

**SECTION 1: Identification of the substance/mixture and of the company/  
undertaking****1.1 Product identifier****Trade name:**

010501 ZINC OXIDE RAC  
010503 ZINC OXIDE AC 100  
010511 ZINC OXIDE RAC 25  
010512 ZINC OXIDE RAC fine  
010514 ZINC OXIDE RAC S  
010530 ZINC OXIDE AC  
011801 ZINC OXIDE SPEZIAL  
011806 ZINC OXIDE WHITE SEAL  
011807 ZINC OXIDE PHARMA  
011812 ZINC OXIDE WHITE SEAL S extra fine  
011813 ZINC OXIDE GREEN SEAL  
011815 ZINC OXIDE AC 45

**ZINC OXIDE****CAS Number:**

1314-13-2

**EC number:**

215-222-5

**Index number:**

030-013-00-7

**Registration number:** 01-2119463881-32**1.2 Relevant identified uses of the substance or mixture and uses advised against  
Sector of Use**

SU0 Other  
SU1 Agriculture, forestry, fishery  
SU3 Industrial uses: Uses of substances as such or in preparations at industrial sites  
SU4 Manufacture of food products  
SU5 Manufacture of textiles, leather, fur  
SU6b Manufacture of pulp, paper and paper products  
SU7 Printing and reproduction of recorded media  
SU8 Manufacture of bulk, large scale chemicals (including petroleum products)  
SU9 Manufacture of fine chemicals  
SU10 Formulation [mixing] of preparations and/or re-packaging (excluding alloys)  
SU11 Manufacture of rubber products  
SU12 Manufacture of plastics products, including compounding and conversion  
SU13 Manufacture of other non-metallic mineral products, e.g. plasters, cement  
SU14 Manufacture of basic metals, including alloys  
SU15 Manufacture of fabricated metal products, except machinery and equipment  
SU16 Manufacture of computer, electronic and optical products, electrical equipment  
SU17 General manufacturing, e.g. machinery, equipment, vehicles, other transport equipment  
SU18 Manufacture of furniture  
SU19 Building and construction work  
SU20 Health services  
SU22 Professional uses: Public domain (administration, education, entertainment, services, craftsmen)  
SU24 Scientific research and development  
SU6a Manufacture of wood and wood products

**Product category**

PC1 Adhesives, sealants  
PC2 Adsorbents  
PC4 Anti-Freeze and de-icing products  
PC7 Base metals and alloys  
PC8 Biocidal products  
PC9a Coatings and paints, thinners, paint removers  
PC9b Fillers, putties, plasters, modelling clay  
PC9c Finger paints

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**Trade name: ZINC OXIDE**

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- PC11 Explosives
- PC12 Fertilisers
- PC14 Metal surface treatment products
- PC15 Non-metal-surface treatment products
- PC16 Heat transfer fluids
- PC17 Hydraulic fluids
- PC18 Ink and toners
- PC19 Intermediate
- PC20 Processing aids such as pH-regulators, flocculants, precipitants, neutralization agents
- PC21 Laboratory chemicals
- PC23 Leather treatment products
- PC28 Perfumes, fragrances
- PC29 Pharmaceuticals
- PC31 Polishes and wax blends
- PC32 Polymer preparations and compounds
- PC33 Semiconductors
- PC34 Textile dyes, and impregnating products
- PC35 Washing and cleaning products (including solvent based products)
- PC37 Water treatment chemicals
- PC39 Cosmetics, personal care products
- PC40 Extraction agents

**Process category**

- PROC1 Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions.
- PROC2 Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions
- PROC3 Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
- PROC4 Chemical production where opportunity for exposure arises
- PROC5 Mixing or blending in batch processes
- PROC6 Calendering operations
- PROC7 Industrial spraying
- PROC8a Transfer of substance or mixture (charging and discharging) at non-dedicated facilities
- PROC8b Transfer of substance or mixture (charging and discharging) at dedicated facilities
- PROC9 Transfer of substance or mixture into small containers (dedicated filling line, including weighing)
- PROC10 Roller application or brushing
- PROC11 Non industrial spraying
- PROC12 Use of blowing agents in manufacture of foam
- PROC13 Treatment of articles by dipping and pouring
- PROC14 Tableting, compression, extrusion, pelletisation, granulation
- PROC15 Use as laboratory reagent
- PROC17 Lubrication at high energy conditions in metal working operations
- PROC19 Manual activities involving hand contact
- PROC20 Use of functional fluids in small devices
- PROC21 Low energy manipulation and handling of substances bound in/on materials or articles
- PROC22 Manufacturing and processing of minerals and/or metals at substantially elevated temperature
- PROC24 High (mechanical) energy work-up of substances bound in /on materials and/or articles
- PROC26 Handling of solid inorganic substances at ambient temperature

**Environmental release category**

- ERC1 Manufacture of the substance
- ERC2 Formulation into mixture
- ERC3 Formulation into solid matrix
- ERC4 Use of non-reactive processing aid at industrial site (no inclusion into or onto article)
- ERC5 Use at industrial site leading to inclusion into/onto article
- ERC6a Use of intermediate
- ERC6b Use of reactive processing aid at industrial site (no inclusion into or onto article)

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- ERC6d Use of reactive process regulators in polymerisation processes at industrial site (inclusion or not into/onto article)
- ERC7 Use of functional fluid at industrial site
- ERC8a Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor)
- ERC8b Widespread use of reactive processing aid (no inclusion into or onto article, indoor)
- ERC8c Widespread use leading to inclusion into/onto article (indoor)
- ERC8d Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor)
- ERC8f Widespread use leading to inclusion into/onto article (outdoor)
- ERC10a Widespread use of articles with low release (outdoor)
- ERC10b Widespread use of articles with high or intended release (outdoor)
- ERC11a Widespread use of articles with low release (indoor)
- ERC12a Processing of articles at industrial sites with low release

**1.3 Details of the supplier of the safety data sheet**
**Manufacturer/Supplier:**

L. Brüggemann GmbH & Co. KG  
 Salzstraße 131  
 74076 Heilbronn  
 Fon: +49 7131 1575-0  
 Fax: +49 7131 1575-25-111  
 E-Mail: info@brueggemann.com

**Further information obtainable from:** ehs@brueggemann.com

**1.4 Emergency telephone number:** +49 761 19240 (english language)

**SECTION 2: Hazards identification**
**2.1 Classification of the substance or mixture**
**Classification according to Regulation (EC) No 1272/2008**

Aquatic Acute 1 H400 Very toxic to aquatic life.

Aquatic Chronic 1 H410 Very toxic to aquatic life with long lasting effects.

**2.2 Label elements**
**Labelling according to Regulation (EC) No 1272/2008**

The substance is classified and labelled according to the CLP regulation.

**Hazard pictograms**


GHS09

**Signal word** Warning

**Hazard statements**

H410 Very toxic to aquatic life with long lasting effects.

**Precautionary statements**

P273 Avoid release to the environment.

P391 Collect spillage.

P501 Dispose of contents/container in accordance with local/regional/national/international regulations.

**2.3 Other hazards**
**Results of PBT and vPvB assessment**
**PBT:** Does not meet the PBT criteria according to annex XIII of Regulation (EC) No 1907/2006.

**vPvB:** Does not meet the vPvB criteria according to annex XIII of Regulation (EC) No 1907/2006.

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**SECTION 3: Composition/information on ingredients****Chemical characterisation: Substances****CAS NO. Description:**

1314-13-2 Zinc oxide

**Registration number:** 01-2119463881-32**Identification number(s)****EC number:** 215-222-5**Index number:** 030-013-00-7**SECTION 4: First aid measures****4.1 Description of first aid measures****General information:**

Personal protection for the First Aider.

Take affected persons out into the fresh air.

**After inhalation:** Supply fresh air; consult doctor in case of complaints.**After skin contact:**

Immediately wash with water and soap and rinse thoroughly.

If skin irritation continues, consult a doctor.

**After eye contact:**

Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.

**After swallowing:**

Rinse out mouth and then drink plenty of water.

Seek medical treatment.

**4.2 Most important symptoms and effects, both acute and delayed**

Gastric or intestinal disorders

Nausea

Headache

Fever

**4.3 Indication of any immediate medical attention and special treatment needed**

No further relevant information available.

**SECTION 5: Firefighting measures****5.1 Extinguishing media****Suitable extinguishing agents:**

Use fire extinguishing methods suitable to surrounding conditions.

The product is not flammable.

**5.2 Special hazards arising from the substance or mixture** Product is not flammable. (EU A.10)**5.3 Advice for firefighters****Protective equipment:**

Wear self-contained respiratory protective device.

Wear fully protective suit.

**Additional information**

Collect contaminated fire fighting water separately. It must not enter the sewage system.

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### **SECTION 6: Accidental release measures**

#### **6.1 Personal precautions, protective equipment and emergency procedures**

Wear protective equipment. Keep unprotected persons away.  
Avoid formation of dust.

#### **6.2 Environmental precautions:**

Do not allow to enter sewers/ surface or ground water.  
Inform respective authorities in case of seepage into water course or sewage system.

