SAFETY DATA SHEET
PURE DIETHYL OXALATE

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Chemical name:	**Diethyl oxalate**
Registration no.:	**01-2119880854-24-0000**
Index number:	**607-147-00-5**
EC (EINECS) number:	**202-464-1**
CAS number:	**95-92-1**
Other names of the substance:	**Oxalic acid diethyl ester**, **Diethyl ethanedionate**

1.2 Relevant identified uses of the substance or mixture and uses advised against

Uses of the substance: **Diethyl oxalate is used especially as a starting material of so-called oxalate syntheses used in many areas, such as in pharmaceutical industry (production of steroids, barbiturates), in dyeing industry (Tartrazin dyestuff), in production of pesticides and other specialised chemicals (the overview of exposure scenarios is set out in Annex 1).**

Uses advised against: **Not established.**

1.3 Details of the supplier of the safety data sheet

Name: **BorsodChem MCHZ, s.r.o.**

Name or business name: **BorsodChem MCHZ, s.r.o.**

Place of business or headquarters: **Chemická 2039/1, 709 00 Ostrava - Mariánské Hory, Czech Republic**

Identification number: **26019388**

Telephone: **+420 596 641 111**

Fax: **+420 596 642 040**

E-mail of the technically competent person responsible for the safety data sheet: **zsvobodova@bc-mchz.cz**

1.4 Emergency telephone number

Company telephone number: **+420 596 643 221 or 596 620 794 non-stop**

24-hours emergency contact CHEMTREC: 001-703-527-3887, company code CCN 206 072

The National Poisons Information Service (NPIS), City Hospital, Birmingham, B18 7QH, UK
Tel: +44 121 507 4123, fax: +44 121 507 5580, e-mail: allistervale@npis.org, www.npis.org

National Capital Poison Center, 3201 New Mexico Ave, Suite 310 Washington, DC 20016
Emergency Line: 1-800-222-1222, fax: 202-362-8377, e-mail: pc@poison.org, www.poison.org

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

According to Regulation (EC) no. 1272/2008:

Acute Tox. 4; H302 Harmful if swallowed.

Skin Corr. 1B; H314 Causes severe skin burns and eye damage.

Eye Irrit. 2; H319 Causes serious eye irritation.

STOT RE2; H373 May cause damage to kidneys through oral prolonged or repeated exposure.

The most important human health adverse effects during use of the substance or preparation: **Harmful if swallowed. Causes severe skin burns and eye damage. May cause damage to kidneys through oral prolonged or repeated exposure.**

The most important adverse effects to environment during use of the substance/preparation: **Not specified.**

2.2 Label elements

According to Regulation (EC) no. 1272/2008:

Symbols:

Signal word: **DANGER**

H phrases:

H302 Harmful if swallowed.

H314 Causes severe skin burns and eye damage.

H319 Causes serious eye irritation.

H373 May cause damage to kidneys through oral prolonged or repeated exposure.

P phrases:

P201 Obtain special instructions before use.

P280 Wear protective gloves/protective clothing/eye protection/face protection.

P301+P330+P331 IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.

P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P308+P313 IF exposed or concerned: Get medical advice/ attention.

P501 Dispose of contents/ container to in accordance with national regulation.

2.3 Other hazards

The substance is not identified as persistent, bio-accumulative and toxic (PBT) or very persistent, very bio-accumulative (vPvB) under Annex XIII of Regulation 1907/2006/EC.

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Chemical name	**Diethyl oxalate**
Index number	**607-147-00-5**
EC No.	**202-464-1**
CAS No.	**95-92-1**
Substance content (% w.)	**min. 99.5**
Synonyms	**Oxalic acid diethyl ester**, **Diethyl ethanedionate**

Impurities: **< 1 % w., CMR impurities < 0.1 % w.**

3.2 Mixtures

The product is a chemical substance.

