

Environmental Footprint Declaration

Aurubis Lead-Antimony Litharge and Lead-Bismuth Alloy



This document presents an environmental footprint declaration of the results of the life cycle assessment (LCA) of lead-antimony litharge and lead-bismuth alloy, developed in accordance with ISO 14040 and ISO 14044 standards and the principles of ISO 14025. No applicable product category rules (PCR) were available at the time of publication.

1. General information

Product name	Lead-antimony litharge; Lead-bismuth alloy
Declared unit	Lead-antimony litharge and lead-bismuth alloy, 1 metric ton
Manufacturer	Aurubis
Site(s) of production	Aurubis plant in Hamburg, Germany
LCA	Aurubis supported by Sphera
Date of publication	19/10/2026
Time coverage	Reference calendar year 2025
Independent verifier	TÜV NORD CERT Prüf- und Umweltgutachtergesellschaft mbH
Review type	Critical review per ISO 14044 (Clause 6)

2. Methodology and scope

Applied standards/guidelines: The study was conducted in accordance with the ISO 14040 (ISO 14040:2021 Environmental management — Life cycle assessment — Principles and framework) and ISO 14044 (ISO 14044:2021 Environmental management — Life cycle assessment — Requirements and guidelines) LCA standards and the Environmental Footprint impact assessment method (3.1). This assessment is carried out in accordance with the methodology adopted by the International Lead Association¹.

Functional unit: 1 metric ton of lead-antimony litharge and lead- bismuth alloy at plant gate.

System boundaries: Cradle-to-gate life cycle inventory from the extraction of raw materials to the production of refined lead, based on allocated profile of solder and lead bullion from copper production. The study draws on the allocated profile of solder and lead bullion and includes further refining steps. Excludes packaging, downstream use, and end-of-life.

Allocation procedures: Economic allocation was applied in the life cycle inventory of lead-antimony litharge and lead-bismuth alloy to fairly account for the wide range of co-products.

3. Product

Product description: Lead-antimony litharge and lead-bismuth alloy are intermediate products that are further refined to recover lead, antimony and bismuth.

Technical properties/applications: Lead-antimony litharge is used as intermediate that is further refined into its individual elements. The lead is used first and foremost in the battery industry. Antimony, a silvery, shiny, brittle semimetal, is used primarily to produce antimony trioxide, a flame retardant. Furthermore, antimony is a component of circuit boards in the electrical industry. Additional applications for antimony compounds include the paint, fireworks and catalyst industries.

Lead-bismuth alloy is used for low-melting alloys and to produce pure bismuth and lead. The pure metals that arise after refining lead-bismuth alloy are applied to different purposes. While lead is primarily used in the battery industry, bismuth serves as a compound in the pharmaceutical industry and as a catalyst in the chemical industry. Moreover, bismuth is used to product pigments, lacquers and paints, as well as to manufacture thermoelectric appliances.

Expected service life: 50+ years (dependent on downstream application, e.g., in electronics, renewable energy systems, or industrial)

4.1 Environmental performance — impact results (per 1 metric ton Lead-Bismuth Alloy)

Impact category	Unit	Result
Climate change	kg CO ₂ eq	289
Ozone depletion	kg CFC-11 eq	0.000000005
Human toxicity, cancer effects ¹	CTUh	0.0000002
Human toxicity, non-cancer effects ¹	CTUh	0.000015
Particulate matter	Disease incidences	0.00002
Ionizing radiation	kBq U235 eq	2.80
Photochemical ozone formation	kg NMVOC eq	0.72
Acidification	mol H+ eq	1.22
Eutrophication (terrestrial)	mol N eq	2.83
Eutrophication (freshwater)	kg P eq	0.000
Eutrophication (marine)	kg N eq	0.26
Ecotoxicity (freshwater) ¹	CTUe	722
Land use ¹	Pt	1228
Water use	m ³ world eq	665
Resource use, fossils	MJ	2846
Resource use, mineral and metals ¹	kg Sb eq	0.011

¹ Impacts are not sufficiently robust and accurate to be used for metals.

4.2 Environmental performance — impact results (per 1 metric ton Lead-Antimony Litharge)

Impact category	Unit	Result
Climate change	kg CO ₂ eq	473
Ozone depletion	kg CFC-11 eq	0.000000008
Human toxicity, cancer effects ¹	CTUh	0.0000004
Human toxicity, non-cancer effects ¹	CTUh	0.000027
Particulate matter	Disease incidences	0.00003
Ionizing radiation	kBq U235 eq	4.90
Photochemical ozone formation	kg NMVOC eq	1.25
Acidification	mol H+ eq	2.11
Eutrophication (terrestrial)	mol N eq	4.90
Eutrophication (freshwater)	kg P eq	0.000
Eutrophication (marine)	kg N eq	0.45
Ecotoxicity (freshwater) ¹	CTUe	1253
Land use ¹	Pt	2131
Water use	m ³ world eq	1154
Resource use, energy carriers	MJ	4939
Resource use, minerals and metals ¹	kg Sb eq	0.020

¹ Impacts are not sufficiently robust and accurate to be used for metals.

¹ ila-lead.org/wp-content/uploads/2026/03/ILA-Lead-Metal-Carbon-Footprint-Guidance.pdf

5. Environmental performance improvement and comparison with global average

The environmental performance of the lead alloys was assessed for the first time in ref. year 2025. As no previous life cycle assessment data is available, a year-on-year comparison cannot be provided. The results represent the baseline environmental footprint against which future improvements will be measured and reported in subsequent updates.

No industry average data is available for comparison.

6. Additional environmental information

Recycled content: The lead-antimony litharge and lead-bismuth alloy are intermediates used for the recovery of valuable metals in downstream processing. The recycled content of the intermediate product has not been quantified.

Environmental labels/Certifications: Aurubis Beerse and Aurubis Hamburg, the lead and lead-alloy producing sites, are certified to ISO 14001 and ISO 50001.

7. Interpretation and conclusions

The environmental impact of Aurubis lead-antimony litharge and lead-bismuth alloy is primarily driven by solder and lead bullion. Direct emissions during the lead refining process and purchased electricity contribute as well.

8. Verification

Verification type	Critical review in accordance with ISO 14040 (2021) and ISO 14044 (2021)
Verifier name & organization	Michael Sommer Dennis Nowroth TÜV NORD CERT Prüf- und Umweltgutachtergesellschaft mbH Am TÜV 1, 30519 Hannover, Germany Phone +49 (0) 511 986-1172 Email micsommer@tuev-nord.de; dnowroth@tuev-nord.de
Date of verification	1/10/2026

The review confirmed that the LCA complies with the applicable standards and is scientifically and technically valid.

9. Disclaimer

This declaration has not been issued under a program operator and has not been verified in accordance with a PCR because none is available. The information is provided for transparency and B2B communication purposes.

10. Annexes

A. LCA Report

Aurubis AG
Corporate Environmental Protection

Tom Stückemann
Environmental Manager
t.stueckemann@aurubis.com

Daniela Cholakova
Director Environmental Protection
d.cholakova@aurubis.com