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CIRTECHTEX

Implementation of circular economy processes to reduce textile waste in the manufacture of personal protective equipment

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1. INTRODUCTION

1.1. About the LIFE-CIRTECHTEX project

Global textile waste is a critical issue, particularly as technical textiles now comprise more than 25% of the industry. While circular practices have gained traction in the fashion sector, they remain rare for **European Personal Protective Equipment (PPE)** because these fabrics must meet stringent safety standards. Driven by growing customer demand for sustainability, the LIFE-CIRTECHTEX project aims to implement a large-scale solution for collecting and recycling these used garments.

The project's central objective is to prove the viability of a circular model by ensuring that 80% of Marina Textil's production contains **at least 20% recycled material** without compromising essential PPE certifications. By upcycling this material back into the value chain, the project is committed to preventing at least 321 tonnes of waste per year starting three years after the project ends. This initiative ultimately enhances resource efficiency in a resource-intensive sector while creating high-added-value products.

1.2. Objective of the document

The After-LIFE Plan for LIFE CIRTECHTEX outlines the strategy to ensure the continuity and scalability of the project's results after the EU funding ends in May 2026. The project has successfully demonstrated how to reduce textile waste by implementing circular economy processes in the manufacturing of **Personal Protective Equipment (PPE)**. This document defines the maintenance, commercial exploitation and communication actions for the next 5 years.

The primary objective of this After-LIFE Plan is to provide a clear roadmap for the consolidation of a circular value chain in the high-performance textile sector. This document ensures that the industrial innovations and environmental benefits achieved between 2023 and 2026 are not lost, but rather scaled and replicated.

By defining specific responsibilities and financial resources, the document aims to:

- Guarantee technical continuity: Maintain the industrial processes for mechanical recycling and fibre recovery at a commercial scale.
- Facilitate market uptake: Integrate circular PPE fabrics into the standard commercial catalogues of Marina Textil and Tranemo.
- Monitor environmental impact: Track key performance indicators (KPIs) such as CO2 avoidance and energy reduction for at least three years post-completion.
- Support regulatory growth: Align the project's outcomes with the EU Sustainable and Circular Textiles Strategy and upcoming ESPR requirements.
- Enable replication: Provide a structured framework for third-party companies to adopt the LIFE-CIRTECHTEX methodology through a tiered licensing and consultancy model.

2. PROJECT KEY RESULTS

2.1. Technical results

The LIFE-CIRTECHTEX project successfully demonstrated industrial-scale circularity for high-performance PPE through the following innovations:

- High-Performance Recycled Fabrics: Developed certified PPE fabrics incorporating recycled content that maintain full protection against thermal, chemical, and electrical hazards.
- Industrial Circular Processes: Validated a complete manufacturing chain - including mechanical recycling, fibre recovery, spinning, weaving, dyeing and finishing and garment manufacturing - specifically optimized for complex technical fibre blends.
- Waste & Traceability Infrastructure: Established internal collection protocols and worker training to prevent contamination, ensuring a high-quality supply of secondary raw materials.
- Validation & Certification: Achieved GRS and OEKO-TEX compliance, supported by LCA frameworks that quantify environmental benefits without sacrificing mechanical durability or wearer comfort.

2.2. Alliances built

The project established a multi-stakeholder ecosystem to bridge the value chain gap in technical textiles:

- Core Consortium Synergy: Combines Marina Textil's commercial leadership with specialized partners (Blaufabric, Fil Man Made, Fontfilva, Grau, Tranemo) for industrial infrastructure, Leitat for technical certification/LCA, and Tèxtils.CAT for European sectoral networking.
- Strategic Stakeholders: Formed vital links with technical waste suppliers to secure feedstock and engaged industrial end-users for real-world validation of recycled PPE.
- Future Roadmap: Post-project, the consortium will transition to a collaborative exploitation model. While protecting proprietary IP, the framework allows for external replication through controlled know-how sharing and joint validation agreements to scale the circular model across Europe.

3. ACTIONS TO EXTEND THE PROJECT AFTER-LIFE

3.1 Policy recommendations and regulatory alignment

The LIFE-CIRTECHTEX project is strategically aligned with the evolving European regulatory landscape, specifically supporting the EU **Sustainable and Circular Textiles Strategy** and the broader **Circular Economy Action Plan**.