SECTION 4: First aid measures

4.1 Description of first aid measures

Inhalation: **Discontinue exposure immediately, transfer the victim to fresh air, loosen clothing, remove contaminated clothing. Protect the victim against chill and call medical help!**

If on skin: **Remove immediately contaminated clothing, wash affected skin area with plenty of preferably lukewarm water. If no injury to skin occurred, it is possible to use soap, soap solution or shampoo. Call a physician!**

If in eyes: **Rinse immediately and thoroughly with plenty of cold or lukewarm water for at least 10 minutes, open eyelids (even by force). If the victim wears contact lenses, remove them immediately. Seek immediately a medical specialist!**

If swallowed: **DO NOT INDUCE VOMITING – *even induction of vomiting may cause complications (inhalation of the substance into airways and lungs, mechanical damage to mucous membranes of pharynges may, in this case, represent higher health risk than the swallowed substance).* If possible, administer 5 broken pills of medicinal charcoal. Call a physician immediately!**

4.2 Most important symptoms and effects, both acute and delayed

Irritating in contact with skin; if swallowed, irritating to stomach mucous membranes and causing drop of concentration of calcium ions in organism which reflects itself in function of central nervous system and the heart's action. Possibility of damage to kidneys.

4.3 Indication of any immediate medical attention and special treatment needed

The intoxication picture is given by progressive release of oxalic acid from the substance. That is why it is necessary to administer intravenously calcium gluconate and to check function of kidneys. It is necessary to keep sufficient diuresis. Symptomatic therapy or even haemodialysis. Digitalis is contra-indicated. In case of fire decomposition beware of pulmonary oedema.

SECTION 5: FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media: **big fire – foam for polar liquids, water mist or water spray.**
small fire – sprinkled water, dry powder, CO_2, water mist

Unsuitable extinguishing media: **not specified**

5.2 Special hazards arising from the substance or mixture: **Flammable liquid. In case of heating up forms toxic and explosive mixtures with air. Fire or heavy heating up causes decomposition with formation of toxic gases and vapours. Contact with humidity, water vapour or water causes slow decomposition with formation of toxic reactive products.**

5.3 Advice for firefighters: **Self-contained breathing apparatus, protective clothing! (Hazchem-Code: 3X)**

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures: **Protection of air ways, protection of non-protected body parts, protection of eyes. Check measurement of diethyl oxalate concentration in the environment, sufficient ventilation.**

6.2 Environmental precautions: **Prevent contamination of soil and water, check concentration of diethyl oxalate in vicinity of accident.**

6.3 Methods and material for containment and cleaning up: **Cover with an adsorbent material (dry earth, sand, ground limestone) and collect into a waste container. For methods of disposal see Section 13.**

6.4 Reference to other sections: **see Section 10 and Section 13.**

SECTION 7: Handling and storage

7.1 Precautions for safe handling: **The product is packed in steel or galvanised barrels, transported in covered means of transport or in truck tankers. Ventilation provided during emptying.**

7.2 Conditions for safe storage, including any incompatibilities:
Store in rooms that may be ventilated. Do not store together with food and strong oxidising agents.

7.3 Specific end use(s): **Use in industry under strictly controlled conditions or while observing conditions stated in the exposure scenario – see Appendix 1.**

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Czech Republic: NPK-P = 1 mg.m^{-3}

EC countries (2000/39/EC): not established

8.1.1 DNEL (Derived No Effect Level) for exposure of workers

Acute exposure (systemic effects) – inhalation:	**3.00 mg/m³**
Acute exposure (systemic effects) – dermal:	**not established**
Acute exposure (local effects) – inhalation:	**3.00 mg/m³**
Acute exposure (local effects) – dermal:	**high danger**
Prolonged exposure (systemic effects) – inhalation:	**1.00 mg/m³**
Prolonged exposure (systemic effects) – dermal:	**0.6 mg/kg of weight/day**
Prolonged exposure (local effects) – inhalation:	**1.00 mg/m³**
Prolonged exposure (local effects) – dermal:	**high danger**

8.2 Exposure controls

When used in a closed circuit or with sufficient vapour exhaust, it is necessary to use standard personal protective equipment. When used in an open facility and insufficient vapour exhaust (diethyl oxalate concentration > DNEL inhalation), it is necessary to use respiratory protection.

