SAFETY DATA SHEET

Based upon Regulation (EC) No 1907/2006, as amended by Regulation (EU) No 2015/830

zinc sulfate, solution

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

1.1. Product identifier

Product name : zinc sulfate, solution

Synonyms : gezuiverde oplossing; sulfate de zinc; zinc sulphate liquor; Zinksulfatlauge; zinksulphate liquor; ZnSO4, NEUTRAL BLEED

Registration number REACH : 01-2119486968-11-0002 (Nyrstar Belgium NV/SA)
01-2119486968-11-0003 (Nyrstar Budel BV)
01-2119486968-11-0004 (Nyrstar France SAS)

Product type REACH : On-site isolated intermediate

: Transported isolated intermediate

CAS number : 69012-24-4

EC number : 273-723-4

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

1.2.1 Relevant identified uses

Under Regulation (EC) No 1907/2006 the substance is defined as an on-site and transported isolated intermediate and must be used in correspondence to that status, including the application of strictly controlled conditions

Industrial use: manufacturing of chemicals

For further details concerning the management measures: see the attached annex

1.2.2 Uses advised against

No uses advised against known

1.3. Details of the supplier of the safety data sheet

Supplier of the safety data sheet

Nyrstar Belgium N.V. on behalf of Nyrstar Sales & Marketing A.G.
Zinkstraat 1
B-2490 Balen
☎ +32 14 44 95 00
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Nyrstar France S.A.S. on behalf of Nyrstar Sales & Marketing A.G.
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Manufacturer of the product

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1.4. Emergency telephone number

24h/24h (Telephone advice: English, French, German, Dutch):

+32 14 58 45 45 (BIG)

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classified as dangerous according to the criteria of Regulation (EC) No 1272/2008

Class	Category	Hazard statements
Acute Tox.	category 4	H302: Harmful if swallowed.

Eye Dam.	category 1	H318: Causes serious eye damage.
Aquatic Acute	category 1	H400: Very toxic to aquatic life.
Aquatic Chronic	category 1	H410: Very toxic to aquatic life with long lasting effects.

2.2. Label elements

Signal word Danger

H-statements

H302	Harmful if swallowed.
H318	Causes serious eye damage.
H410	Very toxic to aquatic life with long lasting effects.

P-statements

P280	Wear eye protection
P264	Wash hands thoroughly after handling.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P330	Rinse mouth.
P310	Immediately call a POISON CENTER/doctor.
P391	Collect spillage.

2.3. Other hazards

No other hazards known

SECTION 3: Composition/information on ingredients

3.1. Substances

Name REACH Registration No	CAS No EC No	Conc. (C)	Classification according to CLP	Note	Remark
zinc sulphate (anhydrous)	7733-02-0 231-793-3	C<30%	Acute Tox. 4; H302 Eye Dam. 1; H318 Aquatic Acute 1; H400 Aquatic Chronic 1; H410	(1)	Constituent
magnesium sulphate	7487-88-9 231-298-2	C<8%			Constituent
manganese sulphate	7785-87-7 232-089-9	<2%	STOT RE 2; H373 Aquatic Chronic 2; H411	(1)(2)	Constituent
sulphuric acid	7664-93-9 231-639-5	C<0.5%	Skin Corr. 1A; H314	(1)(2)(8)(10)	Constituent
water	7732-18-5 231-791-2				Constituent

(1) For H-statements in full: see heading 16
(2) Substance with a Community workplace exposure limit
(8) Specific concentration limits, see heading 16
(10) Subject to restrictions of Annex XVII of Regulation (EC) No. 1907/2006

3.2. Mixtures

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

General:

Check the vital functions. Unconscious: maintain adequate airway and respiration. Respiratory arrest: artificial respiration or oxygen. Cardiac arrest: perform resuscitation. Victim conscious with laboured breathing: half-seated. Victim in shock: on his back with legs slightly raised. Vomiting: prevent asphyxia/aspiration pneumonia. Prevent cooling by covering the victim (no warming up). Keep watching the victim. Give psychological aid. Keep the victim calm, avoid physical strain. Depending on the victim's condition: doctor/hospital.

After inhalation:

Remove the victim into fresh air. Respiratory problems: consult a doctor/medical service.

After skin contact:

Rinse with water. Take victim to a doctor if irritation persists.

After eye contact:

Rinse immediately with plenty of water for 15 minutes. Do not apply neutralizing agents. Take victim to an ophthalmologist.

After ingestion:

Rinse mouth with water. Immediately after ingestion: give lots of water to drink. Consult a doctor/medical service if you feel unwell.

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

4.2.1 Acute symptoms

After inhalation:

No effects known.

After skin contact:

Slight irritation.

After eye contact:

Corrosion of the eye tissue.

After ingestion:

AFTER INGESTION OF HIGH QUANTITIES: Gastrointestinal complaints. Nausea. Vomiting. Abdominal pain. Diarrhoea. Decreased renal function. Change in the haemogramme/blood composition.

4.2.2 Delayed symptoms

No effects known.

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

If applicable and available it will be listed below.

SECTION 5: Firefighting measures

The information in this section is a general description. If available, the documentation for isolated intermediates will be attached in annex to support safe handling arrangements.

5.1. Extinguishing media

5.1.1 Suitable extinguishing media:

Adapt extinguishing media to the environment.

5.1.2 Unsuitable extinguishing media:

No unsuitable extinguishing media known.

5.2. Special hazards arising from the substance or mixture

On burning: release of toxic and corrosive gases/vapours (sulphur oxides, zinc oxide).

5.3. Advice for firefighters

5.3.1 Instructions:

Dilute toxic gases with water spray. Take account of toxic/corrosive precipitation water. Take account of environmentally hazardous firefighting water. Use water moderately and if possible collect or contain it.

5.3.2 Special protective equipment for fire-fighters:

Gloves. Safety glasses. Protective clothing. Heat/fire exposure: compressed air/oxygen apparatus.

SECTION 6: Accidental release measures

The information in this section is a general description. If available, the documentation for isolated intermediates will be attached in annex to support safe handling arrangements.

6.1. Personal precautions, protective equipment and emergency procedures

No naked flames.

6.1.1 Protective equipment for non-emergency personnel

See heading 8.2

6.1.2 Protective equipment for emergency responders

Gloves. Safety glasses. Protective clothing.

Suitable protective clothing

See heading 8.2

6.2. Environmental precautions

Contain released product, pump into suitable containers. Plug the leak, cut off the supply. Dam up the liquid spill. Prevent soil and water pollution. Prevent spreading in sewers.

6.3. Methods and material for containment and cleaning up

Take up liquid spill into absorbent material, e.g.: sand, earth, vermiculite. Scoop absorbed substance into closing containers. Carefully collect the spill/leftovers. Clean contaminated surfaces with an excess of water. Take collected spill to manufacturer/competent authority. Wash clothing and equipment after handling.

6.4. Reference to other sections

See heading 13.

SECTION 7: Handling and storage

The information in this section is a general description. If available, the documentation for isolated intermediates will be attached in annex to support safe handling arrangements.

7.1. Precautions for safe handling

Keep away from naked flames. Gas/vapour heavier than air at 20°C. Observe normal hygiene standards. Keep container tightly closed. Do not discharge the waste into the drain.

7.2. Conditions for safe storage, including any incompatibilities

7.2.1 Safe storage requirements:

Ventilation at floor level. Provide for a tub to collect spills. Keep only in the original container. Meet the legal requirements.

