

# RECYCLING OF COATING AND ADHESION PRODUCTS

---

Benchmark

---

**SUMMARY**

Sept.  
2022



**EXPERTISES**

## ACKNOWLEDGEMENTS

Colin LANG - ADEME  
Eric LECOINTRE - ADEME  
Virginie D'ENFERT - FHER  
Marie H el ene GALIN - AMF  
Olivier CASTAGNO - AMORCE  
Benjamin MATTELY - APCMA  
Val erie FLIS-PLISSON - CAPEB  
Fran ois DE TARRAGON - CHIMIREC  
Philippine DUBOIS - CNR  
Samuel JUST - DGPR  
Giulia BASCLET - FCD  
Adrienne OUVRIEU - FDMC  
Heloise LEMARCHAND-PATCINA - FEDEREC  
Capucine Thomas - FEDEREC  
Bertrand HANNEDOUCHE - FFB  
Teoman BAKOGLU - FIPEC  
Caroline HUPIN - FMB  
Nicolas HUMEZ - FNADE  
Dorothee BRUCHET - FND  
Thomas LE RUDULIER - Jardineries & Animaleries de France  
Franck CHARTON - PERIFEM  
Christine BOURGE - PERIFEM  
Fran ois DE TARRAGON - SNEFiD  
Alain HEIDELBERGER - SYPRED  
S ebastien POUSSON - SYVED  
Isabelle CONCHE - SYVED  
Mathieu DUFOUR - UFCC  
Mo ira TOURNEUR - Zero Waste France

## QUOTATION OF THIS REPORT

**LE BIHAN Mathilde, DESCOS Isabelle, DULBECCO Jos e Rafael, RDC Environment, 2022. Recycling of coating and adhesion products : Benchmark. Summary. 23 pages.**

This report is available online <https://librairie.ademe.fr/>

Any representation or reproduction in whole or in part without the consent of the author or his successors or assigns is unlawful under the Intellectual Property Code (art. L 122-4) and constitutes an infringement punishable by the Penal Code. Only copies or reproductions strictly reserved for the private use of the copier and not intended for collective use, as well as analyses and short quotations justified by the critical, educational or informative nature of the work in which they are incorporated, are authorised (art. 122-5), subject, however, to compliance with the provisions of articles L 122-10 to L 122-12 of the same Code, relating to reproduction by reprography

**This document is distributed by ADEME**

**ADEME**

20, avenue du Grésillé

BP 90 406 | 49004 Angers Cedex 01

Contract number: 2021AC100002/1/0

Study carried out for ADEME by : RDC Environment

Technical coordination - ADEME: Colin LANG

Direction/Service : Direction de la Supervision des filières REP

# CONTENTS

- 1. BACKGROUND AND OBJECTIVES OF THE STUDY ..... 5
  - 1.1. Background ..... 5
  - 1.2. Objectives ..... 5
- 2. METHODOLOGY ..... 6
- 3. STATE OF PLAY OF INITIATIVES IN OECD COUNTRIES ..... 7
- 4. CONCLUSIONS ..... 11
  - 4.1. Transversal ..... 11
  - 4.2. For paints ..... 11
  - 4.3. For PU foams ..... 14
- 5. RECOMMENDATIONS ..... 16
  - 5.1. Organisation of the EPR ..... 16
  - 5.2. Organisation of the collection ..... 18
  - 5.3. Organisation of recycling ..... 19
  - 5.4. Regulation ..... 19
- ABBREVIATIONS AND ACRONYMS ..... 20

# 1. Background and objectives of the study

---

## 1.1. Background

In France, chemical products have been subject to an extended producer responsibility (EPR) scheme since 2012. The products included in the scope of this scheme concern the DIY, decoration, maintenance and gardening sectors. Significant quantities of coating and adhesion products such as glues, paints, varnishes and coatings are placed on the market. The complete list established under article R.543-228 of the Environmental Code is detailed in the Ministerial order of 16 August 2012 listing the chemical products that may present a significant risk to human health and the environment (modified by the Ministerial order of 1 December 2020).

Today, a large proportion of post-consumer waste products from this sector, which concerns household and similar waste<sup>1</sup>, are not recycled. Incineration - with or without energy recovery – thus remains the main treatment solution available.

The French public authorities would like to see the EPR scheme for chemical products tend more to the recycling of certain products to promote a circular economy approach. Indeed, the recycling of chemical products has many environmental advantages. It allows to preserve natural resources, to save energy and raw materials and to reduce the production of final waste.

This desire was confirmed following the publication of the Ministerial order of 1 December 2020 (TREP2026615A), which imposes in the specifications of the eco-organisation<sup>2</sup> in charge of the EPR scheme, an experiment involving the recycling of coating and adhesion products (categories 4 and 5 of the Ministerial order of 16 August 2012). This approach is supported by some of the French stakeholders in the sector.

Coating and adhesion products include different types of chemical products: varnishes, wood stains, oils and saturators, wood treatment products, paints, sealants, glues, resins, particularly in the form of foams and coatings. These products vary in composition (pigments, binders, solvents, additives) and are either water-based or based on organic solvents. According to ECO-DDS, 622 kt of category 4 products and 724 kt of category 5 products were put on the market in France in 2020.

## 1.2. Objectives

Considering these facts, ADEME wanted to conduct an international search, particularly in other industrialised countries, for existing solutions or initiatives for recycling these products. This international review aims to give an overview of the spectrum of potentially recyclable products and to draw up a non-exhaustive inventory of the solutions currently in place and their levels of maturity.

The international review adopts a multi-criteria approach and aims to present the following elements:

- the regulatory context,
- the technical aspect (technologies, maturity, etc.),
- the economic aspect (including markets for recycled products),
- the actors involved.

Within the EPR scheme, this assessment could be used to guide and support the reflections of public authorities and stakeholders towards increasing and improving the recycling of chemical products. This work could also contribute to future experiments and to the development of recycling industrial solutions that are still emerging.