Engineering controls: **Ensure ventilation. Check measurement of diethyl oxylate concentration in the working environment.**

Respiratory protection: **protective mask or half mask with filter (EN 140) against organic vapours - type A/P2**

Hand protection: **protective gloves (EN 374)**

Eye protection: **protective glasses or face shield**

Skin protection: **protective clothing**

Other data: **Do not eat, drink and smoke during work. Wash your hands with hot water and soap after work, apply suitable reparative preparations.**

Environmental exposure controls:
Use in a closed circuit, waste gases burnt in a fire crack or cleaned by adsorption (activated carbon), wastewater treated biologically.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance:	**oily colourless liquid**
Odour:	**characteristic aromatic**
Odour threshold:	**not established**
pH:	**not established**
Melting point/freezing point (℃ at 1013 hPa):	**-38.5**
Initial boiling point (at 1013 hPa in ℃):	**185.7**
Flash point (at 1013 hPa in ℃):	**76.0**
Evaporation rate:	**not established**
Flammability (solid, gas):	**the product is liquid**
Upper/lower flammability or explosive limits (% vol.):	**2.67/0.42**
Vapour pressure (Pa at 25 ℃):	**55.2**
Vapour density:	**not established**
Surface tension (mN/m at 20 ℃):	**32.22**
Density (kg/m^3 at 20 ℃):	**1 079**
Solubility (in g/l at 20 ℃):	**30.0**
Partition coefficient: n-octanol/water (log p_{ow} at 25 °C and pH 6,87):	**1,31**
Auto-ignition temperature (at 1013 hPa in ℃):	**412**
Decomposition temperature:	**not established**
Viscosity (mPa.s at 20 ℃):	**2.01**
Explosive properties:	**none**
Oxidising properties:	**none**

9.2 Other information

Not available.

SECTION 10: Stability and reactivity

10.1 Reactivity: **In case of heating up forms toxic and explosive mixtures with air.**

10.2 Chemical stability: **Stable under normal conditions.**

10.3 Possibility of hazardous reactions: **Contact with strong oxidising agents may cause vigorous reaction.**

10.4 Conditions to avoid: **Possibility of ignition in contact with hot surfaces, sparks or open fire.**

10.5 Incompatible materials: **Strong oxidising agents. Avoid contact with food.**

10.6 Hazardous decomposition products: **In case of heating up forms toxic and explosive mixtures with air. Fire or heavy heating up causes decomposition with formation of toxic gases and vapours. Contact with humidity, water vapour or water causes slow decomposition with formation of toxic reactive products.**

SECTION 11: Toxicological information

Information on toxicological effects

CLP evaluation:

11.1 Acute toxicity:- **category 4**

- LD_{50} (derm., rat) > **2 000** $mg.kg^{-1}$
- LD_{50} (oral, rat) > **400** $mg.kg^{-1}$

11.2 Irritation: **not established**

Eye irritation: **causes serious**

11.3 Sensitisation: **not sensitising**

11.4 Mutagenity: **not mutagenic**

11.5 Carcinogenicity: **not established**

11.6. Reproductive toxicity (READ-ACROSS, oxalic acid): **not toxic for reproduction.**

11.7. Specific target organs toxicity – single exposure: **not established**

11.8 Specific target organs toxicity – repeated exposure (28 days, rat, oral.): **NOAEL=20 mg/kg/day, damage of kidneys - category 2**

11.9 Aspiration hazard: **data not available**

SECTION 12: Ecological information

12.1. Toxicity

12.1.1 Aquatic toxicity - acute

POECILIA RETICULATA	LC_{50} (96 h) = **97.36** $mg.l^{-1}$
DAPHNIA MAGNA	EC_{50} (24 h) = **100** $mg.l^{-1}$
	LC_{50} (24 h) = **100** $mg.l^{-1}$

Plants and land animals:

DESMODESMUS SUBSPICATUS	ErC_{50} (72 h) = **77.1** $mg.l^{-1}$

12.1.2. Sediment toxicity in waste water treatment plants: EC_{50} = **669** $mg.l^{-1}$

12.1.3. PNEC (Predicated No Effect Concentration)

PNEC water (surface):	**0.077** mg.l^{-1}
PNEC water (sea):	**0.0077** mg.l^{-1}
PNEC sediment:	**not established**
PNEC waste water treatment plant:	**6.69** mg.l^{-1}
PNEC soil:	**not established**
PNEC plants:	**not established**
PNEC oral administration:	**1.33** mg.kg^{-1} (calculated value)

