Environmental Product Declaration

In accordance with ISO 14025:2006 for:

Hydrogen peroxide (H_2O_2)

from Nouryon

EPD registration number:	S-P-11034
Publication date:	2023-10-11
Valid until:	2028-10-11

Programme information

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	S-P-11034
Publication date:	2023-10-11
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Programme:	The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com info@environdec.com

Product category rules (PCR):
Name: Basic chemicals product category
PCR 2021:03
Version 1.1
UN CPC code(s): Group 3428

PCR review was conducted by:
The Technical Committee of the International EPD® System. A full list of members available on www.environdec.com. The review panel may be contacted via info@environdec.com.
Chair of the PCR review: Lard-Gunnar Lindfors

Independent third-party verification of the declaration and data, according to ISO 14025:2006:

☐ EPD process certification ☒EPD verification

Third party verifier:
Damien Prunel, LCIE Bureau Veritas

Approved by: The International EPD® System

Procedure for follow-up of data during EPD validity involves third party verifier:

☒ Yes ☐ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programmes may not be comparable.

- An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com.
- This EPD is in conformity with ISO14025:2006
- EPDs within the same product category but from different programmes may not be comparable.

Company information

Owner of the EPD:
Petra Kreij, Product Manager HPPhone: +46706644266
Email: petra.kreij@nouryon.com
Address: Gamlestadsvägen 18 B-C, 415 02 Göteborg, Sweden

Description of the organisation:
Nouryon is a global specialty chemicals leader, providing essential chemicals to manufacturing of everyday products such as construction materials, paper, food, pharmaceuticals, and personal care items. With its about 7,800 employees Nouryon operates in over 80 countries around the world. Sustainability is a cornerstone of the overall strategy to achieve long-term success in Nouryon and the focus is on providing innovative and sustainable solutions that meet customers need, while also improving the company's environmental performance and maximizing the positive societal impact.
Further information on www.nouryon.com

Product-related or management system-related certifications:
ISO 14001:2015 certification for: Rjukan, Bohus, Alby
ISO 14001:2015 certification for: Columbus
ISO 9001:2015 certification for: Rjukan, Bohus, Alby
ISO 9001:2015 certification for: Columbus
GMP (good manufacturing practice) compliance certification for: Rjukan, Bohus
EcoVadis Platinum rating for: Nouryon company

Name and location of production site:
Nouryon Pulp and Performance Chemicals AB: Albyfabrikerna, Albyvägen 65, 841 44 Alby (Sweden)
Nouryon Pulp and Performance Chemicals AB; Nouryon AB: Färjevägen 1, 445 80 Bohus (Sweden)
Nouryon Pulp and Performance Chemicals Norway AS: Svaddeveien 119, 3660 Rjukan (Norway)
Nouryon Chemicals LLC: 4374 Nashville Ferry Road, East, 39702 Columbus, MS (United States)

Product information

Product names
Hydrogen peroxide (H_2O_2)

Product identification
CAS 7722-84-1

Product description
Hydrogen peroxide (H_2O_2) is produced from hydrogen (H_2) and atmospheric oxygen (O_2). Hydrogen is a by-product from manufacturing of sodium chlorate, but can also be produced from propane or natural gas in steam reformers or via water in electrolysers.
The most common method today for producing hydrogen peroxide is the anthraquinone auto-oxidation process. An anthraquinone solution (an organic solvent) continuously circulates in a closed loop and is the carrier for the controlled reaction between hydrogen and oxygen, with a catalyst.

First, hydrogen gas is added and the solvent is hydrogenated. Second, oxygen from the air is added so oxidation takes place and hydrogen peroxide is formed. Third, hydrogen peroxide is extracted from the solvent with water and distilled to the desired concentration, varying from 19-70 wt%. The concentrated hydrogen peroxide solution is stabilised by the addition of small quantities of substances, which give some tolerance towards accidental contamination. Before the organic solvent can be reused in the first step, water is removed in a last drying step. Hydrogen peroxide from Nouryon is supplied as an aqueous solution at a concentration between 19 and 70 wt%.

Hydrogen peroxide is used as an oxidizing agent in the bleaching of both mechanical and chemical pulps, supporting elemental chlorine free (ECF) bleaching and as the main product in totally chlorine free (TCF) bleaching methods. Hydrogen peroxide is also used by many other industries as a speciality oxidant; such applications include water and metal treatment, textile bleaching and even as a pharmaceutical.