---

<sup>1</sup> The chemical products in the scope are those that can be collected by the public waste management service. They are defined by the conditioning volumes of chemical products. In practice, some of the chemicals in the EPR scope are used by professionals (craftsmen).

<sup>2</sup> To date, for the products covered by this study, there is only one eco-organisation in France, the company ECO-DDS.

## 2. Methodology

ADEME has entrusted this work to RDC ENVIRONMENT. The study was conducted between July 2021 and June 2022.

The methodology was carried out in 3 phases, according to the work plan below.

Table 1: Work plan

Phases	Means
<b>Phase 1 - Identification of initiatives</b>	
1.1. Appropriation of the French situation	Interviews with French industry actors
1.2. Identification and characterisation of recycling initiatives	Literature review of recycling initiatives in OECD countries Interviews with industry stakeholders Summary of identified projects, including research projects
1.3. Selection of 5 initiatives for the in-depth analysis	Pre-selection based on the selection criteria Decision by ADEME after opinion of the Steering Committee
<b>Phase 2 - In-depth analysis</b>	
2.1. In-depth analysis	Interviews with stakeholders of each initiative Review of documents made available by stakeholders
<b>Phase 3 - Transversal analysis</b>	
3.1. Transversal analysis	Evaluation criteria (see phase 1.1)
3.2. Analysis of the transposition to the French framework	

### 3. State of play of initiatives in OECD countries

---

Of all the product categories studied, only paints (about 30 initiatives) and, to a lesser extent, polyurethane foams are subject to chemical mixture recycling initiatives in OECD countries (2 initiatives). Wood stains, varnishes and water-based wood treatment products are included in some of the paint recycling initiatives. The initiatives identified for other product categories (adhesives, sealants, etc.) only recycle the container or the production waste, while the post-consumer content is used to produce energy. The recycling initiatives that have been studied in depth in this study discard these products for energy recovery.

Paints and polyurethane foams are also the only products for which research projects or papers have been identified.

About 40 recycling initiatives could be identified, the vast majority of which focus on water-based decorative paints<sup>3</sup> (latex, acrylic). The identified initiatives are described in the full report.

The literature review did not identify a large number of R&D articles on the subject. Two potential causes can be suggested to explain this:

- The coating and adhesion product recycling projects identified are first driven by companies, either the producers themselves or via independent initiatives e.g., led by start-ups. The research and development associated with these projects is therefore not necessarily published because it may be a competitive area.
- The recycling of paints does not involve advanced technologies as it relies on widespread industrial processes such as quality control, sieving, mixing, reformulation. Thus, the kind of academic research that is useful for its development is not necessarily published.

The few R&D projects identified are analysed in the full report.

Based on the set of recycling initiatives identified in OECD countries, 9 initiatives were preselected and contacted to test their compliance with the selection criteria (see full report).

According to the selection criteria, the initiatives selected for Phase 2 are :

- PDR
- PAINT 360
- PRODUCT CARE
- PAINT CARE
- AKZONOBEL-INTERCHEM

Each initiative is the subject of a detailed chapter in the full report (context, technical, economic, regulatory conditions and environmental performance).

The key features of the in-depth initiatives are listed below.

---

<sup>3</sup> Decorative paints are paints used by both private individuals and professionals to decorate interior or exterior surfaces. They differ from industrial paints, which are used for example for coating cars or other products.

Table 2 : Cross-sectional analysis of the preselected initiatives

Criterion	PDR	AKZONOBEL-INTERCHEM	PAINT 360	PRODUCT CARE	PAINTCARE
<b>Nature of the recycled waste</b>	Polyurethane foam (1k and 2k)	Water-based paints for interior decoration	Decorative paints and water-based wood stains	Water-based paints and other coatings ( wood stains , varnishes), Solvent-based paints in small quantities Aerosol paints	Water-based paints and coatings
<b>Country</b>	Germany	Netherlands	United Kingdom	Canada	United States
<b>Context of deployment</b>					
<b>Starting date</b>	1993	2020	2013	1994	2009
<b>EPR scheme</b>	Yes	No	No	Yes	Yes
<b>Collection</b>					
<b>Type of collection points</b>	DIY superstores (10%), waste disposal centres (%), professionals , on-demand collection(60%), professional shops (20%)	Waste disposal centres (100%)	Waste disposal centres, professionals (direct delivery or via waste managers)	Hazardous waste collection points, distributors, deconsignment sites, occasional collections, door-to-door	Hazardous waste collection points (30-50%), distributors (37-52%), occasional collections (1-6%), door-to-door (4-6%)
<b>Collection performance (%)</b>	40% of the available waste stream	< 1% of the market entry	< 1% of the market entry	7% of the market entry(3.5-10%)	5 to 12% of the market entry
<b>Recycling</b>					



Criterion	PDR	AKZONOBEL- INTERCHEM	PAINT 360	PRODUCT CARE	PAINTCARE
<b>Finished products</b>	Prepolymer - for foams 1k only, Propellant - 1k and 2k	Water-based paints for interior decoration	Water-based paints	Recycled paints and rust inhibitors, cement fillers or asphalt renovators (in bitumen - very small share)	Mid-range interior paints, Anti- graffiti paints (niche market)
<b>Share of recycled material in finished products</b>	Prepolymer: 25 to 50%, Propellant: 100%	35%	>65%	50%-80% white paints, up to 93% other paints	Up to 97%
<b>Market in which recycled products are evolving</b>	Mostly European, not linked to quality but to market structure	National and international	Mostly national	Mostly international	Mostly international
<b>Re-use rate (%)</b>	1% (packaging)	0 %	0 %	0-4% depending on the province	Water-based paints: 4 - 6 Solvent-based paints: 3 - 9%
<b>Recycling rate (%)</b>	~70% (content only)	Not comparable	80 %	68 - 90 %	64 to 82% (water-based paints)
<b>Energy recovery rate (%)</b>	~30% (content only)	84 %	0 %	6 - 34 %	39 to 91% (solvent-based paints)
<b>Disposal rate (%)</b>	0%	0 %	20 %	2 - 24 %	7 - 30 % (water-based paints) 48 - 52 % (solvent-based paints)
<b>Economic conditions</b>					
<b>Profitable without support</b>	No	Yes	Yes	No	No
<b>Role of producers</b>					