12.2 Persistence and degradability
Testing method: C.4E (OECD No.301 D)
Evaluation: **kinetic test – degree of removal 67.9 %/28 days - degradable**

12.3 Bio-accumulative potential: **not established**

12.4 Mobility in soil: **May enter the environment from waste water.**
Stability: **partially soluble in water**
Adsorption: **not established, log P_{ow} = 1.381**

12.5 Results of PBT and vPvB assessment: **not included**

12.6 Other adverse effects: **not specified**

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods: **Burning in the hazardous waste incinerator in accordance with Act on waste. Detoxify big quantities through reaction with milk of lime; use 0.5 kg of CaO for 1 kg of diethyl oxylate.**

Disposal of contaminated packaging: **It is recommended to burn contaminated packaging under waste code 15 01 10 in the waste incineration plant in accordance with Act on Waste.**

SECTION 14: TRANSPORT INFORMATION

Land transport (ADR/RID)
Marine transport (IMDG):
Air transport (ICAO/IATA)

14.1 UN number:	**2525**
14.2 UN proper shipping name:	**ETHYL OXALATE**
14.3 Transport hazard class(es):	**6.1, T1**
Hazard identification number (Kemler code):	**60**
14.4 Packing group:	**III**
14.5 Environmental hazards:	**no**
Marine pollutant:	**no**
14.6 Special precautions for user:	**not included in "Segregation Groups"**
EMS:	**F-A, S-A**

14.7 Transport in bulk according to Annex II of MARPOL and the IBC Code	**irrelevant**

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

15.1.1 EU regulations concerning safety, health and environment/specific legislation concerning substances or mixtures, as amended:

- Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006;
- Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC;
- Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives;
- Council Directive 96/82/EC on the control of major-accident hazards involving dangerous substances.

15.1.2 Regulations valid in CR and concerning safety, health and environment/specific legislation concerning substances or mixtures, as amended:

- Act 350/2011 Coll., on chemical substances and chemical mixtures and on amendments to some acts;
- Decree of Ministry of Environment no. 93/2016 Coll. laying down Waste Catalogue;
- Governmental decree no. 361/2007 Coll., laying down occupational health and safety conditions.

15.2 Chemical safety assessment

Chemical safety assessment is a part of the report on chemical safety of diethyl oxalate - the overview of risk management measures is provided in Annex 1.

Detailed information on exposure scenarios will be contained in Annex 2 available at the customer's request.

SECTION 16: Other information

16.1 This safety data sheet supersedes all previous versions.

16.2 List of abbreviations

Carc.:	Carcinogenicity
CAS:	Chemical Abstracts Service
CLP:	Classification, labelling, packaging regulation
CSR:	Chemical safety report
DNEL:	Derived no-effect level
ES:	Exposure scenario
EC:	European Commission
EC_{50}:	Median effective concentration EC_{50} – used in toxicity tests. Median effective concentration EC_{50} is the concentration of substance that causes 50 % mortality or 50 % decrease of growth or growth rate with reference to the control sample.

EINECS:	European Inventory of Existing Commercial Chemical Substances
ELINCS:	European List of Notified Chemical Substances
Irrit.:	Irritant
LC_{50}:	Lethal concentration, 50 % (lethal concentration) is used for toxicity tests
LD_{50}:	Absolute lethal dose that kills 50 % of members of population
LOAEC:	Lowest observed adverse effect concentration
NOAEC:	No observed adverse effect concentration
NOEC:	No observed effect concentration
OECD:	Organisation for Economic Cooperation and Development
PBT:	Persistent, bio-accumulative and toxic
PNEC:	Predicted no-effect concentration
REACH:	Registration, Evaluation, Authorisation and Restriction of Chemicals
Sens.:	Sensitivity
STOT:	Specific target organs toxicity
STOT SE:	Specific target organs toxicity - single exposure
STOT RE:	Specific target organs toxicity - repeated exposure
STP:	Sewage treatment plant
SU:	Sector of use
Tox.:	Toxicity
vPvB:	Very persistent and very bio-accumulative

16.3 A list of mentioned phrases:

H phrases:
H302 Harmful if swallowed.
H314 Causes severe skin burns and eye damage.
H319 Causes serious eye irritation.
H373 May cause damage to kidneys through oral prolonged or repeated exposure.

