Single Use Plastic Products Reduction in Air Cargo

Plastic sheets & stretch wrap

Table of Contents

1. Executive Summary

In an age where environmental sustainability is crucial, the air cargo industry faces a significant challenge in reducing the impact of single-use plastic products (SUPP). This whitepaper offers a comprehensive guide, advocating for a shift towards sustainable practices by focusing on reducing SUPP, particularly plastic sheeting and stretch wrap, within air cargo operations.

The document delves into the environmental consequences of plastic pollution, emphasizing SUPP's detrimental role in exacerbating this global issue. It highlights the need for a circular economy in material usage, product design, procurement policies, and waste management to tackle the environmental threats posed by these materials.

The whitepaper presents practical tools such as life cycle assessments and decision trees to facilitate this transition. These tools empower stakeholders in the air cargo industry to make informed, environmentally conscious decisions about replacing SUPP.

The recommendations aim to curtail the use of unnecessary and problematic SUPP, advocating for the diversion of reusable and recyclable materials from landfills and incineration. The whitepaper encourages the adoption of circular models within the air cargo value chain, fostering a culture of sustainability and responsibility.

Drawing upon research conducted by the International Air Transport Association (IATA) and the collective expertise of the IATA Cargo Handling Council, the guidance offers strategic suggestions tailored for airlines, cargo handlers, and other key stakeholders. These suggestions are meticulously crafted to address the unique challenges and opportunities within the air cargo sector.

The whitepaper's primary focus is on the SUPP prevalent in cargo operations, with a spotlight on plastic sheets and stretch wrap. It presents a roadmap for stakeholders to navigate the complexities of SUPP reduction, aligning operational practices with the broader goals of environmental stewardship and sustainability.

2. Introduction

2.1. Purpose

This report is designed to provide recommendations for airlines, cargo handlers, and other air cargo stakeholders about replacing single-use plastic products (SUPP) with sustainable alternatives, focusing on plastic sheeting and stretch wrapping. It formulates strategic and practical suggestions to reduce unnecessary and problematic SUPP, to divert reusable and recyclable SUPP from landfill and incineration, and to implement more circular models into the air cargo value chain.

This guidance is based on the research conducted by IATA for the publication of the report "*Reassessing Single-Use Plastic Products in the Airline Sector: A Report on the Opportunities and Challenges of Replacement*" and explores the needs of upstream stakeholders, including airports, freight forwarders and shippers among others, to enable a more circular approach to material use, product design and innovation, procurement policies, and appropriate waste management. The guidance also benefits from the findings and expertise provided by industry experts, namely the airlines and handling companies that compose the IATA Cargo Handling Council (ICHC).

Practical tools, such as information on life cycle assessments (LCAs) and a decision tree on replacing plastic sheeting and stretch wrap, have been extracted from the IATA report and included in this guidance.

2.2. Scope

This report primarily focuses on the SUPP used in cargo operations, particularly the plastic sheets and stretch wrap used to consolidate and protect the cargo. Although SUPP in other air cargo operations (e.g., packaging, special cargo containers, labels) are not specifically considered, the information and tools provided can also be applied to these activities.

The scope of this document includes all stakeholders as described in the industry Master Operating Plan (MOP), namely shippers, freight forwarders, cargo handlers and airlines, and their import and export operations.

2.3. Methodology

The methodology included an initial review of airlines' SUPP inventories, targets, and initiatives, an airline web survey and a dedicated one for all air cargo supply chain stakeholders, and a detailed review of LCAs and SUPP legislation.

3. Background

3.1. The global scale of plastic pollution[1]

Plastic pollution is seen as a key challenge for our times. The United Nations Environment Programme (UNEP) states that plastic pollution "can alter habitats and natural processes, reducing ecosystems' ability to adapt to climate change, directly affecting millions of people's livelihoods, food production capabilities, and social well-being."[2] The impacts of plastic pollution can be seen along the entire plastic life cycle. From exposure to chemicals, plastic particles and additives used in the production phase, the leakage of mismanaged plastic that turns into macro and microplastics contributing to air pollution and affecting the marine environment, to the contribution to climate change from plastic production and conversion from fossil fuels.[3]

According to the Organisation for Economic Co-operation and Development (OECD), 430 million metric tons of plastic are produced each year[4], with over one-third being discarded after only one use.[5] Only 10% of plastic is recycled globally. The remainder is either burned—causing air pollution—or dumped in the open, of which around 2% ultimately ends up in the ocean. Plastic now comprises an estimated 85% of total marine waste.[6,7]

Single-use plastic products (SUPP), designed to be discarded after just one use, are the focus of increasing public concern and regulatory action. The inappropriate disposal of SUPP represents a major risk to ecosystems as they decompose very slowly and break into microplastics. These can damage sea life and enter the marine food chain, posing significant threats to wildlife and human health.

3.2. Single-Use Plastics in Air Cargo

The plastic items used throughout the aviation value chain, which have played an important role in delivering the passenger experience and cargo operations for decades, are now under scrutiny as concerns surrounding SUPP continue to grow.

The SUPP used and provided by various parties in the aviation industry have been integral to cargo operations for many years due to their widespread availability, convenience, and lightweight and hygienic properties. Moreover, airline operations must use certain SUPPs according to civil aviation authorities' regulations seeking to ensure safety and security. However, as concerns about the consumption and pollution of single-use plastic continue to increase, these items are now under scrutiny.

Cargo operators also receive requests from end customers to reduce the associated plastic packaging and wrapping. This has led to the introduction of novel solutions to reduce the use of plastic in cargo operations, though these initiatives are not yet widespread. The IATA Shipper Survey 2022[8] showed that 50% of cargo customers include waste reduction along the supply chain among their top priorities, and more than a third include access to sustainable packaging options.

[1] IATA (2024), Reassessing Single Use Plastics in the Aviation Sector
[2] UNEP. Plastic Pollution.
[3] UNEP (2022). Plastic Science.
[4] OECD (2022). Global Plastics Outlook.
[5] Landrigan et al. (2023). The Minderoo-Monaco Commission on Plastics and Human Health.
[6] Chemical Pollution (2022). The huge problem of microplastics.
[7] Stoett, P. (2022). Plastic Pollution: A global challenge in need of multi-level justice-centered solutions.
[8] 2022 IATA Global Shipper Survey.

