted itself in order to be flexible and work properly within a non-homogeneous situation.

In Italy, the national EoW criteria (as laid down in Decree 5/2/1998) apply since 1998 and are functioning very well. Concerning ferrous scrap, Italy experienced a smooth and well organised transition towards EoW status. Only in Italy the EuW Regulation is applied on a larger scale. For iron and steel scrap, a JRC study[75] analysing the impacts of the EU Regulation establishing EoW criteria for iron and steel and aluminium scrap on scrap availability, trade flows, prices, administrative requirements and on environment and human health was carried out in 2014. The study revealed that in Italy more than 1,000 scrap companies generate EoW compliant scrap, whereas in the remaining EU in total only 100 scrap companies generate such scrap. In terms of the quantity of EoW compliant scrap available on the EU market, the study estimates that, as a lower bound, at least 15% of EU scrap steel and 10% of EU scrap aluminium is compliant. The study has found almost no evidence that EoW has caused any negative impacts on the market, whether that be to scrap quality, availability/trade or on the environment. On the contrary, quite a number of the survey participants, both from industry and competent authorities highlighted the perceived benefits of the introduction of EoW for metal scrap. These perceived benefits include: creating a simplified regulatory framework and offering companies greater flexibility and legal certainty. Some companies identified improved scrap quality and increased sales prices. Apart from of Italy, however, uptake is relatively modest to date. Discussions at the JRC workshop in 2014 did reveal significant industry interest from the UK, Netherlands and Spain, in particular. The study did not reveal why the regulations are no success outside of Italy.

[75] European Commission Joint Research Centre, Institute for Prospective Technological Studies Monitoring impacts from Council Regulation (EU) No 333/2011: EoW criteria for Al/Fe scrap, Final Report October 2014

The survey on stakeholders and competent authorities for this study revealed information from Spain and Ireland indicating a well organised, transparent and smooth procedure regulated at national level.

In Hungary, a license from the environmental authorities is needed in order to obtain BP status for scrap metal.

Lack of knowledge on REACH

Through the association, many steel operators throughout Europe reported a lack of knowledge about the implications of having a REACH-registered material.

In conclusion, the following problems could be identified:

- inconsistent application of the revised WFD leading to uncertainty on the status of metal scrap and to misclassification having consequences on cross-border trade and quality specifications, potentially harming circularity;
- underutilisation of the EU Regulations on EoW criteria, and
- inconsistent implementation of REACH restrictions.

As such, the problems relate to several issues which will be discussed below.

It is necessary to guarantee harmonised national interpretations of EU waste and EoW classifications. The market is often uncertain about the status of scrap metal due to the poor adoption of the regulations and to the variety of existing local or national provisions.

Application as BP

Article 5 (BPs) of the WFD states that "A substance or object, resulting from a production process, the primary aim of which is not the production of that item, may be regarded as not being waste, but as being a BP."

From this perspective, new scrap (e.g. off-cuts and similar materials) may be considered a BP, only if the following conditions are met:

- further use of the substance or object is certain: new scrap is completely recycled either onsite or sent directly to a re-melter/refiner or a steel works.
- the substance or object can be used directly without any further processing other than normal industrial practice: as the composition of the scrap is known, no pre-treatment is needed prior to re-melting. Only cutting, which is normal industrial practice, may be necessary.
- the substance or object is produced as an integral part of a production process: new scrap metal emerges during the primary production or at any of the processes leading to final fabrication.
- further use is lawful, i.e. the substance or object fulfils all relevant product, environmental and health protection requirements for the specific use and will not lead to overall adverse environmental or human health impacts: in this regard, the problem with heavy metals comes into play, depending on the type of metal recycled. Airborne heavy metal pollution and the subsequent impact on human health and the environment is something the steel industry is dealing with. Secondary steelmaking for example most often occurs in Electric Arc Furnaces (EAFs), emitting dust which contains volatile organic compounds, polychlorinated dibenzodioxins, polychlorinated dibenzofurans and particulate matter.[76] Secondary aluminium production occurs with hazardous air pollutants like 2,3,7,8- tetrachlorodibenzo-p-dioxin, particulate matter and volatile

[76] Iluţiu-Varvara DA. (2016) Dangerous Emissions During Steelmaking in Electric Arc Furnaces. In: Cavaliere P. (eds) Ironmaking and Steelmaking Processes. Springer.

organic compounds.[77] Further analysis is needed for assessing whether secondary production of other non-ferrous metals may have adverse environmental or human health impacts. Moreover, an issue in this regard relates to whether emissions originating from the new scrap should be allocated to the primary or secondary production. As the primary aim of the production process is not to specifically produce new scrap (e.g. off-cuts) or excess material, it may be reasonable to attribute their emissions to the primary production of the first cycle. If this approach would be followed, sensu stricto the original use (related to primary metal production) clearly has an environmental impact, but the further use (related to secondary production, thus re-entering) of the new scrap could then be perceived as having no supplementary environmental impact if all emissions were to be allocated to the first cycle. This is however not a correct reflection of reality as the new scrap is completely recycled directly onsite or sent to a re-melter/refiner or a steel works, and thus takes part in a new production cycle with likely environmental impact. Secondary production has positive effects on energy consumption and carbon dioxide emissions, but its effect on other emissions compared to primary metal production needs further investigation. In the end, the purity of the secondary material compared to the virgin material and the accompanying volume ratio in the electric arc furnace might be determining factors when it comes to emissions.

As full compliance with these four conditions is possible for clean new scrap only, the status of BP may be given to some of them (e.g. off-cuts and other similar materials) but may not be applied automatically to all metal scrap.

Therefore, it needs to be assessed whether post-consumer metal scrap can be classified as EoW or should remain in the waste phase.

Application as EoW

Recycling of metal scrap is very well developed in Europe and installing the EoW status brought, according to the JRC study[78], little impact on the amount of metal recycled. EoW criteria mean that waste related regulations will not apply once the metal scrap ceases to be waste; therefore, its introduction could reduce the legislative burden and administrative costs, especially in terms of shipments and trade, whilst ensuring that they will not lead to adverse environmental or health impacts.

The status of EoW can be given to ferrous scrap upon fulfilment of several criteria, but in compliance with the EOW Regulation.:

(a) Substance or object is commonly used for specific purposes
Scrap is a very common resource for metal production.

(b) A market or demand exists for such a substance or object
For metal scrap, compliance with these conditions is obvious from the existing, well established and structured market, and from the classifications of metal scrap used for trading.

(c) The substance or object fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products

[77] https://ec.europa.eu/environment/archives/dioxin/pdf/stage1/secaluminium.pdf; https://www.epa.gov/stationary-sources-air-pollution/secondary-aluminum-production-national-emission-standards-hazardous

[78] European Commission Joint Research Centre, Institute for Prospective Technological Studies Monitoring impacts from Council Regulation (EU) No 333/2011: EoW criteria for Al/Fe scrap, Final Report October 2014

For metal scrap, it implies that at the moment of EoW, metal scrap should also meet specifications or standards. Metal scrap is being traded based on standards or specifications (e.g. European Standard EN 13920, European Steel Scrap Specification) very often inserted in the business contract, hence whenever scrap is transported from scrap treatment plants to the steel works or refiner/re-melters, it fulfils a specification or standard.

(d) *The use of the substance or object will not lead to overall adverse environmental or human health impacts*
During recycling, the main environmental impacts occur at the steelworks or refineries/re-melters. Collecting, treating, sorting and separating are mechanical processes with dust as the main air emission, thus having a limited environmental impact. Primary and secondary metal production do have an environmental impact (see BP analysis) and emissions due to the use of metal scrap in the furnace are regulated by the IE Directive, disregarding the fact whether the metal scrap is classified as waste or not. As such, from this perspective, the use of metal scrap cannot lead to supplementary overall adverse environmental or human health impact following the use under non-waste status cannot not lead to additional impact.

Specific EoW criteria

Based on the four general conditions or article 6 of the WFD metal scrap is usually fit for EoW, as long as the specific criteria laid down in Annex I of Council Regulation (EU) No 333/2011 are met as well:

1) Criteria on the quality of metal scrap (standards/specifications, amount of foreign materials, no excessive amounts of ferrous oxide, free of visible oil, no hazardous properties, not exceeding concentration limits, not containing any pressurised, closed or insufficiently open containers).
2) Criteria on waste used as input for the recovery operation (only waste containing recoverable iron or steel, no hazardous waste, no filings/ turnings or barrels/containers containing oily fluids).
3) Criteria on treatment processes and techniques (source segregation, all pre-treatment completed, and requirements on waste containing hazardous components).
4) The producer or the importer shall issue a statement of conformity for each consignment of metal scrap.
5) The producer shall implement a quality management system.

Article 4 of the same Regulation ((EU) No 333/2011) may allow aluminium scrap to become EoW upon fulfilling similar conditions:

a) Criteria on the scrap quality (scrap shall not contain PVC in form of coatings, paints, plastics)
b) Criteria on waste used as input for the recovery operation (only recoverable aluminium or aluminium alloys)
c) Criteria on treatment processes and techniques
d) Statement of conformity
e) Quality management system

The European Commission Regulation (EU) No 715/2013 lays down similar criteria for copper scrap.

As such, these EoW criteria mainly consist of three elements: the source of metal scrap (quality and input material), the minimum required treatment processes, and technical requirements on the output material.

In order to be regarded as EoW, both the four general conditions from the WFD as well as the specific criteria from the regulations are to be met. For example, if scrap meets the specific criteria of the EoW regulation, but is stored for a long time because of problems finding a user, the scrap will remain a waste.

The specific criteria can be challenging, in which case a producer can choose to treat them as wastes instead of complying and treating them as EoW. When re-melters have an environmental permit for waste treatment, they can accept the scrap as secondary raw material under the waste status.

Origin

In order to make the scrap suitable for the re-melting/refining, contaminants have to be removed, safeguarding the required quality for metal applications. Recycling and the accompanying organisation (logistics, machinery and equipment) is based upon the type of contaminants to be separated, which in turn is linked to the source of the metal scrap and the way of collecting.

The European Waste Catalogue is a useful instrument for identifying the origin of metal scrap. The following codes within the Catalogue are applicable to metal scrap:

- 10 02-10: wastes from iron/steel industry, and from non-ferrous thermal metallurgy, mostly slags (see also Case 1 on metal bearing slags).
- 12 01 01-04: (non-)ferrous metal filings and turnings and (non-)ferrous metal dust and particles: metal scrap generated in metal workshop or fabrication plants.
- 15 01 04: metallic packaging: metal scrap generated by source separated collection of municipal waste or industrial packaging waste.
- 15 01 06: mixed packaging: may also contain metal as integrated part of the packaging material/product, thus cannot be separated manually.
- 16 01 06: end of life vehicles containing neither liquids nor other hazardous components.
- 16 01 17/18: ferrous metal and non-ferrous metal.
- 16 02: wastes from electrical and electronic equipment.
- 17 04 02: aluminium scrap from construction and demolition waste.
- 17 04 05: iron and steel scrap from construction and demolition waste.
- 17 04 07: mixed metals: metal scrap in a mixture from construction and demolition waste.
- 17 04 11: cables: metal scrap in a mixture from construction and demolition waste.
- 19 01 02: ferrous materials removed from bottom ash: metal material recovered from bottom ash may also be non-ferrous.
- 19 10 01: iron and steel waste from shredding of metal-containing wastes.
- 19 10 02: non-ferrous waste from shredding of metal-containing wastes.
- 19 12 02/03: (non-)ferrous metal from the mechanical treatment of waste.
- 20 01 40: metals from municipal waste (see also 15 01 04).

These different types of metals can be somewhat clustered in three categories. A first category would contain source separated metals where the metal scrap needs little pre-treatment. This category thus includes material from the Waste Catalogue with codes 12 01 01-04 and some old scrap with codes 17 04 02 and 17 04 05. Turnings and borings may be included if cutting fluids are removed.

A second category includes metal material separated at a collection centre, thus capturing packaging waste, 15 01 04, and municipal waste, 20 01 40.

The last group would then include the materials that need pre-treatment prior to the re-melting process. The group consists of mixed packaging (15 01 06 and 15 01 11), many categories under end-of-life vehicles (16 01) and WEEE (16 02), construction and demolition waste (17 04 07, 17 04 10, and 17 04 11), bottom ash from waste incineration facilities (19 01 02), and some of the separate collected metal containing municipal waste (20 01 23, 20 01 35, 20 01 36).

This clustering of metals allows to reveal the purity, regardless other characteristics such as size or type of alloy.

Minimum required treatment processes somehow guarantee a certain purity in terms of metal content.

Composition and treatment processes

A last element of the EoW Regulation relates to the technical requirements, referring to minimum values of the metal content in the scrap after completion of the minimum required treatment processes.

It should be noted that conditions included in CEN standards might not be as specific as the specific requirements included in the EoW Regulation. The CEN standards do grade the material but do not make a distinction between waste and non-waste status.

Conclusion

In conclusion, secondary materials are frequently produced from different waste streams and fractions, having a different purity. It is therefore of utmost importance to identify the sources of waste and to differentiate them appropriately. After all, the purity determines the recycling path and processes involved and early detection may facilitate early sorting and separation. Moreover, source identification allows to reveal those waste fractions of the waste stream that cannot become EoW before completing the whole recycling process. Mixed sources and sources in close connection to possible non-metal pollutants (e.g. End-of-Life vehicles, packaging) are more complicated and will be harder to classify as EoW or BP than pure fractions like pre-consumer cuttings. Alloys are more complicated as well as metals containing additives. Source separated wastes or mono-materials are usually more clean than mixtures that have undergone sorting afterwards.

Metal can be used in a wide range of applications, implying that metal scrap originates from several different sources. As such, ferrous scrap, aluminium scrap and copper scrap may obtain the EoW status upon fulfilling the criteria outlined above, but due to the several origins and diverging purity of metal scrap it may be difficult to grant EoW status to metal scrap of a certain group automatically as the quality of input material may not be guaranteed. Given the wide range of types and applications of metal scrap, it is impossible to have one set of EoW criteria applicable to all metal scrap.
The well-established market and recycling industry trades, where metal scrap is traded either based on standards or specifications which are often included as part of the business contract, deal with scrap both with a waste and an EoW status. The metal scrap industry is well organised as an integrated part of the metal industry.

Because a one-size-fits-all approach for metal scrap is impossible based on the specificity and purity of the waste, making case-by-case decisions is necessary in order to guarantee full compliance with the EoW criteria or to leave metal scrap in the waste phase. Self-assessment by industry, based on the EoW Regulations, may to some extent be possible as the EU recycling industry is able to treat a variety of complex secondary raw materials. The industry can set requirements on the quality of

input materials, has knowledge on material composition as an integral part of the business model, and complies with strict specifications for output materials. This effectively serves as a quality assurance system between companies.

Since REACH will apply to scrap that ceases to be waste, scrap processors have to fulfil REACH related obligations.

5.3.5.4 Evaluation

The status of BP can be given to new scrap only.

Ferrous scrap and aluminium or copper scrap are eligible for obtaining the EoW status based on both Article 6 of the WFD and EoW Regulations. Other non-ferrous metals (e.g. zinc, lead) are to be evaluated at national or case-by-case level due to lacking European conditions.

A one-size-fits-all approach for metal scrap is impossible due to the specificity and the lack of purity of the waste, thus making case-by-case decisions somewhat necessary for declaring EoW. Given the maturity of the metal recycling market on the one hand and the inherent use of standards/specifications on the other hand, self-assessment by industry may be possible, though still allowing the enforcement or third-party verification for checking the material's compatibility with EoW criteria.

As a summary, the following recommendation can be given:

- Avoiding processing problems (due to impurity levels) potentially leading to metal output not meeting product specifications, by enforcing third-party verification of the material's compatibility with EoW criteria.
- Coordinate national trade agencies and policies across MS.
- Harmonise enforcement of standards at regional and national levels within the EU.
- The EoW criteria should be applied flexibly to accommodate different fractions.
- Scrap consisting of skimmings, drosses, spills and metallics should remain waste until metal content in them is fully recycled. These residues generated from melting and refining operations are not covered by the term metal scrap. Develop EoW criteria for other metal scrap.

5.3.6 Case 6: EoW criteria for rubber from tyres

5.3.6.1 Introduction and market situation

Generally, waste tyres are no longer suitable for use on vehicles due to wear or irreparable damage. These tyres are a challenging source of waste due to the large volume produced, the durability of the tyres, and the components in the tyre that pose serious risk to human health and environment, such as PAHs or heavy metals. When tyres are taken off vehicles, they become part-worn tyres or end of life tyres (ELTs).
The part-worn tyre is a tyre, which is reusable, as a second-hand purchase or re-usable after reprocessing (re-treading). It can be reused as it is for its original purpose when a residual tread depth is left. In general it is not possible to specify a minimum tread depth, which can be valid for all types of tyres. Different minimum legal

remaining tread depths are set in different countries (Council Directive 89/459/EEC[79]). Otherwise it can be reprocessed under a procedure whereby new tread is vulcanised on-to the casing for becoming a re-treaded tyre. Re-treading is the industrial process of replacing a new tread band to a still-robust casing of the original new tyre. Council Decision 2006/443/EC[80] lays down that the provisions of UN/ECE Regulations 108[81] and 109[82] shall apply as a compulsory condition for the placing on the market of re-treaded tyres on the EU MS market. This is designed to ensure that re-treaded tyres fulfil similar safety and quality control requirements as new tyres.

The ELT is a non-reusable tyre in its original form. It enters a waste management system which should ideally be based on product/material recycling. Depending on the final purpose, ELTs can be recycled as a whole, shredded, as rubber or as steel, or energy recovered or used as infill materials in synthetic turf pitches or in loose form on playgrounds and in sport applications.

According to the European Tyre and Rubber Manufacturers Association (ETRMA) every year about 3.2 million tonnes of used tyres (part-worn + end-of-life) are generated in the EU (incl. NO and CH), of which 2.6 million tonnes are either recycled or recovered in some kind of way[83], or approximately 250 million tyres (new tyre weighs 10 kg). The material composition of a tyre varies by category (car, truck, etc.), but all categories include 4 fundamental groups of materials: rubbers (47%), carbon blacks/silicas (21.5%), reinforcing materials, and facilitators. The metal content amounts to about 16.5%, the textile content to about 5.5%, and additives account for about 7.5%. The rubber component can have 9 different applications: tread (32.6%), base (1.7%), sidewall (21.9%), bead apex (5.0%), bead insulation (1.2%), fabric/fibre insulation (11.8%), steel cord insulation (9.5%), inner liner (12.4%), and undercushion (3.9%).[84]

5.3.6.2 Treatment options

In general, the main treatment routes for ELTs are material recovery (recycling, and energy recovery (fuel e.g. RDF, pyrolysis)). Data from ETRMA (2016) indicate that energy recovery, with the cement sector being the main application, is still largely applied throughout the EU.[85] New kilns are equipped to use ELTs as supplementary fuel, since ELTs offer a high net calorific value comparable to petroleum coke. The energy/material recovery ratio is almost 50/50, but energy recovery (49%) slightly outweighs recycling (46%).[86] As such, this leaves a large potential for recycling as secondary materials are lost upon energy recovery.

Tyre recycling can be done in several ways as many treatment options are possible depending on the final application, in derived form as granules/powder or in civil engineering applications.

[79] Directive No. 89/459/EEC: Council Directive of May 3, 1989 on the Approximation of the Laws of the MS Relating to the Tread Depth of Tyres of Certain Categories of Motor Vehicles and their Trailers.

[80] 2006/443/EC: Council Decision of 13 March 2006 amending Decisions 2001/507/EC and 2001/509/EC with a view to making United Nations Economic Commission for Europe (UN/ECE) Regulation Nos 109 and 108 on re-treaded tyres compulsory.

[81] http://www.unece.org/fileadmin/DAM/trans/main/wp29/wp29regs/r108e.pdf

[82] https://www.unece.org/fileadmin/DAM/trans/main/wp29/wp29regs/r109r1e.pdf

[83] http://www.etrma.org/tyres/ELTs

[84] http://www.wrap.org.uk/sites/files/wrap/2%20-%20Composition%20of%20a%20Tyre%20-%20May%202006.pdf

[85] http://www.etrma.org/uploads/Modules/Documentsmanager/20180502---2016-elt-data_for-press-release.pdf

[86] http://www.etrma.org/uploads/Modules/Documentsmanager/elt-report-v9a--final.pdf

Options for recycling and recovery of ELT derived rubber

Recycling of ELT-derived rubber granules and powder

After shredding and removal of the steel and fabric components, the remaining rubber is reduced to rubber granules. Applications of ELT rubber granules include moulded rubber products such as wheels for caddies, dustbins, wheelbarrows and lawnmowers, urban furniture and sign posts.

Rubber granules and powder can also be used as flooring for playgrounds, as athletic tracks, as shock absorbing mats in schools and stables, as paving blocks or tiles for patios and swimming pool surrounds as well as roofing materials. Granules are shredded tyres and have different sizes (25-300 mm) depending on the application, whereas powder consists of finer particles (e.g. particle size less than 0.8 mm).