7.2.2 Keep away from:

(Strong) bases.

7.2.3 Suitable packaging material:

HDPE, stainless steel 316L.

7.2.4 Non suitable packaging material:

No data available

7.3. Specific end use(s)

If available, the documentation for isolated intermediates will be attached in annex to support safe handling arrangements.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

8.1.1 Occupational exposure

a) Occupational exposure limit values

If limit values are applicable and available these will be listed below.

EU

Sulphuric acid (mist)	Time-weighted average exposure limit 8 h (Indicative occupational exposure limit value)	0.05 mg/m³

Belgium

Acide sulfurique (brume)	Time-weighted average exposure limit 8 h	0.2 mg/m³
Manganèse et ses composés (en Mn)	Time-weighted average exposure limit 8 h	0.2 mg/m³

The Netherlands

Mangaanverbindingen (als Mn)	Time-weighted average exposure limit 8 h (Private occupational exposure limit value)	1 mg/m³
	Short time value (Private occupational exposure limit value)	3 mg/m³
Zwavelzuur (nevel), gedefinieerd als de thoracale fractie	Time-weighted average exposure limit 8 h (Public occupational exposure limit value)	0.012 ppm
	Time-weighted average exposure limit 8 h (Public occupational exposure limit value)	0.05 mg/m³

France

Acide sulfurique, fraction thoracique	Time-weighted average exposure limit 8 h (VRI: Valeur réglementaire indicative)	0.05 mg/m³
	Short time value (VL: Valeur non réglementaire indicative)	3 mg/m³

Germany

Mangan und seine anorganischen Verbindungen	Time-weighted average exposure limit 8 h (TRGS 900)	0.02 mg/m³
	Time-weighted average exposure limit 8 h (TRGS 900)	0.2 mg/m³
Schwefelsäure	Time-weighted average exposure limit 8 h (TRGS 900)	0.1 mg/m³

UK

Manganese inorganic compounds (as Mn)	Time-weighted average exposure limit 8 h (Workplace exposure limit (EH40/2005))	0.5 mg/m³
Sulphuric acid (mist)	Time-weighted average exposure limit 8 h (Workplace exposure limit (EH40/2005))	0.05 mg/m³

USA (TLV-ACGIH)

Manganese, inorganic compounds, as Mn	Time-weighted average exposure limit 8 h (TLV - Adopted Value)	0.1 mg/m³ (I)
Sulfuric acid	Time-weighted average exposure limit 8 h (TLV - Adopted Value)	0.2 mg/m³ (T)

(I): Inhalable fraction
(T): Thoracic fraction

b) National biological limit values

If limit values are applicable and available these will be listed below.

8.1.2 Sampling methods

If applicable and available it will be listed below.

Manganese	OSHA	ID 121
Manganese	OSHA	ID 125G
NON-VOLATILE ACIDS (Sulfuric Acid)	NIOSH	7908
Sulfites, & Sulfates	NIOSH	6004
Sulfuric Acid (Acids, inorganic)	NIOSH	7903
Sulfuric Acid mist	ASTM	D 4856-88
Sulfuric Acid	NIOSH	7903
Sulfuric Acid	OSHA	ID 113
Sulfuric Acid	OSHA	ID 165SG
Zinc & Cpds (as Zn)	NIOSH	7030

8.1.3 Applicable limit values when using the substance or mixture as intended

If limit values are applicable and available these will be listed below.

8.1.4 DNEL/PNEC values

DNEL/DMEL - Workers

zinc sulphate (anhydrous)

Effect level (DNEL/DMEL)	Type	Value	Remark
DNEL	Long-term systemic effects inhalation	1 mg/m³	
	Long-term systemic effects dermal	8.3 mg/kg bw/day	

magnesium sulphate

Effect level (DNEL/DMEL)	Type	Value	Remark
DNEL	Long-term systemic effects inhalation	37.6 mg/m³	
	Long-term systemic effects dermal	21.3 mg/kg bw/day	

manganese sulphate

Effect level (DNEL/DMEL)	Type	Value	Remark
DNEL	Long-term systemic effects inhalation	0.2 mg/m³	
	Long-term systemic effects dermal	0.004 mg/kg bw/day	

sulphuric acid

Effect level (DNEL/DMEL)	Type	Value	Remark
DNEL	Long-term local effects inhalation	0.05 mg/m³	
	Acute local effects inhalation	0.1 mg/m³	

DNEL/DMEL - General population

zinc sulphate (anhydrous)

Effect level (DNEL/DMEL)	Type	Value	Remark
DNEL	Long-term systemic effects inhalation	1.25 mg/m³	
	Long-term systemic effects dermal	8.3 mg/kg bw/day	
	Long-term systemic effects oral	0.83 mg/kg bw/day	

magnesium sulphate

Effect level (DNEL/DMEL)	Type	Value	Remark
DNEL	Long-term systemic effects inhalation	11.1 mg/m³	
	Long-term systemic effects dermal	12.8 mg/m³	
	Long-term systemic effects oral	12.8 mg/m³	

manganese sulphate

Effect level (DNEL/DMEL)	Type	Value	Remark
DNEL	Long-term systemic effects inhalation	0.043 mg/m³	
	Long-term systemic effects dermal	0.002 mg/m³	

sulphuric acid

Effect level (DNEL/DMEL)	Type	Value	Remark
			No data available

PNEC

zinc sulphate (anhydrous)

Compartments	Value	Remark
Fresh water	20.6 µg/l	
Marine water	6.1 µg/l	
STP	100 µg/l	
Fresh water sediment	117.8 mg/kg sediment dw	
Marine water sediment	56.5 mg/kg sediment dw	
Soil	35.6 mg/kg soil dw	

magnesium sulphate

Compartments	Value	Remark
Fresh water	0.68 mg/l	
Marine water	0.068 mg/l	
Aqua (intermittent releases)	6.8 mg/l	
STP	10 mg/l	

manganese sulphate

Compartments	Value	Remark
Fresh water	0.013 mg/l	
Marine water	0.0004 mg/l	
Aqua (intermittent releases)	0.03 mg/l	
STP	56 mg/l	
Fresh water sediment	0.011 mg/kg sediment dw	
Marine water sediment	0.00114 mg/kg sediment dw	
Soil	25.1 mg/kg soil dw	

sulphuric acid

Compartments	Value	Remark
Fresh water	0.003 mg/l	
Marine water	0 mg/l	
STP	8.8 mg/l	
Fresh water sediment	0.002 mg/kg sediment dw	
Marine water sediment	0.002 mg/kg sediment dw	

8.1.5 Control banding

If applicable and available it will be listed below.

8.2. Exposure controls

The information in this section is a general description. If available, the documentation for isolated intermediates will be attached in annex to support safe handling arrangements.

8.2.1 Appropriate engineering controls

Keep away from naked flames. Carry operations in the open/under local exhaust/ventilation or with respiratory protection.

8.2.2 Individual protection measures, such as personal protective equipment

Observe normal hygiene standards. Keep container tightly closed. Do not eat, drink or smoke during work.

a) Respiratory protection:

If conc. in air > exposure limit: dust/aerosol mask with filter type P2.

b) Hand protection:

Gloves.

- materials (good resistance)

PVC with nylon coating.

c) Eye protection:

Safety glasses.

d) Skin protection:

Protective clothing.