4. Operational challenges and mitigation

When thinking about single-use plastic (SUPP) in cargo operations, some items can be completely avoided, but it's nearly impossible to conduct cargo handling operations without using any plastic materials. To reduce or eliminate SUPP, we need to replace them with different products or services.

4.1. Impact of SUPP replacement in air cargo operations

Airlines, handlers, freight forwarders, and other air cargo stakeholders need to exercise caution when replacing SUPP with other materials as they may not always generate the best environmental or social outcomes. Every alternative to SUPP has its own set of corresponding impacts, not all immediately obvious as they may be hidden elsewhere within the value chain.

For instance, reducing the number of single-use plastic items can help minimize waste. However, if lightweight items are substituted with heavier alternatives, such as blankets or tarps for weather and dust protection, the added weight could lead to increased emissions during the flight. Additionally, the need to inspect, wash, and dry these heavier items could result in greater water and energy consumption, further impacting the environment.

The air cargo value chain stakeholders need to consider all potential impacts to make informed decisions about the best options. This requires knowledge of operations, improved communication and collaboration along the supply chain, and access to information that clearly and consistently outlines alternatives' environmental advantages and disadvantages. The following are potential solutions for overcoming some challenges of replacing SUPP.

Define problematic and unnecessary SUPP

The Global Tourism Plastics Initiative (GTPI) (2020) defines problematic and unnecessary SUPP as plastic that is not reusable, recyclable, or compostable, contains or is manufactured with hazardous chemicals, can be avoided, disrupts the recyclability or compostability of other items, or is highly likely to become litter. In air cargo, an example could be the use of excessive cargo protection (e.g., extra plastic sheets, overpacking of goods).

Recommendations:

- Undertake an inventory and identify items that are predominantly used out of habit or because of legacy procedures or standards but could be considered unnecessary. In particular, customer requirements and company standards for packaging and cargo protection should be reviewed to determine the necessity of non-essential items.
- For each item, follow a waste reduction hierarchy to determine which could be eliminated and replaced with reusable alternatives or made from different materials.

Cost of replacements

When surveying air cargo stakeholders, the cost of implementing SUPP alternatives was highlighted as the main challenge. This is because many single-use alternatives that offer the same functionality as SUPP are not yet available at scale, making them more expensive per unit. For reusable alternatives, aside from a higher initial cost, stakeholders need to consider the additional costs they generate, such as establishing systems for returns or inspecting, washing, and storing the items before each use.

Air cargo stakeholders should thoroughly assess the cost and overall value of plastic wrapping for their specific cargo needs. It's important to find a cost-effective solution that meets their requirements without compromising the safety of the cargo. This entails finding the right balance between quality, features, and price.

Recommendations:

- Earmark any savings generated by reducing waste and eliminating unnecessary SUPP for investment in alternatives.
- Return on Investment calculations need to consider the break-even point at which the reusable product outperforms the single-use product it is replacing in terms of cost.
- Assuming that waste contracts are based on (or could be renegotiated to be based on) the volume of waste generated, waste handling costs should also be reduced, which would help compensate for the additional costs associated with keeping reusable in service.

Facilitating the role of cargo handling staff

Cargo handling staff work in a complex and time-sensitive environment. They need to adhere not only to detailed customer and company requirements but also to international and local requirements for cargo preparation, such as using the correct quantity of SUPP and sourcing and disposing of plastics. Due to high turnover rates and inadequate standard procedures, staff members may unintentionally damage or misuse single-use and reusable items. Improved collaboration and awareness across the supply chain are necessary to address these challenges.

Recommendations:

- Raise awareness and involve handling staff in decision-making about reducing single-use plastic packaging (SUPP). Provide training and support to minimize, reuse, and recycle SUPP in operations, as well as explore alternative procedures. These educational efforts should also be extended to air cargo customers, particularly those shipping perishable goods.
- Engage and collaborate with suppliers to find customized alternative solutions that align with their company's needs, location, operations, and strategy while promoting industry collaboration and shared best practices.

Functionality and availability of the alternatives

Surveyed cargo stakeholders have expressed their concerns about SUPP alternatives' ability to reach the same level of functionality. For example, alternatives to stretch film and plastic sheets in cargo operations must ensure that pallets are tightly and securely wrapped, and that cargo is protected against adverse weather.

Alternatives to plastic wrapping need to be strong and durable enough to withstand the weight, pressure, and potential hazards during transportation, considering the requirements of the cargo transported. In particular, consider the following aspects when selecting alternatives to SUPP for cargo wrapping purposes:

- Appropriate thickness to support the weight and size of the cargo.
- Water and moisture-resistant to protect the cargo from potential damage during transportation.
- Good tear resistance properties to minimize the risk of damage from rough handling or sharp edges during transportation.
- If necessary, UV resistance to prevent degradation and discoloration due to prolonged sun exposure.

Moreover, the industry faces issues when procuring innovative alternatives, as many products that offer the same functionality as SUPP are not yet available at the scale required by air cargo stakeholders.

Recommendations:

- Keep up to date with innovations in alternatives and appropriate certification standards.

- Proactively search for suppliers that consider operational requirements when creating alternative processes and products. Examples of this in cargo include providing pre-cut plastic sheets adapted to the contour of the different pallet types.

Safety, security, and quality transport

Certain SUPPs are essential for safe and secure cargo operations. Product flammability, in particular, must be considered when seeking alternatives, particularly when transporting dangerous goods.

Different types of cargo may have specific requirements. For example, perishable goods might require breathable plastic sheeting to prevent spoilage, while hazardous materials may need special barrier properties to ensure safety.

