SECTION 1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY

1.1. Product identifier

- Trade name: SULPHUR
- Other names: Liquid sulphur; Molten sulphur
- Registration number REACH: 01-2119487295-27-0059
- Index number:
- CAS Number: 7704-34-9
- ES Number: 231-722-6
- UFI code: not relevant

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

1.2.1. Identified uses

Sulphur is used as a raw material for further industrial processing.

1.2.2. Uses advised against

Sulphur must not be used for other purposes than specified in particular process documentation.

1.3. Details on supplier of the Safety Data Sheet

1.3.1. Business name and identification number

ORLEN Unipetrol RPA s.r.o., Záluží 1, 436 70 Litvínov, Czech Republic

Company IN: 275 97 075

☎: +420 476 161 111

fax: +420 476 619 553

unipetrolrpa@orlenunipetrol.cz

www.orlenunipetrolrpa.cz

1.3.2. Place of business

	Refinery Litvínov	**Refinery Kralupy**
	Záluží 1 436 01 Litvínov	O. Wichterleho 809 278 01 Kralupy n/Vlt.
Phone:	+420 476 163 567	+420 315 718 500
Fax:	+420 476 165 086	+420 315 718 640

1.3.3. E-mail address of professionally qualified person responsible for Safety Data Sheet:

reach.unirpa@orlenunipetrol.cz

1.4. Emergency phone numbers

- Dispatching ORLEN Unipetrol RPA s.r.o. ☎:+420 476 163 111 (NON STOP)
- Toxicological information centre (TIC) ☎:+420 224 919 293 (NON STOP)
  Na bojišti 1, 120 00 Praha 2, Czech Republic ☎:+420 224 915 402 (NON STOP)
  e-mail: tis@vfn.cz
- Transport information and accident system (TRIAS) ☎:+420 476 163 111 (NON STOP)

Note: For emergency phone numbers in EU countries see Section 16

SECTION 2. HAZARDS IDENTIFICATION

2.1. Classification of substance or mixture

The product is classified as hazardous pursuant to Regulation (ES) No. 1272/2008 CLP:

CAUSTICITY / IRRITATION TO SKIN, CATEGORY 2; H315 — **Skin Irrit. 2, H315,**

Note: For unabridged H-phrases and/or EUH-phrases see Section 2.2.

2.2. Label elements

Product identifiers		**SULPHUR** SULPHUR Index number: 601-052-00-2
Hazard warning symbol		
Signal word		WARNING
H-phrases (standard hazard phrases)	H315	Causes skin irritation.
P-instructions (instructions for safety handling)	P280 P302+P352 P332+P313	Wear protective gloves/protective clothing/eye protection/face protection. IF ON SKIN: Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention.
Additional information		None
		ORLEN Unipetrol RPA s.r.o. Záluží 1, 436 70 Litvínov, Czech Republic ☎: +420 476 161 111, +420 476 163 111

2.3. Other hazards

The product is molten sulphur of purity over 99 % m/m. This is a viscous yellow/brown liquid delivered hot at temperatures above its melting point, usually in the range 140 to 160 °C. After cooling down, sulphur is a solid substance of bright yellow colour.

Molten sulphur is highly adhesive to skin and in contact with it causes burns difficult to heal. Danger of molten sulphur lies also in its capability to dissolve sulphane (hydrogen sulphide) that is liberated on cooling. In such case, toxic and explosive mixture of hydrogen sulphide with air can be formed above the surface of molten sulphur.

Ingestion of sulphur is hazardous due to possibility of formation of toxic hydrogen sulphide by action of intestinal microorganisms.

The substance is not included in the Candidate List according to Article 59 (1) of the REACH Regulation due to endocrine disrupting properties.

The meaning of abbreviations used in this section is given in Section 16.

SECTION 3. COMPOSITION / INFORMATION ON INGREDIENTS

3.1. Substances

Name of substance:	SULPHUR
Concentration [% mass] :	> 99.0
Index number (index):	
CAS number:	7704-34-9

ES number:	231-722-6	
IMPURITIES	*NAME:*	*IDENTIFIER:*
The product does not contain any impurities, stabilizing added substances or other ingredients that would affect its classification.		

NOTE: The substance does not contain nanoform

3.2. Mixtures

Not applicable, the product is a substance

SECTION 4. INSTRUCTIONS FOR FIRST AID

4.1. Description of first aid

4.1.1. General instructions

When providing first aid, take care of your own safety.

Call the medical first aid service (☎155 CR, ☎120 EU) and until it comes follow its instructions. Ensure functions essential to life. In case the afflicted person does not breathe normally even when his/her head is leant back, provide resuscitation by pressing the chest down to about 5 cm with frequency 100-120 per minute. If you are trained in artificial breathing provide 2 breaths after every 30 pressings of the chest. Do not interrupt the heart massage until the ambulance comes.

Do not give anything to moth of an unconscious person or a person with spasm, just put him/her into a stabilized position.

If possible and with respect to your own safety, move the afflicted person out of the hazardous area, put down contaminated clothing and shoes.

4.1.2. In case of breathing-in:

With respect to your own safety, move the afflicted person to fresh air, keep warm, and seek for professional medical advice.

4.1.3. In case of contact with skin:

Remove contaminated clothing and shoes. Wash the hit places thoroughly with lukewarm water and soap. If irritation symptoms persist provide professional medical advice.

Hot sulphur stuck on the skin must be cooled down (with water) as quickly as possible. Sulphur can be removed during the first aid only if small areas are hit. Medical attention must always be provided.

In case of burns do not remove the product, cover the hit place with sterile bandage (or clean textile) and provide immediate professional medical advice.

4.1.4. If eyes are hit:

Immediately wash the eyes under running lukewarm water for at least 15 minutes keeping eyelids wide open. In case the afflicted person has contact lenses remove them before washing. Provide professional medical advice.

4.1.5. In case of ingestion:

NEVER INDUCE VOMITING!, just wash the mouth with water. If the afflicted person is vomiting keep his/her head under hip level so that the vomits cannot be breathed in. Provide professional medical advice as quickly as possible.

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

Molten sulphur is highly adhesive to skin and in contact with it causes burns difficult to heal. Danger of molten sulphur lies also in its capability to dissolve sulphane (hydrogen sulphide) that is liberated on cooling. Ingestion of sulphur is hazardous due to possibility of formation of toxic hydrogen sulphide by action of intestinal microorganisms.

4.3. Instruction on immediate medical attention and special treatment

In case of burns, ingestion or any symptoms of nausea provide immediate medical advice.

If gastrolavage is to be made it must only be carried out by a qualified physician using endotracheal intubation.

The workplace should be equipped with a safety shower and a device for eye irrigation.

SECTION 5. FIRE FIGHTING MEASURES

5.1. Extinguishing media

Suitable extinguishing media: heavy foam, water spray or water mist.
Unsuitable extinguishing media: direct water jet.
Extinguishing of small fire: powder or carbon-dioxide (CO_2) extinguisher, dry sand or fire-fighting foam.

5.2. Special hazards connected with the substance or mixture

Burning sulphur produces toxic and caustic sulphur dioxide.
If sulphur is heated to temperature when it is in liquid state it is a flammable liquid of IV. Class of hazard according to ČSN 65 0201.

5.3. Instructions for fire fighters

Penetration of the extinguishing liquid contaminated by the substance into the sewerage, surface and ground water, and into soil should be limited to minimum.
Tanks with the substance should be cooled with water spray as they can explode by heat.
Do not use foam and water at the same time as foam is decomposed with water.
Protective means for fire fighters: protective overall and self-contained breathing apparatus.

SECTION 6. ACCIDENTAL RELEASE MEASURES

6.1. Personal precautions, protective equipment and emergency procedures

Enclose the place of accident and prevent access to the dangerous area. Stay on windward side. If this product is released there is a danger of fire; therefore, remove all possible sources of ignition, do not smoke and do not use open fire. If possible provide sufficient ventilation of enclosed space. Prevent formation of dust from the solid product. Prevent contact with the substance, its dust and vapours. When remedying contingency/accident consequences use all recommended personal protective equipment (see chapter 8.2). In case of large accidents evacuate persons from the whole jeopardized area.

6.2. Environmental precautions

Prevent further escape of the substance and enclose the place of release. Prevent the product from penetrating into the sewerage, surface and ground water by covering sewerage riggots.

6.3. Methods and materials for containment and cleaning up

If this product is released there is a danger of fire; therefore, use non-explosive light fittings and electric appliances, and non-sparkling tools. Leave the released material to solidify, transfer it mechanically into a suitable dry closed vessel for further processing or later liquidation. Dispose in compliance with valid legislation for wastes (see Section 13).

6.4. Reference to other sections

For recommended personal protective equipment see chapter 8.2 („Exposure Control“).
For recommended method of disposing waste see Section 13 („Disposal Considerations“).

SECTION 7. HANDLING AND STORAGE

7.1. Safe handling precautions

General safety and hygienic measures: Use in well ventilated rooms only.
Observe the rules of personal hygiene. Take off contaminated parts of clothing immediately. When working do not eat, drink and smoke! After the work and before eating or drinking, wash your hands and non-covered parts of body thoroughly with water and soap, and treat with a suitable reparation ointment. Do not wear contaminated clothing, shoes, and protective means in the canteen.
During handling use the personal detector of H_2S.

7.2. Conditions for safe storage of substances and mixtures, including incompatible substances and mixtures

Store in a cool well ventilated place with effective exhaust, away from sources of heat and all sources of ignition. Storage containers should be tightly closed, properly labelled and grounded. Do not store in the vicinity of incompatible materials, such as oxidizing agents; protect against moisture. Store the molten product in tanks heated above its temperature of solidification.

7.3. Specific final uses

Sulphur is particularly intended for using as a raw material for further industrial processing, for instance, for production of sulphuric acid, etc. Sulphur must not be used for other purposes than specified in particular process documentation.

In case of accidental release, handling and storage rooms as well as methods of handling the substance must meet regulations for work with flammable substances potentially dangerous to water and soil.

SECTION 8. EXPOSURE CONTROL / PERSONAL PROTECTION MEANS

8.1. Control parameters

8.1.1. Limit values of exposure at workplace

Government Regulation No. 361/2007, laying down conditions of health protection at work, as amended, specifies the following permissible exposition limits (PEL) and maximum allowable concentration (MAC) of chemical substances in atmosphere of workplaces in the Czech Republic:

Name	CAS Number	PEL [mg.m^{-3}]	MAC [mg.m^{-3}]	Note
Sulphur	7704-34-9	not determined	not determined	
Hydrogen sulphide	7783-06-4	7	14	
Sulphur dioxide	7446-09-5	1,5	5	

Note 1: See Section 16 for explanation of abbreviations PEL and MAC.
Note 2: For limit values of exposure at workplace in EU countries see Section 16.