Rubber granules and mulches from scrap ELTs contain hazardous substances, including polycyclic aromatic hydrocarbons (PAHs), metals, and phthalates, and they may also release volatile organic hydrocarbons (VOCs) and semi-volatile organic hydrocarbons (SVOCs).

One of the main uses of ELT granules is rubber infill of artificial turf for example in sports fields, which is a contested application as it poses a risk to human health. In this regard, ECHA Committees on Risk Assessment and on Socio-economic Analysis have recently adopted opinions supporting the Netherlands' proposal to lower the concentration limit for eight PAHs in these applications. These eight PAHs are all classified for carcinogenicity (category 1B) according to CLP. In addition, two of the PAHs (Benzo[a]pyrene and chrysene) are also classified for germ cell mutagenicity in category 1B and 2.[87]

Rubber granules

Recalculated from 2016 ETRMA data, the share of granules as ELT application amounts to 52 %[88], hence representing the highest market outlet.

Rubber infill, rubber granules or rubber crumb: the elastomeric material that is most commonly used worldwide as infill material in synthetic turf systems comes mainly from recycled ELTs. Rubber crumb is the name given to any material derived by reducing scrap tyres or other rubber into uniform granules with the inherent reinforcing materials such as steel and fiber removed along with any other type of inert contaminants such as dust, glass, or rock. Rubber crumb is manufactured out of two different feedstock, namely scrap tyre rubber from different types of tyres (cars, buses, trucks) and tyre buffings, a BP of tyre retreading. The two most common methods for manufacturing rubber crumb are ambient grinding and cryogenic processing. Cryogenic rubber is stated to be the cleanest and highest grade of recycled rubber granule. Ambient rubber differs from cryogenic rubber in its grinding phase, where it is processed through a high powered rubber cracker mill at ambient temperature.

Tyre rubber gets a second life as infill in artificial turf pitches. In this way characteristics such as elasticity, weather resistance and extremely good aging

[87] ECHA's opinion: https://echa.europa.eu/documents/10162/53688823-bf28-7db7-b9eb-9807773b2109

[88] http://www.etrma.org/uploads/Modules/Documentsmanager/20180502---2016-elt-data_for-press-release.pdf

properties are maintained. According to ETRMA (2016), the most commonly used elastomeric infill material in sports fields is ELT rubber being styrene-butadiene rubber (SBR), which can also originate from other rubber materials. Ethylene Propylene Diene Monomer (EPDM) and ThermoPlastic Elastomer (TPE), originating both from recycled rubber or virgin material can also be used as infill material. According to the European Tyre Recycling Association (ETRA) 39% of recycled tyre rubber are being directed to sports surfaces. ETRMA indicates that the share of ELT granules/powder used in synthetic turf (including infill) is decreasing in Portugal, France, Italy and Spain the last years, in favour of moulded objects, export and other uses.

According to ESTC (EMEA Synthetic Turf Council) the number of synthetic turf football fields is expected to grow. ESTC estimates that in Germany 50 % of all fields built use EPDM or TPE and that similar infills have significant usage in Scandinavia (recycled or virgin material is not known).[89]

ESTC data indicate that most ELT, that is recycled to produce rubber infill, is sourced locally (or regionally) due to economic need to minimise transportation costs. However, rubber crumb is also shipped across borders in the EU. According to EUROSTAT, tyre-related rubber wastes are declared mainly under a specific code[90] (Harmonised System code to classify and define internationally traded goods). Under the HS code 4004[91] approximately 43,000 tonnes are imported into the EU per year, with unknown share of recycled rubber granules.

Following the restriction proposal currently being discussed in ECHA Committees[92], ELT derived granular infill material fulfils the definition of an intentionally-added microplastic. Consequently, their use could be restricted in the future. ECHA might also look in the future at the health and potentially also the environmental impacts of other substances contained in rubber granules derived from ELT.

Table 10: Tyre-related rubber wastes under HS code 4004 (EUROSTAT)

EU trade since 1988 by HS2-HS4 [DS-016894]		
PRODUCT	4004	
INDICATOR	QUANTITY_IN_TONNES	
PARTNER	EU28_EXTRA	EU28_INTRA
FLOW/PER	Jan.-Dec. 2018	Jan.-Dec. 2018
IMPORT	43 323	382 945
EXPORT	852 676	301 924

Extra-EU refers to transactions with all countries outside of the EU: the rest of the world except for EU Member States.
Intra-EU refers to all transactions occurring within the EU.

ELT-derived rubber powder

[89] https://www.echa.europa.eu/documents/10162/13641/bd_rubber_granules_en.pdf/87dd5039-3946-4c19-9ebd-158f0903a8d8

[90] the HS code 4004.00 (Harmonised System code to classify and define internationally traded goods).

[91] Waste, parings ad scrap of soft rubber and powders and granules obtained from them

[92] Proposal for a restriction on intentionally added microplastics: https://echa.europa.eu/registry-of-restriction-intentions/-/dislist/details/0b0236e18244cd73

Rubber powder can be used in rubber modified asphalt, taking advantage of the elasticity and noise absorbing characteristics of rubber. Rubber powder as an additional component of asphalt is used to get a bituminous conglomerate. Although this increases the life span of the road surface, reduces the noise pollution and may increase safety in wet road conditions, it is still relatively underutilised. Their application can be found in some roads of Italy, Portugal, Spain, Austria and Germany. In Italy, for example, over 450 km/lane of road have been made with modified asphalt containing ELT recycled rubber. Bitumen binder in asphalt can contain between 5 and 25 per cent of rubber powder, which indicates an enormous market potential.[93] Other applications for rubber powder are e.g. oil absorbent.

Use of ELTs in steel mills

Shredded tyres can be used in steelworks equipped with electric arc furnaces as a substitute for anthracite and source of (scrap) metal. As tyres contain a large amount of carbon, they are able to replace the anthracite (coal) that electric steelworks use to reduce the rust of the scrap metal that they transform into new steel. This application has been validated for industrial use in Belgium and in France. Using ELT which are abundantly available and assumable cheap, makes it possible to avoid using coal. According to ETRMA about 4,000 tonnes of end of life tyres are consistently used in this application. Recalculated from 2016 ETRMA data, its share accounts for less than 0.5%.[94] It can be discussed whether such an application is material recycling or incineration.

Recycling of ELTs in civil engineering applications

Whole tyres are predominantly used in civil engineering applications. Those applications vary from coastal protection, erosion barriers, artificial reefs, breakwaters, avalanche shelters, slope stabilisation, road embankments and landfill construction operations, sound barriers, insulation, and coverage of feedstock silos in agriculture. The market for whole tyres is limited to small projects and therefore of rather small scale.

By reducing the size of whole tyres, **shredded tyres** are obtained. ELTs that are mechanically sheared into shreds ranging in size from 25-300 mm and intended for use in civil engineering applications are called "Tyre Derived Aggregate" (TDA)[95]. TDA is used as foundation for roads and railways, as a draining material replacement for sand and gravels, landfill construction, sub grade fill and embankments, backfill for walls and bridges and sub grade insulation for roads. TDA is 30-50% lighter, drains 10 times better than well graded soil and provides 8 times better insulation than gravel.

Emerging recovery routes: Pyrolysis/Thermolysis

Thermal treatment technologies as pyrolysis, thermolysis and gasification are some of the emerging solutions for ELTs. Tyre pyrolysis involves thermal decomposition of ELTs into intermediate substances such as gas, oil and char. The economic viability of these options has yet to be proved but they may be able to increase recycling rates. Recalculated from 2016 ETRMA data, the share of pyrolysis in ELT applications amounts between 0.5-1 %.

[93] https://www.ecopneus.it/en/elt-recycling/end-of-life-tyres/modified-asphalts
https://www.etrma.org/wp-content/uploads/2019/09/elt-report-v9a-final.pdf
[94] http://www.etrma.org/uploads/Modules/Documentsmanager/20180502---2016-elt-data_for-press-release.pdf
[95] http://www.etrma.org/tyres/ELTs/material-recovery

5.3.6.3 Problems / Examples / Solutions

With 2.6 million tonnes of ELTs recovered annually in Europe and more than 600,000 tonnes of used tyres either reused or sent for re-treading, the tyre industry has a huge potential for turning ELTs into a resource. An important share could be diverted from energy recovery (in cement kilns mostly) to material recycling.

Problems related to the valorisation of this potential are associated with three main issues:

- Different legal status and qualification of ELT derived products: waste versus non-waste.
- The status of ELT derived materials determining the REACH obligations, which in turn depends on how these materials are classified under REACH (note: in 2016, the European Commission agreed with the majority of the Member States that rubber granules should be regarded as a mixture).
- Use of rubber granules in turfs, which is a loose application leading to environmental and health impacts.

ELT are classified as non-hazardous waste (75/442/EEC[96] amended by Directive 91/156/EC[97], and also Council Directive 91/689/EEC[98]), with European Waste Catalogue Code 16 01 03[99]. Materials derived from ELT, when originating from a waste treatment operation, can be classified as 19 12 04.

In Sweden, whole used tyres are classified as articles, having no obligations towards full material disclosure under REACH. Rubber crumb derived from ELT is, however, classified as a mixture which requires an inventory of all substances contained. The Swedish Chemicals Agency (KEMI) requests a full sameness analysis between tyres and rubber crumb. However, this is very hard to prove as the composition of tyres is undisclosed and it is very difficult to chemically analyse vulcanised rubber. Consequently, rubber crumb from ELT is given the status of waste. In Spain, rubber crumb is also sold as waste.

In most EU countries, rubber crumb from ELT is sold as a product without applying any criteria or keeping track of case by case documentation. Only Denmark and the UK (Quality Protocol[100]) have national EoW criteria for rubber crumb from ELT. The UK Quality Protocol indicates that tyre-derived rubber materials will normally be regarded as having ceased to be waste, and are therefore no longer subject to waste management controls, provided they 1) require no further processing before use, and 2) are destined for use in one of the designated applications within the designated market sectors indicated in the Quality Protocol. The PAH content is not yet addressed in EoW criteria in the UK. Finland indicated that there is no EoW criteria for ELTs in force, although the sector is requesting them.

Even if ELT derived materials may not be classified as waste, they still can be classified as mixtures which shall therefore comply with relevant REACH obligations. In

[96] Council Directive 75/442/EEC of 15 July 1975 on waste

[97] Council Directive 91/156/EEC of 18 March 1991 amending Directive 75/442/EEC on waste

[98] Council Directive 91/689/EEC of 12 December 1991 on hazardous waste

[99] http://www.nwcpo.ie/forms/EWC_code_book.pdf

[100] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/321419/LIT_8273.pdf

addition, the PAH restrictions as mentioned earlier may apply. If ELT derived materials are classified as waste, these restrictions will not apply.

For the issues outlined above, solutions are analysed and discussed.

1) *(Some) ELT derived products may cease to be waste according to the provisions of article 6 WFD*

The WFD (2008/98/EC) introduces the concept of EoW, by which selected waste streams could cease to be considered as waste if they comply with EoW criteria. Article 6: "waste shall cease to be waste when it has undergone a recovery, including recycling, operation and complies with specific criteria to be developed in accordance with the following conditions:

(a) *The substance or object is commonly used for specific purposes*.
It is clear that all applications for ELT derived materials outlined above fulfil this condition.

(b) A market or demand exists for such a substance or object.
A variety of recovery routes and end markets is outlined above, although some are small scale.

(c) The substance or object fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products.
Quality standards for ELT derived materials at CEN level (TC366) are being developed. For rubber granules, a number of different technical standards are available (EN 15330-1 (2013)[101], EN 933-1 (2012), EN 14955 (2005), EN 1097-3 (1998), EN 14836 (2005), DIN 18035-7:2002-06, NF P90-112, and PAS 107:2012. Other important standards are CEN/TC 366[102] and CEN TS14243[103]. Different rubber granule market segments have different rubber granule size requirements. Within a specific rubber granule market, each application has its own requirements in terms of particle size and purity.

(d) The use of the substance or object will not lead to overall adverse environmental or human health impacts.
Given the fact that recycled rubber granules used as infill material in synthetic turf has the greatest market outlet, this application will be examined further.

A 2017 report by ECHA on the possible **health risks** of recycled rubber granules used as infill material in synthetic turf concluded that there is a low level of concern from exposure to recycled rubber granules, despite the presence of hazardous substances like polycyclic aromatic hydrocarbons (PAHs), metals, phthalates, volatile organic hydrocarbons (VOCs) and semi-volatile organic hydrocarbons (SVOCs). ECHA however identified several uncertainties in its evaluation, such as knowledge gaps on the substances and their concentrations, uncertainties in the risk assessment based on assumptions, and unknown combined effects of all the substances in rubber granules. Given these uncertainties, ECHA suggested a total of 6 actions to be taken to counteract these uncertainties and to reflect good practice.[104] In this regard, ECHA Committee for Socio-economic Analysis (SEAC) has recently adopted an opinion supporting the Netherlands' proposal to lower the

[101] Surfaces for sports areas - Synthetic turf and needle-punched surfaces primarily designed for outdoor use - Part 1: Specification for synthetic turf surfaces for football, hockey, rugby union training, tennis and multi-sports use

[102] https://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:628903&cs=1C368B28F3B42EA8EC3319542640DEBC3

[103] https://www.evs.ee/products/cen-ts-14243-2010

[104] https://echa.europa.eu/hot-topics/granules-mulches-on-pitches-playgrounds

concentration limit for various PAHs in these applications, and following an earlier opinion by the Committee for Risk Assessment (RAC) in June.[105] The restriction proposal lowers the total concentration limit of eight PAHs to 20 mg/kg. The concentration limits for the eight PAHs in mixtures supplied to the general public are currently set at 100 mg/kg or 1 000 mg/kg and restricted by entry 28 of Annex XVII to REACH. The PAHs all have been identified as causing cancer and the proposed concentration limits will be closer to the limit values for individual PAHs in articles supplied to the general public set up in entry 50 of Annex XVII to REACH. The Commission is now expected to prepare a restriction proposal following ECHA committees' opinion. Possible adoption of a restriction on eight PAHs in granules and mulches for use as infill material in synthetic turf pitches or in loose form on playgrounds and in sport application is foreseen during the course of 2020.

Regarding the **environmental impact**, it is necessary to refer to substances in rubber granules, to substances that evaporate from rubber granules, and to substances that leach from rubber granules, which mainly contain metals and PAHs. Several scientific studies[106] throughout the EU measured substances from recycled rubber granules: some measured emissions to air and others even report on the migration to body fluids and leachate. Most research shows that rubber granulate contains metals capable of entering the environment. In particular, zinc was found to be released from the granulate. This metal can have a negative impact on organisms in the soil or surface water.

Very important in respect to possible environmental impact is the fact that synthetic turf containing (recycled) rubber granules may be a source of microplastic releases.

A report by the Ministry of Environment and Food of Denmark (2015)[107] has identified rubber granules (and artificial grass) as a source of microplastics in the environment. The diameter of the rubber granules from shredded tyres varies between 0.7 and 3 mm, thus regarded as microplastics, having several possible release pathways into the environment (sewage, agricultural soil, aquatic environment), all of which eventually leaching to the sea.

[105] https://echa.europa.eu/nl/-/echa-s-scientific-committees-support-restricting-pahs-in-granules-and-mulches

[106] Plesser, T; Lund, O. (2004). Potential health and environmental effects linked to artificial turf systems-final report. Norwegian Building Research Institute, Trondheim, Norway, Project #O- 10820; Nilsson, NH et al. (2008). Mapping Emissions and Environmental and Health Assessment of Chemical Substances in Artificial Turf. Danish Ministry of the Environment, Environmental Protection Agency; Menichini, E. et al. (2011). Artificial-turf Playing Fields: Contents of Metals, PAHs, PCBs, PCDDs and PCDFs, Inhalation Exposure to PAHs and Related Preliminary Risk Assessment. Science of total Environment. 409(23):4950-7; Marsili, L. et al. (2014): Release of Polycyclic Aromatic Hydrocarbons and heavy metals from rubber crumb in synthetic turf fields: preliminary hazard assessment for athletes. Journal of Environmental and Analytical Toxicology, (2014), 5:2; Ruffino, B. et al. (2013). Environmental Sanitary Risk Analysis Procedure Applied to Artificial Turf Sports Fields. Environ Sci Pollut Res. 20:4980– 4992. DOI 10.1007/s11356-012- 1390-2; RIVM (2016): "Beoordeling gezondheidsrisico's door sporten op kunstgrasvelden met rubbergranulaat" RIVM Rapport 2016-0202, published 20.12.2016 at http://www.rivm.nl/Documenten_en_publicaties/Wetenschappelijk/Rapporten/2016/december/Beoordeling_gezondheidsrisico_s_door_sporten_op_kunstgrasvelden_met_rub bergranulaat; RIVM/van Bruggen, M. (2007). Nitrosamines released from rubber crumb. RIVM report 609300002/2007.

[107] Ministry of Environment and Food of Denmark, Environmental Protection Agency (2015). Microplastics, Occurrence, effects and sources of releases to the environment in Denmark. Environmental project No. 1793, 2015.: https://orbit.dtu.dk/files/118180844/Lassen_et_al._2015.pdf

A study in Sweden by Magnusson K. et al. (2016)[108] estimated that around 2,300 to 3,900 tonnes of rubber granulates per year is lost from the surfaces of artificial football fields. A Norwegian study by Mepex[109] from 2016 mentions that the Swedish estimate for annual loss to water (i.e. by run-off) is around 70 kg per year from each turf on average. In Norway, Mepex (2014) investigated sources of microplastics as well[110]. According to the report, due to the rougher climate and poorer wastewater solutions, losses to waterways may be much higher in Norway compared to Sweden.

As such, criteria a) to c) of the Article 6 of WFD (2008/98/EC) can be seen as somewhat fulfilled for rubber granules derived from ELT. Full compliance with criterion d) cannot be demonstrated. There are uncertainties regarding impacts on human health on the one hand and adverse effects on the environment caused by leaching of hazardous substances as PAHs and heavy metals and by transportation of microplastics to the environment on the other hand. In order to avoid potential overall adverse environmental or human health impacts, it seems appropriate to apply the precautionary principle for ELT derived rubber granules and leave this substance in the waste phase. However, this does not exclude other ELT derived substances to leave the waste phase. Case-by-case decisions are thus needed in order to identify EoW for other ELT derived materials.

2) *Compliance with relevant REACH obligation for any application at all times*

Sometimes, registration of the substance in the recycled product may not be required. The European Commission services (CA/24/2008)[111] noted that:
"*It is also possible that the recovery process results directly in an article, instead of a substance or preparation. This may be the case e.g. if collected and sorted polymer waste is directly melted in new articles. In this case, registration is only required if the article contains a substance with an intended release under certain conditions or if the Agency has taken a decision to require registration pursuant to Article 7(5).*"

For some applications, the recycled rubber can be considered an article with no intended release, or as a (recovered) substance, which may be exempted from registration.
Many ELT derived materials however can be seen as a mixture, which shall comply with relevant REACH obligations at all times.

5.3.6.4 Evaluation

In order to establish a better exchange of ELT-derived materials, the industry asks for harmonisation of criteria and the REACH obligations throughout the European Union.

[108] Magnusson, K. et al. (2016). Swedish sources and pathways for microplastics to the marine environment. Swedish Environmental Protection Agency. Report number C 183.
http://www.ivl.se/download/18.7e136029152c7d48c205d6/1459515769795/C183.pdf

[109] Mepex (2016). Primary microplastic- pollution: Measures and reduction potentials in Norway. Norwegian Environment Agency. Project no 1118/ 100534.
http://www.miljodirektoratet.no/Documents/publikasjoner/M545/M545.pdf

[110] Mepex (2014). Sources of microplastic- pollution to the marine environment. . Norwegian Environment Agency. Project no 1032. Report no: M-321|2015.
http://www.miljodirektoratet.no/Documents/publikasjoner/M321/M321.pdf

[111]https://echa.europa.eu/documents/10162/23047722/consolidated_guidance_on_waste_and_recovered_substances_v3-2_en.pdf/173f6c53-d21a-48a8-9e1e-fc0c4c145d4a

The four general criteria for EoW are:

(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.

For rubber granules (biggest market outlet, 52%) full compliance with criterion (d) cannot be guaranteed and hence this material may remain in the waste phase when applying the precautionary principle. Other particular applications of rubber derived from ELT may cease to be waste when using a case-by-case approach. In summarising the assessment, the following advice can be given:

A good way forward would be a demand on the producers to take back their tyres (Extended Producer Responsibility, EPR) for ensuring environmental friendly collection. EPR is best regulated at EU level, but might as well be arranged at national level. In most European countries, tyre manufacturers have created non-profit ELT producer responsibility organisations managing the collection, sorting and recovery of tyres sold to end consumers. They generally charge the collection and recovery fees to the consumers when buying a new tyre. This model is being progressively extended to most European countries. Not all MS implemented EPR for ELT; the UK, Germany and Austria have the liberal system of a free market. In Denmark, a fixed fee is levied on all tyres brought into the Danish market: collected levies are pooled into a public fund supervised by the authorities, and distributed under specific rules to private collectors and recycling centres.

