

UPDATED ENVIROMENTAL POLICY MANUAL

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EU Contribution: 773,660 €



LIFE-REPOLYUSE

REcovery of POLYurethane for reUSE in eco-efficient materials

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Project Co-funded by the LIFE Programme of the European Unión (LIVE16 ENV/ES/000254)



WHAT IS LIFE-REPOLYUSE?.....

SUCCESS OF LIFE-REPOLYUSE IN THE USE OF

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TECSA





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LIFE-REPOLYUSE is a European Union project that addresses the problem of waste management of polyurethane foams (PUR, PUF, PIR). They are currently being managed as inert waste or recovered using techniques that are not environmentally sustainable..

The project has implemented a **new technology** which integrates this **polyurethane waste** into a new construction material. A **prefabricated gypsum tile** has been developed for removable ceilings, thus extending the life cycle of the waste.

This contributes to the achievement of the objectives of the Roadmap for a resource-efficient Europe and supports the implementation of the European Union's VII Environment Programme.

The project consortium is formed by the University of Burgos, TECSA Construction Company and Yesyforma Europa. The Building Engineering Research Group (GIIE) of the **University of Burgos** (UBU) is leading this project. Its activity is focused on the search for new alternative materials to the traditional ones, through the recycling of industrial waste, to obtain useful products for use in construction.

TECSA Construction Company belongs to the largest services and construction group worldwide (ACS group). Its activity is focused on the construction of large transport infrastructure projects (railways, highways and roads), as well as industrial and urban development works, environmental works and residential and non-residential building.

Yesyforma Europa is the leader in the sector of plaster false ceiling prefabricated products, being a reference in quality and variety in Europe. Specialists in the marketing and export of this type of products, it offers the best solutions in plaster to distributors, installers, specifiers and individuals.

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The main **objective** of this project is to develop a **new building material**, a **prefabricated**, removable **ceiling tile**. It can be said that this objective has been fully achieved.

The implemented technology has allowed to manufacture a new material with similar characteristics to the current commercial standards, being improved in some facets. Furthermore, the added value of the new product on an environmental level must be taken into account, as it manages to reuse **polyurethane waste**.

In the first years of its launch, the new product could **recover** 75 tonnes of polyurethane foam **waste**, with less expenditure on raw materials: (25.71%) in **water savings** and (31.6%) in **gypsum**.

In the new gypsum tiles with polyurethane, a reduction in weight of 28% has been achieved compared to a tile manufactured without waste and a thermal conductivity of 0.22 W/(mK) has been achieved (lower than a standard tile).

The lighter weight of the Life-Repolyuse tile compared to a standard tile allows for increased performance in the placement of the tiles. As they are lighter, the installer can considerably reduce the effort required for movement, resulting in fewer injuries for the operator. The speed of installation is also increased. Similarly, the weight of transporting the material from the factory to the worksite is reduced, so the environmental impact of transport is also reduced.

Having achieved an **A1 classification** in the reaction to fire tests, allows us to compete in better conditions with products of this type on the market, as there are similar products in terms of insulating properties (thermal and acoustic) and lightness, with a worse reaction to fire classification according to the Eurocode. The new material has undergone all the tests indicated by the sector's regulations to certify its technical viability, and it has the CE **mark**.

In order to confirm its constructive viability, pilot tests have been carried out with the new prefabricated material in a false ceiling system, in three buildings. Two of them in Burgos and Vitoria (Spain) and one in Coventry (United Kingdom).

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This "**Updated Manual of Environmental Policies**", presents the analysis of the specific regulations for the treatment of polyurethane waste and the environmental policies of companies, within the European Union.

THIS **DOCUMENT** HAS BEEN REVISED BY THE "SERVICIO DE RESIDUOS Y SUE-LOS CONTAMINADOS, DE LA DIRECCIÓN GENERAL DE CALIDAD Y SOS-TENIBILIDAD AMBIENTAL, DE LA CONSEJERÍA DE FOMENTO Y MEDIO AMBI-ENTE, DE LA **JUNTA DE CASTILLA Y LEÓN**", WHICH IS RESPONSIBLE FOR THE MANAGEMENT OF ENVIRONMENTAL WASTE AND INFRASTRUCTURE POLICIES. AMONG ITS COMPETENCES IS ALSO THE PROCESSING AND MANAGEMENT OF THE INSTRUMENTS OF TERRITORIAL PLANNING IN THE AREA OF THE COUNCIL: THE EXERCISE OF THE FUNCTIONS OF COORDINATION, EXECUTION AND IN-SPECTION IN THE FIELD OF WASTE.

