Life Cycle Assessment of Hygiene Kits

Project: Accelerating the reduction of the environmental impact of humanitarian action

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Science and Technology for Humanitarian Action Challenges (HAC)

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Introduction

Objectives and scope

This analysis aims to enhance understanding of the item's impacts on climate, human health, and plastic leakage. It also identifies potential levers to reduce these impacts. However, assessing the feasibility of implementing these levers falls outside the scope of this project.

By no means is it suggested that life-saving assistance to the most vulnerable populations across the world should be reduced for decarbonisation purposes. Effective emissions and other impact reductions should not result in any reduction in the quality, quantity or timeliness of assistance, but rather should explore ways to reinforce or maintain aid, while identifying low-carbon, sustainable, and resilient alternative options.

Objectives and scope

Objectives:

- To establish GHG Emission Factors for **hygiene kits** adapted to the humanitarian context.
- To analyse the environmental impact of the product's life cycle and identify key levers for impact reduction through a comparison with a previous variation altered by the ICRC to reduce shipping volume

Scope & System Boundary:

- **Cradle-to-grave*** system for the assessment of impact across the complete life cycle.
  - The materials, production, distribution, use and disposal of the product are in scope of the study
  - Any additional processes after production are not in scope e.g. unplanned storage, etc.
  - The procurement of the packaging is modelled, upstream activities related to the packaging are out-of-scope
  - The study focuses on one unit of the product and does not include larger-scale supply activities i.e. shipping per container, etc.

*In life cycle assessment, **cradle-to-grave** refers to evaluating a product's environmental impacts from raw material extraction through manufacturing, use, and final disposal. In contrast, **cradle-to-gate** focuses only on the stages up to the product's departure from the manufacturing site, excluding use and end-of-life phases.

Methodology

The results are calculated following the Environmental Footprint 3.1 indicator system in two categories:

- **Climate Change**: Global Warming Potential (GWP100)
- **Impact on Human Health**:
    - Human Toxicity: Carcinogenic and Non-carcinogenic
    - Ionising Radiation
    - Particulate Matter Formation
    - Photochemical Oxidant Formation
  - Weighted using the approach detailed in the EF methodology – with a percentage assigned to each sub indicator (see reference)
  - Normalized for one citizen so as to aggregate and represent as a single score for human health

Plastic leakage: Experimental projection of the amount of plastic leaked into nature via mismanagement of waste

References:
"European Platform on LCA | EPLCA.". https://eplca.jrc.ec.europa.eu/EnvironmentalFootprint.html
Joint Research Centre (European Commission), Alessandro Kim Cerutti, Rana Pant, and Serenella Sala. 2018. Development of a Weighting Approach for the Environmental Footprint. Publications Office of the European Union. https://data.europa.eu/doi/10.2760/945290

End-of-life

This study aims to model the impact differences between various waste management methods tailored closer to humanitarian contexts. The following end-of-life options were modelled in the analysis, as appropriate:

- **Open dump** (unmanaged)
- **Open burning** (unmanaged)
- **Unsanitary landfill** (minimal management)
- **Sanitary landfill** (managed site)
- **Municipal incineration** (managed plant)
- **Recycling** (as modelled)

For plastics, the differences in measured impact between each end-of-life scenario are similar. (For more info on the impacts and sources of end-of-life impact measurement please see annex.)

