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Classification and handling of FRP waste within the current EC legislation

Introduction

The European Union has developed a set of directives concerning waste control. It started with the introduction of the Waste Framework Directive (75/442/EEC) in 1975. Additional related documents include 91/156/EEC (which is an amendment of 75/442/EEC) and 91/689/EC (The Hazardous waste directive). This Technical Bulletin gives a short overview of the current EU waste legislation with respect to the classification, shipment and disposal of FRP (Fibre Reinforced Plastic) waste. It is offered as an aid to FRP companies in their activities in complying with their legal responsibilities associated with waste handling.

Please note:
This Bulletin is simply a guide and not an interpretation of the law. All local and national legislative regulations must be read and understood. The bulletin is offered in good faith and no liability can be accepted in consequence of action taken by any regulatory authorities associated with compliance to the EU Directives and the resultant national regulations.

Waste Classification

Terminology

Waste is any substance that those in possession intend to discard or are required to discard. Fibre Reinforced Plastics are often referred to as composite materials or composites. However, with respect to EU current waste legislation, it is best to avoid the term 'composite' waste because the only reference to 'composites' waste refers to complex mixtures of chemicals and sludges from various processes, which have nothing to do with reinforced engineering materials. We will therefore consistently use the term 'FRP waste' throughout this document.

The first task when considering specific FRP waste is to define it within the broad classifications as set out in the European Waste list for hazardous and non-hazardous waste. Waste is identified with a six-digit code from within the EC waste list. Any type of waste, whatever its source, is definable with one of the 6-digit codes within the waste list.

Once the waste has been coded then other EC Directives can be used to determine how to ship/transport or dispose of it. These include regulations about trans-border shipment of waste, landfill and incineration of waste. In addition, industry specific Directives could apply with specific reference to recycling, e.g. the End of Life Vehicle Directive or the Directive on Waste of Electronic & Electrical Equipment.

End-of-Life FRP components

The European waste list 2000/532/EC

How to classify waste within the EU waste legislation? The basis for the classification of waste is its origin. In the European Waste List (Commission Decision 2000/532/EEC), waste is always categorized with a 6-digit waste classification code. The first two digits give the origin of the waste. In further subcategories the waste and its origin are defined more precisely.

As the Waste Framework Directive requires that waste be classified by type and by source, FRP waste can be classified under several codes of the EU Waste List, depending upon whether or not the waste is generated from the moulding shop, or is end-of-life waste from vehicles or agricultural use or chemical plant use for example. The composition of the waste governs the classification as either hazardous or non-hazardous waste and determines how the waste will be regulated and how its treatment will be managed, including trans-border shipment control.

Any waste category of the EU Waste List marked with an asterisk (*) is considered as a hazardous waste pursuant to the Hazardous Waste Directive 91/689/EEC (Art.1). The list takes into account, where necessary, limit values of concentration. If a waste is identified as hazardous, because it contains certain dangerous substances, the waste is hazardous only if the concentrations of the substances are such that the waste presents one or more of a list of properties in the Hazardous Waste Directive.

For example, if the waste is 'virgin' FRP, from a FRP moulding shop, then, there will be a chapter for it in the waste list under:
Chapter 07, 'waste from organic chemical processes'.

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The sub-category is **07 02**, 'wastes from the Manufacture, Formulation, Supply and Use (MFSU) of plastics, synthetic rubber and man-made fibres'
The sub-sub-category is **07 02 13**, 'plastics waste'.
Since this category **07 02 13** is not marked with an asterisk (*) it can be classified as non-hazardous waste and, therefore, shipped and disposed of according to the EC Directives for disposal of non-hazardous waste. However, end-of-life FRP components could, in some instances, be contaminated with dangerous substances exceeding the threshold as set out in the Hazardous Waste Directive and their waste classification will be subject to the waste source and the contaminant.

There are more references to plastics in the European Waste List. Relevant for FRP waste are the following:

Category **12 01 05**, Waste from shaping and physical and mechanical surface treatment of metals and plastics - plastic shavings and turnings. This category is possibly applicable for waste from machining of thermosetting components.
Category **16 01 19**, Waste not otherwise specified – end-of-life vehicles - plastics.
Category **17 02 03**, Construction and demolition waste - plastic.
Category **17 02 04*** (M), Construction and demolition waste – wood, glass and plastic
This category could possibly be applied to chemical process plant equipment contaminated with hazardous chemicals.
Category **19 12 04**, Waste from waste management facilities - mechanical treatment of waste - plastics and rubber.
Category **20 01 39**, Municipal waste – separately collected fractions – plastics.

