



ENVIRONMENTAL PRODUCT DECLARATION

In agreement with ISO 14025:2006



**ENVIRONMENTAL PRODUCT DECLARATION OF LIQUID EPOXY RESIN
PRODUCED FROM EPICHLORHYDRIN BASED ON GLYCERINE**

REV. 0 Date 16th March 2010

Number:

Organization:	Spolek pro chemickou a hutní výrobu, akciová společnost (The record in the Company Register (effective from 31.12. 1990) was ordered by the District Court in Ústí nad Labem (27.12. 1990, f.m. Sa 47)	Registration No. / VAT No. 00011789 / CZ699001352
Address	Revoluční 1930/86 400 32 Ústí nad Labem, Czech Republic	
Statutory body	François Vleugels, director general	
EPD representative	Ing. Tomáš Loubal, production manager	
Contact	Phone: +420 47 716 2363 Fax: +420 477 163 244 e-mail: resins@spolchemie.cz	www.spolchemie.cz

Product:	Liquid epoxy resins (LER) made from glycerin (CAS 25068-38-6)	
Use:	The epoxy resins are used in a wide variety of applications. Through its properties as toughness, adhesion, chemical resistance, heat resistance and electrical resistance they are used for protective coatings, floorings, tooling, potting, casting and molding, production of electronic laminates, adhesives and composites, in civil engineering and the automotive industry.	
Weight /kg/:	LER is liquid, volume and weight depends of customer	
Product lifetime /days/:	The products are under warranty for 365 days - 1 year. If the product is stored under producer recommended condition, the product lifetime is approximately 3 years.	
Hazardous substance contents:	Yes/ No	
UN CPC:	CPC Division 34: Basic chemicals (subclass 3417)	

1 PROGRAMME RELATED INFORMATION

1.1 NAME OF THE PROGRAMME AND PROGRAMME OPERATOR

Programme operator for the international EPD® system is the International EPD Consortium (IEC)
Vasagatan 15-17, Stockholm, Sweden
Postal address: Vasagatan 15-17, SE-111 20 Stockholm
Telephone: +46 8 700 66 90
Telefax: +46 8 700 66 99
E-mail: info@environdec.com
WWW: www.environdec.com

1.2 THE REFERENCE PCR DOCUMENT

The reference documents for this EPD are General Programme Instructions (GPI, 2008) and Product Specific Requirement for Chemical Products (PCR 2000:5, 2000) actualized by (PCR Basic Module, in preparation). Product Category Rules (PCR) 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>). EPDs from different programmes may not be comparable.

1.3 REGISTRATION NUMBER

The registration number of this EPD is: XXX

1.4 DATE OF PUBLICATION AND VALIDITY

The publication date of this EPD is: XX.XX.2010
This EPD is valid until: XX.XX. 2013

1.5 GEOGRAPHICAL SCOPE OF APPLICATION OF EPD

The geographical scope of this EPD is fully international.

1.6 INFORMATION ABOUT THE YEAR OR REFERENCE PERIOD OF THE UNDERLYING DATA TO THE EPD

The reference period to this EPD is year 2008. Data shown below refers to 2008 and have been collected directly from the Spolchemie plant. Other data used from the GaBi database (PE International, 2010) were taken.

2 PRODUCT RELATED INFORMATION

Trade name of product: **CHS-EPOXY 510, CHS-EPOXY 520, CHS-EPOXY 525 and CHS-EPOXY 530**
Liquid epoxy resins (LER) made from glycerin (CAS 25068-38-6)
Unequivocal identification of the product according to the CPC classification system: **CPC Division 34: Basic chemicals** (subclass 3417).

2.1 SPECIFICATION OF THE COMPANY

The liquid epoxy resin is produced in Spolek pro chemickou a hutní výrobu, akciová společnost (Spolchemie) located in Ústí nad Labem, Czech Republic.

Spolek pro chemickou a hutní výrobu, akciová společnost, Revoluční 1930/86, 400 32 Ústí nad Labem, Czech Republic. Registration No. / VAT No. 00011789 / CZ699001352.

The company is recorded in the Company Register kept by the Regional Court in Ústí nad Labem, Section B, File 47. (The record in the Company Register (effective from 31.12. 1990) was ordered by the District Court in Ústí nad Labem (27.12. 1990, f.m. Sa 47). Tel.: +420 +477 161 111, fax: +420 +477 163 333.