8.2.3 Environmental exposure controls:

See headings 6.2, 6.3 and 13

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical form	Liquid
Odour	Odourless
Odour threshold	Not applicable
Colour	Colourless
Particle size	Not applicable (liquid)
Explosion limits	No data available
Flammability	Non combustible
Log Kow	Not applicable (mixture)
Dynamic viscosity	No data available
Kinematic viscosity	No data available
Melting point	-20 °C
Boiling point	> 100 °C
Flash point	Not applicable
Evaporation rate	No data available

Relative vapour density	No data available
Vapour pressure	No data available
Solubility	No data available
Relative density	1.4
Decomposition temperature	600 °C
Auto-ignition temperature	No data available
Explosive properties	No chemical group associated with explosive properties
Oxidising properties	No chemical group associated with oxidising properties
pH	2 - 5

9.2. Other information

Absolute density	1400 kg/m³

SECTION 10: Stability and reactivity

10.1. Reactivity

Substance has acid reaction.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

Reacts exothermically with (some) bases.

10.4. Conditions to avoid

Keep away from naked flames.

10.5. Incompatible materials

(strong) bases.

10.6. Hazardous decomposition products

On burning: release of toxic and corrosive gases/vapours (sulphur oxides, zinc oxide).

SECTION 11: Toxicological information

11.1. Information on toxicological effects

11.1.1 Test results

Acute toxicity

zinc sulfate, solution

No (test)data available

zinc sulphate (anhydrous)

Route of exposure	Parameter	Method	Value	Exposure time	Species	Value determination	Remark
Oral	LD50	OECD 401	1710 mg/kg bw		Rat (male)	Experimental value	
Dermal	LD50	OECD 402	> 2000 mg/kg bw	24 h	Rat (male/female)	Experimental value	

magnesium sulphate

Route of exposure	Parameter	Method	Value	Exposure time	Species	Value determination	Remark
Oral	LD50	OECD 425	> 2000 mg/kg bw		Rat (male/female)	Experimental value	
Dermal	LD50	OECD 402	> 2000 mg/kg	24 h	Rat (male/female)	Experimental value	
Inhalation						Data waiving	

manganese sulphate

Route of exposure	Parameter	Method	Value	Exposure time	Species	Value determination	Remark
Oral	LD50		2150 mg/kg		Rat (male/female)	Experimental value	
Dermal						Data waiving	
Inhalation (dust)	LC50	OECD 403	> 4.45 mg/l air	4 h	Rat (male/female)	Experimental value	

sulphuric acid

Route of exposure	Parameter	Method	Value	Exposure time	Species	Value determination	Remark
Oral	LD50	Equivalent to OECD 401	2140 mg/kg bw		Rat (male/female)	Experimental value	Test data of the pure substance
Dermal						Data waiving	
						Expert judgement	Not classified

Classification is based on the relevant ingredients

Conclusion

Harmful if swallowed.

Not classified as acute toxic in contact with skin

Not classified as acute toxic if inhaled

Corrosion/irritation

zinc sulfate, solution

No (test)data available

zinc sulphate (anhydrous)

Route of exposure	Result	Method	Exposure time	Time point	Species	Value determination	Remark
Eye	Highly irritating	OECD 405	21 days (continuous)	1; 24; 48; 72 hrs; 7; 14; 21 days	Rabbit	Experimental value	
Skin	Not irritating	OECD 404	4 h	1; 24; 48; 72 hours	Rabbit	Experimental value	

magnesium sulphate

Route of exposure	Result	Method	Exposure time	Time point	Species	Value determination	Remark
Eye	Not irritating	OECD 405		24; 48; 72 hours	Rabbit	Read-across	
Not applicable (in vitro test)	Not irritating	EU Method B.46	5 minutes	15 minutes	Reconstructed human epidermis	Read-across	

manganese sulphate

Route of exposure	Result	Method	Exposure time	Time point	Species	Value determination	Remark
Eye	Serious eye damage	OECD 405		24; 48 hours	Rabbit	Experimental value	Single treatment
Skin	Not irritating	OECD 404	4 h	24; 72 hours	Rabbit	Experimental value	

sulphuric acid

Route of exposure	Result	Method	Exposure time	Time point	Species	Value determination	Remark
Eye						Data waiving	
Eye	Serious eye damage; category 1					Annex VI	
Skin						Data waiving	
Skin	Corrosive; category 1A					Annex VI	

Classification is based on the relevant ingredients

Conclusion

Causes serious eye damage.

Not classified as irritating to the skin

Not classified as irritating to the respiratory system

Respiratory or skin sensitisation

zinc sulfate, solution

No (test)data available

zinc sulphate (anhydrous)

Route of exposure	Result	Method	Exposure time	Observation time point	Species	Value determination	Remark
Skin	Not sensitizing				Mouse (female)	Experimental value	

magnesium sulphate

Route of exposure	Result	Method	Exposure time	Observation time point	Species	Value determination	Remark
Skin	Not sensitizing	OECD 429			Mouse (female)	Experimental value	

manganese sulphate

Route of exposure	Result	Method	Exposure time	Observation time point	Species	Value determination	Remark
Skin	Not sensitizing	Equivalent to OECD 429			Mouse (female)	Read-across	

sulphuric acid

Route of exposure	Result	Method	Exposure time	Observation time point	Species	Value determination	Remark
Skin						Data waiving	
Inhalation						Data waiving	

Judgement is based on the relevant ingredients

Conclusion

Not classified as sensitizing for skin

Not classified as sensitizing for inhalation

Specific target organ toxicity

zinc sulfate, solution

No (test)data available

zinc sulphate (anhydrous)

Route of exposure	Parameter	Method	Value	Organ	Effect	Exposure time	Species	Value determination
Oral (diet)	NOEL	OECD 408	234 mg/kg bw/day - 243 mg/kg bw/day		No effect	13 weeks (daily)	Rat (male/female)	Experimental value
Dermal								Data waiving

magnesium sulphate

Route of exposure	Parameter	Method	Value	Organ	Effect	Exposure time	Species	Value determination
Oral (diet)	NOAEL	Equivalent to OECD 453	256 mg/kg bw/day - 284 mg/kg bw/day		No effect	52 week(s)	Rat (male/female)	Read-across
Dermal								Data waiving
Inhalation								Data waiving

manganese sulphate

Route of exposure	Parameter	Method	Value	Organ	Effect	Exposure time	Species	Value determination
Oral (diet)	NOAEL	Other	1700 mg/kg bw/day		No effect	13 weeks (daily)	Rat (male)	Read-across
Oral (diet)	NOAEL	Other	2000 mg/kg bw/day		No effect	13 weeks (daily)	Rat (female)	Read-across
Dermal								Data waiving
Inhalation (aerosol)		Subchronic toxicity test		Brain	Haematological changes		Monkey (male)	Experimental value

sulphuric acid

Route of exposure	Parameter	Method	Value	Organ	Effect	Exposure time	Species	Value determination
Oral								Data waiving
Dermal								Data waiving
Inhalation (aerosol)	LOAEC	OECD 412	0.3 mg/m³ air	Respiratory tract	Histology	4 weeks (6h/day, 5 days/week)	Rat (female)	Experimental value
Inhalation (aerosol)	NOAEC		502 mg/m³ air		No effect	7 days (continuous)	Monkey (female)	Experimental value
Inhalation		Human observation	> 1 mg/m³ air	Lungs	Lung tissue affection/degeneration		Human	Weight of evidence