Criterion	PDR	AKZONOBEL- INTERCHEM	PAINT 360	PRODUCT CARE	PAINTCARE
<b>Voluntary sharing of composition from producers to recyclers</b>	Yes	No	No	No	No
<b>Use of recycled products by producers</b>	Yes	Yes	Yes	No incentive	No incentive
<b>Regulatory framework</b>					
<b>Classification of incoming waste as hazardous waste</b>	Yes	No	No	No <sup>4</sup>	No (except California)
<b>ADR transport</b>	Yes, limited quantities scheme to waive certain requirements	Yes	Yes	Possible exemption from certain requirements (licence) but obligation to indicate the substances transported	Obligation to indicate the substances transported
<b>Derogation from registration for substances in finished products</b>	Yes				
<b>End of waste for finished products</b>	Yes (without specific criteria)				
<b>Safety Data Sheet or equivalent</b>	Yes, mandatory	Yes, voluntary	Yes, voluntary	Exempt for recycled products	Exempt for recycled products

<sup>4</sup> Some products approved by the Pest Control Products Act (probably hazardous) are not accepted in the collection and recycling scheme



## 4. Conclusions

---

### 4.1. Transversal

**Conclusion 1.** There is no interest in dissociating the flows of professionals from those of private individuals in terms of recycling (same composition).

**Conclusion 2.** In terms of collection, it is relevant to develop channels adapted to the waste of private individuals and those of professionals, and to rely on the existing system to ensure a sufficient level of service. Collection by retailers should be considered as a regulatory obligation.

In terms of collection, it is relevant to develop appropriate collection channels for both household and professional waste holders (based on frequented places, waste volumes accepted, synergies with waste collection channels that will be developed as part of the French EPR for construction materials and that are likely to collect household chemical waste). It will be possible by ensuring the articulation between :

- waste disposal centres. They are always part of the scheme in the initiatives studied because :
  - holders were used to take their waste to it before the introduction of recycling,
  - actors can also deposit non-recyclable hazardous waste and other waste,
  - it is a place for communication and awareness-raising among households and professionals about the act of sorting and the fact that their waste will be recycled,
  - as these places are places of communication, they can offer paint for re-use or even recycled paint.
- retailers (DIY superstores, specialised shops). In the initiatives studied, the use of the retailer channel is based on an obligation to take back waste and not on a voluntary basis.
- other types of collection such as on-site, on-call and/or occasional.

The level of service for the waste holders is key to achieving a sufficient collection rate. This involves :

- free collection for all holders, sometimes subject to volume conditions,
- networking objectives, as in the United States, Canada and Germany,
- on-demand collections for large volumes (Canada, United States),
- one-off collection events (Canada, United States),
- a free mailing service for waste holders who are far from collection points (Germany),
- the possibility of delivering other hazardous or non-recyclable waste streams via the same collection points (United States, Canada).

**Conclusion 3.** Producers play a key role in the success of recycling by facilitating the sharing of information about composition to recyclers and by creating demand for recycled products.

For the recycling of PU foams, a key success factor is that producers share with PDR the changes in the composition of their products in a confidential manner so that PDR can adapt its recycling process, if necessary, by being a few months ahead.

In the initiatives for water-based paints recycling, there is no active sharing of the composition of the paints, but recyclers can have access to the safety data sheets and to the list of paints participating in the programmes. However, the data provided in the safety data sheets is partial and it could not be established that all compounds relevant for recycling have been identified to comply with French and European requirements. The lack of complete data in the SDS means that additional tests must be carried out before the recycling process starts to compensate for the uncertainty in the composition. This aspect could therefore be improved.

For all the initiatives, producers can directly or indirectly support recycling. They spearhead the initiative (AKZO NOBEL, PDR), finance it (compulsorily for PAINT CARE and PRODUCT CARE or voluntarily for AKZO NOBEL and PDR) or keep pace with the development (PAINT 360). In several cases they participate directly in the recycling and use of recycled material, thus ensuring outlets (PDR, AKZO NOBEL, several recyclers in North America are producers of virgin paint).

**Conclusion 4.** No operational recycling solutions have been identified for used adhesives, coatings and sealants (post-consumer)

### 4.2. For paints

**Conclusion 5.** The recycling of solvent-based paints is technically feasible but more demanding than the recycling of water-based paints: it is not widely practised.

- The recycling of solvent-based paints requires additional skills and authorisations related to the handling of hazardous waste and substances, which increases the costs of recycling compared to the recycling of water-based paints.
- Recycled solvent-based paints must meet the same product regulations in terms of VOC (volatile organic compounds) content, which is not possible when recycling older solvent-based paints.
- The quantities of solvent-based paint waste collected are lower than the quantities of water-based paint waste, and these quantities are decreasing due to the regulations on VOC: the economic potential related to economies of scale is therefore more limited.
- There is a diversity of solvent-based paints that would require the creation of separate streams depending on the solvents used, which further reduces the volume per product recycled.

#### **Conclusion 6. Recycling of water-based paints is technically feasible in France**

From a technical point of view, the recycling processes of water-based paints are mainly composed of a sorting stage of the paints with separation of non-recyclable paints (solvent-based<sup>5</sup>, dry, ...), then mixing by colour and filtration, as well as the addition of optional additives to improve the properties of the paints. Depending on the initiative, one or more colours are produced, and the product range can also be distinguished by the recycled content, the presence of biocides for certain applications.... Then, a quality control step for different parameters (pH, viscosity, brightness, colour, microbiology, drying, covering capacity, presence of lumps) is implemented per batch.

These processes are standard waste treatment and paint formulation processes, so there are no barriers to replication in France.

They require chemical expertise and laboratories for quality control, and storage space to store the result of the sorting before production, and after recycling, to store the pending colours to have sufficient quantities before marketing them.