Regarding the current high volume application in artificial turfs it is recommended to perform an assessment of overall environmental impacts on EU-level (considering inter alia the ongoing studies regarding environmental implications of this application of rubber from ELT). There should come a general conclusion whether the use of rubber granules from ELT is a desired option for recycling or whether such rubber granules are just not suitable for this application or whether they are suitable only under specific conditions, e.g. limit values for hazardous substances in the rubber.

For ELT-derived applications other than synthetic turf infill it could be an option to provide EoW criteria at EU level. In this case, elements of green chemistry could be included to ensure that materials and products are reusable and safe in the whole value chain.

5.3.7 Case 7: Digestate from anaerobic digestion

5.3.7.1 Introduction and market situation

Anaerobic Digestion is a natural process driven by microorganisms which produce biogas and through possible upgrading, biomethane. Hence, two renewable energy carriers providing electricity, heat and fuel. Biogas plants also create another product which can be used for its nutrient and organic matter content: digestate. It is a semisolid or liquid product that has been stabilised by a biological treatment process of which the last step is an anaerobic digestion step. In thermophilic plants, the product may be sanitised. As such, biodegradable material (input material: agricultural

wastes, food industry wastes, source separated bio-waste and sewage sludge) is broken down into biogas on the one hand and digestate (output material) on the other hand, with the latter forming the scope in studies and position papers on EoW or BP status.

Co-digestion refers to the anaerobic digestion (AD) of multiple biodegradable substrates (feedstocks) in an AD system in order to maximize the production of biogas in an AD plant by adding substrates that produce much more biogas per unit mass than the base substrate. Animal manure is very often co-digested with approved co-digestion materials originating from agriculture, horticulture or the feed compound industry.

As such, processes only processing biomass and manure (not in co-digestion) are out of the scope of the case study.

Digestate contains organic matter and essential plant nutrients required for plant growth such as Nitrogen (N) and Phosphorous (P) and therefore primary resources can be substituted, which is a benefit in terms of using digestate as a fertiliser. The downside of using digestate is the fact that the used input material may contain possible loads of contaminants which needs to be taken into consideration for protecting the environment, soil functionality and in case of plant uptake potentially human health. As such, the eligibility of certain digestate materials will depend on the quality of the output material. Standards and specifications for digestate have been elaborated in a number of MS. Austria, Belgium, Germany, Sweden and the UK have quality assurance systems applying standards. These countries also define the input material that can be used[112]. Moreover some of them set process requirements, set limits to physical contaminants (glass, plastics) and heavy metals.

According to the European Biogas Association (EBA) about 80 million tonnes of digestate is generated in about 17,500 biogas plants throughout Europe[113], representing a market where trade across intra-EU borders does not amount more than 2 % of the total market.[114]Given its limited market value, digestate is not traded over large distances (sold/applied within a distance of maximum 100 km from the production plant)[115]. Dried digestate pellets may be transported over a longer distance than liquid digestate. Exports specifically occur in border regions and areas with a saturated digestate market due to use restrictions as a consequence of oversupply of manure for example. Because of small transport distances, it is necessary to consider the regional aspects, implying that cross-border transport of digestate most likely occurs between neighbouring countries. Shortage in national demand for digestate is the main reason for exports from Belgium (Fl) to France and from Holland to Germany.

[112]Austria: https://www.ris.bka.gv.at/eli/bgbl/II/2010/162, Austrian Fertiliser Ordinance BGBl. II Nr. 162/2010
Belgium (Fl): Conformity of input materials with limit values of VLAREA
Germany: Input list of source segregated materials defined by BGK
Sweden: : Input list of source segregated materials defined by AVFALL Sverige
UK: Input materials shall be source segregated bio-wastes materials or other biodegradable materials defined by REA.
[113]https://www.europeanbiogas.eu/wp-content/uploads/2019/05/EBA_Statistical-Report-2018_AbrigedPublic_web.pdf
[114]http://publications.jrc.ec.europa.eu/repository/bitstream/JRC87124/eow%20biodegradable%20waste%20final%20report.pdf
[115]http://publications.jrc.ec.europa.eu/repository/bitstream/JRC87124/eow%20biodegradable%20waste%20final%20report.pdf

5.3.7.2 Treatment options

A total of six main digestate treatment technologies can be identified:

- storage before land application;
- separation in a thick and thin fraction by the use of a mechanical separation device, which results in a thick (30% dry matter) and a liquid fraction. If needed, the thick fraction can be processed further into compost, or dried; the liquid fraction can be purified further by first removing the last bits of dry matter (by e.g. ultrafiltration or a dissolved air flotation unit) and then removing a large part of the minerals (by e.g. nitrogen stripping, struvite production or reversed osmosis);
- composting a batch of thick fraction: the solid fraction is composted in a drum. The thin fraction is stored. Composting is an aerobe process, the material is therefore aerated, either with air bubbles or by mechanically turning the material. If there is insufficient structure or carbon present in the material, additional material such as straw can be added to get the process started;
- drying the dewatered fraction of digestate (thermal treatment) and valorising it mainly for export;
- nitrogen stripping for ammonium-sulphate production (recognized as chemical fertiliser);
- the production of a nitrogen and phosphate rich fertiliser (struvite).

In some plants the digestate is dewatered, resulting in separated liquor and semisolid fractions. The liquid from the process is then reintroduced into the process to a large extent, and the excess, if any, can be used as a liquid fertiliser upon having the right quality.

Digestate is generally used for its fertilising properties, because of its highly available fractions of N, P and K, yet it also holds certain soil improving properties.

Digestate applications actually differ in the various MS; some examples are given in the following. Product status is possible with limitations e.g. in

- Austria if composted according to the Austrian Compost Ordinance (EoW);
- Denmark if only origin is from animal husbandry (BP);
- Estonia and Slovenia if only bio-degradable waste from specific sources is processed (EoW);
- United Kingdom if it meets with the "Anaerobic Digestion Quality Protocol: EoW criteria for the production and use of quality outputs from anaerobic digestion of source-segregated biodegradable waste".[116] The specified standard is BSI PAS 110;
- Germany, the majority of the digestate is used without further treatment;
- The Netherlands, digestate from separately collected organic waste is composted and sold as fertiliser.

In general, EU MS arrange the quality and application of digestate and other biowastes through waste laws (e.g. DK) or fertiliser legislation (e.g. NL). In the UK, digestate is able to receive EoW status through the Quality Protocol. The document describes the complete recovery for digestate, i.e. the point where digestates cease to be waste and can be used as a product, excluding the need for controls on waste management. Also the Czech Republic provides product status for digestate via national regulation:

[116]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/292473/426765_EA_QP_Anaerobic_Digestate_web.pdf

biodegradable waste treatment decree (341/2008 Sb.) or fertiliser law (156/1998 Sb.).

On EU level, Animal BPs Regulation (EC) No 1069/2009[117] also applies to anaerobic digestion facilities. In the event of risks to public or animal health from fertilising products derived from animal BPs, measures in accordance with Regulation (EC) No 178/2002[118] (food law, food safety) may be applicable. Other existing EU legislation relating to aspects of protection of human, animal and plant health, of safety and of the environment are Council Directive 86/278/EEC[119] (sewage sludge in agriculture), 89/391/EEC (safety and health of workers at work), 91/676/EEC[120] (protection of waters against pollution caused by nitrates from agricultural sources) and Directive 2000/60/EC[121] (water policy). Also Regulation (EC) No 1907/2006[122] (REACH), 1272/2008[123] (CLP) and 1107/2009[124] (plant protection) are important in this perspective. Lastly, digestate is also subject to EU Regulation (EC) 1013/2006[125] on shipments of waste.

Germany has no specific legislation dedicated to digestate. Official requirements for digestate are found in waste legislation as well as in legislation on fertilisers. The former arranges bio-waste referring to waste streams listed in the Ordinance on the Utilisation of Bio-wastes on Land used for Agricultural, Silvicultural and Horticultural Purposes, containing a larger number of biodegradable waste streams than the EU definition of bio-waste. A QA system may include extra parameters, on top of the mandatory legal ones. The BGK RAL QA system for example includes the degree of digestion in the form of organic acids that must be lower than 1500 mg/l for liquid digestate. Additives are regulated in the Fertiliser Ordinance and applied in low

[117] REGULATION (EC) No 1069/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL laying down health rules as regards animal BPs and derived products not intended for human consumption and repealing Regulation (EC) No 1774/2002 (Animal BPs Regulation): https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:300:0001:0033:EN:PDF

[118] REGULATION (EC) No 178/2002 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 28 January2002 laying down the general principles and requirements of food law, establishing the European Food SafetyAuthorityand laying down procedures in matters of food safety: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32002R0178&from=EN

[119] COUNCIL DIRECTIVE of 12 June 1986 on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31986L0278&from=EN

[120] COUNCIL DIRECTIVE of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31991L0676&from=en

[121] DIRECTIVE 2000/60/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 23 October 2000 establishing a framework for Community action in the field of water policy: https://eur-lex.europa.eu/resource.html?uri=cellar:5c835afb-2ec6-4577-bdf8-756d3d694eeb.0004.02/DOC_1&format=PDF

[122] REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and the European Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and the European Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02006R1907-20140410&from=EN

[123] REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:353:0001:1355:EN:PDF

[124] REGULATION (EC) No 1107/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009R1107&from=EN

[125] REGULATION (EC) No 1013/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 14 June 2006 on shipments of waste: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32006R1013

concentrations in order to stabilize and optimize the anaerobic process or avoid the emerging of hydrogen sulphide.

In the Netherlands there is no particular EoW legislation for bio-waste or digestate. The Dutch Fertiliser Act[126],however, contains provisions for several types of biowaste which can be used as a fertiliser on agricultural land, creating an identical effect to having an EoW status. The Fertiliser Act provides quality criteria for each group of fertilisers. Regulations on the input side are not in place; it is up to the operator to guarantee that the product meets the quality criteria on the output side. This is not a problem for bio-waste collected separately, but experience in NL with digestate from mixed waste posed a problem as this may contain all sorts of (non-monitored) pollutants, hence increasing the chance that the end product contains unknown pollutants possibly endangering the environment or human health.

Spain has no specific legislation regarding digestate from biodegradable waste. Some parts of existing legislation however can be applied: digested sludge is subject to legislation on sewage sludge and digested source-separated biowaste or digested organic matter from mixed municipal waste (usually composted) is subject to legislation on compost. The Spanish region of Catalonia has technical instructions describing that sewage sludge not suitable for direct application in agriculture is prohibited as input material in co-digestion plants to be co-digested with manures or slurries.

In Estonia, if manure and slurry are the inputs, the quality and use do not fall under the Waste Act regulation, but under the Fertiliser Act and Water Act regulation.

In Slovenia, digestate is covered by the Decree on the treatment of biodegradable waste, where Annex 1 provides a list of bio-waste suitable for biological treatment.

Austria has a positive list of input materials applicable for compost, which also applies for the treatment in biogas plants if the material is suitable for digestion.

As digestate is mostly used as fertiliser, Regulation (EU) No 2019/1009" (EU Fertilising Products Regulation or FPR in short) [127] is important. Article 4 of this Regulation and Annexes I, II and III detail the requirements that an EU fertilising product needs to meet. This is important in respect to digestate as it applies to EU fertilising products which are CE marked when made available on the market.

Part I of Annex I provides the designation of Product Function Categories (PFCs). PFCs that may contain digestate include organic fertiliser (PFC 1A), organic soil improver (PFC 3A), growing medium (PFC 4) and non-microbial plant biostimulant (PFC 6B).
Part 2 of Annex I sets requirements related to the different PFCs.

Annex II provides an overview of the Component Material Categories (CMCs) and the accompanying requirements for EU fertilising products that may contain digestate obtained through anaerobic digestion. Next to requirements on the input material, these CMCs include requirements related to acceptable production and processing techniques as well as mandatory process parameters. For digestate, CMC 4 (Fresh crop digestate) and CMC 5 (Other digestate than fresh crop digestate) are relevant.

[126] https://wetten.overheid.nl/BWBR0018989/2019-07-23

[127] REGULATION (EU) 2019/1009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5 June 2019 laying down rules on the making available on the market of EU fertilising products and amending Regulations (EC) No 1069/2009 and (EC) No 1107/2009 and repealing Regulation (EC) No 2003/2003: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R1009&from=EN

CMC 3(compost) may also be applicable, however CMC 4 and CMC 5 are the main CMCs to this study.

In CMC 4, plants and part of plants, which are grown for biogas production, are allowed. CMC 5 includes bio-waste resulting from separate bio-waste collection at source, certain animal BP of categories 2 and 3 according to Regulation (EC) No 1069/2009 and living or dead organisms or parts thereof except the organic fraction of mixed municipal household waste and sewage sludge, industrial sludge and dredging sludge. Input material for CMC 4 and CMC 5 are either subject to the process requirements for fermentation according to Regulation (EU) 142/2011 or to composting at specific temperature-time profiles as well as a minimum retention time of 20 days inside the fermenter. Digestate derived from input material belonging to CMC 5 shall not contain more than 6 mg/kg DM of PAH_{16} and no more than 5 g/kg DM of macroscopic impurities in the form of glass, metal and plastics above 2 mm of 3 mg/kg each. For both CMC 4 and CMC 5, the requirement for the maximum residual methane potential is set at 0.25 l/g VS. As such, for digestate CMC 5 is the most relevant as it clearly includes (bio)-waste as input material.

Annex III of the FPR holds labelling requirements.

Article 19 of the FPR refers to the EoW status indicating that this Regulation lays down criteria in accordance with which material that constitutes waste, as defined in the revised WFD, can cease to be waste, if it is present in a compliant EU fertilising product. CMC 5 (Digestate other than fresh crop digestate) includes bio-waste as input material, implying the presence of waste in the digestate. As such, upon fulfilling the criteria laid down in the FPR as well as the conditions of Article 6 of the revised WFD, digestate of CMC 5 can be granted the status EoW. The European Compost Network[128] indicates the following general trends regarding the use of digestate:

- Wet fermentation of bio-waste in biogas plants: In Central and West Europe, the digestate is divided into a solid (composted) and liquid (on agricultural land) part, whereas in Scandinavia the whole digestate is used on agricultural land.
- Wet fermentation of energy crops, manure and industrial / commercial waste (food): whole digestate is used on agricultural land
- Dry fermentation: the solid part of the digestion residue is composted with other bio-waste.
- Niche applications (e.g. pellets).

According to the European Biogas Association[129], new products like dried or pelletised digestate are gaining importance on the European market. Through complete upgrading by ultrafiltration and reverse osmosis, a highly concentrated fertiliser and a purified aqueous stream of drinking water quality can be produced, all of which are new developments.

It can be concluded that digestate is often used in agriculture, either as a whole digestate fraction or following separation in a solid and liquid fraction. The solid fraction may undergo additional treatments such as aerobic composting or drying. The liquid fraction, when not used on agricultural land, may be subject a treatment similar to wastewater to produce clean water.

[128] https://www.compostnetwork.info/
[129] https://www.europeanbiogas.eu/

5.3.7.3 Problems / Examples / Solutions

The main problems relate to 3 **issues**:

- Status of digestate as EoW or BP; can digestate lose rightfully its waste status?
- Applicability of REACH: Digestate is in the scope of REACH when it ceases to be waste. What are the consequences for its use and marketability?
- National regulations in setting provisions on digestate. If digestate could be classified as EoW, what should happen with the material streams which are already regulated as BP in the MS? Should they be excluded?

These problems are interconnected as well as linked to other issues related to digestate, especially regarding transboundary shipments.

Exemplified issues (other than outlined under part 2 (treatment options)) on EoW versus BP status:

- In France, digestate is on the wish list of BPs whereas in Ireland there is a smooth procedure for classifying compost and digestate as EoW. Compost and digestate EoW is well organized in Ireland as the material is produced at specific facilities that are subject to permits or licenses and those authorizations require the compost or digestate to meet certain standards (environmental, health, disease control and soil improvement) before it can be spread on land as a non-waste.
- There are consistent standards for compost and digestate across Ireland and this has facilitated the use of these materials as products in a satisfactory way. Currently, there is no harmonised way in the EU for determining whether digestate is a waste or a non-waste product. MS deal with the question rather differently (non-waste, waste and case-by-case decisions). In some cases, specific legislation may be in place for composts or digestate, whereas in other cases other laws are applicable such as fertiliser legislation.
- In Germany only sewage sludge from municipal sewage treatment plants can be used as fertiliser for conventional farm crops. The use of sludge as fertiliser has been banned for organic farming, in forests, in grassland, and for fruit and vegetable cultivation. Sewage sludge use as a fertiliser for forage cultivation is limited.[130]
- In Italy, digestate is used to produce compost with the requirement of the fertiliser national law (product).
- In Flanders, digestate is ending up as bio thermally dried compost for export.

On 28 March 2019, an important court case[131] regarding specific EoW criteria for sewage sludge which has undergone recovery treatment took place in Estonia (see also Chapter 4.5.9). More specifically, the lack of defined criteria at European Union or national level was the matter of discussion. The request for a preliminary ruling has been made in the proceedings between a municipal sewage operator and the Estonian environmental board, concerning the adoption of two notices by the latter which were issued to the operator in relation to the recovery of waste and which refused to recognise EoW status for sewage sludge that had undergone recovery treatment. The court decided that a producer cannot request an authority to deliver an EoW status when no EU or national rules exist (see also section 5.5.9).

[130] https://www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/sewage_sludge_management_in_germany.pdf

[131] http://curia.europa.eu/juris/document/document.jsf?docid=212330&doclang=EN

For each of the 3 issues outlined above, solutions were analysed taking into account elements in favour or in disfavour of the solution.

1) Avoid waste status if unnecessary

From a conceptual point of view, three streams are showing interference when it comes to determining the status of waste, EoW or BP: the input material, the output material and the produced biogas. As the primary aim of anaerobic digestion is to produce biogas, it cannot be categorised in one of these three statuses, biogas is a product. Biogas can be produced from a broad range of feedstocks that are suitable for anaerobic digestion. It can be produced from most biomass materials and biodegradable wastes: commercial food waste, forestry residues (bark, wood residues), waste from agriculture, wastes from the food and beverage industry, and sewage sludge (derived from biological treatment of municipal wastewater). Apart from sludges possibly containing dangerous materials, the input material can be considered non-hazardous waste (European Waste Catalogue[132] Code 02 and to some extent with code 03 as lignin in woody materials not readily degrades anaerobically) or non-waste (biomass, manure). Hence, the question remains how to classify the output material. Digestate as the output material may be regarded as a BP simultaneously generated with the product 'biogas' but also as a waste that after generation and due to its properties may merit the status of EoW.

Application as BP

The generation of digestate as a fertiliser is not the primary aim of anaerobic digestion. As such, paragraph 1 of Article 5 of the WFD is fulfilled and digestate can be a BP upon meeting following conditions:

(a) further use of the substance or object is certain: Digestate is used as fertiliser, with or without prior treatment. It also has other possible treatment options.
(b) the substance or object can be used directly without any further processing other than normal industrial practice: digestate can be directly applied in agriculture without prior treatment, depending on the input material and the temperature in the reactor. In many EU countries however the digestate is treated, mostly comprising of simple separation in a liquid and solid fraction.
(c) the substance or object is produced as an integral part of a production process: Upon producing biogas, not all input material is converted. Digestate is the inherent leftover fraction.
(d) further use is lawful, i.e. the substance or object fulfils all relevant product, environmental and health protection requirements for the specific use and will not lead to overall adverse environmental or human health impacts: the biggest issue is related to the presence of contaminants, which depends on the quality of the input material.

Based on this analysis BP status may only be possible and granted to digestate upon the use of a positive list of input materials in order to have a higher possibility that digestate meets quality criteria on the output side, hence revealing the need for criteria on both input (type and source) and output side (quality criteria). Transparency on the input materials is important for the confidence of users in digestate quality and can therefore increase digestate demand. Info on the input material is necessary to allow using digestate in line with legislation. Moreover, condition (b) can certainly be fulfilled by untreated digestate. In order to be able to grant hardly treated digestate the status of BP, further analysis is needed to assess whether liquid/solid separation and/or biothermal drying can be considered normal

[132] http://www.nwcpo.ie/forms/EWC_code_book.pdf

industrial practice. These applications are common practice upon treating digestate, it is however not clear if they are normal industrial practice and what the term normal precisely entails.

Following from the above, full compliance with article 5 cannot be achieved, implying that in no case BP status can be granted. It depends on the country and the treatment plant whether digestate undergoes further treatment or not. Except for Sweden and Germany, the majority of digestate within the EU undergoes further processing (i.e. liquid/solid separation, drying). Hence, digestate is in these cases not a BP, but possibly EoW.

Application as EoW

EoW status allows setting criteria in order to improve harmonszation and create legal certainty in the internal market. It allows avoiding the waste status, which is sometimes unnecessary and could cause market obstructions and may block the development of a circular economy. Moreover, it is an opportunity to generally recognise product standards for digestate and to promote quality assurance as well as digestate quality in order to create added value and support the market. Standards and technical specifications may facilitate the use as a product. Austria, the UK and Ireland already show that MS can effectively avoid the waste status for digestate within the existing European framework.

