



ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025:2006 for:

LIQUID EPOXY RESIN

based on renewable Epichlorohydrin



Spolek pro chemickou a hutní výrobu, akciová společnost

Programme:

The International EPD® System

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Fully international

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ABOUT THIS EPD®

INTRODUCTION

At SPOLCHEMIE, we have a strong sense of responsibility towards our customers, employees, society and the environment. We focus on production of materials with positive environmental impact. We are constantly working to minimize the adverse effect of industrial manufacturing on the communities where we live and work.

We generate Life-Cycle Assessment (LCA) studies as we want to understand the environmental performance of our products. To communicate results of LCAs to the public in a clear and understandable way and ensure transparency regarding the environmental impact, we publish Environmental Product Declarations, EPD®s.

WHAT IS AN EPD®?

An Environmental Product Declaration EPD® provides transparent information about the environmental performance of a product. In the case of this publication, the results refer to SPOLCHEMIE's liquid epoxy resin **EnviPOXY®** produced from renewable glycerin-based epichlorohydrin starting material (hereinafter LER-G).

DEVELOPMENT OF THIS EPD®

Both the EPD® and the underlying LCA study have been developed and third-party-verified in accordance with the Product Category Rules (PCRs) for basic organic chemicals within the framework of the International EPD® system and its general programme instructions for type III environmental declarations according to ISO 14025.

This EPD® covers the "Cradle to Gate" stage.

REFERENCE PRODUCT CATEGORY RULES DOCUMENTS

The reference documents for this EPD® are General Programme Instructions (GPI 2013) and Product Category Rules (The International EPD® System IEPDS 2012). Product Category Rules are specified for specified information modules "gate-to-gate", so called core modules. The structure and aggregation level of the core modules is defined by the United Nation Statistics Division - Classification Registry CPC codes (<http://unstats.un.org>). For more information visit www.environdedec.com.

Unequivocal identification of the product according to the CPC classification system: CPC Division 341 is Basic organic chemicals (subclass 3417).

DATA COLLECTION

The reference period to this EPD® is year 2016. The data used in the present study is a combination of measured and calculated data. Specific data refers to 2016 have been collected directly from the SPOLCHEMIE plant. Generic data used were taken from the ILCD and Ecoinvent database.

DESCRIPTION OF FUNCTIONAL AND DECLARED UNIT

According to the PCR, the functional (F.U.) / declared unit (D.U.) is 1000 kg of the product – LER-G. No packaging of the final product was assessed, as no specific packaging for this product is used.

COMPARABILITY OF RESULTS

To be able to compare EPD®s within this product category, they have to be based on this particular PCR. EPD®s from different programmes may not be comparable.

DESCRIPTION OF UNDERLYING LCA-BASED INFORMATION

The LCA calculations rules used for this declaration outlines the overall requirements to follow for the International EPD® System. These rules follow the international standards ISO 14040 and ISO 14044. The underlying LCA study was conducted in the year 2017 (Kočí 2017).

VALIDITY OF EPD®

If changes in any of the environmental impacts are larger than +- 5% the EPD® shall be adjusted. Regardless, the EPD® shall be reviewed every three years. Next review is planned in year 2021.

TERMS USED

Environmental product declaration according to ISO14025: “Type III environmental declarations provide quantified environmental data using predetermined parameters and, where relevant, additional environmental information. The predetermined parameters are based on the ISO 14040 series of standards, which is made up of ISO 14040 and ISO 14044. The additional environmental information may be quantitative or qualitative.

Life-cycle assessment (LCA) according to ISO 14040: “Compilation and evaluation of the inputs, outputs and the potential environmental impact of a product system throughout its life cycle.”

Product category rules (PCR) according to ISO 14025: “A set of specific rules, requirements and guidelines for developing Type III environmental declarations for one or more product categories.”

Functional unit (FU) according to ISO 14040: “The quantified performance of a product system for use as a reference unit“

OUR COMPANY

SPOLCHEMIE, Spolek pro chemickou a hutní výrobu, akciová společnost is a leading European manufacturer of synthetic resins, chlor-alkali-based products and chlorine derivatives with sales of € 161 million in the financial year 2016. We have 160 years history of continuous chemical production including 55 years of experience in manufacture of epoxy resins.