#### **6.3 Methods and material for containment and cleaning up:**

Pick up mechanically.  
Send for recovery or disposal in suitable receptacles.

#### **6.4 Reference to other sections**

See Section 7 for information on safe handling.  
See Section 8 for information on personal protection equipment.  
See Section 13 for disposal information.

### **SECTION 7: Handling and storage**

#### **7.1 Precautions for safe handling**

Prevent formation of dust.  
No special precautions are necessary if used correctly.

**Information about fire - and explosion protection:** No special measures required.

#### **7.2 Conditions for safe storage, including any incompatibilities**

##### **Storage:**

##### **Requirements to be met by storerooms and receptacles:**

Store in cool, dry conditions in well sealed receptacles.

**Information about storage in one common storage facility:** Store away from foodstuffs.

**Storage class:** 13

#### **7.3 Specific end use(s)** No further relevant information available.

### **SECTION 8: Exposure controls/personal protection**

**Additional information about design of technical facilities:** No further data; see item 7.

#### **8.1 Control parameters**

**Ingredients with limit values that require monitoring at the workplace:** Not required.

##### **DNELs**

#### **1314-13-2 Zinc oxide**

Dermal syst. 83 mg/kg<sub>bw</sub>/d (worker, long-term)

Inhalative syst. 2.5 mg/m<sup>3</sup> (consumer, long-term)

5 mg/m<sup>3</sup> (worker, long-term)

##### **PNECs**

#### **1314-13-2 Zinc oxide**

Aquatic 21 µg Zn/L (Freshwater)

6 µg Zn/L (Marine Water)

Sedimentary 118 mg Zn/kg (Freshwater)

57 mg Zn/kg (Marine Water)

Terrestrial 35.6 mg Zn/kg (soil)

#### **8.2 Exposure controls**

##### **Personal protective equipment:**

**General protective and hygienic measures:** Wash hands before breaks and at the end of work.

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**Respiratory protection:**

In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use self-contained respiratory protective device.

Filter P2

**Protection of hands:**

Protective gloves and protective skin cream



Protective gloves

Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

**Material of gloves**

Nitrile rubber, NBR

Recommended thickness of the material:  $\geq 0.11$  mm**Penetration time of glove material**Value for the permeation: Level  $\leq 8$  h

The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

**Eye protection:**

Tightly sealed goggles

**Body protection:** Protective work clothing

## SECTION 9: Physical and chemical properties

**9.1 Information on basic physical and chemical properties****General Information****Appearance:**

<b>Form:</b>	Powder
<b>Colour:</b>	White
<b>Odour:</b>	Odourless

**pH-value (100 g/l) at 20 °C:** 7 (DIN EN ISO 10523)**Melting point/freezing point:** 1975 °C (OECD 102)**Flash point:** Not applicable.**Flammability (solid, gas):** Product is not flammable. (EU A.10)**Decomposition temperature:** > 2000 °C (literature)**Auto-ignition temperature:** Product is not selfigniting. (EU A.16)**Explosive properties:** Product does not present an explosion hazard.**Relative density at 20 °C** 5.6 g/cm<sup>3</sup> (literature)**Solubility in / Miscibility with water at 20 °C:** 1.6 mg/l**Partition coefficient: n-octanol/water:** < -4**9.2 Other information** No further relevant information available.

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**SECTION 10: Stability and reactivity****10.1 Reactivity** No further relevant information available.**10.2 Chemical stability**

Stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.

**Thermal decomposition / conditions to be avoided:**

No decomposition if used according to specifications.

**10.3 Possibility of hazardous reactions:** Reacts with strong acids and alkali.**10.4 Conditions to avoid:**

Does not present any particular risk, provided it is handled in accordance with good occupational hygiene and safety practice and that precautions are taken to avoid the inhalation of dust.

**10.5 Incompatible materials:**

Mixtures with aluminium and magnesium powders may react violently.

**10.6 Hazardous decomposition products:** No dangerous decomposition products known.**SECTION 11: Toxicological information****11.1 Information on toxicological effects****Acute toxicity****1314-13-2 Zinc oxide**Oral LD<sub>50</sub> >5,000 mg/kg (rat) (OECD 401)Dermal LD<sub>50</sub> >2,000 mg/kg (rat) (read across; ZnSO<sub>4</sub>)Inhalative LC<sub>50</sub>/4h >5.7 mg/l (rat) (OECD 403)

Based on available data, the classification criteria are not met.

**Primary irritant effect:****Skin corrosion/irritation** Based on available data, the classification criteria are not met.**Serious eye damage/irritation** No irritant effect.**Respiratory or skin sensitisation** Not sensitizing (Guinea pig, OECD 406, IUCLID)**Subacute to chronic toxicity:****1314-13-2 Zinc oxide**Oral NOAEL (90d) 104 mg/kg<sub>bw</sub>/d (mouse) (OECD 408, ZnSO<sub>4</sub>)53.5 mg/kg<sub>bw</sub>/d (rat) (OECD 408, ZnSO<sub>4</sub>)Inhalative NOAEL (5d) 2.7 mg/m<sup>3</sup> (guinea pig)**CMR effects (carcinogenicity, mutagenicity and toxicity for reproduction)****Germ cell mutagenicity** Based on available data, the classification criteria are not met.**Carcinogenicity** Based on available data, the classification criteria are not met.**Reproductive toxicity** Based on available data, the classification criteria are not met.**STOT-single exposure** Based on available data, the classification criteria are not met.**STOT-repeated exposure** Based on available data, the classification criteria are not met.**Aspiration hazard** Based on available data, the classification criteria are not met.**SECTION 12: Ecological information****12.1 Toxicity****Aquatic toxicity:****1314-13-2 Zinc oxide**IC<sub>50</sub> 136 mg/l (selenastrum capricornutum) (72h, OECD 201 (ZnO))EC<sub>50</sub> 0.41 mg/l (ceriodaphnia dubia) (48 h, EPA 821 R-02-012 (Zn))LC<sub>50</sub> 0.17 mg/l (oncorhynchus mykiss) (96h, ASTM E-729-88 (ZnCl<sub>2</sub>))

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NOEC 0.07 mg/L (daphnia magna) (21d, OECD 211 (ZnCl<sub>2</sub>))  
 0.04 mg/L (oncorhynchus mykiss) (30d, OECD 215 (ZnCl<sub>2</sub>))  
 0.011 mg/L (Pseudokirchnerella subcapitata) (5d, OECD 201 (calculation method))

**12.2 Persistence and degradability** Not applicable

**Degree of elimination:**
**Classification:** note: inorganic product

**12.3 Bioaccumulative potential** No further relevant information available.

**12.4 Mobility in soil** No further relevant information available.

**12.5 Results of PBT and vPvB assessment**
**PBT:** Does not meet the PBT criteria according to annex XIII of Regulation (EC) No 1907/2006.

**vPvB:** Does not meet the vPvB criteria according to annex XIII of Regulation (EC) No 1907/2006.

**12.6 Other adverse effects:** No further relevant information available.

### SECTION 13: Disposal considerations

#### 13.1 Waste treatment methods

**Recommendation**

Must not be disposed together with household garbage. Do not allow product to reach sewage system.

Disposal must be made according to official regulations.

**Uncleaned packaging:**
**Recommendation:**

Disposal must be made according to official regulations.

Empty contaminated packagings thoroughly. They may be recycled after thorough and proper cleaning.

### SECTION 14: Transport information

#### 14.1 UN-Number

**ADR, IMDG, IATA**

UN3077

#### 14.2 UN proper shipping name

**ADR**

3077 ENVIRONMENTALLY HAZARDOUS  
 SUBSTANCE, SOLID, N.O.S. (Zinc oxide)  
 ENVIRONMENTALLY HAZARDOUS  
 SUBSTANCE, SOLID, N.O.S. (Zinc oxide),  
 MARINE POLLUTANT

**IMDG**
**IATA**

ENVIRONMENTALLY HAZARDOUS  
 SUBSTANCE, SOLID, N.O.S. (Zinc oxide)

#### 14.3 Transport hazard class(es)

**ADR, IMDG, IATA**

**Class**

9 Miscellaneous dangerous substances and articles.

**Label**

9

**ADN**
**ADN/R Class:**

9

#### 14.4 Packing group

**ADR, IMDG, IATA**

III

#### 14.5 Environmental hazards:

**Marine pollutant:**

Symbol (fish and tree)

**Special marking (ADR):**

Symbol (fish and tree)

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**Special marking (IATA):****14.6 Special precautions for user****Danger code (Kemler):****EMS Number:****Stowage Category****Stowage Code****14.7 Transport in bulk according to Annex II of Marpol and the IBC Code****Transport/Additional information:****ADR****Limited quantities (LQ)****Excepted quantities (EQ)****Transport category****IMDG****Limited quantities (LQ)****Excepted quantities (EQ)****UN "Model Regulation":**

Symbol (fish and tree)

Warning: Miscellaneous dangerous substances and articles.

90

F-A,S-F

A

SW23 When transported in BK3 bulk container, see 7.6.2.12 and 7.7.3.9.

Not applicable.