Waste Framework Directive (WFD) and EPR Implementation

The project's methodologies directly support the goals of the revised **Waste Framework Directive**, which mandates Extended Producer Responsibility (EPR) for textiles. Following the political agreement in early 2025, the consortium is actively monitoring the transposition process during the current 30-month window:

- **Jurisdictional tracking:** The consortium tracks transposition events in **Spain** (via the Circular Economy Law framework) and **Sweden** (affecting Tranemo's home jurisdiction), ensuring the project's collection and recycling protocols exceed national minimums.
- **Policy monitoring bodies:** This oversight is conducted through **Tèxtils.CAT's policy working group** in coordination with **Euratex**, allowing the consortium to anticipate changes in waste classification and producer fee structures.

ESPR and technical contributions

The project anticipates the requirements for product durability and recyclability under the Ecodesign for Sustainable Products Regulation (ESPR). As the delegated act for textiles is expected in the 2026–2027 window, the consortium commits to the following specific contributions. Marina Textil and Leitat will submit formal position papers during the public consultation for the ESPR delegated act on apparel and home textiles. These submissions will utilize LIFE-CIRTECHTEX empirical data regarding the mechanical recyclability of flame-resistant (FR) technical fabrics to advocate for realistic performance-to-recycled-content ratios in the PPE sector.

Consortium proposal

During the LIFE-CIRTECHTEX project, the consortium encountered a significant regulatory hurdle: a critical lack of clear legal directives regarding the classification and management of technical textile waste. Existing and developing frameworks, such as Extended Producer Responsibility (EPR) schemes, are designed almost exclusively for mainstream fashion and footwear, leaving the highly specialized Personal Protective Equipment (PPE) sector completely overlooked. Extensive consultations with public waste agencies and textile organizations across Spain, Italy, and Sweden revealed that current guidelines are entirely unsuitable for closed industrial loops. Official recommendations, such as forcing textile manufacturers to register publicly as waste managers or attempting to register scraps under a complex, unprecedented "subproduct" status, were deemed highly impractical and disruptive to standard manufacturing operations.

Because PPE fabrics must strictly comply with rigorous protective certifications, the recycling process cannot accept external textiles and must only process its own traceable materials to prevent cross-contamination. To navigate this legal void, the consortium proposes that these technical leftovers should not be classified as "waste" under EU Directive 2008/98/EC, since the participating companies do not intend to discard them, but rather systematically recover and reintroduce them directly into the production cycle. By treating these scraps as normal textile articles instead of official waste, the materials can be legally transported using standard tariff codes and commercial documentation, drastically reducing administrative burdens along the value chain.

Under this proposed closed-loop model, garment manufacturers will return cutting remnants directly to the fabric owner for quality verification, mechanical shredding, and spinning. Complete end-to-end traceability will be maintained through the Global Recycled Standard (GRS) system using symbolic value invoices, allowing industrial companies to avoid irrelevant waste management obligations while ensuring a fully controlled recycling loop. Ultimately, by keeping these high-value technical fibres out of landfills, the LIFE-CIRTECHTEX project directly achieves "waste prevention", the highest tier of the European Waste Management Hierarchy, and aligns perfectly with the EU Strategy for Sustainable and Circular Textiles and upcoming Ecodesign regulations.

3.2 Industrial uptake and commercial exploitation

The LIFE-CIRTECHTEX project has established a comprehensive pathway for the industrial-scale adoption of circular PPE, ensuring that technical innovations transition effectively into the commercial market through a structured, phased approach. Marina Textil leads this commercial exploitation by integrating the newly developed recycled-content fabrics directly into its established product catalogue, leveraging existing high-volume sales channels to ensure market reach.

The financial viability of this strategy, specifically regarding the transition of the recycled-content product line, is detailed in D6.5. Exploitation plan including replicating component. Current projections indicate that the circular product line will achieve operational break-even (becoming cash-flow positive) within five to six years post-project, with a cumulative payback period of approximately eight years as upfront R&D and infrastructure costs are recovered. Marina Textil is committed to an annual review of this financial model, implementing corrective actions should actual performance drift from projections by more than 20%.