The liquid epoxy resin **EnviPOXY®** manufactured from glycerin-based epichlorohydrin is produced in SPOLCHEMIE plant located in Ústí nad Labem, Czech Republic. Our Ústí production plant which includes R&D facility and head office is located in an area of 520,000 m² where we employ more than 800 people. Main activities of the company are research and development, production and processing of chemical and biochemical products and trading on these products.

SPOLCHEMIE manufactures about 500 products within the main product profiles:

chlor-alkali based products	sodium and potassium hydroxide, chlorine, hydrochloric acid, sodium hypochlorite
chlorine derivatives	epichlorohydrin, allylchloride, perchloroethylene
synthetic resins	basic and modified low, medium, and high molecular epoxy resins, alkyd and polyester resins, water soluble resins, including also hardeners, reactive diluents and special epoxy systems

All our processes and operations are certified in accordance with **ISO 9001** (Quality Management Systems), **ISO 14001** (Environmental Management Systems) and **BS OHAS 18001** (Occupational Health & Safety Management System) and the commitment of whole company's employees to quality give the customers a guarantee of a standard quality of products.

SPOLCHEMIE, as a member of Association of Chemical Industry of the Czech Republic has obtained **RESPONSIBLE CARE** in chemical industry certificate and is oriented for enhancement of environmental and health and safety.

Further, SPOLCHEMIE was awarded GOLD MEDAL rating in **EcoVadis Corporate Social Responsibility**, (CSR) in 2017. The EcoVadis assessments covers four themes: Environment, Labor Practices & Human Rights, Fair Business Practices and Sustainable Procurement. The 21 issues are based upon international CSR standards such as the Ten Principles of the UN Global Compact, the International Labour Organization (ILO) conventions, the Global Reporting Initiative (GRI)'s standards, the ISO 26000 standard, the CERES Roadmap, and the UN Guiding Principles (Ruggie Framework).

OUR PRODUCT

This EPD[®] is for the product of liquid epoxy resin produced from glycerin-based epichlorohydrin ("LER-G") traded under the name **EnviPOXY[®]** or **CHS-EPOXY[®] G**.

Liquid epoxy resin is intermediate product for a number of organic syntheses. Through its properties as toughness, adhesion, chemical resistance, heat and electrical resistance the epoxy resins are used in a wide variety of application and industries – for manufacturing of coating compositions and especially protective coatings, in construction and civil engineering (masonry primers, insulation and coating compositions, flooring, polymer concretes and polymer mortars, jointing compounds, putty coats, and joint cements), in electronical and electrotechnical industry (insulators, transformers, printed circuit boards), in automotive industry, and in other industries. The epoxy resins are dedicated for tooling, embedding, casting and moulding, producing of laminates, adhesives and composites. Resin based composite materials are used in construction of building, electro industry and consumer goods industry (sport and leisure equipment).

The declaration refers to EnviPOXY[®] / CHS-EPOXY[®] products summarized below:

Table 1: EnviPOXY[®] / CHS-EPOXY[®] product specification

PRODUCT	DESCRIPTION	VISCOSITY [Pa.s /25°C]	E- INDEX [mol/kg]	EEW [g/mol]	HYDR. CHLORINE [%]	NON- VOLATILE SUBSTANCES [2h/140°C]	COLOUR APHA Pt-Co [Hazen]
		EN ISO 12058-1	EN ISO 3001	EN ISO 3001	ASTM D 1726	EN ISO 3251	EN ISO 6271-2
EnviPOXY [®] (CHS-EPOXY [®]) G 510	Low molecular weight liquid epoxy resin based on bisphenol A, containing no modifiers with bio-carbon content of 28 % w/w	12.5 - 16.0	5.18 - 5.46	183 - 193	max. 0.03	min. 99.5	max. 200
EnviPOXY [®] (CHS-EPOXY [®]) G 520		12.0 - 14.5	5.208 - 5.495	182 - 192	max. 0,03	min. 99.5	max. 100
EnviPOXY [®] (CHS-EPOXY [®]) G 525		10.0 - 12.0	5.291 - 5.586	179 - 189	max. 0,03	min. 99.5	max. 100
EnviPOXY [®] (CHS-EPOXY [®]) G 530		8.0 - 10.0	5.38- 5.68	176 - 186	max. 0,03	min. 99.5	max. 100

E- Index = Epoxy Index, **EEW** = Epoxy Equivalent Weight, **Hydr. Chlorine** = Hydrolyzable Chlorine Content

CONTENT OF MATERIALS AND CHEMICAL SUBSTANCES

The hazardous chemical substances included in the products manufactured by SPOLCHEMIE plant is the following: Liquid epoxy resin – 100%.