8.1.2. Values DNEL/DMEL

At usual temperature sulphur is solid and, therefore, exposure of workers and users during breathing-in with air should be considered. Although molten sulphur is a hot liquid any fraction in air at usual temperature is probably aerosol and not vapour; therefore, inhalation exposures to air fraction at surrounding temperature are evaluated as dust. Assigned dustiness for model ECETOC TRA is moderate. Induction DNEL is not suitable for deriving, however, reference values for "non-specific" dust are appropriate and available in several countries in order to assess the effect on workers in the form of dust without working limits of exposure specific for a particular substance. These values range from 4 mg/m^3 in Germany to 15 mg/m^3 in USA. Due to possible general influence of sulphur on dust lower value of this range has been selected so that it would be possible to specify the set of recommended (optional) measures of risk control in order to minimize the exposure to dust.

8.1.3. Values PNEC

Due to absence of toxicity PNEC has not been determined.

8.2. Exposure control

8.2.1. Technical protective measures of controlling exposure of people and the environment:

Protection against undesirable exposure of people and the environment must be provided by strict keeping of the substance under control by technical means and using process and control technologies. Rooms where the substance is handled or stored must be fitted with impermeable floor and collecting vats in order to cope with accidental release of the substance. Total and local ventilation and effective exhaust must be provided.

8.2.2. Individual protective measures:

Workers must use personal protective means (PPM) for protection of airways, eyes, hands and skin that correspond to character of the work performed. All PPM should always be kept in serviceable

state; defective or contaminated equipment should be immediately replaced.
Personal detector of H_2S should be used during handling.

RECOMMENDED PERSONAL PROTECTIVE MEANS (PPM):
(particular type of protective equipment must be chosen according to the type of work performed and with respect to amount and concentration of the hazardous substance/mixture at the workplace).

- ***Protection of airways:*** For release in case of a contingency, protective mask complying with EN 143 with filter against organic vapours and dust; for remedying consequences of contingency/accident, self-contained breathing apparatus;
- ***Protection of eyes/face:*** Protective goggles/shield complying with EN 166;
- ***Protection of hands:*** Chemically-resistant gauntlets tested according to EN 374; the following materials are suitable, for instance:

	gauntlet material	*layer thickness*	*penetration time*
Usual working activity (possibility of staining)	nitrile	0.4 mm	480 minutes
Cleaning-up of release / accident	nitrile	0.4 mm	480 minutes

- ***Protection of other parts of body:*** Antistatic non-flammable protective clothing, antistatic shoes;
- ***Danger of heat:*** Not relevant in recommended way of using; just during filling and bottling of the hot product Kevlar gauntlets should be used.
- ***Other measures:*** It is recommended that the workplace be equipped with safety shower and device for eye irrigation.

8.2.3. Exposure control of the environment:
Prevent the product from being released into the environment by any possible means. See Section 6.2.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

9.1. Information on basic physical and chemical properties

The information is obtained from the registration documentation (RD), unless otherwise stated.

attribute	unit	value	source/method	note
state of matter		solid	CSR	It is delivered melted at a temperature of approx. 160 ° C
colour		in the solid state bright yellow, liquid sulfur is yellow-brown to brown	CSR	
odour		typically sulfur	CSR	
melting point / freezing point	[°C]	115,2	CSR	
initial boiling point / boiling point range	[°C]	444,6	CSR	
flammability		non-flammable solid	CSR	
upper explosive limit	%	data not available		CSR does not state

attribute	unit	value	source/method	note
lower explosive limit	%	data not available		CSR does not state
flash point	[°C]	168	CSR	
spontaneous ignition temperature	[°C]	In accordance with column 2 of Annex VII to REACH, the study does not need to be conducted because the substance is solid and has a melting point of less than 160 ° C.	CSR	
decomposition temperature		does not decompose		CSR does not state
pH		is not relevant		CSR does not state
viscosity kinematic	[Pa.s]	at 120 °C: 0,017 at 158 °C: 0,006 at 160 °C: 5,95 at 188 °C: 93,0 at 200 °C: 78,86 at 300 °C: 3,72	petroleum.cz	
solubility in water	[mg.l^{-1}]	<0,005	CSR	at 22°C
relative density	voda=1	2,07	CSR	at 20°C
distributive coefficient: n-octanol/water	[log Koc]	<3,0	CSR	at 25°C
vapour pressure	[kPa]	0,00014	CSR	at 20°C
relative vapour density	vzduch=1	is not relevant		CSR does not state
particle characteristics		Rhombic - It is the most common and stable modification of sulfur, it consists of 8 atoms (S8) combined into a cycle.	MUNI	

9.2. Additional information

9.2.1. Information concerning physical hazard classes

They are not available.

9.2.2. Other security features

They are not available.

SECTION 10. STABILITY AND REACTIVITY

10.1. **Reactivity**
Under normal conditions the product is stable.

10.2. **Chemical stability**
Under normal conditions the product is stable.

10.3. **Possible hazardous reactions**
Under normal conditions none; toxic and caustic sulphur dioxide is liberated during burning.

10.4. **Conditions to prevent**
Formation of concentration within limits of explosiveness, presence of sources of ignition, contact with open fire.

10.5. **Incompatible materials**
Oxidizing agents.

10.6. **Hazardous decomposition products**
It does not decompose.

SECTION 11. TOXICOLOGICAL INFORMATION

11.1. **Information on toxicological effects**

11.1.1. Toxicological effects of substance/mixture:

CLASS OF HAZARD	DATA FROM REGISTRATION DOCUMENTATION		EVALUATION
	DESCRIPTION	RESULT	
Acute toxicity	oral: dermal: inhalation:	LD_{50} = 2 000 mg/kg LD_{50} > 2 000 mg/kg LC_{50}(4h) = 5 430 mg/m^3	It does not meet criteria for classification
Causticity / irritation to skin		Adverse effects have been recorded	It meets criteria for classification
Serious damage / irritation of eyes		Adverse effects have not been recorded	It does not meet criteria for classification
Sensitization	OECD 406	Adverse effects have not been recorded	It does not meet criteria for classification
Mutagenicity in embryonal cells	OECD 471	Adverse effects have not been recorded	It does not meet criteria for classification
Carcinogenicity		Adverse effects have not been recorded	It does not meet criteria for classification
Toxicity for reproduction	OECD 414	No adverse reproductive or developmental effects have been recorded	It does not meet criteria for classification
STOT – single exposition		No toxic effects have been recorded in tests of acute toxicity	It does not meet criteria for classification

CLASS OF HAZARD	DATA FROM REGISTRATION DOCUMENTATION		EVALUATION
	DESCRIPTION	RESULT	
STOT – repeated exposition	OECD 408 OECD 411	No toxic effects have been recorded during repeated exposition	It does not meet criteria for classification
Hazardous when breathed-in		At 40°C the product is not liquid	It does not meet criteria for classification

11.1.2. Information on probable ways of exposure:
During intended using there is no danger of exposure. In case of contingency or accident, exposure can take place in all ways of which inhalation and contact with skin are of higher importance.

11.1.3. Symptoms and effects (acute, delayed and chronic after short- as well as long-time exposure):
Contact with skin can cause irritation.
During handling the hot product there is a risk of burning.

11.1.4. Interactive effects:
During intended using no interaction occurs.

11.2. **Information on other hazards**
The Substance is not included in the Candidate List under Article 59 (1) of the REACH (due to endocrine disrupting properties or for any other reason).

SECTION 12. ECOLOGICAL INFORMATION

12.1. **Toxicity**

Aquatic environment	Fish	In compliance with column 2 of Annex VII to Regulation REACH, the studies with aquatic animals have not been compiled as toxicity to aquatic environment is probably not present because the substance is highly insoluble in water (solubility in water < 5 µg / l).
	Invertebrates	
	Algae	
Terrestrial environment	Soil organisms	
Microbiological activity (WWTP)	Activated sludge	

12.2. **Persistence and decomposition**
Pure sulphur has decay half-life 4.25 hours with illumination of 80000 lux at 25 ° C.
Active substance from sulphate technical component has decay half-life 3.21 hours with illumination of 80000 lux at 25 ° C.

12.3. **Bioaccumulation potential**
Not reported

12.4. **Mobility in soil**
Not reported

12.5. **Results of assessment of PBT and vPvB**
Not assessed in inorganic substances.

12.6. **Endocrine disrupting properties**
The Substance is not included in the Candidate List under Article 59 (1) of the REACH due to endocrine disrupting properties.

12.7. **Other adverse effects**
Not reported

12.8. **Additional information**
Not reported

SECTION 13. DISPOSAL CONSIDERATIONS

13.1. **Methods of wastes treatment**
In the case a rest of the product (for instance, non-consumed or released product) is to be disposed valid legislation of the European Union and national and local valid regulations must be observed.

Recommended waste classification pursuant Decision 2000/532 / EC on the list of wastes covered by Directive of the European Parliament and of the Council (Waste Catalogue):

13.1.1. Catalogue number
Catalogue number for product that has become a waste:
05 01 16 Wastes containing sulphur from desulphurization of crude oil

13.1.2. Recommended method of waste disposal:
Wastes and unutilized rests are disposed in compliance with valid legislation for wastes, usually by controlled landfilling or recycling. Incineration is an inappropriate method.

13.1.3. Recommend method of disposal of contaminated containers:
Sulphur is usually delivered in railway tank cars or road truck tanks. Decontamination and liquidation of these containers should follow valid regulations ADR/RID.

13.1.4. Precautions of controlling exposure in waste treatment:
The product released during a contingency or an accident should not be flushed into the sewerage system. Proceed in compliance with instructions given in Section 6 („Accidental Release Measures “) and in Chapter 8.2 („Exposure Control “) and observe all valid legal regulations for protection of persons, atmosphere and water.

NOTICE: The above stated information relates to delivered, not yet used material. In case the already used material becomes a waste the waste producer should assign the code to it according to branch and process of using, and specify method of its disposal.