1) In order to be acceptable as EoW, the material should comply with Article 6 of the WFD:

- The substance has undergone a recovery operation: recovery in this case is a material recovery, as the organic matter of the input biodegradable waste is partly recovered and transformed into a material with more desirable properties regarding the nutrient value and soil improvement capacities.
- The substance or object is commonly used for specific purposes: fertilisers and soil improvers from bio-based origin are very frequently applied in agriculture.
- A market or demand exists for such a substance or object: The demand for digestate originates from its advantages as an organic fertiliser; however support to develop the market might be necessary.
- The substance or object fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products: there is a need for harmonised technical standardisation of digestate quality parameters, sampling and testing across the EU. Even though specific legislation is applicable throughout the EU (e.g. Sewage Sludge Directive 86/278/EC[133], Fertilisers Regulation EC 2003/2003[134]), existing legislation and standards for using certain types of digestate for the different applications shows a lot of variation between EU countries. It is logical that specific conditions (e.g. soil condition) and rules on quality and quantity determine the application of digestate, hence the former two (conditions + rules) are arranged on national level of MS. Regulations need to take into account the specificity of each country, making it difficult to create Union-wide technical requirements for using digestate on land. Country specific conditions can thus not be included in EU EoW criteria. Appropriateness for using

[133] COUNCIL DIRECTIVE of 12 June 1986 on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31986L0278&from=EN

[134] REGULATION (EC) No 2003/2003 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 October 2003 relating to fertilisers: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32003R2003&from=EN

digestate therefore may need to be adapted to the national legislation and standards applicable in the place where the digestate will be used.

- The use of the substance or object will not lead to overall adverse environmental or human health impacts: digestate use should not impact any stress on multifunctional soil functions, digestate should not cause health risks because of plastics, metals or glass, which may cause cuts or could be ingested by animals or humans that come into contact with crops and soils treated with digestate, yet again proving the need for quality criteria on the output side, which depends on the quality of the input streams.

Article 19 of REGULATION (EU) 2019/1009 of the European Parliament and of the Council of 5 June 2019 laying down rules on the making available on the market of EU fertilising products refers to the EoW status indicating that this Regulation lays down criteria in accordance with which material that constitutes waste, as defined in the WFD, can cease to be waste, if it is present in a compliant EU fertilising product. In such a case, "the recovery operation under this Regulation shall be performed before the material ceases to be waste, and the material shall be considered to comply with the conditions laid down in Article 6 of the WFD and therefore to have ceased to be waste from the moment that the EU declaration of conformity was drawn up". Recovery in this case is a material recovery and digestate may be classified as EoW. Upon fulfilling the requirements of annex I and II of the revised Fertilisers Regulation as outlined above and the conditions of Article 6 in the WFD, digestate should be given the status EoW.

The classification of digestate as EoW may improve the harmonisation and legal certainty in the internal market.

2) Applicability of REACH on digestate regardless its status (waste versus product)

REACH[135] lays down provisions for manufacture, placing on the market and use of substances, on their own, in mixtures or in articles (Article 1(2) REACH). Article 3(1) of REACH defines a substance as "a chemical element and its compounds in the natural state or obtained by any manufacturing process, including any additive necessary to preserve its stability and any impurity deriving from the process used, but excluding any solvent which may be separated without affecting the stability of the substance or changing its composition." Digestate may thus be within the scope of REACH if it is considered a substance on its own, or a mixture which contains substance/s. As such, for digestate classified as waste, REACH may not be applicable as Article 2(2) of EC 1907/2006 states that "Waste as defined in Directive 2006/12/EC[136]of the European Parliament and of the Council is not a substance, preparation or article within the meaning of Article 3 of this Regulation." Waste can in this context thus be defined in line with the definition of EU Waste Framework Directive 2008/98/EC to which REACH refers: "any substance or object which the holder discards or intends or is required to discard".

Nevertheless, digestate which lost its status of waste under EoW, can be regarded as a substance and therefore may fall under the scope of the REACH Regulation.

[135] REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and the European Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and the European Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32006R1907&from=EN

[136] Replaced by Directive 2008/98/EC (Waste Framework Directive)

Article 2(7)(b) of the Regulation (EC) No 1907/2006 (REACH) provides criteria for exempting substances covered by Annex V from the registration and evaluation requirements as well as certain downstream user obligations as described in Title V, because registration is deemed inappropriate or unnecessary and their exemption does not prejudice the objectives of REACH. Substances indicated in Annex V are exempted from registration for all possible uses, regardless of their volume. Digestate is included as an exemption case in point 12 of Annex V: "Compost, biogas and digestate"[137] In the Guidance for Annex V of REACH[138], the European Chemicals Agency (ECHA) has addressed results of the digestion process of certain materials and the "substance" concept under REACH. ECHA points out that "It should be noted that whole living or unprocessed dead organisms (e.g. yeast […] freeze-dried bacteria) or parts thereof (e.g. body parts, blood, branches, leaves, flowers etc.) are not considered as substances, preparations or articles in the sense of REACH and are therefore outside the scope of REACH. The latter would also be the case if these have undergone digestion or decomposition resulting in waste as defined in Directive 2008/98/EC, even if, under certain circumstances, these might be seen as non-waste recovered materials." This implies that only digestate that is not composed exclusively by living or unprocessed dead organism, and that is not waste or has ceased to be waste, is subject to REACH and exempted from registration.

The question under which conditions bio-waste treated in biogas facilities is legally not considered waste any more, is to be assessed according to Article 6 of the WFD in line with Article 19 of EU Regulation 2019/1009.

In conclusion, it can be stated that digestate may possibly be exempted from REACH registration obligations as long as it is waste resulting from digestion or decomposition, or when it contains non-chemically modified biological materials because of entries 7 and 8 of Annex V if the other conditions there are fulfilled.

Digestate would not be subject to the *REACH Regulation* so long as it is still waste, exempt from *REACH registration obligations* when containing non chemically modified biological materials due to entries 7 and 8 of Annex V, but subject to REACH when containing chemically modified biological materials, thus not benefitting from the exemptions in entries 7 and 8 of Annex V.

In the current situation, digestate producers might have to comply with REACH under certain conditions when the EoW digestate contains chemically modified input materials.

As far as the waste status of digestate, generated from waste, continues to exist at the time of its marketing, following Article 2(2) of REACH it is to be assumed that the digestate is not considered a substance or mixture under REACH, and possibly, in this respect no obligations may apply under REACH.

3) Evaluation on EoW or BP may be covered by national legislation as national markets have their own specificities, but criteria should be set at EU-level.

[137] COMMISSION REGULATION (EU) 2019/1691 of 9 October 2019 amending Annex V to Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH): https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R1691&from=EN

[138] https://echa.europa.eu/documents/10162/23047722/annex_v_draft_changes_10032010clean_en.pdf/ec640502-11c2-4ac6-b08f-1180f948f1fa

In some MS specific digestate legislation based on waste law exists, including explicit provisions on the status of digestate as waste or not (e.g. bio-waste ordinance in Germany). In Austria, the same positive list of input materials applicable for compost also applies for the treatment in biogas plants if the material is suitable for digestion. Such legislation needs to be adapted to be in line with Article 19 of REGULATION (EU) 2019/1009 of the European Parliament and of the Council of 5 June 2019 laying down rules on the making available on the market of EU fertilising products.

In other cases there are well developed official rulings or practices by regulatory authorities that link EoW to compliance with certain standards or protocols, like in the UK, which may need adaptation concerning limit values or the need for quality assurance upon installing EU EoW criteria.

As an accompanying measure to EoW criteria, there is a need to adapt existing legislation in MS regulating the use of digestate to harmonised technical standards on product parameters, sampling and analysis. Moreover, it may be advisable that the use of digestate is also regulated in places where such legislation does not exist yet, for maximizing the environmental benefits whilst minimizing potential risks to human health and the environment.

EU EoW criteria generate a level playing field, support the development of a circular economy market while still guarding the precautionary principle in avoiding pollution to be spread via digestate application.

The EU EoW criteria could possibly create a strengthened market demand for digestate by facilitating the import and export, thus cross-border transport.

Given its restricted market value, digestate is generally not traded over large distances. Most digestate is sold/applied within a distance of maximum 100 km from the production plant, although dried digestate pellets may be transported over a longer distance than the solid fraction and especially the liquid fraction of the digestate.

Facilitated exports are very relevant in border regions and areas where the market for digestate is saturated because of use restrictions due to competition from manure for example. Shortage in national demand is most likely the main reason for exporting digestate, especially in Flanders and The Netherlands.

Dutch exports to Germany require the participation of Dutch digestate plants in the German digestate quality certification scheme determined by RAL (German Institute for Quality Assurance and Certification) and bilateral agreement with German Länder governments. Flemish exports to France need to proof compliance with both Flemish and French standards.

Export possibilities are better developed with European EoW criteria. Despite the relative short distances over which digestate can be traded, European EoW criteria have a number of clear advantages related to facilitate cross-border trade.

Apart from the 3 issues clarified above, it should be specified that there is no need to exclude specific types of digestate which are already regulated as BP. It can be assumed that digestate recognised as BP will become waste again if it is discarded and not used for the intended purpose, hence falling under the waste law again. From the moment it becomes waste, the material may be subject to EoW criteria.

5.3.7.4 Evaluation

The classification of digestate as a BP might be more challenging than classifying it as EoW. Given the EU Regulation on waste derived fertilisers, the classification of digestate as EoW may improve the harmonisation and legal certainty in the internal market, which may not be the case upon BP classification.

As such, granting digestate the status of EoW seems to be the better option.

In summarising the assessment the following advice can be given:

- If no Quality Assurance can be guaranteed, digestate should remain in the waste status.

- For ensuring smooth and free trade, it is recommended that the application to EoW from a producer or importer refers to a statement of conformity, which shall be issued for each consignment of digestate. The producer transmits the statement of conformity to the next holder of the consignment. A copy of the statement of conformity should be kept during a certain period of time (to be decided).

- In order to guarantee quality of the digestate and to remain eligible for EoW status, it should be directly used by the producer or within a certain timeframe after its production.

5.3.8 Case 8: Non treated wood in natural form

Wood is a renewable resource used for several purposes. In order to fulfil specific product requirements most of the wood is used after it has undergone treatment that means the application of chemicals for drying, painting etc. Within this analysis 'non-treated wood' is covered respectively the wood is only dried without chemicals (open air or in an oven) and/or mechanically cut.

For the term 'wood in natural form' definitions are not that clear. It can be said that wood in natural form means a material that is not transformed in any way and the source (e.g. if it comes from a tree or a shrub) can be identified. By that, for example BPs of wood processing are not counted as 'wood in natural form', but residues of forestry and park and garden maintenance are.

The figure below is summarising the definition of wood and possible pathways.

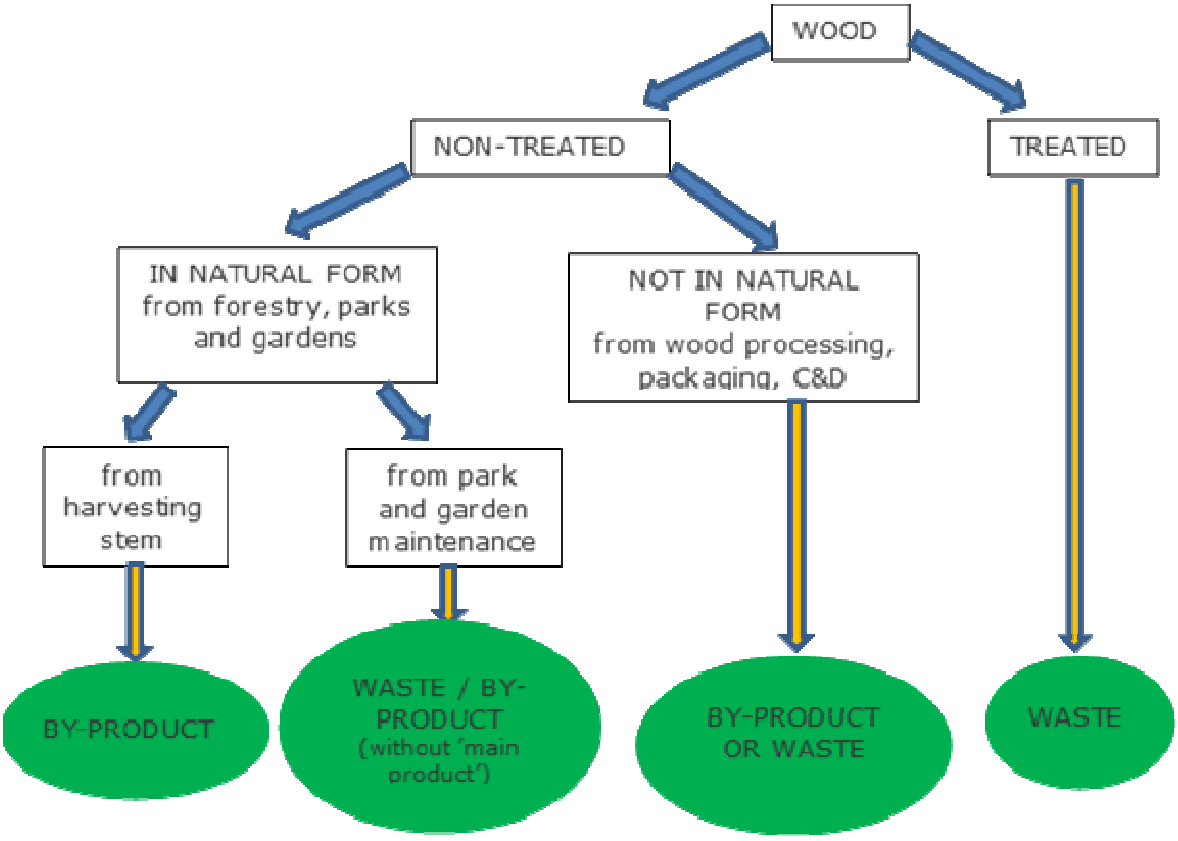


Figure 4: definition and pathways of wood

Data collected by EUROSTAT covers non-treated wood waste under two categories: 07.5 (wood wastes) and 09.2 (vegetal wastes). The table below shows the relevant EWC categories and their List of Waste equivalents. (Hazardous categories are not included.)

Table 11: EWC categories for non-treated wood waste and their LoW equivalents

EWC-Stat Rev 4 (Regulation (EC) No 2150/2002)	List of waste (LoW) established by Commission Decision 2000/532/EC
07.5 Wood wastes	
07.51 Wood packaging	15 01 03 wooden packaging
07.52 Sawdust and shavings	03 01 05 sawdust, shavings, cuttings, wood, particle board and veneer other than those mentioned in 03 01 04
07.53 Other wood wastes	03 01 01 waste bark and cork 03 03 01 waste bark and wood 17 02 01 wood 19 12 07 wood other than that mentioned in 19 12 06 20 01 38 wood other than that mentioned in 20 01 37
09.2 Vegetal wastes	

EWC-Stat Rev 4 (Regulation (EC) No 2150/2002)	List of waste (LoW) established by Commission Decision 2000/532/EC
09.21 Green wastes	02 01 07 wastes from forestry 20 02 01 biodegradable waste

According to EUROSTAT data approximately 55 million tonnes of vegetal waste and 53 million tonnes of non-hazardous wood waste are generated in the EU 28.

It is important to mention that according to Article 2(1)(f) of WFD 'other natural non-hazardous agricultural or forestry material used in farming, forestry or for the production of energy from such biomass through processes or methods which do not harm the environment or endanger human health' is excluded from WFD, meaning it is not counted as waste.

5.3.8.1 Treatment options

According to the principles of a circular economy, material recovery should be the preferred way of using wood wastes.

The two categories ('wood wastes' and 'green wastes') differ in value chain. 'Wood wastes' are wastes in a classical meaning, with a market for manufacturing wood composites (material recovery) or for using it as biomass for energy production. 'Green waste' is generally counted on one hand as bio-waste for composting, for mulch, or for leaving in the forests and on the other hand for energy purposes. (Note: that green waste from forestry used for energy purposes does not count as waste, see above).

These facts determine the legal status of wood wastes as well, treating all these materials mostly as waste and applying mostly EoW solutions for the use of these materials.

Digestion and energy recovery are important pathways for wood wastes and green wastes but these are not covered by this analysis. Digestion is analysed in a separate case (see case 7) and energy related applications are assessed to a certain extent in Case 3.

As EoW and BPs become products, relevant product legislations of the EU apply to them. The most important ones refer to environment and health issues, but we should highlight that in the case of non-treated wood these are not relevant as the materials are basically natural ones without any treatment and pollution. Still in some cases, assessment reports or quality assurance procedures would need to prove the fact of non-treatment itself.

5.3.8.2 Problems / Examples / Solutions

From the consultation with the MS and the stakeholders one end-of waste criteria in Austria relevant to this case[139]: *The Ordinance of the Federal Minister for Agriculture*

[139] In France there is a further EoW criteria for shredded wood packaging for use as biomass fuel in a combustion plant.

and Forestry, the Environment and Water Management on the Recycling of Waste Wood in the Wood Material Industry (Wood for recycling ordinance)[140].

The Ordinance is regulating the use of several wood waste types in wood composite manufacturing plants. In its Annex 1 the ordinance lists the 16 wood waste categories that are covered. Seven of these are categories of different treated wood materials. Beside those the following types of waste can be recycled in the frame of the ordinance:

- bark from machining and processing
- slabs, wood chips from untreated clean, uncoated wood
- sawdust and wood shavings from untreated, clean, uncoated wood
- wood swarf and slurry
- chipboard waste
- wooden packaging and waste wood, uncontaminated (exclusively mechanically treated)
- building and demolition wood (exclusively mechanically treated)
- wood shavings, uncontaminated
- wood for recycling, quality assured

From the list it can be seen that wood materials are generally considered to be waste by the regulations, even when it has BP relevance as well, e.g. bark, woodchips, sawdust etc.

It is understandable that in Austria for simplification reasons all wood waste categories are regulated by one legal document and treated as EoW categories.

On the other hand, categories for 'non-treated wood in natural form' are much more BPs then waste (see Figure above), as they are inevitably produced, can be used without further processing and their further use is lawful (see detailed evaluation below). Beside this, in several cases, especially when we don't have a product (e.g. park and garden maintenance, see evaluation below), case-by-case decision seems to be the best regulatory option.

A guidance with recommendations which category should be used for a certain type of non-treated wood in natural form would be important. The different types and recycling of such materials should also be clearly defined.

On the other hand, harmonised criteria or requirements could create conflicts with the case-by-case approach that may be required depending on material. For example, material recovery in the wood panel industry is possible with a proper environmental permit, but when using the material for mulching an EoW or BP status may be needed. Here it should be mentioned that during the consultation industry indicated in several cases that they are not in favour of too rigid guidelines or handbooks as these can create barriers to use of these materials. However, as during the consultation we haven't come across specific cases related to non-treated wood in natural form we are not aware of the specific problems occurring.

Generally, regarding secondary raw materials public opinion can be sceptical because of environment and health related concerns. However, natural materials are usually considered as safe by the public, therefore the recycling of green wastes from park

[140] AT MoE 2012] National ordinance on recycled wood „Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über das Recycling von Altholz in der Holzwerkstoffindustrie (RecyclingholzV, BGBl. II Nr. 160/2012)

and garden maintenance could be well perceived as a good example for circular economy.

5.3.8.3 Evaluation

From the figure above it can be derived that for non-treated wood end-of waste status is an appropriate approach only in the case of non-treated wood from different sources.

The four general criteria for EoW are:

(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.

Evaluation of these criteria:

- Use for specific purposes is defined by the industry as material for wood composites and also for energy production.
- Based on the consultation process we can see that a market exists for the material, the French and Austrian regulations are reflecting to a market demand.
- Technical requirements and standards can be set in the criteria, together with the product regulation elements, but as assessed above, these are not too complicated in the case of non-treated wood.
- As the materials are by-definition non-treated, adverse environmental or human health effects are not expected to play a major role. However, assessment reports or quality assurance procedures would still need to prove the fact of non-treatment itself (checking PAHs and heavy metal contents).

Based on this evaluation it can be affirmed that, as these materials are having the same origin, characteristics and recycling options (wood composites, energy production), harmonised criteria throughout the European Union could be a way to harmonise unique requirements across the European MS.

Residues of industrial wood processing (bark, sawdust, shavings, wood chips) could count as non-treated wood in non-natural form (see figure above), although by definition it is described in its natural form. This case is clearly a BP issue, because of the representation according to the four general criteria for BP which are:

(a) further use of the substance or object is certain;
(b) the substance or object can be used directly without any further processing other than normal industrial practice;
(c) the substance or object is produced as an integral part of a production process; and
(d) further use is lawful, i.e. the substance or object fulfils all relevant product, environmental and health protection requirements for the specific use and will not lead to overall adverse environmental or human health impacts.

Evaluation of these criteria:

- Further use of industrial wood processing residues is confirmed by the consultation process.

- Direct use of the product without any further processing other than normal industrial practice is expected.
- Wood processing residues are inevitably produced and are integral part of the industrial process.
- As mentioned above non-treated wood, by definition, does not contain hazardous substances, thus does not lead to overall adverse environmental or human health impacts.

Based on this analysis, BP status for industrial wood processing residues from untreated wood is already applied in most MS. For those BPs applications are established which do not have environmental or human health impacts. Harmonised EU regulations on those BPs do not exist up to now. Furthermore, in the Austrian regulatory example these materials may be also regulated as waste, that shows that harmonisation of definitions is desirable.

