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

1.1. Product identifier

Substance Name:	Dimethyl Sulfide (DMS)
EC No.:	200-846-2
REACH Registration Number:	2119487127-32-0002
Synonym:	Dimethyl sulphide.
Product Code:	Not available.

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

Identified uses:	See Technical Data Sheet.
Uses advised against:	All uses other than the identified.

1.3. Details of the supplier of the safety data sheet

Name:	Gaylord Chemical Company, L.L.C.
Address:	1880 Fairlawn Rd Tuscaloosa, AL 35401 United States
Phone Number:	+1 (205) 561-5045
E-mail of competent person responsible for SDS in the EU:	ehs@gaylordchem.com

1.4. Emergency telephone number:

Emergency Phone:	Customer Service: Gaylord Chemical Company, LLC: (985) 649-5464 (8:00am - 5:00pm CST) (205) 342-0652 (Nights and Weekends)

Section 2: Hazards identification

2.1. Classification of the substance or mixture

2.1.1. Classification according to CLP (Regulation (EC) No 1272/2008)

CLP Classification: Flammable Liquids, Category 2, H225

2.1.3 Additional information:

For full text of Hazard- and EU Hazard-statements: see SECTION 16.

2.2. Label elements

Labelling according to CLP (Regulation (EC) No 1272/2008)

Hazard Pictogram(s):

Signal Word: Danger

Hazard Statements: H225: Highly flammable liquid and vapour.

Precautionary Statements

Prevention: P210: Keep away from heat, sparks, open flames, and hot surfaces. – No smoking.
P233: Keep container tightly closed.
P240: Ground/bond container and receiving equipment.
P241: Use explosion-proof electrical, ventilating, and lighting equipment.
P242: Use only non-sparking tools.
P243: Take precautionary measures against static discharge.
P280: Wear protective gloves, protective clothing and eye protection.

Response: P303 + P361 + P353: IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P370 + P378: In case of fire: Use dry chemical, CO2, water spray or regular foam to extinguish.

Storage: P403 + P233: Store in a well-ventilated place.
P235: Keep cool.

Disposal: P501: Dispose of contents/container in accordance with applicable regional, national and local laws and regulations.

2.3. Other hazards

Not Classified as PBT/vPvB by EU criteria.

Section 3: Composition / information on ingredients

3.1. Substances

Ingredient(s)	CAS No.	EC No.	Wt. %	Classification according to Regulation (EC) No 1272/2008 (CLP)[+]
Dimethyl sulfide; DMS	75-18-3	200-846-2	75 - 100	Flam. Liq. 2; H225

[+]See section 16 for the full text of the hazard phrases. Occupational exposure limits, if available, are listed in section 8.

Section 4: First aid measures

4.1. Description of first aid measures

Inhalation: If inhaled: Remove person to fresh air and keep comfortable for breathing. Call a poison center or doctor if you feel unwell.

Eye Contact: If in eyes: Rinse cautiously with water for at least 20 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center or doctor.

Skin Contact: If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. Call a poison center or doctor if you feel unwell. Wash contaminated clothing before reuse.

Ingestion: If swallowed: Call a poison center or doctor if you feel unwell. If vomiting occurs naturally, have victim lean forward to reduce the risk of aspiration. Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person.

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

Inhalation: May cause respiratory irritation. Signs/symptoms may include cough, sneezing, nasal discharge, headache, hoarseness, and nose and throat pain. Excessive inhalation may cause headache, dizziness, confusion, loss of appetite and/or loss of consciousness. Vapour inhalation may cause moderate eye, nose, and throat irritation, making it unlikely that individuals will tolerate moderate to high concentrations. Headache and decreased ability to concentrate may occur.

Eye Contact: May cause serious eye irritation. Signs/symptoms may include redness, swelling, pain, tearing, and blurred or hazy vision.

Skin Contact: May cause skin irritation. Signs/symptoms may include localized redness, swelling, and itching.

Ingestion: May cause gastrointestinal irritation. Signs/symptoms may include abdominal pain, stomach upset, nausea, vomiting and diarrhea.

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

Note to Physicians: Symptoms may not appear immediately.

Section 5: Firefighting measures

5.1. Extinguishing media

Suitable Extinguishing Media: Small Fire: Dry chemical, CO2, water spray or regular foam.

Large Fire: Water spray, fog or regular foam. Move containers from fire area if you can do it without risk.

Unsuitable Extinguishing Media: Do not use straight streams. CAUTION: This product has a very low flash point: Use of water spray when fighting fire may be inefficient.

5.2. Special hazards arising from the substance or mixture

Hazardous combustion products: Oxides of carbon. Oxides of sulphur.