P phrases:
P201 Obtain special instructions before use.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P301+P330+P331 IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308+P313 IF exposed or concerned: Get medical advice/ attention.
P501 Dispose of contents/ container to in accordance with national regulation.

16.4 Sources used

Material safety data sheet – Pure diethyl oxalate, BC MCHZ, 6th version (12/2016)
Update of registration for diethyl oxalate (SIEF-DEOX) from 09/2017.

16.5 History of revisions

Issue	Date	Change
1.0	30 November 2010	Preparation of the safety data sheet according to Regulation (EC) No 1907/2006 of the European Parliament and of the Council
2.0	1 October 2011	Additional information from the registration dossier. Overall revision of all sections of the safety data sheet according to Regulation (EC) No 453/2010 of the European Parliament and of the Council
3.0	1 December 2012	Complementation of the overview of exposure scenarios, update of the regulations valid in the Czech Republic, and revisions according to Regulation (EC) No 286/2011 of the European Parliament and of the Council

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PURE DIETHYL OXALATE

Issue	Date	Change
4.0	1 June 2015	Modification of Section 2 (deletion of classification under DSD) and other sections according to regulations 2015/830/EU
5.0	1 April 2016	Classification and modification according to update registration.
6.0	1 December 2016	Revision according to Commission Regulation (EU) no. 918/2016
7.0	5 January 2018	Classification and modification according to update registration..

Prepared by: Ing. Zuzana Svobodová - IT& Quality, ecology and safety department

Approved by: Ing. Stanislav Pekara, MBA – Head of IT& Quality, ecology and safety department

Version: English
Date: 05.01.2018
Safety Data Sheet
Pure diethyl oxalate

www.borsodchem-cz.com

The mentioned data reflect the present state of knowledge and experience and they are in compliance with valid legislation of the Czech Republic. The client is responsible for observing valid national legislation in the place of use.

Manufactured by:

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Annex No. 1

SUMMARY OF RISK MANAGEMENT MEASURES

Name	**Manufacture or use of diethyl oxalate (further only as DEOX)**
Sectors of Use	SU3, SU8, SU9, SU10, SU19, SU22
Process categories	PROC1, PROC2, PROC3, PROC4, PROC5, PROC7, PROC8a, PROC8b, PROC9, PROC11, PROC14, PROC15, PROC21, PROC24a
Chemical product category	PC19, PC21, PC32
Environmental Release Categories	ERC1, ERC2, ERC3, ERC5, ERC6a, ERC6c, ERC7, ERC8a, ERC8b, ERC8c, ERC8f, ERC10a, ERC11a
Exposure scenario – **ES1**	**Industrial use as an intermediate; 100% substance**
Sectors of Use	SU3, SU8, SU9
Process categories	PROC1, PROC2, PROC3, PROC8b, PROC9, PROC15
Environmental Release Categories	ERC6a, ERC7
Exposure scenario – **ES2**	**Industrial formulation of preparations and/or re-packaging; 100% substance**
Sectors of Use	SU3, SU10
Process categories	PROC1, PROC2, PROC3, PROC4, PROC5, PROC8a, PROC8b, PROC9, PROC15
Environmental Release Categories	ERC2, ERC3
Exposure scenario – **ES3**	**Industrial use as a rigid foam; 10% substance**
Sectors of Use	SU3
Process categories	PROC1, PROC2, PROC3, PROC4, PROC5, PROC7, PROC8a, PROC8b, PROC15, PROC21
Chemical product category	PC32
Environmental Release Categories	ERC5, ERC6c
Exposure scenario – **ES4**	**Professional use as laboratory reagent; 10% substance**
Sectors of Use	SU22
Process categories	PROC15
Chemical product category	PC21
Environmental Release Categories	ERC8a, ERC8b
Exposure scenario – **ES5**	**Professional use as a rigid foam; 10% substance**
Sectors of Use	SU19, SU22
Process categories	PROC3, PROC4, PROC5, PROC8a, PROC8b, PROC11, PROC24a
Chemical product category	PC32

