
Product	SULPHUR (MOLTEN)	Date:	2017/5/18
		Edition:	5

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

1.1. Product identifier

- Trade name: SULPHUR (MOLTEN)
- Chemical name: Sulphur
- Index no.: 016-094-00-1
- EC no.: 231-722-6
- CAS no.: 7704-34-9
- Registration No.: 01-2119487295-27-0060
- Product code: 4000002

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

- Relevant identified uses: Industrial
 Manufacture of substance
 Use of substance as intermediate
 Rubber production and processing
Professional
 Use in agrochemicals
Consumer
 Use in agrochemicals
 Use in matches
Use in fireworks

- Uses advised against: The uses that are in the list above are relevant. Other uses are not recommended unless an assessment that proves that the related risks are controlled has been conducted before starting that use.

1.3. Details of the supplier of the safety data sheet

- Manufacturer/supplier: **INA-Industrija nafte, d.d.**

Address: Av. Većeslava Holjevcica 10
pp 555, 10002 Zagreb, HRVATSKA

Phone: 00-385-1-6450-842 / 00-385-1-6451-075 (24 h)

Fax: 00-385-1-6452-050

e-mail: sds@ina.hr

- Responsible person:

SD & HSE Sector

Mirela Mavrinac, B.Sc.

Tel. 00-385-1-6450-803

Hrvoje Raukar, B.Sc.

1.4. Emergency Telephone Number

- Emergency Service Telephone Number: **112**

National Protection and Rescue Directorate
Nehajska 5, 10000 Zagreb
e-mail: info@duzs.hr

00-385-1-3650-011
00-385-1-3650-084
00-385-1-3650-082
00-385-1-3650-083

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- Medical Information Telephone Number: 00-385-1-23-48-342

2. HAZARDS IDENTIFICATION

2.1. Classification of the substance or mixture

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

Skin Irrit. 2; H315

Full text of H-phrases: see section 16.

2.2. Substance or mixture labelling

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

Hazard pictograms:

Hazard pictograms:



GHS07

Signal word: Warning

Hazard statements (H):	H315	Causes skin irritation.
Precautionary statements (P):	P264	Wash hand and face thoroughly after handling.
	P280	Wear protective gloves, protective clothing, eye protection, respiratory tract protection.
	P302+P352	IF ON SKIN: Wash with plenty of soap and water.
	P321	Specific treatment (see instructions for first aid measures on this label).
	P332+P313	If skin irritation occurs: Get medical advice/attention.

2.3. Other hazards

May cause burns in contact with product at high temperatures. Liquid sulphur can develop sulphur dioxide (SO₂) and hydrogen sulphide (H₂S), toxic and flammable. The fine particles dispersed in the air generate explosive mixtures. When present, hydrogen sulphide may accumulate in tanks or in confined spaces with danger for operators that need to get it. In this case, over exposure can cause respiratory irritation, dizziness, nausea, unconsciousness and death.

The product does not meet the criteria for PBT or vPvB classification in Annex XIII of REACH.

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3. COMPOSITION / INFORMATION ON INGREDIENTS

-Substance:		Mixture:			
- Components contributing to product hazardousness:					
Substance name	Substance identification			[%]	Classification according to Regulation (EC) No 1272/2008 (CLP/GHS)
	CAS no.	EC no.	Registration no. (REACH)		
Sulphur	7704-34-9	231-722-6	01-2119487295-27-0060	99,5	Skin Irrit. 2, H315

4. FIRST AID MEASURES

- General information:

- First aid procedures

- after inhalation: Remove the affected person to fresh air. If breathing has stopped, give artificial respiration/heart massage and immediately seek medical attention.
- after skin contact: Immediately remove soaked clothes and shoes. In case of contact with dust, rinse the skin with water and soap for 15 to 20 minutes. If irritation persists, repeat rinsing procedure. In case of contact with liquid, rinse contact areas with cold running water. Do not tear sulphur residues off the skin! If irritation persists or in case of burns, seek medical attention.
- after eye contact: Remove eyelids with clean hands and rinse the eyes gently with running water for 15 to 20 minutes. If irritation persists, seek medical attention.
- after ingestion: If affected person is awake and does not have cramps, flush the mouth with plenty of water. If larger quantities are swallowed, seek medical assistance.