5.3. Advice for firefighters

Protection of Firefighters: Fire will produce irritating, corrosive and/or toxic gases. Vapors may cause dizziness or suffocation. Runoff from fire control or dilution water may cause pollution. Wear positive

pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing will only provide limited protection.

Section 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1. For non-emergency personnel: Do not touch or walk through spilled material. Use personal protection recommended in Section 8.

6.1.2. For emergency responders: As an immediate precautionary measure, isolate spill or leak area for at least 50 meters (150 feet) in all directions. Keep unauthorized personnel away. Stay upwind. Keep out of low areas. Ventilate closed spaces before entering. ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). All equipment used when handling the product must be grounded.

6.2. Environmental precautions

Prevent entry into waterways, sewers, basements or confined areas.

6.3. Methods and material for containment and cleaning up

6.3.1. Methods for Containment: Stop leak if you can do it without risk. A vapor suppressing foam may be used to reduce vapors.

6.3.2. Methods for Clean-Up: Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean non-sparking tools to collect absorbed material.

6.3.3. Other Information: Dispose of contents/container according to applicable regional, national and local regulations.

6.4. Reference to other sections

See Section 8 for occupational exposure limits and risk management measures. Refer to Section 13 for disposal considerations.

Section 7: Handling and storage

7.1. Precautions for safe handling

Do not swallow. Avoid breathing mist, vapours, or spray. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Keep container tightly closed. Ground and bond container and receiving equipment. Use non-sparking tools. Take action to prevent static discharges. Wash thoroughly after handling. Use only outdoors or in a well-ventilated area. See Section 8 for information on Personal Protective Equipment.

7.2. Conditions for safe storage, including any incompatibilities

Store in a well-ventilated place. Keep container tightly closed. Keep cool. Store locked up. Store away from incompatible materials. See Section 10 for information on Incompatible Materials. Keep out of the reach of children.

7.3. Specific end use(s)

No specific instructions required.

Section 8: Exposure controls / personal protection

8.1. Control parameters

Dimethyl sulfide (DMS) [CAS No. 75-18-3]

ACGIH: 10 ppm (TWA); (2001)

TWA: Time-Weighted Average

8.2. Exposure controls

8.2.1. Appropriate Engineering Controls:

Use ventilation adequate to keep exposures (airborne levels of dust, fume, vapour, gas, etc.) below recommended exposure limits. Use explosion-proof electrical, ventilating, and lighting equipment.

8.2.2. Personal Protection Equipment

Eye/Face Protection: Wear chemical safety goggles. Ensure that eyewash stations are close to the workstation location. Use equipment for eye protection according to European Standard EN 166.

Skin Protection:

Hand Protection: Wear protective gloves. Butyl or nitrile rubber gloves are recommended. Consult manufacturer specifications for further information.

Body Protection: Wear protective clothing. Flame resistant clothing (i.e., Nomex) is recommended in areas where material is stored or handled.

Respiratory Protection: If engineering controls and ventilation are not sufficient to control exposure to below the allowable limits then an appropriate air-purifying respirator, with organic vapor cartridge, or self-contained breathing apparatus must be used. Supplied air breathing apparatus must be used when oxygen concentrations are low or if airborne concentrations exceed the limits of the air-purifying respirators.

Thermal Hazards: Not applicable.

General Hygiene Considerations: Handle according to established industrial hygiene and safety practices. Consult a competent industrial hygienist to determine hazard potential and/or the PPE manufacturers to ensure adequate protection.

8.2.3. Environmental exposure controls:

Follow all applicable environmental protection legislation.

Section 9: Physical and chemical properties

Appearance:	Clear, colourless liquid.
Odour:	Stench.
Odour Threshold:	2.5 ppm
Physical State:	Liquid.
pH (1% solution in water):	Not available.
Melting Point / Freezing Point:	-98 °C (-144.4 °F)
Initial Boiling Point:	37.3 °C (99.1 °F)
Boiling Point:	Not available.
Flash Point:	-49 °C (-56.2 °F)
Evaporation Rate:	Not available.
Flammability (solid, gas):	Not applicable.
Lower Flammability Limit:	2.2 %
Upper Flammability Limit:	19.7 %
Vapour Pressure:	53.2 kPa at 20 °C (68 °F) 103.4 kPa at 38 °C (100 °F)
Vapour Density:	2.1 (Air = 1)
Relative Density:	0.85 (Water = 1)
Solubilities:	Insoluble in water.
Partition Coefficient: n-Octanol/Water:	log Pow: 0.84
Auto-ignition Temperature:	205 °C (401 °F)
Decomposition Temperature:	Not available.
Viscosity:	Not available.
Explosive Properties:	Not available.
Oxidising Properties:	Not considered as oxidizing.
Density:	Not available.
Percent Volatile, wt. %:	Not available.

