ICRC/IFRC/UNHCR Eco-design Tarpaulin Project 2021-2023

Project newsletter, 2022 December 16th

All technical reports, LCA, etc, are available on request (paoger@icrc.org)

TABLE OF CONTENT

1 WHAT HAS BEEN DONE, WHERE DO WE STAND?

The ICRC, UNHCR, and IFRC have launched on May 1st, 2021 a research and development project to design a new tarpaulin with a lesser environmental impact.

The new tarpaulin will be based on the existing specification designed in the mid 90's by a consortium of aid organizations. It already included features to reduce its environmental impact.

The objective of the project is to improve the tarpaulin design to further reduce the environmental impact of the tarpaulin distributions.

1.1. First phase: Design new specification

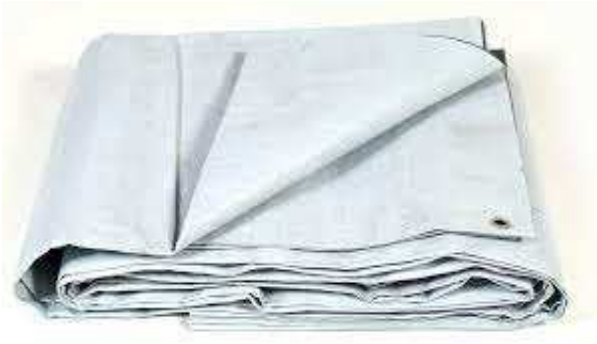
In a first phase from May 2021 until mid-2022, thanks to the collaboration with manufacturers, laboratories, partner aid organizations, and the Research Institute of Sweden (RISE), the project was able to propose an alternative tarpaulin specification. The product development was based on:

- Life Cycle Assessment (LCA) of the current polyethylene (PE) tarpaulin
- Long term UV test on the current tarpaulin (10 years equivalent)
- Field surveys in Mali and DRC involving 140 tarpaulin distribution beneficiaries
- Market analyze of alternative products
- Scientific study of alternative materials (bio based PE, biodegradable PE, recycled PE).

As an outcome of this first phase, in September 2022 the project steering committee validated the proposed alternative specification.

Compared with the current tarpaulin specification, the improvements are expected from the following changes:

- Inclusion of 15% recycled PE
- Lighter weight from 190gsm to 170gsm
- Increased mechanical strength in Tensile (+50%), in Tear (+100%), in fastening points (+33%)
- Introduction of minimum requirements for the resistance to cuts and to puncture
- Introduction of a new fastening system (this point is still under development)



1.2. Second phase: Measure the improvements

In December 2022, concluding the second phase, the project issued the comparative analyze of the new tarpaulin vs the current tarpaulin, with a comparative LCA. The reduction of environmental impact was demonstrated for every change in the specification, see table:

Confirm achievement in reducing the environmental impact	
specification	**Impact**
15% recycled PE	Reduces 8% Global Warming Potential and 8% fossil resources depletion
14% lighter weight	Reduces 14% on all the 11 impact categories of the LCA
twice extended life span	Potentially reduces up to 50% of the tarpaulin distribution impact, only in the case where re-distribution to the same beneficiaries happens
long term UV resistance	Avoids microplastic and chemicals spread and allows 2nd use and recycling
industrial recycling At a concept stage: local recycling, low tech	Reduces 41% GWP and 57% fossil use Reduces 54% GWP and 78% fossil use

Some of these achievements are context dependent, some are not:

- The impact reduction linked to the recycled PE and to the lighter weight are the most assured and solid impact reduction. The link between the specification and the reduction is direct.
- The extended life span is an improvement linked to the higher mechanical strength (tensile, tear, cut, puncture, fastening point). This improvement should first be confirmed with field test and furthermore with field experience on the long term.
- The extended life span can be counted as an impact reduction only in the case where re-distribution would really happen, mostly in refugee or IDPs camps. Nevertheless it will also help to extend the second life of the tarpaulin in many other usages. The environmental benefits are multiplied when beneficiaries re-use tarpaulins beyond their anticipated use in a given project, reducing future purchases of tarpaulins with lower quality and higher environmental risks. Such benefits are not included in the calculations above.
- The long term UV resistance is a factor that was already included in the current tarpaulin. Here It helps the extended lifespan to be real, and it helps the potential recycling and reuse to happen. It can avoid lot of plastic pollution by giving time to the collecting and recycling to happen.
- The recycling at end of life cycle has the largest impact reduction potential, but it is linked to the capacity to collect the waste and ensure the recycling, which seams difficult to achieve in many places. In most instances, beneficiaries leave camps at different times, and often choose to keep their tarpaulins for future use, so a consolidated recycling effort proves challenging. With a proposed solution for local low tech recycling, this may become less uncertain, although the process and methods remain in concept phase (see section 3.3).

