CASE STUDY

GLOBAL 2021-2023 / ECO-DESIGN TARPAULIN

CRISIS	Within a global initiative, field testing was carried out in areas affected by floods and conflict-related displacement
PROJECT LOCATION	Global, with field testing in Diffa, Maradi and Tillabery, Niger
PROJECT OUTPUTS	**Validation and release of a revised eco-design tarpaulin specification for humanitarian use**

PROJECT SUMMARY

The project revised the standard humanitarian tarpaulin specification to reduce environmental impact while maintaining the durability, safety and performance required for emergency shelter use. Through life cycle assessment, market review, laboratory testing and field validation in Niger, the project confirmed that a lighter tarpaulin with recycled content and improved UV resistance could perform well in real shelter conditions. If adopted at scale, the revised specification could reduce emissions, resource use, toxic pollution and repeat distributions of one of the most widely used shelter items globally.

For more information on this project, access the video at this link: https://sl1nk.com/1wkcweh

PROJECT	1	2 IMPACT ANALYSIS		3 SPECIFICATION DESIGN		4 LAB AND HQ TESTING		5 FIELD TESTING	6
TIMELINE	1996	MAY 2021	DEC	JAN 2022	AUG	SEP	APR 2023	MAY	DEC

1. **1993–1996:** The original standard humanitarian tarpaulin was developed through inter-agency work and became a common reference for major humanitarian organizations.
2. **May-Dec 2021:** The project reviewed the environmental footprint of the existing product and identified where improvements could be made.
3. **Jan-Aug 2022:** Life cycle assessment, market review and stakeholder consultation informed the revised technical specification.
4. **Sep 2022 - Apr 2023:** Produced batches were tested for key performance requirements, including strength, durability, UV resistance and fire behaviour.
5. **May-Dec 2023:** The revised tarpaulin was tested in real shelter conditions through structured household use and blind distribution.
6. **Dec 2023:** The validated eco-design tarpaulin specification was re-leased for wider humanitarian use.

Good quality, shelter-grade tarpaulin can last decades. In this photo, a 14-year old tarp is being shown in Ethiopia.

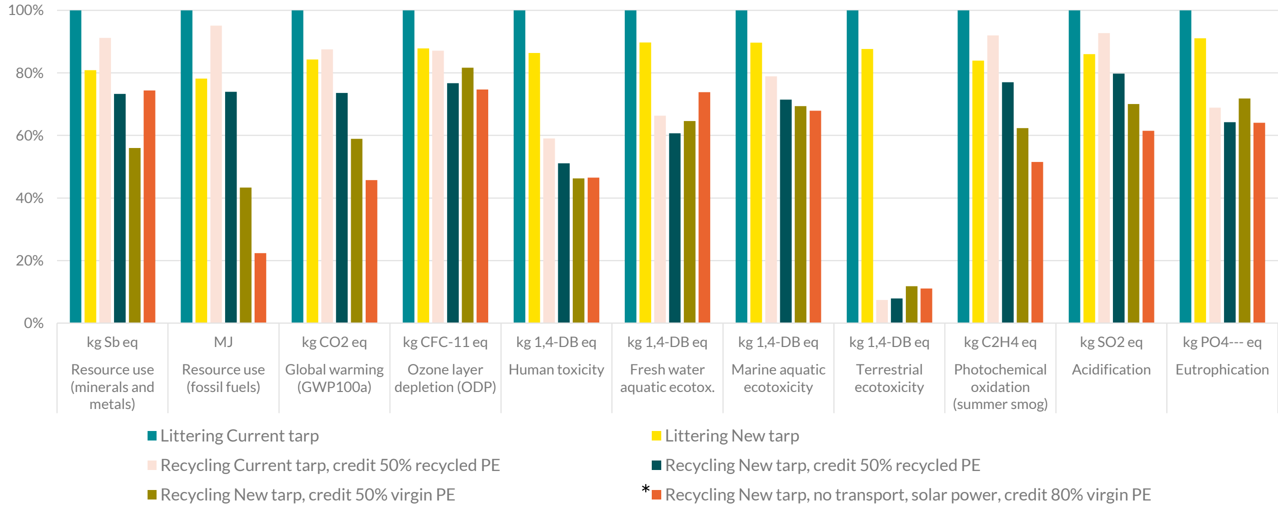
BACKGROUND / RATIONALE

Humanitarian agencies distribute millions of plastic tarpaulins every year, so even small improvements to this standard shelter item can significantly affect resource use, emissions, waste and the quality of assistance provided. The project aimed to determine whether the existing humanitarian tarpaulin specification could be revised to reduce environmental impact while maintaining the durability, safety and operational reliability required in emergency shelter responses.