Hazardous property assessment
If a waste category is marked with an asterisk, one or more from the hazardous properties H1 to H14 of the Hazards Waste Directive apply:

H1 'explosive' substances.
H2 'oxidising' substances.
H3A 'highly flammable' substances (flash point of 21°C).
H3B 'highly flammable' substances (flash point 21° to 55°C).
H4 'irritant' substances causing inflammation on contact.
H5 'harmful' substances involving limited life risk by inhalation, ingestion or skin penetration.
H6 'toxic' substances involving serious, acute or chronic health risks or even death by inhalation ingestion or skin penetration.
H7 'carcinogenic' substances, which may induce cancer or increase its incidence by inhalation ingestion or skin penetration.
H8 'corrosive' substances.
H9 'infectious' substances.
H10 'toxic for reproduction' substances.
H11 'mutagenic' substances.
H12 substances and preparations, which release toxic or very toxic gases in contact with water, air or acid.
H13 substances and preparations capable by any means, after disposal, of yielding another substance, e.g. leachate, which possesses any of the characteristics listed in the above 'H' categories.
H14 'ecotoxic' substances and preparations

Details about the assessment methods and threshold concentrations of the dangerous substances can be found in Annexe III of the Hazardous Waste Directive 91/689/EEC.

Other considerations regarding FRP waste
Once the category of FRP waste from a particular source has been established then issues of shipment and disposal have to be considered. Since FRP waste from whatever source can, most often be classified as non-hazardous, it simplifies the requirements with respect to shipment and disposal.

Waste Shipment
The following waste-shipment regulations apply to FRP waste:

- *EC Waste shipment regulations (259/93/EEC and EC regulation number 2557/2001)*

When FRP waste is disposed of in the EC country of origin then the EC trans-border shipment of waste regulations does not apply. Only when waste is being shipped to another country for disposal do these regulations need consideration. In any event, FRP, non-hazardous waste will present less of a problem for shipment than hazardous waste.

The shipment regulations do bring into consideration the mineral content of the FRP waste because the question of waste classification for shipment purposes depends upon its composition. If the mineral content of the waste is more than 50% by weight then it could, possibly, be considered as mineral waste for shipment purposes. Waste however containing more than 50% resin (organic) would be considered as organic waste for shipment purposes.

- *The Basel trans-boundary shipment of waste convention*

This convention controls the trans-boundary shipment of hazardous wastes and their disposal.[1] When the FRP waste contains principally organic constituents (over 50% by weight), then it is considered to be non hazardous for shipment across country boundaries –

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category B3010, in Annex IX of the Convention, unless they contain Annex I material to an extent causing them to exhibit one or more of the Annex III hazard characteristics. Other possible categories for FRP waste are Annex IX / B2020 and B4020, both classified as non-hazardous. In case FRP waste contains Annex I material to an extent causing them to exhibit one or more of the Annex III hazard characteristics, categories A3050 or A3120 may be applicable.

In summary, relevant Basel Convention Annex VIII and IX entries for FRP waste falling under the scope of the Convention are:

B 3010	Solid plastic waste

Possibly also:

B 2020	Glass waste in non-dispersible form
B 4020	Wastes from production, formulation and use of resins,
A 3050	waste from production, formulation and use of resins
A 3120	fluff – light fraction from shredding

A= hazardous waste (Annex VIII) and B = non-hazardous waste (Annex IX).

Landfill

The EC Landfill Directive (1999/31/EC) encourages waste minimisation and recovery, including recycling, initiatives. There are targets to progressively reduce the level of biodegradable waste going to landfill, to treat most waste before they are land filled, to ban land filling of liquid wastes, certain hazardous wastes and to ban the co-disposal of hazardous and non-hazardous waste. Under many national legislations, the land-filling restrictions apply to organic waste (i.e. they unambiguously encompass plastics waste) and some of them have already totally banned organic waste land-filling for some time. The EC Landfill Directive distinguishes three separate classes of landfill:

- Inert waste
- Non-hazardous waste
- Hazardous waste

Inert waste

Includes amongst others waste glass based fibrous materials, concrete, tiles and ceramics, etc. Since FRP contains organic material the inert category is not applicable to the landfill of FRP. It is possible, however, that waste recovery from FRP incineration, in the form of glass fibre and inorganic fillers, would generate inert waste that could be used for recovery or for landfill purposes. This residual incineration waste should fit within the definition of inert waste given in the LF Directive.

Non-hazardous waste for landfill

[1] NB: 1. The Basel Convention does not deal with non-hazardous waste 2. For the purpose of the Basel Convention, the definition of disposal encompasses operations which may lead to resource recovery, recycling, reclamation, direct re-use or alternative uses – See Annex IV of the Convention.

From the European Waste Catalogue it has been deduced that most FRP, provided that they are completely polymerised, can be classified as non-hazardous waste [1] and will, therefore, have access to landfills for non-hazardous waste, as long as the national legislation transposing the LF Directive still allows the land-filling biodegradable or organic waste.

FRP waste cannot be classified as inert waste because it contains an organic component, which means that it will be considered as 'bio-degradable' or organic even though it may take decades or, possibly, centuries to totally (bio-)degrade [NB UV degradation or any other oxidation has also to be considered as a lack of inertness].