- Note to person administering first aid/ physician: None

5. FIRE FIGHTING MEASURES

- Extinguishing media

- SUITABLE: Sand, dry chemical powder, foam, water mist, dispersed water, CO₂.
- NOT SUITABLE: Water jet.

- Firefighting measures for special hazards: Eliminate all sources of ignition; call the fire brigade and police. Special attention should be given to permanent risk of forming explosive mixtures with air. Cool the sulphur container with water mist to prevent sulphur combustion.

- Special firefighting measures: Use of water mist and spray for cooling the surfaces exposed to heat and for protection of persons. Only persons trained in fire-fighting should use water spray.

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- **Special fire fighter protective equipment:** Wear protective fire fighter clothing (intervention suit) in accordance with HRN EN 469 and a self-sustained open-circuit compressed-air breathing apparatus in accordance with HRN EN 137.
- **Special hazards arising from the substance or mixture:** Air and dust mixture is highly flammable and explosive! Combustion produces flammable and toxic gases (SO₂). Dangerous levels of toxic hydrogen sulphide (H₂S) concentration may be created under confinement.
- **Advice for firefighters:** No data available.
- **Additional information:** No data available.

6. ACCIDENTAL RELEASE MEASURES

- **Personal precautions:** Do not smoke. Remove all sources of ignition and sparking. Thoroughly ventilate affected areas. Monitor hydrogen sulphide fumes concentration in the air. Use of protective equipment listed in Section 8 is obligatory. If liquid sulphur is used, allow it to harden and cool.
- **Environmental precautions:** Determine areas at risk and prevent leaking and spilling into watercourses, channels, drainage systems or soil by digging a protective ditch, or setting up partitions of dry sand, earth or clay bags. Provide good room ventilation. In case of larger leaks/spills notify Emergency Centre on 112.
- **Methods for cleaning-up and recovery:** Thoroughly remove larger pieces of sulphur, moist them or cover with inert gas to prevent sulphur combustion. Remove soil residues with adsorbents (sawdust, sand, mineral adsorbents). Extract sulphur from watercourse bottom by suction or nets.
Store the waste material that was removed in closed containers in well-ventilated premises. Hand over for disposal to legal entities for hazardous waste disposal, authorised by the Ministry in charge of environmental protection.
- **Additional warnings:** Dust or vapours (H₂S) form explosive mixture with air which generates toxic fumes. Eliminate all sources of ignition. Stand upwind of spillage.
In case of traffic accident shut down the engine, ground the tank-truck properly, mark the accident site and call responsible person and service in charge of eliminating consequences of the accident.

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7. HANDLING AND STORAGE

- Handling

- safety precautions: Keep away from the sources of heat. Immediately remove all sources of ignition. Use only properly functioning equipment and devices. Do not use sparking tools. Decant at designated areas with sufficient ventilation. Take precautionary measures against static electricity by earth bonding.

Liquid sulphur may generate static electricity; forming of dust and air explosive mixture must be prevented.

- safe handling advice: Avoid contact with skin and eyes. See Sections 3 and 4.

- **Storage:** technical measures and storage conditions:

- **SUITABLE:** Store in well sealed concrete containers, properly built and equipped, at 127°C to 149°C. Take precautionary measures against electrostatic charge. Keep away from water, vapour, sources of ignition, oxidising materials, chemically active materials, aluminium, sodium, coal, phosphorus, metal nitrates, metal carbides, and metal halogens.

Make sure that receiving tank farms are below the self-supporting tanks.

- **TO BE AVOIDED:** Avoid storing with other chemicals, especially flammable ones. Do not use sparking tools or devices in storage area.

- Packaging materials

- **RECOMMENDED:** Steel container or pressurised vessel, properly vented. Atmospheric pressure tanks must be properly vented in order to avoid fracture due to internal pressure change during filling/emptying.