Main activities of the Company are Research, Development, Production and processing of chemical and biochemical products and sales of these products.

Spolchemie manufactures about 500 products within three main product profiles:

Chlor-alkali based compounds	Sodium and potassium hydroxide (soda and potash lye). Chlorine, hydrochloric acid, sodium hypochlorite. Epichlorohydrin, allylchloride.
Special Inorganic compounds	Potassium permanganate. Aluminium oxide, synthetic sapphire.
Synthetic resins	Basic and modified low, medium, and high molecular epoxide resins. Alkyd and polyester resins. Rosin based resins. Water soluble resins.

2.2 INTENDED USE

Epoxy resins are used in a wide variety of applications, due to their unique and desirable properties for example toughness, adhesion, chemical resistance, heat resistance and electrical resistance. They are used for protective coating, flooring, tooling, potting, casting and molding, production of laminates, adhesives and composites, in civil engineering and the automotive industry. Final resin based compositions are used in the building, the electrical and electronic Industries and the consumer goods industry. Synthetic resins are used for the manufacture of coating compositions, in the building industry (masonry primers, insulation and coating compositions, self levelling floorings, polymer concrete and polymer mortars, jointing compounds, putties, and fillers), in the electrical and electronic industries, consumer goods, and in other industries.

2.3 SPECIFICATION OF THE PRODUCT

This EPD is for production of liquid epoxy resin (CAS 25068-38-6) which is sold on the international market. Liquid epoxy resin is an intermediate product for a number of organic syntheses.

2.4 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 (CAS 25068-38-6).

Classification of the substance: Xi; N, R36/38, R43, R51/53, S2, S24, S28, S37/39, S61

2.5 LIFE CYCLE ASSESSMENT AND ENVIRONMENTAL PERFORMANCE

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 international EPD®system has adopted an LCA calculations procedure which is separated into different life cycle stages:

- Upstream processes (from cradle-to-gate)
- Manufacturing processes (from gate-to-gate)
- Downstream processes (from gate-to-grave)

The study is mainly aimed to evaluate carbon footprint following with other environmental impacts due to the production of liquid epoxy resin in order to support the communication of the Spolchemie environmental performances. For this study the Life Cycle Assessment method was used which is regulated by the international standards ISO 14040 (ISO 14040, 2006) and ISO 14044 (ISO 14044, 2006). The reference LCA study for this EPD is LER G LCA (Kočí, 2010).

The product system for this LCA has been described by using specific data when available; generic data have been used in accordance with PCR and GPI requirements.

2.6 FUNCTIONAL/DECLARED UNIT

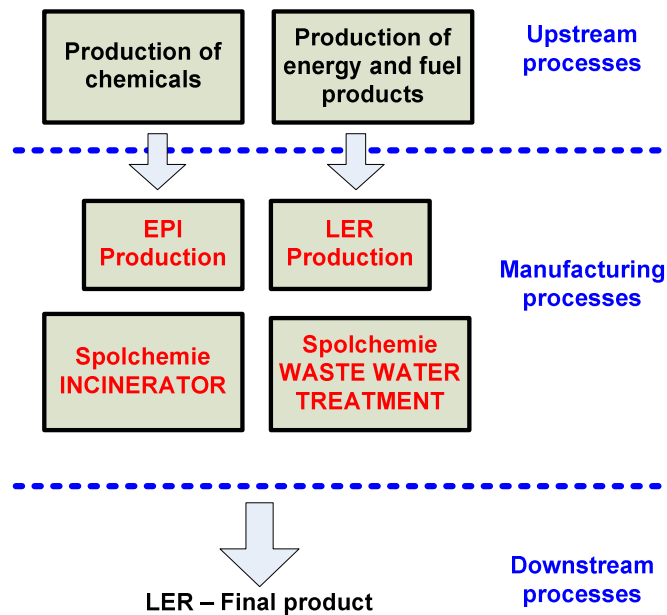
According to the PCR (PCR 2000:5, 2000), the functional/declared unit is 1000 kg of the product – liquid epoxy resin. No packaging of the final product was assessed, as no specific packaging for this product is used.

The total 2008 liquid epoxy resin production resulted in a value of about 38 500 tons that corresponds to 38 500 DU. The capacity of Spolchemie plant is production of 60 000 tons per year that corresponds to 60.000 DU.

