

ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH EN 15804+A2 & ISO 14025

Photoluminescence glow in the dark safety signs

Smart Signs AS



EPD HUB, HUB-4305 HUB-4308

Published on 03.11.2025, last updated on 03.11.2025, valid until 02.11.2030

Life Cycle Assessment study has been performed in accordance with the requirements of EN 15804, EPD Hub PCR version 1.2 (24 Mar 2025) and JRC characterization factors EF 3.1.

GENERAL INFORMATION

MANUFACTURER

Manufacturer	Smart Signs AS
Address	Grenseveien 99, 0663 Oslo, Norway
Contact details	info@smartsigns.no
Website	www.smartsigns.no

EPD STANDARDS, SCOPE AND VERIFICATION

Program operator	EPD Hub, hub@epdhub.com
Reference standard	EN 15804:2012+A2:2019/AC:2021 and ISO 14025
PCR	EPD Hub Core PCR Version 1.2, 24 Mar 2025
Sector	Construction product
Category of EPD	Third party verified EPD
Parent EPD number	-
Scope of the EPD	Cradle to gate with options, A4-A5, and modules C1-C4, D
EPD author	Christopher Dahl, Smart Signs
EPD verification	Independent verification of this EPD and data, according to ISO 14025: <input type="checkbox"/> Internal verification <input checked="" type="checkbox"/> External verification
EPD verifier	Vera Durão, as an authorised verifier acting for EPD Hub Limited

This EPD is intended for business-to-business and/or business-to-consumer communication. The manufacturer has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programs may not be comparable. EPDs of construction products

may not be comparable if they do not comply with EN 15804 and if they are not compared in a building context.

PRODUCT

Product name	Photoluminescence glow in the dark safety signs
Additional labels	Smart Signs, glow in the dark
Product reference	NO5000, NO6000, NO4000 series
Place(s) of raw material origin	China
Place of production	Province of Zhejiang, China
Place(s) of installation and use	Norway, Sweden, Denmark, Finland, Iceland
Period for data	01/01/2024 - 31/12/2024
Averaging in EPD	No grouping
Variation in GWP-fossil for A1-A3 (%)	-
GTIN (Global Trade Item Number)	-
NOBB (Norwegian Building Product Database)	-
A1-A3 Specific data (%)	22,5

ENVIRONMENTAL DATA SUMMARY

Declared unit	1 kg of photoluminescent signs
Declared unit mass	1 kg
Mass of packaging	kg
GWP-fossil, A1-A3 (kgCO ₂ e)	24
GWP-total, A1-A3 (kgCO ₂ e)	24,1
Secondary material, inputs (%)	5,21
Secondary material, outputs (%)	54
Total energy use, A1-A3 (kWh)	77,7
Net freshwater use, A1-A3 (m ³)	0,14

PRODUCT AND MANUFACTURER

ABOUT THE MANUFACTURER

About Us

Smart Signs AS is your trusted full-service partner for photoluminescent (glow-in-the-dark) emergency, fire and safety signage, as well as low location lighting (LLL) solutions. Since our founding in 2010 we've established ourselves as a leading provider in the Nordic region. Our reputation for expertise, fast delivery and reliable stock availability has made us a preferred supplier for developers and construction companies alike.

Our Mission

We take pride in maintaining full control over our supply chain from product innovation and quality assurance to research, development, and procurement. For over 15 years we've worked in close partnership with our long-standing manufacturing partner in China to deliver high-quality products at competitive prices. With extensive stock held in Norway, we ensure rapid dispatch and minimal lead times giving our clients a clear logistical and operational advantage.

Market Sector and Credibility

Smart Signs serves both large-scale residential and commercial developments, securing projects through competitive tenders and strong partnerships with resale distributors. We also support individual customers via our web-shops in Norway and Sweden.

Our extensive product portfolio includes all categories of emergency and fire safety signage as well as LLL (Low Location Lighting) solutions. While aluminum is our primary material, we supply signage in steel, PVC, acrylic, and various other materials to accommodate a wide range of project specifications. Our credibility, built over 15 years, is reinforced by long-standing relationships with leading developers and construction companies across the Nordic region.

Sustainability Commitment

Sustainability is a core principle of Smart Signs. We are committed to environmentally responsible practices throughout our operations from raw material sourcing and manufacturing to logistics. By minimizing our carbon footprint and continuously improving our efficiency, we aim to deliver products that meet both high-quality and environmental standards. Our goal is to provide wayfinding systems and signage that perform reliably in emergency situations clearly visible in the dark through photoluminescent technology.

Value Proposition and Deliverability

To support our professional clients, we offer direct credit accounts to fire safety companies, M&E contractors, electrical installers and construction firms. These facilities are now available not only in Scandinavia but across Europe. Our competitive pricing, combined with large in-country stockholdings, enables clients to control project costs while benefiting from fast and reliable delivery.

Our flexibility, production control and deep market understanding make us a dependable partner for commercial ventures throughout Scandinavia and beyond. With a firm commitment to innovation, quality, sustainability and client satisfaction, Smart Signs delivers high-quality signage solutions tailored to every project's needs.