UN CPC code: Group 342 (Basic inorganic chemicals) – Class 3428

Other codes for product classification:
CPV 24315300-8 (hydrogen peroxide)
UNSPSC 51473503 (Carbamide peroxide or hydrogen peroxide)
NACE 20.13 (Manufacture of other inorganic basic chemicals)

Geographical scope: Global
The hydrogen peroxide product is produced for world-wide distribution

LCA information

The Environmental performance was calculated using LCA (life cycle assessment).

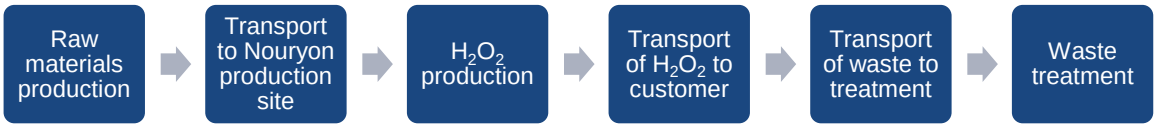
Declared unit:
All environmental impacts are calculated using the declared unit of "1 kg of a 49% solution of hydrogen peroxide in water", ready for delivery, as prescribed in the PCR of basic chemicals.

Reference service life: not applicable for this product category

Time representativeness:
Site-specific data for the year 2020 was collected from Nouryon through a questionnaire and from Enablon, including information about the production processes, transport and end-of-life.

Database(s) and LCA software used:
The software GaBi version 10.5.1.124 is used to perform the LCA. Background data is sourced from Ecoinvent 3.7.1 (2020). The temporal correlation is as of the documentation of the respective used processes. The datasets representativeness is within 10 years of the reference year.

System diagram:



Description of system boundaries:
All major steps from the extraction of natural resources to transport of the product to the customer are included in the environmental performance of the manufacturing phase (cradle-to-gate plus transport to customer).

Upstream activities

- Raw material supply: This life cycle stage includes the production process of raw materials. The bill of materials (BOM) is supplied by Nouryon. None of the materials in the BOM are listed in the "Candidate List of Substances of Very High Concern for authorisation" by ECHA.

Core activities

- Transport of raw materials: This life cycle stage includes the transport of raw materials to the Nouryon production factory gate. Specific data regarding the transport mode and distances were communicated by Nouryon or, if not available, a distance of 1000 km via truck was assumed.
- Production: This life cycle stage describes the production process of H_2O_2. Specific and generic data on utilities, freshwater consumption and emissions generated was obtained by Nouryon via direct measurement. During this life cycle stage hazardous and non-hazardous waste is generated which is incinerated or sent to landfill. The transport mode and distance for waste were communicated by Nouryon.

Downstream activities

- Transport of product to customers: This life cycle stage describes the transport of the H_2O_2 product from the production site to the main customer. Specific data regarding the transport mode and distances were communicated by Nouryon.

Excluded lifecycle stages:
The use stage of the chemical product is excluded due to a strong variation in possible applications of H_2O_2.
End-of-life treatment of the chemical product is excluded because all of the following criteria are fulfilled:

- the product is physically integrated with other products in subsequent life-cycle process so they cannot be physically separated from them at end of life,
- the product or material is no longer identifiable at end-of-life as a result of a physical or chemical transformation process,
- the product or material does not contain biogenic carbon, and
- the EPD shall not be used for business-to-consumer communication.

More information:
The environmental indicators of the H_2O_2 product are presented as the weighted average of the four production sites, based on the production volume of each production site.

Content Declaration

Product

Materials / chemical substances	m%	Environmental / hazardous properties
Hydrogen peroxide (H_2O_2)	49	H302: Harmful if swallowed H332: Harmful if inhaled H315: Causes skin irritation H318: Causes serious eye damage H335: May cause respiratory irritation H413: May cause long lasting harmful effects to aquatic life
Water	51	None
Stabilizer	0.04	H290: May be corrosive to metals H318: Causes serious eye damage
Corrosion inhibitor	0.02	H272: May intensify fire, oxidizer H319: Causes serious eye irritation

Packaging

Distribution packaging: the H_2O_2 product is transported in bulk, so there is no packaging.

Consumer packaging: n.r.