Section 10: Stability and reactivity

10.1. Reactivity	Contact with incompatible materials. Sources of ignition. Exposure to heat.
10.2. Chemical stability	Stable under normal storage conditions.
10.3. Possibility of hazardous reactions	None known.
10.4. Conditions to avoid	Contact with incompatible materials. Sources of ignition. Exposure to heat.

10.5. Incompatible materials Oxidizers.

10.6. Hazardous decomposition products Not available.

Section 11: Toxicological information

11.1. Information on toxicological effects

Acute Toxicity:

Inhalation: May cause respiratory irritation. Signs/symptoms may include cough, sneezing, nasal discharge, headache, hoarseness, and nose and throat pain. Excessive inhalation may cause headache, dizziness, confusion, loss of appetite and/or loss of consciousness. Vapour inhalation may cause moderate eye, nose, and throat irritation, making it unlikely that individuals will tolerate moderate to high concentrations. Headache and decreased ability to concentrate may occur.

Eye: May cause eye irritation. Signs/symptoms may include redness, swelling, pain, tearing, and blurred or hazy vision.

Skin: May cause skin irritation. Signs/symptoms may include localized redness, swelling, and itching.

Ingestion: May cause gastrointestinal irritation. Signs/symptoms may include abdominal pain, stomach upset, nausea, vomiting and diarrhea.

Component	CAS No.	LD_{50} oral	LD_{50} dermal	LC_{50} inhalation
Dimethyl sulfide	75-18-3	3300 mg/kg (rat)	> 5000 mg/kg (rabbit)	40250 mg/m³ (rat); 4H

Skin corrosion / irritation: Dimethyl sulfide was slightly irritating to rabbit skin.

Serious eye damage/irritation: The liquid is a moderate to severe eye irritant.

Respiratory or skin sensitisation: Not available.

Germ cell mutagenicity: Dimethyl sulfide was not mutagenic to *Salmonella typhimurium* or *Escherichia coli* (bacterial reverse mutation assay) in vitro, with or without metabolic activation. It was also negative in a DNA damage and repair assay using *Salmonella typhimurium*. Dimethyl sulfide was not mutagenic in an in vivo mouse micronucleus study.

Carcinogenicity: This product does not contain any carcinogens or potential carcinogens as listed by ACGIH or IARC.

Reproductive toxicity: Dimethyl sulfide had no effect on male or female reproductive organs following repeated oral dosing in rats for up to 14 weeks. When pregnant rats were dosed with dimethyl sulfide from gestation days 6 to 19 via gavage at doses as high as 1000 mg/kg bw/day, no maternal toxicity, embryo-fetal or developmental toxicity or teratogenicity was observed.

STOT-single exposure: Vapour exposure can cause moderate nose and throat irritation.

STOT-repeated exposure: Not available.

Aspiration hazard: Not an aspiration hazard.

Chronic Effects: Repeated skin exposure to the liquid results in defatting dermatitis and irritation.

Other information on adverse health effects: No other adverse effects expected.

Section 12: Ecological information

12.1. Toxicity

Oncorhynchus mykiss (Rainbow trout): LC50 = 213 mg/L, 96-hr;
Daphnia magna: EC50 = 29 mg/L, 48-hr;
Daphnia magna: EC50 = 81 mg/L, 48-hr;
Pseudokirchneriella subcapitata: EC50 = 23 to > 113.7 mg/L, 96-hr.

12.2. Persistence and degradability

Dimethyl sulfide is photodegraded by reaction with hydroxyl radicals in the atmosphere with a half-life of 2.8 days (calculated). Experimental studies show dimethyl sulfide is rapidly degraded in sunlight (natural and simulated) forming a number of breakdown products including sulfur dioxide. Dimethyl sulfide does not hydrolyze with hydrolysis half-lives of > 1 year at pH 4, 7 and 9.

12.3. Bioaccumulative potential

A low bioaccumulation potential is expected based on the partition coefficient log Kow of 0.919. Dimethyl sulfide is readily biodegradable (67.4% degraded over 28 days; OECD TG 301D).

12.4. Mobility in soil

Fugacity model Level III indicates dimethyl sulfide will distribute in air, water and sediment dependent on the route of the emission.

Fugacity model Level III distribution with 100% of the dimethyl sulfide released to air is: 98.6% (air), 1.3% (water), 0.1% (soil) and <0.01% (sediment); with 100% of the dimethyl sulfide released to water the distribution is: 8.6% (air), 91.2% (water), 0.01% (soil) and 0.2% (sediment); with 100% of the dimethyl sulfide released to soil the distribution is: 39.4% (air), 7.2% (water), 53.4% (soil) and 0.01% (sediment).