Environmental Release Categories	ERC8c, ERC8f
Exposure scenario – **ES6**	**Use in articles; 10% substance**
Environmental Release Categories	ERC10a, ERC11a
Exposure scenario – **ES7**	**Industrial use as a flexible foam; 10% substance**
Sectors of Use	SU3
Process categories	PROC1, PROC2, PROC3, PROC4, PROC5, PROC8a, PROC8b, PROC14, PROC15, PROC21
Chemical product category	PC32
Environmental Release Categories	ERC6c, ERC5
Included processes, tasks, activities	This overview covers the production and use of DEOX prevailingly in closed processes where workers come into contact with DEOX and/or where such contact may occur (whether by means of inhalation and/or skin contact) during sampling, maintenance and/or breakage of equipment. It also covers other processing (use) of DEOX in the manufacture of various products, such as pharmaceutical products, dyes and pesticides, which contain DEOX, but where contact may occur during sampling, maintenance and/or breakage of equipment. It covers the same processing (use) of DEOX in batch process or other processes where due to the structure of such process there is a possibility of contact with DEOX and that are controlled by operational conditions or risk management measures. It covers the transfer of DEOX by charging/discharging from/to small or large containers at dedicated facilities which are controlled by operational conditions or risk management measures. It also covers the use of DEOX as laboratory reagent at small scale laboratories with quantities of 1 L or 1 kg or less present in the workplace with exposure to DEOX controlled by operational conditions or risk management measures. All processes are presumed to run at ambient temperatures.
	Operating conditions and risk management measures
	Control of worker exposure
Frequency and duration of use	It includes the exposure to effects of the substance for over 4 hours (unless stated otherwise)
Other operating conditions with the effect on worker exposure to the substance	When using DEOX and where the process is not a closed process protect the health of workers by using local exhaust and implementing a suitable work process. They include: • keeping the equipment under negative pressure, • checking the entry of workers to the workplace, • assurance of proper maintenance of all the equipment, • permissions to perform maintenance of the equipment, • regular tidying and cleaning of the equipment and the workplace, • a workplace system which ensures adherence to risk management measures and conditions for the working environment, training of employees focused on the correct set procedures,

	• procedures and training for emergency situations, including decontamination and removal procedures, • stipulated level of personal hygiene, • near miss record, • periodic health checks of employees.
Process categories	**Risk management measures***
1, 2, 3, 4, 5, 7, 8a, 8b, 9, 11, 14, 15, 21 a 24a	**DEOX is listed among hazardous substances, therefore the following applies in cases of potential contact with DEOX:** Handle substance within a predominantly closed system provided with extract ventilation [E49]; at least 30% efficiency. Provide extract ventilation to points where emissions occur [E54]; recommended at least 80% efficiency. Wear chemically resistant gloves (tested to EN374); recommended at least 90% efficiency, in combination with specific activity training [PPE17]. Use suitable eye protection [PPE26]. Wear suitable coveralls to prevent exposure to the skin [PPE27]. It includes the exposure to effects of the substance for over 4 hours (unless stated otherwise)
1 – Use in closed process, no likelihood of exposure.	**ES1, ES2, ES3, ES7, ES8** - Handle substance within a closed system. [E47].
2 – Use in closed, continuous process with occasional controlled exposure (e.g. sampling).	**ES1, ES2, ES3, ES7** - Handle substance within a closed system. [E47]. Provide extract ventilation to points where emissions occur [E54]; recommended at least 90% efficiency.
3 – Use in closed batch process (synthesis or formulation).	**ES1** - Handle substance within a closed system. [E47]. Handle substance within a predominantly closed system provided with extract ventilation [E49]; at least 70% efficiency. Wear chemically resistant gloves (tested to EN374); recommended at least 95% efficiency. **ES2** - Handle substance within a closed system. [E47]. Provide extract ventilation to points where emissions occur [E54]; recommended at least 98% efficiency. **ES5** - Handle substance within a closed system. [E47].
4 – Use in batch and other process (synthesis) where opportunity for exposure arises.	**ES2, ES3** - Provide extract ventilation to points where emissions occur [E54]; recommended at least 98% efficiency. **ES5** – see above **ES7** - Provide extract ventilation to points where emissions occur [E54]; recommended at least 90% efficiency. Avoid carrying out operation for more than 4 hours [OC12].
5 – Mixing or blending in batch processes for formulation of preparations* and articles (multistage and/or significant contact).	**ES2, ES3, ES6** - Provide extract ventilation to points where emissions occur [E54]; recommended at least 98% efficiency. **ES5** – see above **ES7** - Provide extract ventilation to points where emissions occur [E54]; recommended at least 90% efficiency. Avoid carrying out operation for more than 1 hour [OC11].