Recommendations:

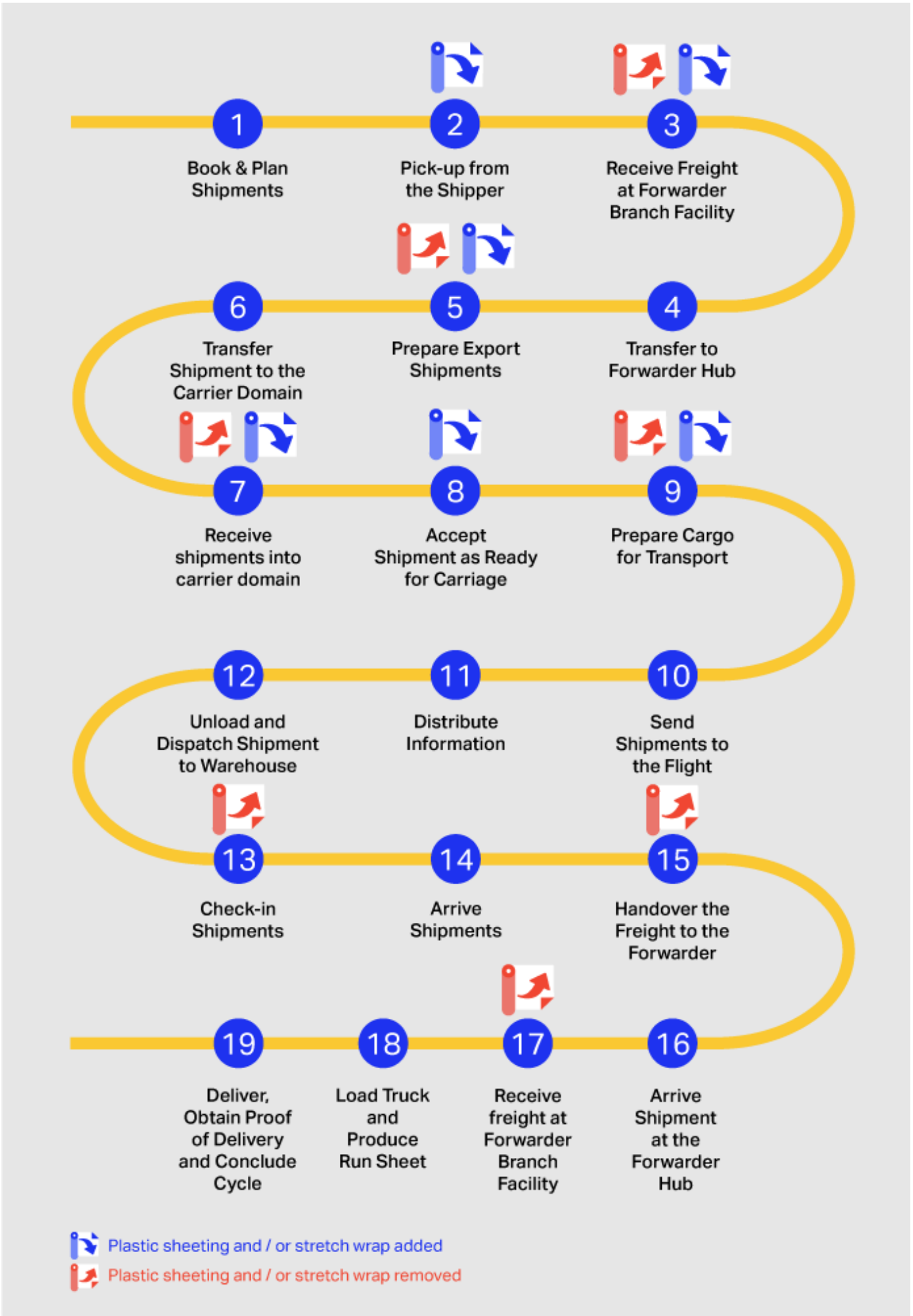
- Stakeholders must consider the nature of the cargo and any specific requirements it may have.
- Proactively search for suppliers that consider operational requirements and different cargo type.

4.2. Plastic use across the air cargo journey

To track the use of SUPP along the air cargo transport chain, from shipper to consignee, IATA has mapped all the processes that may require adding or removing plastic sheeting and/or stretch wrap, including those items used only for cargo protection during ramp transportation. The graphic below shows that a shipment could have plastic added/removed in up to nine processes from the 19 that form the industry Master Operating Plan.

The Industry Master Operating Plan (MOP) is a comprehensive guide for the air cargo industry, mapping out processes from shipper to consignee. It serves as a common reference for industry participants and associations, aiding in developing new standards and practices, facilitating discussions with regulators, and helping industry participants improve their internal processes.

The MOP aims to harmonize procedures across stakeholders, improve quality, and meet regulatory requirements. It outlines 19 main processes, categorized into five activities: Origin Forwarder, Origin Carrier, Transport Carrier, Destination Carrier, and Destination Forwarder. Each process is further detailed into sub-processes. The MOP describes what needs to happen, while the IATA Cargo Handling Manual provides instructions on executing it.


1
Book & Plan Shipments
2
Pick-up from the Shipper
3
Receive Freight at Forwarder Branch Facility
4
Transfer to Forwarder Hub
5
Prepare Export Shipments
6
Transfer Shipment to the Carrier Domain
7
Receive shipments into carrier domain
8
Accept Shipment as Ready for Carriage
9
Prepare Cargo for Transport
10
Send Shipments to the Flight
11
Distribute Information
12
Unload and Dispatch Shipment to Warehouse
13
Check-in Shipments
14
Arrive Shipments
15
Handover the Freight to the Forwarder
16
Arrive Shipment at the Forwarder Hub
17
Receive freight at Forwarder Branch Facility
18
Load Truck and Produce Run Sheet
19
Deliver, Obtain Proof of Delivery and Conclude Cycle
Plastic sheeting and / or stretch wrap added
Plastic sheeting and / or stretch wrap removed

4.3. Policy landscape and regulatory compliance

In 2018, UNEP reported that 127 countries banned SUP bags, and 51 countries introduced additional restrictions on SUPP, including materials such as polystyrene.[9,10].

In May 2021, the 27 Member States of the European Union transposed the EU Directive on SUPP into national legislation, and bans on certain SUPPs commenced in July 2021. Not only do multiple regulations keep emerging in different countries, as the new rules for disposable plastic cups and containers in The Netherlands[11]; other organizations have also introduced sectoral restrictions. For example, the Civil Aviation Administration of China banned a range of plastic items in airports that have an annual passenger throughput of 200 million or more passengers, starting in 2022[12].

A deep dive into SUPP legislation in five territories (Australia, Canada, European Union, India, and the People's Republic of China) and across five item categories (bottles, cutlery, crockery, cups, and cargo stretch wrap) performed by IATA in 2024 identified the current impacts on airlines and any possible exemptions.

Only China had set restrictions among the territories analyzed for cargo plastic sheets and stretch film. However, the Chinese legislation does not clarify whether the restrictions apply to plastics in incoming flights.