Fugacity model Level III distribution with equal release of dimethyl sulfide to air, water and soil is: 28.1% (air), 57.2% (water), 14.6% (soil) and 0.1% (sediment).

12.5. Results of PBT and vPvB assessment

Not available.

12.6. Other adverse effects

Not available.

Section 13: Disposal considerations

13.1. Waste treatment methods

Disposal Instructions:

Disposal should be in accordance with applicable regional, national and local laws and regulations. Local regulations may be more stringent than regional or national requirements.

Section 14: Transport information

ADR / RID

14.1. UN number:	UN1164
14.2. UN proper shipping name:	UN1164, DIMETHYL SULFIDE, 3, PG II
14.3. Transport hazard class(es):	3
14.4. Packing group:	II
14.5. Environmental hazards:	Not applicable.
14.6 Classification Code:	F1
14.7. Special precautions for user:	Not available.
14.8. Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code:	Not applicable.

IMDG Transport Information

Proper Shipping Name:	UN1164, DIMETHYL SULFIDE, 3, PG II
Class:	3
UN Number:	UN1164
Packing Group:	II
Label Code:	 Flash point: -49 °C (-56.2 °F) (Closed Cup)
EmS Number:	F-E, S-D

ICAO/IATA Transport Information

Proper Shipping Name: UN1164, DIMETHYL SULFIDE, 3, PG II

Class: 3

UN Number: UN1164

Packing Group: II

Label Code:

Flash point: -49 °C (-56.2 °F) (Closed Cup)

Section 15: Regulatory information

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

Authorisations: Not applicable.

Restrictions on use: Use only as intended.

Other EU regulations: Not available.

National regulations: Not applicable.

15.2. Chemical safety assessment

Chemical Safety Assessment: No Chemical Safety Assessments have been carried out for this substance.

Section 16: Other information

Classification and procedure used to derive the classification for mixtures according to Regulation (EC) 1272/2008 [CLP]:

Classification according to Regulation (EC) No 1272/2008	Classification procedure
Flammable Liquids, Category 2, H225	Self-classification.

Relevant H-statements (number and full text):

H225: Highly flammable liquid and vapour.

Disclaimer:

The information contained in this document applies to this specific material as supplied. It may not be valid for this material if it is used in combination with any other materials. It is the user's responsibility to satisfy oneself as to the suitability and completeness of this information for their own particular use.

Date of Preparation of SDS: October 26, 2017

Version: 1.2

SDS Prepared by: **Aegis Regulatory Inc.**

Phone: (519) 488-0351

www.aegisreg.com

Gaylord Chemical Company, L.L.C.
1880 Fairlawn Rd, Tuscaloosa, AL 35401, United States

ES FOR COMMUNICATION

Annex to Safety Data Sheet

Trade Name: Dimethyl Sulfide (DMS)

Substance Name: Dimethyl Sulfide (DMS)

EC Number: 200-846-2

CAS Number: 75-18-3

Registration Number: 01-2119487127-32-0002

Date of Generation/Revision: 18/01/2017

Author: Chemservice S.A.

Table of Contents

1. ES 1: Formulation or re-packing;

1.1. Use descriptors

ES name: Food flavour additive - very small amount used (<1% of final product)(Formulation)

Environment	
CS 1: Food flavour additive - very small amount used (<1% of final product)(Formulation)	ERC 2
Worker	
CS 2: Use in closed process, no likelihood of exposure	PROC 1

1.2. Conditions of use affecting exposure

1.2.1. Control of environmental exposure: Food flavour additive - very small amount used (<1% of final product)(Formulation) (ERC 2)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.2 tonnes/day
Annual amount per site <= 20.0 tonnes/year
Conditions and measures related to biological sewage treatment plant
Assumed domestic sewage treatment plant flow >= 2000 m3/day
Provide onsite wastewater treatment.
No application of sewage sludge to soil
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
Receiving surface water flow >= 18000 m3/day

1.2.2. Control of worker exposure

Product (Article) characteristics
Covers concentrations up to 100.0 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8.0 h/day
Technical and organisational conditions and measures
Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions
Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Supervision in place to check that the risk management measures in place are being used correctly and operation conditions followed.; Ensure control measures are regularly inspected and maintained.
Other conditions affecting workers exposure
Assumes process temperature up to 40.0 °C
Indoor use

1.3. Exposure estimation and reference to its source

1.3.1. Environmental release and exposure: Food flavour additive - very small amount used (<1% of final product)(Formulation) (ERC 2)