Judgement is based on the relevant ingredients

Conclusion

Not classified for subchronic toxicity

Mutagenicity (in vitro)

zinc sulfate, solution

No (test)data available

zinc sulphate (anhydrous)

Result	Method	Test substrate	Effect	Value determination
Negative with metabolic activation, negative without metabolic activation	Ames test	Bacteria (S.typhimurium)		Experimental value

magnesium sulphate

Result	Method	Test substrate	Effect	Value determination
Negative with metabolic activation, negative without metabolic activation	OECD 476	Mouse (lymphoma L5178Y cells)		Experimental value

manganese sulphate

Result	Method	Test substrate	Effect	Value determination
Negative with metabolic activation, negative without metabolic activation	OECD 473	Human lymphocytes	No effect	Read-across
Negative	OECD 471	Bacteria (S.typhimurium)	No effect	Read-across
Negative with metabolic activation, negative without metabolic activation	OECD 476	Mouse (lymphoma L5178Y cells)	No effect	Read-across

sulphuric acid

Result	Method	Test substrate	Effect	Value determination
Negative with metabolic activation, negative without metabolic activation	Ames test	Bacteria (S.typhimurium)	No effect	Weight of evidence
Negative with metabolic activation, negative without metabolic activation	Equivalent to OECD 471	Bacteria (S.typhimurium)	No effect	Read-across

Mutagenicity (in vivo)

zinc sulfate, solution

No (test)data available

zinc sulphate (anhydrous)

Result	Method	Exposure time	Test substrate	Organ	Value determination
Negative	Micronucleus test	2 dose(s)/24-hour interval	Mouse (male/female)		Experimental value

manganese sulphate

Result	Method	Exposure time	Test substrate	Organ	Value determination
Negative	OECD 474		Mouse (female)		Read-across

sulphuric acid

Result	Method	Exposure time	Test substrate	Organ	Value determination
Not applicable					Data waiving

Carcinogenicity

zinc sulfate, solution

No (test)data available

zinc sulphate (anhydrous)

Route of exposure	Parameter	Method	Value	Exposure time	Species	Effect	Organ	Value determination
Oral (drinking water)	NOAEL	Carcinogenic toxicity study	> 22000 mg/l	52 weeks (daily)	Mouse (male/female)	No carcinogenic effect		Experimental value

magnesium sulphate

Route of exposure	Parameter	Method	Value	Exposure time	Species	Effect	Organ	Value determination
Unknown								Data waiving

manganese sulphate

Route of exposure	Parameter	Method	Value	Exposure time	Species	Effect	Organ	Value determination
Oral	NOAEC	Carcinogenic toxicity study	615 mg/kg bw	103 weeks (daily)	Rat (male)	No carcinogenic effect		Experimental value
Oral	NOAEC	Carcinogenic toxicity study	715 mg/kg bw	103 weeks (daily)	Rat (female)	No carcinogenic effect		Experimental value

Reproductive toxicity

zinc sulfate, solution

No (test)data available

zinc sulphate (anhydrous)

	Parameter	Method	Value	Exposure time	Species	Effect	Organ	Value determination
Developmental toxicity	NOAEL	Developmental toxicity study	425 mg/kg bw/day	10 day(s)	Rat	No effect		Experimental value
Maternal toxicity	NOAEL	Other	42.5 mg/kg bw/day	10 day(s)	Rat	No effect		Experimental value
Effects on fertility	Dose level		4000 ppm		Rat (male)	Adverse effect on sperm	Reproductive organs	Experimental value

magnesium sulphate

	Parameter	Method	Value	Exposure time	Species	Effect	Organ	Value determination
Developmental toxicity	NOAEL	OECD 422	≥ 1500 mg/kg bw/day	28 day(s) - 53 day(s)	Rat	No effect		Read-across
Effects on fertility	NOAEL	OECD 422	≥ 1500 mg/kg bw/day	4 week(s)	Rat (male/female)	No effect		Read-across

sulphuric acid

	Parameter	Method	Value	Exposure time	Species	Effect	Organ	Value determination
Developmental toxicity	NOAEC	Equivalent to OECD 414	19.3 mg/m³ air	10 days (gestation, daily)	Mouse (female)	No effect		Experimental value
	NOAEC	Equivalent to OECD 414	19.3 mg/m³ air	13 days (gestation, daily)	Rabbit (female)	No effect		Experimental value
Maternal toxicity	LOAEC	Equivalent to OECD 414	19.3 mg/m³ air	10 days (gestation, daily)	Mouse (female)	Reduced food consumption	General	Experimental value
	NOAEC	Equivalent to OECD 414	5.7 mg/m³ air	10 days (gestation, daily)	Mouse (female)	No effect		Experimental value
	LOAEC	Equivalent to OECD 414	19.3 mg/m³ air	13 days (gestation, daily)	Rabbit (female)	Local effects	Respiratory tract	Experimental value
	NOAEC	Equivalent to OECD 414	5.7 mg/m³ air	13 days (gestation, daily)	Rabbit (female)	No effect		Experimental value
Effects on fertility	NOAEC	Equivalent to OECD 414	19.3 mg/m³ air	10 days (gestation, daily)	Mouse (female)	No effect		Experimental value
	NOAEC	Equivalent to OECD 414	19.3 mg/m³ air	13 days (gestation, daily)	Rabbit (female)	No effect		Experimental value

Judgement is based on the relevant ingredients

Conclusion CMR

Not classified for carcinogenicity

Not classified for mutagenic or genotoxic toxicity

Not classified for reprotoxic or developmental toxicity

Toxicity other effects

zinc sulfate, solution

No (test)data available

Chronic effects from short and long-term exposure

zinc sulfate, solution

ON CONTINUOUS/REPEATED EXPOSURE/CONTACT: Gastrointestinal complaints. Skin rash/inflammation.

SECTION 12: Ecological information

12.1. Toxicity

zinc sulfate, solution

No (test)data available

zinc sulphate (anhydrous)

	Parameter	Method	Value	Duration	Species	Test design	Fresh/salt water	Value determination
Acute toxicity fishes	LC50	Other	330 µg/l	95 h	Pimephales promelas	Static system	Fresh water	Experimental value
Acute toxicity invertebrates	LC50	Other	280 µg/l	48 h	Daphnia magna	Static system	Fresh water	Experimental value
Toxicity algae and other aquatic plants	IC50	OECD 201	136 µg/l	72 h	Selenastrum capricornutum	Static system	Fresh water	Experimental value; Growth rate
	NOEC	OECD 201	24 µg/l	3 day(s)	Selenastrum capricornutum	Static system	Fresh water	Experimental value; Growth rate

magnesium sulphate

	Parameter	Method	Value	Duration	Species	Test design	Fresh/salt water	Value determination
Acute toxicity fishes	LC50		15500 mg/l	96 h	Gambusia affinis	Static system		
Acute toxicity invertebrates	EC50		1700 mg/l	24 h	Daphnia magna			
Toxicity algae and other aquatic plants	EC50		2700 mg/l	72 h	Scenedesmus subspicatus			Biomass