OTHER REGULATIONS APPLYING TO AIR CARGO SHIPMENTS

When handling cargo, stakeholders should use plastic wrapping that meets all relevant regulations and standards, especially when transporting regulated or hazardous materials. This means considering factors such as fire resistance, chemical resistance, and compliance with international shipping regulations. Some regulations to take into account are:

- **Customs regulations** can vary from country to country and may include specific requirements for packaging and labeling goods. Some countries may restrict certain plastics, particularly regarding plastic color, or require specific documentation regarding the plastic sheeting used for cargo containment.
- **National and regional regulations**: Different countries and regions have regulations for packaging, labeling, and transporting goods. These regulations may address environmental concerns, safety standards, or specific requirements for certain types of cargo. It is important to research and comply with the regulations of the countries involved in the international shipping process.

[9] United Nations Environment Program (2018). Legal Limits on Single-Use Plastics and Microplastics.
[10] https://environment.ec.europa.eu/topics/plastics/single-use-plastics/eu-restrictions-certain-single-use-plastics_en
[11] Nieuwe regels voor plastic wegwerpbekers en -bakjes | Ondernemersplein (kvk.nl).
[12] Plan for Civil Aviation Plastic Pollution Control Measures 2021–2025.

5. SUPP in air cargo operations

5.1. Inventory

In July-August 2023, IATA surveyed air cargo stakeholders, including airlines, freight forwarders, ground handlers, and shippers, on their strategies regarding SUPP reduction. Based on these findings, a simplified SUPP list of plastic items in air cargo operations has been created:

Cargo	SUPP
Packaging	Styrofoam containers
	Tape / security tape
	Plastic envelopes & pouches for documentation
	Bubble wrap
Cargo Build Up	Plastic sheets / covers
	Plastic straps
	Absorbent sheets / pads
	Stretch wrap
	Single-use thermal blankets
	Styrofoam for padding
	Plastic labels
	Plastic skid / pallet
	Slip sheets

While some items in this table, such as those required for medical, hygiene, and safety purposes, remain essential, replacements for other everyday consumable items are increasingly available. However, switching from SUPP to an alternative material or product may result in one or a series of often hidden consequences.

5.2. Plastic types in air cargo operations

This guidance focuses on plastic sheeting and stretch wrapping used in air cargo operations. Plastic sheeting is a type of ULD cover, typically 0.03 to 0.05 mm thick polyethylene film with fire retardant additives, used to protect cargo against the weather, prevent leakage, and/or secure loads. Stretch wrapping is a highly stretchable plastic film wrapped around items during pallet buildup to secure and protect them.

The paragraph below shows some types of plastic commonly used in cargo operations. Low-density polyethylene is the most common SUPP used for plastic sheeting, while linear low-density polyethylene is commonly used for stretch wrap.

COMMON PLASTIC TYPES

- **Low-Density Polyethylene (LDPE)** is a widely used plastic for various purposes, including **protective sheeting**. While it is recyclable, its lower density and higher flexibility can make it more prone to littering or improper disposal, which can have negative environmental consequences.

- **Linear Low-Density Polyethylene (LLDPE**) has higher tensile strength and impact and puncture resistance than LDPE. It is very flexible and elongates under stress, and it is the main material used for **stretch wrap** production.

- **High-density polyethylene (HDPE**) is a type of thermoplastic polymer. It is known for being relatively more environmentally friendly than other plastic materials due to its recyclability and lower impact during production. HDPE is commonly used in the air cargo sector to make **reusable protective covers, plastic pallets, and other multi-use items**, and it is present in other single-use products such as absorbent sheeting.

- **Polyvinyl Chloride (PVC)** is known for its durability and chemical resistance, making it suitable for certain applications. However, its production process involves chlorine, which can have adverse environmental effects. PVC is also difficult to recycle, and when incinerated or improperly disposed of, it can release harmful toxins.

- **Polyethylene Terephthalate (PET)** is commonly used for food packaging and water bottles. It has a relatively low recycling rate and can persist in the environment for a long time.

Recycled Plastic Sheeting

Made from post-consumer or post-industrial recycled plastic, these sheets reduce the demand for virgin plastic production and divert waste from landfills. Using recycled resin in their creation, they help conserve resources and lower energy consumption,

Biodegradable plastics

Wrapping products primarily made from plant-derived materials like polylactic acid (PLA) or starch blends are engineered to decompose efficiently via biological processes, thus reducing environmental impact compared to conventional plastic sheeting. Biodegradable plastics decompose naturally through microorganism activity, transforming into simpler substances like water, carbon dioxide, and biomass. They can be synthesized from various materials, including petroleum-based plastics with biodegradation-facilitating additives and plant-based materials like corn starch or PLA.

Air cargo stakeholders should note that not all plastic wrapping labeled as "biodegradable" is necessarily environmentally friendly. Some products may only partially degrade or require specific conditions or treatments to break down. It's essential to verify the claims and understand the specific environmental impact of the product.

Compostable Plastics

Compostable plastics are designed to decompose under specific conditions into nutrient-rich compost. Composting is a controlled process that requires specific temperature, moisture, and microbial activity to transform organic waste into compost. Compostable plastics are typically made from renewable resources such as plant-based materials like corn starch, sugarcane, or cellulose. They undergo a more thorough breakdown process than biodegradable plastics and are intended to be composted in specialized industrial composting facilities. Compostable plastics should break down within a specific timeframe and leave no harmful residues in the resulting compost.

BIODEGRADABLE VS COMPOSTABLE

The key difference lies in the intended disposal method and the resulting end products. Biodegradable plastics break down through natural processes, while compostable plastics require specific composting conditions to break down into compost. Compostable plastics have stricter standards and are typically more environmentally friendly since they produce compost that can enrich the soil. In contrast, biodegradable plastics may not fully break down or leave behind microplastic fragments. Following proper waste management practices and checking specific product certifications and guidelines for appropriate disposal methods is critical.

IDENTIFYING BIODEGRADABLE AND COMPOSTABLE PRODUCTS

Recognizing biodegradable and compostable plastic can be challenging since it often resembles regular plastic. However, there are a few ways air cargo stakeholders can identify or inquire about biodegradable and/or compostable plastic sheeting and stretch wrap:

- Look for specific labels or certifications
- Analyze the product description or packaging
- Research the product or manufacturer
- Inquire with the supplier or manufacturer
- Communicate with your customers if doubts arise regarding plastics on import

It's important to note that even the less harmful options should be properly managed, disposed of, or recycled to minimize their impact. Whenever possible, preventing SUPP use should be the priority.