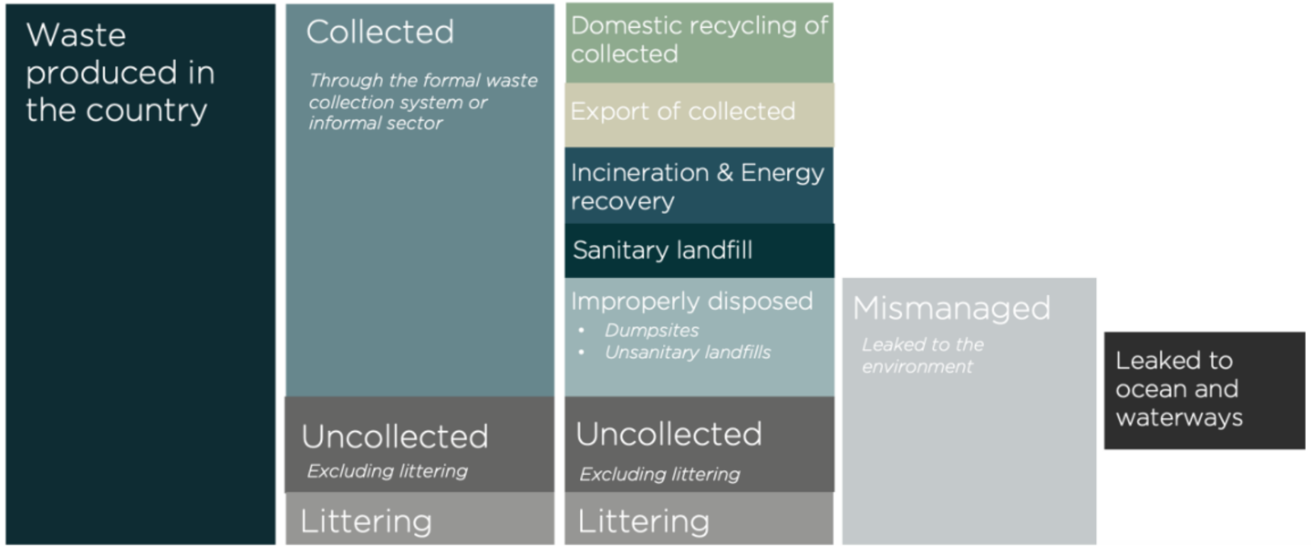
According to the LCA methodology, the analysis of greenhouse gas (GHG) emissions (Global Warming Potential)—is limited to a 100-year timeframe. As a result, any additional impact from plastic degradation in landfills occurring beyond this period is neither measured nor compared to other waste disposal methods.

Plastic leakage

This project aims to estimate the mismanaged waste that may occur at the end of life of products distributed by humanitarian organisations.

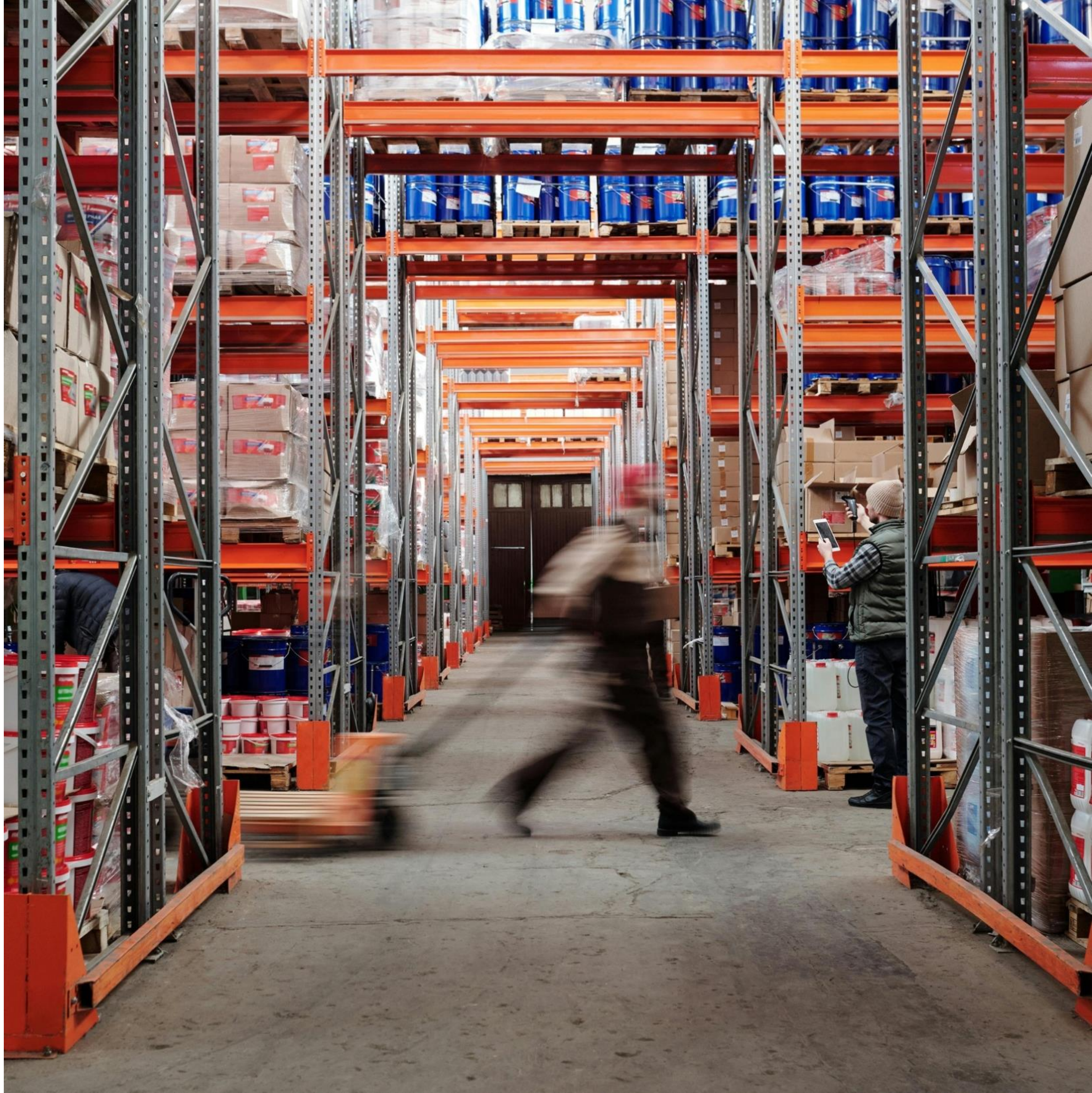
The modelled scenarios are analysed for plastic leakage by selecting the waste management method that is modelled and calculating the projected leakage (or lack thereof) due to the same.