manganese sulphate

	Parameter	Method	Value	Duration	Species	Test design	Fresh/salt water	Value determination
Acute toxicity fishes	LC50		3.17 mg/l	96 h	Oncorhynchus mykiss	Flow-through system	Fresh water	Weight of evidence; Manganese ion
Acute toxicity invertebrates	LC50		9.8 mg/l	48 h	Daphnia magna	Static system	Fresh water	Read-across; Manganese ion
Toxicity algae and other aquatic plants	ErC50	OECD 201	61 mg/l	72 h	Desmodesmus subspicatus	Static system	Fresh water	Experimental value; GLP
Long-term toxicity fish	NOEC	OECD 210	0.76 mg/l	65 day(s)	Oncorhynchus mykiss	Flow-through system	Fresh water	Weight of evidence; Manganese ion
Long-term toxicity aquatic invertebrates	NOEC		0.01 mg/l	60 day(s)	Macroinvertebrata	Static system	Fresh water	Read-across; Manganese ion

sulphuric acid

	Parameter	Method	Value	Duration	Species	Test design	Fresh/salt water	Value determination
Acute toxicity fishes	LC50		16 mg/l - 28 mg/l	96 h	Lepomis macrochirus	Static system	Fresh water	Experimental value
Acute toxicity invertebrates	EC50	OECD 202	> 100 mg/l	48 h	Daphnia magna	Static system	Fresh water	Experimental value
Toxicity algae and other aquatic plants	EC50	OECD 201	> 100 mg/l	72 h	Desmodesmus subspicatus	Static system	Fresh water	Experimental value; Pure substance
Long-term toxicity fish	NOEC		0.025 mg/l	65 day(s)	Jordanella floridae	Flow-through system	Fresh water	Experimental value
	NOEC		0.31 mg/l		Salvelinus fontinalis	Flow-through system	Fresh water	Experimental value
Long-term toxicity aquatic invertebrates	NOEC		0.15 mg/l	3		Static system	Fresh water	Experimental value
Toxicity aquatic micro-organisms	NOEC		26 g/l	37 day(s)	Bacteria	Static system	Fresh water	Read-across; Pure substance
Toxicity sediment organisms								Data waiving

	Parameter	Method	Value	Duration	Species	Value determination
Toxicity soil macro-organisms						Data waiving
Toxicity soil micro-organisms						Data waiving
Toxicity terrestrial plants						Data waiving
Toxicity other terrestrial organisms	NOEC		0.15 mg/l		Tanytarsus dissimilis	Experimental value
Toxicity birds						Data waiving

Classification is based on the relevant ingredients

Conclusion

pH shift

Inhibition of activated sludge

Very toxic to aquatic life with long lasting effects.

12.2. Persistence and degradability

manganese sulphate

Biodegradation water

Method	Value	Duration	Value determination
			Data waiving

Biodegradation soil

Method	Value	Duration	Value determination
			Data waiving

sulphuric acid

Biodegradation water

Method	Value	Duration	Value determination
			Data waiving

Half-life water (t1/2 water)

Method	Value	Primary degradation/mineralisation	Value determination
			Data waiving

Conclusion

Biodegradability: not applicable

12.3. Bioaccumulative potential

zinc sulfate, solution

Log Kow

Method	Remark	Value	Temperature	Value determination
	Not applicable (mixture)			

zinc sulphate (anhydrous)

BCF fishes

Parameter	Method	Value	Duration	Species	Value determination
BCF		59 - 242		Cyprinus carpio	

Log Kow

Method	Remark	Value	Temperature	Value determination
	No data available			

magnesium sulphate

Log Kow

Method	Remark	Value	Temperature	Value determination
	No data available			

manganese sulphate

BCF fishes

Parameter	Method	Value	Duration	Species	Value determination
					Data waiving

BCF other aquatic organisms

Parameter	Method	Value	Duration	Species	Value determination
					Data waiving

Log Kow

Method	Remark	Value	Temperature	Value determination
	No data available			

sulphuric acid

BCF fishes

Parameter	Method	Value	Duration	Species	Value determination
					Data waiving

Log Kow

Method	Remark	Value	Temperature	Value determination
				Not applicable

Conclusion

Contains bioaccumulative component(s)

12.4. Mobility in soil

sulphuric acid

(log) Koc

Parameter	Method	Value	Value determination
			Data waiving

Conclusion

No (test)data on mobility of the components available

12.5. Results of PBT and vPvB assessment

The criteria of PBT and vPvB as listed in Annex XIII of Regulation (EC) No 1907/2006 do not apply to inorganic substances.

12.6. Other adverse effects

zinc sulfate, solution

Fluorinated greenhouse gases (Regulation (EU) No 517/2014)

None of the known components is included in the list of fluorinated greenhouse gases (Regulation (EU) No 517/2014)

Ozone-depleting potential (ODP)

Not classified as dangerous for the ozone layer (Regulation (EC) No 1005/2009)

sulphuric acid

Ground water

Ground water pollutant

SECTION 13: Disposal considerations

The information in this section is a general description. If available, the documentation for isolated intermediates will be attached in annex to support safe handling arrangements.

13.1. Waste treatment methods

13.1.1 Provisions relating to waste

Hazardous waste according to Directive 2008/98/EC, as amended by Regulation (EU) No 1357/2014.
Waste material code (Directive 2008/98/EC, Decision 2000/0532/EC).
11 02 07* (wastes from non-ferrous hydrometallurgical processes: other wastes containing hazardous substances). Depending on branch of industry and production process, also other waste codes may be applicable.

13.1.2 Disposal methods

Recycle/reuse. Remove waste in accordance with local and/or national regulations. Hazardous waste shall not be mixed together with other waste. Different types of hazardous waste shall not be mixed together if this may entail a risk of pollution or create problems for the further management of the waste. Hazardous waste shall be managed responsibly. All entities that store, transport or handle hazardous waste shall take the necessary measures to prevent risks of pollution or damage to people or animals. Treat using the best available techniques before discharge into drains or the aquatic environment.

13.1.3 Packaging/Container

Waste material code packaging (Directive 2008/98/EC).
15 01 10* (packaging containing residues of or contaminated by dangerous substances).

SECTION 14: Transport information

Road (ADR)

14.1. UN number

UN number	3082

14.2. UN proper shipping name

Proper shipping name	Environmentally hazardous substance, liquid, n.o.s. (zinc sulphate (anhydrous))

14.3. Transport hazard class(es)

Hazard identification number	90
Class	9
Classification code	M6

14.4. Packing group

Packing group	III
Labels	9

14.5. Environmental hazards

Environmentally hazardous substance mark	yes

14.6. Special precautions for user

Special provisions	274
Special provisions	335
Special provisions	375
Special provisions	601
Limited quantities	Combination packagings: not more than 5 liters per inner packaging for liquids. A package shall not weigh more than 30 kg. (gross mass)

Rail (RID)

14.1. UN number

UN number	3082

14.2. UN proper shipping name

Proper shipping name	Environmentally hazardous substance, liquid, n.o.s. (zinc sulphate (anhydrous))

14.3. Transport hazard class(es)

Hazard identification number	90
Class	9
Classification code	M6

14.4. Packing group

Packing group	III
Labels	9

14.5. Environmental hazards

Environmentally hazardous substance mark	yes

14.6. Special precautions for user

Special provisions	274
Special provisions	335
Special provisions	375
Special provisions	601
Limited quantities	Combination packagings: not more than 5 liters per inner packaging for liquids. A package shall not weigh more than 30 kg. (gross mass)

Inland waterways (ADN)

14.1. UN number

UN number	3082

14.2. UN proper shipping name

Proper shipping name	Environmentally hazardous substance, liquid, n.o.s. (zinc sulphate (anhydrous))