#### **Conclusion 7. Source separation targets for water-based and solvent-based paints are not necessary, at least not initially**

To recycle water-based paints, a separation between water-based and solvent-based paints must be achieved at some point in the chain. Recycling initiatives identified abroad have shown that several operational arrangements are possible (separation at source, at the gathering point or at the beginning of the recycling process). The choice of when to carry out the separation should be made according to the economic optimum of the value chain. It seems appropriate to leave flexibility in the operational choices for separate collection, depending on local conditions. The recycling targets will be the policy instrument to drive the implementation of either separate collection or sorting of water-based paints.

#### **Conclusion 8. The quality of recycled paints depends on how selective the acceptance criteria are, and on the post-consumer recycled content. It is a matter of strategic positioning.**

For North American initiatives, quality defects can be explained by low input selectivity and high recycled paint incorporation rates (50 to 80% for white paints in Canada, up to 93% in the US). The quality of recycled paints is considered lower than the quality of virgin paints.

For the European initiatives, the prices of recycled paints are equivalent to those of virgin paints. This can be explained by a higher selectivity and a lower incorporation rate of recycled paints (35% recycled for AKZONOBEL, 65% for PAINT 360). Recycled paints are considered to be of equivalent quality to virgin paints.

Thus, the quality of finished products is a matter of strategic positioning of the sector: high recycling targets may lead to a reduction in product quality, but this can be compensated for by the addition of virgin products. The sector may also consider the loss of quality acceptable in view of the market segments targeted. Lastly, the user's perception may be different from the real quality of the product, due to image effects.

#### **Conclusion 9. The existence of paint recycling initiatives in the Netherlands and the United Kingdom indicate the likely economic feasibility of recycling water-based paints under certain conditions (access to a sufficient waste volume, input selectivity, and relatively more expensive competing outlets). However, the profitability of possible initiatives in France needs to be further studied. An increase in the EPR downstream support scale and additional outlets (paint use in concrete, export) are likely to be necessary to achieve high recycling / material recovery rates (lower selectivity).**

<sup>5</sup> some recyclers, notably in Canada, indicate that they can recycle water-based and solvent-based products in separate streams

Recycling initiatives in the Netherlands and the UK operate without financial support from an EPR scheme or government, and without regulatory recycling targets. This indicates that it can be economically feasible to recycle water-based paints under certain conditions without additional costs compared to energy recovery. The UK initiative has been operating for several years and can therefore be considered cost-effective. The Dutch initiative is more recent, and its profitability cannot be guaranteed at this stage.

However, North American industries would not be profitable without financial support.

In reality, the way of operating of these initiatives is intrinsically different and the scope of the economic analysis is therefore not comparable:

- Voluntary recycling initiatives in Europe do not finance the treatment of non-recyclable flows (excluded brands, solvent-based paints) and focus on the profitable part of the waste stream (choice of profitable volumes via collection partners, choice of white paints for the Dutch initiative). Colours that are not in high demand are used for material recovery in concrete. It should also be noted that the initiatives operate in a national context where the alternatives for the treatment of paint waste (energy recovery or landfill) are relatively less competitive than recycling.
- North American initiatives fund the collection and recycling of all streams, including colours in low demand and low-quality products, which are then destined for export or for use in concrete or energy recovery.

In conclusion, three conditions are necessary for the emergence of a recycling scheme without additional costs compared to current management:

- allow recycling initiatives to access a source of material currently destined for energy recovery,
- the use of public policy instruments for waste that make recycling more competitive than alternative treatment methods (taxation, regulation),
- selection of the most profitable volumes (collection points located near recycling units and possibly able to set up source separation) and with a domestic market (colours, composition). This makes it possible to guarantee a certain initial profitability, to develop R&D for other types of outlets, etc., and then to gradually expand to other products,

Nevertheless, to recycle a larger part of the available waste stream, it would imply :

- to seek out flows that are less profitable from a logistical point of view, which could lead to additional collection costs,
- to be less selective in terms of input to the recycling process, which would generate waste management costs for the part that cannot be recycled and would require the development of other outlets (material recovery for concrete use, export) for paints of lesser quality, or which have no domestic attractiveness due to colour trends. This would have to be studied on a case-by-case basis and according to the associated environmental issues (no data on paint use in concrete and export).

**Conclusion 10. The re-use of paints is not a profitable solution today but could be envisaged via the social economy or municipal waste disposal centres. An appropriate legal framework and more communication would be necessary for a deployment in France.**

Only North American EPR schemes encourage re-use. Paints are offered to users either freely or for a small fee, and this with no specific guarantee of quality. Re-use sites are usually municipal waste collection sites or sites run by NGOs with a social vocation (such as Habitat for Humanity in the US). These places seem to be relevant in practice, but in an unclear legal context concerning the quality framework.

In order to make this outlet more consistent, it would be useful to develop an evaluation of these paints to be re-used, as well as a system of warranty assuring the final consumer of the quality of the re-used product. Another obstacle to re-use is the limited quantity of paint containers available. Communication should also be developed to generate more demand.

**Conclusion 11. The recycling of water-based paints can be achieved within the current regulatory framework. To allow projects to emerge, several preconditions seem necessary (waste status, validation of market entry based on the label and some tests).**

The management of collection and recycling operations is similar to the French one (registration of operators, environmental licence for recycling facilities, waste tracking slips for hazardous waste, ADR transport when water-based paints are transported in the same truck as solvent-based paints, occupational health and safety rules...). The regulations are not an obstacle to the implementation of water-based paint recycling. The need to develop less stringent regulations concerning the transport of water-based paints was not identified in the countries surveyed.

Although water-based paints are generally classified as non-hazardous waste in the countries surveyed (unless they contain biocides), the hazardous or non-hazardous waste classification of water-based paints did not emerge as a particularly key issue abroad, as water-based paints are often transported together with solvent-based paints and sorted at the gathering centre or recycling plant. Thus, hazardous waste management licences are largely

required within the industry. If the French recycling industry wished to validate that water-based paint waste can be considered non-hazardous, to operate within the associated regulatory framework, the categorization as non-hazardous waste based on label sorting would not be possible. A representative characterisation would be needed to demonstrate that waste from products that do not show any hazard pictogram on their label are indeed non-hazardous waste, and thus to validate or not the relevance of a label-based sorting.

