PACKAGING IMPROVEMENT TOOLKIT

Partnering for Progress on Packaging Sustainability

Check out our other sustainability toolkits at:
sigmaaldrich.com/sustainabilitytoolkits

The Life Science business of Merck operates as MilliporeSigma in the U.S. and Canada.

disclaimer

The materials in this toolkit are intended to serve as general guidance and background information on our packaging sustainability strategy.

We have compiled the content of this toolkit carefully and in accordance with our current state of knowledge.

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What You'll Find

The Packaging Improvement Toolkit helps you to create an action plan and consider the entire lifecycle of packaging, including the source of materials and end-of-life.

Leveraging insights from over one hundred completed projects and our packaging improvement strategy, the SMASH Packaging Plan, we've developed a framework to help you. This toolkit will help you develop a strategy, collaborate with key stakeholders, execute projects, and measure progress.

You can see our projects come to life in case studies throughout the toolkit.

SUPPLIER EXPECTATIONS

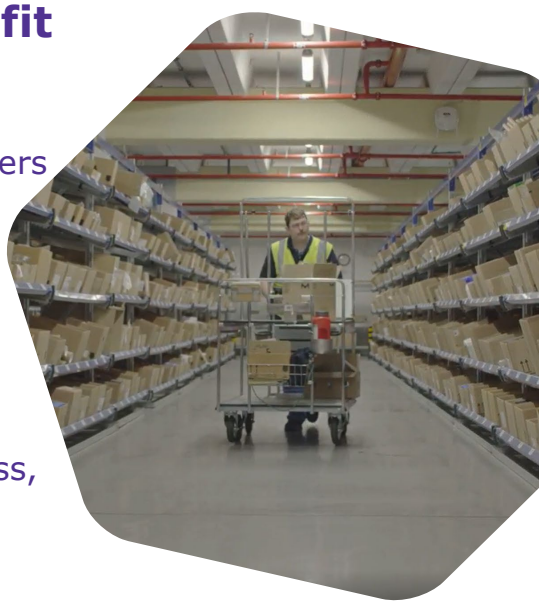
- Optimize packaging to minimize use and maximize circularity, leading to reduced CO_2 emissions.
- Use wood and fiber-based packaging materials with sustainable forestry certification.
- Be proactive in offering alternative packaging solutions to minimize environmental impacts (e.g. reusable packaging) while ensuring protection and quality of the materials.

We set supplier expectations across a variety of impact areas. **Click here** to view them all.

WHY DOES PACKAGING SUSTAINABILITY MATTER?

Packaging sustainability doesn't just benefit the planet, it benefits your business.

These changes can increase efficiency and reduce costs in the short and long-term. We want to partner with our suppliers to help reduce the carbon footprint of our sourced materials.



Creating Competitive Advantage

Packaging plays a crucial role in sustainability and can Significantly influence purchasing decisions. Adopting more sustainable packaging strategies is helpful for retaining business, increasing market share and fostering customer loyalty.

Cost Savings

Packaging sustainability can offer long-term cost savings. While the initial investment may be higher, recyclable or biodegradable materials can lower disposal costs and exceed customer expectations. Furthermore, they can reduce operational costs by decreasing packaging weight and improving shipping efficiency.

Supply Chain Emissions Reporting (Scope 3)

We prioritize collaboration with suppliers committed to reducing their carbon impact along their value chain (Scope 3). Packaging sustainability is a key element in helping your customers achieve their sustainability goals.

Scope 3 Emissions:
All indirect emissions (not included in Scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions.

To learn more about emission categories, check out our **Environmental Accounting & Goal Setting toolkit.**

GET STARTED

1. Collect packaging data

Evaluating inventory and purchasing records can help you generate a baseline and guide your packaging sustainability strategy. Be sure to consider future demand for these items as this may influence your approach.