14.3. Transport hazard class(es)

Class	9
Classification code	M6

14.4. Packing group

Packing group	III
Labels	9

14.5. Environmental hazards

Environmentally hazardous substance mark	yes

14.6. Special precautions for user

Special provisions	274
Special provisions	335
Special provisions	375
Special provisions	601
Limited quantities	Combination packagings: not more than 5 liters per inner packaging for liquids. A package shall not weigh more than 30 kg. (gross mass)

Sea (IMDG/IMSBC)

14.1. UN number

UN number	3082

14.2. UN proper shipping name

Proper shipping name	Environmentally hazardous substance, liquid, n.o.s. (zinc sulphate (anhydrous))

14.3. Transport hazard class(es)

Class	9

14.4. Packing group

Packing group	III
Labels	9

14.5. Environmental hazards

Marine pollutant	P
Environmentally hazardous substance mark	yes

14.6. Special precautions for user

Special provisions	274
Special provisions	335
Special provisions	969
Limited quantities	Combination packagings: not more than 5 liters per inner packaging for liquids. A package shall not weigh more than 30 kg. (gross mass)

14.7. Transport in bulk according to Annex II of Marpol and the IBC Code

Annex II of MARPOL 73/78	Not applicable, based on available data

Air (ICAO-TI/IATA-DGR)

14.1. UN number

UN number	3082

14.2. UN proper shipping name

Proper shipping name	Environmentally hazardous substance, liquid, n.o.s. (zinc sulphate (anhydrous))

14.3. Transport hazard class(es)

Class	9

14.4. Packing group

Packing group	III
Labels	9

14.5. Environmental hazards

Environmentally hazardous substance mark	yes

14.6. Special precautions for user

Special provisions	A97
Special provisions	A158
Special provisions	A197
Passenger and cargo transport: limited quantities: maximum net quantity per packaging	30 kg G

SECTION 15: Regulatory information

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

European legislation:

VOC content Directive 2010/75/EU

VOC content	Remark
	Not applicable (inorganic)

European drinking water standards (Directive 98/83/EC)

zinc sulphate (anhydrous)

Parameter	Parametric value	Note	Reference
Sulphate	250 mg/l		Listed in Annex I, Part C, of Directive 98/83/EC on the quality of water intended for human consumption.

magnesium sulphate

Parameter	Parametric value	Note	Reference
Sulphate	250 mg/l		Listed in Annex I, Part C, of Directive 98/83/EC on the quality of water intended for human consumption.

manganese sulphate

Parameter	Parametric value	Note	Reference
Manganese	50 µg/l		Listed in Annex I, Part C, of Directive 98/83/EC on the quality of water intended for human consumption.
Sulphate	250 mg/l		Listed in Annex I, Part C, of Directive 98/83/EC on the quality of water intended for human consumption.

sulphuric acid

Parameter	Parametric value	Note	Reference
Sulphate	250 mg/l		Listed in Annex I, Part C, of Directive 98/83/EC on the quality of water intended for human consumption.

REACH registration

This substance is handled under Strictly Controlled Conditions in accordance with Reach regulation Article 17(3) for on-site isolated intermediates and, in case the substance is transported to other sites for further processing, the substance should be handled at these sites under Strictly Controlled Conditions as specified in Reach regulation Article 18(4). Site documentation to support safe handling arrangements including the selection of engineering, administrative and personal protective equipment controls in accordance with risk based management systems is available at each manufacturing site. Written confirmation of application of Strictly Controlled Conditions should be available at the premises of every affected Distributor and Downstream Processor/User of the Registrants' intermediate.

Information exposure scenarios

This safety data sheet does not contain an exposure scenario; exempted as (isolated) intermediate

REACH Annex XVII - Restriction

Contains component(s) subject to restrictions of Annex XVII of Regulation (EC) No 1907/2006: restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles.

	Designation of the substance, of the group of substances or of the mixture	Conditions of restriction
· sulphuric acid	Liquid substances or mixtures which are regarded as dangerous in accordance with Directive 1999/45/EC or are fulfilling the criteria for any of the following hazard classes or categories set out in Annex I to Regulation (EC) No 1272/2008: (a) hazard classes 2.1 to 2.4, 2.6 and 2.7, 2.8 types A and B, 2.9, 2.10, 2.12, 2.13 categories 1 and 2, 2.14 categories 1 and 2, 2.15 types A to F; (b) hazard classes 3.1 to 3.6, 3.7 adverse effects on sexual function and fertility or on development, 3.8 effects other than narcotic effects, 3.9 and 3.10; (c) hazard class 4.1;	1. Shall not be used in: — ornamental articles intended to produce light or colour effects by means of different phases, for example in ornamental lamps and ashtrays, — tricks and jokes, — games for one or more participants, or any article intended to be used as such, even with ornamental aspects,2. Articles not complying with paragraph 1 shall not be placed on the market.3. Shall not be placed on the market if they contain a colouring agent, unless required for fiscal reasons, or perfume, or both, if they: — can be used as fuel in decorative oil lamps for supply to the general public, and, — present an aspiration hazard and are labelled with R65 or H304,4. Decorative oil lamps for supply to the general public shall not be placed on the market unless they conform to the European Standard on Decorative oil lamps (EN 14059) adopted by the European Committee for Standardisation (CEN).5. Without prejudice to the implementation of other Community provisions relating to the classification, packaging and labelling of dangerous substances and mixtures, suppliers shall ensure, before the placing on the market, that the following

	(d) hazard class 5.1.	requirements are met: a) lamp oils, labelled with R65 or H304, intended for supply to the general public are visibly, legibly and indelibly marked as follows: “Keep lamps filled with this liquid out of the reach of children”; and, by 1 December 2010, “Just a sip of lamp oil — or even sucking the wick of lamps — may lead to life- threatening lung damage”; b) grill lighter fluids, labelled with R65 or H304, intended for supply to the general public are legibly and indelibly marked by 1 December 2010 as follows: “Just a sip of grill lighter may lead to life threatening lung damage”; c) lamp oils and grill lighters, labelled with R65 or H304, intended for supply to the general public are packaged in black opaque containers not exceeding 1 litre by 1 December 2010.6. No later than 1 June 2014, the Commission shall request the European Chemicals Agency to prepare a dossier, in accordance with Article 69 of the present Regulation with a view to ban, if appropriate, grill lighter fluids and fuel for decorative lamps, labelled R65 or H304, intended for supply to the general public.7. Natural or legal persons placing on the market for the first time lamp oils and grill lighter fluids, labelled with R65 or H304, shall by 1 December 2011, and annually thereafter, provide data on alternatives to lamp oils and grill lighter fluids labelled R65 or H304 to the competent authority in the Member State concerned. Member States shall make those data available to the Commission.’

National legislation Belgium

zinc sulfate, solution

No data available

sulphuric acid

Additional classification	C; La mention “C” signifie que l’agent en question relève du champ d’application de l’arrêté royal du 2 décembre 1993 concernant la protection des travailleurs contre les risques liés à l’exposition à des agents cancérigènes et mutagènes au travail.