The registration of recycled substances is not mandatory due to the possibility of benefiting from the exemption provided for in Article 2.7d) of the REACH Regulation.

The production of Safety Data Sheets is not mandatory for the market entry of most non-hazardous recycled water-based paints but has been implemented on a voluntary basis by the two European recycling initiatives. The sheet is produced from information on input waste (selection at the entrance of predefined brands) and analyses of composition on the finished product. Little information was obtained on the parameters monitored and the protocol. The validity of this protocol for the French authorities would need to be confirmed.

Recycled water-based paints cease to be waste in all the countries surveyed. Compared with France, the framework to receive end-of-waste is more flexible in studied countries in the sense that no application file was required but self-assessment was allowed. End-of-waste allows products to be transported and marketed without any particular constraints compared to virgin products. Additionally, in the absence of any dispute from importing countries on the waste status<sup>6</sup>, to lift the requirements related to waste transboundary shipment.

### **Conclusion 12. Recycling water-based paints provides environmental benefits**

The elements identified in this study (results of a life cycle analysis, effective saving of virgin material, low energy and resource intensity of the recycling process, possibility of limiting the logistical impact by setting up several recycling units, significant achievable recycling rate) provide elements to support the hierarchy of waste treatment methods<sup>7</sup> and not to turn away from it.

No specific data is available on the recovery of paints for export or the material recovery of paints for use in concrete.

### **4.3. For PU foams**

#### **Conclusion 13. Recycling the content of PU foam cans is technically feasible, for the prepolymer (1k foams only) and the propellant (1k and 2k foams).**

The PU foam recycling process consists of crushing the cans to extract the propellant gas and drop the prepolymer into a solvent bath from which it is recovered by distillation. The packaging is also recovered (>80% recycling and re-use, 70% on the content alone). The prepolymer is reformulated with virgin materials into a blend, at different recycled content rates, depending on the users' needs.

In principle, this process can be replicated in France without any obstacles. It is a hazardous waste treatment process with specific operating conditions (under vacuum). It requires control of environmental requirements (avoiding propellant gas leaks) and safety requirements (preventing exposure to isocyanate, which is a carcinogenic substance). Capital requirements are higher than for water-based paint recycling.

The presence of water in the process must be avoided, as it leads to a hardening of the prepolymer, which reacts in the plant and causes costly cleaning of the recycling line. Therefore, rusty or perforated cans, which potentially contain water, should not be accepted in the collection scheme and if collected, they should be discarded at the entrance of the recycling unit.

For 1k PU foams (single component), both the propellant and the prepolymer (which had not reacted) are recyclable. For 2k PU foams (bicomponent), only the propellant is recyclable, as the polymer is already formed and hardened it can only be used to produce energy. In practice, the 1k and 2k PU foam cans are manually sorted at the entrance of the recycling process and undergo separate shredding so that the polymer does not contaminate the prepolymer. The option of sorting at source was not chosen by PDR.

---

<sup>6</sup> According to Article 28 of Regulation 1013/2006 of 14/06/06 on shipments of waste "If the competent authorities of expedition and destination cannot agree on its classification as waste or not, the object of the shipment shall be treated as if it were a waste". This is adapted from the Basel Convention. In the countries surveyed there was no explicit verification of agreement by the competent authorities of the importing countries. France requests such verification.

<sup>7</sup> Cf. Waste Framework Directive

**Conclusion 14. The quality of the finished products is close to that of the virgin products, but lower and more variable, so formulation tests are necessary.**

The quality of the finished products is close to that of the virgin products but lower and more variable (within a given range), justifying a lower selling price and a mixing of the recycled product with virgin to avoid problems during storage and transfer of the prepolymer (cold thickening).

The prepolymer can be re-used for the manufacture of PU foams, or glues depending on the constraints of the manufacturers' formulations.

**Conclusion 15. A French separate collection scheme for recycling PU foams would not be cost-effective and requires an increase in the EPR downstream support scale compared to the collection of aerosols for energy recovery.**

In Germany, the material revenues only compensate for the recycling costs, and it can be assumed that separate collection of PU foams is more expensive than collection with all aerosols (current collection system in France). In Germany, collection for recycling has an additional cost of 11ct EUR/can placed on the market compared to collection for energy recovery. Thus, any development of a recycling scheme in France would require the EPR scheme to provide funding for a dedicated separate collection. Pooling the collection of PU foams with the French EPR scheme under development for construction materials could help contain costs.

**Conclusion 16. The recycling of PU foams can be done within the existing legal framework, but a framework will have to be established so that the prepolymer and propellant both cease to be waste, a necessary condition to develop the market for these products.**

The regulatory framework covering collection and recycling operations is similar to the French framework (registration of operators, environmental licences for recycling facilities, waste tracking slips for hazardous waste, occupational health and safety regulations, etc.). These elements are not an obstacle to the implementation of PU foam recycling.

The registration of recycled substances is not mandatory due to the possibility of benefiting from the exemption provided for in Article 2.7d) of the REACH Regulation. This exemption is applied by PDR in Germany.

The recycled products (prepolymer and propellant) are subject to Safety Data Sheets. The sheet is produced from information on the incoming products (information from the producers) and a quality control on the finished product. Little information was obtained on the parameters monitored and on the protocol.

Prepolymer and propellant finished products benefit from an end-of-waste in Germany. The framework is more flexible than in France, insofar as no application file was required (self-assessment was allowed). This has made it possible to lift the requirements linked to waste transboundary shipment and to market the products without any particular constraint compared to virgin products.

The collection scheme has the derogation of limited quantities within the ADR regulation if the cans are closed (by hardened foam or a cap for full cans) and packed vertically. This derogation enables a reduction of collection costs.