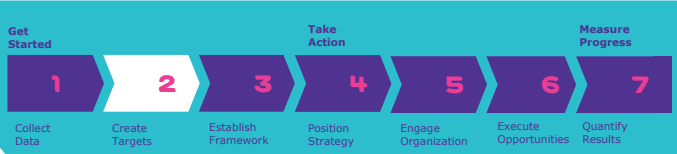
*The following data is critical for measuring impact:
Weight
Quantity
Assembled Dimensions (length, width, height)
Material type (e.g. glass, metal, plastic, fiber, etc)
Intended Use (e.g. bottle, bag, insert, crate, etc)
Certification type (e.g. FSC, SFI, PEFC)
% Recycled Content

*For more information see **Step 7**

CASE STUDY

We launched our **Greener Cooler pilot program** to replace expanded polystyrene coolers.

Through these pilots, we expect to avoid **1,200 m³ of EPS** for more than **60,000 shipments** at distribution centers in the U.S., Germany, South Korea and Australia. We plan to expand the program to all regions in the coming years.



GET STARTED

2. Create specific targets

Define specific, measurable, achievable, relevant, and time-bound (SMART) goals for your packaging program.

These could include:

- Reducing packaging weight by a certain percentage
- Achieving a specific ratio of zero-deforestation fiber packaging
- Increasing recycled content usage in packaging

These goals should be **aligned with industry standards** (see resources on page 15) and can be used for leadership engagement.

PACKAGING IMPROVEMENT FOCUS AREAS

Integrate these focus areas while developing a packaging sustainability strategy.

Optimize Packaging Usage

Customers find excess packaging to be undesirable. Reducing the size, weight, and selecting appropriate materials can reduce:

- Consumption of resources
- Material and shipping costs
- Transportation emissions

Zero Deforestation

Deforestation is a significant cause of global warming and a threat to biodiversity. The aim is to ensure that wood and fiber-based packaging materials used do not contribute to deforestation and maintain the productivity of natural ecosystems without compromising their capacity for future generations.

Circular Design Principles

Applying circular design principles can help improve the sustainability of the materials used in packaging applications. This can include:

- Use of materials with lower environmental impacts such as recycled plastics and bioplastics
- Avoiding plastics produced with chemicals of concern
- Maximizing reusability and recyclability with the goal of minimizing waste

What is circularity?

Circularity is the design of products and processes to minimize waste and maximize resource efficiency throughout their lifecycle.

GET STARTED

3. Establish an operational framework

- Identify key stakeholders. This may include executives and decision-makers from operations, procurement, sales, finance, and product development.
- Secure leadership buy-in by preparing a compelling business case. Position cost impacts through the lens of total cost of ownership. Include market data to show the **increasing preference for more sustainable packaging among your target customers.**
- Create packaging guidelines and best practices suited to your company needs. Assign responsibilities, set deadlines, and establish key performance indicators (KPIs) to track progress towards your targets.
- Share an action plan to align stakeholders across your business and to promote accountability.

WHY ADOPT MORE SUSTAINABLE PACKAGING?

1. Reduce total cost of ownership through material efficiency and waste reduction.
2. Save time and labor by establishing more efficient packaging processes.
3. Differentiate your products in a competitive market.
4. Meet growing customer demands for more sustainable packaging solutions.
5. Ensure compliance with regulations and industry standards related to packaging sustainability.
6. Contribute to the circular economy through use of recycled and reusable materials.

Take Action

4. Position your strategy

When aligning business stakeholders with your strategy and targets, organizing activities around broader business objectives and clear themes can be beneficial. We align packaging targets with our Scope 3 goals and our **four SMASH Packaging pillars**.

To support our Scope 3 ambitions, we aim to reduce our packaging emissions by 20% per Euro of revenue. To achieve this and ensure a more responsible supply chain, we have set three targets focused on **packaging weight reduction**, **zero-deforestation**, and **circular design concepts**.