PRODUCT DESCRIPTION

The Smart Signs product range in aluminum includes the NO5000 Series for photoluminescent Exit and Wayfinding signage used in emergency egress routes, the NO6000 Series for Fire Safety Equipment signage and the NO7000 Series for Low Location Lighting (LLL) applications.

Description of Technical and Functional Characteristics of Photoluminescence Products.

1. General Description

Photoluminescent exit and fire equipment signs are safety identification devices that provide continuous visibility of emergency routes, exits and fire equipment locations under all lighting conditions, including power failures. The signs absorb and store ambient light energy and automatically emit a bright, visible glow in darkness. They operate without electricity or batteries ensuring a reliable, maintenance-free safety solution compliant with international safety standards.

2. Principle of Operation

The signs are manufactured using high-performance photoluminescent pigments, typically strontium aluminate-based compounds. When exposed to light (natural or artificial), the pigments absorb and store energy. Once lighting is lost they release the stored energy as visible light, allowing exit and fire equipment signs to remain visible for several hours. The photoluminescence effect is fully reversible and can be recharged indefinitely.

3. Technical Characteristics:

Parameter	Typical Value / Range	Description
Luminance after 10 min @ 1000 lx	150 – 400 mcd/m ²	Initial brightness after standard charging
Luminance after 60 min	≥ 10 mcd/m ²	Brightness one hour after light extinction
Glow duration	3 – 12 hours	Time until luminance falls below 10 mcd/m ² (visibility threshold)

Parameter	Typical Value / Range	Description
Charging source	Natural sunlight or artificial lighting (fluorescent, LED, halogen)	Energy source for excitation
Charging time	5 – 30 minutes	Depends on light intensity and pigment formulation
Emission color	Yellow-green (520–540 nm)	High-visibility color optimized for human vision in low light
Base materials	Aluminum with photoluminescent coating	Fire-retardant and durable materials
Surface finish	Gloss or matte, anti-scratch coating	Enhances visibility and longevity
Operating temperature	-20°C to +60°C	Suitable for indoor and outdoor environments
Service life	≥ 15 years	Retains photoluminescent properties with minimal degradation
Compliance	Non-toxic, non-radioactive, RoHS and REACH compliant materials	Environmentally safe

4. Functional Characteristics

- Automatic Illumination: The signs charge automatically under ambient light and glow in darkness without external power.
- Reliability in Emergencies: Provides critical visibility during blackouts, fires or smoke-filled environments.
- Energy-Free Operation: No wiring, batteries or maintenance required.
- Luminance test: Every 3 years.
- Durable Construction: Resistant to UV radiation, humidity and temperature variations.
- High Contrast and Legibility: Clear symbols and text ensure fast recognition of escape routes and fire safety equipment.
- Easy Installation: Lightweight and simple to mount on walls, doors or ceilings with standard fixings or adhesive backing.
- Sustainability: 100% passive illumination system reducing energy consumption and maintenance waste.

5. Typical Applications

- Exit route and door signage
- Fire extinguisher and hose reel markers
- Fire alarm call point identification
- Directional arrows and evacuation path indicators
- Stairway and floor-level emergency markings

6. Standards and Certifications

Photoluminescent exit and fire equipment signs are manufactured and tested in accordance with the following international standards:

- ISO16069: Safety way guidance systems (SWGS)
- ISO7010: Graphical hazard symbols
- DIN67510: Phosphorescent pigments and products
- NS3926:2017 Norwegian standard for SWGS
- SOLAS (Safety of Life at Sea) – Chapter II-2, Rule 13.3.2.5.1
- IMO Resolution A.752(18) – “Guidelines for the Evaluation, Testing and Application of Low-Location Lighting on Passenger Ships

7. Route Signage Luminance (RSL) and Low Location Lighting (LLL)

Smart Signs photoluminescent products are designed to ensure maximum visibility and safety along evacuation routes under emergency conditions.

Route Signage Luminance (RSL) refers to the measurable brightness of exit and fire safety signage along escape routes, typically expressed in millicandela per square meter (mcd/m^2). RSL ensures that signage remains clearly visible even in complete darkness, following power failure or during smoke-filled conditions, in compliance with ISO16069, NS3926 and SOLAS II-2/13.3.2.5.1, IMO Res. A.752(18).

Low Location Lighting (LLL) complements photoluminescent signage by providing illumination at floor level along escape paths, guiding occupants safely toward exits. Combined, RSL and LLL guarantee that both signs and pathways are clearly discernible, supporting rapid evacuation and meeting international safety standards for maritime and building applications.

Signs construction

The signs are constructed with a base layer of high-quality aluminum for durability, corrosion resistance and lightweight handling. The glowing effect is created by a photoluminescent pigment based on strontium aluminate (SrAl_2O_4), a high-performance phosphorescent material. This compound is activated by rare-earth ions, specifically europium (Eu^{2+}) and dysprosium (Dy^{3+}) introduced in the form of europium oxide and dysprosium oxide. These activators enhance the pigment’s ability to absorb and store light, resulting in an exceptionally bright and long-lasting afterglow.