Recycled material

Prevalence of recycled materials (pre-consumer or post-consumer) in the product:
Not relevant for this product category

Environmental performance

Potential environmental impact

PARAMETER	UNIT	Upstream	Core	Downstream	TOTAL
Global warming potential (GWP) – fossil	kg CO_2 eq.	2.06E-01	3.24E-01	8.38E-02	6.14E-01
Global warming potential (GWP) – biogenic	kg CO_2 eq.	5.76E-05	9.95E-04	4.02E-04	1.45E-03
Global warming potential (GWP) – land use and land use transformation	kg CO_2 eq.	7.06E-05	3.47E-05	4.21E-05	1.48E-04
Global warming potential (GWP) – total	kg CO_2 eq.	2.06E-01	3.25E-01	8.43E-02	6.15E-01
Acidification potential (AP)	mol H+ eq.	4.23E-04	9.20E-04	4.62E-04	1.81E-03
Eutrophication potential (EP) – aquatic freshwater	kg P eq.	3.76E-05	4.47E-05	1.06E-05	9.29E-05
Eutrophication potential (EP) – aquatic marine	kg N eq.	5.26E-05	1.67E-04	1.61E-04	3.80E-04
Eutrophication potential (EP) – terrestrial	Mol N eq.	5.30E-04	1.62E-03	1.75E-03	3.90E-03
Photochemical ozone creation potential (POCP)	kg NMVOC eq.	2.18E-04	5.08E-04	5.02E-04	1.23E-03
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	1.45E-08	3.45E-08	1.71E-08	6.62E-08
Abiotic depletion potential (ADP) – Minerals and metals	kg Sb eq.	3.77E-07	1.79E-07	3.12E-07	8.68E-07
Abiotic depletion potential (ADP) – Fossil resources	MJ	2.84E+00	6.52E+00	1.27E+00	1.06E+01
Water deprivation potential (WDP)	m^3 eq.	1.58E-02	-4.26E-02	9.48E-03	-1.74E-02

Use of resources

PARAMETER		UNIT	Upstream	Core	Downstream	TOTAL
Primary energy resources – Renewable	**Use as energy carrier**	MJ, net calorific value	2.80E-02	1.48E+00	3.11E-02	1,54E+00
	Used as raw materials	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0,00E+00
	TOTAL	MJ, net calorific value	2.80E-02	1.48E+00	3.11E-02	1,54E+00
Primary energy resources – Non-renewable	**Use as energy carrier**	MJ, net calorific value	2.84E+00	6.52E+00	1.27E+00	1,06E+01
	Used as raw materials	MJ, net calorific value	3.65E-05	5.52E-06	2.26E-05	6,46E-05
	TOTAL	MJ, net calorific value	2.84E+00	6.52E+00	1.27E+00	1,06E+01
Secondary material		kg	0,00E+00	0.00E+00	0.00E+00	0.00E+00

Renewable secondary fuels	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-renewable secondary fuels	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m^3	3,69E-04	-2.62E-02	2.21E-04	-2.56E-02

Waste production

PARAMETER	UNIT	Upstream	Core	Downstream	TOTAL
Hazardous waste disposed	kg	0.00E+00	4.70E-03	0.00E+00	4.70E-03
Non-hazardous waste disposed	kg	0.00E+00	6.99E-04	0.00E+00	6.99E-04
Radioactive waste disposed	kg	0.00E+00	8.77E-06	0.00E+00	8.77E-06

Output flows

PARAMETER	UNIT	Upstream	Core	Downstream	TOTAL
Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, electricity	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Interpretation

In most impact categories the largest contributor is the core stage, followed by the the upstream and downstream stages.

For global warming potential (GWP), the impacts in the upstream stage are caused by raw materials, mainly hydrogen, followed by aluminium oxide and, to a lesser extent, phosphonic acid and anthraquinone. Which of the utilities contribute to the GWP of the core stage depends on the practices of the production site, such as steam, fuels or emissions. The GWP in the downstream stage is caused by the transport of the product.

Looking at the other impact categories, acidification potential (AP), eutrophication potential (EP), ozone depletion potential (ODP) and photochemical ozone creation potential (POCP) all show a similar distribution of the impact between the life cycle stages as GWP. However, for abiotic depletion potential (ADP), a greater percentage of the impacts can be attributed to the upstream stage where aluminium oxide and anthraquinone contribute the most.

Aluminium oxide and anthraquinone also contribute the most to the upstream stages of AP, EP, and POCP. In the core stage, the use of fuels and steam contribute to AP, EP, ODP and POCP. Also, hydrogen production contributes significantly to all impact categories. Lastly, transport of the product in the downstream stage contributes in particular to impact categories such as ADP elements, AP, EP and POFP.

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