These targets will be met through projects that deliver on our four pillars: **Shrink**, **Secure**, **Switch**, and **Save**.

Our SMASH Packaging Framework

4 PILLARS	2030 TARGETS
Shrink Reduce amount of packaging	Reduce **10% of packaging weight** per unit sales
Secure Achieve zero deforestation	**100%** of fiber packaging **deforestation-free**
Switch Improve plastic sustainability	**100%** of packaging designed following **circular design principles**
Save Maximize recycling	

Reduce **20% of packaging GHG emissions** per sales

CASE STUDY:

ZERO-DEFORESTATION FIBER-BASED PACKAGING

Wood and fiber-based packaging are a major driver of deforestation.

Packaging Improvement Area: ZERO DEFORESTATION

Our target is for **100% of our fiber packaging to be deforestation-free by 2030.**

We are addressing deforestation risks in our wood and fiber-based packaging supply chain. By engaging our vendors, we gather data on their sourcing practices, allowing us to pinpoint sites not meeting our zero-deforestation standards.

We then use this data to work with site representatives and vendors to find alternatives and opportunities for improvement.

For instance, at our site in Molsheim, France, we transitioned to FSC-certified vendors, and established guidelines to ensure any new items are sourced with FSC certification.

At the end of 2024, 81.5% of our wood and fiber paper-based materials used for packaging and shipping were aligned with our zero-deforestation standards.

our ask...

We expect our suppliers to source fiber-based materials that are certified by one of the following:

- Forest Stewardship Council (FSC)
- Programme for the Endorsement of Forest Certification (PEFC)
- Sustainable Forestry Initiative (SFI)

TAKE ACTION

5. Engage your organization

Present your action plan and packaging sustainability goals with employees, raw material suppliers, and customers. Provide regular updates to encourage collaboration, gather feedback, and highlight successes. Showcase real-life projects to outline your proposed initiatives and the required resources.

This might include:

- Invest in R&D for innovative, more sustainable materials.
- Upgrade production lines to accommodate alternative packaging.
- Obtain sustainable sourcing certifications (e.g., FSC for paper-based packaging).
- Engage suppliers to develop more sustainable solutions and use renewable electricity in their operations.

keys to success

A strong foundation is built upon collaboration across the organization and equipping stakeholders with tools and resources to drive change toward your common goal.

Organize a cross-functional team

Include members from:

- Packaging Engineering
- Procurement
- Product Design
- Production
- Quality Assurance
- Commercial

Provide training resources

These could be:

- Workshops
- Webinars
- Detailed guidelines and checklists
- Industry regulations and best practices

Take Action

6. Prioritize and execute opportunities

- Use the data that you have collected to identify hotspots and prioritize projects based on potential impact towards your **sustainability goals**, also considering the added **value** to your customers and technical **feasibility**.
- Leverage your **cross-functional team** (assembled in Step 3) to develop and identify alternative solutions aligned with your goals.
- Apply **Life Cycle Assessment (LCA)** software to evaluate different packaging options, enabling stakeholders to analyze the environmental impact of various solutions from raw material extraction to disposal. See resources on page 15 for LCA solutions.
- Pilot solutions with highly engaged sites or champions to **demonstrate success** and iterate if necessary.
- **Scale** the solution across your organization, sharing best practices to maximize impact.

CASE STUDY

We switched to LLDPE pallet wrapping film with 30-40% **recycled content** in South Korea and Germany, saving **70 tons of CO_2e annually.**

TAKE ACTION

Here are specific action items you can implement within each packaging focus area:

Optimize Usage

- Eliminate unnecessary components and consider lighter alternative materials.
- Offer alternative packaging solutions that minimize amount of packaging per unit.
- Optimize package dimensions to **minimize air space** and **maximize pallet utilization**.
- Consider packaging during product development to limit packaging constraints.