When it comes to non-treated wood in natural form originating from harvesting stems it is clearly a BP issue. This could also be established by a first European implementing act on BPs, but until now no examples exist.

Evaluation of the above BP criteria:

- Further use of the green waste is presumable; as if it would not be the case the materials would be simply dumped or burnt at source.
- Direct use of the product without any further processing other than normal industrial practice is expected. However, it depends on the intended use. It deserves further consultation and analysis to assess the possible use of the material.
- Green wastes are inevitably produced and are integral part of harvesting stems.
- As mentioned above non-treated wood, by definition, does not contain hazardous substances, thus does not lead to overall adverse environmental or human health impacts (even though a possible use of pesticides has to be verified.) To avoid administrative burdens in certain cases a simple certificate on the origin could be sufficient: forestry, park and garden maintenance wood is generally always untreated. In the cases of roadside green wastes a more detailed assessment on pollutions may be needed.

Based on this analysis BP status of non-treated wood in natural form originating from harvesting stems is possible.

In the case of green wastes from park and garden maintenance the possibility of treating these materials as BP, instead of the practice of treating this as a waste has been examined in the framework of this study.

Evaluation of the above BP criteria:

- Further use of the green waste is presumable which it would not be the case if the materials would be simply dumped or burnt at source.
- Direct use of the material without any further processing other than normal industrial practice is expected. However, it depends on the intended use. It deserves further consultation and analysis to assess the possible use of the material.
- It has to be questioned whether garden and park maintenance activities can be treated as a 'production process' and whether there is a product resulting from

the activity. In a classical way no, but according to NACE codes, under code 8130 Landscape service activities are listed, which cover park and garden maintenance, where 'maintained park and garden' can be regarded as a product.

- As mentioned above, non-treated wood, by definition, does not contain hazardous substances and therefore does not lead to overall adverse environmental or human health impacts (verification of possible use of pesticides required.) To avoid administrative burden in certain cases a simple certificate on the origin could be sufficient, because forestry, park and garden maintenance wood is generally always untreated. In the cases of roadside green wastes a more detailed assessment on pollutions may be needed.

Based on the above analysis BP status of non-treated wood in natural form originating from park and garden maintenance seems to be possible. However, it needs further research on existing practices in the MS and on the demand for such material on the market.

5.3.9 Case 9: Registers and reporting obligations on case by case decisions for BPs and EoW materials

5.3.9.1 Introduction and market situation

BPs and materials which ceased to be waste are not covered by the monitoring and reporting provisions of the European waste legislation. Even at national level it is not a rule that monitoring and reporting obligations of those BP/EoW streams are stipulated by law. As a consequence, these missing monitoring and reporting requirements require less effort to supervise those material streams, which from an administrative point of view might be of advantage. However, in order to track those material streams supervision might be requested.

Even though environmentally safe processing of those materials is in principle guaranteed through the EoW/BP conditions, knowledge on the specific criteria under which they fulfil EoW/BP status and other information related to the handling (e.g. operator, origin, destination, type of material, amount) are important in order to verify the functioning of the regulative proceeding. This is also requested to a specific extent for EoW materials as they may legally effect the calculation of recycling targets for different waste streams.

Leaving the umbrella of the waste status may result in additional registration, evaluation, authorisation and reporting obligations stipulated in the EU REACH Regulation. According to Article 2.2 of this Regulation waste as defined in the WFD is not a substance, mixture or article within the meaning of the Regulation and therefore falls out of its scope.

In terms of BP, EoW and any other recycling activities where a material is not classified as waste it falls under the registration provisions of REACH, unless it is exempted from registration in accordance with Article 2.7 of REACH.

Materials having EoW / BP status compete on the free market with other primary products most of them having a price value which make further handling/application economically feasible. By now, amounts on the overall material streams handled as

EoW/BP are not available at European level in a structured way which makes detailed analyses on the competitive ability and the market situation difficult.

In 2014 the European Commission published a study on monitoring impacts from Council Regulation (EU) No 333/2011 on EoW criteria for Al/Fe scrap. As revealed by the study comprehensive information even for the materials regulated under the EU EoW Regulations are not available and difficult to collect

In the following section, different approaches on reporting/monitoring taken on the basis of European and national legislation with regard to EoW/BPs are analysed and main differences are presented in order to highlight any further need for harmonisation. Revealed by the stakeholder consultation process the monitoring / reporting practices in this context are varying to a high extent throughout the MS (from no information at all to public available registers with an exhaustive information) and lead to crucial challenges in terms of evaluating the situation in the respective MS and at European level.

5.3.9.2 Status quo on data notified, reported and monitored

Reporting under the EU Regulations on EoW

Except for self-monitoring requirements as part of the requested management system no specific monitoring / reporting obligations are stipulated in the Council Regulation (EU) 333/2011 on iron, steel and aluminium scrap, Commission Regulation (EU) 1179/2012 on glass cullet and Commission Regulation (EU) 715/2013 on copper scrap.

Several MS have data available on the respective waste / material streams regulated by the EU Regulations on the basis of national monitoring and reporting obligations.

Notification of national criteria on EoW to the EC

According to Article 5 (BPs) and Article 6 (EoW) of the WFD, MS shall notify the Commission of the detailed criteria established at national level for EoW/BPs in accordance with Directive[141] (EU) 2015/1535 where so required by that Directive.

The notification procedure established by Directive (EU) 2015/1535 is a tool for information, prevention and dialogue in the field of technical regulations on products and Information Society services (European Commission Web 2019) and operated by following website:

https://ec.europa.eu/growth/tools-databases/tris/en/
(Technical Regulation Information System)

According to the revised Article 38 WFD an exchange of information and sharing of best practices, interpretation and adaption to technical progress shall be organised by the EC. This includes an exchange on national BPs and EoW criteria, as referred to in Article 5(3) and in Article 6 (3) and (4) facilitated by a Union-wide electronic register to be established by the European Commission (WFD 2018).

Examples for notified EoW regulations in TRIS:

[141] Directive (EU) 2015/1535 of the European Parliament and of the Council of 9 September 2015 laying down a procedure for the provision of information in the field of technical regulations and of rules on Information Society services.

- Austria
    - Regulation of the Federal Environmental Minister on the obligations during construction and demolition activities, the separation and processing of waste arising from construction activities, the production and classification as non-waste of recycled construction materials (the Recycled Construction Materials Regulation) (Reference 2014/564/A see also amendment 2016/154/A)
    - Decree of the Federal Environmental Minister, amending the Waste Incineration Ordinance (AVV Amendment 2009) (Reference 2012/635/A)
    - Ordinance of the Federal Environmental Minister on the Recycling of Waste Wood in the Wood Material Industry (Recycled Wood Ordinance) (Reference 2011/551/A)
- Italy
    - Draft Regulation laying down standards governing EoW status of absorbent hygiene products (PAPs) pursuant to Article 184-ter, subparagraph 2 of Legislative Decree No 152 of 3 April 2006 (Reference 2019/36/I)
    - Draft Regulation laying down standards governing EoW status of bituminous concrete, pursuant to and for the purposes of Article 184-ter, subparagraph 2 of Legislative Decree No 152 of 3 April 2006 (Reference 2017/531/I)
    - Draft Regulation laying down standards governing EoW status of vulcanised rubber from end-of-life tyres, pursuant to and for the purposes of Article 184-ter, subparagraph 2 of Legislative Decree No 152 of 3 April 2006 (Reference 2017/522/I)
    - Ministerial Decree concerning a regulation governing EoW status to determine types of Solid Recovered Fuel (SRF), pursuant to article 184-ter, paragraph 2 of Legislative Decree No 152 of 3 April 2006 (Reference 2012/480/I)

Until end of 2019 up to 60 different criteria on the EoW issues have been established by the MS and notified to the EC[142].

Up to now, no numbers on operators and on the amount of EoW/BP materials were reported via a Union-wide tool. Therefore, no overview on the situation / applicability of the defined criteria can be provided for EoW and BP materials.

National reporting and monitoring systems on EoW / BPs

Apart from the criteria on EoW to the European Commission via the TRIS database MS have established national reporting formats and registers to provide information on criteria, operators and further information on the processed EoW / BP materials (not all publicly available). National criteria are part of the respective national legislation and in several cases include specific obligations on monitoring/reporting.

Example: Ireland

In Ireland a public register on EoW / BP issues has been established by the Irish Environment Protection Agency covering:

[142] see TRIS database: https://ec.europa.eu/growth/tools-databases/tris/de/search/

- A register of BP notifications received by the EPA: http://web.epa.ie/Article27Register/
    - The notification includes information on case ID, Date Received, Economic Operator, Substance/Object, Source, Local Authority at Source, Destination, Local Authority at Destination, Destination Planning Reference, Determination Date, Status (Notified / Determined as waste / Withdrawn) (by 27/08/2019 more than 300 cases were reported).
- Publishing information / decisions on EoW according to Article 28 of the European Communities (Waste Directive) Regulations, 2011, S.I. No. 126 of 2011 which transposes Article 6 of the WFD. Following two decisions are highlighted and can be accessed:
    - 12 June 2018: The EPA decided that recycled LDPE material produced by Irish Packaging Recycling will cease to be waste if it complies with EoW criteria as set out in the EPA's decision document.
    - 11 June 2019: The EPA decided that recycled aggregate produced by Integrated Materials Solutions Limited Partnership will cease to be waste if it complies with EoW criteria as set out in the EPA's decision document.
- Link to the EU Regulations on EoW (Union-wide criteria on glass cullet; iron, steel, aluminium scrap; copper scrap).

Example: Austria

In Austria EoW operators report their amounts on waste which cease to be waste via the electronical reporting on waste balances (obligation on a yearly basis). Related obligations are defined in the national EoW regulations. The database is operated by the Ministry on Environment:
https://www.edm.gv.at

The information on the yearly reporting by the operators is analysed by the Ministry on Environment and is not publicly available. Overviews on specific EoW streams are analysed within the elaboration of the Austrian Federal Waste Management Plan, e.g. for waste fuels more than 100 EoW entries have been reported by 61 operators (approx. 250,000 tonnes per anno); for compost EoW have been reported by 278 operators (approx. 380,000 tonnes per anno).

Relevant amounts related to the European Commission EoW Regulations (glass cullet; iron, steel, aluminium scrap; copper scrap) are reported by the same electronical system but not validated in detail.

5.3.9.3 Problems / Examples / Solutions

The European Commission Implementation Decision[143] lays down rules for the calculation, verification and reporting of data on waste in accordance with the WFD and stipulates that municipal waste that has achieved EoW status[144] is to be used for the calculation of the targets on municipal waste for 2025, 2030 and 2035. By that, knowledge on the amount of waste that ceases to be waste at Member State level is

[143] Decision (EU) of 7.6.2019 laying down rules for the calculation, verification and reporting of data on waste in accordance with Directive 2008/98/EC of the European Parliament and of the Council and repealing the European Commission Implementing Decision C(2012) 2384

[144] Specific materials are excluded to be accounted as recycled in order to be considered for the calculation of targets: e.g EoW materials that are used as fuels or backfilling materials.

essential in order to apply the calculation rules. Having a look at the monitoring and reporting established at national and European level there is room for improvement on monitoring and reporting in this context.

Also to achieve a clear overview of material streams in the European economy, waste as well as EoW materials need to be counted. Statistics prepared by the Flemish Region of Belgium[145] show how EoW represents an important and growing fraction of material for further utilisation. Measuring EoW is necessary to have a full image on waste generation, waste prevention and waste treatment trends and quantities.

[145] Bedrijfsafvalstoffen productiejaar 2004-2016, OVAM (2018) + own calculations.

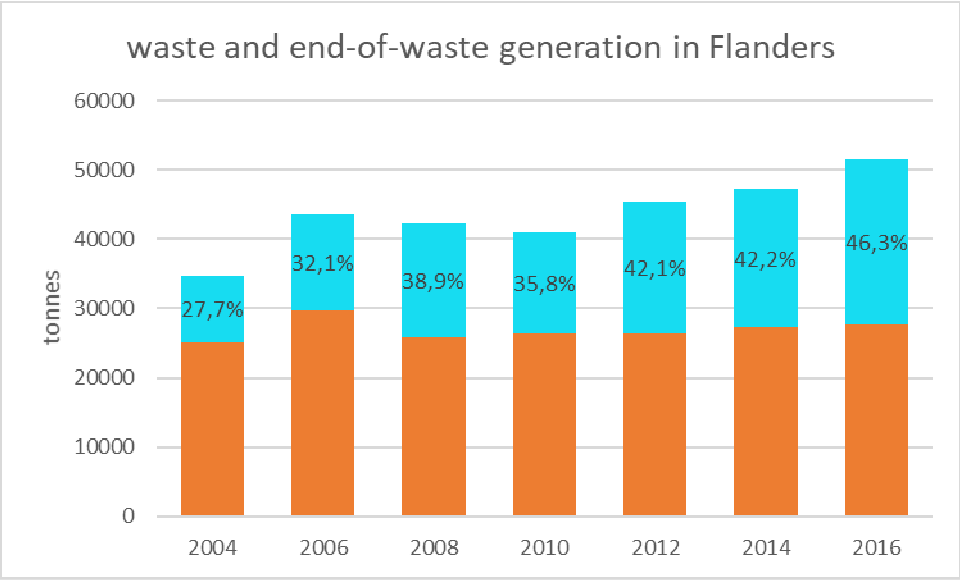


Figure 5: Amounts and share of EoW materials compared to total waste generation (orange: waste generation; blue: EoW materials)

In contrast to EoW, the material streams which are handled as BPs do not have to fulfil the monitoring/reporting requirements related to waste status from the beginning of their 'lifetime'. In addition, those BP materials do not count for any target calculation under European or national waste legislation. This might bring up the question whether the need for monitoring/reporting on BPs has to be requested to a lower extent compared to those for EoW materials. Even if not being part of waste statistics, BPs may have a big influence on statistical data if MS consider similar materials in different ways. This issue is relevant for the European waste statistics e.g. for waste streams such as slags from metal industry or waste wood.

Even at national level, data on BPs are rarely known by amount and quality. If decided by single case decision usually no further monitoring / reporting is requested and knowledge on the overall national situation is not known in detail.

5.3.9.4 Evaluation

Following the recent application of monitoring/reporting for EoW/BP materials at European and national level, in this Chapter the needs for further harmonization are discussed.

A. BPs

By now, at European level the European Commission Communication (COM(2007) 59 final, published by EC services) on the Interpretative Communication on waste and BPs and the Guidance[146] on the interpretation of key provisions of the WFD (2008/98/EC) provide guidance for MS in order to distinguish between waste and BPs. Specific examples are given for waste streams. In addition, case law decisions may also give indications how specific streams shall be classified.

[146] https://ec.europa.eu/environment/waste/framework/pdf/guidance_doc.pdf

Several different material streams which show high total volumes are already regulated under BP regime even on a case-by-case decision (e.g. metal bearing slags, waste wood, etc.). In none of the national or the European guidance documents, nor via the reporting by MS or monitoring by operators is a requirement to be fulfilled for those BP material streams. High amounts of the BP materials may be again re-processed at the same site for the same purposes.

In order to gain more insight into all the national guidance documents and criteria established for BPs, the reporting, e.g. via a notification procedure to the EC, should be established and enhanced.

Furthermore, this proceeding shall enable to establish additional European Commission guidance on specific material streams also taking into account national and European Commission court decisions to further harmonise the criteria set out for BPs.

The information on the total amounts on material streams managed under BP status and information on related operators are not considered as a crucial information to be collected (monitored and reported) by the administration.

Conclusion: No additional monitoring and/or reporting requirements are proposed on BP material streams. Based on the analysed situation in the MS and revealed by the stakeholder consultation carried out in this study rare information on the specific amounts and qualities of BPs is currently available. In addition, no claims in terms of harming the environment was reported for selected material streams already regulated under BP status. Taking into account that the WFD stipulates clear pre-conditions to be met in order to achieve BP status (see Article 5) and considering that big amounts of those material streams are already handled as BPs in different sectors without harming the environment, harmonisation should focus on further information exchange and guidance to be established at European and national levels.

B. EoW materials

At European level a major step in terms of harmonisation of EoW criteria throughout the EU has been set with the publication of the three EU Regulations on iron, steel and aluminium scrap (see Council Regulation (EU) No 333/2011), glass cullet (see Commission Regulation (EU) N° 1179/2012) and copper scrap (see Commission Regulation (EU) N° 715/2013). Even having in place proper criteria for those waste / material streams, monitoring and reporting requirements have only been established for metal scrap in order to enable assessing the uptake of those regulations.

Further criteria already established at national level have to be notified to the European Commission via TRIS database (Technical Regulation Information System): https://ec.europa.eu/growth/tools-databases/tris/en/

As demonstrated via the outcome of the MS consultation conducted within this study, in contrast to the situation revealed for BPs, monitoring and reporting obligations covering information on the total amounts on material streams managed under EoW status and information on related operators have been established in some MS (e.g. Austria, Ireland, Flanders/Belgium). In most cases the stipulated obligations on monitoring and reporting follow the line within the framework of the national waste legislation.

Considering that the material in question had been waste before, it is crucial to know also how much and by which operator the EoW material is managed in the phase where it ceases to be waste.

Conclusion: Additional monitoring and/or reporting requirements are proposed for EoW material streams. The WFD stipulates clear pre-conditions to be met in order to achieve EoW status (see Article 6) but does not give the obligation to report the amounts on those waste streams to the EC. Possibly this may be introduced following an additional requirement stipulated as part of Article 6 of the WFD in order to require MS to report on the total amounts of material streams managed under EoW status and information on related operators. In technical views, this reporting by the MS authority to the European Commission may be also implemented via existing reporting procedures such as the Eurostat reporting on waste generation and waste treatment (established under the European Waste Statistics Regulation). For example, this may include the requirement to give additional information which waste amounts have ceased to be waste on a yearly basis at national level following the specific criteria which have been notified to the European Commission in advance.

At national level, it makes sense, that operators or QMS certifier should report the amounts of waste that cease to be waste under national criteria complemented e.g. by the declaration of conformity to the MS authority. This monitoring and reporting could be part of national waste legislation.

5.3.10 Case 10: EoW status of ashes from biomass combustion

5.3.10.1 Introduction and market situation

According to the Industrial Emissions Directive[147] "biomass" stands for any of the following:(a) products consisting of any vegetable matter from agriculture or forestry which can be used as a fuel for the purpose of recovering its energy content; (b) the following waste: (i) vegetable waste from agriculture and forestry; (ii) vegetable waste from the food processing industry, if the heat generated is recovered; (iii) fibrous vegetable waste from virgin pulp production and from production of paper from pulp, if it is co-incinerated at the place of production and the heat generated is recovered; (iv) cork waste;(v) wood waste with the exception of wood waste which may contain halogenated organic compounds or heavy metals as a result of treatment with wood preservatives or coating and which includes, in particular, such wood waste originating from construction and demolition waste.

Biomass can be used to generate heat and electricity as well as to produce fuels for transport. Besides providing heat and energy, the combustion of biomass results in the generation of biomass ashes.

The quality and types of the biomass ashes vary according to the biomass they were generated from. Ashes from the combustion of ligneous fuels feature high amounts of Ca, Si, Mg and K while ashes from herbaceous fuels are dominated by Si, K and Ca. Moreover, ashes from herbaceous fuels have lower heavy metal contents (due to significantly shorter rotations periods, higher pH values and a lower heavy metal

[147] Directive 2010/75/EU of the European Parliament and the Council on industrial emissions (the Industrial Emissions Directive or IED)

deposition on agricultural soils, a lower heavy metal uptake occurs).[148] Chlorine content is seen as typically more relevant for straw ashes compared to wood ashes.

Studies show that there are significant differences between MS, making a generalisation difficult. As an indication[149]:

- In Austria, the bulk of biomass ashes are generally referred to as wood ash, although there are considerable amounts of straw ash which may have strong effects on chlorine content.
- Italy only shows wood combustion ashes (the quantities in Italy are approx. 30% higher compared to other MS due to inclusion of residential wood combustion in the statistics).
- In the Netherlands forest biomass (pellets) are typically utilised in co-combustion with coal in percentages of 5 – 15% on calorific content, stand-alone plants combust waste wood, but there is also combustion of several biogenic sludge fractions that are typically landfilled in other countries.
- Sweden has a high quantity of paper and pulp mill residues and forest wood combustion but also uses a lot of waste wood streams in combined heat and power plants.

Apart from the biomass fuel type, the combustion technology as well as the type of fractioning the ashes determine the chemical composition of the ashes. Ashes from fluidised bed furnaces (bubbling fluidised bed or circulating fluidised bed furnaces) contain significant amounts of bed material (usually SiO_2). Due to this dilution, the concentrations of other elements in the ashes are usually lower compared to ashes from fixed bed furnaces.

Usually, different ash fractions are generated in biomass combustion and co-firing plants. The main ash fractions are:

- Bottom ash (collected from the combustion chamber; main ash fraction of fixed bed furnaces)
- Coarse fly ash (boiler fly ash, cyclone fly ash)
- Fine fly ash (e.g. from electrostatic precipitators or baghouse filters; main ash fraction of fluidized bed furnaces).