Release route	Release rate	Release estimation method
Water	1 kg/day	SpERC based Formulation & (re)packing of substances and mixtures (industrial): solvent-borne - Formulation & packing of preparations and mixtures;Formulation, packing and re-packing of the substance and its mixtures in batch or continuous operations, including storage, materials transfers, mixing, tabletting, compression, pelletisation, extrusion, large and small scale packing, sampling, maintenance and associated laboratory activities. ESVOC SpERC 2.2.v1 (4)
Air	5 kg/day	SpERC based same as above
Soil	0.02 kg/day	SpERC based same as above

Protection target	Exposure estimate (based on: EUSES 2.1.2)	RCR
Fresh water	3.52E-3 mg/L	0.122
Sediment (freshwater)	0.023 mg/kg dw	0.19
Marine water	3.52E-4 mg/L	0.121
Sediment (marine water)	2.27E-3 mg/kg dw	0.189
Sewage Treatment Plant	0.035 mg/L	0.175
Agricultural soil	1.36E-5 mg/kg dw	< 0.01
Man via environment - Inhalation	3.92E-4 mg/m³	< 0.01
Man via environment - combined routes		< 0.01

1.3.2. Worker exposure: Use in closed process, no likelihood of exposure (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.026 mg/m³ (TRA Workers 3.0)	< 0.01
Dermal, systemic, long term	0.034 mg/kg bw/day (TRA Workers 3.0)	< 0.01
Combined, systemic, long term		< 0.01

1.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Human health and environmental safety

Confirm that mentioned Risk Management Measures (RMMs) and Operational Conditions (OCs) are implemented as described. If this is not applicable to all sites, scaling may be necessary to define appropriate site-specific risk management measures.

2. ES 2: Use at industrial sites; Manufacture of bulk, large scale chemicals (including petroleum products) (SU 8);

2.1. Use descriptors

ES name: Anti-coking agent in ethylene production (Industrial use)
Sector of use: Manufacture of bulk, large scale chemicals (including petroleum products) (SU 8)

Environment	
CS 1: Anti-coking agent in ethylene production (Industrial use)	ERC 6b
Worker	
CS 2: Use in closed process, no likelihood of exposure	PROC 1
CS 3: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b

2.2.1. Control of environmental exposure: Anti-coking agent in ethylene production (Industrial use) (ERC 6b)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 3.0 tonnes/day
Annual amount per site <= 500.0 tonnes/year
Conditions and measures related to biological sewage treatment plant
Assumed domestic sewage treatment plant flow >= 2000 m3/day
Provide onsite wastewater treatment.
No application of sewage sludge to soil
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
Receiving surface water flow >= 18000 m3/day

2.2. Conditions of use affecting exposure

2.2.2. Control of worker exposure

Product (Article) characteristics
Covers concentrations up to 100.0 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8.0 h/day
Technical and organisational conditions and measures
Supervision in place to check that the risk management measures in place are being used correctly and operation conditions followed.; Ensure control measures are regularly inspected and maintained.
Other conditions affecting workers exposure
Assumes process temperature up to 40.0 °C
Indoor use

Contributing scenario	Specific measures
Use in closed process, no likelihood of exposure (PROC 1)	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities (PROC 8b)	*Local exhaust ventilation. Inhalation - minimum efficiency of 95.0 %* Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Wear suitable gloves tested to EN374.; For further specification, refer to section 8 of the SDS.

2.3. Exposure estimation and reference to its source

2.3.1. Environmental release and exposure: Anti-coking agent in ethylene production (Industrial use) (ERC 6b)

Release route	Release rate	Release estimation method
Water	4.5 kg/day	Estimated release factor *(Site specific information)*
Air	3 kg/day	ERC based
Soil	0.75 kg/day	ERC based

Protection target	Exposure estimate (based on: EUSES 2.1.2)	RCR
Fresh water	0.016 mg/L	0.543
Sediment (freshwater)	0.102 mg/kg dw	0.849
Marine water	1.58E-3 mg/L	0.543
Sediment (marine water)	0.01 mg/kg dw	0.849
Sewage Treatment Plant	0.157 mg/L	0.787
Agricultural soil	1.94E-5 mg/kg dw	< 0.01
Man via environment - Inhalation	3.92E-4 mg/m³	< 0.01
Man via environment - combined routes		< 0.01

2.3.2. Worker exposure: Use in closed process, no likelihood of exposure (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.026 mg/m³ (TRA Workers 3.0)	< 0.01
Dermal, systemic, long term	0.034 mg/kg bw/day (TRA Workers 3.0)	< 0.01
Combined, systemic, long term		< 0.01

2.3.3. Worker exposure: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	13.59 mg/m³ (TRA Workers 3.0)	0.55
Dermal, systemic, long term	2.742 mg/kg bw/day (TRA Workers 3.0)	0.11
Combined, systemic, long term		0.66

2.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Human health and environmental safety

Confirm that mentioned Risk Management Measures (RMMs) and Operational Conditions (OCs) are implemented as described. If this is not applicable to all sites, scaling may be necessary to define appropriate site-specific risk management measures.

