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Product Carbon Footprint Report

for Actifed

Protocol Data (Accounting Standard):
GHG Protocol

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Disclaimer: This report is generated based on available data, industry averages, and recognized sustainability standards. While every effort has been made to ensure accuracy and detail, specific primary data from the product manufacturer was not available and assumptions have been made based on typical pharmaceutical formulations and supply chain practices within the specified geographic

Generated Date: April 17, 2026

Product Carbon Footprint Analysis: Actifed

Executive Summary

This report presents a high-detail Product Carbon Footprint (PCF) analysis for one unit of Actifed, a common over-the-counter medication for cold and allergy symptoms. Conducted by Remko Weingarten, Senior Sustainability Consultant specializing in GHG Protocol, this analysis adheres strictly to the GHG Protocol standards, including the 2026 Land Sector and Removals (LSR) update. The system boundary is defined as \'cradle-to-gate\' (factory_gate), focusing on emissions from raw material acquisition, manufacturing, and associated transportation up to the point of dispatch from the production facility in the Netherlands, with a European supply chain focus.

The primary objective is to quantify the greenhouse gas (GHG) emissions, expressed in kilograms of carbon dioxide equivalent (kg CO2e), across the product\'s defined lifecycle. The analysis identifies key emission hotspots, primarily within the upstream supply chain for active pharmaceutical ingredients (APIs), excipients, and packaging materials, as well as energy consumption during manufacturing. This report provides a foundational understanding for Actifed\'s environmental performance and offers actionable recommendations for emissions reduction.

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1. Define Scope

The scoping phase establishes the foundational parameters for the Product Carbon Footprint (PCF) study of Actifed, ensuring clarity, consistency, and adherence to the GHG Protocol.

Functional Unit

The functional unit for this analysis is defined as **1.0 unit of Actifed (one tablet)**, designed to deliver a single dose of antihistamine and nasal decongestant for the relief of cold and allergy symptoms. This unit serves as the reference basis for all quantified inputs and outputs throughout the product\'s lifecycle.

System Boundary

The system boundary is defined as **\'factory_gate\' (cradle-to-gate)**. This includes all processes from the extraction and processing of raw materials (Active Pharmaceutical Ingredients, excipients, and packaging components), their transportation to the manufacturing facility, and the emissions associated with the production and packaging of the final Actifed tablet at the factory in the Netherlands. Emissions associated with the use phase, distribution to the consumer, and end-of-life treatment of the product and packaging are outside this defined boundary.

Geographic Scope

The **Final Production Country is the Netherlands**, with a **Supply Chain Focus on Europe**. This implies that emission factors and transportation distances are primarily sourced or approximated for European contexts, reflecting regional energy mixes, manufacturing practices, and logistical networks.

Accounting Standard

This PCF analysis is conducted in strict accordance with the **GHG Protocol Product Standard** (A Life Cycle Approach to Assessing Greenhouse Gas Emissions of Products and Services), incorporating the requirements and guidance from the **GHG Protocol Corporate Standard** and **Scope 3 Standard**. Emissions are categorized into Scope 1 (direct emissions), Scope 2 (indirect emissions from purchased energy), and Scope 3 (other indirect value chain emissions) to ensure comprehensive reporting.

Allocation

For any shared processes or co-products within the manufacturing of Actifed, emissions are allocated based on **mass allocation**. Given that Actifed tablets are a specific, distinct product, direct allocation is applied where possible. For multi-product input materials (e.g., in upstream

chemical synthesis of APIs), industry-average allocation principles are assumed based on mass or economic value, as typical in secondary LCI databases.

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2. Map Lifecycle & 3. Collect Data

This section outlines the key lifecycle stages within the \'factory_gate\' boundary and details the assumed data points for material and energy inputs. Given the proprietary nature of pharmaceutical manufacturing data, specific quantities and origins are illustrative, based on typical tablet formulations and industry-average data.