The mass ratio between the individual ash fractions is depending on the combustion technology. In fixed bed furnaces, the bottom ash usually accounts for 60 to 90% and the coarse fly ash for 2 to 30%, whereas the fine fly ash fraction amounts only to 2 to 15% of the total ashes generated. In fluidized bed furnaces, usually the fine fly ash fraction accounts for the largest fraction of the total ash. Depending on the plant size, the combustion technology and the plant design some of the ash fractions may be also collected together (bottom and coarse fly ash or coarse and fine fly ash).[148]

There are significant differences in the nutrient and heavy metal content between bottom ash, coarse fly ash and fine fly ash. Volatile heavy metals such as Zn, Pb and Cd as well as the semi-volatile nutrient K exhibit highest concentrations in the fine fly ash, while non-volatile elements like Ca, Mg, Si, show the highest concentrations in the bottom ash. Due to the fact that the combustion temperature in fluidised bed furnaces is usually lower (between 800 and 900 °C) than in fixed bed furnaces (900 to 1,050 °C) the enrichment of volatile elements in the fly ash fractions of fluidised bed

[148] KEMA (2012): Options for increased utilisation of ash from biomass combustion and co-firing. IEA Bioenergy Task 32. Deliverable D4. Arnhem.

[149] IEA Bioenergy (2018): Options for increased use of ash from biomass combustion and co-firing. IEA Bioenergy: Task 32: Biomass Combustion and Cofiring.

furnaces is less pronounced compared to fly ashes from fixed bed furnaces. The presence of Cadmium (Cd) and to a lesser extent Zink (Zn) in ash is of particularly relevance due to its potential environmental impacts. Based on the current state-of-the-art, about 35 to 65% of the total amount of Cd and 35 to 55% of Zn in the ash is concentrated in the fine fly ash fraction of fixed bed furnaces. [148]

These differences in biomass types have an impact on the possibilities for utilisation.

According to the World Bioenergy Association, energy from biomass contributes 59.2 EJ/year or 10.3 % to the worldwide primary energy supply (World Bioenergy Association, 2017, data 2014). Using biomass, 493 TWh of renewable electricity was generated, comparable with around 2% of worldwide electricity production. Biomass dominates the renewable fraction in derived heat (heat produced in power plants) and direct heat (directly consumed in end sectors). The renewables share is 7.1% in derived heat and 27.7% in direct heat. In both sectors, the contribution of biomass is more than 95%. The heat sector is the single most important future development sector for biomass. The current practice implies that sizeable amounts of ashes from biomass are generated.[149]

According to Obernberger & Supancic (2009) the annual amount of ash from biomass combustion plants in the EU would amount to approximately 5.6 million tons. The use of energy from these renewable sources will lead to the annual production of an estimated amount of 15.5 million tons of biomass ash in the EU by 2020[150] representing a huge market.

In the near future, the demand for biomass-based heat and electricity will increase because of targets for generating energy from renewables and decreasing the emission of fossil CO_2. Because of this increase of biomass conversion, there will be an increase of biomass ash production.[148]
This asks for further development of suitable and environmental sound strategies for utilisation of biomass ashes.

5.3.10.2 Treatment options

According to IEA Bioenergy[149] several classes of utilisation of biomass ashes can be distinguished, which differ significantly across European MS. Since the types of biomass fuel inputs are not always strictly regulated, also the final ash products show large variations in quality, making it challenging to meet utilisation standards. In many types of utilisation there are limitations because of technical or environmental requirements, either from European or national standards, or from project specifications in which the biomass is used. The following treatment options have been established in the past[149]:

Use in forestry
Not all countries have regulations for the use of biomass ash or wood ash in forestry. In case there are no regulations (IT and NL), the use in forestry has to be qualified as dispersion of waste, which is forbidden. Sweden as an example does have specific regulations and policy to return ashes from forestry origin back to the forest if it is not contaminated. The policy to return ashes to the forest is considered a mitigation strategy against acidification. In Sweden, regulations focus on technical quality

[150] Obernberger, I., Supancic, K., Possibilities of ash utilisation from biomass combustion plants, in Proceedings of the 17th European Biomass Conference & Exhibition, Hamburg, Germany, 2009. https://www.bios-bioenergy.at/uploads/media/Paper-Obernberger-ash-utilisation-2009.pdf

(Content of lime / nutrients) and on environmental quality (trace elements). A major drawback on the use of biomass ashes in forests is their solubility and reactivity that may have a negative effect on vegetation and soil life. To reduce instantaneous release of soluble components from ashes, they can be pelletized with binders so that nutrients will be released more slowly. This is also done in Sweden. In Austria, a directive for the utilisation of biomass ash in agriculture and forest is in force, which was developed by the Council for soil - fertility and protection in 2013. This includes the legal requirements for the utilisation of biomass ash in forests in Austria, limit values for the pollutant content and a quality assurance scheme.

Fertiliser use / soil amendment
Presently, a new EU regulation has been published, laying down rules on the making available on the market of EU fertilising products and amending the EU Regulations (EC) No 1069/2009 and (EC) No 1107/2009. Article 4 of this EU regulation on EU fertilising products refers to product requirements set out in the Annex I (Product Function Categories) and Annex II (component material category or categories), detailing requirements that an EU fertilising product shall meet. This is important in respect to possible applications. The expectation is that in a lot of cases, contents in Pb and Cd will prevent the use as a fertiliser component. In Austria, a directive for the utilisation of biomass ash in agriculture is in force (see above). This includes the legal requirements for the utilisation of biomass ash as fertiliser, limit values for the pollutant content and a quality assurance program.

Addition to compost
In some countries (such as Austria) a maximum of 2% of biomass ashes can be added within the composting process to improve the process. Also Germany allows the use of ashes in compost, even up to 5%. This is done to improve the pH of the compost and improve the lime content of the compost for fertilising. Within the EU Regulation on fertilising materials (previously mentioned) additions to compost are allowed, up to 5%. Any additives must have a proven effect on composting process or lowering of environmental impact. This has to be substantiated and demonstrated.

Cement raw meal constituent
In principle, several types of biomass ashes (preferably clean wood but also for instance paper sludge ashes) can be used as raw meal substitute for the production of Portland clinker, which is the basis for most types of cement. In that case the biomass ashes are alternative raw material and carriers for CaO, SiO_2, Al_2O_3 and Fe_2O_3. The requirements for this application are established in bilateral contracts in B2B relations. This type of utilisation usually requires a nearby cement factory that needs specific additions to their limestone raw materials and in view of the scale of cement production a sizeable feedstock.

Asphalt concrete filler
Depending on the grain size distribution of aggregates for asphalt concrete, fillers need to be added to asphalt concrete mixtures to improve the grain size distribution related properties. These fillers can be prepared from limestone but also different types of fly ashes. In the Netherlands common biomass ash types used in asphalt concrete fillers are sewage sludge ash and biomass fly ash. Technical product regulations allow this.

Underground mining
Underground mining cavities need a lot of material for structural filling. Biomass ashes, in particular in lower qualities with lower economic values (or even a negative economic value) is used for that application.

Civil engineering
Bottom ashes from bio energy plants using waste wood is used as a road construction base material (embankment material, road foundation material etc.). In some countries, this is applied in combination with solid waste incineration ashes.

Other building materials
Following specifications of the building materials producers, biomass ashes is used as a raw material / intermediate product for industrial construction materials, cement replacement in building products.

Landfill
In many Member States landfilling of ashes is still the main outlet following a solidification/stabilisation step of the ashes.

5.3.10.3 Problems / Examples / Solutions

The ashes need to have a minimum technical suitability for the intended application as well as a constant quality. The specific application can be particularly attractive if ashes have a special property which provides an added value for using them.

Different properties of the biomass ash are of relevance, dependent on the application (e.g. in order to provide higher durability to concrete). Examples are the physical properties (particle size, density), chemical properties (pozzolanic behaviour in concrete, amount of nutrients, such as P and K, amount of macro elements Al, Si, Ca, amount of unburned carbon), ecological properties (amount of heavy metals, leaching behaviour). [148]

If ashes are used as a fertiliser, the EU Regulation on fertilisers and existing national requirements have to be applied.

EU Regulation 2019/1009 on EU fertilising products might be revised in the future to include also precipitated phosphate salts and derivates, thermal oxidation materials and derivates, and pyrolysis and gasification materials. The JRC's STRUBIAS project has drafted recovery rules and carried out a market study for these materials. In case the Regulation will be revised via respective Delegated Acts, harmonised rules will also apply for these fertilising products.

The national policies on ashes differ across European MS. Limit values are usually set on minimum content and availability of nutrients (N, P or K) or (Ca, Mg, or S). Ashes usually will not be used as a source of nitrogen since this element is missing in ashes. In addition, a maximum content of heavy metals (e.g. Cd, Cr, Cu, Pb, and Zn) may be set.

In the following examples national approaches are explained:[148]

- In Sweden, only ash from clean biomass fuels is allowed for agriculture or forestry applications. The Swedish Forest Agency recommended minimum and maximum levels of substances in ash products for distribution on woodland. The recommendations relate to solids concentrations in the ash product used in the forest, i.e. after the addition of plant nutrients and a binder. The stated guidelines relate to ash residues only.
- The Austrian Compost Ordinance regulates the use of various organic and inorganic wastes as basic materials and additives for the production of compost. Requirements include limiting values for concentrations of certain

heavy metals in the ash; the maximum addition of biomass ash to compost materials is limited to 2% related to the material weight of the input material into composting.

- The German Fertiliser Decree (Düngemittelverordnung) enables the use of biomass ashes as fertiliser. Different conditions are set based on different types of fertiliser. For all fertilisers there are limit values for heavy metals.
- In Denmark the Ordinance on the use of bio-ash for agricultural purposes was updated in 2008. This regulation also includes limitations on concentrations of polycyclic aromatic hydrocarbons (PAH).
- In Finland the Decree of the Ministry of Agriculture and Forestry on Fertiliser Products came into force in 2011. Wood, peat or agro-biomass ashes can be used as fertilisers as such. There are two possible type names: "Agro-ash": to be used in agriculture, horticulture, landscaping and forestry; "Forest ash": to be used only in forestry. For both types, there are minimum values for content of nutrients and maximum values for the content of minor elements. In addition, there are limit values for maximum loads (g/ha/year) for As and Cd. Addition of nutrients in the form of inorganic fertilisers product is allowed to improve granulated ash fertilisers.
- In Austria there is a guideline for the practical use of biomass ashes on agricultural and forest soils. The guideline is not legally binding but often serves as a basis for the application of biomass ashes as a fertilising agent for ash producers, ash users and authorities. Requirements consist of limiting values for concentrations of certain heavy metals or organic compounds in the ash; limiting values for the maximum amount of ash applied per year and ha, based on the quality of the ash as well as on the type of soil (agriculture, grassland, forest); recommendations for the proper application of biomass ashes on agricultural (farmland and grassland) and forest soils.[151]

When ashes are sold as a product in the EU, the producer needs to register the ashes according to REACH. REACH however is not applicable to waste as defined by Directive 2008/98/EC. Several utilities and ash traders in Belgium, Finland, Germany, Poland, The Netherlands and other countries already have registered their hard coal ashes, lignite ashes, peat ashes, co-firing ashes and 100 % biomass ashes in 2010. As a follow-up to this registration procedure, safety information has been compiled and made available to downstream users of the ashes.[148]

Other applicable environmental regulations on ash utilisation relate to waste handling and classification, waste disposal, soil and water quality. General guidelines exist regarding the management, monitoring, collection and treatment of waste, i.e. ashes. Within the EU, the WFD defines criteria on which to decide whether a residue is a BP and when it is considered an EoW product.

When landfilling is carried out in the EU, it has to be done in compliance with the provisions of the Landfill Directive 1999/31/EC. Furthermore, Council Decision 2003/33/EC establishes criteria and procedures for the acceptance of waste at landfills, laying down limiting values for concentrations of certain elements and components in the waste (i.e. ash), as measured in the leachate. In most EU countries, taxes need to be paid for each ton of waste disposed. In the Netherlands there is a landfill ban for fly ash disposal. Alternative applications are established such as cement and concrete filler, soil amendment / fertiliser, asphaltic filler, underground mining, civil engineering. A landfill ban makes the recovery of ashes compulsory in the country.[148]

[151] Umweltbundesamt Wien (2016): Biomasse-Aschenströme in Österreich. Reports Band 0561. Wien.

Also for utilisation of ashes in civil engineering, national legislation has been established. In the Netherlands, the National Decree on Soil Quality gives limits for leaching behaviour for inorganic compounds and compositional requirements for organic compounds. In Germany, the application of ashes has to comply with the provisions of the German LAGA (Länder Arbeitsgemeinschaft Abfall) regulation for the application of mineral BPs. This regulation sets limits on leaching behaviour. In Finland, the Government decree on recovery of certain wastes in earth construction is applicable. This decree limits the use of ashes to certain constructions (public roads, pavements, parking areas, sports ground, etc.).[148]

Based on the application requirements listed above, the IEA Bioenergy Task 32 country representatives were asked to list and prioritise limitations for improved ash utilisation. An overview of the responses is given below:[148]

- One issue relates to spreading the ashes as fertiliser. Ashes often do not meet the requirements of fertiliser spreading devices regarding particle size and dust formation. Therefore, ash pre-treatment (e.g. metal separation, milling screening, wetting) as well as the appropriate selection of a suitable spreading technology is necessary, if direct ash application on soils shall take place. The lack of application technologies optimised for biomass ash leads to problems at the interface between plant operators and farmers and during application regarding ash logistics and appropriate transport and spreading techniques.
- Although regulations exist for the use of ashes in concrete or fertiliser in some countries, they often do not (fully) cope with the possibility of using biomass ashes. An example is the EN-450 regulation for use of fly ash in cement. Only co-firing ashes up to 50% m/m (green) wood can fulfil the revised EN-450. A 100% biomass will not comply by definition.
- Only very small fractions can be used as an additive in compost production, e.g. established in Austria or Germany, which limits the utilisation potential significantly.

The legislation on the utilisation of biomass ashes for practical use as fertiliser is far from optimal. Only in some MS there are some (legally not binding) guidelines regarding the application of biomass ashes on agricultural and forest land, or as an additive in compost production. This situation often leads to a complex approval procedure for the application of biomass ashes on soils which leads to delays, causing problems with potential users of the ash. Generally, the lack of sufficient legislation causes uncertainty for both plant operators and authorities.[148]

If the ashes are used as a fertilising agent, usually large storage areas are required since the main part of the ash is often produced during the winter season whereas ash application usually takes place during spring and summer. Therefore, a logistic concept considering intermediate storage sites is necessary. When ash is to be used in infrastructural works it also has to be available in large quantities.[148]

Ash quality and composition differ greatly between different plants. The quality of the biomass changes frequently over time (due to different biomass sources, seasonal variations, etc.), leading to changes in the ash quality. The different types of boilers cause differences in ash properties. Examples are the presence of bed material from of fluidised bed boilers, or the higher shares of unburnt carbon from the use of smaller, less efficient heating systems.[148]

As far as the question of BP or EoW status is concerned there are only a few regulations in the MS:

- Lithuania reports that there are specific requirements for usage (in agriculture, civil engineering, re-cultivation of damaged territories etc.) of wood fuel ashes

as BPs. Requirements are determined in the Order of the Minister of the Environment 2011-01-05[152]. The provisions are adopted by the national authority. For the usage of wood fuel ash in the soil, different characteristics of the soil are taken into account, whether there is a lack of different chemical material or too much of them, and how much and which chemical material is needed in order to improve the quality of soil and not to worsen it.

- In Portugal a LIFE project[153] examines the EoW status of ashes from biomass combustion ("Management of biomass ash and organic waste in the recovery of degraded soils: a pilot project set in Portugal"), covers the time period of 2016-2019. The objectives are to demonstrate and disseminate the use of ash (from forest biomass residues combustion) combined with organic waste materials (sludge from the pulp and paper industry or compost) to regenerate degraded soils from mining areas. It involves pilot-scale application of soil additives produced by the mixture of ash with organic waste materials in the recovery of 3 areas degraded by mining (a total of 12 test plots of 100 m^2 each).

The IEA Bioenergy recommends the classification of biomass ashes as EoW to remove - via common harmonization – one of the bottlenecks for ash recycling.[149]

5.3.10.4 Evaluation

Currently, only a limited amount of biomass ashes is utilised and a large part is still disposed of in many countries. Studies show that the main reasons for this situation relate to environmental concerns, sustainability, low market volumes and differences and variations in ash quality. In addition, there are limitations in technical and regulatory regulations as well as logistics. General issues are also the lack of awareness, lack of knowledge and lack of willingness of plant operators, potential end-users and authorities alike to start or increase utilisation. [148]

Considering the nutrient and heavy metal concentrations and distributions among the different ash fractions, it seems reasonable to recycle the bottom ash or a mixture of bottom and coarse fly ash (proportional to the actual amount generated at the combustion/CHP plant) to soils. The utilisation of bottom ash only has the advantage of lower heavy metal concentrations but results in higher nutrient losses (due to the cut-off of both fly ash fractions only about 40 to 60% of K, P and Mg can be used sustainably). If a mixture of bottom ash and coarse fly ash would be utilised, a better closure of the nutrient cycle can be achieved, against the backdrop of higher heavy metal concentrations in the ash. [148]

An improvement of the process technology and logistics between the operator of the biomass energy plant and the user of the ash regarding ash removal, treatment, storage and transport is required. [148]

Mixing of different ash fractions and ashes from different fuels in power plants should be avoided; however, this is not always possible. Fuels and portions of fuels are varying which has an effect on the ash quality. Variation of quality (environmental and technical) hinders ash utilisation and should be avoided. If possible, significant changes in the fuel quality used in biomass energy plants should be avoided in order to keep ash quality as stable as possible. [148]

[152] No. D1-14: https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.390822/asr

[153] LIFE Project: ENV/PT/000369, Title: Management of biomass ash and organic waste in the recovery of degraded soils: a pilot project set in Portugal (2016-2019)

5.4 Sub-optimal cases identified in the consultation process

Based on the analysis of responses of 57 industry stakeholders and 25 MS following frequently occurring suboptimal functioning of EoW or BP systems established in MS were identified.

The stakeholder group consulted consists of industry representatives covering waste treatment and waste incineration companies as well as MS authorities. In the following the main tendencies are presented, not going into detail on individual country-based cases.

- **Inconsistencies between MS in applying EoW and BP regimes**

There is no consistency in how EoW and BP regimes are organised at the national level in the different MS. This generates market inequalities between neighbouring MS and complicates the business cases and the administrative burden for multinational operating companies. EoW or BP decisions made in one MS are not approved or valid in other MS. Difficulties in interpretation and application of the waste legislation in force lead to inconsistencies. This may also include different applications of technical specifications and standards across European MS. It is requested by both the industry and the authorities in charge that the European Commission can make a major improvement by establishing Union-wide harmonised regulations on EoW and BP for further specific material streams.

- **Lack of data exchange in case of self-assessment**

In some MS the waste owner or industry is taking the decision to classify the status of a material (waste / EoW / BP). Consequently, in case of transboundary movement, it is impossible for the country of destination to verify the status of the material which leads to unfair competition with operators in the country of destination when there is no EoW or BP status for the considered material.

- **Lack of uniformity and arbitration**

Decisions on EoW or BP can vary significantly due to divergent application of criteria and procedures in MS. No uniform procedure for establishing national EoW criteria is in place. Even for the national criteria on EoW that are notified to the EC, there is no effective procedure in place to arbitrate between diverging national EoW criteria adopted in different MS. In addition, for single case-by-case decisions on the status of EoW and BP, the level playing field among countries is rather broader, having no procedure in place for those decisions to be notified or assessed by an arbitration body.

- **Interpretation issues**

When applying the conditions set out in Articles 5 and 6 of the revised WFD, competent authorities differ in their interpretation: e.g. it is asked what is considered as "directly" and what are "normal industrial practices"? Industry and authorities complain on too many options for interpretation of terms.

- **Enforcement, quality of EoW materials and BP and their safe processing**

The waste treatment sector and authorities argue that quality of EoW materials and BP must be guaranteed by stringent and compulsory standardised controls and checks. Dilution of harmful substances and harming the environment or human health under the umbrella of EoW and BP regimes needs be prohibited. Environmental standards and state-of-the art technology needs to be applied in facilities where EoW materials and BP are processed.

- **Legislative coherence**

Coherence between waste, product and chemicals legislation are not always ensured.

- **No self-assessment**

The waste treatment sector claims that a self-assessment by industry, even followed by inspection, can have an adverse effect and be a source of environmental risks. Self-assessment may cause inequality and variation in decisions. The lack of procedure will result in a very unclear situation for the industry. The operator has to take the decision if a recycled material has reached EoW status. But it is difficult to persuade customers that a material is no longer a waste when an affirmative decision from an authority is unavailable.

- **Inconsistency in single case decisions**

Single case decisions may imply potential discrepancies among local decisions for the same demand and cannot ensure a homogeneous legal frame at national level.