2.7 SYSTEM BOUNDARIES

The boundaries of the industrial system considered include all the phases from raw materials extraction to final production. In detail, the system comprises: core raw material production, liquid epoxy resin production, epichlorohydrin production, treatment of off gases in incinerator, treatment of waste organic in industrial waste water treatment plant use phase and treatment of other waste waters in biological waste water treatment plant. As stated in GPI (GPI, 2008) all elementary flows at resource extraction are included, except for the flows that fall under the general 1% cut off rule.

Figure 1 System boundaries



The upstream processes include the following inflow of raw materials and energies needed for the production of the product (PCR Basic Module, 2008):

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

The core processes include (PCR Basic Module, 2008):

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

Downstream processes defined in GPI (GPI, 2008) are not relevant as no packaging of final product is realized as transport to costumers in tanks is realized.

2.8 DESCRIPTION OF MANUFACTURING PHASE

Liquid epoxy resins (LER) are produced from epichlorohydrin and bisphenol A in the presence of an alkali catalyst (NaOH). The intermediate arisen in this first step is dehydrochlorinated and a new epoxy ring is formed. The purity of final product depends on the reaction conditions and the design of the production unit. The epichlorohydrin is the main raw material used for the liquid epoxy resin production. The LER production has been subdivided into six phases: Etherification, first dehydrochlorination, second dehydrochlorination, neutralization and washing, concentration and finally filtration. The product is analyzed and then transferred into storage tanks.

2.9 TRANSPORT DATA

The delivery from suppliers is carried out by truck, train and/or pipeline. As the Spolchemie plant is located in Ústí nad Labem, where other chemical plants are operated, some chemicals are produced on site. Transport of other chemicals was modeled using GaBi databasis (PE International, 2010).

2.10 DESCRIPTION OF USE PHASE

Liquid epoxy resin is sold to customers all over the world and ends up in different chemical syntheses for different applications. Epoxy resins are typically used in anticorrosive paint applications and in structural applications to reduce weight for example in the automotive or aerospace industries. Thus epoxy resins will typically significantly reduce carbon usage during their use phase either by extending the life of the product they protect or increasing fuel efficiency.

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.

2.11 RECYCLING AND END-OF-LIFE INFORMATION

Since the product is located at the beginning of several sectors, end of life scenarios are not included in this declaration.

3 ENVIRONMENTAL PERFORMANCE-RELATED INFORMATION

The environmental parameters are declared for up-stream processes and for core processes (manufacturing). Inclusion of use phase into declaration is not reasonable, as stated above. As stated in reference PCR basic module for Basic chemicals (PCR Basic Module, 2008) the environmental performance of the product is divided on use of resources, potential impacts and other indicators. All environmental performance is reported per declared unit.

3.1 USE OF RESOURCE

Table 1 reports the main consumption of resources for liquid epoxy resin 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 net caloric value. Electricity consumption during manufacturing (core) processes is expressed in kWh/D.U. (PCR Basic Module, 2008).

Table 1 Resource consumption associated with the liquid epoxy resin manufacturing phase. Data are referred to D.U.

	Unit	Upstream processes	Core processes	Total
Non-renewable resources				
Material resources				
Sodium chloride (rock salt)	kg/D.U.	4,29E+02	3,01E+01	4,59E+02
Crude oil for material production	kg/D.U.	1,01E+03	0,00E+00	1,01E+03
Other material (non energy) resources	kg/D.U.	6,09E+03	5,41E+03	1,15E+04
Energy resources (used for energy conversion purposes)				
Non renewable energy resources (Total)	MJ/D.U.	9,19E+04	1,94E+04	1,11E+05
Crude oil (resource)	MJ/D.U.	4,62E+04	1,08E+03	4,73E+04
Hard coal (resource)	MJ/D.U.	5,14E+03	1,08E+04	1,59E+04
Lignite (resource)	MJ/D.U.	3,04E+03	3,69E+03	6,72E+03
Natural gas (resource)	MJ/D.U.	3,14E+04	1,79E+03	3,32E+04
Uranium (resource)	MJ/D.U.	6,02E+03	2,03E+03	8,05E+03
Renewable resources				
Water	liter/D.U.	4,13E+03	2,56E+04	2,97E+04
Energy resources (used for energy conversion purposes)				
Renewable energy resources	MJ/D.U.	1,70E+04	1,47E+02	1,72E+04
Primary energy from hydro power	MJ/D.U.	3,87E+02	1,09E+02	4,96E+02