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The **European Union's environmental policy** is divided and regulated by sectors, including agriculture, air, chemicals, the circular economy, cities, climate change, energy, industry, land and soil, the marine and coastal environment, nature and biodiversity, noise, research and innovation, transport, waste and water.

The European Union's **approach** to **waste management** is based on the "**waste hierarchy**" which sets out the following order of priority in shaping waste policy and waste management at the operational level: prevention, preparing for re-use, recycling and other recovery as worst-case options, landfill and incineration without energy recovery.

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1. Introduction

vided and regulated by secar economy, cities, climate ad coastal environment, natransport, waste and water. **agement** is based on the of priority in shaping waste el: prevention, preparing for ptions, landfill and incineraUPDATED ENVIROMENTAL POLICY MANUAL



At present, the polymer industry is in the process of **transitioning** to a **circular economy**, with very different recycling, energy recovery and landfill values in different EU member states and, consequently, in the absence of harmonised global standards



According to the European Union waste list (2014/955/EU), polyurethane waste is classified with the following codes (Table 1).

02 01 04	Wastes from agriculture, horticulture, aquacul
	hing
	Plastic waste (excluding packaging)
	Waste from the MFSU of plastics, synthetic rub
07 02 13	Plastic waste
12 01 05	Waste from shaping and physical and mechanic
	and plastics
	Plastic chips and burrs
15 01 02	Packaging (including packaging waste from mu
	Plastic packaging
10 01 10	End-of-life vehicles from different means of tra
	chinery) and waste from the dismantling of e
10 01 13	maintenance
	Plastic
17 02 03	Construction and demolition waste
	Plastic
17 02 04*	Construction and demolition waste
	Glass, plastic and wood containing or contamina
19 12 04	Wastes from mechanical treatment of wastes n
	Plastic and rubber
	Separately collected fractions of municipal was
20 01 39	Plastics

Table 1. Table with the polyurethane waste classified according to the Commission Decision of 18December 2014, amending Decision 2000/532/EC, on the list of waste, in accordance with Directive2008/98/EC of the European Parliament and of the Council. (2014/955/EU).

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2. Environmental Policies of the Companies, associated to the Treatment of Polyurethane Waste

Iture, forestry, hunting and fis-

ber and man-made fibres

cal surface treatment of metals

nicipal selective collection)

Insport (including non-road maend-of-life vehicles and vehicle

ated by hazardous substances

not otherwise specified

te



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In RD 110/2015 on RAEES, Annex XII, polyurethane is classified according to the following Code (Table 2):

19 12 10 Polyurethane foam from the RAEES treatment

 Table 2. Fractions, substances, materials and components resulting from WEEE

 treatment operations RD 110/2015 on WEEE, Annex XII.

Polyurethane from a car wreck (or from a shredder or from the degassing of a polyurethane refrigerator insulator) is a **waste** product and as such must be collected and managed by managers authorised by the Autonomous Community where your plant is located. In this case the regulatory framework is Law 22/2011 on Waste.

In the case of polyurethane trimmings from manufacturing processes, the regulatory framework is **Order APM/397/2018**, of 9 April, which determines when the polyurethane foam trimmings used in the manufacture of composite foam are considered **by-products** in accordance with Law 22/2011, of 28 July, on waste and contaminated soil. In the last decades, within the polyurethane industry, the treatment and recovery of waste has increased, through recycling and internal reuse within the same organisation. The external recovery of waste is also increasing through the sale of waste as a by-product

As a well-known example in Spain, the use of polyurethane foam trimmings as a raw material for the manufacture of composite foam has been in use since the 1950s. **Transforming a waste into a useful by-product** for another company allows to obtain income from the waste generated, give it an added value and solve an environmental problem. This line includes the innovative concept of **industrial symbiosis**. The industrial symbiosis is a related system of markets, with the aim of optimizing, to the maximum, the life cycle of the materials.

The main primary producers of polymers and transformers of finished products are committed to reuse, sustainable recycling and energy recovery through technological innovation, and are developing educational programmes to encou-

2. Environmental Policies of the Companies, associated to the Treatment of Polyurethane Waste

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rage public participation in the waste management process: sorting and separation.

In the European Union, the PasticsEurope partnership stands out with the "Zero plastics to landfill" and "Plastics 2030" initiatives, with the aim of reducing to zero the amount of plastic waste deposited in landfills and contributing to a more circular economy with greater efficiency in the use of resources.