By combining cutting-edge materials with rigorous quality standards, Smart Signs delivers photoluminescence signage that performs when it matters most - helping to save lives through better visibility and reliable guidance. ISO 16069, DIN 67510 and NS 3926.

Performance test

Our products are tested at Rise Research Institutes of Sweden for standards ISO16069, DIN 67510 and NS3926.

Further information can be found at:

www.smartsigns.no, www.smartsigns.se

PRODUCT RAW MATERIAL MAIN COMPOSITION

Raw material category	Amount, mass %	Material origin
Metals	60%	China
Minerals	20%	China
Fossil materials	20%	China
Bio-based materials	-	-

BIOGENIC CARBON CONTENT

Product's biogenic carbon content at the factory gate

Biogenic carbon content in product, kg C	0,019
Biogenic carbon content in packaging, kg C	0,04

FUNCTIONAL UNIT AND SERVICE LIFE

Declared unit	1 kg of photoluminescent signs
Mass per declared unit	1 kg
Functional unit	N/A
Reference service life	-

SUBSTANCES, REACH - VERY HIGH CONCERN

The product does not contain any REACH SVHC substances in amounts greater than 0,1 % (1000 ppm).

PRODUCT LIFE-CYCLE

SYSTEM BOUNDARY

This EPD covers the life-cycle modules listed in the following table.

Product stage			Assembly stage		Use stage							End of life stage				Beyond the system boundaries		
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D		
X	X	X	X	X	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X		
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction/ demolition	Transport	Waste processing	Disposal	Reuse	Recovery	Recycling

Modules not declared = ND. Modules not relevant = MNR

MANUFACTURING AND PACKAGING (A1-A3)

The environmental impacts considered for the product stage cover the manufacturing of raw materials used in the production as well as packaging materials and other ancillary materials. Also, fuels used by machines and handling of waste formed in the production processes at the manufacturing facilities are included in this stage. The study also considers the material losses occurring during the manufacturing processes as well as losses during electricity transmission.

A market-based approach is used in modelling the electricity mix utilized in the warehouse in Norway.

A location-based approach is used in modelling the electricity mix utilized in the production unit. The supply of electricity comes from local grid. Chinese factories in southeast part of China have no heating in factories.

The manufacturing process begins with shaping an aluminum ingot to a size suitable for the extruder machine. Within the extruder, the ingot is heated to temperatures between 300°C and 600°C, then forged into the required shape. It is subsequently cut, stretched, and trimmed to achieve the final dimensions. The most common sizes are 150 × 300 mm, 150 × 150 mm, 200 × 200 mm and 50*1000 mm with a typical plate thickness of 0.5 mm.

After forming, the aluminum plates are coated with a white primer. They are then spray-painted using a 50/50% mixture of strontium and clear paint. Text and pictograms are applied using the silkscreen printing method. In this process the design motif is transferred onto the surface by pressing colored paint through a fine-mesh silk cloth stretched over a frame. Specific sections of the mesh are sealed allowing paint to pass only through the intended areas to create the desired pattern.

Once printed, the aluminum plates undergo final inspection and are packaged for distribution.

In terms of waste management, the handling of additional materials is integrated into the A3 stage of manufacturing waste processing. For each declared unit produced, approximately 10% aluminum waste is generated. This waste is collected and transported to a waste management facility located 10 km from the manufacturing site.

The signs are placed in corrugated cardboard boxes with plastic foam used for internal insulation to protect against impact during transport. The boxes are wrapped in waterproof paper and stacked on pallets for shipment. Freight is transported by sea in shipping containers.

Next step is packaging the finished signs for shipping to our warehouse in Norway. The signs are placed in corrugated cardboard boxes with plastic foam used for internal insulation to protect against impact during transport. The boxes are wrapped in waterproof paper and stacked on pallets for shipment. Freight is transported by sea in shipping containers.

Raw materials are coming from a variety of places in China and distances are assumed to be between 10 km and 800 km using lorry or sea transportation by ship. The manufactured products are then transported 20250 km from China to Norway using a combination of both lorry and ship transport.

Waste that is included in A3 is production losses in aluminum and the packaging from China.

The use of green energy in manufacturing is demonstrated through contractual instruments (GOs, RECs, etc.), and its use is ensured throughout the validity period of this EPD.

TRANSPORT AND INSTALLATION (A4-A5)

Transportation impacts occurred from final products delivery to construction site (A4) cover fuel direct exhaust emissions, environmental impacts of fuel production, as well as related infrastructure emissions.

Transportation impacts occurred from final products delivery to construction sites (A4) and other customers cover fuel direct exhaust emissions, environmental impacts of fuel production, as well as related infrastructure emissions.

The finished products are shipped from our factory in the province of Zhejiang, China to our main warehouse in Oslo, Norway by container ship. Upon arrival at our warehouse in Oslo, the signs are unpacked, sorted and shelved. They are then repackaged in smaller quantities using corrugated cardboard boxes and dispatched to local customers based on incoming orders.