SECTION 14. TRANSPORT INFORMATION

The given information is valid for road (ADR) and railway (RID) transport of hazardous goods:

UN 2448 is used for the case of transporting hazardous goods in road truck tanks and railway tank cars.

14.1. **UN number or ID-number**
2448

14.2. **Official (UN) designation for transport:**
SULPHUR, MOLTEN

14.3. **Class/classes of hazard for transport:**
4.1

14.4. **Packaging group:**
III

14.5. **Danger to the environment:**
-

14.6. **Special safety measures for users:**
None

14.7. **MARITIME BULK TRANSPORT ACCORDING TO IMO INSTRUMENTS:**

Not applicable. The product is transported in railway tank cars or road truck tanks**.**

14.8. **Additional information:**

Identification number of hazard:	44
Classification code:	F3
Safety mark:	4.1

Note: During filling/bottling, the product is heated to temperature above 100°C and, therefore, it is necessary to use Kevlar gauntlets and mark the tank with a label for heated-up substances.

The information on transport classification is provided according to the following master regulations UN:
European treaty on international road transport of hazardous goods (ADR),
Rules for international railway transport of hazardous goods (RID).

UN 1350 is used for transport of hazardous goods in below-limit, limited and exempt amounts.

14.1. **UN number or ID-number**
2448

14.2. **Official (UN) designation for transport:**

SULPHUR

14.3. **Class/classes of hazard for transport:**

4.1

14.4. **Packaging group:**

III

14.5. **Danger to the environment:**

-

14.6. **Special safety measures for users:**

None

14.7. **Maritime bulk transport according to IMO instruments:**

Not applicable. The product is transported in railway tank cars or road truck tanks.

14.8 Additional information

Identification number of hazard:	44
Classification code:	F3
Safety mark:	4.1

SECTION 15. REGULATORY INFORMATION

15.1. **Regulations relating to safety, health and environment / Specific legislation applicable to substance or mixture**

15.1.1. European Union:

Regulation of EP and Council (ES) No. 1907/2006 (REACH), as amended
REGISTRATION (CHAPTER II OF REGULATION REACH):
The product has been fully registered as substance.

PERMIT (CHAPTER VII OF REGULATION REACH):
The product is not included in the list of substances in Annex XIV to Regulation (ES) No. 1907/2006 REACH and, therefore, the permit obligation is not applicable to it.
LIMITATION (CHAPTER VIII OF REGULATION REACH):
The product must not be put on market for sale to the public except for cosmetic preparations, medicines and fuels defined in detail in Record No. 28 of Annex XVII to Regulation (ES) No. 1907/2006 REACH.
Regulation EP and Council (ES) No. 1272/2008 (CLP), as amended:
The product has been classified in compliance with the above stated regulation; obligations connected with packaging and labelling of container of hazardous chemical substance are only applicable to the product if it is put on the market in containers subject to obligation of their labelling according to Regulation CLP
Regulation EP and Council (ES) No. 649/2012 on export and import of hazardous chemical substances, as amended:
The product is not subject to special restrictions of export and import.
Decision 2000/532 / EC on the list of wastes covered by Directive of the European Parliament and of the Council

15.1.2. Czech Republic:

Act No. 350/2011 on chemical substances and chemical mixtures, as amended.
The obligation of reporting to system CHLAP is not applicable to the product.
Act No. 258/2000 on protection of public health, as amended.
The obligation of elaborating Rules for handling is not applicable to the product.
Act No. 254/2001 on waters, as amended.
Act No. 201/2012 on protection of atmosphere, as amended.
Act No. 185/2001 on wastes, as amended.
Decree No. 93/2016 on Catalogue of wastes, as amended.
Government Regulation No. 361/2007 laying down conditions of health protection at work, as amended.
Act No. 224/2015 on prevention of serious accidents caused by selected hazardous chemical substances or mixtures, as amended.
The obligation of reporting to system CHLAP is not applicable to the product

15.2. **Assessment of chemical safety**

Chemical safety was assessed on registration of the substance. The substance meets the criteria for being classified as hazardous according to Regulation (ES) No. 1272/2008 CLP. Assessment of exposure and subsequent step of characterization of risks have been carried out.

SECTION 16. ADDITIONAL INFORMATION

Amendments during revision

Changes in this version of the safety data sheet are indicated by a black and red vertical line to the left of the text.
24.4.2023 In section 9, the term “ignition point” was replaced by the term “flash point”.

Abbreviated words and abbreviations used in the text:

ADR	European treaty on international road transport of dangerous goods
CAS	Registration number assigned to substance by Chemical Abstracts Service of American Chemical Society.
CLP	Regulation (ES) No. 1272/2008 on classification, labelling and packaging of chemical substances and mixtures implementing the United Nations´ globally harmonized system of classification and labelling of chemical substances
CMR	Carcinogenic, mutagenic or toxic for reproduction

CSR	Chemical safety report
WWTP	Waste water treatment plant
ČSN EN (ISO)	European standard taken over to the system of Czech technical standards
DMEL	Derived minimal effect level – level of exposure corresponding to low and possibly theoretical risk that should be considered an acceptable risk (for effects with no threshold, i.e. there is no level of exposure without an effect)
DNEL	Derived no-effect level – level of exposure derived from toxicological data at which no adverse effects on human health occurs.
DW	Waiving of information (Data waiving)
EC_{50}	Concentration of substance (Effect concentration) that causes immobilization of 50 % individuals.
ErC_{50}	Concentration of substance (Effect concentration) that causes 50 % reduction of growth rate of algae.
ECHA	European Chemicals Agency
ES	Official number of chemical substance in the European Union: EINECS from European inventory of existing commercial chemical substances, or ELINCS from European list of notified chemical substances, or NLP from List of substances no longer considered polymers („No longer polymer“)
HSDB	Hazardous substances data bank
IATA	International Air Transport Association
IBC	International regulation for building and rigging ships transporting bulk dangerous chemicals (Intermediate Bulk Container)
IC_{50}	Concentration of substance (Inhibition concentration) that causes inhibition of 50% individuals
ICAO	International Civil Aviation Organization
ICE	System of Intervention in chemical transport emergencies providing professional and practical assistance in solving contingencies connected with transport and storage of dangerous chemical substances.
IMDG	International maritime transport of dangerous goods.
IMO	International Maritime Organisation
ISO	International Organization for Standardization
LC_{50}/LD_{50}	Concentration/dose of substance (Lethal concentration/level) that causes death of 50 % individuals.
LOEC/LOEL	Lowest observed effect concentration/level.
log Kow	Logarithm of distribution coefficient n-octanol/water
MARPOL	International treaty on preventing contamination by ships.
nf	Not feasible.
NOAEC/NOAEL	Maximum no observed adverse effect concentration/level.
NOEC/NOEL	Maximum no observed effect concentration/level”)
MAC	Maximum permissible concentration of chemical substance in atmosphere (concentration of substance to which a worker can be exposed for maximum of 15 minutes and that must never be surpassed).
OECD	Organization for Economic Co-operation and Development.
PPM	Personal protective means
UN	United Nations
(Q)SAR	Theoretical mathematical model that can be used, based on relation between structure and activity of chemical substance, for deriving its properties (Quantitative structure-activity relationship“)
PBT, vPvB	Persistent, bio-accumulating and toxic, very persistent and very bio-accumulating.
PEL	Permissible exposition limit of chemical substance in atmosphere (exposure value to which a worker can be exposed for the whole working shift (8 hours) without his/her health being jeopardized, even with lifelong working exposition).
PNEC	Estimated concentration at which no hazardous effects occur in the given component of the environment.
REACH	Regulation (ES) No. 1907/2006 on registration, evaluation, authorisation and limitation of chemicals.
RID	Rules of international railway transport of dangerous goods
SDS	Safety Data Sheet
STOT	Specific target organ toxicity
su	Scientifically unjustified.
TRIAS	Transport information and accidental system of CR providing professional and practical assistance in solving contingencies connected with transport and storage of dangerous chemical

	substances, included into ICE
UACRON	Chemical database (The University of Akron).
UN number	Four-digit identification number of substance or object identifying dangerous material within international transport.
UVCB	Substances of unknown or variable composition, complex reaction products or biological materials.

Sources of data used in completing the Safety Data Sheet

Annexes I, IV, VI and VII to Regulation (ES) No. 1272/2008 CLP, as amended.
Principles of providing first aid in exposure to chemical substances (MUDr. Daniela Pelclová at al.)
Registration documentation of substance according to Regulation (ES) No. 1907/2006 REACH.
Decision of European Chemicals Agency ECHA No. SUB-D-2114383145-49-01/F on registration according to Regulation (ES) No. 1907/2006 REACH.

Instructions for training

Persons handling the product must be familiarized with risks in handling and with requirements for protection of health and environment (see particular provisions of the Labour Code).

Access to information

According to Art. 35 of Regulation (ES) No. 1907/2006 REACH, each employer must allow access to information from the Safety Data Sheet to all workers using this product or being exposed to its effects during their work, and also to representatives of these workers.