The work built on the inter-agency tarpaulin development process of the 1990s, when a common standard was established and adopted by major humanitarian organizations. For more information on that process, see case study B.02 from Shelter Projects 2017-2018. As of 2021, that standard had proved effective over several decades, but it had not been comprehensively revisited through a reduced environmental-impact lens.

The project therefore sought to update a proven product rather than replace it, using life cycle assessment, material screening, laboratory testing, manufacturer engagement and field validation to identify improvements that could be adopted at scale.

Environmental impact was considered in several dimensions. Raw materials and production represented the largest share of carbon emissions, while end-of-life management was the largest concern when broader environmental criteria were considered. The project also recognized that poor-quality tarpaulins can degrade rapidly and require recurrent distributions on top of the environmental impact of the fragmented microplastics. By contrast, a durable product with strong UV resistance could remain useful for longer, support reuse and repurposing, and retain value for future waste collection and recycling.



Comparison of environmental impact of current and new PE tarpaulin with different end of life scenarios (highest value set to 100%).

STAKEHOLDERS CONSULTATIONS

More than 90 stakeholders were consulted, including humanitarian practitioners, manufacturers, laboratories, research bodies and specialists in product design, procurement and quality assurance. These consultations helped test assumptions, review findings and ensure that proposed changes remained feasible for manufacturing and field use. Earlier user surveys in Mali and the Democratic Republic of Congo, involving 140 tarpaulin recipients, showed how the existing product was used and which performance features users valued most, helping guide the improved design before field validation in Niger.

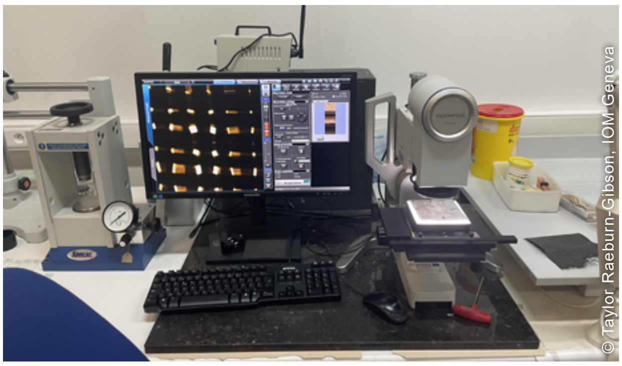
LIFE CYCLE ASSESSMENT

A life cycle assessment, including investigation of biodegradable, biosourced and recycled materials, compared the existing polyethylene tarpaulin with possible alternatives across raw materials, manufacturing, use and end-of-life scenarios. It showed that the largest gains would come from a combination of lower weight, recycled content, extended service life and improved end-of-life potential:

- **Biobased polyethylene** was not retained because of market scarcity, higher costs, possible competition with food production and higher impacts in most of the Life Cycle Assessment categories reviewed.
- **Biodegradable plastic** was also not retained because current technologies are not suited to products expected to last for long periods in varied and unpredictable climatic contexts, and because appropriate end-of-life treatment could not be guaranteed.
- **Recycled polyethylene** was identified as the most viable option, provided that it could be integrated without reducing durability, safety or manufacturing feasibility.

LONG-TERM UV RESISTANCE TESTING

Laboratory testing equivalent to 10 years of real-life exposure was carried out to assess UV resistance, a critical parameter since sunlight degradation is a major factor in tarpaulin failure. The results showed that the revised product retained very high resistance compared with lower-grade products commonly available on the market. This supported the design logic of a lighter but more durable tarpaulin: if the material remains stable for longer, it can reduce the need for recurrent replacement and remain suitable for collection, reuse or recycling rather than fragmenting into microplastics.



The gaps between the fibers were analysed using microscopes.

UV testing was essential for the new specification development, as durability largely depends on the capacity of the tarps to withstand solar radiation.