- **NOT SUITABLE:** Any other.

- **Special use:** No data available.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1. Exposure limit values

Hazardous substance (CAS No.)	Occupational exposure limit values/short term values (OEL/STEL)		Biological limit values
	ppm	mg/m ³	
Hydrogen sulphide	5/10	7/14	No data available

- **Monitoring procedures:** Monitoring of hydrogen sulphide concentration, according to regulations.

8.2. Exposure controls

- **Summary of risk management measures:** No data available.

8.2.1. Occupational exposure controls

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- Description of operating procedure and technological control:

If you hand of hot product in confined areas, ensure adequate ventilation. Before accessing the storage tanks and start any kind of intervention (*with the meaning of work/maintenance...*) in a confined space, control the atmosphere and check the content of oxygen, the presence of hydrogen sulphide (H₂S) and of the sulphur dioxide (SO₂) and the degree of flammability.

- Personal protective equipment

- respiratory tract protection: Full-face mask (HRN EN 136) with A filter (HRN EN 14387). In case of fire, wear self-contained open circuit compressed air breathing apparatus (HRN EN 137).
- hand protection: Wear protective gloves made of stable and impervious material (neoprene, PVC).
- eye protection: Protective goggles with side shields or full-face protective mask (HRN EN 136).
- skin and body protection: Protective clothes made of impervious material and protective footwear.
- **Special hygienic and safety precautions:** Avoid inhalation of vapours! Regularly maintain the prescribed hygiene for working with hazardous substances. Remove contaminated clothes and shoes. Do not smoke, drink or eat when handling the product. Wash hands before breaks and at the end of work.

8.2.2. Environmental exposure controls

- **Summary of risk management measures:** No data available.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1. General information:

- state: liquid
- colour: yellow
- odour: odourless
- odour threshold: No data available.

9.2. Important health, safety and environmental information:

- pH value (indicate conc. and temp.): Not applicable.
- boiling point/boiling range: °C 444.6
- flash point: °C 168
- flammability (solid, gas): Flammable at or above flash point
- explosive properties: vol. % Not applicable.
- oxidizing properties: Not applicable.
- vapour pressure: kPa 0.11 mmHg (14.665 Pa)
- density at 15 °C: kg/m³ No data available.
- specific density: 1,8
- solubility (indicate solvent): g/L No data available.

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- Solubility in water:	g/L	Insoluble
- partition coefficient n-octanol / water	logPow	No data available.
- viscosity (kinematic) at 100 °C:	mm ² /s	11 mPas
- vapour density at 15°C:	kg/m ³	1.790
- volatility:		No data available.

9.3. Other data:

- melting point/freezing point:	°C	114-119
- disintegration temperature:	°C	No data available.
- auto ignition temperature:	°C	190-220
- conductivity:	pS/m	No data available.

10. STABILITY AND REACTIVITY

- Reactivity:	Liquid sulphur may degrade rubber and plastic.
- Chemical stability:	Stable at surrounding's temperature.
- Possibility of hazardous reactions:	Avoid moisture. At higher temperatures, molten sulphur may react with hydrocarbons in the absence of air, whereby hydrogen sulphide (H ₂ S) may be created. H ₂ S is a flammable gas and may pose a risk of indoor explosion. Under certain conditions, H ₂ S can react to form of pyrophoric iron compounds in enclosed spaces such as sulphur pits. Dissolved sulphur forms sulfides with most metals including iron and strongly reacts with sodium and magnesium.
- Conditions to avoid:	Conditions that lead to sulphur dust dispersion, flame and all other sources of ignition.
- Incompatible materials:	Oxydants (perchlorates, chlorates, nitrates, permanganates, peroxydes, halogens, oxygen).
- Hazardous decomposition products:	Sulphur dioxide and sulphur trioxide.