Limit values exposure at workplace for EU countries (see Cl. 8.1.1)

Data for sulphur (number CAS 7704-34-9)

	8-hour limit [mg.m^{-3}]	short-time limit [mg.m^{-3}]
European Union (Directive 2000/39/ES)	Not determined	Not determined

Emergency phone numbers in EU countries (see Chapter 1.4)

National centres (NON STOP)		**TOXICOLOGY (information on first aid)**	**ICE (information from SDS)**	
Belgium		☎+32/70245245	Belintra	☎+32/35699232
Bulgaria		☎+359/29154378		
Croatia		☎+385/12348342		
Czechia		☎+420/224-919293; 915402	TRIAS	☎+420/47 6163111; 6163267
Denmark		☎+45/82121212	PIBF/RVK	☎+45/45906000
Estonia		☎+372/6269379		
Finland		☎+358/9471977		
France		☎+33/(0)140054848	Transaid	☎+33/298331010
Ireland		☎+353/18092566		
Italy		☎+39/063054343	SET	☎+39/0362512868
Cyprus		☎+357/1401		
Lithuania		☎+370/52362052		
Latvia		☎+371/67042473		
Luxemburg		☎+32/70245245 (see Belgium)		
Hungary		☎+36/80201199	VERIK	☎+36/23552205
Malta		☎+356/21450000		
Germany		☎+49/3019240	TUIS	☎+49/6216043333
Netherlands		☎+31/302748888	TRC	☎+31/102468642
Poland		☎+48/226196654	SPOT	☎+48/243657032
Portugal		☎+351/808250143		

National centres (NON STOP)		TOXICOLOGY (information on first aid)	ICE (information from SDS)	
Austria		☎+43/14064343	TUIS	☎+49/6216043333
Greece		☎+30/2107793777		
Rumania		☎+40/212106282		
Slovakia		☎+421/254774166	DINS	☎+421/317754112; 2771
Slovenia		☎+386/41635500		
Spain		☎+34/915620420	CERET	☎+34 915373 248; 238
Sweden		☎+46/(0)104566700	KEMIAKUTEN	☎+46/8337043; 170970
Great Britain		☎ 8448920111	Chemsafe	☎+44/123 5836002; 5753363

Statement: *The Safety Data Sheet has been elaborated in compliance with Regulation (ES) No. 1907/2006 REACH. It contains data necessary for ensuring safety and health protection at work and protection of the environment. These data have been presented in good will, they correspond to actual state of knowledge and experience and are in compliance with our valid legislation. The stated data do not supersede quality specification and cannot be considered a guarantee of suitability and usability of this product to a particular application. It is on responsibility of the product user to assess correctness of information in a particular application in which properties of the product can be influenced by various factors. The customer is responsible for observation of regional valid legal regulations.*

ANNEX TO SAFETY DATA SHEET

SCENARIOS OF EXPOSURE ACCORDING TO ART. 31 OF REGULATION OF THE EUROPEAN PARLIAMENT AND COUNCIL (ES) NO.1907/2006 (REACH)

The Annex contains exposure scenarios applied from Chapter 9 of the Report on chemical safety submitted on registration of sulphur compiled for production and identified uses of sulphur.

9. EXPOSURE ASSESSMENT

Table 9.1. Identified Use Description and Exposure Scenario Number Key

IU	Category	Identified Use Name	Sector	ES Number	Sector of Use (SU)	Product Category (PC)	Process Category (PROC)	Environmental Release Category (ERC)	Specific Environmental Release Category (SpERC)
1	Sulfur	01 – Manufacture of Substance	Industrial	ES 9.1.1	3, 8, 9	NA	1, 2, 3, 4, 8a, 8b, 15	1	ESVOC SpERC 1.1.v1
2	Sulfur	01b Use of Substance as Intermediate	Industrial	ES 9.2.1	3, 8, 9	NA	1, 2, 3, 4, 8a, 8b, 15, 22, 23	6a	ESVOC SpERC 6.1a.v1
3	Sulfur	01a Distribution of Substance	Industrial	ES 9.3.1	3	NA	1, 2, 3, 4, 8a, 8b, 9, 15	4, 5, 6a, 6b, 6c, 6d, 7	ESVOC SpERC 1.1b.v1
4	Sulfur	02 Formulation & (Re)packing of Substances and Mixtures	Industrial	ES 9.4.1	3, 10	NA	1, 2, 3, 4, 5, 8a, 8b, 9, 14, 15, 23, 24	2	ESVOC SpERC 2.2.v1
5	Sulfur	10a Use as Release Agents or Binders: Industrial	Industrial	ES 9.5.1	3	NA	1, 2, 3, 4, 6, 8a, 8b, 10, 13, 14	4	ESVOC SpERC 4.10a.v1
6	Sulfur	10b Use as Release Agents or Binders: Professional	Professional	ES 9.6.1	22	NA	1, 2, 3, 4, 6, 8a, 8b, 10, 13, 14	8a, 8d	ESVOC SpERC 8.10b.v1

IU	Category	Identified Use Name	Sector	ES Number	Sector of Use (SU)	Product Category (PC)	Process Category (PROC)	Environmental Release Category (ERC)	Specific Environmental Release Category (SpERC)
7	Sulfur	11a Use in Agrochemicals: Professional	Professional	ES 9.7.1	22	NA	1, 4, 8a, 8b, 11, 13	8a, 8d	ESVOC SpERC 8.11a.v1
8	Sulfur	11b Use in Agrochemicals: Consumer	Consumer	ES 9.8.1	21	12, 22, 27	NA	8a, 8d	ESVOC SpERC 8.11b.v1
9	Sulfur	15 Use in Road and Construction Applications: Professional	Professional	ES 9.9.1	22	NA	8a, 8b, 9, 10, 11, 13	8d, 8f	ESVOC SpERC 8.15.v1
10	Sulfur	19 Rubber Production and Processing: Industrial	Industrial	ES 9.10.1	3, 10, 11	NA	1, 2, 3, 4, 5, 6, 7, 8a, 8b, 9, 13, 14, 15, 21	4, 6d	ESVOC SpERC 4.19.v1
11	Sulfur	12a Use as a Fuel: Industrial	Industrial	ES 9.11.1	3	NA	1, 2, 3, 4, 8a, 8b, 16	7	ESVOC SpERC 7.12a.v1
12	Sulfur	18b Explosives Manufacture & Use: Professional	Professional	ES 9.12.1	22	NA	1, 3, 5, 8a, 8b	8e	ERC DEFINED RELEASE FRACTIONS
13	Sulfur	Use in Matches	Consumer	ES 9.13.1	21	11	NA	8e	ERC DEFINED RELEASE FRACTIONS

14	Sulfur	Use in Fireworks	Consumer	ES 9.14.1	21	11	NA	8e	ERC DEFINED RELEASE FRACTIONS

Exposure Scenarios and Risk Characterisation Introduction

General considerations for the development of Exposure Scenarios

Most sulfur is produced in de-sulfurization processes of oil refinery streams and natural gas. In a refinery sulfur-containing petroleum streams are passed through a de-sulfurization unit where the sulfur is extracted in the form of hydrogen sulphide which is subsequently converted to elemental sulfur. The sulfur in oil refineries is produced, stored and shipped to customers in its molten state as a liquid (at approximately 130°C) or in solid form. Sour natural gas contains sulfur mainly as hydrogen sulphide. Similar conversion processes as in oil refineries may produce the elemental sulfur either as a hot liquid or in its solid form, e.g. as pellets, for shipment to customers over long distances.

Inputs for the development of the Exposure Scenarios

The process of mapping uses and characterising risks has often identified a series of supporting measures that may further contribute to the management of exposure. The measures are identified in *blue* text in the Appendices contained in section 10. These measures are not contained within the Exposure Scenarios (ES) as they do not need to be implemented in order to achieve satisfactory exposure control. However, they are identified within the CSA in order that stakeholders are able to benefit from access to other exposure control information that has been obtained during the process of CSA/ES development.

Sulfur is a solid at ambient temperature and hence inhalation exposures of workers and consumers to airborne dust require consideration. Although molten sulfur is a hot liquid, any airborne fraction at ambient temperatures is likely to be an aerosol and not a vapour, therefore inhalation exposures to airborne fraction at ambient temperature are assessed as dust. The assigned dustiness for the ECETOC TRA model is moderate. An inhalation DNEL is not appropriate to derive, but reference values for 'nuisance dust' or 'non -specific' dust are appropriate and available in several countries to assess occupational exposures to substances in the form of dusts without substance-specific Occupational Exposure Limits. These values range from 4 mg/m3 in Germany to 15 mg/m3 in the USA. In view of the possible health impact of sulfur dust in general, the lower value of this range has been selected in order to identify a set of recommended (non-mandatory) risk management measures (printed in blue) to minimise exposure to dust.

Sulfur is classified as a skin irritant (H315), which requires a qualitative risk characterisation of any dermal exposures according to REACH guidance Chapter E. The resulting risk management measures are considered mandatory and are printed in black in the Exposure Scenarios. A quantitative assessment of dermal exposures has not been conducted.

Sulfur is not classified as hazardous for environmental endpoints. A quantitative exposure assessment for the environment has not been conducted.

Impurities of concern potentially present in sulfur, e.g. in the headspace of a storage tank include hydrogen sulphide (H2S), a highly toxic gas, and sulfur dioxide, an irritant gas. Risk Management Measures fall outside the scope of the Exposure Scenarios but can be addressed in the main body of the Safety Data Sheet (see IUCLID Section 11 information). Proposed language for the SDS to deal with the H2S hazard is as follows:

- Product may release Hydrogen Sulphide: a specific assessment of inhalation risks from the presence of hydrogen sulphide in tank headspaces, confined spaces, product residue, tank waste and waste water, and unintentional releases should be made to help determine controls appropriate to local circumstances (E500)

These controls may include: Segregation of areas, Access only to authorised persons, Permit to work systems, Confined space working procedures, Area H_2S alarms, Personal H_2S alarms, Personal escape sets, H_2S awareness training (E501)

9.1. Manufacture of Sulfur – Industrial

9.1.1. Exposure Scenario

Section 1 Exposure Scenario Title: Sulfur	
Title	
Manufacture of Substance	
Use Descriptor	
Sector(s) of Use	3, 8, 9
Process Categories	1, 2, 3, 4, 8a, 8b, 15 *Further information on the mapping and allocation of PROC codes is contained in Table 9.1*
Environmental Release Categories	1
Specific Environmental Release Category	ESVOC SpERC 1.1.v1
Processes, tasks, activities covered	
Manufacture of the substance or use as a process chemical or extraction agent. Includes recycling / recovery, material transfers, storage, sampling, associated laboratory activities, maintenance and loading (including marine vessel/barge, road/rail car and bulk container).	
Assessment Method	
See Section 3.	
Section 2 Operational conditions and risk management measures	
Section 2.1 Control of worker exposure	
Product characteristics	
Physical form of product	Solid at STP, liquid at elevated operating temperature, vapour pressure < 0.5 kPa OC29
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently) G13
Amount used	Not applicable
Frequency and duration of use/exposure	Covers daily exposures up to 8 hours (unless stated differently) G2
Human factors not influenced by risk management	Not applicable
Other Operational Conditions affecting exposure	Operation is carried out at elevated temperature (> 20°C above ambient temperature). OC7. Assumes a good basic standard of occupational hygiene is implemented G1.
Contributing Scenarios	**Specific Risk Management Measures and Operating Conditions**
General measures (skin irritants) G19	Avoid direct skin contact with product. Identify potential areas for indirect skin contact. Wear gloves (tested to EN374) if hand contact with substance likely. Clean up contamination/spills as soon as they occur. Wash off any skin contamination immediately. Provide basic employee training to prevent / minimise exposures and to report any skin problems that may develop. E3
CS15 General exposures (closed systems)	No other specific measures identified. EI20
CS15 General exposures (closed systems) CS56 With sample	No other specific measures identified. EI20

collection	
CS15 General exposures (closed systems) CS55 Batch process CS56 With sample collection	No other specific measures identified. EI20
CS2 Process sampling	No other specific measures identified. EI20
CS16 General exposures (open systems)	No other specific measures identified. EI20
CS36 Laboratory activities	No other specific measures identified. EI20
CS14 Bulk transfers CS81 Dedicated facility	No other specific measures identified. EI20
CS39 Equipment Cleaning and Maintenance	No other specific measures identified. EI20
CS85 Bulk product storage	No other specific measures identified. EI20
Additional information on the basis for the allocation of the identified OCs and RMMs is contained in Appendices 1 to 2	
Section 2.2 Control of environmental exposure	
Not applicable	
Section 3 Exposure Estimation	
3.1. Health	
The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. G21.	
3.2. Environment	
Not applicable	
Section 4 Guidance to check compliance with the Exposure Scenario	
4.1. Health	
Available hazard data do not enable the derivation of a DNEL for dermal irritant effects. G32. Risk Management Measures are based on qualitative risk characterisation. G37. Available hazard data do not support the need for a DNEL to be established for other health effects. G36. Users are advised to consider national Occupational Exposure Limits or other equivalent values. G38. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. G23.	
4.2. Environment	
Not applicable	

9.1.2. Exposure Estimation

9.1.2.1. Human Health

See Appendix 1.a and 1.b.