Actifed tablets typically contain two active ingredients: Pseudoephedrine hydrochloride (60 mg) and Triprolidine hydrochloride (2.5 mg) per tablet. Common excipients include Lactose, Maize starch, Povidone, and Magnesium Stearate. Microcrystalline Cellulose (MCC) is also a widely used excipient in tablet formulations as a binder and disintegrant. The packaging usually consists of a blister pack (typically PVC/PVDC and aluminum foil) and a cardboard carton.

Material Inputs (per 1.0 Actifed tablet, illustrative weights)

Material data is sourced from typical pharmaceutical tablet compositions and packaging structures.

Category	Material	Illustrative Weight per Tablet (mg)	Key Function	Typical Origin / Material Class
Active Pharmaceutical Ingredients (APIs)	Pseudoephedrine HCl	60.0	Nasal Decongestant	Synthetic Organic Chemical
Active Pharmaceutical Ingredients (APIs)	Triprolidine HCl	2.5	Antihistamine	Synthetic Organic Chemical
Excipient		127.5	Diluent, Filler	

Category	Material	Illustrative Weight per Tablet (mg)	Key Function	Typical Origin / Material Class
	Lactose Monohydrate			Dairy-derived (Europe)
Excipient	Maize Starch (Corn Starch)	~30.0	Disintegrant, Filler	Agricultural (Europe)
Excipient	Povidone (Binder)	~5.0	Binder	Synthetic Polymer
Excipient	Microcrystalline Cellulose (MCC)	~20.0	Binder, Disintegrant	Wood pulp/ Cotton-derived (Europe)
Excipient	Magnesium Stearate	~2.0	Lubricant	Vegetable/ Animal derived
Packaging (Blister)	PVC/PVDC Film (Blister Base)	~150.0	Primary Product Protection	Polymer (Europe)
Packaging (Blister)	Aluminum Foil (Blister Lid)	~20.0	Primary Product Protection	Metal (Europe)
Packaging (Carton)	Paperboard (Box)	~1500.0 (for 12 tablets, so ~125.0 per tablet)	Secondary Protection, Information	Wood fibre (Europe)
Packaging (Other)	Leaflet (Paper)	~500.0 (for 12 tablets, so ~41.7 per tablet)	Product Information	Wood fibre (Europe)

Energy Inputs (Illustrative per 1.0 Actifed tablet production at factory)

Manufacturing processes for tablets include blending, granulation, compression, and blistering. Energy consumption is a significant factor.

Energy Type	Illustrative Consumption per Tablet	Unit	Source
Electricity	0.005	kWh	Netherlands Grid Mix
Natural Gas (for heating/steam)	0.0005	m^3	European Average

Transportation Data (Illustrative, European Focus)

Transportation distances and modes for key raw materials to the Netherlands manufacturing facility. Assumed average European road freight.

Material Category	Mode of Transport	Illustrative Distance (km)	Load Factor
APIs & Complex Excipients	Road Freight (Lorry, >16-32 tonne)	1,500	0.6 (Partial Return Load)
Bulk Excipients (Lactose, Starch, MCC)	Road Freight (Lorry, >16-32 tonne)	750	0.7 (Good Load)
Packaging Materials (PVC, Al, Paperboard)	Road Freight (Lorry, >16-32 tonne)	500	0.8 (Full Load)

Waste Generation (Illustrative, from manufacturing)

Waste generated during the manufacturing and packaging process, excluding product loss.

Waste Type	Illustrative Quantity per Tablet (g)	Disposal Method
Process Waste (API/ Excipient scraps)	0.001	Incineration (with energy recovery)
Packaging Trim Waste (PVC, Al, Paper)	0.005	Recycling (where applicable), Incineration

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4. Calculate Emissions

Emissions are calculated by multiplying activity data (quantities of materials, energy, transport) by appropriate emission factors (kg CO2e per unit of activity). Emission factors are sourced from industry-standard databases such as Ecoinvent or DEFRA equivalents, adapted for a European context. The GHG Protocol categorizes these emissions into Scope 1, Scope 2, and Scope 3.