5 kg

Code: E1

Maximum net quantity per inner packaging: 30 g

Maximum net quantity per outer packaging: 1000

g

3

5 kg

Code: E1

Maximum net quantity per inner packaging: 30 g

Maximum net quantity per outer packaging: 1000

g

UN 3077 ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (ZINC OXIDE), 9, III

**SECTION 15: Regulatory information****15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture**

Ozone layer depleting substances: Not subject to Regulation (EC) No 1005/2009.

Persistent organic pollutants (POPs): Not subject to Regulation (EC) No 850/2004.

Export and import of dangerous chemicals: Not subject to Regulation (EC) No 649/2012.

Detergents Regulation: Not subject to Regulation (EC) No 648/2004

Restrictions (REACH, Title VIII), SVHC: No restrictions according to Title VIII of Regulation (EC) No 1907/2006.

SVHC status: negative

Regulation (EC) No 1223/2009 entry 144 of Annex IV:

Zinc oxide is not to be used in applications that may lead to exposure of the end-user's lungs by inhalation.

**Directive 2012/18/EU****Named dangerous substances - ANNEX I** Substance is not listed.**Seveso category** E1 Hazardous to the Aquatic Environment**Qualifying quantity (tonnes) for the application of lower-tier requirements** 100 t**Qualifying quantity (tonnes) for the application of upper-tier requirements** 200 t**National regulations:****Information about limitation of use:**

Employment restrictions concerning juveniles must be observed.

**Waterhazard class:** Water hazard class 2 (Assessment by list): hazardous for water.**15.2 Chemical safety assessment:** A Chemical Safety Assessment has been carried out.

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**SECTION 16: Other information**

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

**Recommended restriction of use**

Only for industrial use. The fields of application are specified in the "Technical Information" belonging to the product(s). Any further intended application should be discussed with the manufacturer.

**Abbreviations and acronyms:**

RID: Règlement international concernant le transport des marchandises dangereuses par chemin de fer (Regulations Concerning the International Transport of Dangerous Goods by Rail)  
ICAO: International Civil Aviation Organisation  
ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)  
IMDG: International Maritime Code for Dangerous Goods  
IATA: International Air Transport Association  
GHS: Globally Harmonised System of Classification and Labelling of Chemicals  
EINECS: European Inventory of Existing Commercial Chemical Substances  
CAS: Chemical Abstracts Service (division of the American Chemical Society)  
DNEL: Derived No-Effect Level (REACH)  
PNEC: Predicted No-Effect Concentration (REACH)  
PBT: Persistent, Bioaccumulative and Toxic  
vPvB: very Persistent and very Bioaccumulative  
Aquatic Acute 1: Hazardous to the aquatic environment - acute aquatic hazard – Category 1  
Aquatic Chronic 1: Hazardous to the aquatic environment - long-term aquatic hazard – Category 1

**Sources**

D'Ans Lax, Taschenbuch für Chemiker und Physiker, Springer-Verlag, 1998, 4th edition  
Risk Assessment Zinc Oxide (Draft 1999)  
GESTIS-substances data base (BIA)

**\* Data compared to the previous version altered.**

## EXPOSURE SCENARIOS

### Introduction to (short) Generic Exposure Scenarios (GES): ZnO

For assessment of exposures at local scale, several generic exposure scenarios (GES) were developed in the chemical safety report (CSR) for each zinc substance. This was necessary because of the significant number of uses that was identified for each of the substances. The multitude of identified uses was assigned to the respective GES based on similarity of process, and , consequently, similarity in exposure and risk management measures. So, GES are relevant for the different identified uses that they group at the same time.

#### Approaches for local exposure assessment

- Assessment of workers exposure is related to the place /process the worker is involved in. The GES group different processes; exposure assessment is done using the worst case approach by considering full shift exposure at the workplace with highest potential for exposure. Risk management measures are specified accordingly.
- Environmental emissions (notably to water) are usually integrating the totality of emissions from a given site, and cannot be distinguished for each process. Therefore assessments in the GES are done for the site as a whole.

#### Shortened GES for annexing to the e-SDS

For reasons of clarity, shortened versions of the GES as documented in the CSR have been listed below. These shortened versions focus on a) operational conditions and b) risk management measures. Repetition of information contained in the SDS has been avoided by cross-referencing.

#### How to identify the GES related to a given use?

In table below, the generic exposure scenarios (GES) developed for ZnO are presented.

**Table : Generic exposure scenarios (GES) for ZnO (ref : CSR zinc oxide, version Nov 2010)**

Number	Sector	Uses	Code
0	Zinc oxide production	Manufacture Substance	GES <sub>ZnO</sub> 0
1	Formulation step	Formulation general	GES <sub>ZnO</sub> 1
2	First tier applications	Manufacturing of other zinc compounds	GES <sub>ZnO</sub> 2
3		Laboratory reagent	GES <sub>ZnO</sub> 3
4		As component for solid blends & matrices	GES <sub>ZnO</sub> 4
5		As component for production of dispersions, pastes and other viscous matrices	GES <sub>ZnO</sub> 5
6	Second tier applications	DU of ZnO-containing solid preparations	GES <sub>ZnO</sub> 6
7		DU of ZnO-containing liquid & pasty preparations	GES <sub>ZnO</sub> 7

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To facilitate the identification of the GES related to a given downstream use, the table below lists the different uses that were identified for ZnO. In this table, the downstream user can look up its use(s) and find the corresponding GES for attachment to his e-SDS.

Table: Identified uses for ZnO and corresponding Generic Exposure Scenario (GES) (ref: CSR zinc oxide, version Nov 2010)

IU number	Identified Use (IU) name	GES code
1	Zinc oxide production-Direct	GESZnO 0
2	Zinc oxide production-Indirect	GESZnO 0
3	Zinc oxide production-Wet	GESZnO 0
9	Component for production of inorganic zinc compounds	GESZnO 2
10	Electrogalvanizing	GESZnO 2
11	Electroplating	GESZnO 2
12	Zinc production by electrowinning	GESZnO 2
13	Laboratory reagent	GESZnO 3
14	Zinc production by pyrometallurgy	GESZnO 2
15	Zinc oxide production & refining	GESZnO 0
16	Component for production of organic zinc compounds	GESZnO 2
17	Component for production of Inorganic pigments	GESZnO 1, GESZnO 4
18	Component for production of Coatings / paints, inks, enamels, varnishes	GESZnO 1, GESZnO 4
19	Use of ZnO-containing paints & coatings	GESZnO 7
20	Artists supply: Use of ZnO-containing paints & coatings	Generic consumer/environment*
21	Component for Paper coating	GESZnO 1, GESZnO 5
22	Use of ZnO-containing paper coatings	GESZnO 6
23	Component for Textile & leather coating / treatment	GESZnO 1, GESZnO 5
24	Use of ZnO-containing textile & leather coatings	GESZnO 6
25	Additive / component for production of ceramics	GESZnO 1, GESZnO 4
26	Additive /component for production of frits	GESZnO 1, GESZnO 4
27	Use of ZnO-containing glazes and glassy thin film coatings	GESZnO 6
28	Additive for the production of Friction agents	GESZnO 1, GESZnO 4
29	Use of ZnO-containing friction agents: Brake pads	GESZnO 6
30	Additive / component for production of glass	GESZnO 1, GESZnO 4
31	Surface treatment of flat glass	GESZnO 1, GESZnO 4
32	Use of ZnO-containing glass & ceramics in dinnerware	GESZnO 6
33	Use of ZnO-containing glass in displays	GESZnO 6
34	Use of ZnO-containing glassy thin film coatings	GESZnO 6
35	Additive in the manufacturing of electronic components	GESZnO 1, GESZnO 4
36	Additive in the manufacturing of ferrites	GESZnO 1, GESZnO 4
37	Additive in the manufacturing of varistors	GESZnO 1, GESZnO 4
38	ZnO in electrotechnical contact material	GESZnO 1, GESZnO 4
39	Batteries/Fuel cells	GESZnO 1, GESZnO 4, GESZnO 5