9.1.2.2. Environment

Not applicable.

9.2. Use of Sulfur as Intermediate – Industrial

9.2.1. Exposure Scenario

Section 1 Exposure Scenario Title: Sulfur	
Title	
Use of Substance as Intermediate	
Use Descriptor	
Sector(s) of Use	3, 8, 9
Process Categories	1, 2, 3, 4, 8a, 8b, 15, 22, 23 *Further information on the mapping and allocation of PROC codes is contained in Table 9.1*
Environmental Release Categories	6a
Specific Environmental Release Category	ESVOC SpERC 6.1a.v1
Processes, tasks, activities covered	
Use of substance as an intermediate. Includes recycling/ recovery, material transfers, storage, sampling, associated laboratory activities, maintenance and loading (including marine vessel/barge, road/rail car and bulk container).	
Assessment Method	
See Section 3.	
Section 2 Operational conditions and risk management measures	
Section 2.1 Control of worker exposure	
Product characteristics	
Physical form of product	Solid at STP, liquid at elevated operating temperature, vapour pressure < 0.5 kPa OC29
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently) G13
Amount used	Not applicable
Frequency and duration of use/exposure	Covers daily exposures up to 8 hours (unless stated differently) G2
Human factors not influenced by risk management	Not applicable
Other Operational Conditions affecting exposure	Operation is carried out at elevated temperature (> 20°C above ambient temperature). OC7. Assumes a good basic standard of occupational hygiene is implemented G1.
Contributing Scenarios	**Specific Risk Management Measures and Operating Conditions**
General measures (skin irritants) G19	Avoid direct skin contact with product. Identify potential areas for indirect skin contact. Wear gloves (tested to EN374) if hand contact with substance likely. Clean up contamination/spills as soon as they occur. Wash off any skin contamination immediately. Provide basic employee training to prevent / minimise exposures and to report any skin problems that may develop. E3
CS15 General exposures (closed systems)	No other specific measures identified. EI20
CS15 General exposures (closed systems) CS56 With sample	No other specific measures identified. EI20

collection	
CS15 General exposures (closed systems) CS55 Batch process CS56 With sample collection	No other specific measures identified. EI20
CS2 Process sampling	No other specific measures identified. EI20
CS16 General exposures (open systems)	No other specific measures identified. EI20
CS36 Laboratory activities	No other specific measures identified. EI20
CS14 Bulk transfers CS81 Dedicated facility	No other specific measures identified. EI20
CS39 Equipment Cleaning and Maintenance	No other specific measures identified. EI20
CS85 Bulk product storage	No other specific measures identified. EI20
Additional information on the basis for the allocation of the identified OCs and RMMs is contained in Appendices 1 to 2	
Section 2.2 Control of environmental exposure	
Not applicable	
Section 3 Exposure Estimation	
3.1. Health	
The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. G21.	
3.2. Environment	
Not applicable	
Section 4 Guidance to check compliance with the Exposure Scenario	
4.1. Health	
Available hazard data do not enable the derivation of a DNEL for dermal irritant effects. G32. Risk Management Measures are based on qualitative risk characterisation. G37. Available hazard data do not support the need for a DNEL to be established for other health effects. G36. Users are advised to consider national Occupational Exposure Limits or other equivalent values. G38. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. G23.	
4.2. Environment	
Not applicable	

9.2.2. Exposure Estimation

9.2.2.1. Human Health

See Appendix 1.a and 1.b.

9.2.2.2. Environment

Not applicable

9.3. Distribution of Sulfur – Industrial

9.3.1. Exposure Scenario

Section 1 Exposure Scenario Title: Sulfur	
Title	
Distribution of Substance	
Use Descriptor	
Sector(s) of Use	3
Process Categories	1, 2, 3, 4, 8a, 8b, 9, 15 *Further information on the mapping and allocation of PROC codes is contained in Table 9.1*
Environmental Release Categories	4, 5, 6a, 6b, 6c, 6d, 7
Specific Environmental Release Category	ESVOC SpERC 1.1b.v1
Processes, tasks, activities covered	
Bulk loading (including marine vessel/barge, rail/road car and IBC loading) and repacking (including drums and small packs) of substance, including its sampling, storage, unloading, maintenance and associated laboratory activities.	
Assessment Method	
See Section 3.	
Section 2 Operational conditions and risk management measures	
Section 2.1 Control of worker exposure	
Product characteristics	
Physical form of product	Solid at STP, liquid at elevated operating temperature, vapour pressure < 0.5 kPa OC29
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently) G13
Amount used	Not applicable
Frequency and duration of use/exposure	Covers daily exposures up to 8 hours (unless stated differently) G2
Human factors not influenced by risk management	Not applicable
Other Operational Conditions affecting exposure	Operation is carried out at elevated temperature (> 20°C above ambient temperature). OC7. Assumes a good basic standard of occupational hygiene is implemented G1.
Contributing Scenarios	**Specific Risk Management Measures and Operating Conditions**
General measures (skin irritants) G19	Avoid direct skin contact with product. Identify potential areas for indirect skin contact. Wear gloves (tested to EN374) if hand contact with substance likely. Clean up contamination/spills as soon as they occur. Wash off any skin contamination immediately. Provide basic employee training to prevent / minimise exposures and to report any skin problems that may develop. E3
CS15 General exposures (closed systems)	No other specific measures identified. EI20
CS15 General exposures (closed systems) CS56 With sample	No other specific measures identified. EI20

collection	
CS15 General exposures (closed systems)CS55 Batch process CS56 With sample collection	No other specific measures identified. EI20
CS2 Process sampling	No other specific measures identified. EI20
CS16 General exposures (open systems)	No other specific measures identified. EI20
CS36 Laboratory activities	No other specific measures identified. EI20
CS14 Bulk transfers CS81 Dedicated facility	No other specific measures identified. EI20
CS7 Small package filling	No other specific measures identified. EI20
CS39 Equipment Cleaning and Maintenance	No other specific measures identified. EI20
CS85 Bulk product storage	No other specific measures identified. EI20
Additional information on the basis for the allocation of the identified OCs and RMMs is contained in Appendices 1 to 2	
Section 2.2 Control of environmental exposure	
Not applicable	
Section 3 Exposure Estimation	
3.1. Health	
The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. G21.	
3.2. Environment	
Not applicable	
Section 4 Guidance to check compliance with the Exposure Scenario	
4.1. Health	
Available hazard data do not enable the derivation of a DNEL for dermal irritant effects. G32. Risk Management Measures are based on qualitative risk characterisation. G37. Available hazard data do not support the need for a DNEL to be established for other health effects. G36. Users are advised to consider national Occupational Exposure Limits or other equivalent values. G38. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. G23.	
4.2. Environment	
Not applicable	

9.3.2. Exposure Estimation

9.3.2.1. Human Health

See Appendix 1.a and 1.b.

9.3.2.2. Environment

Not applicable

9.4. Formulation & (Re)packing of Sulfur – Industrial

9.4.1. Exposure Scenario

Section 1 Exposure Scenario Title: Sulfur	
Title	
Formulation & (Re)packing of Substances and Mixtures	
Use Descriptor	
Sector(s) of Use	3, 10
Process Categories	1, 2, 3, 4, 5, 8a, 8b, 9, 14, 15, 23, 24 *Further information on the mapping and allocation of PROC codes is contained in Table 9.1*
Environmental Release Categories	2
Specific Environmental Release Category	ESVOC SpERC 2.2.v1
Processes, tasks, activities covered	
Bulk loading (including marine vessel/barge, rail/road car and IBC loading) and repacking (including drums and small packs) of substance, including its sampling, storage, unloading, maintenance and associated laboratory activities.	
Assessment Method	
See Section 3.	
Section 2 Operational conditions and risk management measures	
Section 2.1 Control of worker exposure	
Product characteristics	
Physical form of product	Solid at STP, liquid at elevated operating temperature, vapour pressure < 0.5 kPa OC29
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently) G13
Amount used	Not applicable
Frequency and duration of use/exposure	Covers daily exposures up to 8 hours (unless stated differently) G2
Human factors not influenced by risk management	Not applicable
Other Operational Conditions affecting exposure	Operation is carried out at elevated temperature (> 20°C above ambient temperature). OC7. Assumes a good basic standard of occupational hygiene is implemented G1.
Contributing Scenarios	**Specific Risk Management Measures and Operating Conditions**
General measures (skin irritants) G19	Avoid direct skin contact with product. Identify potential areas for indirect skin contact. Wear gloves (tested to EN374) if hand contact with substance likely. Clean up contamination/spills as soon as they occur. Wash off skin contamination immediately. Provide basic employee training to prevent / minimise exposures and to report any skin effects that may develop. E3
CS15 General exposures (closed systems)	No other specific measures identified. EI20
CS15 General exposures (closed systems) CS56 With sample	No other specific measures identified. EI20

collection	
CS15 General exposures (closed systems) CS55 Batch process CS56 With sample collection	No other specific measures identified. EI20
CS2 Process sampling	No other specific measures identified. EI20
CS16 General exposures (open systems)	No other specific measures identified. EI20
CS30 Mixing operations (open systems)	No other specific measures identified. EI20
CS512 Milling, grinding and similar activities	No other specific measures identified. EI20
CS7 Small package filling	No other specific measures identified. EI20
CS 53 Pelletising	No other specific measures identified. EI20
CS36 Laboratory activities	No other specific measures identified. EI20
CS14 Bulk transfers CS81 Dedicated facility	No other specific measures identified. EI20
CS39 Equipment Cleaning and Maintenance	No other specific measures identified. EI20
CS16 General exposures (open systems) CS111 elevated temperature	No other specific measures identified. EI20
CS85 Bulk product storage	No other specific measures identified. EI20
Additional information on the basis for the allocation of the identified OCs and RMMs is contained in Appendices 1 to 2	
Section 2.2 Control of environmental exposure	
Not applicable	
Section 3 Exposure Estimation	
3.1. Health	
The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. G21.	
3.2. Environment	
Not applicable	
Section 4 Guidance to check compliance with the Exposure Scenario	
4.1. Health	
Available hazard data do not enable the derivation of a DNEL for dermal irritant effects. G32. Risk Management Measures are based on qualitative risk characterisation. G37. Available hazard data do not support the need for a DNEL to be established for other health effects. G36. Users are advised to consider national Occupational Exposure Limits or other equivalent values. G38. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. G23.	
4.2. Environment	
Not applicable	

9.4.2. Exposure Estimation

9.4.2.1. Human Health

See Appendix 1.a and 1.b.