Customer orders whether from across the Nordic region (Norway, Sweden, Denmark, Finland and Iceland) or directly from construction projects are fulfilled by repacking materials into smaller quantities and shipping them to the respective sites. In addition to deliveries, orders are often picked up directly by end-customers at our warehouse.

Our warehouse maintains a large inventory of materials to ensure availability at all times. Approximately one-third of all orders are shipped via local transportation companies, another third is delivered by our own fleet within the local area and the remaining third is collected directly from the warehouse by customers. We have calculated that on average the transportation distance for an order is 78,5 km. Most deliveries are made using electric vehicles, aligning with our sustainability goals. The transportation process does not result in any material losses.

The waste is mainly packaging materials from our warehouse in Oslo, which is deposited in local waste containers on our warehouse premises and mixed with waste from other tenants. Every week this waste is picked up and sent to incineration. The waste processing plant site is located 5 km from our warehouse.

PRODUCT USE AND MAINTENANCE (B1-B7)

The use phase is not relevant for the life cycle emissions of this product and is, therefore, not accounted for in the assessment.

Air, soil, and water impacts during the use phase have not been studied.

PRODUCT END OF LIFE (C1-C4, D)

In C1 (deconstruction) signs are removed manually or with minimal mechanical support.

In C2 (transport) dismantled signs are transported to local waste treatment or recycling facilities by electrical van for a distance of less than 10 km.

During C3 (waste processing) it is assumed that more than 90% of the aluminum is recycled, while the remaining portions are landfilled.

100% of the paint and strontium per sign goes as explained in C4 below.

In C4 (disposal) all unrecyclable components are disposed of in accordance with local regulations, using either landfill or thermal treatment to neutralize the paint and the strontium and to recirculate the aluminum. The waste processing plant is located 5 km from our warehouse. The name is Norsk Gjenvinning who specializes in recycling scrap metal.

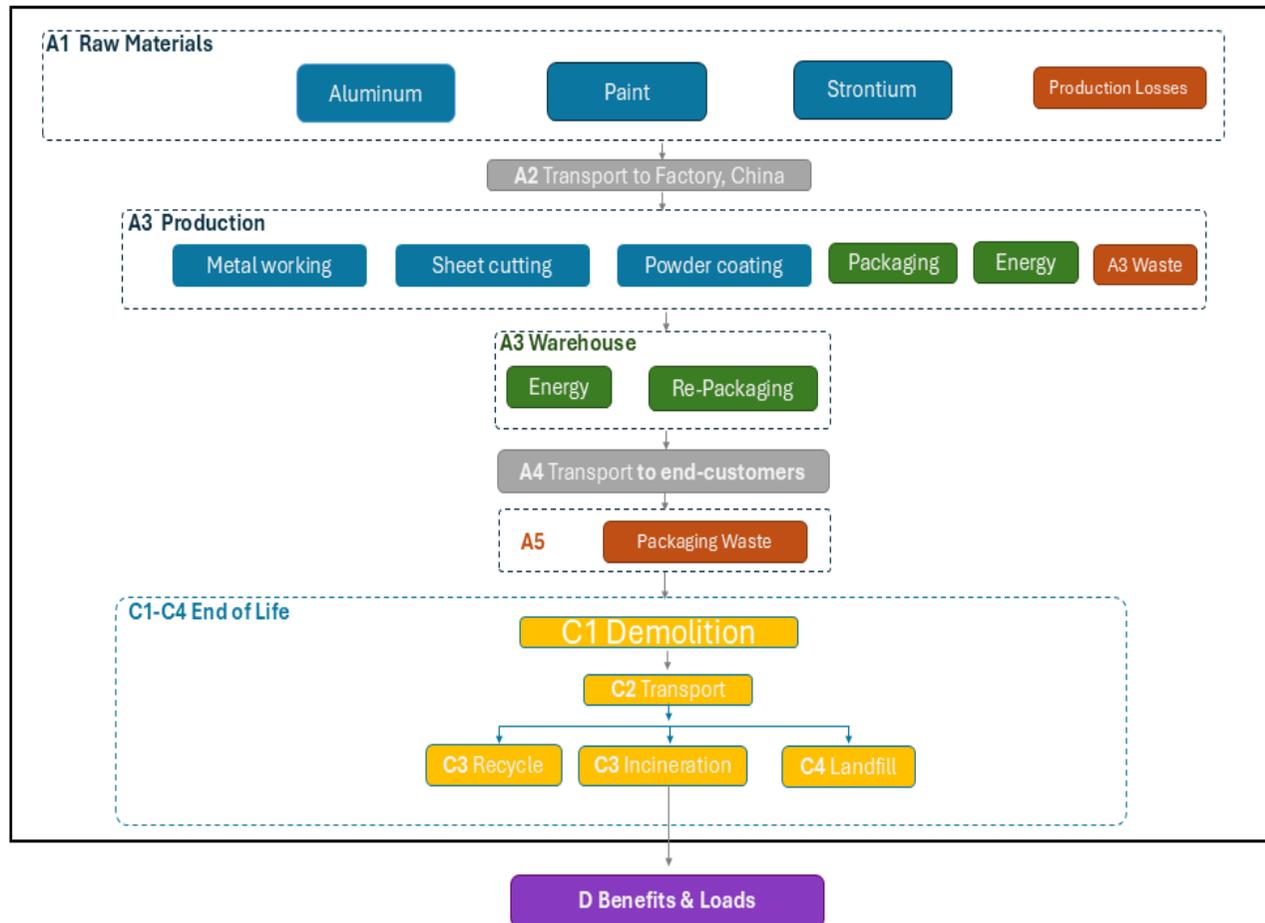
EoL of these products are in Norway as the EoL scenario is representative of waste treatment scenarios in Norway.