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<b>IU number</b>	<b>Identified Use (IU) name</b>	<b>GES code</b>
40	Component for production of rubber, resins and related preparations	GESZnO 1, GESZnO 5
41	Use of ZnO-containing rubber for tyres	GESZnO 7
42	Use of ZnO-containing rubber and other resins for medical devices and applications	GESZnO 7
43	Component for polymer-matrices, plastics and related preparations	GESZnO 1, GESZnO 5
44	Use of ZnO-containing polymers for floor, wall coverings and similar preparations	GESZnO 7
45	Use of ZnO-containing polymers for cable protecting & isolating coatings	GESZnO 7
46	Use of ZnO-containing polymers for tube & sheet articles	GESZnO 7
47	Use of ZnO-containing polymers for molded articles	GESZnO 7
48	Use of ZnO-containing plastic thin films coatings	Generic consumer/environment
49	Additive for the production of Sealants / Adhesives / Mastics	GESZnO 1, GESZnO 5
50	Use of ZnO-containing Sealants / Adhesives / Mastics	Generic consumer/environment
51	Additive for the production of Lubricants / Grease / Metal working fluids	GESZnO 1, GESZnO 5
52	Use of ZnO-containing Lubricants / Grease / Metal working fluids	Generic consumer/environment
53	Additive for the production of Polishes / wax blends	GESZnO 1, GESZnO 5
54	Use of ZnO-containing Polishes/ wax blends	Generic consumer/environment
55	Use of ZnO-containing catalysts	GESZnO 1, GESZnO 5
56	Use of ZnO-containing adsorbents	GESZnO 1, GESZnO 5
57	Additive for production of de-icing products	GESZnO 1, GESZnO 5
58	Use of ZnO-containing de-icing products	Generic consumer/environment
59	Additive for the production of pyrotechnic products	GESZnO 1, GESZnO 4
60	Use of ZnO-containing pyrotechnic products	Generic consumer/environment
61	Additive for the formulation of nutrition additives	GESZnO 1, GESZnO 4, GESZnO 5
62	Additive for the formulation of animal feedstuffs	GESZnO 1, GESZnO 4, GESZnO 5
63	Additive for the formulation of biocidal products	GESZnO 1, GESZnO 4, GESZnO 5
64	Use of ZnO-containing biocidal products	GESZnO 6, GESZnO 7, Generic consumer/environment
65	Additive for the formulation of cleaning products	GESZnO 1, GESZnO 4, GESZnO 5
66	Use of ZnO-containing cleaning products	GESZnO 6, GESZnO 7, Generic consumer/environment
67	Additive for the formulation of fertilizers	GESZnO 1, GESZnO 4, GESZnO 5
68	Use of ZnO-containing fertilizer's formulations	Generic consumer/environment
69	Additive in the formulation of cosmetics	GESZnO 1, GESZnO 4, GESZnO 5
70	Use of cosmetics	GESZnO 6, GESZnO 7, Generic consumer/environment
71	Additive in dentistry products	GESZnO 1, GESZnO 4, GESZnO 5
72	Additive in the formulation of pharma / veterinary products	GESZnO 1, GESZnO 4, GESZnO 5

<b>IU number</b>	<b>Identified Use (IU) name</b>	<b>GES code</b>
73	Use of pharma / veterinary products	GESZnO 6, GESZnO 7, Generic consumer/environment

<b>GES ZnO-0: Industrial use of primary or secondary zinc bearing material in the manufacture of ZnO by several pyro-or hydrometallurgical processes.</b>
SU: 3, 8, 9 PROC: 1, 2, 3, 4,5 , 8b, 9, 22, 26 PC: 19, 20 AC: not applicable ERC: 1, 6a
<b>Description of activities and processes covered in the exposure scenario:</b> There are 3 production processes for ZnO: <ul style="list-style-type: none"> <li> <b>the indirect process</b>  In this process, the starting material is zinc metal (with a purity of 92 – 99.995 %), refined metal, metallic residues and scrap.  The zinc metal is melted, vaporised by boiling and oxidised in the vapour state to zinc oxide with excess of air.  Afterwards, the zinc vapour is burned (oxidised) to produce zinc oxide, which is quenched in excess of air, precipitated from the ZnO/air mixture in settling chambers, in which the fractionation of the zinc oxide particles takes place according to their size. </li> <li> <b>the direct process</b>  In this process, the starting material is zinc oxide containing residue.  The material is blended with reducing agent (coke breeze) and fed to a furnace. At elevated temperature (~1000°C); the ZnO is reduced to Zinc which vaporises by boiling at that temperature. Air is blown above the surface and oxidises Zinc in the vapour state to Zinc oxide which is entrained in the exhaust airflow.  The entrained Zinc oxide is quenched in excess of air, precipitated from that ZnO/air mixture in settling chambers, in which the fractionation of the zinc oxide particles takes place according to their size. </li> <li> <b>the wet process</b>  In this process, the starting material is a purified zinc salt solution (predominantly dithionate, sulphate or chloride).  Zinc hydroxide and/or carbonate are subsequently precipitated by the addition of alkalines and filtered from the solutions.  Finally, zinc oxide is generated by calcination (dehydration, de-carboxylation) of the Zinc hydroxide or Zinc carbonate or a mixture of both.  The resulting zinc oxide is subsequently collected in bag filters after cooling the exhaust air, and is then packed, as such in powdery form, into paper sacks or big bags, or further granulated before packaging </li> </ul>
<b>Contributing scenario (1) controlling environmental exposure</b>
<b>Product characteristics:</b> see sections 3 (composition) & 9 (phys-chem properties) of SDS ZnO is produced in minimum 80% purity
<b>Amounts used:</b> maximum 50000 T/y
<b>Frequency and duration of use:</b> Continuous production
<b>Environment factors not influenced by risk management:</b> Flow rate receiving waters default for generic scenario: 18,000 m3/d, unless specified otherwise
<b>Other given operational conditions affecting environmental exposure:</b> <ul style="list-style-type: none"> <li>In the wet process, most of the operations are in wet phase.</li> <li>In the direct and indirect dry process, all operational conditions are dry throughout the process; there are no process waters; high temperature steps;</li> <li>Even when no process waters (e.g. when dry process throughout), some non-process water can be generated containing zinc (e.g. from cleaning)</li> <li>All processes are performed indoor in a confined area. All residues containing zinc are recycled.</li> </ul>
<b>Technical conditions and measures at process level (source) to prevent release:</b> See MSDS section 8
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil:</b> See section 8 of SDS
<b>Organizational measures to prevent/limit release from site:</b> See section 8 of SDS
<b>Conditions and measures related to municipal sewage treatment plant:</b> In cases where applicable: default size of the municipal STP (2000 m3/d), unless specified otherwise.
<b>Conditions and measures related to external treatment of waste for disposal:</b> If any, all hazardous wastes are treated by certified contractors according to EU and national legislation.

<b>Conditions and measures related to external recovery of waste:</b> <ul style="list-style-type: none"> <li>All residues from the wet process are recycled.</li> <li>By-products (ashes) from the dry process that are formed in the reactor are recovered and either recycled in the system or handled further according the waste legislation.</li> <li>Users of Zn and Zn-compounds have to favour the recycling channels of the end-of-life products</li> <li>Users of Zn and Zn-compounds have to minimize Zn-containing waste, promote recycling routes and, for the remaining, dispose the waste streams according the Waste regulation.</li> </ul>
<b>Contributing scenario (2) controlling worker exposure</b>
<b>Product characteristics:</b> see sections 3 (composition) & 9 (phys-chem properties) of SDS ZnO (100%) as solid (dry powder) The manufactured zinc oxide is collected in bag filters after cooling the exhaust air, and is then packed, as such in powdery form, into paper sacks or big bags, or further granulated before packaging.
<b>Amounts used:</b> Maximum 96 T/day, 32T/shift
<b>Frequency and duration of use/exposure:</b> 8hrs shift
<b>Human factors not influenced by risk management:</b> Uncovered body parts, (potentially) face can be exposed due to nature of activity
<b>Other given operational conditions affecting workers exposure:</b> All processes are carried out indoor in confined areas.
<b>Technical conditions and measures at process level (source) to prevent release:</b> See MSDS section 8
<b>Technical conditions and measures to control dispersion from source towards the worker:</b> See MSDS section 8
<b>Organisational measures to prevent /limit releases, dispersion and exposure:</b> See MSDS section 8
<b>Conditions and measures related to personal protection, hygiene and health evaluation:</b> <ul style="list-style-type: none"> <li>Wearing of gloves and protective clothing is compulsory (efficiency <math>\geq 90\%</math>).</li> <li>With normal handling, no respiratory personal protection (breathing apparatus) is necessary. If risk for exceedance of OEL/DNEL, use mask as described in MSDS section 8</li> <li>Eyes: safety glasses are optional</li> </ul>

**Exposure estimation and reference to its source: not relevant, refer to CSR.**

Risks for workers and to the environment have to be assessed considering the PNECs and DNELs mentioned under SDS section 8

**Guidance to DU to evaluate whether he works inside the boundaries set by the (G)ES.**

Occupational exposure/environmental emissions

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. Detailed guidance for evaluation of ES can be acquired via your supplier or from the ECHA website (guidance R14, R16). Environmental and human exposure can be measured or modelled (more information on tools available in SDS section 8).