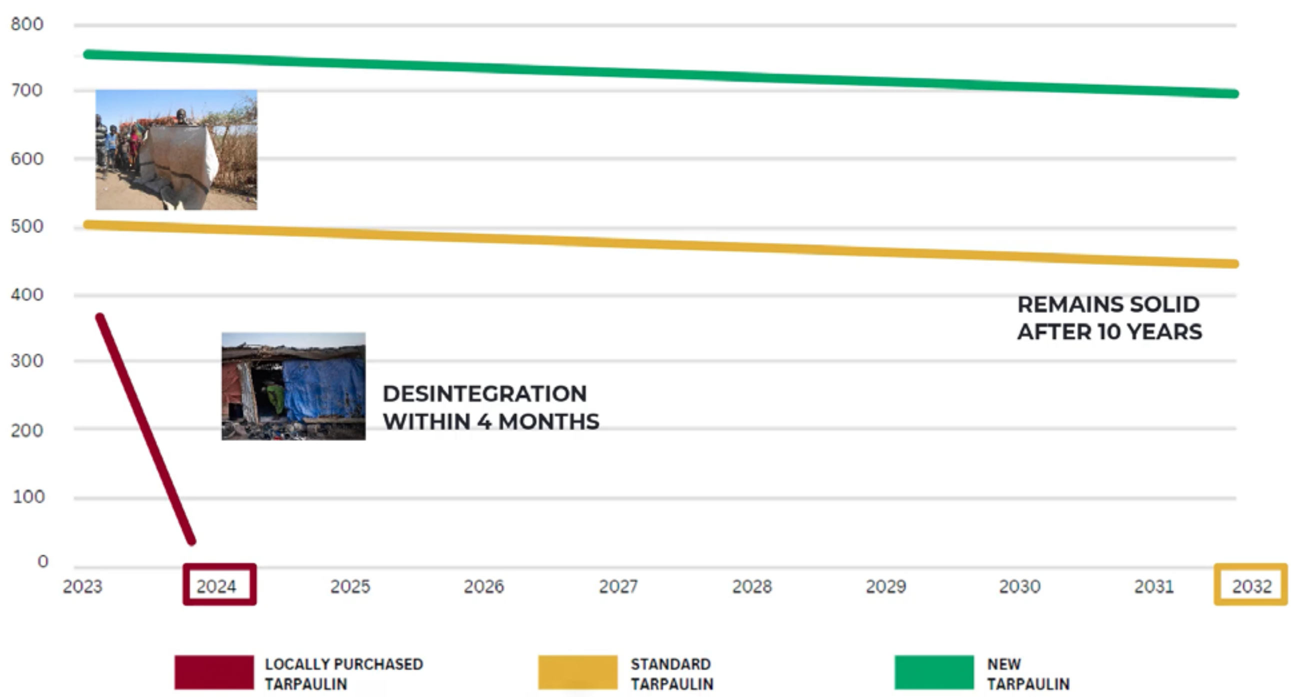


Chart showing the remaining tensile strength of different types of tarpaulins after UV degradation over eight years. Access this video for more information.

ALTERNATIVE PRODUCT DESIGN

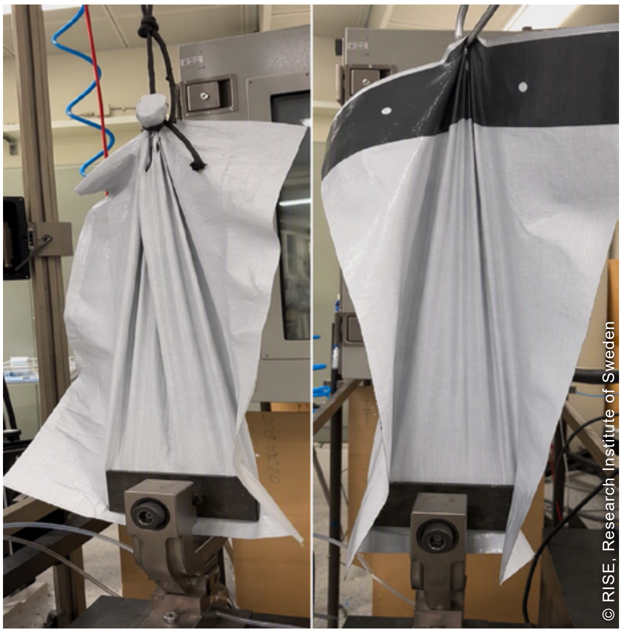
By September 2022, the project steering committee had validated a proposed alternative specification based on consultation, market review, life cycle assessment and laboratory evidence. Industry partners were then invited through a request for proposals to design and produce batches of tarpaulins using the revised specification.