Primary energy from solar energy	MJ/D.U.	1,64E+04	4,12E+01	1,64E+04
Primary energy from wind power	MJ/D.U.	2,95E+02	-3,83E+00	2,91E+02
Renewable fuels	MJ/D.U.	8,51E-03	9,50E-05	8,60E-03
Wood	MJ/D.U.	4,50E-01	6,25E-02	5,13E-01
Electricity consumption (electricity consumption during manufacturing)	kWh/D.U.	-	544,92	544,92

3.2 POTENTIAL ENVIRONMENTAL IMPACT

The reported results of environmental impacts resulted from characterization models recommended by EPD® programme (PCR Basic Module, 2008) of liquid epoxy resin production. Total pollutant emissions from the operations included in the system boundaries are as potential environmental impacts.

Table 2 Main environmental results associated with the liquid epoxy resin manufacturing phase using EPD characterization (MSR 1999:2, 2000). Data are referred to D.U.

	Upstream processes	Core processes	Total
Acidification Potential (AP) [mol H ⁺ -Equiv./D.U.]	3,73E+02	4,83E+02	8,56E+02
Eutrophication Potential (EP) [kg O ₂ Equiv./D.U.]	1,82E+02	1,39E+02	3,21E+02
Global warming potential (GWP 100 years) [kg CO ₂ -Equiv./D.U.]	1,59E+03	3,01E+03	4,60E+03
Ozone Layer Depletion Potential (ODP, 20y) [kg CFC11-Equiv./D.U.]	5,54E-05	1,63E-04	2,18E-04
Photochem. Ozone Creation Potential (POCP) [kg Ethene-Equiv./D.U.]	6,60E-01	1,44E+00	2,10E+00

Table 3 Main environmental results associated with the liquid epoxy resin manufacturing phase using CML 2001 characterization with respect to (PCR Basic Module, 2008). Data are referred to D.U.

	Upstream processes	Core processes	Total
Acidification (AP) [kg SO ₂ -Equiv./D.U.]	1,55E+01	1,20E+01	2,75E+01
Eutrophication (EP) [kg Phosphate-Equiv./D.U.]	3,56E+00	4,03E+00	7,59E+00
Global Warming (GWP 100 years) [kg CO ₂ -Equiv./D.U.]	3,03E+03	1,60E+03	4,63E+03
Ozone Layer Depletion (ODP, steady state) [kg CFC11-Equiv./D.U.]	1,61E-04	5,48E-05	2,16E-04
Photochemical Ozone Creation (POCP) [kg Ethene-Equiv./D.U.]	1,44E+00	6,60E-01	2,10E+00

3.3 OTHER INDICATORS

3.3.1 MATERIAL SUBJECT FOR RECYCLING

During the production of D.U. of liquid epoxy resin 49,55 kg of hydrochloric acid HCl (24,1 % w/w) as waste product is collected and sent for recovery.

3.3.2 HAZARDOUS AND OTHER WASTE

Hazardous waste is defined by regional directives. In different regions substances of different properties are characterized as hazardous waste. For purpose of this EPD only waste and hazardous waste from core processes located in Spolchemie, Czech Republic are reported.

Table 4 Hazardous and other wastes. Data are referred to D.U.

	kg/D.U.
Hazardous waste - total	29,49
Sludge [Hazardous waste]	23,32
Gel for solidification [Hazardous waste]	6,18
Other waste	0,00

3.3.3 TOXIC SUBSTANCES

Emission of toxic substances is expressed in kg/D.U.

Table 5 Emissions of toxic substances. Data are referred to D.U.

kg/D.U.	Upstream processes	Core processes	Total
Heavy metals to air	3,60E-03	1,41E-03	5,00E-03
Group NMVOC to air	3,12E+00	1,45E-01	3,26E+00
Group PAH to air	8,93E-04	5,24E-05	9,45E-04
Halogenated organic emissions to air	2,15E-04	7,19E-05	2,87E-04
Heavy metals to fresh water	5,24E-01	5,44E-01	1,07E+00
Halogenated organic emissions to fresh water	1,37E-06	1,78E-07	1,54E-06
Heavy metals to sea water	9,72E-03	1,92E-04	9,91E-03
Heavy metals to agricultural soil	2,54E-01	0,00E+00	2,54E-01
Heavy metals to industrial soil	5,94E-02	2,85E-03	6,22E-02

4 ADDITIONAL ENVIRONMENTAL INFORMATION

Obtained certificates **EN ISO 9001** and **14001**, and the commitment of whole company's staff to quality give the customers a guarantee of a standard quality of products. Spolchemie has established and applied a combined management system for development, production, sales and services of products of Inorganic, Specialities and Resins. An audit was performed, Report No. 015619. Proof has been furnished that the requirements according to DIN EN ISO 9001:2000 and ISO 14001:2004 are fulfilled.