Zero Deforestation

- Use **80% of recycled content** where possible.
- Integrate fiber-based packaging with forest management and chain of custody certification such as **FSC, PEFC, or SFI.**
- Adhere to relevant deforestation regulations, such as the EU Deforestation Regulation (EUDR).
- Use packaging from vendors that **demonstrate responsible sourcing.**

Circular Design Principles

- Prioritize materials from renewable resources.
- **Maximize recycled content** when considering the materials and their application.
- Prioritize materials that are **highly recyclable** and **minimize the use of mixed and multilayer materials**, which are difficult to separate and recycle.
- **Eliminate materials of concern** such as expanded polystyrene (EPS), polyvinyl chloride (PVC), and per- and polyfluoroalkyl substances (PFAS).
- Avoid hazardous substances in packaging such as toxic inks, non-soluble adhesives, and some fiber-based packaging coatings.
- Avoid the use of plastic with biodegradability additives as these are detrimental to the recycling process.
- Implement packaging reuse programs for both intercompany shipments and with customers.

CASE STUDIES

Applying Circular Design Principles

Expanded Polystyrene (EPS) Replacement with Pulp Inserts

Darmstadt, Germany

We're replacing EPS with molded components made of cellulose and recycled paper pulp to pack a variety of glass bottle configurations in shipping boxes.

3,000,000
EPS parts
replaced per year

53
metric tons of CO_2eq.
reduced annually

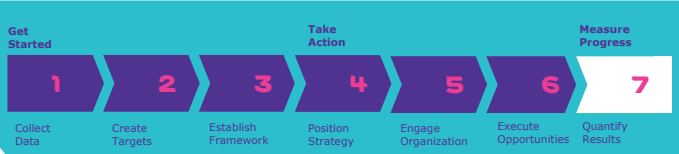
Milli-Q® Protective Foam

Molsheim, France

We replaced conventional **petroleum-based** polyethylene (PE) foam with protectors made from **bio-based** polyethylene.

11.7
metric tons of CO_2eq.
reduced annually

6
metric tons of PE foam
reduced annually



MEASURE PROGRESS

7. Quantify and share results

- Quantify impacts from each project before and after changes (materials, unit weight, unit cost, annual quantities, etc.).
- Partner with LCA experts and/or use LCA tools to measure emissions reductions associated with a project.
    - **Full LCAs** provide a very detailed report but require extensive effort that may not be necessary for each project.
    - **Streamlined LCAs** can reduce effort but provide limited information.
- Monitor your KPIs and progress against targets.
- Set a regular cadence to report to leadership and your customers.

Quantify the changes made across these dimensions:

Measurement	Example Units
Weight	Metric tons
Quantity Used	Number per year
Material Type	Metric tons Replaced
Reduction of CO_2e	Metric tons of CO_2e per unit
Certification Type	# of SKUs and tons certified
Amount of Recycled Content	% and # of pieces replaced

Streamlined LCA Tools

There are many streamlined LCA tools to calculate environmental impacts from your packaging data. Examples:

- OpenLCA (Free)
- EcoImpact-COMPASS (Paid)

SHARE YOUR PROGRESS

Our organization wants to work with partners engaged in sustainability initiatives to contribute to the reduction of the carbon footprint of the materials we source from them.

Please share your strategies, plans and successes with your procurement contact.

CASE STUDIES

SMASH PACKAGING PLAN

In 2019, we created SMASH Packaging to enhance the sustainability of our packaging for our 300,000+ products while meeting a variety of safety, quality, and performance requirements.

SMASH has established key principles of packaging sustainability, resulting in the completion of 100+ projects. In 2024, we avoided **1,500+ metric tons** of packaging.

Foam Chips Replacement

Lyon, France

We replaced foam chips with crumpled paper as filling material at the Lyon, France Distribution Center. The dunnage consists of 100% recycled paper.

23 metric tons of foam peanuts avoided annually, representing **2,900 cubic meters**, the **volume of 4 jumbo jets**.