3. ES 3: Use at industrial sites; Manufacture of bulk, large scale chemicals (including petroleum products) (SU 8);

3.1. Use descriptors

ES name: Sulfiding agent for catalysts in petroleum refining and petrochemical manufacture (Industrial use)
Sector of use: Manufacture of bulk, large scale chemicals (including petroleum products) (SU 8)

Environment	
CS 1: Sulfiding agent for catalysts in petroleum refining and petrochemical manufacture (Industrial use)	ERC 4
Worker	
CS 2: Use in closed process, no likelihood of exposure	PROC 1
CS 3: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b

3.2. Conditions of use affecting exposure

3.2.1. Control of environmental exposure: Sulfiding agent for catalysts in petroleum refining and petrochemical manufacture (Industrial use) (ERC 4)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 15.0 tonnes/day
Annual amount per site <= 100.0 tonnes/year
Conditions and measures related to biological sewage treatment plant
Assumed domestic sewage treatment plant flow >= 2000 m3/day
Provide onsite wastewater treatment.
No application of sewage sludge to soil
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
Receiving surface water flow >= 18000 m3/day

3.2.2. Control of worker exposure

Product (Article) characteristics
Covers concentrations up to 100.0 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8.0 h/day
Technical and organisational conditions and measures
Supervision in place to check that the risk management measures in place are being used correctly and operation conditions followed.; Ensure control measures are regularly inspected and maintained.
Other conditions affecting workers exposure
Assumes process temperature up to 40.0 °C
Indoor use

Contributing scenario	Specific measures
Use in closed process, no likelihood of exposure (PROC 1)	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities (PROC 8b)	*Local exhaust ventilation. Inhalation - minimum efficiency of 95.0 %* Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Wear suitable gloves tested to EN374.; For further specification, refer to section 8 of the SDS.

3.3. Exposure estimation and reference to its source

3.3.1. Environmental release and exposure: Sulfiding agent for catalysts in petroleum refining and petrochemical manufacture (Industrial use) (ERC 4)

Release route	Release rate	Release estimation method
Water	3.75 kg/day	Estimated release factor
Air	1.5E4 kg/day	ERC based
Soil	750 kg/day	ERC based

Protection target	Exposure estimate (based on: EUSES 2.1.2)	RCR
Fresh water	0.013 mg/L	0.453
Sediment (freshwater)	0.085 mg/kg dw	0.708
Marine water	1.31E-3 mg/L	0.453
Sediment (marine water)	8.49E-3 mg/kg dw	0.707
Sewage Treatment Plant	0.131 mg/L	0.656
Agricultural soil	2.52E-3 mg/kg dw	0.35
Man via environment - Inhalation	0.076 mg/m³	0.018
Man via environment - combined routes		0.018

3.3.2. Worker exposure: Use in closed process, no likelihood of exposure (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.026 mg/m³ (TRA Workers 3.0)	< 0.01
Dermal, systemic, long term	0.034 mg/kg bw/day (TRA Workers 3.0)	< 0.01
Combined, systemic, long term		< 0.01

3.3.3. Worker exposure: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	13.59 mg/m³ (TRA Workers 3.0)	0.55
Dermal, systemic, long term	2.742 mg/kg bw/day (TRA Workers 3.0)	0.11
Combined, systemic, long term		0.66

3.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Human health and environmental safety

Confirm that mentioned Risk Management Measures (RMMs) and Operational Conditions (OCs) are implemented as described. If this is not applicable to all sites, scaling may be necessary to define appropriate site-specific risk management measures.