Module D accounts for the benefits and loads associated with material recovery and recycling at the end of life. It includes scenarios for aluminum, plastic, wood, cardboard and paper packaging. The loads are represented by

the energy used for recycling the waste materials, while the benefits are represented by the avoided production of new materials.

SYSTEM DIAGRAM

Smart Signs AS, Oslo Norway - Life-cycle diagram EPD



LIFE-CYCLE ASSESSMENT

CUT-OFF CRITERIA

The study does not exclude any modules or processes which are stated mandatory in the reference standard and the applied PCR. The study does not exclude any hazardous materials or substances. The study includes all major raw material and energy consumption. All inputs and outputs of the unit processes, for which data is available for, are included in the calculation. There are no neglected unit processes more than 1% of total mass or energy flows. The module specific total neglected input and output flows also do not exceed 5% of energy usage or mass.

The production of capital equipment, construction activities, and infrastructure, maintenance and operation of capital equipment, personnel-related activities, energy and water use related to company management and sales activities are excluded.

This LCA study includes the provision of all materials, transportation, energy and emission flows, and end of life processing of product. The use phase is not covered assuming there are no use emissions or replacements. All industrial processes from raw material acquisition and pre-processing, production, product distribution and installation, use and end-of-life management are included. For easier modelling and because of lack of accuracy in available modelling resources, some constituents under 1% of product mass are excluded. These include some ancillary materials which are used in the product manufacturing only in very small amounts and have a negligible impact on the emissions of the product. The production of capital equipment, construction activities, and infrastructure, maintenance and operation of capital equipment, personnel-related activities, energy and water use related to company management and sales activities are excluded.

VALIDATION OF DATA

Data collection for production, transport, and packaging was conducted using time and site-specific information, as defined in the general information section on page 1 and 2. Upstream process calculations rely on generic data as defined in the Bibliography section. Manufacturer-provided specific and generic data were used for the product’s manufacturing stage. The analysis was performed in One Click LCA EPD Generator, with the 'Cut-Off, EN 15804+A2' allocation method, and characterization factors according to EN 15804:2012+A2:2019/AC:2021 and JRC EF 3.1.

ALLOCATION, ESTIMATES AND ASSUMPTIONS

Allocation is required if some material, energy, and waste data cannot be measured separately for the product under investigation. All allocations are done as per the reference standards and the applied PCR. In this study, allocation has been done in the following ways:

Data type	Allocation
Raw materials	Allocated by mass or volume
Packaging material	Allocated by mass or volume
Ancillary materials	Not applicable
Manufacturing energy and waste	Allocated by mass or volume

All estimations and assumptions regarding the cut off criteria and the allocation are declared in the part “Cut-off Criteria except the estimations/assumptions below: - Module A3: Proxy data is used for certain materials during their absence from the database such as a Aluminum recycling.- Module A2, A4 & C2: Vehicle capacity utilization volume factor is assumed to be 1 which means full load. It may vary but as the role of transportation emission in total results is small, the variety in load is assumed

to be negligible. Empty returns are included as an average load factor in the ecoinvent database. Transport distances for waste transportation were assumed to be within 50 km radius- Module A4: Transportation does not cause losses as products are packaged properly. Also, volume capacity utilization factor is assumed to be 1 for the nested packaged products. Additionally, transportation distances are assumed based on an average of deliveries locally, regionally, nationally and in the Nordics minus pick-up orders from our warehouse in Oslo. We have calculated that on average the transportation distance for an order is 78,5 km.

PRODUCT & MANUFACTURING SITES GROUPING

Type of grouping	No grouping
Grouping method	N/A
Variation in GWP-fossil for A1-A3, %	N/A

LCA SOFTWARE AND BIBLIOGRAPHY

This EPD has been created using One Click LCA EPD Generator for EPD Hub V3 v3.2.3. The LCA and EPD have been prepared according to the reference standards and ISO 14040/14044. The EPD Generator uses Ecoinvent v3.10.1/3.11 and One Click LCA databases as sources of environmental data. Allocation used in Ecoinvent 3.10.1/3.11 environmental data sources follow the methodology ‘allocation, Cut-off, EN 15804+A2’.

ENVIRONMENTAL IMPACT DATA

The estimated impact results are only relative statements which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks.