Packaging for Smalls in Milwaukee

Milwaukee, Wisconsin, US

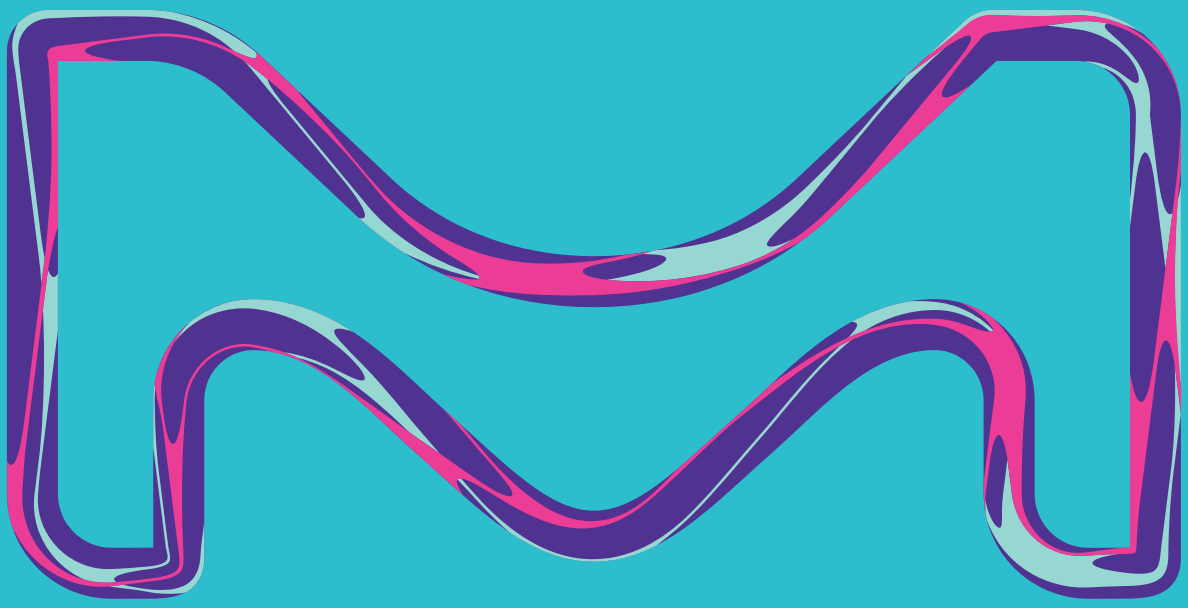
A smaller box was developed and validated for shipping around 1,000 products daily at our Milwaukee distribution center.

>50% air space reduction, saving 60 metric tons of packaging materials annually.

RESOURCES

Explore additional resources to enhance your packaging sustainability strategy and take further action.

REGULATIONS	**EUDR (EU):** EU Deforestation Regulation **PPWR (EU):** Packaging and Packaging Waste Regulation **EU Directive 2019/904**: Impact of Plastic Taxes on the Environment
GENERAL	**SMASH Packaging Plan** **TfS Academy** **PSCI Resources** **Sustainable Packaging Coalition (US)** **SPHERE:** Packaging Sustainability Framework by WBCSD **OpenLCA:** Free Streamlined LCA Tool **Trayak, EcoImpact Sustainability Platform (US):** Paid Streamlined LCA Tool **SimaPro**: Paid Full LCA Tool
MATERIALS	**Forest Stewardship Council:** Sustainable forestry certification **Programme for the Endorsement of Forest Certification:** Sustainable forestry certification **Sustainable Forestry Initiative:** Sustainable forestry certification **FEFCO Corrugated Packaging (EU):** The European Federation of Corrugated Board Manufacturers **Cepi (EU):** The European association representing the paper industry
CIRCULARITY	**Plastics Recyclers Europe (EU)** **The Association of Plastic Recyclers (NA)** **Recyclass (EU)** **Ellen Mac Arthur Foundation**



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