4. ES 4: Use at industrial sites; Manufacture of fine chemicals (SU 9);

4.1. Use descriptors

ES name: Solvent or Intermediate for synthesis applications – primarily agrichemical and pharmaceutical (Industrial use)
Sector of use: Manufacture of fine chemicals (SU 9)

Environment	
CS 1: Solvent or Intermediate for synthesis applications – primarily agrichemical and pharmaceutical (Industrial use)	ERC 6a
Worker	
CS 2: Use in closed batch process (synthesis or formulation)	PROC 3
CS 3: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b

4.2. Conditions of use affecting exposure

4.2.1. Control of environmental exposure: Solvent or Intermediate for synthesis applications – primarily agrichemical and pharmaceutical (Industrial use) (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.8 tonnes/day
Annual amount per site <= 100.0 tonnes/year
Conditions and measures related to biological sewage treatment plant
Assumed domestic sewage treatment plant flow >= 2000 m3/day
Provide onsite wastewater treatment.
No application of sewage sludge to soil
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
Receiving surface water flow >= 18000 m3/day

4.2.2. Control of worker exposure

Product (Article) characteristics
Covers concentrations up to 100.0 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8.0 h/day
Technical and organisational conditions and measures
Local exhaust ventilation. Inhalation - minimum efficiency of 90.0 %
Supervision in place to check that the risk management measures in place are being used correctly and operation conditions followed.; Ensure control measures are regularly inspected and maintained.

Other conditions affecting workers exposure
Assumes process temperature up to 40.0 °C
Indoor use

Contributing scenario	Specific measures
Use in closed batch process (synthesis or formulation) (PROC 3)	Provide a basic standard of general ventilation (1 to 3 air changes per hour). Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities (PROC 8b)	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Wear suitable gloves tested to EN374.; For further specification, refer to section 8 of the SDS.

4.3. Exposure estimation and reference to its source

4.3.1. Environmental release and exposure: Solvent or Intermediate for synthesis applications – primarily agrichemical and pharmaceutical (Industrial use) (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.8 kg/day	Estimated release factor *(based initially on ESVOC SPERC 6.1a.v1, Use as an intermediate in Chesar 2.3)*
Air	4 kg/day	Estimated release factor *(based initially on ESVOC SPERC 6.1a.v1, Use as an intermediate in Chesar 2.3)*
Soil	0.8 kg/day	Estimated release factor *(based initially on ESVOC SPERC 6.1a.v1, Use as an intermediate in Chesar 2.3)*

Protection target	Exposure estimate (based on: EUSES 2.1.2)	RCR
Fresh water	2.82E-3 mg/L	0.097
Sediment (freshwater)	0.018 mg/kg dw	0.152
Marine water	2.82E-4 mg/L	0.097
Sediment (marine water)	1.82E-3 mg/kg dw	0.152
Sewage Treatment Plant	0.028 mg/L	0.14
Agricultural soil	1.36E-5 mg/kg dw	< 0.01
Man via environment - Inhalation	3.92E-4 mg/m³	< 0.01
Man via environment - combined routes		< 0.01

4.3.2. Worker exposure: Use in closed batch process (synthesis or formulation) (PROC 3)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	12.94 mg/m³ (TRA Workers 3.0)	0.524
Dermal, systemic, long term	0.69 mg/kg bw/day (TRA Workers 3.0)	0.028
Combined, systemic, long term		0.552

4.3.3. Worker exposure: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	13.59 mg/m³ (TRA Workers 3.0)	0.55
Dermal, systemic, long term	2.742 mg/kg bw/day (TRA Workers 3.0)	0.11
Combined, systemic, long term		0.66

4.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Human health and environmental safety

Confirm that mentioned Risk Management Measures (RMMs) and Operational Conditions (OCs) are implemented as described. If this is not applicable to all sites, scaling may be necessary to define appropriate site-specific risk management measures.

5. ES 5: Use at industrial sites; Manufacture of bulk, large scale chemicals (including petroleum products) (SU 8);

5.1. Use descriptors

ES name: Odorant in natural gas (very small amount mixed with natural gas (<1% of final product) (Industrial use)
Sector of use: Manufacture of bulk, large scale chemicals (including petroleum products) (SU 8)

Environment	
CS 1: Odorant in natural gas (very small amount mixed with natural gas (<1% of final product) (Industrial use)	ERC 7
Worker	
CS 2: Use in closed process, no likelihood of exposure	PROC 1

5.2. Conditions of use affecting exposure

5.2.1. Control of environmental exposure: Odorant in natural gas (very small amount mixed with natural gas (<1% of final product) (Industrial use) (ERC 7)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.8 tonnes/day
Annual amount per site <= 100.0 tonnes/year
Conditions and measures related to biological sewage treatment plant
Assumed domestic sewage treatment plant flow >= 2000 m3/day
Provide onsite wastewater treatment.
No application of sewage sludge to soil
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
Receiving surface water flow >= 18000 m3/day

5.2.2. Control of worker exposure

Product (Article) characteristics
Covers concentrations up to 100.0 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8.0 h/day
Technical and organisational conditions and measures
Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions
Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Supervision in place to check that the risk management measures in place are being used correctly and operation conditions followed.; Ensure control measures are regularly inspected and maintained.
Other conditions affecting workers exposure