The product is a pure chemical compound: Oxirane, 2,2'-[(1-methylethylidene)bis (4,1-phenyleneoxymethylene)]bis / 2,2'-[(1-methylethylidene)bis (4,1- phenyleneoxymethylene)]bisoxirane (CAS 1675-54-3).

Classification of the substance according to 1272/2008/EC: Skin Irrit.2: H315, Skin Sens.1: H317, Eye Irrit.2: H319, Aquatic Chronic 2: H411.

Classification of the substance according to 67/548/EHS, 199/45/ES: Xi; N, R36/38, R43, R51/53, S2, S24, S28, S37/39, S61.

BIO CARBON CONTENT

Sequestered biogenic carbon as defined by ASTM D 6866-06 is 28 % w/w.



SYSTEM BOUNDARIES AND PRODUCTION PROCESS

The system boundaries of the industrial system considered are “cradle to gate” covering all the phases from raw materials extraction to final production. In detail, the system comprises: core raw material production, epichlorohydrin (ECH) production, liquid epoxy resin (LER-G) production, treatment of off-gases in incinerator, treatment of waste organics in industrial waste water treatment plant and treatment of other waste waters in biological waste water treatment plant.

Upstream processes include the following inflow of raw materials and energy wares needed for the production of the product:

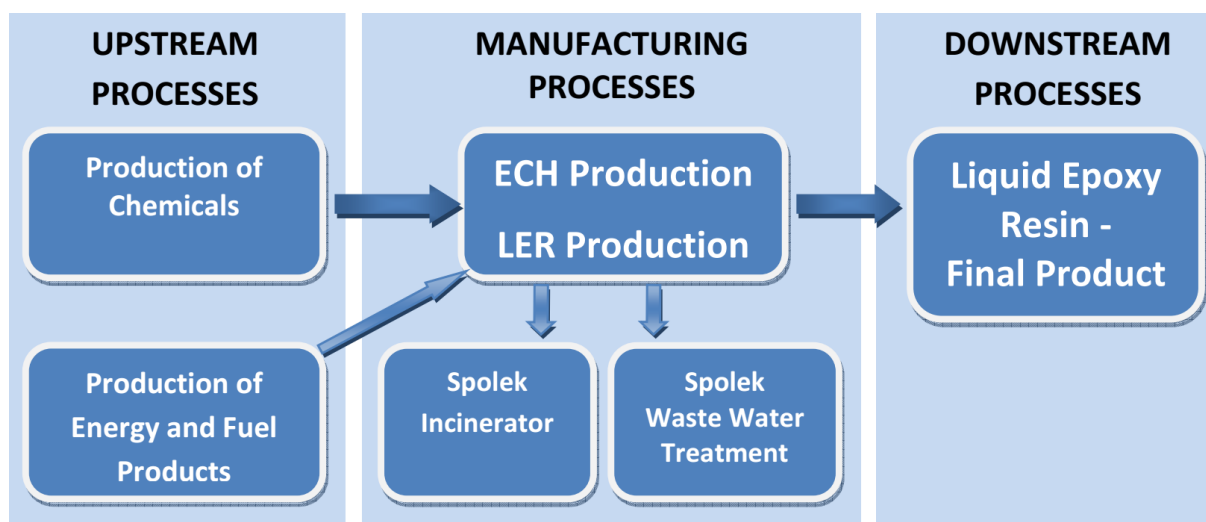
- Extraction of resources
- Transport of resources to refinement and transport of materials to manufacturer
- Refinement of resources
- The production processes of energy wares used in the extraction, refinement and manufacturing
- Production of auxiliary products used such as detergents for cleaning etc.

Core processes include:

- Manufacturing of the liquid epoxy resin, LER-G
- Storage
- Treatment of waste generated from the manufacturing of main parts and assembly of the product

Downstream processes: Post-production processes. Downstream processes are not relevant as no packaging of final product is realized as transport to customers is realized in tanks.

Table 2: System Boundaries



DATA QUALITY

All relevant data of core processes are of specific quality. Data used for calculation of upstream module are selected generic. All data used were relevant for year 2016. Data set needed for calculation was complete.