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, EF 3.1

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP – total ¹⁾	kg CO ₂ e	1,88E+01	5,42E-01	4,84E+00	2,41E+01	4,59E-02	1,51E-01	ND	0,00E+00	2,12E-02	1,46E-02	1,56E+00	-4,75E+00						
GWP – fossil	kg CO ₂ e	1,85E+01	5,41E-01	4,98E+00	2,40E+01	4,59E-02	2,08E-03	ND	0,00E+00	2,12E-02	1,47E-02	1,42E+00	-4,61E+00						
GWP – biogenic	kg CO ₂ e	-7,09E-02	1,12E-04	-1,48E-01	-2,19E-01	1,03E-05	1,49E-01	ND	0,00E+00	4,80E-06	-4,38E-05	1,43E-01	-3,82E-02						
GWP – LULUC	kg CO ₂ e	3,14E-01	2,96E-04	4,02E-03	3,18E-01	1,86E-05	5,67E-07	ND	0,00E+00	9,47E-06	1,73E-05	6,48E-05	-9,98E-02						
Ozone depletion pot.	kg CFC ₋₁₁ e	1,36E-07	7,49E-09	1,10E-07	2,54E-07	9,07E-10	1,03E-11	ND	0,00E+00	3,13E-10	1,58E-10	7,24E-09	-3,66E-08						
Acidification potential	mol H ⁺ e	1,17E-01	7,62E-03	2,28E-02	1,48E-01	1,35E-04	4,16E-06	ND	0,00E+00	7,22E-05	1,57E-04	1,05E-03	-3,72E-02						
EP-freshwater ²⁾	kg Pe	5,74E-03	3,64E-05	1,05E-03	6,82E-03	3,65E-06	2,23E-07	ND	0,00E+00	1,65E-06	7,94E-06	1,48E-05	-1,41E-03						
EP-marine	kg Ne	2,11E-02	1,96E-03	5,04E-03	2,81E-02	4,24E-05	6,47E-06	ND	0,00E+00	2,37E-05	3,49E-05	1,79E-04	-4,76E-03						
EP-terrestrial	mol Ne	2,07E-01	2,17E-02	5,25E-02	2,82E-01	4,61E-04	1,35E-05	ND	0,00E+00	2,58E-04	3,93E-04	1,97E-03	-4,89E-02						
POCP (“smog”) ³⁾	kg NMVOCe	6,70E-02	6,33E-03	1,47E-02	8,81E-02	2,05E-04	5,04E-06	ND	0,00E+00	1,06E-04	1,16E-04	1,16E-03	-1,79E-02						
ADP-minerals & metals ⁴⁾	kg Sbe	5,42E-05	1,59E-06	4,35E-06	6,02E-05	2,05E-07	6,47E-09	ND	0,00E+00	5,91E-08	8,65E-07	5,32E-07	-7,50E-06						
ADP-fossil resources	MJ	1,91E+02	7,08E+00	5,97E+01	2,57E+02	6,39E-01	9,23E-03	ND	0,00E+00	3,07E-01	1,73E-01	6,40E+00	-4,40E+01						
Water use ⁵⁾	m ³ e depr.	5,07E+00	3,03E-02	7,71E-01	5,88E+00	3,66E-03	2,76E-04	ND	0,00E+00	1,52E-03	2,74E-03	2,48E-02	-3,78E+00						

1) GWP = Global Warming Potential; 2) EP = Eutrophication potential. Required characterisation method and data are in kg P-eq. Multiply by 3,07 to get PO4e; 3) POCP = Photochemical ozone formation; 4) ADP = Abiotic depletion potential; 5) EN 15804+A2 disclaimer for Abiotic depletion and Water use and optional indicators except Particulate matter and Ionizing radiation, human health. The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

ADDITIONAL (OPTIONAL) ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, EF 3.1

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Particulate matter	Incidence	1,43E-06	2,67E-08	2,89E-07	1,74E-06	2,65E-09	5,54E-11	ND	0,00E+00	2,12E-09	2,19E-09	1,17E-08	-5,06E-07						
Ionizing radiation ⁶⁾	kBq 11235a	4,85E-01	5,61E-03	6,34E-01	1,12E+00	1,20E-03	5,92E-05	ND	0,00E+00	2,68E-04	6,22E-04	2,54E-03	-3,98E-01						
Ecotoxicity (freshwater)	CTUe	1,02E+02	1,08E+00	2,31E+01	1,26E+02	1,14E-01	3,18E-02	ND	0,00E+00	4,35E-02	1,01E-01	1,25E+01	-1,11E+01						
Human toxicity, cancer	CTUh	1,11E-08	1,14E-10	6,08E-10	1,18E-08	8,47E-12	7,63E-13	ND	0,00E+00	3,50E-12	1,18E-11	2,68E-09	-5,67E-09						
Human tox. non-cancer	CTUh	1,43E-07	3,31E-09	3,02E-08	1,77E-07	3,87E-10	3,96E-11	ND	0,00E+00	1,99E-10	7,51E-10	4,53E-09	-3,93E-08						
SQP ⁷⁾	-	7,61E+01	2,21E+00	2,12E+01	9,95E+01	2,68E-01	7,03E-03	ND	0,00E+00	3,09E-01	3,28E-01	5,08E-01	-5,97E+00						

6) EN 15804+A2 disclaimer for Ionizing radiation, human health. This impact category deals mainly with the eventual impact of low-dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator; 7) SQP = Land use related impacts/soil quality.