5.3. Procurement considerations

When evaluating the different available options for plastic sheeting and stretch wrapping products, these are the components to take into account suggested by air cargo stakeholders:

- **Density:** Plastic density is a crucial factor in aviation. Lower-density plastics can reduce fuel consumption and costs. Sourcing plastic locally may also decrease emissions from shipping.
- **Reusability:** Plastic reusability can reduce the total amount used, adding complexity to material selection.
- **Recyclability:** To promote a circular economy, preference should be given to recyclable plastics with established recycling infrastructure in the regions where shipments terminate.
- **Biodegradability and Compostability:** Depending on specific needs and available waste management systems, biodegradable or compostable plastics should be considered. These materials can decompose naturally, reducing their environmental impact.
- **Certifications:** Plastics certified by reputable environmental standards such as C2C, FSC, or GRS should be chosen, ensuring sustainability and responsible production.
- **Waste Reduction:** Designs and plastic types contributing to waste reduction should be prioritized. Lightweight plastics that use fewer resources, alternative packaging options, and the potential for reusability to minimize single-use plastic waste should be considered.
- **Social Impact:** The social aspects of plastic production, such as worker safety, fair labor practices, and human rights considerations, should be assessed. Products produced ethically and promoting social responsibility within the supply chain should be chosen.
- **Regulatory Compliance:** The chosen plastic should comply with relevant local and international regulations and standards regarding environmental impact and safety.
- **Supplier Transparency:** Suppliers that provide transparent information about their plastic materials, manufacturing processes, and environmental initiatives should be sought. This transparency allows for informed decisions and collaboration with suppliers who share sustainability goals.
- **Long-term Viability:** The long-term viability of chosen materials should be considered. Potential changes in regulations, market demands, and technological advancements that may affect the sustainability of plastic over time should be anticipated.

6. Tools

6.1. Life Cycle Assessment

A life cycle assessment (LCA) is a technique developed to better understand and address the impacts associated with the manufacture and consumption of different products[13]. The LCAs can be expensive and time-consuming, but they can help estimate the environmental impacts of various products in a transparent, replicable, and comparable manner throughout their whole life cycle. However, it is important to understand the comparison between different scopes and boundaries since variations in assumptions can lead to significant changes, and this determines how comparable one study can be with another.

To guarantee that an LCA is robust, it should be a peer-reviewed, independent study that respects the steps in ISO14040 and 14044 frameworks and standards. The highest possible number of indicators should be included, and any exclusion of any indicators should be justified. The study should also be cradle to grave, with upstream and downstream impacts being assessed, clear hypotheses being addressed, and different business model configurations for the use and end-of-life phases considered. Importantly, at the interpretation stage, the final aim should be to formulate recommendations to improve the environmental performance of the system under study.

Box 1. LCA commissioning guidance for the airline sector.

It is important that the starting point of any SUPP replacement program be focused on preventing and minimizing waste at the source. When replacements are required, an LCA can help compare different options.

Guidance

- Undertake a cradle-to-grave study, including all the life cycle stages so that comparisons between studies are more straightforward.
- Be extremely clear on what is included in the scope, such as functional units, environmental impact categories and systems boundaries (see definitions below).
- Be aware that environmental impact categories are chosen at the discretion of the researchers and their commissioners, so the same topics might not be included in all assessments.
- It is essential that the emissions from jet fuel consumption are included in the scope, but it should not be the only focus. Including other impact categories will enable an airline to make more informed decisions.
- An LCA should include the results associated with different end-of-life scenarios, including landfill and incineration, and not solely focus on one.
- Remember that the consequences on biodiversity and of plastics in the environment are not fully understood, nor is there a consensus on how to measure them, so LCAs are not likely to be able to consider these issues.

Definitions and scope

- A functional unit is the reference unit for the study, covering the service being provided (what), the extent to which it is provided (how much), its quality (how well) and its duration (how long). For airlines, this means comparing the same amount of single use items with the number of uses for the reusable alternative (e.g., 100 SUP plastic sheets versus 100 uses of a reusable tarp).
  An example of a functional unit could be: "The safe provision of cargo protection wrapping for 20 pallets per flight over 200 medium-haul flights". In this example, safe refers to how well, provision of cargo

[13] https://www.iso.org/obp/ui/en/#iso:std:iso:14040:ed-2:v1:en

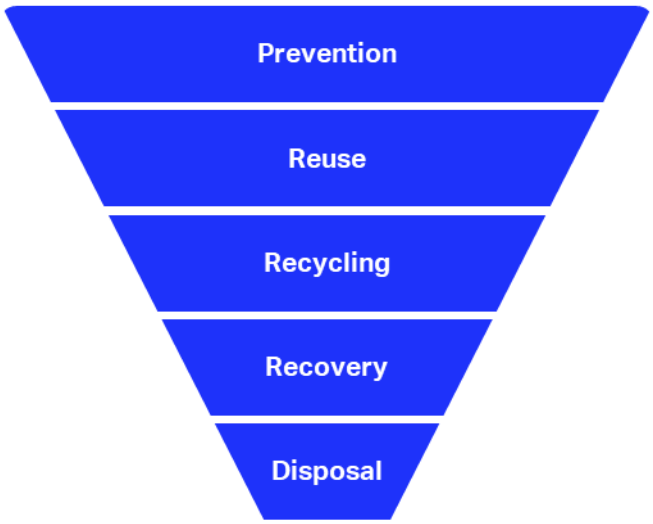
protection wrapping is what, the number of pallets refers to how much and the number of flights covers how long.

- Environmental impact categories can range from global warming potential (the potential for a product or process to contribute to climate change by quantifying GHG emissions), to eutrophication (the potential for a product or process to lead to excessive nutrient levels in bodies of water causing algal blooms) and soil acidification (by emitting harmful substances that contribute to acid rain). The choice of environmental impact categories is at the discretion of the researchers and/or their commissioners/clients, and not all will be included in the assessment.