11. TOXICOLOGICAL INFORMATION

- Information on toxicological effects:

- Acute toxicity

- oral (LD ₅₀):	>2000 mg/kg _{body mass} (rat)
- inhalation (LC ₅₀):	>5430 mg/m ³ (4 h, rat)
- dermal (LD ₅₀):	>2000 mg/kg _{body mass} (rabbit)

- Irritation/Corrosion

- skin:	Dust may cause irritation, redness and dermatitis, and liquid may cause burns.
- eyes:	Irritating to inner eyelid.
- respiratory tract:	No data available

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- Sensitisation

- skin: No data available.
- respiratory tract: No data available.

- Aspiration hazard:

- **Other classic effects: (e.g. unconsciousness, particularly toxic metabolites, etc.):** No data available.

- **Permanent effects due to acute or chronic exposure:** Repeated exposure may cause permanent damage to eyes and blindness.

- Special effects

- mutagenicity: Not mutagenic.
- carcinogenicity: Not carcinogenic.
- fertility decrease: No data available.
- harmful effect on unborn child: No data available.
- toxicity to reproduction: No data available.
- other (e.g. endocrine disruptors): No data available.
- STOT (SE): No data available.
- STOT (RE): No data available.

- **Prohibitions and restrictions:** No data available.

- **Other:** No data available.

12. ECOLOGICAL INFORMATION

12.1. Toxicity

- to aquatic organisms: No data available.
- to ground organisms: No data available.
- to plants and land animals: Sulphur excess from the environment, due to creation of H₂S may poison the animals. The excess of certain sulphur compounds is toxic to plants.

12.2. Persistence and degradability

- biodegradation: No data available.
- other degradation processes: No data available.
- degradation in wastewater: No data available.

12.3. Bioaccumulative potential

- bio-concentration factor (BCF): No data available.

12.4. Mobility in soil

Method:

- Known or predicted distribution in environmental compartments: No data available.
- surface tension: No data available.
- absorption/desorption: No data available.
- other physical and chemical properties: See Section 9

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12.5. Results of PBT and vPvB assessment

- data from chemical safety report: No data available.

12.6. Other adverse effects:

Due to sudden cooling at ambient temperature and bottom sedimentation, it can have long-term harmful effect in water.

13. DISPOSAL CONSIDERATIONS

- **Waste codes:** 05 01 16
- **Waste treatment methods:** If possible, waste shall be recovered.
- **Waste from residues:** Hand over for disposal to legal persons for waste disposal, authorized by the ministry responsible for environmental protection.
- **Contaminated packaging:** Used plastic packaging shall be placed in suitable waste containers and disposed of in accordance with applicable legal regulations.
- **Relevant provisions:** Act on Sustainable Waste Management; Regulation on categories, types and classification of waste with a waste catalogue and list of hazardous waste; Ordinance on waste management

14. TRANSPORT INFORMATION

- **UN proper shipping name:** SULPHUR, MOLTEN
 - **UN number:** **2448**
 - **Transport hazard class(es)**
ADR/RID/ADN/ICAO/IATA: 4.1
IMDG:
 - **Packing group**
ADR/RID/ADN/IMDG/ICAO/IATA: III
 - **Environmental hazards**
ADR, RID, ADN, ICAO/IATA: No.
IMDG: No.
 - **Special precautions for user**
- | | |
|-------------------------------|---|
| ADR | RID |
| Transport category: 3 | Transport category: 3 |
| Vehicle for tank carriage: AT | Tank code: LGBV(+) |
| Tank code: LGBV(+) | Label: 4.1 |
| Tunnel restriction code: E | Classification code: F3 |
| Label: 4.1 | Hazard identification: 44 |
| Classification code: F3 | Special provisions: 538, TU27, TE4, TE6 |
| Hazard identification: 44 | |

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Special provisions: 538

ADN

Label: 4.1

Additional requirements/Remarks:

*Toxicometer for H₂S; 7;20: + 150°C; 28; 32.

Dangers: 4.1+S

Equipment required: PP, EP, TOX*, A.

Classification code: F3

Carriage permitted: T

Type of tank vessel: N

Anti-explosion protection required: no

Maximum degree of filling in %: 95

ICAO

Label: 4.1

Cargo IMP code: RFS

Passenger and cargo aircraft: forbidden /
forbidden

Cargo aircraft only: forbidden

ERG code: 3L

**Transport in liquid/bulk condition according to MARPOL Convention, Annex II and IBC
Codex**

Not applicable.