2 WHAT ARE THE NEXT STEPS?

In 2023, the project will continue with the test at HQ, the lab test on the fastening system, and the field testing in Niger.

The objective is to confirm the new specification by the end of September 2023.

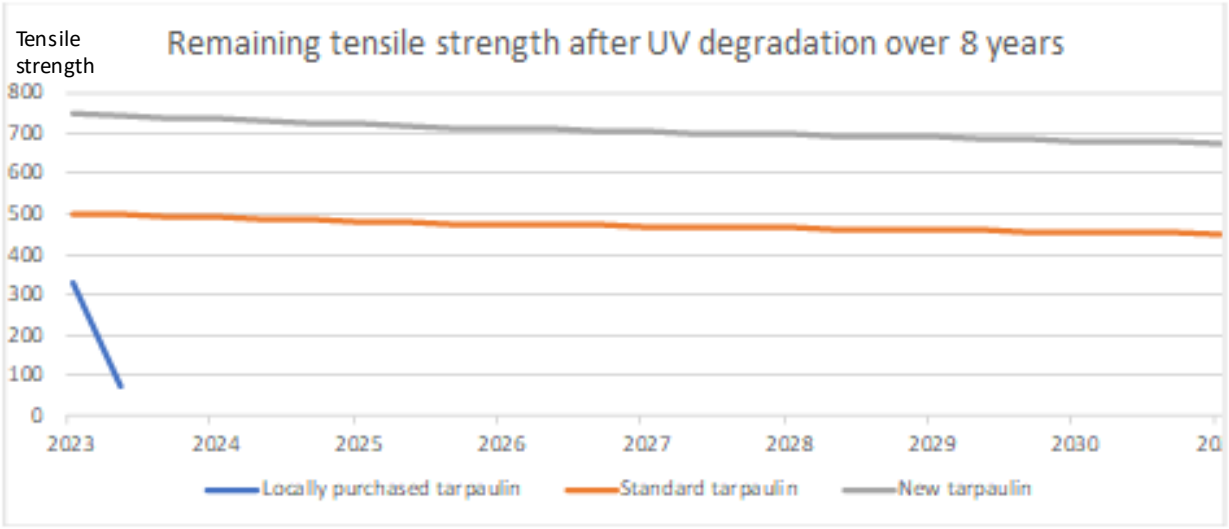
Planning:

- Laboratory test to confirm that the new specification are reached (Dec 2022-Jan 2023)
- Practical testing of samples of the new product with proposed new fastening systems (Jan 2023)
- Laboratory test on the different fastening systems (January 2023)
- Adjust the new specification if required (Feb 2023)
- Finalize field test protocol (Jan / Feb 2023)
- Field test in Niger, performed by the International Aid Luxembourg Red Cross (Apr / Jul 2023) with ICRC, IFRC, and UNHCR being present in Niger.
- Deliver the final specification (Sept 2023)

3 SPECIFIC TECHNICAL NOTES:

3.1. UV resistance

The long term UV test confirmed that the standard tarpaulin has an extremely high resistance to UV. We could compare with a tarpaulin purchased locally in DRC in 2017.



The tarpaulin from the local market is falling into small pieces after 4 months, while the standard tarpaulin still offers 90% of its original tensile strength after 8 years. The new tarpaulin is expected to offer the same UV resistance, as there is no change in the formulation.

3.2. Alternative materials

RISE made a thorough exploration of the possibilities to use biodegradable material, bio-sourced material, and recycled material as a base material for the tarpaulin. Here are the findings and decision made.

3.2.1. Biodegradable PE

The research confirmed that there is no such plastic that would biodegrade in any environment when litter. All the biodegradable plastics need to be placed into specific conditions to biodegrade. This can be in a home controlled compost for the most degradable types, or mixed with soil for agricultural plastic mulch, or collected and brought back to an industrial composting facility. This last one being the most found. If not handled as recommended, all these types of plastic will quickly degrade in the form of micro plastics, potentially harmful for all living organisms.

In general we do not have any control on the plastic wastes generated by the humanitarian aid distribution. Therefore, including biodegradable plastics in our products, and packaging, is presenting a high risk of disseminating micro plastics.