In addition, bioavailability corrections can be integrated in the exposure assessment, if the environmental parameters that are needed for the calculations are documented (see SDS section 8)

<b>ZnO GES-1: Industrial use of ZnO in the formulation of preparations by mixing thoroughly, dry or in a solvent, the starting materials with potentially pressing, pelletizing, sintering, and possibly followed by packaging.</b>
SU: 3,8,9, 10 PROC: 1,2,3,4,5, 8b,9,13, 14, 15, 22,26 PC: Not applicable AC: not applicable ERC: 1,2, 6a



<p>In the described process, the zinc oxide is:</p> <ul style="list-style-type: none"> <li>Removed from the packaging and stored in silos after delivery.</li> <li>Extracted from the silo, dosed and fed with the other reagents to the mixing tank. Mixing occurs batch-wise or continuously, according the process receipt. The mixing occurs in a closed tank/chamber.</li> <li>The preparation (dry or wet (solvent/paste) matrix) is further used as such or packed for further treatment/use.</li> </ul>
<b>Contributing scenario (1) controlling environmental exposure</b>
<b>Product characteristics:</b> see sections 3 (composition) & 9 (phys-chem properties) of SDS, ZnO is used in minimum 80% purity
<b>Amounts used:</b> maximum 5000 T/y
<b>Frequency and duration of use</b> Continuous production is assumed as a worst case. It is possible that use is not continuous; this has to be considered when estimating exposure.
<b>Environment factors not influenced by risk management</b> Flow rate receiving waters default for generic scenario: 18,000 m <sup>3</sup> /d, unless specified otherwise
<b>Other given operational conditions affecting environmental exposure</b> <ul style="list-style-type: none"> <li>All processes are performed indoor in a confined area. High temperature steps are possible. All residues containing zinc are recycled.</li> <li>Even when no process waters (e.g. when dry process throughout), some non-process water can be generated containing zinc(e.g. from cleaning)</li> </ul>
<b>Technical conditions and measures at process level (source) to prevent release:</b> see MSDS section 8
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil:</b> see MSDS section 8
<b>Organizational measures to prevent/limit release from site:</b> see MSDS section 8
<b>Conditions and measures related to municipal sewage treatment plant:</b> In cases where applicable: default size of the municipal STP (2000 m <sup>3</sup> /d), unless specified otherwise.
<b>Conditions and measures related to external treatment of waste for disposal:</b> <ul style="list-style-type: none"> <li>If any, all hazardous wastes are treated by certified contractors according to EU and national legislation.</li> <li>Users of Zn and Zn-compounds have to favour the recycling channels of the end-of-life products</li> <li>Users of Zn and Zn-compounds have to minimize Zn-containing waste, promote recycling routes and, for the remaining, dispose the waste streams according the Waste regulation.</li> </ul>
<b>Conditions and measures related to external recovery of waste:</b> All residues are recycled or handled and conveyed according to the waste legislation.
<b>Contributing scenario (2) controlling worker exposure</b>
<b>Product characteristic:</b> see sections 3 (composition) & 9 (phys-chem properties) of SDS The preparation can be solid or liquid. When the preparation is in solid state, it can be in a) powdery, b) glassy or c) pelletized form. In the powder form, it can be characterised by high dustiness in a worst case situation.
<b>Amounts used:</b> Max 5000T/y = 14T/d = 5T/shift depending on the application.
<b>Frequency and duration of use/exposure:</b> 8 hour shifts (default worst case) are assumed as starting point; it is emphasised that the real duration of exposure could be less. This has to be considered when estimating exposure.
<b>Human factors not influenced by risk management:</b> Uncovered body parts, (potentially) face can be exposed due to nature of activity
<b>Other given operational conditions affecting workers exposure:</b> <ul style="list-style-type: none"> <li>high temperature steps can occur;</li> <li>all indoor processes in confined area.</li> </ul>
<b>Technical conditions and measures at process level (source) to prevent release:</b> See MSDS section 8
<b>Technical conditions and measures to control dispersion from source towards the worker:</b> See MSDS section 8
<b>Organisational measures to prevent /limit releases, dispersion and exposure:</b> See MSDS section 8

## ZINC OXIDE

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**Conditions and measures related to personal protection, hygiene and health evaluation:**

- Wearing of gloves and protective clothing is compulsory (efficiency  $\geq 90\%$ ).
- With normal handling, no respiratory personal protection (breathing apparatus) is necessary. If risk for exceedance of OEL/DNEL, use mask as described in MSDS section 8
- Eyes: safety glasses are optional

**Exposure estimation and reference to its source: not relevant, refer to CSR.**

Risks for workers and to the environment have to be assessed considering the PNECs and DNELs mentioned under SDS section 8

**Guidance to DU to evaluate whether he works inside the boundaries set by the (G)ES.**

Occupational exposure/environmental emissions

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. Detailed guidance for evaluation of ES can be acquired via your supplier or from the ECHA website (guidance R14, R16). Environmental and human exposure can be measured or modelled (more information on tools available in SDS section 8).

In addition, bioavailability corrections can be integrated in the exposure assessment, if the environmental parameters that are needed for the calculations are documented (see SDS section 8)

<b>GES ZnO-2: industrial use of zinc oxide or ZnO-formulations in the manufacturing of other inorganic or organic zinc substances through different process routes, with potentially drying, calcining and packaging.</b>
SU: 3, 8, 9, 10, 14, 15,17, 0 (Nace C24. 4.3., E38.3, C25. 6.1) PROC: 1, 2, 3, 4, 8b, 9, 13, 15, 21, 22, 23, 26 PC : 7, 14, 19, 20, 21 AC : 2, 7, 12 ERC : 1, 2, 4, 5, 6a, 6b, 8a, 8d
Description of activities/process(es) covered in the Exposure Scenario <ul style="list-style-type: none"> <li>• Reception of the ZnO or ZnO-containing formulation, or ZnO-bearing raw material in the reaction tank</li> <li>• Sequential addition of reagents for purification steps and filtration on press filter, when needed (ventilation is adapted).</li> <li>• Concentration by water evaporation, under exhaust hood.</li> <li>• Possible pouring on a cooling belt</li> <li>• Discharge and packaging of produced zinc compounds. Workers have to place and adjust the bag or drum under the discharge pipe and to set the process in motion. Filled bags or drums are subsequently closed and carried to the storage area.</li> <li>• Exposure to dust can occur during packing of the powder. Solutions are packed in intermediate bulk containers (ca. 1 m3 capacity); solids are packed in bags or drums.</li> <li>• Maintenance activities</li> </ul>
<b>Contributing scenario (1) controlling environmental exposure</b>
<b>Product characteristics:</b> see sections 3 (composition) & 9 (phys-chem properties) of SDS Zn-compounds are produced in their pure form e.g; >99%, or in solution.
<b>Amounts used:</b> Up to 75 T/d of ZnO is transformed to equivalent Zn compound
<b>Frequency and duration of use:</b> Continuous production is assumed as a worst case. It is possible that use is not continuous; this has to be considered when estimating exposure.
<b>Environment factors not influenced by risk management</b> Flow rate of receiving surface water usually 18,000 m3/d by default, unless specified otherwise
<b>Other given operational conditions affecting environmental exposure</b> <ul style="list-style-type: none"> <li>• Wet processes (leaching, filtering, purification) followed by drying (possible grinding), and packaging;</li> <li>• All indoor processes, in confined area.</li> </ul>
<b>Technical conditions and measures at process level (source) to prevent release:</b> see SDS section 8
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil:</b> see SDS section 8
<b>Organizational measures to prevent/limit release from site:</b> see SDS section 8
<b>Conditions and measures related to municipal sewage treatment plant:</b> In cases where applicable: default size of the municipal STP (2000 m3/d), unless specified otherwise.
<b>Conditions and measures related to external treatment of waste for disposal:</b> <ul style="list-style-type: none"> <li>• If any, all hazardous wastes are treated by certified contractors according to EU and national legislation.</li> <li>• Users of Zn and Zn-compounds have to favour the recycling channels of the end-of-life products</li> <li>• Users of Zn and Zn-compounds have to minimize Zn-containing waste, promote recycling routes and, for the remaining, dispose the waste streams according the Waste regulation.</li> </ul>

<p><b>Conditions and measures related to external recovery of waste:</b></p> <ul style="list-style-type: none"> <li>All residues from the wet process are recycled.</li> <li>Users of Zn and Zn-compounds have to favour the recycling channels of the end-of-life products</li> <li>Users of Zn and Zn-compounds have to minimize Zn-containing waste, promote recycling routes and, for the remaining, dispose the waste streams according the Waste regulation.</li> </ul>
<p><b>Contributing scenario (2) controlling worker exposure</b></p>
<p><b>Product characteristic:</b> see sections 3 (composition) &amp; 9 (phys-chem properties) of SDS</p> <ul style="list-style-type: none"> <li>Zinc oxide is transformed to equivalent pure zinc compound.</li> <li>The formed zinc compound can be produced as a powder with varying particle size (worst case scenario) or can be in solution.</li> </ul>
<p><b>Amounts used:</b> Up to maximum 25T/shift</p>
<p><b>Frequency and duration of use/exposure:</b> 8hrs shift (worst case)</p>
<p><b>Human factors not influenced by risk management:</b> Uncovered body parts, (potentially) face can be exposed due to nature of activity</p>
<p><b>Other given operational conditions affecting workers exposure:</b> All processes are carried out indoor in confined areas.</p>
<p><b>Technical conditions and measures at process level (source) to prevent release:</b> see section 8 of SDS</p>
<p><b>Organisational measures to prevent /limit releases, dispersion and exposure:</b> see section 8 of SDS</p>
<p><b>Conditions and measures related to personal protection, hygiene and health evaluation:</b></p> <ul style="list-style-type: none"> <li>Wearing of gloves and protective clothing is compulsory (efficiency <math>\geq 90\%</math>)</li> <li>With normal handling, no respiratory personal protection (breathing apparatus) is necessary. If risk for exceedance of OEL/DNEL, use filter masks as described in section 8 of SDS</li> <li>Eyes: safety glasses are optional</li> </ul>

**Exposure estimation and reference to its source: not relevant, refer to CSR.**

Risks for workers and to the environment have to be assessed considering the PNECs and DNELs mentioned under SDS section 8

**Guidance to DU to evaluate whether he works inside the boundaries set by the (G)ES.**

Occupational exposure/environmental emissions

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. Detailed guidance for evaluation of ES can be acquired via your supplier or from the ECHA website (guidance R14, R16). Environmental and human exposure can be measured or modelled (more information on tools available in SDS section 8).