- **Complex and time-consuming procedures**

Referring to the situation in different MS the procedure for receiving the BP or EOW status is quite demanding in terms of documentation. A very long administrative procedure is applied in which exhaustive documentation is requested. The system lacks efficiency when decisions are not made in a timely manner. No statutory time limit exists for analysis on notifications for EOW or BPs, competent authorities are not obliged to make a decision.

- **Lack of resources and expertise in governments**

According to industry respondents, a decision on EoW or BP status seems to be more dependent on who the government is handling the application than on objective criteria or conditions. This makes the decision-making processes seem random to the industry. The industry also state that authorities might sometimes lack the required knowledge of specific materials to make a substantiated decision.

Industry and some authorities mention a lack of sufficient qualified personnel which they link to the delay with EoW or BP decisions and a lack of enforcement.

- **Claims on "gold plating"**

Official EoW criteria for aluminium and copper scrap have been laid down in an EU Regulation on EoW. Although those official criteria are in place, industry sometimes faces additional criteria at the national level which create uncertainty.

- **Overlapping procedures**

Extensive amounts of information are needed for EoW or BP procedures. Most of the needed information is already included in the REACH registration, so a double effort is requested to prepare and translate it into other languages. One of the requirements for BP procedural approval is the REACH registration. In practice it is reported that even when a REACH registration with all its relevant and high expenses has been successfully prepared there is no guarantee that the application for BP will be approved.

- **Non-adapted administrative provisions**

In some of the reported procedures the signature of the file is required by the final users of the BP or EOW. But in many cases it is complicated if not impossible for industry to know in advance who will be the final users.

- **Risk control versus hazard control**

The industry states that the check on hazardous properties of the substances contained by EoW and/or BP should be assessed in term of bioavailability and bioaccessibility. In other words, does the substance represents a real risk for human health and environment during all the life cycle stages? A major focus could be laid on risk control/reduction rather than hazard reduction/control. Waste classification, however, is solely hazard-based. As a result, the EoW or BP assessment by authorities tends to be a hazard based approach. Often these authorities use the hazard control approach out of respect for the precautionary principle, which is justifiable although it could hinder circular economy.

- **Public opinion**

The public opinion is often skeptical about the use of secondary raw materials. The public perceives product status more positively than waste, but what really counts is the quality (e.g. performance, appearance, no impact on health and the environment).

- **Need for flexibility**

Purely technical aspects of specific documents (quality protocols, guidelines, etc.) may need to be updated more easily. Inclusion in a ministerial decree hinders the ability to respond quickly to developments in scientific knowledge and recovery activities (materials, technologies, processes).

- **Absence of markets**

A vicious circle appears when - because of no existing markets - no EoW declarations are made. Because of the lack of an EoW declaration no markets are generated and available. There are not enough incentives for the use of recycled products or materials (reduction of VAT, incentives to green procurement and buy-green initiatives).

6. Recommendations for the design of national legal and enforcement regimes for EoW and BP

6.1 Identifying drivers/barriers for applying rules

In this chapter, the main areas for action relevant to BP/EoW regimes are identified and potential drivers and barriers are discussed. The drivers/barriers were derived from the stakeholder consultation (see also task 5.1) and from the literature research conducted within this study. On this basis, measures are proposed.

Table 12: Analysing drivers/barriers for appropriate institutional set-up and capacity (no. 1)

Area for action	Drivers	Barriers
Appropriate institutional set-up and capacity to enable the establishment of **new** rules for EoW and BPs (at national level) in accordance with Article 5 and 6 of the revised WFD	- **Legal certainty** by establishing new legislation and guidance, both at European and national level stipulating criteria for specific material streams - **Sharing competences** between involved bodies and different authority levels	- **Overload** of the administrative capacity of involved national and EU bodies (the design and establishment of a new legislation is a time-consuming process)
Proposed measures to stimulate this area for action:	➔ **Empowering responsible bodies** (European, regional and national authorities / EIPPCB) to establish new rules (e.g. additional EoW criteria) by providing related administrative capacities; to be addressed to the administrative (authority) level to be empowered with appropriate legal and technical expertise ➔ **Lifting administrative burdens among different regions and institutions of a country**, e.g. the proceedings for granting waste permits and initiating an evaluation procedure for EoW ➔ Simplifying certain aspects of the **decision making process** by referring to the 'ex-post' assessment of the EoW decisions taken by the economic operators.	

Table 13: Analysing drivers/barriers for compliance with product and chemicals legislation (no. 2)

Area for action	Drivers	Barriers
Compliance with product and chemicals legislation for materials regulated under EoW and BP regimes	- The materials regulated under EoW and BP regimes **compete on the free market** with other products - Materials are re-processed in industry chains which **contributes to circular economy**	- **Administrative costs** to fulfill all requirements stipulated under the chemicals legislation (REACH registration and compliance with requirements in product legislation is not always evident to recyclers attempting to achieve EoW status for their materials. - **Access to information,** not all information required by the product/chemicals legislation for EoW and BP materials (e.g. information gathered by the registration consortia under the REACH registration process) is accessible to recyclers. - **Lack of knowledge,** the complexity of the chemicals legislation is challenging for involved parties (both industry and authorities)
Proposed measures to stimulate the area for action:	➔ **Considering existing product standards** when establishing EoW and BP criteria (both at EU and national level) where the specific use will not lead to overall adverse environmental or human health impacts and fulfils all environmental and health protection standards and requirements. ➔ Foster **information exchange on chemicals legislation** and harmonise approaches on how specific EoW and BP materials are classified in order to comply with products and chemicals legislation ➔ Foster **information exchange on administrative procedures**, insisting that the administrative burden affects also primary materials and products. In some case, secondary materials/waste/BPs might be favoured, e.g. with exemptions on the registration	

Table 14: Analysing drivers/barriers for public perception and consumer acceptance (no. 3)

Area for action	Drivers	Barriers
Public perception and consumer acceptance of material streams managed under EoW and BP regimes	- **Public awareness / information campaigns** on new rules and materials demonstrating no harm to environment and human health while using e.g. secondary materials regulated under EoW and BP regimes (especially for sensible applications such as compost, fertilisers) - **Execution of enforcement actions and quality assurance schemes** for materials regulated under their respective product regimes to enhance confidence in the applied system	- **`Rogue traders'** and operators not acting according to the defined rules often spoil the picture of success stories.
Proposed measures to stimulate the area for action:	➔ **Consider the application of quality assurance schemes** as a minimum requirement in determining criteria for EoW and BP regimes (see case analysis in Chapter 5; best practice examples are given for construction materials and RDF) ➔ **Conduct awareness / information campaigns** on new rules to be applied for all involved parties covering public and industry sectors as well as authority levels ➔ **Enhance efforts on enforcement**, including cross-border cooperation and improve exchange of information with customs and fiscal authorities to better combat cross-border illegal activities	

Table 15: Analysing drivers/barriers for enabling high quality EoW and BP materials (no. 4)

Area for action	Drivers	Barriers
Enabling high quality material streams managed under EoW and BP regimes and their proper application	- **Identification and separation of contaminants** in terms of preparation / treatment of materials intended for EoW and BP status (defining input and process quality) - **Execution of enforcement actions and quality assurance schemes** for materials regulated under EoW and BP regimes	- **Contaminants/harmful substances** cannot be separated/removed by state-of-the-art technologies - **`Rogue traders'** and operators not working according to the defined rules. - **Lack of standards and data** for comparisons to be made between a product that is made of waste and a product that is made of raw materials, e.g. for the purpose of performance criteria for the industry and increase of trust of consumers - **Competition** of EoW and BPs **with raw materials and lack of demand** by the market
Proposed measures to stimulate the area for action:	➔ **Selection of specific material streams** in order to focus on those materials which are prioritised, at both EU and national level; the selection should take into consideration benefits/impacts which will occur in applying new rules on specific material streams (see case analysis in Chapter 5; best practice examples are given for construction materials and non-treated wood) ➔ **Consider the application of quality assurance schemes** as a minimum requirement in determining criteria for EoW and BP regimes (see case analysis in Chapter 5; best practice examples are given for construction materials and RDF) ➔ **Definition of proper input /recovery process and output requirements** and related applications in terms of establishing criteria for EoW and BP regimes ➔ **Develop standards,** i.e. for comparing different materials (secondary raw materials following EoW versus primary raw materials) and increase trust in products made from EoW materials (see case analysis in Chapter 5; best practice examples are given for construction materials and RDF) ➔ **Regulators should** work with businesses to examine possible new markets for secondary raw materials, to identify and match suppliers and users, and to support the development of new circular economy ideas and business models	

	➔ Introducing financial **market mechanisms** making EoW or BP materials more attractive than virgin raw materials, either by subsidising the use of EoW and BP materials or by taxing the use of virgin materials. ➔ Generate **impact on the markets** by creating sales volume for EoW and BP materials via green public procurement criteria, e.g. by including EoW of BP provisions in official project specifications

Table 16: Analysing drivers/barriers for establishing a level playing field (no. 5)

Area for action	Drivers	Barriers
Level playing field for EU industry in MS having different circular economy ambitions and EU MS in managing BP and EoW criteria to facilitate EoW material´ shipping and transboundary movements	- **Saturation of market demand in a MS** and need for EoW and BPs in another MS, e.g. the demand of one country can be satisfied by the overproduction in another - **Higher recycling targets** will put significantly larger quantities of recovered materials on the market, while performance criteria will require more sophisticated infrastructure which will require economies of scale going beyond individual MS to achieve economic viability	➔ **Approaches, criteria, and standards** might differ substantially across MS and outside the EU ➔ **Access to market disadvantages** for green companies located in MS with lower environmental ambitions. ➔ Missed single market effect from non-integrated circular value chains
Proposed measures to stimulate the area for action:	➔ Development of **harmonised approaches** to facilitate the exchange of EoW and BP materials among EU MS such as mutual recognition of EoW decisions ➔ Consider harmonising the classification of waste / non waste status in the shipment processes of EoW / BP materials ➔ Development of an EU **arbitration procedure** in case of disagreement on waste or EoW/BP status of materials with the effect of 'precedence'.	

6.2 Analysing impacts on market and environment

The market conditions for secondary raw materials and their possible impact on human health and the environment are essential in order to establish a framework for treatment conditions as well as quality assurance for specific EoW / BP materials suitable to be introduced onto the market. Without proper market demand the appropriate use of secondary raw materials under positive price values might hardly be economical feasible.

Along with the market demand and the economic feasibility of EoW / BP materials, their environmental and health impacts should not be higher than that of the primary materials.

Both aspects are shortly addressed in the following analysis for the selected cases covered by this study.

Table 17: Analysing the market situation for the considered material stream related cases

No.	Material stream	What is the volume of the waste stream or the produced EoW / BP?	Is it priced on the market? Do market prices exist and are they positively / negatively valued?	Which market sectors receive the EoW/ BP?	Trans-boundary movement is applied to which extent?
1	Metal bearing slags used as raw material under an EoW status	46 Mio tonnes of ferrous slag; 6 million tonnes of non-ferrous slag (latter estimated).	Non-ferrous slags very often have a medium to high economic value due to their residual content in other metals.	Slags are used to separate the remaining metals, or as granulates in diverse construction and infrastructure works (construction sector).	Medium
2	Mineral construction and demolition wastes broken into aggregates and used as a building material under EoW status	In 2016 a total of 344 Mio tonnes of mineral CDW were generated in EU28. Out of this amount, approximately 10 Mio tonnes were classified as hazardous waste and the remaining 334 Mio tonnes as non-hazardous.[154]	There is an existing market for aggregates. As demand/application is mainly at local/regional level, prices probably follow local/regional circumstances.	Construction sector.	Low
3	Refuse derived fuel and solid recovered fuel as EoW material	Current use of SRF and RDF in EU is about 13.5 Mill tonnes of which approximately 5 to 10 Mio tonnes are co-incinerated in cement kilns.	Depending on the calorific value, the biodegradable fraction and the chlorine content, a price is established with a positive value in EU MS such as Germany and other EU countries.	Cement industry; co-incineration plants in other industrial sectors.	High
5	Metal scraps and residues, other than slags and ashes	Approximately 75 Mio tonnes of ferrous waste; 9 Mio tonnes of non ferrous waste and 14.6 Mio tonnes of mixed ferrous/non ferrous waste.[154]	Especially non ferrous metal scraps, but also ferrous metal scraps have a positive economic value[154], examples are the following: mixed metal scrap 0.08 €/kg, copper scrap 4 €/kg, zinc scrap 1.4 €/kg.	It is redirected mainly to the producers/recyclers of ferrous and non ferrous metals itself. Metallurgical industry/sector.	High
6	Rubber from tyres	3.3 Mio tonnes of rubber waste were generated in	End-of-life tyres only have a positive value if they can	Production sector using rubber granulates e.g. for	Medium

[154] EUROSTAT, data for reference year 2016.

No.	Material stream	What is the volume of the waste stream or the produced EoW / BP?	Is it priced on the market? Do market prices exist and are they positively / negatively valued?	Which market sectors receive the EoW/ BP?	Trans-boundary movement is applied to which extent?
		2016, a major part of it being tyres.[154]	be refurbished or applied for reuse. If not, treatment costs have predominantly impact and have to be considered.	sport fields; Cement industry; Steel mills; Civil engineering.	
7	Digestate from anaerobic digestion	According to the European Biogas Association (EBA) about 80 Mio tonnes of digestate is generated in about 17,500 biogas plants throughout Europe.	As also for compost, digestate has only a limited positive value.	The use is focused to the application as compost or as liquid fertiliser by farmers for green maintenance; a minor application is the use as pelletized digestate for further energy generation use.	Low
8	Non-treated wood in natural form	Approximately 55 Mio tonnes of vegetal waste and 53 Mio tonnes of non-hazardous wood waste are generated in the EU 28.[154]	No general positive price levels known.	Wood production sector, Compost production sector as mulch etc.; energy supply sector.	Low
10	EoW status of ashes from biomass combustion	Energy from biomass contributes 59.2 EJ/year or 10.3 % to the global primary energy supply[155]. Using biomass, 493 TWh of renewable electricity or 2% of worldwide electricity production was generated. So the amount of biomass ashes is considerably high.	No general price levels having positive values could be investigated.	Building materials production sector, Agriculture sector.	Low

All the analysed cases comprise material/waste streams with considerable high amounts generated in the Union-wide market (up to more than 300 Mio tonnes per year for CDW). For several EoW / BP materials which have been described in the case analysis, a positive price value is already established on the market (e.g. CDW, RDF/SRF, metal bearing slags, metal scrap). Even prices have been established which may fluctuate depending on demand and pricing of the primary materials. The price value in combination with the volumes generated and the related demand reflects to which extent EoW / BP materials are shipped across boarders. Main sectors which use the EoW / BP materials analysed in this study are: the construction sector (including the cement industry), the metallurgical sector, the energy supply sector (for industrial purposes), the wood production sector, the agriculture sector.

It is difficult to establish direct correlations between the different aspects illustrated in Table 17 due to the specific framework conditions set for the related material/waste streams (such as national versus European legislative framework; the different waste management level established in the MS which might influence the availability of material/waste streams for EoW / BP to be used again in specific industrial sectors).

Beside the market assessment, the impacts on the environment resulting from the production and use of EoW / BP materials need to be considered in order to highlight

[155] World Bioenergy Association (2017), data 2014.

future priority areas for circulating secondary raw materials back to industrial purposes.

Table 18 gives an overview on the main aspects related to the environmental impacts considering the input material/waste streams used for producing EoW / BP materials as well as the treatment steps and related uses/applications which might take place in authorised facilities or without any further processing.

Table 18: Analysing the environmental impacts for the analysed material stream related cases

No.	Material stream	Are there many different input material/waste streams suitable to produce the EoW / BP? Has the input material/waste stream high probability to contain hazardous substances?	Are the EoW / BP materials delivered to authorised facilities or are they delivered without further processing? Are standards available for the EoW / BP materials?	Are multiple applications for the EoW / BP materials possible? Is the application bound or unbound (e.g. concrete: bound; compost: unbound)?	Can direct emissions deriving from the applications be expected, if yes, are the potentials considered as high, medium or low?
1	Metal bearing slags used as raw material under an EoW status	The input is limited to slags coming from thermic metal winning processes. Yes, especially heavy metals.	They are delivered for construction purposes without further processing. No standards available.	Limited applications in the construction sector. Both types of application, bound, e.g. granulate in concrete, and unbound, loose granulate.	Water: High Soil: High Air: No
2	Mineral construction and demolition wastes broken into aggregates and used as a building material under EoW status	Many different input types possible as mineral CDW may comprise broken concrete, tiles, and other materials from construction and demolition activities. If source separation of hazardous materials is carried out during demolition, hazardous substances can be limited.	Serves as input in the construction materials sector and related facilities. Yes, several EN standards available.	Limited applications in the construction sector. Both types of application, bound, e.g. in concrete and asphalt, and unbound, in base layers, surfaces.	Water: Medium Soil: Medium Air: Medium
3	Refuse derived fuel and solid recovered fuel as EoW material	High variety, as RDF can be produced from plastics, textiles, card, wood, etc. It may be also produced from residual waste. Yes, especially heavy metals. Composition may vary a lot and depends on the quality of the input material.	SRF/RDF is delivered to authorized facilities only (e.g. cement kilns, CHP plants and power plants). Yes, EN standard is available.	Limited to incineration only. Unbound, to be suitable for e.g. fluidised bed incineration kilns.	Water: No Soil: No Air: High
5	Metal scraps and residues, other than slags and ashes	Both, pre-consumer and post-consumer scrap can be used as an input. If not contaminated, no specific hazardous potential is expected.	Delivered to authorised installations for metal production only. No standards available.	One single application, reprocessing in the metal industry resulting in multiple uses of recycled metals. Bound application, as new metal rod, plates etc.	Water: Low Soil: Low Air: Low
6	Rubber from tyres	A very specific input material, only tyres, although of different properties. Yes, potentially hazards coming from contaminants such as PAH and heavy metals.	Both authorised facilities (e.g. cement kilns) and use in disperse applications (e.g. sport fields). No standards available.	Very diverse application fields such as use in cement industry but also for new rubber materials. Unbound, especially when granulated and e.g. used in synthetic turf applications ; in	Water: High Soil: High Air: Low

No.	Material stream	Are there many different input material/waste streams suitable to produce the EoW / BP? Has the input material/waste stream high probability to contain hazardous substances?	Are the EoW / BP materials delivered to authorised facilities or are they delivered without further processing? Are standards available for the EoW / BP materials?	Are multiple applications for the EoW / BP materials possible? Is the application bound or unbound (e.g. concrete: bound; compost: unbound)?	Can direct emissions deriving from the applications be expected, if yes, are the potentials considered as high, medium or low?
				agglomerated form, e.g. in rubber tiles, sound barriers, etc.	
7	Digestate from anaerobic digestion	It varies due to agricultural wastes, food industry wastes, source separated bio-waste and sewage sludge can serve as input. If not contaminated input materials are used, no specific hazardous potential is expected.	Typically disperse application outside of authorised facilities. Standards and specifications for digestate have been elaborated in a number of MS at national level. Criteria for CE-marked organic fertiliser constituted by compost and digestate also defied in new Fertilising Products Regulation.	Limited to use for its fertilising properties. Typically unbound application as fertiliser.	Water: Low Soil: Low Air: No
8	Non treated wood in natural form	Materials consisting of any green and wood matter from agriculture, forestry, wood industry. If not contaminated, no specific hazardous potential is expected.	Mainly directed to authorized facilities, e.g. wood in natural form may be directed to wood production sector or to composting facilities. No standards available.	Varying applications possible from energy supply sector to wood production sector. Bound when used in wood composites, unbound when used in other areas.	Water: No Soil: No Air: Low
10	EoW status of ashes from biomass combustion	Materials consisting of any vegetable matter from agriculture, forestry or food processing industry; wood waste. Yes, especially heavy metals. Composition may vary a lot and depends on the quality of the input material.	Both, biomass ashes are delivered to authorized facilities in order to produce building materials but may be used also directly as a fertiliser without further processing. No standards available.	Varying applications as biomass ashes may can be used as a fertiliser or used for the production of building materials. Both types of application, bound in building materials or unbound in fertiliser applications.	Water: High Soil: High Air: Low

For the specific material/waste streams analysed in this study the impact assessment provides the following summary in order to facilitate further up-take for EoW / BP regimes to be established at national level in the near future:

Metal bearing slags used as raw material under an EoW status

One may consider the appropriateness of re-entering these slags into use cycles to promote circular economy, as they can replace natural aggregates and avoid mining impacts. Nevertheless, due to its potential hazard characteristics (such as SVHCs), e.g. for non-ferrous slags care should be taken and the precautionary principle needs to be applied. This may comprise monitoring the composition, long-term stability and leaching behaviour in the proposed applications. Strict regulation is needed (see more detailed analysis in case no. 1 in Chapter 5.3.1).

Mineral construction and demolition wastes broken into aggregates and used as a building material under EoW status

Aggregates have a relatively mature market and high demand, transboundary movement of this material is currently is not carried out due to high density and low market prices. Standards for building materials are well developed specifically taking up technical minimum requirements. Promotion of higher up-take and higher level recycling is needed considering the source separation during demolition activities (see more detailed analysis in case no. 2 in Chapter 5.3.2).