Furthermore, the life expectancy of the biodegradable plastic is entirely dependent on the climatic and microbiologic conditions, that varies from one location to another, and is unpredictable.

Decision about the biodegradable PE:

With today's technologies, biodegradable plastic cannot be designed for applications where the expected service life covers a long period of time in many different types of usages and unpredictable biological and climatic conditions. Furthermore, the end-of-life treatment of biodegradable plastic is key to ensure a lower environmental footprint than traditional plastics, but this cannot be guaranteed in humanitarian contexts.

Therefore, the project recommends not to explore further biodegradable plastics as an alternative material for the tarpaulins used in humanitarian responses.

3.2.2. Biobased PE

Even though bio-based plastics could completely replace fossil-based plastics in the formulation of the tarpaulin, several concerns need to be taken into consideration before deciding on its usage. This includes:

- Scarcity of the bio-based plastics on the market and higher prices.
- Bio-based plastic was found to have a higher environmental impact in the following impact categories when compared to fossil-based plastic in the LCA on polyethylene performed by RISE: resource use (mineral), ozone depletion, human toxicity, terrestrial ecotoxicity, photochemical oxidation, acidification, freshwater toxicity, marine aquatic toxicity and eutrophication. Only for global warming potential (GWP) and resource use (fossil) was bio-based PE found to have lower environmental impact by 24% and 68% respectively.
- Potentially conflicting situation between food production and plastic production
- Bio-based does not imply that it is biodegradable.

Decision about the bio-based PE:

Because it is not intended to use bio-based material potentially issued from food crops, and there is no standard that certifies bio-based PE is made from non-food materials; because bio-based PE has many impacts higher than fossil based as described by the LCA; and because including bio-based PE would highly complexify the supply chain, the bio-based material is disqualified as a potential material for the tarpaulin, in our specific usage, considering the current state of the technology.

3.2.3. Recycled PE

The recycled PE presents a good potential for impact reduction as described by the LCA. Therefore recycled PE should be included in the final product.

Nevertheless several issues were identified:

- availability on the long term of the recycled plastic and at a constant quality
- confusion between post-consumer waste recycled plastic and industrial waste direct recycling
- impact of the inclusion of recycled plastic on the final product quality and durability
- social and environmental aspects in the whole recycling industry

Decision about the recycled PE:

Recycled PE will be included in the tarpaulin specification. This will be only as a recommended option, until further evolution, to avoid supply chain breakdown, or quality issues. Reference to recycled plastic in the product specification will clearly distinguish post consumer's recycled plastic (PCR) from industrial recycled plastic (IRP).

3.3. Concept proposal: Low tech local recycling

Recycling the tarpaulins at their end of life is the largest factor to reduce their environmental impact, as demonstrated by the LCA.

The existing recycling industry requires a long chain of actions with environmental impacts:

- Transport to recycling factory for producing the recycled PE granules
- Release of plastics additives and micro plastics during the recycling process
- Energy consumption for the recycling process (shredding, melting, granulating…)

Furthermore, the environmental impact of the new product should also be analyzed. For example, is it recyclable again, or not?

The proposal for a local and low tech recycling solution consists of using the plastic tarpaulins at the end of life, and at the same time include most of the other plastics present in a humanitarian crisis context.

All these plastics would be used to produce plastic corrugated roof sheets, locally, by thermoforming. This is a low technology solution as it can be adapted from existing technology with a simplified equipment. It needs low energy supply that can be an autonomous photovoltaic power supply. It does not need to be connected to any local network (electricity, water, sewage…), and can fit in a transport container that can be set up anywhere.

Recycling on the spot, with extremely low impact, producing a very durable and highly demanded item would reduce the environmental impact of the tarpaulins and of many other plastic wastes through:

- Incentive to collect plastic waste, by providing a valuable item (a new roof sheet) to every person who brings 5kg of plastic waste
- Recycling in a very long lasting product: The roof sheet is UV resistant as much as the tarpaulin (10 years+). Reduces fossil resources depletion, fossil fuel consumption, toxicity in the environment of the tarpaulin and of all the other collected plastics.
- Supplying a high quality product: The plastic roof sheet is superior to the equivalent corrugated galvanized iron sheet (better thermal insulation, noise reduction, and durability). This avoids the use of the equivalent number of galvanized iron sheets.
- Recycling plastics in a product that can be entirely recycled again: The plastic roof sheet can be recycled in the same way or in the usual industrial way, as it contains only PE and PP that are fully compatible to produce copolymers.