For more information, please refer to: “Global Plastic Environmental Analytics Platform.” Plasteax. https://plasteax.earth/.



Source: EA – Earth Action

LCA Results



Key Product Parameters & Assumptions

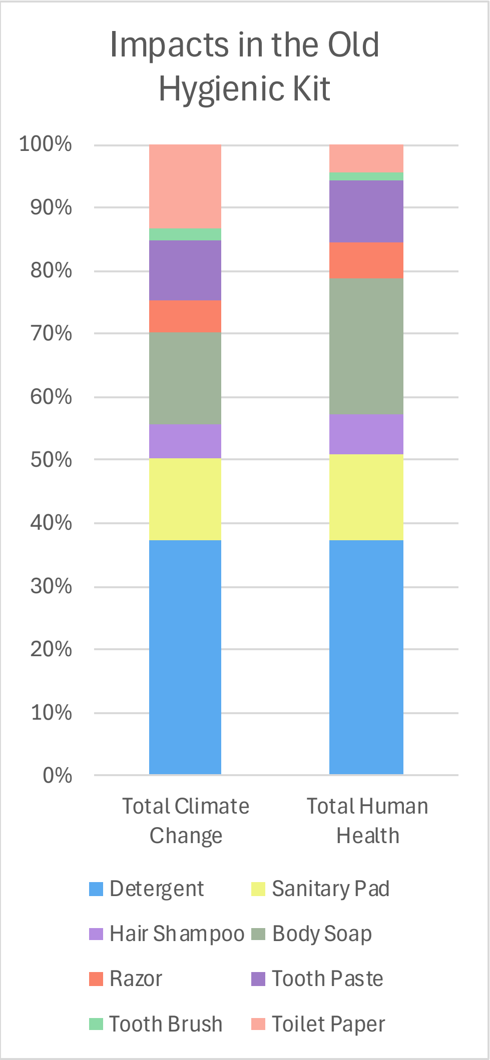
LIFE-CYCLE STAGE	PARAMETER	DESCRIPTION OF PRODUCT
GENERAL	Field Context	The kits are assembled and sent to the field with the function of serving one person per kit **ICRC has updated the kit by increasing the quality of certain items, reducing the volume of some products by 40%, by switching to concentrated detergent and to shampoo bars, and reducing the amount of razors distributed. The analysis compares the old version of the kit with the new version.**
Raw Material	Bill of Materials	Varied
	Packaging	Plastic or laminated paper film
Production	Manufacturing Location	Spain
	Manufacturing Processes	Varied
Supply & Distribution	Transport Chain	TRUCK to European port SHIP to distribution port TRUCK to warehouse and/or distribution site
Use	Lifespan	Depending on usage (assumed)
	Usage Processes	Varied
Waste Management	Product Disposal Method	Varied
	Packaging Disposal Method	Open dumping