In this regard, Directive 2008/98/EC of the European Parliament and of the Council, of 19 November 2008 on waste and repealing certain Directives, transposed into Spanish law by Law 22/2011, of 28 July, on waste and contaminated soil, defines the conditions under which a substance or object, resulting from a production process, and whose primary purpose is not the production of that substance or object, may be considered a by-product and not a waste (Diagram 1).



Diagram 1. Diagram for obtaining a by-product

2. Environmental Policies of the Companies, associated to the Treatment of Polyurethane Waste

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In accordance with **Article 4.1 of Law 22/2011 of 28 July**, production waste must fulfil the following **4 conditions** in order **to be considered a by-product**:

a) There must be certainty that the substance or object will be used subsequently.

b) That the substance or object can be used directly without having to undergo further processing other than normal industrial practice.

(c) The substance or article is produced as an integral part of a production process.

(d) Further use satisfies all relevant requirements relating to products as well as to the protection of human health and the environment without leading to overall adverse impacts on human health or the environment. The **environmental policies** followed by some of the **producers** of **polyurethane waste**, stakeholders in the LIFE-REPOLYUSE project, have been consulted:

Paneles Aislantes Peninsulares, S.L. (PAP)

 $\sqrt{}$ Grupo Antolín, S.A.

The **polyurethane waste** used in the **LIFE-REPOLYUSE Project** can be considered as by-products if they meet the 4 conditions required in article 4.1 of Law 22/2011, of 28 July. This is the case of "clean waste" or polyurethane cuttings from manufacturing processes. In a different case to that of a sub-product, they will be considered waste and, the regulatory framework is Law 22/2011 on Waste.

2. Environmental Policies of the Companies, associated to the Treatment of Polyurethane Waste







Below is the **justification** of why the polyurethane trimmings used in LIFE-REPOLYUSE can be **considered as by-products**:

With regard to compliance with the **first condition** established in Article 4.1 of Law 22/2011 of 28 July, namely, the assurance that the substance or object will be used at a later date, the use of polyurethane foam trimmings as a raw material for the manufacture of composite foam has been in place since the 1950s.

As regards compliance with the **second condition**, namely whether the substance or object can be used directly without having to undergo further processing other than normal practice, the process to which the polyurethane foam trimmings are subjected in order to manufacture the new LIFE-REPOLYUSE material is similar to that to which the raw material is subjected, consisting of grinding, mixing with conglomerant, fibres and additives, and shaping into new parts with subsequent drying. Regarding the fulfilment of the **third condition**, i.e. if the substance or object is produced as an integral part of a production process, the polyurethane foam cuttings used in the LIFE-REPOLYUSE Project are produced in the polyurethane foam production process itself, originating as a consequence of the adjustment of the product to the client's specifications.

PICTURE 1. CUTTINGS OF POLYURETHANE WASTE





3. Environmental Policy for Waste Used in the Life-Repolyuse Project

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PICTURE2. POLYURETHANE WASTE BRIQUETTES





Finally, with regard to the fulfilment of **the fourth condition**, namely that the further use complies with all relevant requirements relating to the products as well as to the protection of human health and the environment, without any overall adverse impact on human health or the environment, polyurethane foam trims have the same composition as polyurethane foam and only their physical form changes (given that they are subjected to a previous grinding process) and the process for transforming the trims into a new gypsum product is the same as that used to obtain the primary product. Therefore, it is considered that, during the use of these trims as a raw material, there are no adverse impacts other than those that may be generated in the foam production process itself.

In the LIFE-REPOLYUSE Project, waste (a mixture of polyurethane waste, with other possible waste, destined for recovery operations) refers to waste which is mixed at source, as is the case with polyurethane pellets from milling in the refrigeration industries (Picture 2), which includes metal particles in its composition; polyurethane waste from the seats of end-of-life vehicles and





PICTURE 3. SOBRANTES DE POLIURETANO **PARA TECHOS**

waste from the roof (Picture 3), which includes polyurethane, fibreglass and ce-Ilulose from the automotive industry. In this case, if the manufacturer of the LI-FE-REPOLYUSE product intends to use this waste in its product, it should register as a Waste Manager, in compliance with Law 22/2011 on Waste.