This stage was designed to test whether the proposed changes could be manufactured consistently and at the level required for humanitarian procurement.

LAB TESTING OF THE PRODUCED BATCHES

The produced batches were tested at headquarters and in laboratories focusing on key technical parameters linked to operational performance and safety, including mechanical strength, durability, UV resistance and fire behaviour. Results confirmed that the revised specification was feasible and supported final refinements before field validation.

The tests also showed that the required level of fire safety could be achieved without toxic chemical fire-retardant additives: comparative tests on large samples with and without such additives showed similar reactions to large fire, a finding also supported by real-size tests on polyethylene tents.



The produced batches were laboratory tested, including for tensile strength.

Fire resistance testing showed the feasibility of the new specification, even without the use of fire-retardant additives.

FIELD TESTING IN NIGER

Conducted in 2023, the field test assessed whether the eco-design tarpaulin could match or improve the performance of the standard product under real shelter conditions. The test took place in Niger, in areas affected by floods and armed conflict-related displacement. It combined two complementary approaches: a structured field assessment with 30 volunteer households across three locations, and a blind distribution test in which 100 tarpaulins were distributed to 50 beneficiaries without identifying which was the revised product. The results were highly positive, with 94 per cent satisfaction reported.

NEXT STEPS

The results from the field test were consolidated with final technical adjustments from the laboratory assessment. The revised specification was released at the end of the project and adopted as a standard by the Quality, Social and Environmental (QSE) Working Group, whose members include major humanitarian agencies involved in emergency relief item specifications. The next phase is dissemination and uptake: the benefits of the new design will depend on whether procurement and operational teams understand the specification, apply it consistently and maintain quality control during large-scale purchasing.

COMMUNITY ENGAGEMENT

Although this was not a conventional community-based shelter project, end users played an important role in the field validation stage. Households in Niger tested the tarpaulins in realistic shelter applications and provided feedback on handling, installation, thermal comfort, robustness and usability. The blind distribution approach helped reduce response bias by ensuring that users assessed the product through experience rather than expectations linked to a new or environmentally improved item.

COORDINATION

The project relied on coordination between humanitarian agencies, research bodies, laboratories, manufacturers and field-testing partners. The work combined environmental analysis, product design, laboratory verification, manufacturing feasibility and user validation. In Niger, the field test was directly linked with the Shelter/NFI and CCCM coordination structures, supporting the selection of relevant operational sites and ensuring that field testing was grounded in coordinated shelter practice.

ENVIRONMENTAL IMPACT

- The revised tarpaulin includes 15 per cent recycled polyethylene, reducing reliance on new fossil-based raw material while maintaining the strength needed for humanitarian use.
- The product is 14 per cent lighter, reducing the amount of plastic produced, transported and eventually discarded. At the scale of millions of tarpaulins per year, this reduction can translate into meaningful savings in resources and emissions.
- Improved durability is the most important environmental gain. A longer-lasting product reduces the need for replacement distributions and therefore avoids repeated production, transport and waste.
- High UV resistance helps prevent rapid degradation and fragmentation into microplastics. This makes reuse, repurposing and collection for recycling more realistic after the first shelter use.
- The project showed that transport impacts are relatively limited when long-distance movement is by sea freight, reinforcing that product durability and end-of-life management are central to reducing the overall footprint.

The newly developed eco-tarpaulins were tested in the field in two locations in Niger, using a blind distribution approach whereby beneficiaries did not know which type of plastic sheeting they had received. 30 families were included in the field testing and the result proved very positive, with 94 per cent satisfaction rate.

MAIN CHALLENGES

- Maintaining consistency at scale: The environmental and technical benefits of the improved specification depend on procurement systems being able to verify products reliably across suppliers.
- Market availability remained limited, particularly for reliable sources of recycled polyethylene. As a result, recycled content could be encouraged but not guaranteed in all future procurement.
- End-of-life recycling: the largest environmental gains depend on waste collection systems that are difficult to organize in many humanitarian contexts.

During the field testing phase, following community consultations, the new tarps were distributed and installed in displacement sites in Niger.