Spolchemie has established and applied an Occupational Health & Safety Management System for development, production, sales and services of products of Inorganic, Resins and Dyestuff sections. An audit was performed, Report No. 060021. Proof has been furnished that the requirements according to **OHSAS 18001:1999** are fulfilled.

Obtained certificates **RESPONSIBLE CARE**, in chemical industry. Spolchemie are oriented for enhancement of environmental, health and safety.

Spolchemie also produces LER by the traditional production route from propylene. We have completed a study on the environmental impact of LER based on propylene using the same EPD methodology. The propylene route to LER used in Spolchemie is comparable to the route used for the vast majority of LER production worldwide. Comparison of the environmental impact data of the LER produced by the two processes gives the following differences. LER produced by the Spolchemie proprietary glycerine route has generally much lower environmental impact than LER produced from propylene. Differences are approximately: 50% lower values for Global Warming potential and Ozone Layer depletion potential and 75% lower values for Acidification potential and Photochemical Ozone Creation. 1000kg of LER produced from glycerine by the Spolchemie process produces around 4000kg LESS carbon dioxide than 1000kg produced by the conventional propylene process.

5 MANDATORY STATEMENT

The same products environmental declarations from different programmes need not to be comparable. Downstream processes are excluded what is in relation to (GPI, 2008).

5.1 MEANS OF OBTAINING EXPLANATORY MATERIALS

For information about this environmental declaration:

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Tel.: +420 47 716 2363

e-mail: loubal@spolchemie.cz

For information on Spolchemie contact:

Tel.: 420 477 161 111

e-mail: info@spolchemie.cz

5.2 REFERENCES

The main references used to prepare this EPD are:

- Product Category Rules for Chemical products (PSR 2000:5, 2000) with respect to PCR Basic Module for Basic Chemicals (PCR Basic Module, in preparation).
- Kočí, V. (2010) LCA study of liquid epoxy resin produced from ECH based on glycerin, Praha (Kočí, 2010).
- General Programme Instructions for EPD, 2008-02-29;
- Announcement of Rules of the National Eco-Labeling Programme publication, Official Journal of the Ministry of the Environment of the Czech Republic, annual vol. XVII, vol. 8, 2007

5.3 VALIDITY OF THE 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 2013.

This declaration was generated by doc. Ing. Vladimír Kočí, Ph.D. e-mail: Vladimir.Koci@vscht.cz

Independent verification of the declaration and data accordance to ISO 14025:2006:

internal external

Programme:	EPD [®] system (www.environdec.com)
Verification procedure:	ISO 14025: 2006 Environmental labels and declarations – Type III environmental declarations – principle and procedures General Programme Instructions for Environmental Product Declarations, EPD, version 1.0 Rules of the National Eco-Labeling Programme
Product category rules (PCR):	Chemical products (PSR 2000:5, 2000), version 1.0 Swedish Environmental Management Council, Vasagatan 15-17, SE-111 20 Stockholm

Výzkumný ústav pozemních staveb - Certifikační společnost, s.r.o., (Building Research Institute – Certification Company, Ltd.) – Certification Body for EPD verification no. 3013 accredited by Czech Accreditation Institute made independent verification of EPD in 27th April 2010 in agreement with ISO 14025:2006. The certificate results from the Final report no. P-3013EPD-10-0234 from 1st June 2010 that includes certification body ascertaining and validity conditions of the certificate.

The verified EPD has reg. no. 3013EPD-10-0234-01.

Registration number	3013EPD - 10 - 0234 from 1 st June 2010
Certified validity	to 1 st June 2013 Výzkumný ústav pozemních staveb - Certifikační společnost, s.r.o., Pražská 16, 102 21 Praha 10 – Hostivař, Czech Republic tel.: 271751148 fax: 241017241 e-mail: votockova@vups.cz
Contact	

1st June 2010

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Tereza Votočková
Head of Certification Body

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stamp

Distributed to:
No. 1 Spolek pro chemickou a hutní výrobu, akciová společnost
No. 2 Certification Body
No. 3 Mgr. Tereza Votočková, head of Certification Body
No. 4 CENIA