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PICTURE 4. SOBRANTES DE TECHOS CONFORMADOS



DEFINITIONS

POLYURETHANE FOAM: product formed by the addition of diisocyanates, polyols, ether/polyols, ester and water controlled by catalysts, stabilizers and other additives, resulting in a cellular polyurethane foam, in which all the reagents are chemically bonded to the polyurethane matrix of the polymer.

FOAM CUTTINGS: Production waste generated in the adaptation of the polyurethane foam blocks to the dimensions and sizes demanded by the client.

WASTE: any substance or object which the holder discards or intends or is required to discard.

WASTE MIXING: waste obtained by mixing, whether intentionally or unintentionally, two or more different wastes, provided that there is no specific category for such mixing in Annexes III, IIIB, IV and IVA. A joint shipment of two or more separate wastes is not considered to be a mixture of wastes.



tested as part of the LIFE-REPOLYUSE project and have been determined to be one of the most suitable waste products for achieving the best performance from

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POLYURETHANE WASTE PRO-DUCER: the natural or legal person who generates the polyurethane foam trimmings

This is the case of the polyurethane production industry, which is collaborating in the LIFE -REPOLYUSE project, Paneles Aislantes Peninsulares, S.L., which produces polyurethane cuttings in its block-shaped processes, whose characteristics have been

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the final product.

USER: the natural or legal person who receives the polyurethane foam trimmings for the manufacture of the product which integrates the polyurethane waste. At LIFE-REPOLYUSE, the User is Yesyforma Europa, S.L., manufacturer of plasterboards with polyurethane for registerable ceilings.

LIFE-REPOLYUSE PRODUCT: Ceiling tile. Product obtained in the process made up of the following stages: selection of foam, grinding of the foam, mixing with gypsum conglomerant, addition of fibres, mixing with water and additive, filling of moulds, drying, demoulding and packaging of the product. Ceiling tile that integrates polyurethane foam cuttings, gypsum and possible use of fibreglass and additive.

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QUALITY CONTROL

It will be necessary to establish a protocol that ensures the traceability of the by-product or waste from the moment it is generated in the producer's facilities until it reaches the user's facilities. Table 3 presents the traceability sheet that each type of waste to be reused must have.



This will be done following definition the in the "Deliverable D2.2. Protocol for the collection, storage, packaging and shipment of polyurethane waste from the waste generator".

DATA OF ORIGIN	WASTE GENERATING COMPANY NAME: ADDRESS:			
	DATE OF MATERIAL MANUFACTURE			
			YES	NO
	TYPE OF WASTE	Polyurethane(PUR)		
		Polyisocyanurate (PIR)		
	ORIGINAL WASTE FORMAT	BLOCK		
		POWDER		
	1	CDUSUED		r
WASTE TRANSFORMATION	TYPE OF TRANSFORMATION	CKUSHED		<u> </u>
		OTHER		
	WASTE FINAL FORMAT	BLOCK		
		PELLETS		
	TRANSPORT FORMAT	SACKS		
		PALLETS		
		BOX		
	1			
N	TRANSPORT COMPANY	NAME:		
ESTINATIC DATA		ADDRESS:		
	TRANSPORTATION DATE			
		NAME:		
	TASTE DESTINATION COMPANY	ADDRESS:		

Table 3. Waste traceability sheet

3. Environmental Policy for Waste Used in the Life-Repolyuse Project

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OBLIGATIONS OF THE WASTE PRODUCER AND THE WASTE USER IN THE FRAMEWORK OF THE LIFE-REPOLYUSE PROJECT

The producer who wishes to manage the polyurethane trimmings, as a byproduct for use in the manufacture of the LIFE-REPOLYUSE product, must make a responsible declaration to the competent environmental body of the autonomous community where they are generated, indicating in this declaration the intended user or users. If the user is located in an autonomous location other than that of the producer, the producer will send a copy of the responsible declaration to the competent body of the autonomous community of destination.

In the declaration of responsibility, the producer must state, under his own responsibility, that the data indicated for the producer and user are true.

Producers of polyurethane foam trimmings and polyurethane waste intended for recovery must keep a chronological record of the quantities produced and those managed as by-products and/or waste, as well as the destinations of the latter, which must be kept and made available to the authority for inspection for a period of three years.

In the case of polyurethane waste mixed with other possible wastes, destined for recovery operations, the provisions of Law 22/2011 on Waste must also be complied with.