In addition, bioavailability corrections can be integrated in the exposure assessment, if the environmental parameters that are needed for the calculations are documented (see SDS section 8)

<p><b>GES ZnO-3: Industrial and professional use of ZnO as active laboratory reagent in aqueous or organic media, for analysis or synthesis.</b></p>
<p>SU: 3, 10, 22, 24          PROC: 1, 2, 3, 4, 5, 8b, 9, 15          PC: 19, 21, 28, 39          AC: not applicable          ERC: 1,2, 4, 6a, 6b, 8a, 8b, 8d</p>
<p><b>Contributing scenario (1) controlling environmental exposure</b></p>
<p>The zinc oxide is used for:  <b>Analysis:</b> sample (solid or liquid) treatment or preparation: the substance is in the sample or in the reagent  <b>Synthesis:</b> manipulations are usually under ventilation (e.g. laminar flow, ventilation hood)          The substance is used at the industrial scale, in industrial installations for air control and water treatment and at the professional scale by laboratories</p>
<p><b>Product characteristics:</b> see sections 3 (composition) &amp; 9 (phys-chem properties) of SDS</p>

<b>Amounts used:</b> <ul style="list-style-type: none"> <li>• maximum 5 T/y (industrial scale)</li> <li>• maximum 0.5 T/y (professional scale)</li> </ul>
<b>Frequency and duration of use:</b> Use is usually intermittent but continuous use is assumed as a worst case.
<b>Environment factors not influenced by risk management</b> Flow rate of receiving surface water: default for generic scenario: 18,000 m <sup>3</sup> /d, unless specified otherwise
<b>Other given operational conditions affecting environmental exposure</b> All processes are performed indoor in a confined area, with dedicated laboratory equipment. All solid residues containing zinc are recovered for recycling.
<b>Technical conditions and measures at process level (source) to prevent release:</b> see section 8 of SDS
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b> <ul style="list-style-type: none"> <li>• Industrial scale: please refer to section 8 of SDS</li> <li>• At professional scale, the emissions are treated usually by STP. Professional services will be used for treating waste streams e.g. for the recovery of metallic solids (for recycling), and for the recovery of e.g. acid solutions containing the substance.</li> </ul>
<b>Organizational measures to prevent/limit release from site:</b> see section 8 of SDS
<b>Conditions and measures related to municipal sewage treatment plant:</b> In cases where applicable: default size (2000 m <sup>3</sup> /d), unless specified otherwise.
<b>Conditions and measures related to external treatment of waste for disposal:</b> <ul style="list-style-type: none"> <li>• If any, all hazardous wastes are treated by certified contractors according to EU and national legislation.</li> <li>• Users of Zn and Zn-compounds have to favour the recycling channels of the end-of-life products</li> <li>• Users of Zn and Zn-compounds have to minimize Zn-containing waste, promote recycling routes and, for the remaining, dispose the waste streams according the Waste regulation.</li> </ul>
<b>Conditions and measures related to external recovery of waste:</b> All residues are recycled or handled and conveyed according to waste legislation.
<b>Contributing scenario (2) controlling worker exposure</b>
<b>Product characteristic:</b> see sections 3 (composition) & 9 (phys-chem properties) of SDS
<b>Amounts used:</b> <ul style="list-style-type: none"> <li>• maximum 5 T/y (industrial scale)</li> <li>• maximum 0.5 T/y (professional scale)</li> </ul>
<b>Frequency and duration of use/exposure:</b> Use is usually intermittent but continuous use is assumed as a worst case
<b>Human factors not influenced by risk management:</b> Uncovered body parts, (potentially) face can be exposed due to nature of activity
<b>Other given operational conditions affecting workers exposure:</b> <ul style="list-style-type: none"> <li>• high temperature steps can occur in protected zones (fume cupboards);</li> <li>• all indoor processes in confined area, including hazardous substances cabinets.</li> </ul>
<b>Technical conditions and measures at process level (source) to prevent release:</b> see section 8 of SDS for general measures
<b>Technical conditions and measures to control dispersion from source towards the worker:</b> See section 8 of SDS for general measures Local exhaust ventilation systems are provided where needed on the benches and in the fume cupboards.
<b>Organisational measures to prevent /limit releases, dispersion and exposure:</b> see section 8 of SDS
<b>Conditions and measures related to personal protection, hygiene and health evaluation:</b> see section 8 of SDS

**Exposure estimation and reference to its source: not relevant, refer to CSR.**

Risks for workers and to the environment have to be assessed considering the PNECs and DNELs mentioned under SDS section 8

**Guidance to DU to evaluate whether he works inside the boundaries set by the (G)ES.**

Occupational exposure/environmental emissions

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions

and implemented risk management measures are adequate. Detailed guidance for evaluation of ES can be acquired via your supplier or from the ECHA website (guidance R14, R16). Environmental and human exposure can be measured or modelled (more information on tools available in SDS section 8).

In addition, bioavailability corrections can be integrated in the exposure assessment, if the environmental parameters that are needed for the calculations are documented (see SDS section 8)

<b>GES ZnO-4: Industrial use of ZnO or ZnO-formulations as component for the manufacture of solid blends and matrices for further downstream use.</b>
SU: 1, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 16, 20, 0 (Nace C20.1.2., C20.2, C20.5.1., C23.1.1., C23.2) PROC: 1, 2, 3, 4, 5, 6, 8b, 9, 13, 14, 15, 22, 24, 26 PC: 1, 5, 7, 9a, 9b, 9c, 11, 14, 15, 17, 18, 19, 20, 21, 29, 37, (ucnF05990, E070000, 30200) AC: 2, 3, 4, 7, TARIC 6813.18, 854121) ERC: 1, 2, 3, 4, 5, 6a, 6b, 7, 8a, 8b, 8d, 10a, 10b, 11a
ZnO or ZnO-containing preparations are used in the manufacture of dry preparations by mixing thoroughly the starting materials, possibly followed by pressing or pelletizing, and finally packaging of the preparation. The ZnO (/Zn compound) containing preparation/mixture can be either <ul style="list-style-type: none"> <li>• Pressed at high temperature (&gt;1000°C), grinded and re-pressed/sintered or fritted at high temperature</li> <li>• Molten at high temperature (&gt;500°C) and further cast as glassy material</li> <li>• Pressed and pelletized at low temperature</li> </ul> And subsequently packed, or used as such, in further treatment/use
<b>Contributing scenario (1) controlling environmental exposure</b>
<b>Product characteristics:</b> see sections 3 (composition) & 9 (phys-chem properties) of SDS
<b>Amounts used:</b> maximum 5000 T/y
<b>Frequency and duration of use:</b> Continuous production is assumed as a worst case
<b>Environment factors not influenced by risk management:</b> Flow rate of receiving surface water default for generic scenario: 18,000 m <sup>3</sup> /d, unless specified otherwise
<b>Other given operational conditions affecting environmental exposure</b> <ul style="list-style-type: none"> <li>• All dry processes throughout, no process waters. Even when no process waters occur (with dry process throughout), some non-process water can be generated containing zinc (e.g. from cleaning)</li> <li>• High temperature steps are possible.</li> <li>• All processes are performed indoor in a confined area. High temperature steps are possible. All residues containing zinc are recycled.</li> </ul>
<b>Technical conditions and measures at process level (source) to prevent release:</b> see section 8 of SDS
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b> See section 8 of SDS for general measures No process waters, so possible emissions to water are limited and non-process related.
<b>Organizational measures to prevent/limit release from site:</b> see section 8 of SDS
<b>Conditions and measures related to municipal sewage treatment plant:</b> In cases where applicable: default size STP (2000 m <sup>3</sup> /d), unless specified otherwise.
<b>Conditions and measures related to external treatment of waste for disposal</b> <ul style="list-style-type: none"> <li>• If any, all hazardous wastes are treated by certified contractors according to EU and national legislation.</li> <li>• Users of Zn and Zn-compounds have to favour the recycling channels of the end-of-life products</li> <li>• Users of Zn and Zn-compounds have to minimize Zn-containing waste, promote recycling routes and, for the remaining, dispose the waste streams according to the Waste regulation.</li> </ul>
<b>Conditions and measures related to external recovery of waste</b> <ul style="list-style-type: none"> <li>• All residues are recycled or handled and conveyed according to waste legislation.</li> <li>• Users of Zn and Zn-compounds have to favour the recycling channels of the end-of-life products</li> <li>• Users of Zn and Zn-compounds have to minimize Zn-containing waste, promote recycling routes and, for the remaining, dispose the waste streams according to the Waste regulation.</li> </ul>
<b>Contributing scenario (2) controlling worker exposure</b>