National legislation The Netherlands

zinc sulfate, solution

Waste identification (the Netherlands)	LWCA (the Netherlands): KGA category 01
Waterbezwaarlijkheid	A (1)

manganese sulphate

SZW - List of reprotoxic substances (fertility)	Suspected of damaging fertility.
SZW - List of reprotoxic substances (development)	Suspected of damaging the unborn child.

sulphuric acid

SZW - List of carcinogenic substances	Listed in SZW-list of carcinogenic substances

National legislation France

zinc sulfate, solution

No data available

National legislation Germany

zinc sulfate, solution

Lagerklasse (TRGS510)	12: Nicht brennbare Flüssigkeiten
WGK	3; Classification water polluting based on the components in compliance with Verwaltungsvorschrift wassergefährdender Stoffe (VwVwS) of 27 July 2005 (Anhang 4)

manganese sulphate

TA-Luft	5.2.2; III
TRGS900 - Risiko der Fruchtschädigung	Y; Risiko der Fruchtschädigung braucht bei Einhaltung des Arbeitsplatzgrenzwertes und des biologischen Grenzwertes nicht befürchtet zu werden
	Y; Risiko der Fruchtschädigung braucht bei Einhaltung des Arbeitsplatzgrenzwertes und des biologischen Grenzwertes nicht befürchtet zu werden

sulphuric acid

TRGS900 - Risiko der Fruchtschädigung	Y; Risiko der Fruchtschädigung braucht bei Einhaltung des Arbeitsplatzgrenzwertes und des biologischen Grenzwertes nicht befürchtet zu werden

National legislation United Kingdom

zinc sulfate, solution

No data available

Other relevant data

zinc sulfate, solution

No data available

manganese sulphate

TLV - Carcinogen	Manganese, inorganic compounds, as Mn; A4

sulphuric acid

IARC - classification	1; Strong-inorganic-acid mists containing sulfuric acid
TLV - Carcinogen	Sulfuric acid; A2

15.2. Chemical safety assessment

No chemical safety assessment is required; registered as an isolated intermediate.

SECTION 16: Other information

Full text of any H-statements referred to under headings 2 and 3:

H302 Harmful if swallowed.
H314 Causes severe skin burns and eye damage.
H318 Causes serious eye damage.
H373 May cause damage to organs (brain) through prolonged or repeated exposure if inhaled.
H400 Very toxic to aquatic life.
H410 Very toxic to aquatic life with long lasting effects.
H411 Toxic to aquatic life with long lasting effects.

(*) = INTERNAL CLASSIFICATION BY BIG

PBT-substances = persistent, bioaccumulative and toxic substances

CLP (EU-GHS) Classification, labelling and packaging (Globally Harmonised System in Europe)

Specific concentration limits CLP

sulphuric acid ... %	C ≥ 15 %	Skin Corr. 1A; H314	CLP Annex VI (ATP 0)
	5 % ≤ C < 15 %	Skin Irrit. 2; H315	CLP Annex VI (ATP 0)
	5 % ≤ C < 15 %	Eye Irrit. 2; H319	CLP Annex VI (ATP 0)

The information in this safety data sheet is based on data and samples provided to BIG. The sheet was written to the best of our ability and according to the state of knowledge at that time. The safety data sheet only constitutes a guideline for the safe handling, use, consumption, storage, transport and disposal of the substances/preparations/mixtures mentioned under point 1. New safety data sheets are written from time to time. Only the most recent versions may be used. Old versions must be destroyed. Unless indicated otherwise word for word on the safety data sheet, the information does not apply to substances/preparations/mixtures in purer form, mixed with other substances or in processes. The safety data sheet offers no quality specification for the substances/preparations/mixtures in question. Compliance with the instructions in this safety data sheet does not release the user from the obligation to take all measures dictated by common sense, regulations and recommendations or which are necessary and/or useful based on the real applicable circumstances. BIG does not guarantee the accuracy or exhaustiveness of the information provided and cannot be held liable for any changes by third parties. This safety data sheet is only to be used within the European Union, Switzerland, Iceland, Norway and Liechtenstein. Any use outside of this area is at your own risk. Use of this safety data sheet is subject to the licence and liability limiting conditions as stated in your BIG licence agreement or when this is failing the general conditions of BIG. All intellectual property rights to this sheet are the property of BIG and its distribution and reproduction are limited. Consult the mentioned agreement/conditions for details.

Annex to the Safety Data Sheet
Wastewater, zinc sulfate electrolytic, acid (273-723-4)

This annex contains information on risk management measures as specified in appendix 3 of the registration dossier for isolated on-site and transported intermediates

1. Brief description of technological process applied in manufacture of the intermediate EC 273-723-4

During the hydrometallurgical production of zinc, the leachate undergoes several steps of refining and electrolysis; a part of the circulating solution can be extracted and isolated for further processing in other production units of Zinc metal or Zinc compounds..

- The Zinc sulphate solution is, subsequently to the leaching steps, refined and transferred to the electrolysis cell-house through especially designed transfer launders,
- When needed, the Zinc Sulphate solution can be bled either just before or after the electrolysis cellhouse
- Transfer of the bled Intermediate solution in appropriate containers or ADR-trucks, according to applicable regulation
- This Intermediate is typically used in production units of Zinc metal or Zinc compounds.
- Waste of the process: none

2. Brief description of technological processes applied in use of the intermediate EC 273-721-3

The Intermediate Zinc Sulphate solution is unloaded, potentially blended with other material streams and loaded in vessels for further use, reaction and production of Zinc metal or Zinc compounds.

- The Zinc sulphate solution is unloaded, potentially mixed with other solutions or reagents and transferred to the reaction vessels through especially designed transfer launders,
- This Intermediate is typically used in production units of Zinc metal or Zinc compounds
- Waste treatment: theoretically, the elements other than zinc may be concentrated in a final residue $MnSO_4$/$MgSO_4$

3. Means of rigorous containment and minimisation technologies applied by the registrant during the manufacturing and /or use process

⇨ Description of the technical means to rigorously contain the substance

- Process enclosures and closed circuits where relevant and possible.
- Containment of liquid volumes in sumps to collect/prevent accidental spillage, acid solutions are treated appropriately
- Chemical storage is within a controlled, isolated area having monitored secondary containment.
- Air emissions are controlled by use of scrubbers, absorbers, demisters.
- On-site waste water treatment techniques can be applied to prevent releases to water (if applicable) e.g.: chemical precipitation, sedimentation and filtration.
- All residues containing zinc are recycled

⇨ Identification of residual emissions to workplace & environment

Residual exposures at the workplace and the environment are assessed from regular measurements of dust/metals and represent usually a global exposure to several steps in a process. Typical residual emission for the zinc sulphate based intermediate is aerosols. Measurements in the workplace air (static or individual) according to national regulations.