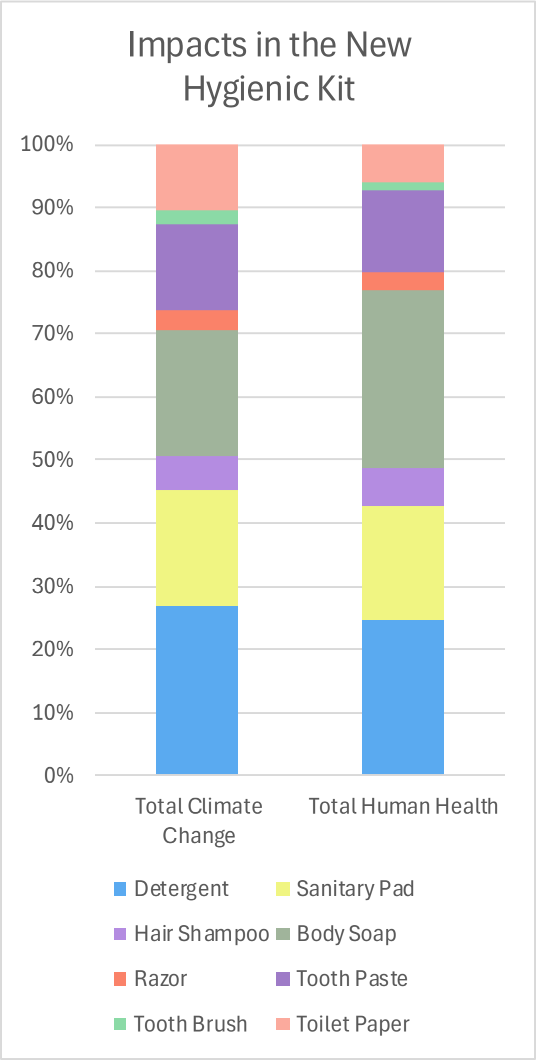
Hygienic Kit Contents

PRODUCT	OLD KIT	NEW KIT	DESCRIPTION (NEW KITS)
Washing Powder	1 x 450g in a plastic bag	1 x 225g concentrate detergent	Packed in laminated cardboard box
Sanitary Pad	1 x 10pcs in a plastic bag	No Change	
Hair Shampoo	1 x 275ml in a plastic bottle	1 x 70g solid shampoo	Packed in laminated paper bag
Body Soap	2 x 100g in plastic bags	Packed in laminated paper bag	
Razor	1 x 5 in one plastic bag	1 x 2 in one plastic bag	New razors are higher quality and therefore 2 new razors provide the same usage as the 5 older variants
Tooth Paste	1 x 75g plastic tube	No Change	
Tooth Brush	1 pce 100% PP in a plastic bag	1 pce 50% PP + 50% wheat straw	New version packed in laminated cardboard
Toilet Paper	2 rolls virgin tissue paper in plastic bag	2 rolls recycled, unbleached tissue paper in paper wrap	

Baseline Results

- Detergent is the biggest contributor of GHG emissions in the new kit, consisting of **27%** of the total GHG Emissions with soap being second at **20%.**
- Soap Bars, mainly due to their water consumption, are the biggest contributors for impact on human health, making up **28%** of the total impact on human health, with detergent being the second highest at **25%.**
- Other notably high impact items are sanitary pads, accounting for about **18%** of the impact in both the old and new kits