To enable market entry, the consortium prioritizes alignment with the Global Recycled Standard (GRS), Recycled Claim Standard (RCS) and OEKO-TEX, providing the transparency required by procurement departments. Beyond the garments, the project exploits critical soft results and intellectual property developed during the lifecycle:

- Process know-how & SOPs: Detailed protocols for yarn spinning and finishing specifically calibrated for recycled fibres (IP shared by the technical partners).
- Contamination-prevention SOP: A specialized framework for maintaining fibre purity during collection (Owned by the waste management leads).
- Operator training package: A modular curriculum for industrial scaling (owned by the consortium for internal use and future licensing).

These assets allow partners to enhance their own industrial processes and foster a broader transition toward circularity across the European textile manufacturing base.

3.3 Replication and transferability strategy

The replication of the LIFE-CIRTECHTEX model is based on the transfer of validated knowledge and processes to other actors within the technical textile sector. Within this framework, Leitat and Tèxtils.CAT act as key catalysts, facilitating the adoption of developed solutions by third-party companies interested in implementing circular economy models.

Leitat provides the necessary technical and scientific foundation for replication, offering specialized consultancy in the characterization of recovered materials, the optimization of mechanical recycling processes, and the verification of regulatory compliance. This support enables other manufacturers to validate the technical feasibility of their own circular solutions under the strict safety standards required for PPE. Simultaneously, Tèxtils.CAT leverages its networking capacity and sectoral connectivity to identify replication opportunities, acting as a strategic bridge through transfer sessions, technical seminars, and collaborative activities designed to scale the model at a European level.

Quantified replication pipeline

To transition from theoretical facilitation to industrial reality, the consortium has established a roadmap with specific adoption targets:

Milestone	Target Replicating Companies	Focus Area
Year 2 (M+24)	3 Companies	Early adopters; testing the collection SOPs
Year 3 (M+36)	8 Companies	Full process replication and
Year 5 (M+60)	15 Companies	Broad European market penetration

Table 1. Replication strategy organisation

Currently, the consortium is in early-stage discussions with a named pipeline of potential replicators:

- A Tier-1 firefighter PPE manufacturer (Italy): Interested in integrating mechanical recycling feedstock.
- A leading provider of industrial workwear (France): Focused on the circular procurement model.
- A technical textile finisher (Germany): Evaluating low-impact finishing protocols.
- A regional waste management cooperative (Spain): Looking to adapt collection and sorting SOPs.

The replication package and IP framework

The project is designed to be highly accessible while safeguarding the consortium's competitive advantage. Rather than a generic "copy," external organizations can replicate or adapt the methodology through a tiered approach:

- Public Blueprint (Open Access): By gathering technical guidelines and validated results produced during the project, external companies can adopt the LIFE-CIRTECHTEX methodology as a blueprint. This encourages a broader industry transition toward zero-waste manufacturing.
- Proprietary Replication Package (Licensable): Key technical knowledge, such as the Contamination-Prevention SOP, optimized spinning parameters, and operator training packages, is retained within the consortium. These assets are available to third parties through structured licensing or technology transfer agreements managed by Leitat.

3.4 Risks and external dependencies

It is critical for companies to maintain a constant and rigorous monitoring of the regulatory landscape, as the cross-border movement of textile waste is subject to complex and evolving international requirements.

Navigating the logistics of transporting waste between different countries is not a straightforward process; it requires strict adherence to EU Waste Shipment Regulations and environmental protocols to avoid legal complications or operational delays. By staying proactive and aligned with both existing and emerging European standards, organizations can mitigate the risks associated with regulatory changes and ensure that their circular supply chains remain compliant and efficient across borders.

The risks that the project can meet during the next years are listed and evaluated below:

Risk	Likelihood	Impact	Mitigation owner
Revised WFD/EPR transposition delays in Spain	medium	medium	Tèxtils.CAT policy WG
Volatility in virgin polymer prices	medium	high	Marina Textil commercial
Loss of GRS or OEKO-TEX	low	high	Leitat technical
Key-person dependency at	medium	medium	Marina Textil HR
Competing recycling	medium	medium	Leitat strategy
REACH SVHC restriction on a	low	high	Leitat regulatory
IP leakage from licensing partners	low	medium	Leitat IP management
EU Waste Shipment	medium	medium	Marina Textil procurement

Table 2. Risks of the after-life process.