- System boundaries define the beginning and end points of the life cycle that is being assessed. Using plastic products as an example, this might start with raw material extraction of fossil fuels through to end of life disposal such as incineration. The many processes and activities between these two points can also be at the discretion of researchers, commissioners and/or clients.

6.2. Decision Trees

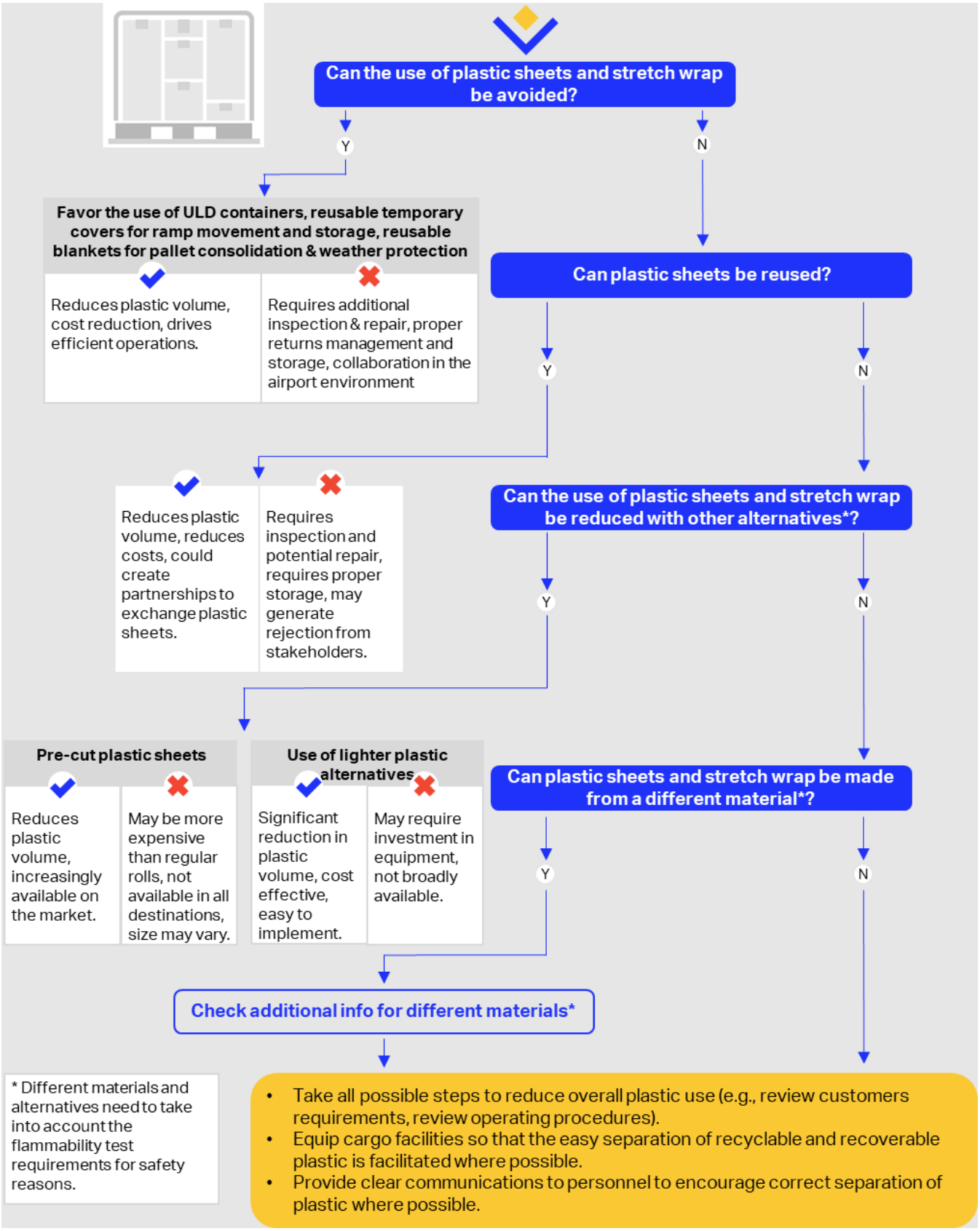
A simplified decision tree that considers environmental and operational trade-offs has been created to support more informed decision-making for plastic sheets and stretch wrap. The tree focuses on the potential for eliminating waste at its source. Subsequent steps follow a logical path through the waste reduction hierarchy and provide some insight into the pros and cons of alternative products and materials.

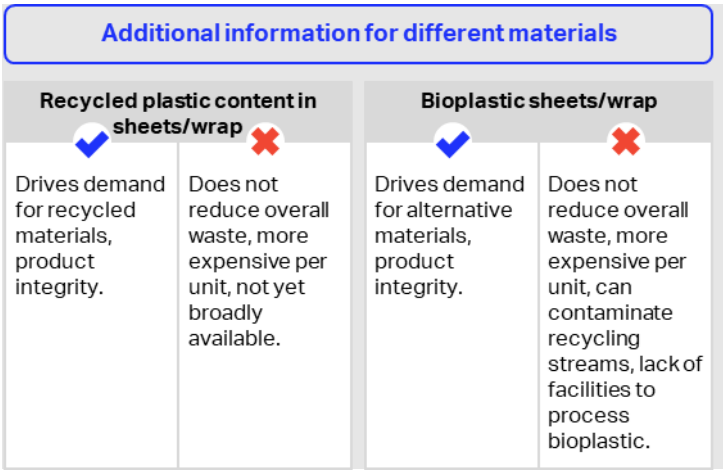


Waste Reduction Hierarchy. Source: IATA, 2019

Air cargo stakeholders should question first if there are possibilities to prevent the use of SUPP (e.g., is there possibility to change procedures or customer expectations, are the processes efficient in terms of use and load, is there space onboard and on the ground support for reusable items to be stored), and after such considerations have been taken into account, look for the most suitable replacement options (from highly recyclable to less plastic content).

Where steps to eliminate or reduce waste are not possible, the minimum desired outcome is to divert recyclable and recoverable waste from landfills and incineration where regulations allow. The information provided in the decision trees is designed to inspire thinking; it is not exhaustive. Stakeholders would benefit from carrying out a similar exercise relevant to their own specific situations.