**Conclusion 17. The recycling of PU foams provides environmental benefits. However, the efficiency of this scheme needs to be studied (environmental benefits per unit cost). The fact that producers are favourable to a scheme argues in favour.**

The recycling of PU foams is superior to its energy recovery (incineration) in the waste treatment hierarchy. The elements identified in this study support this idea (life cycle analysis, low energy and resource consumption of the recycling process, high achievable recycling rate).

It should be noted that the additional cost of collecting PU foams for recycling (0.11 EUR /can) is about 300 €/t CO<sub>2</sub> avoided, i.e., about the reference value of carbon recommended for France in order to judge the efficiency of public policies (250 €/t in 2030). The question of the efficiency of a separate collection obligation financed by PU foam producers arises. In principle, the costs and benefits should be further investigated before considering a separate collection obligation.

However, as most PU-foam producers are in favour of setting up this scheme at their own expense<sup>8</sup>, it seems relevant and acceptable to launch the collection scheme for recycling in France.

---

<sup>8</sup> French producers are largely in common with PU foam producers who have set up a voluntary content recycling scheme in Germany, and with producers considering a similar scheme in the Benelux.

## 5. Recommendations

---

### 5.1. Organisation of the EPR

**Recommendation 1. Ensure synergies between the EPR scheme for Chemical Products and the EPR scheme for Construction Materials. Ensure a coherence between the objectives applicable to both schemes and the associated collection channels.**

The EPR scheme for Chemical Products only deals with chemical waste below a certain volume<sup>9</sup>. Above these volume thresholds, the EPR scheme for Construction Materials will take care of chemical waste<sup>10</sup>. The products covered by these two schemes may be conditioned in several types of packaging, or even used by different types of users, but their composition is similar, and they can therefore be recycled together.

In addition, some of the household-like chemical waste<sup>11</sup> are not currently covered by the collection systems set up by ECO-DDS for professionals (e.g., aerosols, including PU foams or paints, are not accepted in the Rekupe system). Household-like waste from professionals can be accepted at municipal waste disposal centres, but the question of how this service is implemented in practice, and whether it meets the needs of waste holders arises.

The texts relating to the EPR scheme for Construction Materials are still under discussion at the time of writing this report<sup>12</sup>, so the framework that will apply is not yet stabilised. However, craftspeople will gradually have access to collection channels via the EPR scheme for construction materials, which could also receive chemical products (intentionally or as an error in the sorting procedure).

It is therefore important to establish communication between the Producer Responsibility Organisations in charge of the two schemes, which can be facilitated by the public authorities, if necessary, with regard to the development of suitable collection channels, possible financial compensation and synergies in terms of treatment.

**Recommendation 2. Progressively implement recycling of water-based paints within the framework of the current recycling targets of the EPR scheme for Chemical Products and the planned experimentation, assess the waste volume, and then increase the ambition of the recycling targets and make them more specific to recyclable waste flows**

In France, it will be difficult for the recycling scheme to emerge outside of the EPR scheme, which currently captures a significant part of the water-based paint deposit. A boost may therefore be needed to promote collection for recycling and the massification of EPR and non-EPR recyclable waste.

The existing recycling targets (1% of the content of categories 4 and 5 in the framework of the experiment to be carried out by 1<sup>er</sup> July 2022, and 5% of the quantities of chemical waste of categories 3 to 10 collected from 2023 onwards) constitute a boost, but they have not been reached to date. They are technically largely achievable given the large share of recyclable water-based paints inside the chemical waste volumes being collected and considering the recycling rates achieved by individual water-based paint initiatives assessed in this study (64-90% of the quantities collected<sup>13</sup>).

A gradual deployment of the scheme is preferable to initially favour the recycling of the most profitable flows (choice of collection points and types of waste entering the recycling process, etc.). This is possible within the framework of the current objectives. Such a deployment guarantees some initial profitability, gives some time to study the waste stream, to develop R&D for other types of outlets, and then to gradually expand recycling to other products. This should preferably be organised in coordination with the EPR scheme for Construction Materials to optimise flows and infrastructure development.

The need for a higher EPR downstream support scale for water-based paint recycling than for energy recovery is not proven by this study, as some initiatives are operating in other countries in a cost-effective and voluntary way. It is therefore relevant to set recycling targets that guarantee recyclers a quantity of waste collected for recycling and to let the Producer Responsibility Organisation organise itself to achieve this target. It might also be possible

---

<sup>9</sup> Sprayable products (paints and PU foams) are now accepted in the aerosol collection scheme.

<sup>10</sup> Decree No. 2021-1941 of 31 December 2021 on extended producer responsibility for construction products and materials in the building sector specifies that "mortars, coatings, paints, varnishes, resins, preparation and implementation products, including their containers, other than those mentioned in 7° of Article L 541-10-1", i.e. other than those concerned by EPR for chemical products, will be concerned by EPR for PMCB.

<sup>11</sup> List of the Ministerial order of 1 December 2020 establishing the list of chemicals mentioned in 7° of Article L. 541-10-1 of the Environmental Code

<sup>12</sup> The draft specifications currently under public consultation do not specify how chemical waste will be collected by the EPR PMCB [http://www.consultations-publiques.developpement-durable.gouv.fr/IMG/pdf/projet\\_cdc\\_rep\\_batiment\\_consultation\\_public.pdf](http://www.consultations-publiques.developpement-durable.gouv.fr/IMG/pdf/projet_cdc_rep_batiment_consultation_public.pdf)

<sup>13</sup> The 16% figure for the quantities collected by Interchem is not comparable with the others.



for public authorities to financially support particularly innovative projects whose benefits exceed the regulatory targets.

Once the recyclable waste stream has been assessed, the recycling targets may evolve and become more specific to certain products such as water-based paints, varnishes and water-based wood stains. In time, targets for products that are more difficult to recycle could also be added.