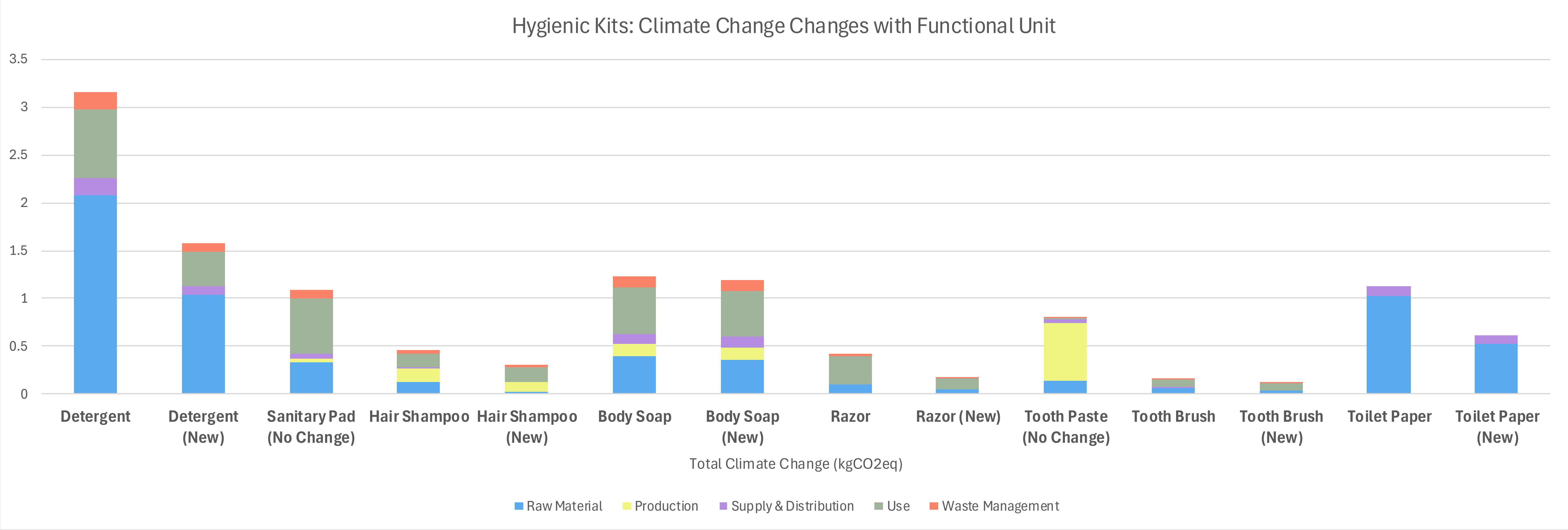




Emission factors (OLD)		Unit
Cradle-to-grave	8.4	kgCO2eq/unit
Cradle-to-gate	5.2	kgCO2eq/unit

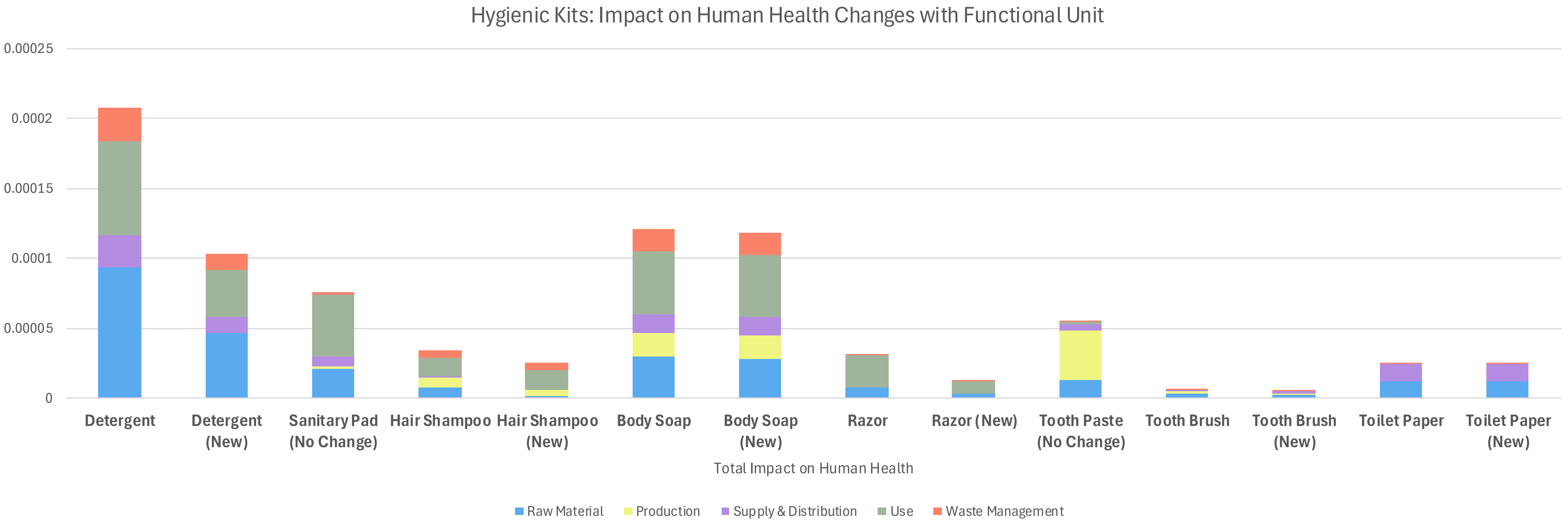
Emission factors (NEW)		Unit
Cradle-to-grave	5.9	kgCO2eq/unit
Cradle-to-gate	3.4	kgCO2eq/unit

Comparative Analysis



- **With the changes made to products inside the kit, the new hygiene kit has an overall 30% reduction in GHG Emissions as compared to the previous kit.** The greatest reduction in emissions on a product level was seen in razors (**59%**), detergent/washing powder (**50%**) and toilet paper (**45%**)
- ***NOTE:*** *These improvements assume that the extent of usage of the old and new hygiene kits is the same, for e.g. if the previous razor pack lasted the user for 15 shaves, then so will the new razor pack*