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SHIPMENT OF BY-PRODUCT OR WASTE WITHIN THE EUROPEAN UNION

In the case of **by-products**, in accordance with art. 7 of Order APM/397/2018, of 9 April, Regulation (EC) No 1013/2006 of the European Parliament and of the Council, of 14 June 2006, on shipments of waste, will not apply if the producer sends the polyurethane foam trim to a user in another European Union Member State that has also declared the polyurethane foam trim as a by-product for use in the manufacture of composite foam.

Similarly, if a user in Spain receives the polyurethane foam trim from a producer in an EU Member State which has declared the polyurethane foam trim as a by-product for use in the manufacture of composite foam, in accordance with the principle of mutual recognition.

In the specific case of the LIFE-REPOLYUSE project, this concerns clean foam trimmings for the manufacture of the LIFE-REPOLYUSE plasterboard product. The



case of Italy and Portugal is given as an example because they are considered to be potential countries for replication in LIFE-REPOLYUSE.

PICTURE: www.pixabay.com

3. Environmental Policy for Waste Used in the Life-Repolyuse Project





In Italy, the Decree of the Ministero dell'Ambiente 3 ottobre 2016, n. 264, "Regolamento recante criteri indicativi per agevolare la dimostrazione della sussistenza dei requisiti per la qualifica dei residui di produzione come sottoprodotti e non come rifiuti". And in the case of Portugal, "Diretiva Quadro Resíduos (DQR) que define, en su Art 5.º, as quatro condições segundo as quais uma substância ou objeto, pode pa um subproduto".

In the case of a mixture of polyurethane waste with other waste, if any, destined for recovery operations, Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste applies. If the shipment is within Spain, RD 180/2015 on shipments of waste within Spain will apply.

In the LIFE-REPOLYUSE project, it refers to waste that is mixed at source, such as polyurethane pellets from milling in the refrigeration industry, which includes metal particles in its composition; polyurethane waste from the seats of end-oflife vehicles; and waste for roofs, which includes polyurethane, glass fibre and ceIlulose, from the automotive industry. As this is non-hazardous waste, a treatment contract and identification document are required.

The treatment contract: Non-hazardous waste - is required for all waste shipments, hazardous and non-hazardous. Its content is detailed in art. 5 of RD 180/2015.

Identification document: Non-hazardous waste - shall be accompanied in its transfer by a DI with the content of Annex I of RD 180/2015 and shall be sent in paper format to the Autonomous Communities of origin and destination of the transfer, as long as the transfer is not available by electronic means.

3. Environmental Policy for Waste Used in the Life-Repolyuse Project

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After an exhaustive search for specific regulations for the treatment of polyurethane waste and the environmental policies of the companies, specific to the treatment of polyurethane waste, it was concluded that there is a lack of specific regulatory definition for the treatment of low density polyurethane foam waste, and a Ministerial Order was found in Spain that allows the use of polyurethane foam cuttings to make composite materials. There are other EU countries that also have a similar regulation, such as Portugal.

However, for polyurethane waste other than cuttings from the production process, there is a lack of specific coding as a material of a thermosetting nature in the regulatory framework of Law 22/2011 on Waste. The polyurethane foam from the recycling of WEEE that treats refrigeration equipment is also used for energy assessment in cement plants, provided that they are authorised for this purpose. Although specific cases of reuse of mixed waste in other products have been found, the general rule is that producing companies store them in their

own industries and then send them to landfill through an authorised waste manager.

In the case of LIFE-REPOLYUSE, a specific protocol has been drawn up according to the type of waste generated by the producer. In the case of clean polyurethane foam cuttings, Order APM/397/2018 of 9 April applies, and in the case of mixed waste, as there are no specific regulations beyond Law 22/2011 on Waste, a specific reuse model is established based on the analyses and tests carried out at research and industrial level, which validate the integration of the waste into a gypsum product, all of which is collected through the CE Marking issued by the manufacturer.

In addition, if manufacturers intend to use polyurethane waste as a raw material in a product, the manufacturer must register as a Waste Manager, in accordance with Law 22/2011 on Waste.

4. Conclusions

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In both cases, the waste can be integrated into new gypsum materials for the manufacture of ceiling tiles (Image 5 and 6), following the protocol defined in this report which also includes the Protocol for the collection, storage, packaging and dispatch of polyurethane waste from the waste generator defined in Deliverable D2.2 of the LIFE-REPOLYUSE Project.



PICTURE 5. MANUFACTURE OF GYPSUM CEILING TILES WITH POLYURETHANE



PICTURE 6. PLACEMENT OF LIFE-REPOLYUSE CEILING TILES



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To make the use of resources more efficient in Europe