7 – Industrial spraying	**ES3** - Provide extract ventilation to points where emissions occur [E54]; recommended at least 95% efficiency.
8a – Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities.	**ES2, ES**5 - Provide extract ventilation to points where emissions occur [E54]; recommended at least 98% efficiency. **ES3, ES7** - Provide extract ventilation to points where emissions occur [E54]; recommended at least 90% efficiency. **ES7** -. Avoid carrying out operation for more than 1 hour [OC11].
8b – Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	**ES1 -** Handle substance within a predominantly closed system provided with extract ventilation [E49]; at least 70% efficiency. Provide extract ventilation to points where emissions occur [E54]; recommended at least 95% efficiency. Wear chemically resistant gloves (tested to EN374); recommended at least 95% efficiency. **ES2** - Provide extract ventilation to points where emissions occur [E54]; recommended at least 98% efficiency. **ES3** - Provide extract ventilation to points where emissions occur [E54]; recommended at least 99% efficiency. **ES7** - Provide extract ventilation to points where emissions occur [E54]; recommended at least 95% efficiency. Avoid carrying out operation for more than 1 hour [OC11]. **ES8** - Provide extract ventilation to points where emissions occur [E54]; recommended at least 98% efficiency.
9 – Transfer of substance or preparation into small containers (dedicated filling line, including weighing).	**ES1 -** Handle substance within a predominantly closed system provided with extract ventilation [E49]; at least 70% efficiency. Wear chemically resistant gloves (tested to EN374); recommended at least 95% efficiency. **ES2, ES8** - Provide extract ventilation to points where emissions occur [E54]; recommended at least 98% efficiency.
11 – Non industrial spraying	**ES5** - Provide extract ventilation to points where emissions occur [E54]; recommended at least 99% efficiency. Wear a full face respirator conforming to EN140 with Type A/P2 filter or better [PPE32]; recommended 98 % efficiency. Avoid carrying out operation for more than 6 hours.
14 – Production of preparations or articles by tabletting, compression, extrusion, pelletisation	**ES7 -**. Provide extract ventilation to points where emissions occur [E54]; recommended at least 90% efficiency. Avoid carrying out operation for more than 1 hour [OC11].
15 – Use as laboratory reagent	**ES1** - Provide extract ventilation to points where emissions occur [E54]; recommended at least 90% efficiency. Wear chemically resistant gloves (tested to EN374); recommended at least 95% efficiency. **ES2, ES8** - Provide extract ventilation to points where emissions occur [E54]; recommended at least 98% efficiency.

	ES3 - Provide extract ventilation to points where emissions occur [E54]; recommended at least 100% efficiency. **ES4** – see above **ES7** - Provide extract ventilation to points where emissions occur [E54]; recommended at least 90% efficiency.
21 – Low energy manipulation of substances bound in materials and/or articles	**ES3** - Provide extract ventilation to points where emissions occur [E54]; recommended at least 100% efficiency. **ES5** - Provide extract ventilation to points where emissions occur [E54]; recommended at least 99% efficiency. Wear a full face respirator conforming to EN140 with Type A/P2 filter or better [PPE32]; recommended 98 % efficiency. **ES7** - Provide extract ventilation to points where emissions occur [E54]; recommended at least 100% efficiency.
24a – High (mechanical) energy work-up of substances bound in materials and/or articles	**ES5** - Provide extract ventilation to points where emissions occur [E54]; recommended at least 100% efficiency.

* Standard statements and labelling come from the Worker Chemical Safety Assessment (CSA) Template for GES at the Cefic website – http://www.cefic.org.