USE OF NATURAL RESOURCES

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Renew. PER as energy ⁸⁾	MJ	2,05E+01	9,88E-02	2,73E+00	2,33E+01	1,55E-02	-4,23E-01	ND	0,00E+00	4,21E-03	2,69E-02	4,12E-02	-3,45E+01						
Renew. PER as material	MJ	1,19E+00	0,00E+00	1,26E+00	2,46E+00	0,00E+00	-1,26E+00	ND	0,00E+00	0,00E+00	0,00E+00	-1,19E+00	1,93E-01						
Total use of renew. PER	MJ	2,17E+01	9,88E-02	3,99E+00	2,58E+01	1,55E-02	-1,69E+00	ND	0,00E+00	4,21E-03	2,69E-02	-1,15E+00	-3,43E+01						
Non-re. PER as energy	MJ	1,90E+02	7,08E+00	5,93E+01	2,56E+02	6,39E-01	-2,72E-02	ND	0,00E+00	3,07E-01	1,73E-01	-1,32E+00	-4,40E+01						
Non-re. PER as material	MJ	8,39E-01	0,00E+00	1,79E-01	1,02E+00	0,00E+00	-1,79E-01	ND	0,00E+00	0,00E+00	0,00E+00	-8,39E-01	1,22E-01						
Total use of non-re. PER	MJ	1,91E+02	7,08E+00	5,95E+01	2,57E+02	6,39E-01	-2,07E-01	ND	0,00E+00	3,07E-01	1,73E-01	-2,16E+00	-4,39E+01						
Secondary materials	kg	5,21E-02	3,62E-03	4,91E-02	1,05E-01	3,50E-04	1,59E-05	ND	0,00E+00	1,31E-04	2,01E-04	2,55E-03	6,05E-01						
Renew. secondary fuels	MJ	1,79E-03	3,17E-05	2,11E-02	2,29E-02	3,79E-06	9,31E-08	ND	0,00E+00	1,66E-06	9,12E-06	3,93E-06	-1,48E-04						
Non-ren. secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	ND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00						
Use of net fresh water	m ³	1,16E-01	8,12E-04	2,72E-02	1,44E-01	1,01E-04	-5,37E-06	ND	0,00E+00	4,54E-05	7,57E-05	4,33E-04	-8,13E-02						

8) PER = Primary energy resources.

END OF LIFE – WASTE

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Hazardous waste	kg	3,50E+00	1,26E-02	5,52E-01	4,06E+00	9,97E-04	1,63E-04	ND	0,00E+00	5,21E-04	1,35E-03	1,65E-02	-1,49E+00						
Non-hazardous waste	kg	5,04E+01	2,23E-01	5,67E+00	5,63E+01	2,42E-02	1,84E-02	ND	0,00E+00	9,64E-03	3,80E-02	4,36E-01	-5,98E+00						
Radioactive waste	kg	1,19E-04	1,38E-06	1,56E-04	2,76E-04	3,00E-07	1,51E-08	ND	0,00E+00	6,55E-08	1,53E-07	6,20E-07	-8,65E-05						

END OF LIFE – OUTPUT FLOWS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	ND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00						
Materials for recycling	kg	0,00E+00	0,00E+00	3,88E-02	3,88E-02	0,00E+00	2,24E-02	ND	0,00E+00	0,00E+00	5,40E-01	0,00E+00	0,00E+00						
Materials for energy rec	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	ND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00						
Exported energy	MJ	0,00E+00	0,00E+00	1,13E-01	1,13E-01	0,00E+00	1,59E-02	ND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00						
Exported energy – Electricity	MJ	0,00E+00	0,00E+00	4,75E-02	4,75E-02	0,00E+00	6,60E-03	ND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00						
Exported energy – Heat	MJ	0,00E+00	0,00E+00	6,54E-02	6,54E-02	0,00E+00	9,30E-03	ND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00						

ENVIRONMENTAL IMPACTS – EN 15804+A1, CML

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Global Warming Pot.	kg CO ₂ e	1,87E+01	5,39E-01	4,95E+00	2,42E+01	4,56E-02	4,76E-03	ND	0,00E+00	2,11E-02	1,46E-02	1,41E+00	-4,64E+00						
Ozone depletion Pot.	kg CFC ₁₁ e	1,21E-07	5,97E-09	7,95E-08	2,06E-07	7,23E-10	8,39E-12	ND	0,00E+00	2,49E-10	1,31E-10	5,76E-09	-3,14E-08						
Acidification	kg SO ₂ e	9,83E-02	6,06E-03	1,86E-02	1,23E-01	1,04E-04	3,17E-06	ND	0,00E+00	5,51E-05	1,26E-04	8,72E-04	-3,20E-02						
Eutrophication	kg PO ₄ ³ e	2,80E-02	7,80E-04	2,76E-03	3,15E-02	2,71E-05	4,52E-06	ND	0,00E+00	1,34E-05	1,80E-05	9,39E-05	-2,10E-03						
POCP (“smog”)	kg C ₂ H ₄ e	8,05E-03	3,33E-04	1,12E-03	9,50E-03	9,88E-06	8,97E-07	ND	0,00E+00	4,91E-06	7,47E-06	6,89E-05	-2,97E-03						
ADP-elements	kg Sbe	5,10E-05	1,55E-06	4,29E-06	5,68E-05	1,99E-07	6,34E-09	ND	0,00E+00	5,76E-08	8,63E-07	4,79E-07	-6,32E-06						
ADP-fossil	MJ	1,83E+02	6,99E+00	4,88E+01	2,39E+02	6,18E-01	8,20E-03	ND	0,00E+00	3,03E-01	1,64E-01	6,36E+00	-3,83E+01						