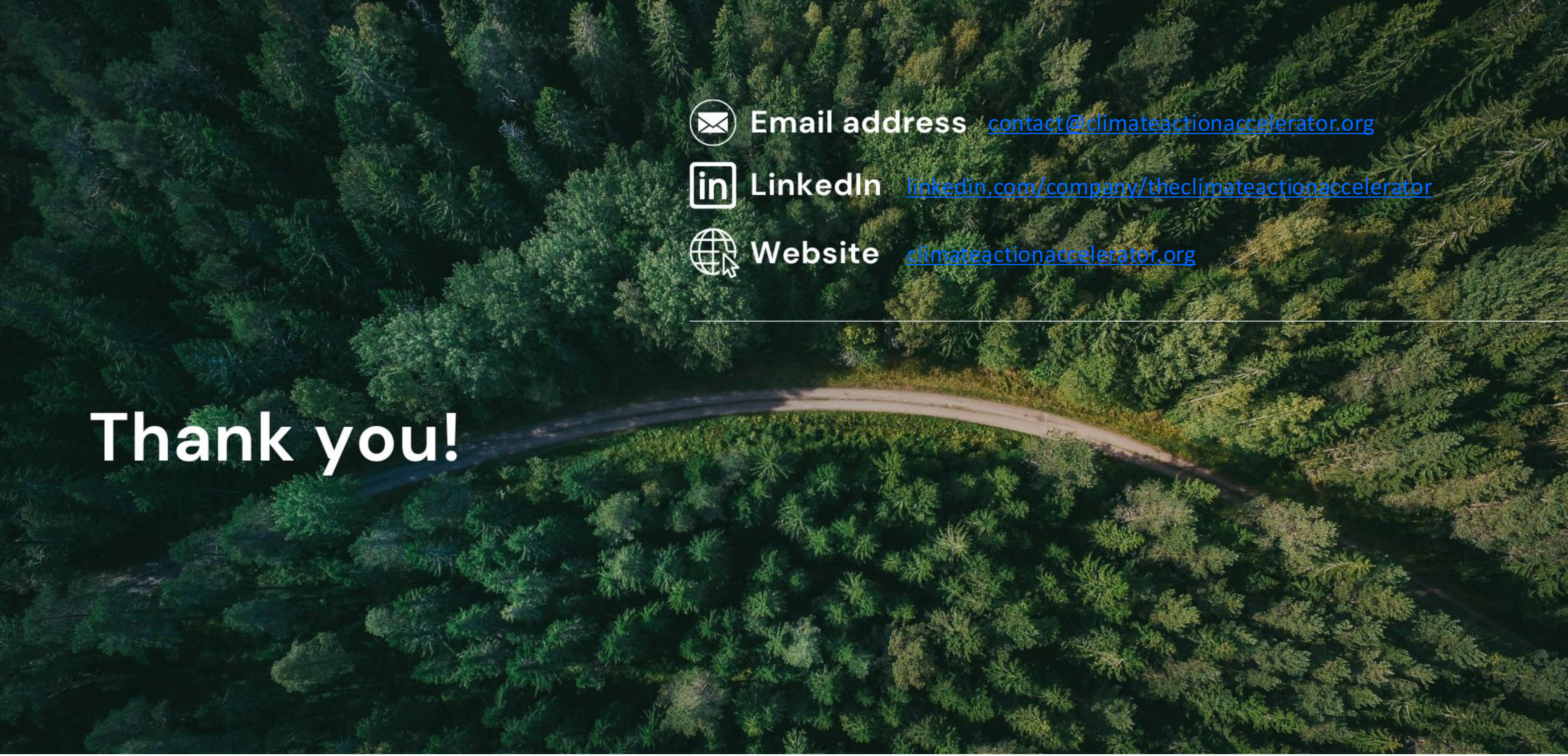
Comparative Analysis



- **With the changes made to products inside the kit, the new hygiene kit has an overall 24% reduction in impact on human health.** The greatest reduction in impact on human health on a product level was seen in razors (**61%**), detergent/washing powder (**50%**) and hair shampoo (**27%**)
- ***NOTE:*** *These improvements assume that the extent of usage of the old and new hygiene kits is the same, for e.g. if the previous razor pack lasted the user for 15 shaves, then so will the new razor pack*

Key conclusions of comparative analysis

- The changes made to the hygiene kit (see slide 11) had the below effect on its environmental impact according to the updated specifications
  - ▼ 30% climate change
  - ▼ 24% impact on human health
- While the study focuses on a singular hygienic kit, the reduction in volume causes a reduction of impacts related to transport at the level of a shipment which is out of scope of the analysis
- For further impact reduction for future revisions of the kit, additional impact reductions of the most impactful products within the hygiene kit would need to be addressed, such as
  - Washing powder or detergent
  - Soap bars
  - Sanitary pads



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Thank you!