### **Recommendation 3. Define specific recycling targets for PU foam cans after assessing the waste**

In Germany, it was the regulatory framework in place for packaging that led to a voluntary scheme to recycle the content of waste PU foam cans. However, the lack of common recycling targets for PU foam cans' content prevents recycling from covering the entire PU foam market.

In France, PU foam cans are already collected but are not destined for recycling. To develop the recycling of PU foams, specific targets for separate collection for recycling or for recycling of the PU foam stream will have to be developed. Indeed, PU foams will have a low contribution to the overall chemical waste recycling targets due to the quantities involved<sup>14</sup>. Specific recycling targets will therefore be needed to direct these streams towards recycling. In Germany, about 70% of the collected stream is recycled (content).

### **Recommendation 4. As part of the EPR, foresee a dedicated downstream support scale for PU foam cans' collection for recycling**

The complete collection for recycling of PU foams is more expensive than the collection for energy recovery (about 11 EUR ct per can in Germany). The additional collection costs are not compensated by the material resales, which only compensate the recycling costs.

The downstream support scale must therefore be adapted to finance collection for recycling. This could be done by increasing the financial contributions for these products. It should be noted that this could be done with the support of the producers, who are for the most part common with the members of the PDR programme in Germany.

### **Recommendation 5. Integrate as part of the system of bonus/malus<sup>15</sup> for EPR fees a criterion on post-consumer recycled content for water-based paints**

The incorporation of recycled paint is not suitable for all market segments, due to a degradation of certain properties and a mismatch between the colours sold and the colours available as waste. A mandatory post-consumer recycled content could not be applicable to all producers depending on their positioning (quality, colours) and is therefore not a relevant instrument. The relevance of this instrument would have to be evaluated for the incorporation of recycled ingredients (e.g., binders, pigments) depending on the environmental relevance of this type of recycling, which remains to be assessed (see experimental project on TiO<sub>2</sub> recycling in the full report).

However, the introduction of a bonus / malus for water-based paints' EPR fees according to the post-consumer recycled content could provide an incentive for producers to experiment or generalise the incorporation of recycled paint in their products. Such an approach would have the advantage of :

- Encouraging an exchange between producers and recyclers on the composition of virgin and recycled products, allowing the sector to build capacity related to paint eco-design and recyclability,
- Encourage producers to think about the development of outlets and marketing for recycled paints.

### **Recommendation 6. Provide support to the scheme to develop outlets for recycled coating and adhesion products**

Matching recycled products with market demand is challenging in terms of technical properties and image. Recycled paints have a different range of colours and properties which need to be considered in terms of market positioning. Recycled prepolymer from PU foam recycling requires compatibility testing with formulations of foam or adhesives that incorporate it.

The Producer Responsibility Organisation, public authorities or professional federations (depending on the subject) should provide stakeholder support in order to remove the obstacles to the use of recycled products by producers and end consumers. This support could, for example, cover the following aspects:

---

<sup>14</sup> <1,000 tonnes of content collected in Germany with a mature scheme, compared to a waste stream ranging between 10,000 and 20,000 tonnes of water-based paints in France

<sup>15</sup> Art. L. 541-10-3 of the Environment Code - modulation of financial contributions

- Highlighting the benefits of recycling: comparative life cycle analysis, development of arguments,
- Development of a label or logo or integration with existing logos/labels. For example, PDR has developed a logo for manufacturers incorporating recycled material. Recycled paints are more difficult to comply with the European Ecolabel today, according to AFNOR, because of the label criteria (e.g., supplier declarations of raw materials, audit of the purchasing process).
- Market research,
- Development of partnerships to ensure outlets,
- Industrialization tests.

#### **Recommendation 7. Mobilise public purchasing on recycled paints**

Public procurement has been a driver for the development of recycled paint markets for some recyclers in the US. Recycled paint can be relevant for indoor uses, or anti-graffiti paints used by local authorities.

#### **Recommendation 8. Study the feasibility of recycling products similar to water-based paints, considering the available volume**

Volumes of water-based varnishes, wood stains and wood oils are relatively small<sup>16</sup> but is growing in France (confidential figures). The recycling of varnishes, wood stains, wood oils, etc. could :

- Either be organised in a similar way to water-based paint recycling with separation of similar products, mixing and sieving and quality control. The main obstacle according to PAINT 360 is the small volume of available material compared to water-based paints, which does not allow a critical volume of recycled products to be reached to develop a marketable range with sufficient volumes. Could other marketing models, such as those developed by the social economy for re-use, be envisaged to market recycled flows in reduced volumes? This could be explored.
- Or be mixed (in limited quantities) with the paints. This is the choice made by a recycler in Canada, given the small volumes involved.

#### **Recommendation 9. Encourage R&D for the recycling of other products (glues, sealants, coatings)**

No initiatives have been identified for these product categories.

### **5.2. Organisation of the collection**

#### **Recommendation 10. Ensure the existence of collection channels for PU foam suitable for professionals, possibly with a deposit system or geographical coverage targets**

Used expansive foam cans from professionals are not accepted by the French collection channels intended for professionals (Rekupo does not accept aerosols) but must be accepted at the municipal waste disposal centres, as it is the case for all household-like products. The effective use of municipal waste disposal centres by craftspeople is uncertain. Given that PU-foam cans professional waste volumes would represent 80% of the waste collected in Germany, it is essential to develop suitable collection channels for professionals to consider setting up a viable recycling scheme for PU foam. The collection of the professional waste stream could be organised via dedicated channels (on call, professional waste disposal centres) or via retailers, in addition to the municipal waste disposal centres.

The introduction of a deposit system is recommended by the German PDR initiative to improve collection rates. This could not be implemented in Germany because it would not have concerned the entire market (some producers are not part of the recycling scheme). It appears technically feasible because of the relative standardisation of packaging formats, which enables to envisage simple pricing for purchase and return.

Alternatively, it is necessary to ensure that the network of collection points is sufficient to provide an incentive for household and professional waste holders.

<sup>16</sup> It represents 1% of the total collected disposal in the US.