<b>Product characteristic:</b> see sections 3 (composition) & 9 (phys-chem properties) of SDS <ul style="list-style-type: none"> <li>Concentration of ZnO in the mixtures can be up to &gt;25% but is usually of the order of &lt;= 5%, depending on the application</li> <li>The preparation is in the solid state, usually with a low level of dustiness; however, powder forms can occur, the high dustiness is therefore applied as a worst case</li> </ul>
<b>Amounts used:</b> Max 5000T/y = 15T/d = 5T/shift depending on the application.
<b>Frequency and duration of use/exposure:</b> 8 hour shifts (default worst case) are assumed as starting point
<b>Human factors not influenced by risk management</b> Uncovered body parts, (potentially) face can be exposed due to nature of activity
<b>Other given operational conditions affecting workers exposure</b> <ul style="list-style-type: none"> <li>Dry processes: dry operational conditions throughout the process; no process waters;</li> <li>high temperature steps can occur;</li> <li>indoor processes in confined area.</li> </ul>
<b>Technical conditions and measures at process level (source) to prevent release:</b> see section 8 of SDS
<b>Technical conditions and measures to control dispersion from source towards the worker:</b> see section 8 of SDS
<b>Organisational measures to prevent /limit releases, dispersion and exposure:</b> see section 8 of SDS
<b>Conditions and measures related to personal protection, hygiene and health evaluation:</b> see section 8 of SDS (personal protection)

**Exposure estimation and reference to its source: not relevant, refer to CSR.**

Risks for workers and to the environment have to be assessed considering the PNECs and DNELs mentioned under SDS section 8

**Guidance to DU to evaluate whether he works inside the boundaries set by the (G)ES.**

Occupational exposure/environmental emissions

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. Detailed guidance for evaluation of ES can be acquired via your supplier or from the ECHA website (guidance R14, R16). Environmental and human exposure can be measured or modelled (more information on tools available in SDS section 8).

In addition, bioavailability corrections can be integrated in the exposure assessment, if the environmental parameters that are needed for the calculations are documented (see SDS section 8)

<b>GES ZnO-5: Industrial use of ZnO or ZnO-formulations as component for the manufacture of dispersions, pastes or other viscous or polymerized matrices.</b>
SU: 1, 3, 4, 5, 6b, 7, 8, 9, 10, 11, 12, 16, 18, 20,0 (Nace C20.2. C27.2) PROC:1, 2, 3, 4, 5, 6, 7, 8a, 8b, 9, 10, 12, 13, 14,19, 20, 21, 22, 24, 26 PC: 1, 2, 4, 7, 8, 9a, 9b, 12, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 28, 29, 31, 32, 33, 34, 35,37, 39, 40 AC: 1, 2,3,7, 10, 11, 13 ERC: 1, 2, 3, 4, 5, 6a, 6b, 6d, 7, 8a, 8b, 8c, 8d, 8f, 10a, 10b, 11a
In the described process, the zinc oxide containing preparation/mixture is: <ul style="list-style-type: none"> <li>Unpacked and stored in silos</li> <li>Extracted from the silo, dosed and fed with the other reagents and/or solvents to the mixing tank, batch-wise or continuously, according the process receipt.</li> <li>The resulting zinc salt containing mixture (solution, dispersion, paste) is directly further processed, or packed, for further treatment/use.</li> </ul>
<b>Contributing scenario (1) controlling environmental exposure</b>
<b>Product characteristics:</b> see sections 3 (composition) & 9 (phys-chem properties) of SDS ZnO in preparation can be > 25%, usually <5%
<b>Amounts used:</b> maximum 5000 T/y
<b>Frequency and duration of use:</b> Continuous production is assumed as a worst case.
<b>Environment factors not influenced by risk management:</b> Flow rate of receiving surface water default: 18,000 m <sup>3</sup> /d, unless specified otherwise

<b>Other given operational conditions affecting environmental exposure</b> <ul style="list-style-type: none"> <li>• Even when no process waters occur, some non-process water can be generated containing zinc (e.g. from cleaning)</li> <li>• All processes are performed indoor in a confined area.</li> <li>• All residues containing zinc are recycled.</li> </ul>
<b>Technical conditions and measures at process level (source) to prevent release:</b> see section 8 of SDS
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil:</b> see section 8 of SDS
<b>Organizational measures to prevent/limit release from site:</b> see section 8 of SDS
<b>Conditions and measures related to municipal sewage treatment plant</b> In cases where applicable: default size of municipal STP (2000m <sup>3</sup> /d), unless specified otherwise.
<b>Conditions and measures related to external treatment of waste for disposal</b> <ul style="list-style-type: none"> <li>• If any, all hazardous wastes are treated by certified contractors according to EU and national legislation.</li> <li>• Users of Zn and Zn-compounds have to favour the recycling channels of the end-of-life products</li> <li>• Users of Zn and Zn-compounds have to minimize Zn-containing waste, promote recycling routes and, for the remaining, dispose the waste streams according the Waste regulation.</li> </ul>
<b>Conditions and measures related to external recovery of waste</b> <ul style="list-style-type: none"> <li>• All residues are recycled or handled and conveyed according to waste legislation.</li> <li>• Users of Zn and Zn-compounds have to favour the recycling channels of the end-of-life products</li> <li>• Users of Zn and Zn-compounds have to minimize Zn-containing waste, promote recycling routes and, for the remaining, dispose the waste streams according the Waste regulation.</li> </ul>
<b>Contributing scenario (2) controlling worker exposure</b>
<b>Product characteristic:</b> see sections 3 (composition) & 9 (phys-chem properties) of SDS <ul style="list-style-type: none"> <li>• The concentration of ZnO in the mixtures can be up to &gt;25% but is usually of the order of &lt;= 5%, depending on the application.</li> <li>• The preparation is in the liquid state, as a paste or dispersion or other viscous or polymerized matrix, with a low level of dustiness; however, powder forms can occur, medium dustiness is therefore applied as a worst case</li> </ul>
<b>Amounts used:</b> Max 5000T/y = 20 T/d = 7T/shift depending on the application.
<b>Frequency and duration of use/exposure:</b> 8 hour shifts (default worst case) are assumed as starting point
<b>Human factors not influenced by risk management</b> Uncovered body parts (potentially) face can be exposed as a result of the nature of the activity
<b>Other given operational conditions affecting workers exposure</b> <ul style="list-style-type: none"> <li>• Wet processes</li> <li>• All indoor processes in confined area.</li> </ul>
<b>Technical conditions and measures at process level (source) to prevent release:</b> see section 8
<b>Technical conditions and measures to control dispersion from source towards the worker:</b> see section 8 LEV in work area: efficiency 84% (generic LEV)
<b>Organisational measures to prevent /limit releases, dispersion and exposure:</b> see section 8
<b>Conditions and measures related to personal protection, hygiene and health evaluation:</b> see section 8 In particular, when PROC 7, 11, 19 are involved, respiratory protection is recommended

**Exposure estimation and reference to its source: not relevant, refer to CSR.**

Risks for workers and to the environment have to be assessed considering the PNECs and DNELs mentioned under SDS section 8

**Guidance to DU to evaluate whether he works inside the boundaries set by the (G)ES.**

Occupational exposure/environmental emissions

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. Detailed guidance for evaluation of ES can be acquired via your supplier or from the ECHA website (guidance R14, R16). Environmental and human exposure can be measured or modelled (more information on tools available in SDS section 8).



In addition, bioavailability corrections can be integrated in the exposure assessment, if the environmental parameters that are needed for the calculations are documented (see SDS section 8)