Can the use of plastic sheets and stretch wrap be avoided?
Y
N
Favor the use of ULD containers, reusable temporary covers for ramp movement and storage, reusable blankets for pallet consolidation & weather protection
Reduces plastic volume, cost reduction, drives efficient operations.
Requires additional inspection & repair, proper returns management and storage, collaboration in the airport environment
Can plastic sheets be reused?
Y
N
Reduces plastic volume, reduces costs, could create partnerships to exchange plastic sheets.
Requires inspection and potential repair, requires proper storage, may generate rejection from stakeholders.
Can the use of plastic sheets and stretch wrap be reduced with other alternatives*?
Y
N
Pre-cut plastic sheets
Reduces plastic volume, increasingly available on the market.
May be more expensive than regular rolls, not available in all destinations, size may vary.
Use of lighter plastic alternatives
Significant reduction in plastic volume, cost effective, easy to implement.
May require investment in equipment, not broadly available.
Can plastic sheets and stretch wrap be made from a different material*?
Y
N
Check additional info for different materials*
* Different materials and alternatives need to take into account the flammability test requirements for safety reasons.
• Take all possible steps to reduce overall plastic use (e.g., review customers requirements, review operating procedures).
• Equip cargo facilities so that the easy separation of recyclable and recoverable plastic is facilitated where possible.
• Provide clear communications to personnel to encourage correct separation of plastic where possible.



6.3. Risk identification and mitigation

If the transition from SUPP use to alternatives is not carried out properly, it may pose certain risks to the business, operational safety, cargo integrity, and appropriate waste segregation along the transport chain. Below, you'll find examples of potential risks and recommendations for mitigation.

Issue	Item	Risk	Recommendations for Prevention
Flammability	All alternatives	Replacement materials, whether single-use or reusable, may be unsuitable for transporting certain cargoes if they have not been treated with fire-resistant/retardant treatments.	Selection of suitable alternatives that meet your operational needs and cargo requirements. This involves seeking certification and collaborating with the manufacturer to ensure compliance with regulations.
Phytosanitary	Reusable alternatives, reused SUPP	Contamination when reusing items during the transportation of special cargoes	Proper inspection and cleaning of reusable items, assessment of the risks of contamination, and use of materials adequate to minimize those risks
Wear & tear	All alternatives	Damage to reusable alternatives / reused SUPP endangering or causing damage to the cargo	Inspection is incorporated into the process to ensure that items are in good condition, any potential repairs for reusable items are identified, and proper storage is used to minimize risks.
Shipment build-up	All alternatives	Materials not being appropriate for proper buildup (too weak, prone to tear, not waterproof, others)	Selection of suitable SUPP alternatives that meet the operational needs and the nature of the cargo. This involves seeking certification and product specification data, engaging with the manufacturer, and conducting tests to ensure the materials meet

			requirements. Proper staff training is also essential.
Returns	Reusable alternatives	Reusable items, including weather protection tarps used for ramp movements, are not returned to their owner at the end of their use.	Priority should be given to reusable items in airports/routes with high collaboration and integration with stakeholders along the transport chain. This will ensure that items are returned in good condition and allow the benefits of SUPP reduction efforts to be shared.
Waste Segregation	All items, including SUPP from import	Improper segregation of SUPP and alternatives may lead to contamination of recycling streams (for example, mixing bioplastics with regular HDPE sheeting for recycling)	Adequate infrastructure, such as bins and compactors, is needed to facilitate waste segregation in the cargo facility. The nature of the different SUPP and alternatives should be clearly marked. Proper staff training on waste segregation is essential.
Security	Tarps, sheeting, stretch wrap	Difficulty in procuring plastics meeting the conditions for some types of cargo, puncture resistance, etc.	Selection of suitable SUPP alternatives that meet the operational needs and the nature of the cargo. This involves seeking certification and product specification data, engaging with the manufacturer, and conducting tests to ensure the materials meet requirements. Proper staff training is also essential.

7. Recommendations for the air cargo industry

The following recommendations are designed to be both practical and strategic, considering short-term, medium-term, and long-term solutions for air cargo stakeholders. The focus is on reducing waste at its source, enabling informed decision-making regarding SUPP replacement programs, increasing opportunities for material recovery where regulations allow, collaborating within the industry to advocate with suppliers to enhance the circularity of plastics at the production level, and establishing collaboration avenues within the air cargo industry to facilitate collective steps towards reduce and reuse models in line with circularity principles.

7.1. Reducing SUPP use at source

Eliminating waste at source that would otherwise be incinerated or landfilled has the added benefit of reducing associated negative impacts (such as air pollution and greenhouse gas emissions) and procurement costs. Waste management costs may also be reduced if contracts are based on volumes of waste generated.

To reduce waste at source, air cargo stakeholders are encouraged to review brand standards and operating procedures through the lens of waste reduction and reuse and to honestly and professionally critique the need for single-use products versus the legacy operational procedures, learned habits, and customer expectations that have encouraged the use of SUPP to date.

Collaboration along the value chain in support of waste reduction at source is a critical component of success. Solutions-focused discussions involving key stakeholders along the cargo transport chain can help to identify previously unconsidered opportunities.

Key recommendations

- Review brand standards and operating procedures through the lens of waste reduction and reuse.
- Integrate end-of-life / waste disposal consideration into material/product procurement decisions
- Identify unnecessary and problematic SUPP and prioritize their removal or replacement.
- Set clear internal targets for elimination, measure and track implementation, and disclose progress.
- Introduce positive messages and calls to action at key communications touchpoints along the cargo journey and actively communicate with your staff, customers and other stakeholders.
- Facilitate open dialogue with other key stakeholders in the cargo supply chain to identify and overcome shared logistical changes that will lead to waste reduction initiatives. When feasible, promote the creation of multi-stakeholder working groups to identify and implement process changes to ensure best practices are adopted to minimize waste generation at every stage of the MOP.
- Enhance collaboration and sharing best practices to reduce waste and harmonize SUPP alternatives used across the cargo journey.
- Optimize the use of SUPP by, for example, using pre-cut sheeting in appropriate sizes for the ULD type and eliminating excess packaging

REDUCING SINGLE-USE PLASTIC SHEET USE

Utilizing pre-cut sheeting for cargo coverage is recommended as it can minimize waste resulting from accidental under-sizing or overestimation of required plastic. In the absence of cost-effective pre-cut sheeting, ordering rolls of plastic of the correct width is suggested. Markings on the floor can facilitate operators' cutting the sheets to the optimal width.