The 2026 Land Sector and Removals (LSR) Standard is acknowledged for its relevance to biogenic products and land-intensive materials within the supply chain. For excipients like Lactose (from dairy) and Maize Starch (from agriculture), the upstream emissions inherently reflect land use impacts. Microcrystalline Cellulose, being plant-derived, also falls under this consideration. The LSR Standard, effective January 1, 2027, will require detailed accounting for land management and land use change emissions, as well as CO_2 removals for companies with significant land sector activities in their value chain. While this report is in 2026, the principles of accounting for biogenic emissions from agricultural inputs are considered.

For Scope 3 compliance, at least 95% coverage is targeted for this \'factory_gate\' boundary, focusing heavily on upstream purchased goods and services, and upstream transportation.

Illustrative Emission Factors Used (Examples)

- Lactose (production): 1.38 kg CO2e/kg
- Maize Starch (production): ~1.0 kg CO2e/kg (illustrative, often derived from corn production)

- Povidone (production): ~5.0 kg CO2e/kg (illustrative for synthetic polymer)
- Microcrystalline Cellulose (MCC) (production): ~0.8 kg CO2e/kg (reflects lower impact for cellulose-based materials)
- Magnesium Stearate (production): ~2.5 kg CO2e/kg (illustrative)
- PVC (production, Europe): ~2.0-2.37 kg CO2e/kg (using 2.2 kg CO2e/kg as an average)
- Aluminum Foil (production, Europe): 3.17 kg CO2e/kg
- Paperboard (production, Europe): ~0.7 kg CO2e/kg
- Electricity (Netherlands grid mix): ~0.35 kg CO2e/kWh (illustrative for 2026)
- Natural Gas (combustion): ~0.2 kg CO2e/m^3
- Road freight (Lorry, >16-32 tonne, Europe): ~0.1 kg CO2e/tonne-km

Estimated GHG Emissions per 1.0 Actifed tablet (kg CO2e)

The following table presents the estimated emissions broken down by scope and lifecycle stage. These values are illustrative and based on the assumed data and emission factors.

Lifecycle Stage / Material	Scope 1 (kg CO2e)	Scope 2 (kg CO2e)	Scope 3 (kg CO2e)	Total (kg CO2e)
Raw Material Acquisition & Production	0.000	0.000		
Pseudoephedrine HCl (API)	0.000	0.000	0.0120	0.0120
Triprolidine HCl (API)	0.000	0.000	0.0010	0.0010
Lactose Monohydrate (Excipient)	0.000	0.000	0.000176	0.000176
Maize Starch (Excipient)	0.000	0.000	0.000030	0.000030
Povidone (Excipient)	0.000	0.000	0.000025	0.000025

Lifecycle Stage / Material	Scope 1 (kg CO2e)	Scope 2 (kg CO2e)	Scope 3 (kg CO2e)	Total (kg CO2e)
Microcrystalline Cellulose (Excipient)	0.000	0.000	0.000016	0.000016
Magnesium Stearate (Excipient)	0.000	0.000	0.000005	0.000005
PVC/PVDC Film (Packaging)	0.000	0.000	0.000330	0.000330
Aluminum Foil (Packaging)	0.000	0.000	0.000063	0.000063
Paperboard (Packaging)	0.000	0.000	0.000088	0.000088
Leaflet (Paper)	0.000	0.000	0.000029	0.000029
Transportation of Raw Materials	0.000	0.000		
APIs & Complex Excipients Transport	0.000	0.000	0.000009	0.000009
Bulk Excipients Transport	0.000	0.000	0.000002	0.000002
Packaging Materials Transport	0.000	0.000	0.000009	0.000009
Manufacturing (Netherlands Factory)				
On-site Fuel Combustion (Natural Gas, Scope 1)	0.000100	0.000	0.000	0.000100
Purchased Electricity (Scope 2)	0.000	0.001750	0.000	0.001750
Waste Treatment (from manufacturing, Scope 3)	0.000	0.000	0.000005	0.000005
Total (Sum of above)	**0.000100**	**0.001750**	**0.013723**	**0.015573**

Total Product Carbon Footprint for 1.0 Actifed Tablet (Cradle-to-Gate)

Scope	Emissions (kg CO2e)	Percentage of Total
Scope 1 (Direct Emissions)	0.000100	0.64%
Scope 2 (Purchased Energy)	0.001750	11.24%
Scope 3 (Value Chain - Upstream)	0.013723	88.12%
Grand Total PCF	**0.015573**	**100.00%**

The total Product Carbon Footprint for 1.0 Actifed tablet, from \'cradle-to-gate\', is estimated to be approximately **0.0156 kg CO2e**.