4. AFTER-LIFE COMMUNICATION PLAN

Communication plays a vital role in supporting the successful implementation and dissemination of project results, ensuring a long-term impact within the participating countries and across the European Union. This After-LIFE Communication Plan outlines the promotional activities for the LIFE-CIRTECHTEX project, which will serve as the communication strategy for the 5 years following the project's completion.

4.1 Objectives of communication and dissemination

In order to continue the promotion of the achievements of LIFE-CIRTECHTEX, a strategy has been defined to be performed for at least five years after the project end. The approach is aimed at:

- Promoting the benefits generated by circular economy processes in the high-performance technical textile sector.
- Maintaining awareness regarding the environmental and safety advantages of using recycled-content fibres in Personal Protective Equipment (PPE).
- Attracting new clients and stakeholders for the circular PPE product lines developed by Marina Textil and Tranemo.
- Encouraging knowledge sharing to avoid technical barriers in the replication of mechanical recycling and fibre recovery.

4.2 Target groups

To foster effective communication, the following target groups have been identified:

1. Key industrial members and associations: Strategic partners and clusters, such as Tèxtils.CAT, serve as key alliances in disseminating results to the wider European textile network.
2. Garment manufacturers: Companies like Tranemo and other garment makers who are essential for integrating circular fabrics into finished protective workwear.
3. Industrial End-Users: Large-scale organizations and safety managers in sectors with high protection requirements, such as foundries, petrochemical plants, and electrical utilities.
4. Scientific & Technical Organizations: Research centres and study groups (leveraging the expertise of Leitat) focused on textile recycling, Life Cycle Assessment (LCA), and material characterization.
5. Public Authorities & Policy Makers: Local, national, and EU decision-makers interested in Green Public Procurement and the implementation of the EU Strategy for Sustainable and Circular Textiles.
6. Media Representatives: Specialized industrial and environmental press to highlight the project’s contribution to the EU Green Deal.

4.3 Project communication tools

Communication tools developed during the project will remain available for After-LIFE activities:

1. Layman's report (summarizing project results for a general audience).
2. Project brochure and visual identity (Logo and presentation layouts).
3. Project website (The central hub for all technical documentation).
4. Technical guidelines for textile waste collection and recycling processes.
5. Project social networks: LinkedIn profile will remain open, keeping all its connections and posts showing the project results available.

4.4 After-LIFE communication channels

Different channels will be used to direct communications during the upcoming years:

Digital channels:

1. LIFE-CIRTECHTEX Website: Will remain active for at least 5 years after the project completion:

- The site provides access to public reports, background material, and LCA results.
- News and progress updates will be posted at least twice a year.

2. Social media (LinkedIn): The project profile or partner corporate profiles will share semi-annual updates regarding the consortium's ongoing advancements and new circular milestones.

Physical channels:

1. Trade fairs: Continued presence at major international industry events, specifically A+A in Düsseldorf (Safety, Security and Health at Work) and other regional occupational safety fairs.
2. Technical conferences: Participation in textile innovation summits and circular economy workshops organized by regional development agencies or the Tèxtils.CAT cluster.
3. Bilateral meetings: Direct engagement with industrial clients to showcase the commercial portfolio of certified recycled PPE.
4. Scientific publications: Submission of papers regarding the mechanical recycling of technical fibres and the validation of safety standards in recycled PPE.

4.5 Timeline and resources

The coordination of the After-LIFE Communication Plan will be led by Marina Textil, supported by the technical expertise of Leitat and the networking reach of Tèxtils.CAT.

Period: May 2026 to May 2031.

Estimated budget for After-LIFE: Approximately €125,000 to €250,000 over 5 years (calculated as a total of partner contributions, largely covered by internal communication and R&D budgets).

Beneficiary	Category	Approx. annual budget
Marina Textil	Sales/Exploitation effort & Trade fairs	€15,000 – €20,000
Marina Textil	After-LIFE Coordination & Website hosting	€5,000 – €10,000
Leitat	Replication consultancy & LCA maintenance	€10,000 – €15,000
Leitat	Scientific publications	€5,000 – €7,500
Tèxtils.CAT	Website updates & Cluster networking	€5,000 – €10,000
Tèxtils.CAT	Policy monitoring & Trade fair support	€5,000 – €10,000
Tranemo	Sales/Exploitation effort (Garments)	€10,000 – €15,000
Blaufabric / Fontfilva / Grau / Fil Man Made	Process maintenance & Technical updates	€5,000 – €10,000 (per partner)

Table 3. Resources allocated for the After-life plan.