IMDG

Subsidiary risk: - Melting point: 119°C

Molten sulphur may contain hydrogen sulphide which is highly poisonous in low concentrations. When involved in a fire, evolves toxic, very irritating and suffocating gas. Forms explosive and extremely sensitive mixtures with oxidizing substances. Shipped molten above its melting point.

Stowage category: Category C, separate from class 5.1

Special provisions: TP3

EmS: F-A, S-H

Segregation group: SG17

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15. REGULATORY INFORMATION

- **Applicable EU regulations:** EU Regulation No. 1906/2007 and No. 1272/2008 of the European Parliament and the Council; Commission Regulation (EU) No 453/2010 of 20 May 2010 (amending Regulation (EC) No 1907/2006 (REACH)
EU Regulation No. 2037/2000 of the European Parliament and of the Council of 29 June 2000 on substances that deplete the ozone layer; EU Regulation No 689/2008 of the European Parliament and of the Council of 17 June 2008 concerning the export and import of dangerous chemicals; EU Regulation No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants; Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives;
- **Applicable national regulations:** Chemicals Act; Regulations on Hazardous Substance Exposure Limit Values during Work and Biological Limit Values; Sustainable Waste Management Act, Ordinance on Waste Catalogue, Ordinance on Waste Management.
- **Chemical Safety Assessment carried out (CSA):** YES X NO
- **Authorization information:** -
- **Restriction information:** -

16. OTHER INFORMATION

Revision indicators

Section: **Subject of change:**

Completely new edition of SDS "Sulphur (molten)", with changes in all sections.

Full text of H- phrases, EUH- and P-phrases:

H315	Causes skin irritation.
R38	Irritating to skin.
P264	Wash hand and face thoroughly after handling.
P280	Wear protective gloves, protective clothing, eye protection, respiratory trackt protection.
P302+P352	IF ON SKIN: Wash with plenty of soap and water.
P321	Specific treatment (see instructions for first aid measures on this label).
P332+P313	If skin irritation occurs: Get medical advice/attention.

Abbreviations and acronyms:

ADN	European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways
ADR	European Agreement concerning the International Carriage of Dangerous Goods by Road

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CAS number	Chemical Abstract Service number
CLP	Classification, Labelling and Packaging of substances and mixtures
CSA	Chemical Safety Assessment
CSR	Chemical Safety Report
EC number	European Community number for identification of chemical substances commercially available in the EU
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IMDG	International Maritime Dangerous Goods Code transport
LC50	Lethal concentration for 50% of tested organisms
LD50	Lethal concentration for 50% of tested organisms (medium lethal concentration)
OIN	Oil industry notes
PBT	Persistent, bioaccumulative and toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RID	Regulations Concerning the International Transport of Dangerous Goods by Rail
STOT (SE)	Specific Target Organ Toxicity (Single Exposure)
STOT (RE)	Specific Target Organ Toxicity (Repeated Exposure)
UVCB	Chemical Substances of Unknown or Variable Composition, Complex Reaction Products and Biological Materials
vPvB	Very persistent and very bioaccumulative

Statement:

This SDS is in compliance with the EU Regulation No. 1907/2006 and No. 1272/2008 of the European Parliament and the Council. It contains important user health and safety and environmental protection information. The information provided herein is not a substitute for any specification of quality and should not be deemed as a guarantee of the adequacy and applicability of this product for any purpose whatsoever. All information provided herein is based on our current knowledge and compliant with applicable legal regulations. The user is responsible for adherence to relevant legal regulations.