9.4.2.2. Environment

Not applicable

9.5. Use of Sulfur as Release Agents or Binders – Industrial

9.5.1. Exposure Scenario

Section 1 Exposure Scenario Title Sulfur	
Title	
Use as Release Agents or Binders	
Use Descriptor	
Sector(s) of Use	3
Process Categories	1, 2, 3, 4, 6, 8a, 8b, 10, 13, 14 *Further information on the mapping and allocation of PROC codes is contained in Table 9.1*
Environmental Release Categories	4
Specific Environmental Release Category	ESVOC SpERC 4.10a.v1
Processes, tasks, activities covered	
Covers the use as binders and release agents including material transfers, mixing, application (including spraying and brushing), mould forming and casting, and handling of waste.	
Assessment Method	
See Section 3.	
Section 2 Operational conditions and risk management measures	
Section 2.1 Control of worker exposure	
Product characteristics	
Physical form of product	Solid at STP, liquid at elevated operating temperature, vapour pressure < 0.5 kPa OC29
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently) G13
Amount used	Not applicable
Frequency and duration of use/exposure	Covers daily exposures up to 8 hours (unless stated differently) G2
Human factors not influenced by risk management	Not applicable
Other Operational Conditions affecting exposure	Operation is carried out at elevated temperature (> 20°C above ambient temperature). OC7. Assumes a good basic standard of occupational hygiene is implemented G1.
Contributing Scenarios	**Specific Risk Management Measures and Operating Conditions**
General measures (skin irritants) G19.	Avoid direct skin contact with product. Identify potential areas for indirect skin contact. Wear gloves (tested to EN374) if hand contact with substance likely. Clean up contamination/spills as soon as they occur. Wash off skin contamination immediately. Provide basic employee training to prevent / minimise exposures and to report any skin effects that may develop. E3 Other skin protection measures such as impervious suits and face shields may be required during high dispersion activities which are likely to lead to substantial aerosol release e.g. spraying. E4.
CS15 General exposures (closed systems)	No other specific measures identified. EI20

CS15 General exposures (closed systems) CS56 With sample collection	No other specific measures identified. EI20
CS15 General exposures (closed systems) CS55 Batch process CS56 With sample collection	No other specific measures identified. EI20
CS16 General exposures (open systems)	No other specific measures identified. EI20
CS30 Mixing operations (open systems)	No other specific measures identified. EI20
CS98 Roller, spreader, flow application	No other specific measures identified. EI20
CS4 Dipping, immersion and pouring	No other specific measures identified. EI20
CS130 Article formation in mould	No other specific measures identified. EI20
CS14 Bulk transfers CS81 Dedicated facility	No other specific measures identified. EI20
CS39 Equipment Cleaning and Maintenance	No other specific measures identified. EI20
Additional information on the basis for the allocation of the identified OCs and RMMs is contained in Appendices 1 to 2	
Section 2.2 Control of environmental exposure	
Not applicable	
Section 3 Exposure Estimation	
3.1. Health	
The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. G21.	
3.2. Environment	
Not applicable	
Section 4 Guidance to check compliance with the Exposure Scenario	
4.1. Health	
Available hazard data do not enable the derivation of a DNEL for dermal irritant effects. G32. Risk Management Measures are based on qualitative risk characterisation. G37. Available hazard data do not support the need for a DNEL to be established for other health effects. G36. Users are advised to consider national Occupational Exposure Limits or other equivalent values. G38. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. G23.	
4.2. Environment	
Not applicable	

9.5.2. Exposure Estimation

9.5.2.1. Human Health

See Appendix 1.a and 1.b.

9.5.2.2. Environment

Not applicable

9.6. Use of Sulfur in Release Agents or Binders – Professional

9.6.1. Exposure Scenario

Section 1 Exposure Scenario Title Sulfur	
Title	
Use as Release Agents or Binders	
Use Descriptor	
Sector(s) of Use	22
Process Categories	1, 2, 3, 4, 6, 8a, 8b, 10, 13, 14 *Further information on the mapping and allocation of PROC codes is contained in Table 9.1*
Environmental Release Categories	8a, 8d
Specific Environmental Release Category	ESVOC SpERC 8.10b.v1
Processes, tasks, activities covered	
Covers the use as binders and release agents including material transfers, mixing, and application by spraying, brushing and handling of waste.	
Assessment Method	
See Section 3.	
Section 2 Operational conditions and risk management measures	
Section 2.1 Control of worker exposure	
Product characteristics	
Physical form of product	Solid at STP, liquid at elevated operating temperature, vapour pressure < 0.5 kPa OC29
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently) G13
Amount used	Not applicable
Frequency and duration of use/exposure	Covers daily exposures up to 8 hours (unless stated differently) G2
Human factors not influenced by risk management	Not applicable
Other Operational Conditions affecting exposure	Operation is carried out at elevated temperature (> 20°C above ambient temperature). OC7. Assumes a good basic standard of occupational hygiene is implemented G1.
Contributing Scenarios	**Specific Risk Management Measures and Operating Conditions**
General measures (skin irritants) G19.	Avoid direct skin contact with product. Identify potential areas for indirect skin contact. Wear gloves (tested to EN374) if hand contact with substance likely. Clean up contamination/spills as soon as they occur. Wash off skin contamination immediately. Provide basic employee training to prevent / minimise exposures and to report any skin effects that may develop. E3 Other skin protection measures such as impervious suits and face shields may be required during high dispersion activities which are likely to lead to substantial aerosol release e.g. spraying. E4.
CS15 General exposures (closed systems)	No other specific measures identified. EI20

CS15 General exposures (closed systems) CS56 With sample collection	No other specific measures identified. EI20
CS15 General exposures (closed systems) CS55 Batch process CS56 With sample collection	No other specific measures identified. EI20
CS16 General exposures (open systems)	No other specific measures identified. EI20
CS30 Mixing operations (open systems)	No other specific measures identified. EI20
CS98 Roller, spreader, flow application	No other specific measures identified. EI20
CS4 Dipping, immersion and pouring	No other specific measures identified. EI20
CS130 Article formation in mould	No other specific measures identified. EI20
CS14 Bulk transfers CS81 Dedicated facility	No other specific measures identified. EI20
CS39 Equipment Cleaning and Maintenance	No other specific measures identified. EI20
Additional information on the basis for the allocation of the identified OCs and RMMs is contained in Appendices 1 to 2	
Section 2.2 Control of environmental exposure	
Not applicable	
Section 3 Exposure Estimation	
3.1. Health	
The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. G21.	
3.2. Environment	
Not applicable	
Section 4 Guidance to check compliance with the Exposure Scenario	
4.1. Health	
Available hazard data do not enable the derivation of a DNEL for dermal irritant effects. G32. Risk Management Measures are based on qualitative risk characterisation. G37. Available hazard data do not support the need for a DNEL to be established for other health effects. G36. Users are advised to consider national Occupational Exposure Limits or other equivalent values. G38. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. G23.	
4.2. Environment	
Not applicable	

9.6.2. Exposure Estimation

9.6.2.1. Human Health

See Appendix 1.a and 1.b.

9.6.2.2. Environment

Not applicable

9.7. Uses of Sulfur in Agrochemicals – Professional

9.7.1. Exposure Scenario

Section 1 Exposure Scenario Title: Sulfur	
Title	
Uses in Agrochemicals	
Use Descriptor	
Sector(s) of Use	22
Process Categories	1, 4, 8a, 8b, 11, 13 *Further information on the mapping and allocation of PROC codes is contained in Table 9.1*
Environmental Release Categories	8a, 8d
Specific Environmental Release Category	ESVOC SpERC 8.11a.v1
Processes, tasks, activities covered	
Use as an agrochemical excipient for application by manual or machine spraying, smokes and fogging; including equipment clean-downs and disposal.	
Assessment Method	
See Section 3.	
Section 2 Operational conditions and risk management measures	
Section 2.1 Control of worker exposure	
Product characteristics	
Physical form of product	Solid at STP, liquid at elevated operating temperature, vapour pressure < 0.5 kPa OC29
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently) G13
Amount used	Not applicable
Frequency and duration of use/exposure	Covers daily exposures up to 8 hours (unless stated differently) G2
Human factors not influenced by risk management	Not applicable
Other Operational Conditions affecting exposure	Operation is carried out at elevated temperature (> 20°C above ambient temperature). OC7. Assumes a good basic standard of occupational hygiene is implemented G1.
Contributing Scenarios	**Specific Risk Management Measures and Operating Conditions**
General measures (skin irritants) G19	Avoid direct skin contact with product. Identify potential areas for indirect skin contact. Wear gloves (tested to EN374) if hand contact with substance likely. Clean up contamination/spills as soon as they occur. Wash off any skin contamination immediately. Provide basic employee training to prevent / minimise exposures and to report any skin problems that may develop. E3. Other skin protection measures such as impervious suits and face shields may be required during high dispersion activities which are likely to lead to substantial aerosol release, e.g. spraying E4
CS15 General exposures (closed systems)	No other specific measures identified. EI20

CS16 General exposures (open systems)	No other specific measures identified. EI20
CS14 Bulk transfers CS81 Dedicated facility	No other specific measures identified. EI20
CS10 Spraying	No other specific measures identified. EI20
CS4 Dipping, immersion and pouring	No other specific measures identified. EI20
CS39 Equipment Cleaning and Maintenance	No other specific measures identified. EI20
Additional information on the basis for the allocation of the identified OCs and RMMs is contained in Appendices 1 to 2	
Section 2.2 Control of environmental exposure	
Not applicable	
Section 3 Exposure Estimation	
3.1. Health	
The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. G21.	
3.2. Environment	
Not applicable	
Section 4 Guidance to check compliance with the Exposure Scenario	
4.1. Health	
Available hazard data do not enable the derivation of a DNEL for dermal irritant effects. G32. Risk Management Measures are based on qualitative risk characterisation. G37. Available hazard data do not support the need for a DNEL to be established for other health effects. G36. Users are advised to consider national Occupational Exposure Limits or other equivalent values. G38. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. G23.	
4.2. Environment	
Not applicable	

9.7.2. Exposure Estimation

9.7.2.1. Human Health

See Appendix 1.a and 1.b.