DESCRIPTION OF MANUFACTURING PHASE

Liquid epoxy resins, LER-G are produced from glycerin-based epichlorohydrin and bisphenol A in the presence of an alkaline agent. The intermediate adduct arising in the first step (which is etherification) is further dehydrochlorinated to result in formation of diglycidyl ether of bisphenol A with two epoxy rings in the molecule. The purity of the final product depends on the reaction conditions and the design of the production unit. The epichlorohydrin is the main raw material used for the LER-G production. The LER-G production has been subdivided into six phases: etherification, first dehydrochlorination, second dehydrochlorination, neutralization / washing, concentration and filtration. Final product is analyzed and transferred into the storage tanks.

DESCRIPTION OF USE PHASE

Liquid epoxy resin is sold to customers all over the world and ends up in different chemical syntheses. The product is not considered to contribute to an increased environmental load during the use phase and it will eventually end up together with other chemical waste.

RECYCLING AND END-OF-LIFE INFORMATION

Since the product is located at the beginning of several sectors, end-of-life scenarios of liquid epoxy resin, LER-G are not included in this declaration.



RESULT OF THE STUDY - ENVIRONMENTAL PERFORMANCE

The environmental parameters are declared for upstream and core processes. All environmental performance is reported per declared unit, i.e. per 1000 kg of LER-G.

USE OF MATERIAL AND ENERGY RESOURCES

Table 3 and Table 4 reports the main consumption of resources for LER-G production. Use of resources without energy content is expressed in kg/D.U. The use of resources with energy content is expressed in MJ/D.U. All energy data are expressed as gross caloric value (The International EPD[®]System IEPDS 2012).

Table 3: Resources consumption associated with the LER-G EnviPOXY[®] manufacturing phase.

RESOURCE CONSUMPTION		TOTAL	UPSTREAM MODULE	CORE MODULE
NON-RENEWABLE ENERGY RESOURCES [kg/D.U.]	Crude oil (resource)	738	726	12
	Hard coal (resource)	137	137	0
	Lignite (resource)	1 210	1 282	-72
	Natural gas (resource)	538	539	0
	Peat (resource)	0.112	0.111	0.002
	Uranium (resource)	0.008	0.008	0.000
	TOTAL	2 624	2 684	-60
MATERIAL RESOURCES * [kg/D.U.]	Dolomite	7.774	7.764	0.010
	Limestone (calcium carbonate)	234	236	-2
	Phosphate ore	111	111	0
	Potashsalt, crude (hard salt, 10% K ₂ O)	192	192	0
	Sodium chloride (rock salt)	262	263	-1
	Sylvite (25% in Sylvinite)	0.0000173	0.0000173	0.000
	TOTAL	806.8	809.8	-3
RENEWABLE RESOURCES [m ³ /D.U.]	Water	1 638	1 602	36.6
	Fresh water	3 463	3 477	-13
	Ground water	7 177	7 258	-81
	Lake water	307	306	0
	TOTAL	12 585	12 643	-58

* Life Cycle consumption of selected resources and materials consumed in significant amount (per D.U.).

Table 4: Resources consumption associated with the LER-G EnviPOXY[®] manufacturing phase.

RESOURCE CONSUMPTION [MJ/D.U.]		TOTAL	UPSTREAM MODULE	CORE MODULE
FLOWS		104 206	92 825	11 382
RESOURCES		89 343	89 650	-307
ENERGY RESOURCES		89 300	89 607	-307
NON RENEWABLE ENERGY RESOURCES	Crude oil (resource)	31 408	30 890	518
	Hard coal (resource)	3 680	3 676	3
	Lignite (resource)	14 229	15 093	-863
	Natural gas (resource)	23 960	23 977	-18
	Peat (resource)	0.944	0.931	0.013
	Uranium (resource)	4 282	4 263	19
	TOTAL	77 560	77 900	-340
RENEWABLE ENERGY RESOURCES	Energy, calorific value, in organic substance	0.240	0.240	0.000
	Energy, gross calorific value, in biomass, primary forest	0.017	0.017	0.000
	Energy, kinetic (in wind), converted	0.024	0.024	0.000
	Energy, potential (in hydropower reservoir), converted	0.203	0.203	0.000
	Energy, solar, converted	0.000	0.000	0.000
	Primary energy from geothermics	2.39	2.35	0.03
	Primary energy from hydro power	349	347	2
	Primary energy from solar energy	10 871	10 841	29
	Primary energy from waves	0.001	0.001	0.000
	Primary energy from wind power	518	516	2
	TOTAL	11 740	11 707	33
ELECTRICITY CONSUMPTION DURING MANUFACTURING				1 780

RESULT OF THE STUDY - POTENTIAL ENVIRONMENTAL IMPACT

Table 5 and Table 6 reports results of environmental impacts resulted from characterization (The International EPD® System IEPDS 2012) of one metric ton of LER-G production.