<b>GES ZnO-6: Industrial and professional use of solid substrates containing less than 25%w/w of ZnO.</b> SU: 0 (Nace C23.1., C23.4., F43.3.4.), 3, 5, 6b, 9, 10, 13, 16, 17,20, 22 PROC: 4, 5 ,6, 7, 8b, 9,10, 11, 13, 14, 19, 21, 22, 26 PC: 1, 8, 9a, 9b, 9c,14,15, 18, 19, 20, 21, 23, 28, 29, 33, 34, 35, 39, 0(UCN F40000, G15000) AC: 1, 2, 4, (Taric 6813.81, 6911), 0 (coatings for art and creative items) ERC: 2, 4, 5, 8a, 8d, 10a, 10b, 11a, 12a
This scenario covers both the industrial scale processes and professional use. In the described process, the ZnO containing preparation/mixture is further processed, involving potentially the following steps: <ul style="list-style-type: none"> <li>reception/unpacking of material</li> <li>Final application, embedding, or shaping to produce the end product or article.</li> </ul>
<b>Contributing scenario (1) controlling environmental exposure</b>
<b>Product characteristics:</b> see sections 3 (composition) & 9 (phys-chem properties) of SDS ZnO (or Zn compound) in the article is < 25%
<b>Amounts used:</b> Typical quantities for both Industrial and professional are 50T/y (typical), maximum 500T/y (in industrial setting).
<b>Frequency and duration of use:</b> Continuous production is assumed as a worst case.
<b>Environment factors not influenced by risk management:</b> Flow rate of receiving surface water default: 18,000 m3/d, unless specified otherwise
<b>Other given operational conditions affecting environmental exposure</b> <ul style="list-style-type: none"> <li>Solid, so in principle all dry processes throughout, no process waters. Even when no process waters occur (with dry process throughout), some non-process water can be generated containing zinc (e.g. from cleaning)</li> <li>In industrial and professional setting, all processes are performed indoor in a confined area. All residues containing zinc are recycled.</li> </ul>
<b>Technical conditions and measures at process level (source) to prevent release:</b> See section 8
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b> In industrial and professional setting, the following applies: <ul style="list-style-type: none"> <li>No process waters, so possible emissions to water are limited and non-process related.</li> <li>By exposure modeling it is predicted that at use quantities of &gt;100T/y, refinement of the exposure assessment to water and sediment needs to be made (exposure assessment based on real measured data and local parameters). Treatment of the emissions to water may be needed under such conditions.</li> <li>See section 8 of SDS for air and water emissions abatement systems</li> </ul>
<b>Organizational measures to prevent/limit release from site:</b> see section 8 of SDS
<b>Conditions and measures related to municipal sewage treatment plant</b> In cases where applicable: default size of the municipal STP (2000 m3/d), unless specified otherwise.
<b>Conditions and measures related to external treatment of waste for disposal</b> <ul style="list-style-type: none"> <li>If any, all hazardous wastes are treated by certified contractors according to EU and national legislation.</li> <li>Users of Zn and Zn-compounds have to favour the recycling channels of the end-of-life products</li> <li>Users of Zn and Zn-compounds have to minimize Zn-containing waste, promote recycling routes and, for the remaining, dispose the waste streams according the Waste regulation.</li> </ul>
<b>Conditions and measures related to external recovery of waste:</b> All residues are recycled or handled and conveyed according to the waste legislation.
<b>Contributing scenario (2) controlling worker exposure</b>
<b>Product characteristic:</b> see sections 3 (composition) & 9 (phys-chem properties) of SDS <ul style="list-style-type: none"> <li>The concentration of ZnO (or Zn compound) in the mixture is &lt; 25%</li> <li>The mixture is in the solid state, with a low level of dustiness; however, powder forms can occur, the medium dustiness is therefore applied as a worst case.</li> </ul>
<b>Amounts used</b> <ul style="list-style-type: none"> <li>Typical quantities for both Industrial and professional are 50 T/y (typical), or 0.15 T/day, 0.05 T/shift</li> <li>Maximum use quantity is 500T/y (1.5T/d, 0.5T/shift) in industrial setting.</li> </ul>

<b>Frequency and duration of use/exposure:</b> 8 hour shifts (default worst case) are assumed as starting point
<b>Human factors not influenced by risk management:</b> Uncovered body parts (potentially) face can be exposed as a result of the nature of the activity
<b>Other given operational conditions affecting workers exposure</b> Industrial / Professional: <ul style="list-style-type: none"> <li>• Dry processes: dry operational conditions throughout the process, no process waters;</li> <li>• Indoor processes in confined area.</li> </ul>
<b>Technical conditions and measures at process level (source) to prevent release</b> Industrial /professional see section 8 of SDS
<b>Technical conditions and measures to control dispersion from source towards the worker</b> Industrial /professional: LEV in work area: efficiency 84% (generic LEV) See section 8 for more specific abatement systems
<b>Organisational measures to prevent /limit releases, dispersion and exposure:</b> see section 8 of SDS
<b>Conditions and measures related to personal protection, hygiene and health evaluation:</b> see section 8 of SDS

**Exposure estimation and reference to its source: not relevant, refer to CSR.**

Risks for workers and to the environment have to be assessed considering the PNECs and DNELs mentioned under SDS section 8

**Guidance to DU to evaluate whether he works inside the boundaries set by the (G)ES.**

Occupational exposure/environmental emissions

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. Detailed guidance for evaluation of ES can be acquired via your supplier or from the ECHA website (guidance R14, R16). Environmental and human exposure can be measured or modelled (more information on tools available in SDS section 8).

In addition, bioavailability corrections can be integrated in the exposure assessment, if the environmental parameters that are needed for the calculations are documented (see SDS section 8)

<b>GES ZnO-7: Industrial and professional use of dispersions, pastes and polymerised substrates containing less than 25%w/w of ZnO.</b>
SU:1, 3, 4, 5, 6, 9, 10, 11, 12, 13, 15, 17, 18, 19, 20, 22, 0 (Nace C22.1.1.) PROC: 1, 4, 5, 7, 8a, 8b, 9, 10, 11, 13, 14, 15, 17, 19, 21, 24 PC: 1, 4, 8, 9a, 9b, 9c, 14,, 15, 18, 19, 20, 21, 24, 25, 28, 29, 31, 32, 33, 35, 39 AC: 1, 2, 3, 5, 7, 10, 13, 0 (coatings for art and creative items) ERC: 5, 6d, 8a, 8c, 8d, 8f, 10a, 10b, 11a, 12a
This scenario covers both the industrial scale processes and professional use. In the described process, the ZnO containing preparation/mixture is further processed, involving potentially the following steps: <ul style="list-style-type: none"> <li>• Reception/unpacking of material</li> <li>• Final application, spraying, embedding or to produce the end product or article.</li> </ul>
<b>Contributing scenario (1) controlling environmental exposure</b>
<b>Product characteristics:</b> see sections 3 (composition) & 9 (phys-chem properties) of SDS ZnO (or Zn compound) in the article is < 25%
<b>Amounts used:</b> Typical quantities for both industrial and professional are 50T/y (typical), maximum 500T/y (in industrial setting).
<b>Frequency and duration of use:</b> Continuous production is assumed as a worst case
<b>Environment factors not influenced by risk management:</b> Flow rate of receiving surface water default: 18,000 m <sup>3</sup> /d, unless specified otherwise
<b>Other given operational conditions affecting environmental exposure</b> <ul style="list-style-type: none"> <li>• Wet processes. All process and non-process waters should be recycled internally to a maximal extent. Even when no process waters occur, some non-process water can be generated containing zinc (e.g. from cleaning)</li> <li>• In industrial and professional setting, all processes are performed in a confined area. All residues containing zinc are recycled.</li> </ul>
<b>Technical conditions and measures at process level (source) to prevent release:</b> see section 8

<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b> See section 8 of SDS By exposure modeling it is predicted that at use quantities of >100T/y, refinement of the exposure assessment to water and sediment needs to be made (exposure assessment based on real measured data and local parameters). Treatment of the emissions to water may be needed under such conditions.
<b>Organizational measures to prevent/limit release from site:</b> see section 8 of SDS
<b>Conditions and measures related to municipal sewage treatment plant:</b> In cases where applicable, default size of the municipal STP (2000 m <sup>3</sup> /d), unless specified otherwise.
<b>Conditions and measures related to external treatment of waste for disposal</b> <ul style="list-style-type: none"><li>• If any, all hazardous wastes are treated by certified contractors according to EU and national legislation.</li><li>• Users of Zn and Zn-compounds have to favour the recycling channels of the end-of-life products</li><li>• Users of Zn and Zn-compounds have to minimize Zn-containing waste, promote recycling routes and, for the remaining, dispose the waste streams according the Waste regulation.</li></ul>
<b>Conditions and measures related to external recovery of waste</b> All residues are recycled or handled and conveyed according to waste legislation.

<b>Contributing scenario (2) controlling worker exposure</b>
<b>Product characteristic:</b> see sections 3 (composition) & 9 (phys-chem properties) of SDS <ul style="list-style-type: none"><li>• Particles can occur sporadically, the low level of dustiness is basically applied.</li><li>• Most of the processes imply the use of solutions or pastes; the “solution status” is therefore taken as the worst case.</li></ul>
<b>Amounts used</b> <ul style="list-style-type: none"><li>• Typical quantities for both Industrial and professional are 50 T/y (typical), or 0.15 T/day, 0.05 T/shift.</li><li>• Maximum use quantity is 500T/y (1.5T/d, 0.5T/shift) in industrial setting.</li></ul>
<b>Frequency and duration of use/exposure:</b> 8 hour shifts (default worst case) are assumed as starting point
<b>Human factors not influenced by risk management</b> Uncovered body parts, (potentially) face exposed as a result of the nature of the activity
<b>Other given operational conditions affecting workers exposure</b> Industrial / Professional: Wet processes, all indoor in confined area.
<b>Technical conditions and measures at process level (source) to prevent release:</b> see section 8
<b>Technical conditions and measures to control dispersion from source towards the worker</b> Industrial /professional: LEV in work area: efficiency 84% (generic LEV). See section 8 of SDS
<b>Organisational measures to prevent /limit releases, dispersion and exposure:</b> see section 8 of SDS
<b>Conditions and measures related to personal protection, hygiene and health evaluation:</b> see section 8 of SDS