LOCAL VS GLOBAL SUPPLY

The project showed that material choice and supply-chain feasibility must be considered together. While local purchase is often encouraged in humanitarian responses, tarpaulin quality varies widely and reliable manufacturers are not available in many regions. Without long-term support to manufacturers to meet the required standard, local procurement may result in lower-grade products degrade rapidly and contribute to microplastic pollution while offering very limited assistance to people in need. For large emergencies, global sourcing and harmonized specifications remain important to ensure that the right quality can be procured in sufficient quantities. For an example of this concept at scale, see case study A.03 from this edition of Shelter Projects, on the Common Pipeline in South Sudan.

Locally procured tarps, such as the ones in this photo, degrade rapidly in harsh climates, reducing the durability for users and polluting the environment.

STRENGTHS, WEAKNESSES AND LESSONS LEARNED

STRENGTHS

√ **The project built on decades of operational experience** with humanitarian tarpaulins, which gave the revised specification a credible starting point for practitioners and procurement teams.

√ **Rather than relying on one source of information,** the project combined practitioner knowledge, manufacturer input, laboratory evidence and user feedback.

√ **Wide consultation** helped keep the revised design realistic for procurement, manufacturing and field use, while also providing peer review at key stages.

√ **User surveys** in Mali and the Democratic Republic of Congo, followed by field validation in Niger, helped ensure that the product remained relevant to end-user needs and shelter realities.

√ **The step-by-step process,** from life cycle assessment to prototype production, laboratory testing and field validation, built confidence that environmental improvements would not reduce performance.

√ **As an inter-agency effort,** the result has wider relevance and can influence wider humanitarian procurement practice and footprint reduction.

WEAKNESSES

× Improving the specification was only one part of the solution; the **expected benefits still depend on consistent quality control** during procurement and production.

× **Reliable testing, verification and follow-up remain demanding** when an improved product is procured at large scale across multiple suppliers.

× **Some of the largest environmental gains,** especially those linked to recycled content and end-of-life recycling, **depend on conditions beyond the specification itself,** including market supply, user practices and waste collection systems.

× **Reliable sources of recycled polyethylene were limited,** meaning that recycled content could not yet be guaranteed across all future supply.

× **Harmonized specifications can create supply-chain bottlenecks** if demand rises quickly during large emergency operations.

× **Field feedback collection required significant planning** and could have been organized more efficiently from the start to support easier comparison across locations.

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Three months after the installation of the tarps, a questionnaire was conducted to analyse the level of acceptance of the tarps in field conditions.

LESSONS LEARNED

- Environmental improvement in humanitarian products works best when treated as a full design and testing process, not as a simple material substitution.
- Durability, weight, user acceptance and procurement feasibility need to be considered together, since improving one feature in isolation can create trade-offs elsewhere.
- Quality management is as important as product innovation, because a better specification will have limited impact if delivered products do not meet the intended standard.
- Joint research and development across agencies can produce stronger results than isolated organizational efforts, especially for standard relief items used at global scale.
- Global sourcing remains important for products that require consistent quality and large quantities during major emergencies.
- Long-lasting products can bring major environmental gains by reducing the need for replacement distributions and limiting repeated production, transport and waste.
- End-user feedback remains essential, even for highly technical products, because field experience can confirm or challenge assumptions made in design and laboratory testing.
- Reuse, repurposing and recycling need to be considered early if the full environmental value of a durable item is to be realized.

RECOMMENDATIONS MOVING FORWARD

- Setting up a more structured user-feedback system from the start, so that field evidence can be collected more efficiently and compared more easily across locations.
- Building stronger quality management and procurement follow-up into the global supply chain, so that delivered products are up to standard and reliable suppliers are reassured to participate into a fair competition process.
- Planning earlier for longer-term follow-up on reuse, repurposing and end-of-life recovery, since the value of a durable tarpaulin depends on what happens after first use.
- Continuing to invest in technical dissemination and awareness-raising for procurement and operational teams, so that the risks of poor-quality purchases and the benefits of durable, well-tested products are better understood.
- Engaging donors on how they can support the development and procurement of lower-impact humanitarian products adapted to operational realities.

FURTHER READING ON SHELTER PROJECTS

On the history of tarpaulin development: SP 17-18 / B.02

On the use of plastic sheeting in the field:
SP 2008 / A.2 ERITREA; SP 17-18 / A.3 KENYA FLOODS.

On a tent recycling project: SP 13-14 / A.12 JORDAN