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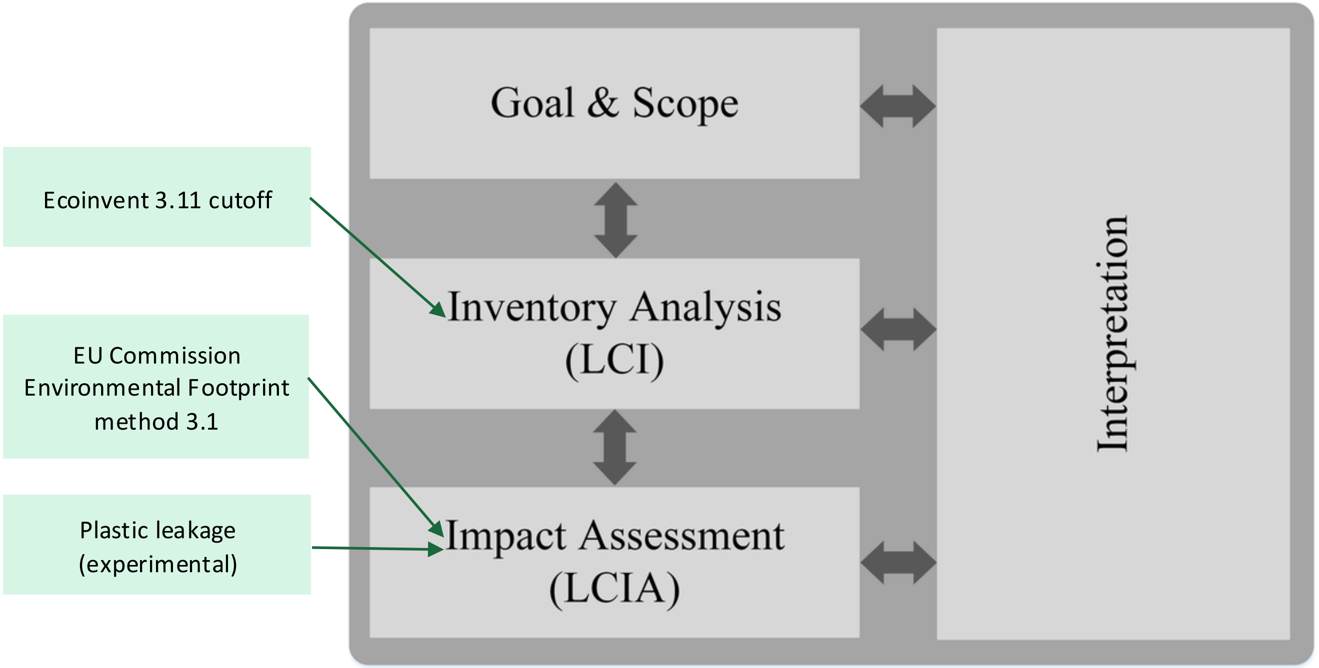
Methodology

The primary database used is Ecoinvent 3.11

The studies utilize the data from the **cut-off system model which allocates the entire impact of the material to its primary user** without any 'rewards' for its potential for being recycled.

Consequently, any recycled materials do not carry the burden of the impact of the primary use of the material and rather track the impacts from the recycling process onward.



Life cycle assessment (LCA) steps according to ISO 14040, 14044, and 14067.