9.7.2.2. Environment

Not applicable

9.8. Uses of Sulfur in Agrochemicals – Consumer

9.8.1. Exposure Scenario

Section 1 Exposure Scenario Title: Sulfur		
Title		
Use in Agrochemicals		
Use Descriptor		
Sector(s) of Use	21	
Product Categories	12, 22, 27 *Further information on the mapping and allocation of PC codes is contained in Table 1.*	
Environmental Release Categories	8a, 8d	
Specific Environmental Release Category	ESVOC SpERC 8.11b.v1	
Processes, tasks, activities covered		
Covers the consumer use in agrochemicals in liquid and solid forms.		
Assessment Method		
See Section 3.		
Section 2 Operational conditions and risk management measures		
Section 2.1 Control of worker exposure		
Product characteristics		
Physical form of product	Solid at STP, liquid at elevated operating temperature, vapour pressure < 0.5 kPa OC29	
Concentration of substance in product	Unless otherwise stated, cover concentrations up to 100% [ConsOC1]	
Amounts used	Unless otherwise stated, covers use amounts up to37500g [ConsOC2]; covers skin contact area up to 6600cm2 [ConsOC5]	
Frequency and duration of use/exposure	Unless otherwise stated, covers use frequency up to 4 times per day [ConsOC4]; covers exposure up to 8 hours per event [ConsOC14]	
Other Operational Conditions affecting exposure	Unless otherwise stated assumes use at ambient temperatures [ConsOC15]; assumes use in a 20 m^3 room [ConsOC11]; assumes use with typical ventilation [ConsOC8].	
Product Category	**Specific Risk Management Measures and Operating Conditions**	
PC12:Fertilizers	OC	Unless otherwise stated, covers concentrations up to 90% [ConsOC1]; covers use up to 1 days/year[ConsOC3]; covers use up to 1 time/on day of use[ConsOC4]; covers skin contact area up to 857.50 cm2 [ConsOC5]; for each use event, assumes swallowed amount of 0.3g [ConsOC13]; for each use event, covers use amounts up to 2500g [ConsOC2]; covers outdoor use [ConsOC12];
	RMM	~~No specific RMMs identified beyond those OCs stated~~
PC22: Lawn and garden preparations, including fertilizers	OC	Products containing Sulfur in high percentages (assume 90%) are sold for acidification of soil, to treat certain plant diseases (e.g. scab on potatoes) and as worm-deterrent (http://www.progreen.co.uk/index.php?c=61&p=132). The products are provided as prill (pellets) in bags of 1 kg. Recommended application frequency is of the order of once

		per year. The exposure assessment is conducted using the <0.1 Pa band values of the ESIG consumer assessment tool (Appendix 1.c).
	RMM	No specific RMMs identified beyond those OCs stated
PC27_n: Plant protection products--	OC	Unless otherwise stated, covers concentrations up to 90% [ConsOC1]; covers use up to 1 days/year[ConsOC3]; covers use up to 1 time/on day of use[ConsOC4]; covers skin contact area up to 857.50 cm2 [ConsOC5]; for each use event, assumes swallowed amount of 0.3g [ConsOC13]; for each use event, covers use amounts up to 2500g [ConsOC2]; covers outdoor use [ConsOC12];
	RMM	No specific RMMs identified beyond those OCs stated
Additional information on the basis for the allocation of the identified OCs and RMMs is contained in Appendices 1 to 2		
Section 2.2 Control of environmental exposure		
Not applicable		
Section 3 Exposure Estimation		
3.1. Health		
The ECETOC TRA tool has been used to estimate consumer exposures, consistent with the content of ECETOC Report #107 and the Chapter R15 of the IR&CSA TGD. Where exposure determinants differ to these sources, then they are indicated. G42		
3.2. Environment		
Not applicable		
Section 4 Guidance to check compliance with the Exposure Scenario		
4.1. Health		
Predicted exposures are not expected to exceed the applicable consumer reference values when the operational conditions/risk management measures given in section 2 are implemented. G39. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. G23.		
4.2. Environment		
Not applicable		

9.8.2. Exposure Estimation

9.8.2.1. Human Health

See Appendix 1.b. & 1.c.

9.8.2.2. Environment

Not Applicable

9.9. Use of Sulfur in Road and Construction Applications – Professional

9.9.1. Exposure Scenario

Section 1 Exposure Scenario Title: Sulfur	
Title	
Use in Road and Construction Applications	
Use Descriptor	
Sector(s) of Use	22
Process Categories	8a, 8b, 9, 10, 11, 13 *Further information on the mapping and allocation of PROC codes is contained in Table 9.1*
Environmental Release Categories	8d, 8f
Specific Environmental Release Category	ESVOC SpERC 8.15.v1
Processes, tasks, activities covered	
Application of surface coatings and binders in road and construction activities, including paving uses, manual mastic and in the application of roofing and water-proofing membranes.	
Assessment Method	
See Section 3.	
Section 2 Operational conditions and risk management measures	
Section 2.1 Control of worker exposure	
Product characteristics	
Physical form of product	Solid at STP, liquid at elevated operating temperature, vapour pressure < 0.5 kPa OC29
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently) G13
Amount used	Not applicable
Frequency and duration of use/exposure	Covers daily exposures up to 8 hours (unless stated differently) G2
Human factors not influenced by risk management	Not applicable
Other Operational Conditions affecting exposure	Operation is carried out at elevated temperature (> 20°C above ambient temperature). OC7. Assumes a good basic standard of occupational hygiene is implemented G1.
Contributing Scenarios	**Specific Risk Management Measures and Operating Conditions**
General measures (skin irritants) G19	Avoid direct skin contact with product. Identify potential areas for indirect skin contact. Wear gloves (tested to EN374) if hand contact with substance likely. Clean up contamination/spills as soon as they occur. Wash off skin contamination immediately. Provide basic employee training to prevent / minimise exposures and to report any skin effects that may develop. E3 Other skin protection measures such as impervious suits and face shields may be required during high dispersion activities which are likely to lead to substantial aerosol release, e.g. spraying E4
CS14 Bulk transfers CS81	No other specific measures identified. EI20

Dedicated facility	
CS7 Small package filling	No other specific measures identified. EI20
CS98 Roller, spreader, flow application	No other specific measures identified. EI20
CS10 Spraying	No other specific measures identified. EI20
CS4 Dipping, immersion and pouring	No other specific measures identified. EI20
CS39 Equipment Cleaning and Maintenance	No other specific measures identified. EI20
Additional information on the basis for the allocation of the identified OCs and RMMs is contained in Appendices 1 to 2	
Section 2.2 Control of environmental exposure	
Not applicable	
Section 4 Guidance to check compliance with the Exposure Scenario	
4.1. Health	
Available hazard data do not enable the derivation of a DNEL for dermal irritant effects. G32. Risk Management Measures are based on qualitative risk characterisation. G37. Available hazard data do not support the need for a DNEL to be established for other health effects. G36. Users are advised to consider national Occupational Exposure Limits or other equivalent values. G38. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. G23.	
4.2. Environment	
Not applicable	

9.9.2. Exposure Estimation

9.9.2.1. Human Health

See Appendix 1.a and 1.b.

9.9.2.2. Environment

Not Applicable

9.10. Use of Sulfur in Rubber Production and Processing – Industrial

9.10.1. Exposure Scenario

Section 1 Exposure Scenario Title: Sulfur	
Title	
Rubber Production and Processing	
Use Descriptor	
Sector(s) of Use	3, 10, 11
Process Categories	1, 2, 3, 4, 5, 6, 7, 8a, 8b, 9, 13, 14, 15, 21 *Further information on the mapping and allocation of PROC codes is contained in Table 9.1*
Environmental Release Categories	4, 6d
Specific Environmental Release Category	ESVOC SpERC 4.19.v1
Processes, tasks, activities covered	
Manufacture of tyres and general rubber articles, including processing of raw (uncured) rubber, handling and mixing of rubber additives, calendaring, vulcanising, cooling and finishing as well as maintenance.	
Assessment Method	
See Section 3.	
Section 2 Operational conditions and risk management measures	
Section 2.1 Control of worker exposure	
Product characteristics	
Physical form of product	Solid at STP, liquid at elevated operating temperature, vapour pressure < 0.5 kPa OC29
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently) G13
Amount used	Not applicable
Frequency and duration of use/exposure	Covers daily exposures up to 8 hours (unless stated differently) G2
Human factors not influenced by risk management	Not applicable
Other Operational Conditions affecting exposure	Operation is carried out at elevated temperature (> 20°C above ambient temperature). OC7. Assumes a good basic standard of occupational hygiene is implemented G1.
Contributing Scenarios	**Specific Risk Management Measures and Operating Conditions**
General measures (skin irritants) G19	Avoid direct skin contact with product. Identify potential areas for indirect skin contact. Wear gloves (tested to EN374) if hand contact with substance likely. Clean up contamination/spills as soon as they occur. Wash off skin contamination immediately. Provide basic employee training to prevent / minimise exposures and to report any skin effects that may develop. E3 Other skin protection measures such as impervious suits and face shields may be required during high dispersion activities which are likely to lead to substantial aerosol release, e.g. spraying E4