Beside the national approaches taken in the Member States the revision of the Construction Products Regulation (CPR, 305/2011/EU) may be a driver to foster recycling of CDW and act as a driver to establish minimum conditions for CDW when used in construction products.

Refuse derived fuel and solid recovered fuel as EoW material

The production of SRF is a well-established practice in EU with high amounts generated used for energy production in important European industrial sectors. Existing quality standards are related to the maximum content of specific parameters only (e.g. chlorine thresholds); nevertheless, the environmental hazards are limited due to the fact that the SRF are just destined to permitted and authorised facilities having in place state-of-the-art gas abatement systems (according to the European Commission IED).

Producing RDF in any way shall consider that it does not recover the most value out of the resources as the resources are incinerated and cannot be transposed back to the original material purposes. Material recovery should be given highest priority in the view of a circular economy. Material separation to the highest economically and environmentally feasible extent shall be performed before resources are incinerated (see more detailed analysis in case no. 3 in Chapter 5.3.3). All forms of uses shall take into account potential hazard characteristics (such as SVHCs) in order to minimise risks to the environment and human health.

Metal scraps and residues, other than slags and ashes

By now, the existing market already absorbs large quantities of scrap due to its high positive price value. Environmental concerns are not prominent to the Union-wide application, they may be more linked to the recycling conditions in non-EU countries where installations operate under lower environmental, health and safety standards and to which scrap is shipped for cheaper processing (see more detailed analysis in case no. 5 in Chapter 5.3.5).

Rubber from tyres

Although large markets have been developed for the use of shredded tyre waste, environmental concerns have to be raised about these applications, e.g. as a source of leakage of hazardous materials or of marine litter. These concerns should be clearly addressed by current and future research activities (see more detailed analysis in case no. 6 in Chapter 5.3.6).

Digestate from anaerobic digestion

Digestate can be re-circulated in the biological use cycles of circular economy specifically using the nutrient content and the functionality as a fertiliser. The market demand for digestate could still be enhanced and digestate could, to higher extent, replace less sustainable, synthetic fertilisers. This shall be performed by taking into

account the possible presence of hazardous substances in digestate, which requests the need for control of input material as well as production processes (in relation to the envisaged requirements for EU fertilising products, see the new EU Regulation on fertilizing products). Additionally, its use could be a driver for increased digestion of bio-waste which is the most attractive way for treating those kind of wastes having in mind energy and nutrient recovery aspects (see more detailed analysis in case no. 7 in Chapter 5.3.6).

None-treated wood in natural form

Several green wastes are inevitably produced and in several cases just dumped or burnt, even though other applications and uses with higher environmental benefits are available. Basically no environmental harm is connected to non-treated, natural wood. Market demand in terms of material recovery is low for specific fractions out of none-treated wood which may also be forced by the prominent alternative thermal treatment option hindering the facilitation of re-circulation of those material/waste streams (see more detailed analysis in case no. 8 in Chapter 5.3.8).

EoW status of ashes from biomass combustion

The range of application is very broad for this material/waste stream and varies from landfilling to the use as additives in the production of building materials. As unbound application without further processing is an option, effects on soil and groundwater need to be monitored in order to guarantee safe application (see more detailed analysis in case no. 10 in Chapter 5.3.10).

6.3 Main findings for design of national legal/enforcement regimes

In the following, main recommendations to be considered in terms of establishing national legal/enforcement regimes are described:

Improvement of knowledge and enhancing monitoring and reporting of specific waste streams directed to recycling / EoW

By introducing EoW criteria for recycled aggregates, specifications on waste codes covering different quality types have been established in Austria in order to monitor / report the respective amounts and qualities. Similarly, the Flemish competent authority in Belgium has developed a specific code list to identify 143 EoW fractions split up over manure and soil improver, building material, soils, landfill coverage, metallurgy (non-ferrous), metallurgy (ferrous). Those examples show the intention of MS authorities to better monitor specific waste qualities directed towards recycling / EoW which can be both established by guidance or legislative instruments.

- Examples of related regimes in place: Austrian Construction Materials Regulation (2016); Flemish Ministerial Decree (2012) establishing the material code list for the coding of materials in the materials registers of raw material producers and users.
- Further analysis shown in the study: Chapter 5.3.2, Case no. 2 on mineral construction and demolition wastes broken into granulates and used as a building material under EoW status.
- Addressee of the recommendation: National authorities establishing EoW criteria and minimum criteria for recycling.

- Key benefits: Substitution of primary resources, improving the traceability of secondary raw materials, amounts reported under the respective codes are increasing during the past years.

Improve public perception and consumer acceptance of material streams managed under EoW and BP regimes

Having in mind experiences from success stories on EoW, the involvement of the public and relevant stakeholders shall be given high priority in terms of bringing materials recovered from waste back to open markets. By that, public awareness / information campaigns on new rules and materials shall be carried out in order to demonstrate environmental and human health safety of secondary materials regulated under EoW and BP regimes (especially for sensible applications such as compost, fertilisers used in agriculture or public areas). The related measures may also comprise instruments having guidance character.

- Examples of related regimes in place: Austrian Ordinance on Compost (2001) and related information and awareness raising campaigns on source separation of bio-waste performed at national and regional level.
- Further analysis shown in the study: Chapter 4.5.8 on drivers/barriers.
- Addressee of the recommendation: National authorities establishing EoW criteria and criteria for recycling, plant operators, municipalities, public sector.
- Key benefits: Generating a market for secondary materials and improving acceptance for different applications.

Enhance statistical transparency on EoW material streams

Materials achieving EoW status no longer need to be reported under waste obligations and therefore risk to disappear out of the statistics, unless appropriate measures on specific reporting obligations are taken. By that, national obligations on monitoring and reporting of amounts and qualities of materials recovered from waste shall be introduced by legislative instruments.

- Examples of related regimes in place: VLAREMA, executive legislation of the Flemish part of Belgium (2012).
- Further analysis shown in the study: Chapter 5.3.9, case no. 9 on registers and reporting obligations on case-by-case decisions.
- Addressee of the recommendation: National authorities establishing EoW legislation, including reporting obligations.
- Key benefits: Integrated statistics allow for a better overall view on material streams of either waste or BP/EoW thus enhancing policy evaluation e.g. on prevention, EoW. Knowledge on waste/material streams can improve the evaluation of defined measures.

Arbitration in case of disagreement on the status of waste/EoW

In practice, the application of Article 28 of the Waste Shipment Regulation means that in case of disagreement on the waste/non-waste status the material should be shipped as waste. Arbitration e.g. by establishing a coordination/clearing body can be a way to reach agreement between MS to the benefit of all.

- Examples of related regimes in place: Correspondents' Guidelines (such as No. 1, 5, 6, 7, and 9), Austrian Handbook on Waste Shipment as part of the

Austrian Federal Waste Management Plan (2017), Shipping green-listed waste by the Nordic Council of Ministers (2018).
- Further analysis shown in the study: Chapter 5.4 on sub-optimal cases; Chapter 6.1 on drivers and barriers; Chapter 5.3.4, case no. 4 on EoW and BP to facilitate trans-frontier movement.
- Addressee of the recommendation: MS involved in mutual trans-frontier shipments, the European Commission as a facilitator.
- Key benefits: More harmonised application of the distinction between waste and EoW might facilitate the circular economy or enhance the harmonised application of the pre-cautionary principle.

Enhanced preparedness of competent authorities

The industry needs to find a counterpart in the competent authority which is equipped with appropriate staff and resources in order to discuss the status of BP or EoW. The discussion needs to be science-based and taking into account market knowledge as well as the material properties and potential environmental impacts. This might be established by intensifying guidance or in terms of establishing accurate proceedings/training/staffing at national and especially regional and local level.

- Examples of related regimes in place: Multiple cases where high-level knowledge is present within the administrations, e.g. Austria, Belgium, UK. Good practice examples are consultants who support the with technical know-how..
- Further analysis shown in the study: Chapter 5.4 on sub-optimal cases.
- Addressee of the recommendation: MS competent authorities acting as counterparts for industry requests.
- Key benefits: Science-based policy is r more suitable for enhancing circular economy while minimising environmental impacts.

Provide legal certainty through applied formal procedures

Self-assessment can lead to a misjudgment on the waste/product status. A firm legal framework generates certainty for those material streams not yet covered by European Regulations. Introduction of a legal framework can be facilitated by national legislation and/or guidance papers.

- Examples of related regimes in place: See national regimes already established under Table 2 and Table 3 in Chapter 4.5.
- Further analysis shown in the study: Chapter 5.4 on sub-optimal cases.
- Addressee of the recommendation: National authorities establishing EoW criteria and minimum criteria for recycling.
- Key benefits: Legislation provides traceability, legal certainty, and controllability and avoids arbitrariness thus enhancing a level playing field on the markets as well as better safeguarding of environmental quality.

Enhanced procedural efficiency

Competent authorities are responsible for swift implementation of national or EU legislation, enabling easy market access for approved EoW or BPs. Sufficient manpower capacity and technical knowledge should be foreseen for it (multiple examples of time-consuming procedures are reported). Introduction can be facilitated by guidance or in terms of increased efficiency at national / regional level.

- Examples of related regimes in place: Good practice is reported by several MS, e.g. Austria, Belgium, Netherlands (see regimes in Table 2 and Table 3 in Chapter 4.5).
- Further analysis shown in the study: Chapter 5.4 on sub-optimal cases.
- Addressee of the recommendation: National competent authorities responsible for the administrative implementation.
- Key benefits: Swifter procedures facilitate materials to enter circular economy markets and allow for more efficient inspection and more transparency.

Information on material/waste streams to be used for several purposes

Specific information on waste/material streams (e.g. on composition, properties, qualities) is needed both for the EoW / BP procedures and for the fulfilment of obligations under products and/or chemicals legislation. Once gathered and reported, the information should be publicly available for both procedures. The enhancement can be facilitated by both, instruments for guidance and with legislative character.

- Examples of related regimes in place: No specific examples are available.
- Further analysis shown in the study: Chapter 5.4 on sub-optimal cases; Chapter 4.5.8.1 on barriers identified by MS authorities; Chapter 6.1 on identifying drivers/barriers; Chapters covering specific material/waste streams within the case analysis conducted in Chapter 5.
- Addressee of the recommendation: National competent authorities responsible for the administrative throughput of both, REACH and EoW / BP procedures.
- Key benefits: Swifter procedures facilitate materials to enter circular economy markets, allow for better inspection and more transparency.

Markets for EoW and BP

Materials can only obtain an EoW or BP status if its further use is guaranteed. Therefore, markets need to be available to absorb the generated material streams. National authorities may enhance this through a mixture of instruments like taxes, levies and subsidies, standard specifications, green public procurements, labels, voluntary business alliances (like the Circular Plastics Alliance). This might be introduced by guidance or in terms of establishing accurate proceedings at national and European level.

- Examples of related regimes in place: No detailed information available in this study (a good example is the requirement of using a specific content of recycled materials in the context of green public procurements as already discussed in several MS).
- Further analysis shown in the study: Chapter 5.4 on sub-optimal cases.
- Addressee of the recommendation: Competent authorities in MS responsible for product specifications, public works, procurement, taxes etc.
- Key benefits: The promotion of markets for EoW or BP will enhance the absorption of materials in the circular economy. Creation of a demand for specific waste/material streams will create a market and contribute to the development of related treatment chains.

Support to innovative technologies

Support to innovative recycling/recovery technologies (e.g. in taking them up in related financing/funding schemes) will foster higher level recycling and recovery of waste/materials and minimize low-level recycling and down-cycling. The enhancement can be facilitated by both, instruments with guidance and legislative character.

- Examples of related regimes in place: No detailed information available in this study (a good example is the Portuguese LIFE project[156] which examines the EoW status of ashes from biomass combustion).
- Further analysis shown in the study: Chapter 5.3.2, case no. 2 on mineral construction and demolition wastes broken into granulates and used as a building material under EoW status; Chapter 5.3.10, case no. 10 on EoW status of ashes from biomass combustion.
- Addressee of the recommendation: EU and national authorities/regimes supporting innovative projects.
- Key benefits: New technologies with proved application will enhance circular economy and reduce harm to environment and human health.

Establish databases on case studies / single approaches taken on specific waste/material streams

A Union-wide database on case studies and approaches taken on specific waste / material streams related to EoW / BP status is needed. TRIS is a useful tool but contains only national regulations intended to be notified to the European Commission. Practical case studies (good and bad practices) would be very informative and would contribute to the information exchange between MS. The enhancement can be facilitated by instruments with both guidance and legislative character.

- Examples of related regimes in place: Some national databases exist but giving rather information on main existing legislation and guidance than a full overview on the national situation.
- Further analysis shown in the study: Chapter 6.1 on drivers and barriers; Chapter 5.3.9, case no. 9 on registers and reporting obligations on case by case decisions.
- Addressee of the recommendation: EU and national authorities/regimes.
- Key benefits: A proper level of knowledge can become a driver.

Enhance standardisation for waste/material streams regulated under EoW / BP regimes and related proceedings

Standardisation is an instrument to enforce trust and provides a unique application of processes related to the treatment of waste/material streams regulated under EoW / BP regimes. Related proceedings conducted on e.g. sampling might in addition support harmonised application of approaches. The enhancement can be facilitated by instruments with both guidance and legislative character.

- Examples of related regimes in place: See standards established already for RDF, CDW, etc. at European and national level.
- Further analysis shown in the study: Chapters covering specific material/waste streams within the case analysis conducted in Chapter 5.
- Addressee of the recommendation: EU and national competent authorities, European and national standardisation institutes.
- Key benefits: Unique application of standards will enhance to increase the markets for the use of secondary raw materials.

[156] LIFE Project: ENV/PT/000369, Title: Management of biomass ash and organic waste in the recovery of degraded soils: a pilot project set in Portugal (2016-2019)

7. Annexes

7.1 Annex to Chapter 4.1: Expert list MS authorities

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7.2 Annex to Chapter 4.2: Template written questionnaire to the MS' authorities

Electronically attached to the report: AT, BG, EE, FI, IT, LT, SI and UK
EC FWC Study on EoW Annex 7.2 to Chapter 4-2 Template Q MS.docx

7.3 Annex to Chapter 4.3: Documentation of exchange with MS' authorities

Member State	Key expert in contact with	Questionnaire provided by 12th of June 2019	Approval on factsheet by 12th of June 2019
Austria	Franka Boldog	9/4/2019	Yes
Belgium Brussels	Celine Schaar	26/3/2019	Yes
Belgium Flemish	John Wante	6/4/2019	Yes
Belgium Wallonia	Didier Gohy	18/4/2019	Yes
Bulgaria	Gayla Kostava	2/4/2019	Yes
Croatia	Toncika Jarak	26/3/2019	Yes
Cyprus	Elena Christodoulidou	3/4/2019	Yes
Czech Republic	Vojtech Pilnacek	4/4/2019	Yes
Denmark	Charlotte Moosdorf	20/3/2019	No
Estonia	Kristel Murumaa	21/3/2019	Yes
Finland	Eevaleena Häkkinnen	13/3/2019	Yes
France	Elora Barillot	22/6/2019	Yes
Germany	-	No	-
Greece	Georgia Mantzava	29/3/2019	Yes
Hungary	Vivien Ifka	17/4/2019	Yes
Ireland	Darren Byrne	30/4/2019	Yes
Italy	Andrea Lanz	25/3/2019	Yes
Latvia	-	No	-
Lithuania	Lina Valintele	5/4/2019	Yes
Luxembourg	Stephanie Georgen	12/3/2019	Yes
Malta	-	No	-
Netherlands	Inge de Weerd	31/5/2019	Yes
Poland	Iwona Andrzejczuk-Garbacz	26/4/2019	No
Portugal	Catarina Quintela Costa	29/3/2019	Yes
Romania	Simona Ghita	24/6/2019	Yes
Slovakia	Viera Spalkova	26/4/2019	Yes
Slovenia	Lucija Jukic Sorsak	21/3/2019	Yes
Spain	Alicia Lopez Leal	21/3/2019	Yes
Sweden	Hendrik Sandström	26/3/2019	Yes
UK	Kate Nicholls	15/5/2019	Yes

7.4 Annex to Chapter 4.4: MS factsheets

Electronically attached to the report:
EC FWC Study on EoW Annex 7-4 EoW Factsheets.docx

7.5 Annex to Chapter 5.1: List of industry/NGOs contacted

Organisation Short Name (National / European Association)	Organisation Long Name	Link with contact details
BDE (DE)	Bundesverband der Deutschen Entsorgungs-, Wasser- und Rohstoffwirtschaft	https://bde.de/verband/praesidium-und-vorstand/
CEFIC (EU)	Representing large, medium and small chemical companies across Europe	http://www.cefic.org/About-us/About-Cefic/
CEPI (EU)	Confederation of European Paper Industries	http://www.cepi.org/about-us/cepi-staff
CEWEP (EU)	Confederation of European Waste-to-Energy Plants	http://www.cewep.eu/contact-and-team/
CIF (IE)	Irish Construction industry Federation	https://cif.ie/
CIRFS (EU)	European Man-made Fibres Association	https://www.cirfs.org/about-cirfs-1/staff
DWMA (NL)	Dutch waste management association	https://www.verenigingafvalbedrijven.nl/
EAA (EU)	European aluminium association	https://european-aluminium.eu/contact-us/
EBA (EU)	European biogas association	http://european-biogas.eu/about-us/contact/
EBRA (EU)	European battery recycling association	https://www.ebra-recycling.org/contact-info
EERA (EU)	European Electronics Recyclers Association	https://www.eera-recyclers.com/contact-us
ERP (EU)	European recycling platform	https://erp-recycling.org/
ERPA (EU) branch part of Euric	European Recovered Paper Association	https://www.euric-aisbl.eu/who-we-are/board
EPRC (EU)	European paper recycling council	http://www.paperforrecycling.eu/about-the-eprc/
ERSCP (EU)	European Roundtable for Sustainable Consumption and Production	http://erscp.eu/
ETIRA (EU)	European Toner and Inkjet Remanufacturers Association	http://www.etira.org/
ETRA (EU)	European Tyre Recycling Association	https://www.etra-eu.org/
Eucopro (EU)	European association for co-processing	http://www.eucopro.org/
EURIC (EU)	European recycling industries	https://www.euric-aisbl.eu/who-we-are/board
Euroalliages (EU)	Association of European ferro-alloy producers	http://www.euroalliages.com/
Eurocommerce (EU)	European retail and wholesale	https://www.eurocommerce.eu/about-us/our-team.aspx
Eurogypsum (EU)	European Gypsum Industry	http://www.eurogypsum.org/contact-us/
Eurometaux (EU)	non-ferrous metals producers and recyclers in Europe	https://eurometaux.eu/about-eurometaux/meet-the-team/
Europen (EU)	European Organization for Packaging and the Environment	https://europen-packaging.eu/about-us/staff.html
Eurofer (EU)	European Steal Association	http://www.eurofer.org/
FEAD (EU)	European Federation of Waste Management and Environmental Services	https://www.fead.be/who-we-are/secretariat
FEFCO (EU)	The European Federation of Corrugated Board Manufacturers	http://www.fefco.org/about-fefco/whos-who
FIR (EU)	Fédération Internationale du Recyclage	http://www.fir-recycling.com/
Food Drink Europe (EU)	European food and drink companies	https://www.fooddrinkeurope.eu/about-

Organisation Short Name (National / European Association)	Organisation Long Name	Link with contact details
		us/secretariat/#mella-frewen
Go4Circle (BE)	Belgian business federation for private-law companies focusing on waste treatment and the circular economy	https://go4circle.be/dagelijks-secretariaat
HWE (EU)	Hazardous Waste Europe	http://www.hazardouswasteeurope.eu/contact/
ISWA (International)	International solid waste association	https://www.iswa.org/iswa/organisation/about-iswa/
MWE (EU)	Municipal Waste Europe	https://www.municipalwasteeurope.eu/secretariat
Plastics Europe (EU)	Association of plastics manufacturers	https://www.plasticseurope.org/en/about-us/who-we-are/steering-board-members
Porr (company, AT)	Private company in construction	https://porr.at/
Pro Europe (EU)	Packaging recovery organisation Europe	https://www.pro-e.org/about-us/who-we-are
RReuse (EU)	Social enterprises active in reuse, repair and recycling.	https://www.rreuse.org/team/
UEPG (EU)	Union Européenne des Producteurs de Granulats (European Aggregates Association)	http://www.uepg.eu/what-is-uepg/uepg-history
WEEE forum (EU)	Association of WEEE producer responsibility organisations in Europe and globally	http://www.weee-forum.org/meet-the-team
EEB (NGO, EU)	European environmental bureau	https://eeb.org/who-we-are/staff/
Zero Waste Europe (NGO, EU)	NGO on the topic of waste treatment	https://zerowasteeurope.eu/about/team/

7.6 Annex to Chapter 5.1: Template written questionnaire to industry/NGOs representatives

Electronically attached to the report:
EC FWC Study on EoW Annex 7-6 to Chapter 5-1 Template Q industry.docx

7.7 Annex to Chapter 5.2: Long list of cases for in-depth analysis

Electronically attached to the report:
EC FWC Study on EoW Annex 7-7 to Chapter 5-2 Long list cases.xlsx

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