### **5.3. Organisation of recycling**

#### **Recommendation 11. Develop synergies with neighbouring countries for the recycling of small waste streams, while respecting the principle of proximity**

According to PDR, an additional PU foam recycling facility is to be envisaged from 20 million cans to be recycled, which probably exceeds the full size of the French market. Other countries (Belgium, Netherlands) are working on a PU foam recycling project. It is necessary to ensure that recycling units are properly located to avoid overcapacity.

The same type of conclusions could be applied to small waste streams: glues, varnishes, coatings, wood stains, etc., for which the technical recycling options have yet to be developed.

These synergies must respect the principle of proximity of waste management methods, so that environmental impacts of waste transport remain limited.

### **5.4. Regulation**

#### **Recommendation 12. For the collection of PU foams, investigate the relevance of applying the limited quantity regime of the ADR regulation and the exemption from the obligation to have a hazardous waste collection licence**

According to the German authorities, closed PU foam waste cans packed in cartons would not present a clear physical risk, which could justify the application of the limited quantity regime. The derogation reduces regulatory requirements for cans collection and thus reduce collection costs. Furthermore, Germany does not require collectors of waste PU foam cans to have a licence for the collection of hazardous waste.

The relevance of applying the limited quantities regime, and of lifting the requirement for a hazardous waste collection licence; should be studied by the French competent authorities to examine the risks and opportunities.

## ABBREVIATIONS AND ACRONYMS

<b>ADEME</b>	French Agency for Ecological Transition
<b>ADR</b>	Agreement on the Transport of Dangerous Goods by Road
<b>AMF</b>	Association des Maires de France
<b>AMORCE</b>	Association of communities, waste management, heat networks, local energy management
<b>APCMA</b>	Permanent assembly of chambers of trade and artisanal crafts
<b>CAPEB</b>	Confederation of crafts and small building enterprises
<b>CNR</b>	National Circle of Recycling
<b>DGPR</b>	Department for the prevention of risks at the French Ministry of Ecological Transition
<b>DIY</b>	Do it yourself
<b>ECO-DDS</b>	Producer Responsibility Organisation approved in France for the management of municipal chemical waste
<b>EPR</b>	Extended Producer Responsibility
<b>FCD</b>	Trade and Retail Federation
<b>FDMC</b>	Federation of Building Materials Distributors
<b>FEDEREC</b>	Professional Federation of Recycling Companies
<b>FFB</b>	French Building Federation
<b>FHER</b>	French Association of the Detergency, Maintenance and Industrial Hygiene Industries
<b>FIPEC</b>	Federation of Paints, Inks, Colours, Glues and Adhesives Industries
<b>FMB</b>	Federation of DIY shops
<b>FNADE</b>	National federation of decontamination and environmental businesses
<b>FND</b>	National Federation of Decoration
<b>Jardineries &amp; Animaleries de France</b>	National Federation of Gardening Trades
<b>PERIFEM</b>	Technical Association for Trade and Distribution
<b>PU</b>	Polyurethane
<b>REACH</b>	Registration, Evaluation, Authorization and restriction of CHemicals (REACH) - Regulation No 1907/2006 of the European Parliament and of the Council of the European Union, adopted on 18 December 2006
<b>SDS</b>	Safety Data Sheet

<b>SNEFID</b>	National Union of Waste Management Contractors
<b>SYPRED</b>	Union of professionals in recycling, recovery, regeneration and treatment of hazardous waste
<b>SYVED</b>	Union for the recovery and disposal of waste
<b>UFCC</b>	French Union of Chemical Sales

## ABOUT ADEME

At ADEME - the French Agency for Ecological Transition - we are firmly committed to the fight against global warming and degradation of natural resources.

On all fronts, we are mobilising citizens, economic players and regions, giving them the means to move towards a resource-efficient, low-carbon, fairer and more harmonious society.

In all areas - energy, circular economy, food, mobility, air quality, adaptation to climate change, soil, etc. - we advise, facilitate and help finance many projects, from research to sharing solutions.

At all levels, we put our expertise and foresight capacities at the service of public policy.

ADEME is a public agency under the joint authority of the Ministry of an Ecological and Solidary Transition and the Ministry of Higher Education, Research and Innovation.

### ADEME'S COLLECTIONS



#### FACTS AND FIGURES

ADEME is a reference: It provides objective analyses based on regularly updated quantitative indicators.



#### KEYS TO ACTION

ADEME is a facilitator: It compiles practical handbooks and guidelines to help actors implement their projects methodically and in compliance with regulations.



#### FOCUS ON ACTION

ADEME is a catalyst: Actors and stakeholders talk about their experience and share their know-how.



#### EXPERTISE

ADEME is an expert: It reports on research, studies and collective work carried out under its supervision.



#### HORIZONS

ADEME looks to the future: It promotes a forward-looking and realistic view of the energy and environment transition and what is at stake for society, to build a desirable future together.



## RECYCLING OF COATING AND ADHESION PRODUCTS : BENCHMARKING

In France, chemical products have been subject to an extended producer responsibility (EPR) scheme since 2012. Significant quantities of coating and adhesion products such as glues, paints, varnishes and coatings are placed on the market. Today, a large proportion of used products from this sector are not recycled but incinerated - with or without energy recovery.

The French public authorities would like to see the EPR system for chemicals tend more to the recycling of certain products to promote a circular economy approach. Considering these facts, ADEME wanted to conduct international research, particularly in other industrialised countries, for existing solutions or initiatives for recycling these products.

Within the EPR scheme, this assessment could be used to guide and support the reflections of public authorities and stakeholders in the sector towards increasing and improving the recycling of chemical products. This work could also contribute to future experiments and the development of recycling channels that are still emerging.

*Mature recycling initiatives for water-based paints (some including water-based wood stains, varnishes, and oils) and for polyurethane foams has been identified.*

*The study identified the key success factors for initiatives that could inspire the development of such scheme in France (collection channels and level of service to the waste holder, selectivity of flows at the collection or recycling level, information sharing within the sector, existence of funding, end-of-waste, final outlets, quality control to develop SDS, etc.).*