ADDITIONAL INDICATOR – GWP-GHG

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP-GHG ⁹⁾	kg CO ₂ e	1,88E+01	5,42E-01	4,98E+00	2,44E+01	4,59E-02	2,08E-03	ND	0,00E+00	2,12E-02	1,47E-02	1,42E+00	-4,71E+00						

9) This indicator includes all greenhouse gases excluding biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. In addition, the characterisation factors for the flows – CH₄ fossil, CH₄ biogenic and Dinitrogen monoxide – were updated. This indicator is identical to the GWP-total of EN 15804:2012+A2:2019 except that the characterisation factor for biogenic CO₂ is set to zero.

SCENARIO DOCUMENTATION

DATA SOURCES

Manufacturing energy scenario documentation

1. Electricity, medium voltage, residual mix, Norway, Ecoinvent, 0.62 kgCO₂e/kWh
2. Market for electricity, medium voltage, eastChinaGrid, Ecoinvent, 0.86 kgCO₂e/kWh

Transport scenario documentation - A4 (Transport resources)

1. Transport, freight, lorry 3.5-7.5 metric ton, EURO5, 78,5 km

Transport scenario documentation A4

Scenario parameter	Value
Capacity utilization (including empty return) %	50
Bulk density of transported products	0,00E+00
Volume capacity utilization factor	1

Installation scenario documentation - A5 (Installation waste)

1. Treatment of waste polyethylene, for recycling, unsorted, sorting, Ecoinvent, Materials for recycling, 3.6E-4 kg
2. Treatment of waste polyethylene, municipal incineration, Ecoinvent, 3.3E-4 kg
3. Exported Energy: Electricity, Ecoinvent, 0.0023 MJ
4. Exported Energy: Electricity, Ecoinvent, 0.0043 MJ
5. Exported Energy: Thermal, Ecoinvent, 0.0031 MJ
6. Exported Energy: Thermal, Ecoinvent, 0.0062 MJ
7. Treatment of waste polyethylene, sanitary landfill, Ecoinvent, 2.1E-4 kg
8. Treatment of waste paperboard, unsorted, sorting, Ecoinvent, Materials for recycling, 0.022 kg
9. Treatment of waste packaging paper, municipal incineration, Ecoinvent, 0.0022 kg
10. Treatment of waste packaging paper, sanitary landfill, Ecoinvent, 0.0024 kg

Use stages scenario documentation - C1-C4 (Data source)

1. Sorting and pressing of iron scrap, Ecoinvent, Materials for recycling, 0.54 kg
2. Treatment of waste aluminum, sanitary landfill, Ecoinvent, 0.061 kg
3. Treatment of waste paint, hazardous waste incineration, Ecoinvent, 0.39 kg
4. Treatment of waste paint, sanitary landfill, Ecoinvent, 0.0039 kg

Scenario information	Value
Scenario assumptions e.g. transportation	Transport 250 km recycling, transport 50 km to landfill, transport 150 km to incineration

THIRD-PARTY VERIFICATION STATEMENT

EPD Hub declares that this EPD is verified in accordance with ISO 14025 by an independent, third-party verifier. The project report on the Life Cycle Assessment and the report(s) on features of environmental relevance are filed at EPD Hub. EPD Hub PCR and ECO Platform verification checklist are used.

EPD Hub is not able to identify any unjustified deviations from the PCR and EN 15802+A2 in the Environmental Product Declaration and its project report.

EPD Hub maintains its independence as a third-party body; it was not involved in the execution of the LCA or in the development of the declaration and has no conflicts of interest regarding this verification.

The company-specific data and upstream and downstream data have been examined as regards plausibility and consistency. The publisher is responsible for ensuring the factual integrity and legal compliance of this declaration.

The software used in creation of this LCA and EPD is verified by EPD Hub to conform to the procedural and methodological requirements outlined in ISO 14025:2010, ISO 14040/14044, EN 15804+A2, and EPD Hub Core Product Category Rules and General Program Instructions.

Verified tools

Tool verifier: Magaly Gonzalez Vazquez

Tool verification validity: 27 March 2025 - 26 March 2028

Vera Durão, as an authorised verifier acting for EPD Hub Limited
03.11.2025