Assumes process temperature up to 40.0 °C
Indoor use

5.3. Exposure estimation and reference to its source

5.3.1. Environmental release and exposure: Odorant in natural gas (very small amount mixed with natural gas (<1% of final product) (Industrial use) (ERC 7)

Release route	Release rate	Release estimation method
Water	4 kg/day	ERC based
Air	40 kg/day	ERC based
Soil	40 kg/day	ERC based

Protection target	Exposure estimate (based on: EUSES 2.1.2)	RCR
Fresh water	0.014 mg/L	0.483
Sediment (freshwater)	0.091 mg/kg dw	0.755
Marine water	1.4E-3 mg/L	0.483
Sediment (marine water)	9.05E-3 mg/kg dw	0.754
Sewage Treatment Plant	0.14 mg/L	0.699
Agricultural soil	1.31E-4 mg/kg dw	0.018
Man via environment - Inhalation	3.82E-3 mg/m³	< 0.01
Man via environment - combined routes		< 0.01

5.3.2. Worker exposure: Use in closed process, no likelihood of exposure (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.026 mg/m³ (TRA Workers 3.0)	< 0.01
Dermal, systemic, long term	0.034 mg/kg bw/day (TRA Workers 3.0)	< 0.01
Combined, systemic, long term		< 0.01

5.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Human health and environmental safety

Confirm that mentioned Risk Management Measures (RMMs) and Operational Conditions (OCs) are implemented as described. If this is not applicable to all sites, scaling may be necessary to define appropriate site-specific risk management measures.

6. ES 6: Widespread use by professional workers; Scientific research and development (SU 24);

6.1. Use descriptors

ES name: Laboratory supply (Professional use)
Sector of use: Scientific research and development (SU 24)

Environment	
CS 1: Laboratory supply (Professional use)	ERC 8a
Worker	
CS 2: Transfer of substance or preparation into small containers (dedicated filling line, including weighting)	PROC 9
CS 3: Using materials as fuel souces, limited exposure to unburned product to be expected	PROC 16

6.2. Conditions of use affecting exposure

6.2.1. Control of environmental exposure: Laboratory supply (Professional use) (ERC 8a)

Conditions and measures related to biological sewage treatment plant
Municipal sewage treatment plant is assumed.
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.

6.2.2. Control of worker exposure

Technical and organisational conditions and measures
Local exhaust ventilation. Inhalation - minimum efficiency of 80.0 %
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Other conditions affecting workers exposure
Assumes process temperature up to 40.0 °C
Indoor use

Contributing scenario	**Specific measures**
Transfer of substance or preparation into small containers (dedicated filling line, including weighting) (PROC 9)	Covers concentrations up to 5.0 % Covers use up to 4.0 h/day
Using materials as fuel souces, limited exposure to unburned product to be expected (PROC 16)	Covers concentrations up to 100.0 % Covers use up to 8.0 h/day

6.3. Exposure estimation and reference to its source

6.3.1. Environmental release and exposure: Laboratory supply (Professional use) (ERC 8a)

Release route	Release rate	Release estimation method
Water	0.165 kg/day	ERC based
Air	- kg/day	ERC based
Soil	- kg/day	ERC based

Protection target	Exposure estimate (based on: EUSES 2.1.2)	RCR
Fresh water	6.02E-4 mg/L	0.021
Sediment (freshwater)	3.89E-3 mg/kg dw	0.032
Marine water	5.97E-5 mg/L	0.021
Sediment (marine water)	3.86E-4 mg/kg dw	0.032
Sewage Treatment Plant	5.77E-3 mg/L	0.029
Agricultural soil	2.69E-4 mg/kg dw	0.037
Man via environment - Inhalation	2.79E-5 mg/m³	< 0.01
Man via environment - combined routes		< 0.01

6.3.2. Worker exposure: Transfer of substance or preparation into small containers (dedicated filling line, including weighting) (PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	10.87 mg/m³ (TRA Workers 3.0)	0.44
Dermal, systemic, long term	0.823 mg/kg bw/day (TRA Workers 3.0)	0.033
Combined, systemic, long term		0.473

6.3.3. Worker exposure: Using materials as fuel souces, limited exposure to unburned product to be expected (PROC 16)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	18.12 mg/m³ (TRA Workers 3.0)	0.734
Dermal, systemic, long term	0.34 mg/kg bw/day (TRA Workers 3.0)	0.014
Combined, systemic, long term		0.747

6.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Human health and environmental safety

Confirm that mentioned Risk Management Measures (RMMs) and Operational Conditions (OCs) are implemented as described. If this is not applicable to all sites, scaling may be necessary to define appropriate site-specific risk management measures.