References:
"Ecoinvent v3.11." n.d. Ecoinvent. https://ecoinvent.org/ecoinvent-v3-11/

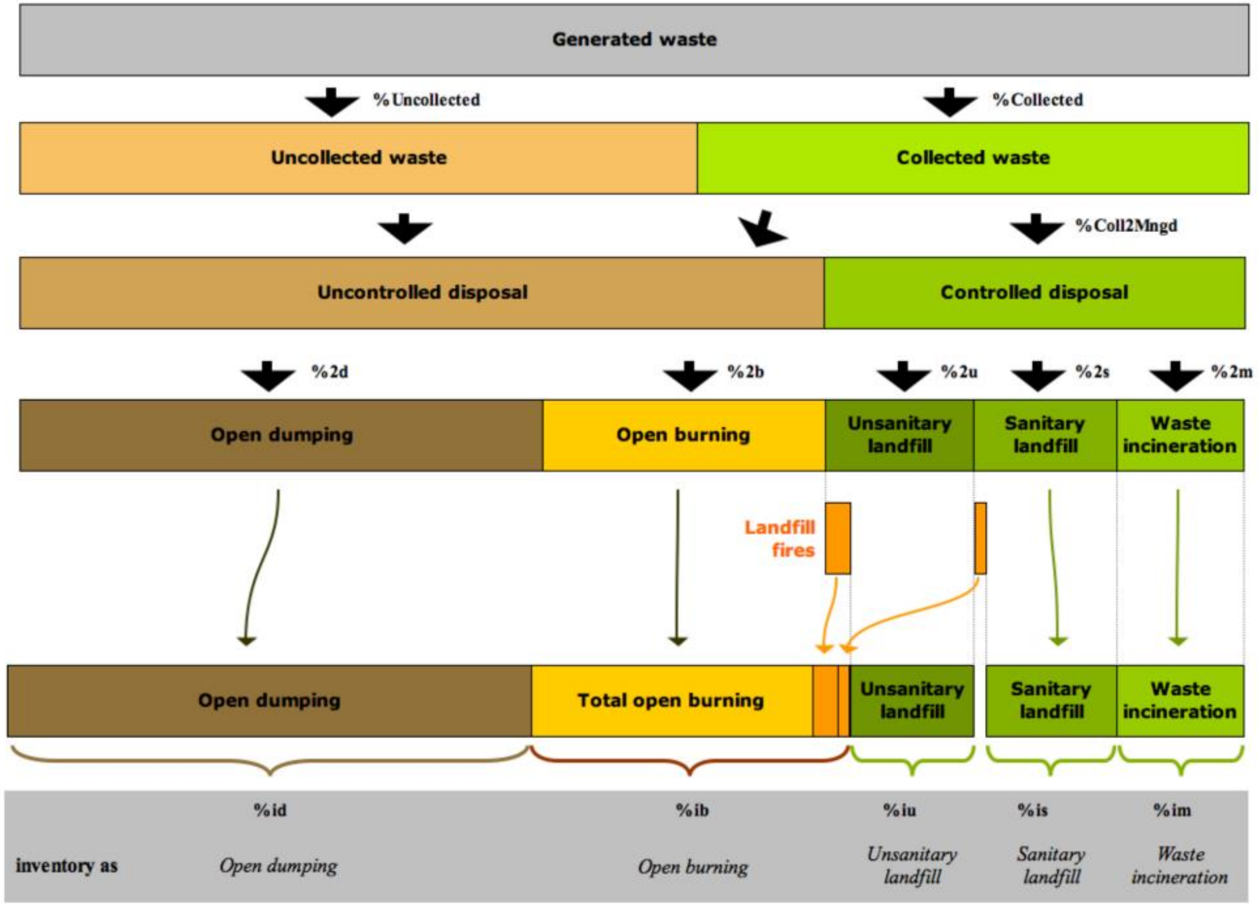
End-of-life waste management

This study aims to model the impact differences between **managed and mismanaged** waste tailored closer to humanitarian contexts.

The end-of-life impact for *a mix of plastic waste* reduces as below:

Method	GHG Emissions	Impact on Human Health
Open Burning	~HIGHEST~	~HIGHEST~
Municipal Incineration	-2.60%	-96.03%
Unsanitary Landfill	-93.80%	-99.40%
Open Dumping	-95.50%	-99.87%
Sanitary Landfill	-96.22%	-99.06%

Open burning creates maximum impact for both categories, but beyond that there are differences between climate change and human health on the specific magnitude of reduction.



Doka, G., 2018, Inventory parameters for regionalised waste disposal mixes

This study uses values for specific types of plastic wherever necessary, however the proportions of impact follow similar trends across the types of plastic product. This is therefore the standard impact implication for plastic products at end-of-life. Whenever possible, recycling is also modelled as a waste treatment option within the scope of the study.

NOTE: The methods listed above have differences in how long it takes for the plastic to be removed. It is part the LCA methodology that measurements are limited to a 100 years, therefore any further impact due to the degradation of plastic in landfills is not measured or compared with other methods of disposal.