These tasks should be done considering:

- Budget ownership: These costs are generally absorbed into the partners' existing internal communication, marketing, and R&D departments.
- Coordination: As the lead beneficiary, Marina Textil assumes the largest share of the exploitation effort to ensure the circular product line reaches the projected eight-year cumulative payback period.
- Technical support: Leitat remains the primary technical validator for third-party replication enquiries, ensuring the safety standards of the PPE are never compromised during the transfer of know-how.
- Monitoring: The budget allows for bi-annual website updates and the annual KPI review conducted by Leitat (environmental) and Marina Textil (production).

5. AFTER LIFE RESPONSABILITIES

The tasks that the project will face in the next 3 years are listed in the next RACI matrix.

TASK	RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
Website & digital hub maintenance	Tèxtils.CAT	Marina Textil	Partners	Public
LCA dataset & environmental kpi updates	Leitat	Leitat	Marina Textil	Consortium
IP management & licensing (replication)	Leitat	Marina Textil	Technical Partners	Stakeholders
Regulatory & policy monitoring	Tèxtils.CAT	Tèxtils.CAT	Euratex	Consortium
Recycled content production targets (80%)	Marina Textil	Marina Textil	Blaufabric/Fil Man Made	Customers
Commercial catalog integration	Marina Textil	Marina Textil	Tranemo	End-Users
Waste collection protocol training	Marina Textil	Marina Textil	Regional Co-ops	Workers
Annual after-LIFE coordination meeting	Marina Textil	Marina Textil	Leitat/Tèxtils.CAT	All partners

Table 4. After life tasks and responsibilities.

5.1. Task descriptions & strategic alignment

- Website & social media management: Maintaining the website and LinkedIn profile for at least 5 years to host public deliverables, technical guides, and bi-annual progress updates.
- KPI & environmental monitoring: Specifically tracking the reduction of CO2 emissions and energy consumption (GWh) for three years post-project to validate the environmental impact.
- Replication & technology transfer: Managing the "Proprietary Replication Package," including licensing the specialized yarn spinning SOPs and contamination-prevention frameworks to third parties.
- Regulatory alignment (ESPR & WFD): Monitoring the transposition of the Waste Framework Directive in Spain and Sweden and submitting position papers for the Ecodesign for Sustainable Products Regulation (ESPR) delegated acts.
- Commercial exploitation: Ensuring the circular product line reaches its operational break-even point (projected within 5-6 years) and monitoring for financial drift.
- Stakeholder engagement: Continuing presence at international trade fairs like A+A in Düsseldorf to attract new clients and industrial end-users.

5.2. Coordination schedule

Marina Textil should chair an annual coordination meeting (for example, every January during the 2027–2030 period) to review these tasks and the progress of the KPI targets.

6. CONCLUSIONS

The LIFE-CIRTECHTEX project has successfully demonstrated that circular economy principles can be applied to the highly demanding Personal Protective Equipment (PPE) sector without compromising safety or technical performance. By achieving the milestone of integrating recycled content into certified fabrics, the consortium has proven that a ≈ zero-waste and circular industrial model is both technically viable and environmentally necessary.

The strategic roadmap for the 2026 - 2031 period leads to several key conclusions:

- Economic sustainability: While circular PPE requires significant upfront R&D, the product line is projected to reach operational break-even within five to six years, with full investment recovery by the eighth year.
- Environmental leadership: The project is on track to prevent 321 tonnes of textile waste per year and avoid 1,224 tonnes of CO_2 equivalent (combining manufacturing and end-of-life avoidance) by 2029.
- Regulatory readiness: The consortium is uniquely positioned to influence and adapt to the upcoming Ecodesign for Sustainable Products Regulation (ESPR) and the revised Waste Framework Directive.
- Collaborative legacy: The continued involvement of Tèxtils.CAT, Leitat, and the industrial partners ensures that the project's "Soft Results", such as specialized SOPs and training packages, will remain available for the wider European industry.

In conclusion, the After-LIFE period will transform LIFE-CIRTECHTEX from a successful pilot initiative into a permanent, self-sustaining industrial standard, driving the European technical textile industry toward a more resilient and sustainable future.