CS15 General exposures (closed systems)	No other specific measures identified. EI20
CS15 General exposures (closed systems) CS56 With sample collection	No other specific measures identified. EI20
CS15 General exposures (closed systems) CS55 Batch process CS56 With sample collection	No other specific measures identified. EI20
CS16 General exposures (open systems)	No other specific measures identified. EI20
CS30 Mixing operations (open systems)	No other specific measures identified. EI20
CS64 Calendering (including Banburys) CS70 Vulcanisation CS71 Cooling cured articles	No other specific measures identified. EI20
CS10 Spraying	No other specific measures identified. EI20
CS90 Small scale weighing	No other specific measures identified. EI20
CS4 Dipping, immersion and pouring	No other specific measures identified. EI20
CS73 Pressing uncured rubber blanks	No other specific measures identified. EI20
CS102 Finishing operations	No other specific measures identified. EI20
CS36 Laboratory activities	No other specific measures identified. EI20
CS14 Bulk transfers CS81 Dedicated facility	No other specific measures identified. EI20
CS39 Equipment Cleaning and Maintenance	No other specific measures identified. EI20
Additional information on the basis for the allocation of the identified OCs and RMMs is contained in Appendices 1 to 2	
Section 2.2 Control of environmental exposure	
Not applicable	
Section 3 Exposure Estimation	
3.1. Health	
The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. G21.	
3.2. Environment	
Not applicable	
Section 4 Guidance to check compliance with the Exposure Scenario	
4.1. Health	
Available hazard data do not enable the derivation of a DNEL for dermal irritant effects. G32. Risk Management Measures are based on qualitative risk characterisation. G37. Available hazard data do not support the need for a DNEL to be established for other health effects. G36. Users are advised to consider national Occupational Exposure Limits or other equivalent values. G38. Where other Risk Management Measures/Operational Conditions are adopted, then users should	

ensure that risks are managed to at least equivalent levels. G23.
4.2. Environment
Not applicable

9.10.2. Exposure Estimation

9.10.2.1. Human Health

See Appendix 1.a and 1.b.

9.10.2.2. Environment

Not Applicable

9.11. Use of Sulfur as a Fuel – Industrial

9.11.1. Exposure Scenario

Section 1 Exposure Scenario Title: Sulfur	
Title	
Use as a Fuel	
Use Descriptor	
Sector(s) of Use	3
Process Categories	1, 2, 3, 4, 8a, 8b, 16 *Further information on the mapping and allocation of PROC codes is contained in Table 9.1*
Environmental Release Categories	7
Specific Environmental Release Category	ESVOC SpERC 7.12a.v1
Processes, tasks, activities covered	
Covers the use as a fuel (or fuel additives and additive components) and includes activities associated with its transfer, use, equipment maintenance and handling of waste.	
Assessment Method	
See Section 3.	
Section 2 Operational conditions and risk management measures	
Section 2.1 Control of worker exposure	
Product characteristics	
Physical form of product	Solid at STP, liquid at elevated operating temperature, vapour pressure < 0.5 kPa OC29
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently) G13
Amount used	Not applicable
Frequency and duration of use/exposure	Covers daily exposures up to 8 hours (unless stated differently) G2
Human factors not influenced by risk management	Not applicable
Other Operational Conditions affecting exposure	Operation is carried out at elevated temperature (> 20°C above ambient temperature). OC7. Assumes a good basic standard of occupational hygiene is implemented G1.
Contributing Scenarios	**Specific Risk Management Measures and Operating Conditions**
General measures (skin irritants) G19.	Avoid direct skin contact with product. Identify potential areas for indirect skin contact. Wear gloves (tested to EN374) if hand contact with substance likely. Clean up contamination/spills as soon as they occur. Wash off skin contamination immediately. Provide basic employee training to prevent / minimise exposures and to report any skin effects that may develop. E3
CS15 General exposures (closed systems)	No other specific measures identified. EI20
CS15 General exposures (closed systems) CS56 With sample collection	No other specific measures identified. EI20

CS15 General exposures (closed systems) CS55 Batch process CS56 With sample collection	No other specific measures identified. EI20
CS2 Process sampling	No other specific measures identified. EI20
CS16 General exposures (open systems)	No other specific measures identified. EI20
CS 107 (closed system)	No other specific measures identified. EI20
CS14 Bulk transfers CS81 Dedicated facility	No other specific measures identified. EI20
CS39 Equipment Cleaning and Maintenance	No other specific measures identified. EI20
CS85 Bulk product storage	No other specific measures identified. EI20
Additional information on the basis for the allocation of the identified OCs and RMMs is contained in Appendices 1 to 2	
Section 2.2 Control of environmental exposure	
Not applicable	
Section 3 Exposure Estimation	
3.1. Health	
The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. G21.	
3.2. Environment	
Not applicable	
Section 4 Guidance to check compliance with the Exposure Scenario	
4.1. Health	
Available hazard data do not enable the derivation of a DNEL for dermal irritant effects. G32. Risk Management Measures are based on qualitative risk characterisation. G37. Available hazard data do not support the need for a DNEL to be established for other health effects. G36. Users are advised to consider national Occupational Exposure Limits or other equivalent values. G38. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. G23.	
4.2. Environment	
Not applicable	

9.11.2. Exposure Estimation

9.11.2.1. Human Health

See Appendix 1.a and 1.b.

9.11.2.2. Environment

Not Applicable

9.12. Use of Sulfur in Explosives Manufacture and Use – Professional

9.12.1. Exposure Scenario

Section 1 Exposure Scenario Title: Sulfur	
Title	
Explosives Manufacture and Use	
Use Descriptor	
Sector(s) of Use	22
Process Categories	1, 3, 5, 8a, 8b *Further information on the mapping and allocation of PROC codes is contained in Table 9.1*
Environmental Release Categories	8e
Specific Environmental Release Category	*Not Applicable*
Processes, tasks, activities covered	
Covers exposures arising from the manufacture and use of slurry explosives (including materials transfer, mixing and charging) and equipment cleaning	
Assessment Method	
See Section 3.	
Section 2 Operational conditions and risk management measures	
Section 2.1 Control of worker exposure	
Product characteristics	
Physical form of product	Solid at STP, liquid at elevated operating temperature, vapour pressure < 0.5 kPa OC29
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently) G13
Amount used	Not applicable
Frequency and duration of use/exposure	Covers daily exposures up to 8 hours (unless stated differently) G2
Human factors not influenced by risk management	Not applicable
Other Operational Conditions affecting exposure	Operation is carried out at elevated temperature (> 20°C above ambient temperature). OC7. Assumes a good basic standard of occupational hygiene is implemented G1.
Contributing Scenarios	**Specific Risk Management Measures and Operating Conditions**
General measures (skin irritants) G19.	Avoid direct skin contact with product. Identify potential areas for indirect skin contact. Wear gloves (tested to EN374) if hand contact with substance likely. Clean up contamination/spills as soon as they occur. Wash off any skin contamination immediately. Provide basic employee training to prevent / minimise exposures and to report any skin problems that may develop. E3
CS15 General exposures (closed systems)	No other specific measures identified. EI20
CS15 General exposures (closed systems)	No other specific measures identified. EI20

CS55 Batch process CS56 With sample collection	
CS30 Mixing operations (open systems)	No other specific measures identified. EI20
CS14 Bulk transfers CS81 Dedicated facility	No other specific measures identified. EI20
CS39 Equipment Cleaning and Maintenance	No other specific measures identified. EI20
Additional information on the basis for the allocation of the identified OCs and RMMs is contained in Appendices 1 to 2	
Section 2.2 Control of environmental exposure	
Not applicable	
Section 3 Exposure Estimation	
3.1. Health	
The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. G21.	
3.2. Environment	
Not applicable	
Section 4 Guidance to check compliance with the Exposure Scenario	
4.1. Health	
Available hazard data do not enable the derivation of a DNEL for dermal irritant effects. G32. Risk Management Measures are based on qualitative risk characterisation. G37. Available hazard data do not support the need for a DNEL to be established for other health effects. G36. Users are advised to consider national Occupational Exposure Limits or other equivalent values. G38. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. G23.	
4.2. Environment	
Not applicable	

9.12.2. Exposure Estimation

9.12.2.1. Human Health

See Appendix 1.a and 1.b.

9.12.2.2. Environment

Not Applicable

9.13. Use of sulfur in Matches – Consumer

Basic data for the assessments:
Sulfur is classified for skin irritation effects (H315). There are no DNELs set for inhalation, dermal or oral route. A reference value of >5000 mg/kg, representing a "guide LD_{50}" was used in modeling. Specific gravity of Sulfur considered for this assessment is 2,07 g/cm^3. The Vapour Pressure considered for this assessment was 2.65E-20Pa@115.36°C (http://environmentalchemistry.com/yogi/periodic/S.html).

9.13.1. Human Health Exposure Scenario / Estimation for Use of Sulfur in Matches (PC 11; ERC 8e; ERC Defined release fractions):

Matches contain approximately 4% S
(http://nopr.niscair.res.in/bitstream/123456789/8636/1/IJCT%2012(3)%20369-380.pdf).

During intended use (lighting of a match) the S burns instantly and there is no exposure to Sulfur. Matches are considered a common household good. In line with REACH guidance (Chapter R.15) the only scenario requiring further analysis is an infant mouthing (not swallowing) a match. The calculation assumes a match head with radius of 3 mm, a layer of 0,01 cm removed by mouthing and a Sulfur content of 4%. Infant body weight is 7.62 kg (RIVM 320104002). The resulting dose is 0.12 mg/kg.

9.13.2. Environment Exposure Scenario / Estimation for Use of Sulfur in Matches (PC 11; ERC 8e; ERC Defined release fractions):

Not applicable

9.14. Use of sulfur in Fireworks – Consumer

9.14.1. Human Health Exposure Scenario / Estimation for Use of Sulfur in Fireworks (PC 11; ERC 8e; ERC Defined release fractions):

During intended use (explosion of fireworks) the Sulfur burns instantly and there is no exposure to Sulfur. Fireworks are not considered a common household good, hence infants are not expected to encounter mouthing opportunities. No exposure calculation is performed.

9.14.2. Environment Exposure Scenario / Estimation for Use of Sulfur in Fireworks (PC 11; ERC 8e; ERC Defined release fractions):

Not applicable

9.15. Regional Environment Exposure Estimation

Not applicable