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5. Review & Report

Emission Hotspots

The analysis reveals that the vast majority of emissions for Actifed within the \'factory_gate\' boundary originate from **Scope 3 (Value Chain)**, accounting for approximately 88.12% of the total PCF. This is a common finding for manufactured products, especially pharmaceuticals, where the production of complex raw materials is highly energy- and resource-intensive.

- **Raw Material Acquisition & Production (Upstream Scope 3):** This is the dominant hotspot. Specifically, the Active Pharmaceutical Ingredients (APIs) — Pseudoephedrine HCl and Triprolidine HCl — represent a significant portion of these emissions due to their complex chemical synthesis processes. Packaging materials, especially PVC/PVDC and Aluminum foil, also contribute substantially.
- **Purchased Electricity (Scope 2):** Manufacturing energy, predominantly electricity from the Netherlands grid mix, contributes a notable 11.24% of the total PCF. Decarbonization of the energy supply for the manufacturing facility offers a clear pathway for reduction.

- **On-site Fuel Combustion (Scope 1):** Direct emissions from the manufacturing facility are comparatively small at 0.64%, indicating that the facility itself likely has efficient direct operations or a low reliance on on-site fossil fuel combustion.

Data Reliability and Limitations

This report relies heavily on **secondary data** from industry-average emission factor databases (e.g., Ecoinvent, DEFRA equivalents) and publicly available information regarding Actifed\'s composition. Specific, primary data directly from the manufacturer for Actifed\'s supply chain, energy consumption, and waste generation were not available.

- **Assumptions:** Illustrative weights, transportation distances, and specific emission factors have been assumed based on typical industry practices and publicly sourced averages. These assumptions introduce a degree of uncertainty.
- **LSR Standard Application:** While the principles of the 2026 LSR Standard have been considered for biogenic and land-derived inputs, a full, detailed accounting under the standard (which comes into effect in 2027) would require more granular, potentially farm-specific, data for agricultural raw materials like lactose and maize starch.
- **Scope 3 Coverage:** The report achieves good Scope 3 coverage within the \'factory_gate\' boundary by focusing on purchased goods and services (raw materials and packaging) and upstream transportation, aligning with the 95% compliance target for 2026 requirements. Downstream Scope 3 categories are outside the defined system boundary.

Recommendations

Based on this PCF analysis, the following recommendations are provided to reduce the environmental impact of Actifed production:

- **Supplier Engagement for Scope 3 Data:** Engage with API and excipient suppliers to obtain primary data on their manufacturing emissions, particularly for high-impact synthetic chemicals and agricultural products. This would reduce reliance on secondary data and reveal more precise reduction opportunities.
- **Material Optimization:** Explore opportunities for material substitution with lower carbon footprint alternatives, especially for packaging (e.g., using recycled content in paperboard or exploring

alternative blister materials like PET with better recyclability). Investigate excipients with demonstrably lower environmental impacts, such as sustainably produced microcrystalline cellulose.

- **Renewable Energy Adoption:** Support the transition to 100% renewable electricity sources for the manufacturing facility in the Netherlands (Scope 2). This could involve purchasing renewable energy certificates or investing in on-site renewable energy generation.
- **Logistics Optimization:** Optimize transportation routes and modes for raw materials within Europe. Prioritize suppliers with efficient logistics, higher load factors, or those utilizing lower-emission transport options (e.g., rail over road where feasible).
- **Waste Reduction and Recycling:** Implement robust waste reduction strategies in manufacturing and actively seek out and implement recycling programs for all feasible production and packaging waste streams.
- **Further Lifecycle Assessment:** Consider expanding the system boundary in future analyses to include the use phase, distribution to market, and end-of-life treatment to gain a full \'cradle-to-grave\' understanding of Actifed\'s environmental impact.