- Workplaces: metal concentrations depending on composition and risk assessment
- Workers: individual measurement in air (frequency depending on local regulation)
- Environment air: point source measurement (metal concentrations) - stack
- Environment water: typically measured prior to discharge, if emissions to surface waters are relevant

- Some non-process waters can be generated containing Zn (e.g. from cleaning)
- Run-off water from building

⇨ **Description of the procedural and control technologies to minimise emission and resulting exposure**

- Process enclosures and closed circuits where relevant and possible.
- Air emissions are controlled by use of scrubbers, absorbers, demisters
- Run-off water from building are collected and treated in our water treatment installations

⇨ **Specification of management means and training that particularly contribute to the functioning of the technical means described above**

- integrated management system is implemented on the workplace e.g. ISO 9000, ISO ICS13100 series, ISO 1400X series, EMAS and, as usually applicable, by being IPPC/IED-compliant (cf. NFM-BREF)
- compliance with the applicable legislation such as Seveso, Chemical agents directive, carcinogenic agents directive
- housekeeping and hygiene procedures in place
- training provided for internal and external cleaning teams or technicians

4. Means of rigorous containment and minimisation technologies recommended to the user of the intermediate

- Means of containment and minimisation technologies are same as above
- The zinc sulphate solution is unloaded (tank trucks) and transferred to storage zones or process through especially designed transfer units
- Material composition, handling, storage procedures and general guidance on safe use are communicated to the personnel or downstream (external) user by means of Safety Data Sheet

5. Special procedures applied before cleaning and maintenance

- Procedures are in place to ensure safe cleaning and maintenance operations
  - Stopping (part of) the process
  - Special procedures such as system purging and washing before opening devices
  - Switch off power supply and lock out procedure
  - Special PPE mandatory for cleaning personnel or maintenance technicians
  - Planning and training for internal and external personnel
- general guidance on safe use is communicated to the personnel or downstream (external) user by means of Safety Data Sheet

6. Describe activity and type of PPE in case of accidents, incidents, maintenance and cleaning activities

Accident release measures:

- **Workers**: use protective glasses

- **Environment**: Do not permit the product to enter water bodies. If necessary, warn extractors of drink, cooling water.
- **Cleaning**: dam small quantities with lime and pump them out of calcium. Call experts for greater volume.

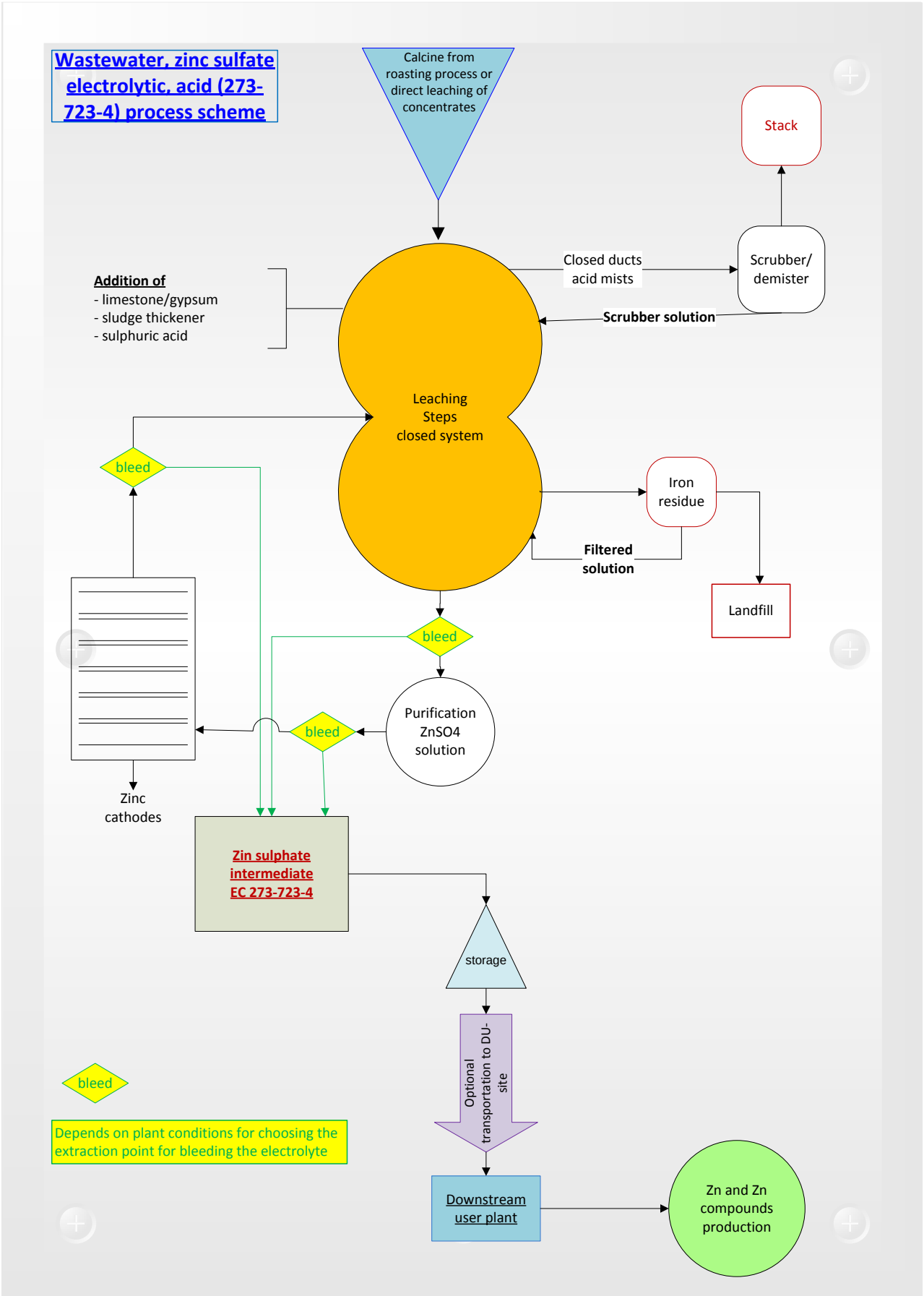
Fire: fire extinguishers are all suitable. Waste water, zinc sulfate electrolytic, acid does not burn. After evaporation of the liquid, sulfur trioxide is produced above 600°C. Use independent ventilated breathing protection if waste water, zinc sulfate electrolytic, acid can evaporate.
Periodic maintenance (leaching and associated equipment; demisters - scrubbers; Repair operations; Observational tasks and control activities):

- General protective and hygiene measures: Avoid contact with eyes, skin or clothes. Use safety gloves and safety glasses; Keep away from food, beverages and animal feed. At work do not eat, drink, smoke; Eyewash should be available at the workplace
- Respiratory protection: with normal handling, no respiratory personal protection is necessary
- Hand protection: use liquid impermeable gloves (BGR 195)
- Eye protection: Use protective glasses with side shields. Face shield or tight-closing safety goggles (DIN EN 166), if necessary
- Body protection: Usual chemical work clothing

Cleaning activity (Process equipment; workshop): same as above

7. Waste information

- The intermediate is a product from the production of zinc. If the normal processing route cannot be adhered to, returning it to the producer is recommended. Disposal should be in accordance with the official regulations
- PPE equipment is collected and disposed of
- Classified as hazardous waste
    - EWC-code: 06 03 13 solid salts and solutions containing heavy metals. Specification of the waste material number and EWC-code are for illustrative purposes only. Other Waste should be recycled. If recycling is not possible, the waste is classified as hazardous waste.


Wastewater, zinc sulfate electrolytic, acid (273-723-4) process scheme
Calcine from roasting process or direct leaching of concentrates
Stack
Scrubber/ demister
Closed ducts acid mists
Scrubber solution
Addition of
- limestone/gypsum
- sludge thickener
- sulphuric acid
Leaching Steps closed system
bleed
Iron residue
Filtered solution
Landfill
bleed
Purification ZnSO4 solution
bleed
Zinc cathodes
Zin sulphate intermediate EC 273-723-4
storage
Optional transportation to DU-site
bleed
Depends on plant conditions for choosing the extraction point for bleeding the electrolyte
Downstream user plant
Zn and Zn compounds production