Table 5: Impact category indicators of LER-G EnviPOXY®. Data are referred to 1 ton of LER-G.

IMPACT CATEGORY	UNIT per D.U.	TOTAL	UPSTREAM MODULE	CORE MODULE
Abiotic Depletion (ADP elements)	kg Sb-Eq.	0.006	0.006	0.000
Abiotic Depletion (ADP fossil)	MJ	72 100	72 400	-353
Acidification Potential (AP)	kg SO ₂ -Eq.	11.70	11.40	0.29
Eutrophication Potential (EP)	kg Phosphate-Eq.	3.920	2.960	0.959
Global Warming Potential (GWP 100 years)	kg CO ₂ -Eq.	3 160	3 180	-23
Ozone Layer Depletion Potential (ODP, steady state)	kg CFC11-Eq.	0.000044	0.000043	0.000001
Photochem. Ozone Creation Potential (POCP)	kg Ethene-Eq.	11.20	0.92	10.30

Table 6: Waste production. Data referred to kg/D.U.

TYPE OF FLOW	TOTAL	UPSTREAM MODULE	CORE MODULE
Radioactive waste	1.595	1.588	0.007
Hazardous waste (deposited)	0.0004	0.0001	0.0003
Waste (deposited)	52.92	51.27	1.65
Material subject for recycling:			90.3

CONTACT INFORMATION



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REFERENCES

GPI (2013). General Programme Instruction for The International EPD System, version 2.01. Stockholm, The International EPD Consortium (IEC).

Kočí, V. (2017). LCA study of liquid epoxy resin produced from ECH based on glycerin 2017. Praha, Česká republika, Spolchemie.

The International EPD® System IEPDS (2012). PCR 2011:17 CPC Division 341 Basic Organic Chemicals, The International EPD® System.

This issue replaces all previous versions.

This declaration is publicly available on www.environdec.com and www.cenia.cz

GLOSSARY

IMPACT CATEGORY	DESCRIPTION
ADP: Abiotic Depletion	is an environmental impact category, measuring the extraction of primary resources, such as minerals, metals and fossil fuels. The unit is indicated in Antimony equivalents for ADP for non-fossil sources and in MJ for fossil sources.
AP: The Acidification Potential	is an index for the emissions of acid-forming substances whereby the acidification of soil and water results through the forming of acids by oxygen. The unit is indicated in SO ₂ equivalents.
EP: The Eutrophication Potential	is an index which describes the enrichment of nutrients in soil and water; thus it is an indicator of overfertilization. The unit is indicated in PO ₄ ³⁻ equivalents.
ODP: The Ozone Depletion Potential	evaluates the reduction of the ozone layer through anthropogenic emissions. The unit of the index is indicated in R11 equivalents (CCl ₃ F-eq. = trichloro- fluoromethane equivalents).
GWP₁₀₀: The Global Warming Potential	is an index for the calculation of the anthropogenic part of the global greenhouse effect. The unit is indicated in kg CO ₂ equivalents. Due to the fact that gases only stay for a time in the atmosphere, the GWP is calculated for a period of 100 years.
POCP: The Photochemical Ozone Creation Potential	is an index for ozone creation in the troposphere (summer smog). The unit is indicated in ethene equivalents.

VERIFICATION AND REGISTRATION

See PCR for detailed requirements.

PCR moderator:	Karin Sanne, AkzoNobel, karin.sanne@akzonobel.com
PCR review was conducted by:	The Technical Committee of the International EPD® System. info@environdec.com
Independent verification of the declaration and data, according to ISO 14025:	☐ EPD® process certification ☐ internal ☒ external
Third party verifier:	Barbora Vlasatá, Certification Body for EPD® Výzkumný ústav pozemních staveb - Certifikační společnost, s.r.o. Pražská 16, 102 21 Praha 10, Czech Republic www.vups.cz
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