Even FRP waste, such as SMC/BMC waste, which contains a high level of inorganic components (fillers and glass fibres) will have to be declared as non-hazardous biodegradable/organic waste (e.g. category 07 02 13, 17 02 03, 20 01 39 etc., depending upon the waste source, within the EC Waste Directive) for landfill purposes.

Hazardous waste

FRP waste containing hazardous substances or materials above the threshold levels must be examined, with respect to the threshold levels of such additives, within the H1 to H14 list of Annex III of the EC Hazardous Waste Directive.

If it appears that the waste is hazardous, then it may only be land filled in a site designated for hazardous waste provided it does not contain any components banned from landfill under the EC Landfill Directive and its transposition into national law. [NB It may also be disposed of by incineration / See 3.3]

Waste FRP from chemical plant applications may be contaminated at a level, which could change its classification, with respect to the landfill requirements, from non-hazardous to hazardous. Such waste FRP should be evaluated via appendix C of the EC Waste Directive 'Hazardous Property Assessment' prior to disposal.

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Incineration
The EC Incineration Directive (2000/76/EC) sets minimum requirements for waste (co-) incineration plants. It includes a list of specific provisions for the (co-)incineration of hazardous waste (e.g. substances with which it cannot be mixed, and precautions to be taken in handling the waste) and encompasses the co-incineration of waste on its place of production. The Directive gives detailed requirements about items, such as:

- Which waste is excluded from the scope of the Directive - (Art.2)
- Acceptance criteria and reception procedure - (Art.5)
- How the incinerator plants shall be operated in order to achieve a required level of incineration (e.g. permit and conditions for non-hazardous or for hazardous waste) (Art.6)
- Air emission levels (including mandatory measurements) – (Art.7, 10, 11)
- the quality of water discharges from cleaning of exhaust gases – (Art.8)
- what to do with residues from the incinerator process in terms of their amount and harmfulness - (Art.9)

FRP waste can be incinerated provided the emissions from the waste issuing from the incinerator stack are within the emission targets set out in the Incineration Directive. In addition, the waste must be able to supply sufficient fuel to enable completion of incineration without the addition of other fuel except in the form of other waste. Hence, where the type of FRP does not contain sufficient energy for complete combustion it can be incinerated via a co-incineration process where mixed waste is incinerated together.

There are constraints on how the grate ashes (as opposed to flying ashes, always a hazardous waste) from incinerators is treated but once classified with respect to the hazard it may present, it can be either land-filled or recovered as material. Residual incineration waste (or grate ashes) from FRP (co-) incineration, containing inorganic filler and glass fibre residues, could, if properly treated, be classified as inert waste for recovery or landfill purposes.

In some industry specific EC Directives, such as the End-of-Life Vehicle (ELV) Directive, incineration is an option with reuse and recycling designated as the route for waste materials from vehicles. Similar legislation is applicable to the Electrical and Electronic Component Industry.

Important reminders
Presence of substances rendering the waste hazardous
Care has to be taken that substances susceptible to render the waste hazardous, (e.g. un-reacted substances, heavy metal based catalysts or other substances – (due e.g. to absorption in the GFR plastic item during use-) don't exceed the limit values defined in the Dangerous substances or in the Dangerous preparations or in the Waste Shipment Directives when applicable.

[1] *Provided that the FRP waste is fully cured.*

Mixing of wastes
It should be noted that mixing of wastes, (e.g. to reach concentrations of dangerous substances lower than the admissible limit values or to meet acceptance criteria), is prohibited by various provisions of the above mentioned Directives.

Relevant EU legislative documents regarding FRP waste

75/442/EEC	The Waste Framework Directive
89/369/EEC	The Municipal Waste Directive (new MSWI - Repealed by 2000/76/EC)
89/429/EEC	The Municipal Waste Directive (existing MSWI - Repealed by 2000/76/EC)
91/156/EEC	Amendment of Directive 75/442/EEC on waste
91/689/EEC	The Hazardous Waste Directive
93/259/EEC	The Regulation on Trans-border Shipment of Waste
94/67/EEC	The Hazardous Waste Incineration Directive
1999/31/EC	The Landfill Directive
1999/45/EC	The Dangerous Preparations Directive
2000/76/EC	The Incineration of Waste Directive
2000/53/EC	The End-of-Life of Vehicles Directive
2000/532/EC	List of Waste in relation to the Waste Framework Directive 75/442/EEC (EU Waste list)
2002/95/EC	The RoHS Directive (restriction of use of hazardous substances in E&E equipment)
2002/96/EC	The WEEE Directive on Waste of Electronic and Electrical Equipment

And their subsequent amendments

PlasticsEurope
Association of Plastics Manufacturers

PlasticsEurope
Avenue E. van Nieuwenhuyse 4
B-1160 Brussels, Belgium
Telephone + 32 2 676 1732
Fax +32 2 675 3935
Email info@plasticseurope.org
www.plasticseurope.org