Data source:

1. <http://ecb.jrc.ec.europa.eu/esis/>
2. **Concawe Report 10/14**, *Hazard classification and labelling of petroleum substances in the European Economic Area – 2014*
3. <http://echa.europa.eu/>

APPENDIX: EXPOSURE SCENARIOS ACCORDING TO CHEMICAL SAFETY REPORT

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APPENDIX: EXPOSURE SCENARIOS FOR SULFUR ACCORDING TO CHEMICAL SAFETY REPORT

Table 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	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
4	Sulfur	11b – Use in Agrochemicals: Consumer	Consumer	ES 9.8.1	21	12, 22, 27	NA	8a, 8d	ESVOC SpERC 8.11b.v1
5	Sulfur	19 – Rubber	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
		Production and							
		Processing: Industrial							
6	Sulfur	Use in Matches	Consumer	ES 9.13.1	21	11	NA	8e	ERC DEFINED RELEASE FRACTIONS
7	Sulfur	Use in Fireworks	Consumer	ES 9.14.1	21	11	NA	8e	ERC DEFINED RELEASE FRACTIONS

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1. Manufacture of Sulfur – Industrial

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 <i>Further information on the mapping and allocation of PROC codes is contained in Table 9.1</i>
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 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

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CS16 General exposures (open systems)	No other specific measures identified. E120
CS36 Laboratory activities	No other specific measures identified. E120
CS14 Bulk transfers CS81 Dedicated facility	No other specific measures identified. E120
CS39 Equipment Cleaning and Maintenance	No other specific measures identified. E120
CS85 Bulk product storage	No other specific measures identified. E120
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	

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2. Use of Sulfur as Intermediate – Industrial

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 <i>Further information on the mapping and allocation of PROC codes is contained in Table 9.1</i>
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 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

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CS2 Process sampling	No other specific measures identified. E120
CS16 General exposures (open systems)	No other specific measures identified. E120
CS36 Laboratory activities	No other specific measures identified. E120
CS14 Bulk transfers CS81 Dedicated facility	No other specific measures identified. E120
CS39 Equipment Cleaning and Maintenance	No other specific measures identified. E120
CS85 Bulk product storage	No other specific measures identified. E120
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	

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3. Uses of Sulfur in Agrochemicals – Professional

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 <i>Further information on the mapping and allocation of PROC codes is contained in Table 9.1</i>
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

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CS39 Equipment Cleaning and Maintenance	No other specific measures identified. E120
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	

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4. Uses of Sulfur in Agrochemicals – Consumer

Section 1 Exposure Scenario Title: Sulfur		
Title		
Use in Agrochemicals		
Use Descriptor		
Sector(s) of Use	21	
Product Categories	12, 22, 27 <i>Further information on the mapping and allocation of PC codes is contained in Table 1.</i>	
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 to 37500g [ConsOC2]; covers skin contact area up to 6600cm ² [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 cm ² [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];

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		covers use up to 1 time/on day of use[ConsOC4]; covers skin contact area up to 857.50 cm ² [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		

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

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 <i>Further information on the mapping and allocation of PROC codes is contained in Table 9.1</i>
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	No other specific measures identified. EI20

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(closed systems) CS55 Batch process CS56 With sample collection	
CS16 General exposures (open systems)	No other specific measures identified. E120
CS30 Mixing operations (open systems)	No other specific measures identified. E120
CS64 Calendering (including Banburys) CS70 Vulcanisation CS71 Cooling cured articles	No other specific measures identified. E120
CS10 Spraying	No other specific measures identified. E120
CS90 Small scale weighing	No other specific measures identified. E120
CS4 Dipping, immersion and pouring	No other specific measures identified. E120
CS73 Pressing uncured rubber blanks	No other specific measures identified. E120
CS102 Finishing operations	No other specific measures identified. E120
CS36 Laboratory activities	No other specific measures identified. E120
CS14 Bulk transfers CS81 Dedicated facility	No other specific measures identified. E120
CS39 Equipment Cleaning and Maintenance	No other specific measures identified. E120
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	

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6. 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 LD₅₀” was used in modeling. Specific gravity of Sulfur considered for this assessment is 2,07 g/cm³. The Vapour Pressure considered for this assessment was 2.65E-20Pa@115.36°C (<http://environmentalchemistry.com/yogi/periodic/S.html>).

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](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.

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

Not applicable

7. Use of sulfur in Fireworks – Consumer

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.

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

Not applicable