The thickness of a sheet is typically measured in microns (one-thousandth of a millimeter in metric) or mil (one-thousandth of an inch). For an area with identical dimensions of plastic sheeting, the selection of a plastic that is 30% thinner will result in a 30% overall reduction in the amount of plastic used.

7.2. Drive circularity

A circular economy is a sustainable model in which products and materials are designed in such a way that they can be reused, remanufactured, or recovered and thus maintained in the economy for as long as possible.[14]

The focus on continued reuse of the same product differentiates the circular economy from the recycling economy. Within a recycling economy (and using plastic as an example), products are collected, sorted, shredded, and turned into different products depending on the quality of processed material. With each downcycling process, plastic degrades to the point where, for example, it is eventually only suitable to be turned into yarn for synthetic textiles, filling for furniture and soft toys, or building aggregate.

Implementing circular economy principles into the air cargo value chain will require considerable changes to processes and procedures for stakeholders both upstream and downstream, and it will not be possible without public/private sector collaboration and significant investment.

The principal strategy air cargo stakeholders can employ to drive circularity is the introduction of reusable items. However, their introduction will require logistical changes to enable efficient returns, additional inspection and cleaning, and reinforcing collaboration among value chain stakeholders. Collaboration with key stakeholders will be necessary to conceptualize the processes to optimize reuse models.

A key concern regarding reusables on aircraft is the impact of added weight on fuel burn and carbon emissions. A well-structured LCA that incorporates suitable functional units, impact categories, and systems boundaries, together with oversight of operational considerations, should enable airlines and other key value chain actors to make more informed decisions about introducing reusable items.

Key recommendations

- Strengthen engagement with industry peers, trade associations, and other key stakeholders in the value chain to conceptualize processes that would reduce the burden of individual responses to the same challenges
- Where reuse infrastructure is currently in place, and when feasible within current operational limitations, and a robust LCA has indicated that reusable alternatives are a better solution, give contractual preference to suppliers of reusable products.
- When commissioning an LCA on SUPP, follow the detailed guidance in Annex 4 of the IATA *Reassessing Single-Use Plastic Products in the Airline Sector* report.
- Be critical of manufacturers' LCAs.
- Where reuse infrastructure is not in place, advocate for this.
- Regularly review policies and standards with reusability and circularity principles in mind.
- Build capacity among your staff and equip them with the necessary tools and knowledge to identify and achieve more circular solutions.

REUSING SINGLE-USE PLASTIC SHEETS

Extending the lifespan of plastic sheeting through reuse reduces the need for new materials. Stakeholders seeking to extend the use of standard single-use plastic sheeting should consider the following procedures:

- Plastic sheeting should be inspected for damages, such as holes or tears. If these damages are found, prompt repair using appropriate patches or adhesives is necessary.

[14] https://www.unep.org/resources/turning-off-tap-end-plastic-pollution-create-circular-economy

- Where a risk of cargo contamination exists when reusing the sheeting (for example, when it has previously been used in the transportation of perishable products), the company should assess the risks and separate those plastics for recycling if it is deemed that they outweigh the benefits.
- The plastic sheeting should be stored in a clean, dry area to prevent damage and degradation when not in use.
- Creating a network with other businesses or companies to exchange used plastic sheeting that is still in good condition but no longer needed is advisable, particularly if customers / other stakeholders are unwilling to accept reused sheeting.

7.3. Interventions to drive waste segregation and recycling

Collaboration between equipment suppliers, handling companies, airports, and other stakeholders can ensure that air cargo facilities are designed to facilitate quick and easy segregation of items for recovery and reuse and recycling, with minimal or no repercussions on either the time required to perform the task or the quality of waste segregation. Where this may require additional expenditure, costs could potentially be offset against recyclable revenues and cost reductions associated with reducing mixed waste collection.

The supporting infrastructure for waste segregation and recovery in the sector must be ambitious, such as developing materials recovery facilities (MRF) at or close to airport premises. It is recognized that international airports can generate the same amount of waste as a "small city" and considering the high proportion of organic waste generated from airport restaurants, kitchens and sewage, the concept of integrated biotreatment could be viable and a valuable asset for those companies seeking to use biobased SUPP alternatives.

Key recommendations

- Facilitate waste segregation in cargo facilities, if not already doing so, by implementing new operating procedures and infrastructure, such as plastic compactors, in strategic locations.
- Undertake waste composition audits to identify waste stream characteristics.
- Evaluate waste management costs and build a business case for intervention.
- When possible, discuss with all relevant stakeholders how to implement end-to-end solutions to ensure that practices are adopted that minimize waste generation at every stage of the cargo journey
- Conduct regular waste segregation training with staff to ensure consistency
- Renegotiate waste collection contracts that incentivize segregation.
- Consider the SUPP restrictions enforced at destination airports and countries before making alternative product procurement choices and the infrastructure available.
- Work with SUPP suppliers to learn more about the requirements for disposal after use through valid certifications, test results, and credible documented evidence.
- Support research and development to identify and promote alternative sustainable materials for the aviation sector.
- Maintain a holistic approach to waste management and coordination among the total waste processing chain to improve and develop recycling infrastructure, making use of the economies of scale for different end-of-life processes

ADDITIONAL ADVICE FOR PLASTIC SHEETING AND STRETCH WRAP RECYCLING

Recycling plastic sheeting ensures that it is properly disposed of and can be turned into new products, reducing the need to manufacture new plastics. Air cargo stakeholders are encouraged to follow the processes below when deploying recycling initiatives:

- It is essential to ensure the plastic sheeting in use is recyclable. This can be confirmed by checking for recycling symbols (although these are seldom found on plastic sheeting) and consulting local recycling facilities or guidelines to ascertain if this type of plastic is accepted.

- Before recycling, all dirt, debris, or other contaminants must be eliminated from the plastic sheeting. It should be separated from other materials, such as cardboard or metal, to guarantee proper recycling.

- Engagement with local recycling centers or facilities is necessary to understand their specific requirements for plastic sheeting recycling. Some centers may accept it directly, while others may necessitate drop-off or special arrangements.

- Adopting a comprehensive approach that includes reducing plastic sheeting use, reusing it when feasible, and recycling it responsibly is crucial. This helps minimize waste and contributes to a more sustainable freight industry.