SAFETY DATA SHEET

HSFO / residual fuel oil AR

Document: DE-SDS-HSFO-RESIDUAL-FUEL-OIL | Revision 1.2 | 20 March 2026 | English
Technical source: Burgas SDS 901071 v01 (5 January 2023).

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

1.1. Product identifier

Name of the substance	Fuel oil, residual
Identification number	649-024-00-9 (Index number)
Registration number	01-2119474894-22-0089
Synonyms	Fuel oil * Component of raw material for production of technical carbon and special products grade B

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

Identified uses	Use as a fuel. Use as an intermediate. A complete list of registered uses for this product can be found in the table of content of the exposure scenario for communication, available as an annex to the eSDS.
Uses advised against	Use in accordance with supplier's recommendations.

1.3. Details of the supplier of the safety data sheet

Supplier / distributor: Drakensberg Energy Europe EOOD | UIC 208760847
1st office, 5th floor, 9–11 Knyaginya Maria Luisa Blvd.
Vazrazhdane, 1000 Sofia, Bulgaria
Business telephone: +27 82 902 0083
SDS contact: gonnie@drakensbergenergy.com
Manufacturer: LUKOIL Neftohim Burgas AD, Burgas 8104, Bulgaria

1.4. Emergency telephone numbers
Bulgaria / EU emergency services: 112 (24 hours).
National Toxicology Centre, N. I. Pirogov, Sofia: +359 2 9154 233.
At destination, also contact the local emergency / poison service and activate the client site or vessel emergency response plan. Give this SDS to responders.
The business mobile above is not a medical emergency advisory service.

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 as amended

Health hazards		
Acute toxicity, inhalation	Category 4	H332 - Harmful if inhaled.
Carcinogenicity	Category 1B	H350 - May cause cancer.
Reproductive toxicity	Category 2	H361d - Suspected of damaging the unborn child.
Specific target organ toxicity - repeated exposure	Category 2 (blood, thymus, liver)	H373 - May cause damage to organs (blood, thymus, liver) through prolonged or repeated exposure.
Environmental hazards		
Hazardous to the aquatic environment, acute aquatic hazard	Category 1 M-Factor = 1.	H400 - Very toxic to aquatic life.
Hazardous to the aquatic environment, long-term aquatic hazard	Category 1 M-Factor = 1.	H410 - Very toxic to aquatic life with long lasting effects.

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2.2. Label elements

Label according to Regulation (EC) No. 1272/2008 as amended

Contains: Fuel oil, residual

Hazard pictograms

Signal word Danger

Hazard statements

H332	Harmful if inhaled.
H350	May cause cancer.
H361d	Suspected of damaging the unborn child.
H373	May cause damage to organs (blood, thymus, liver) through prolonged or repeated exposure.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary statements

Prevention

P201	Obtain special instructions before use.
P260	Do not breathe dust/fume/gas/mist/vapours/spray.
P273	Avoid release to the environment.
P280	Wear protective gloves/protective clothing/eye protection/face protection.

Response

P308 + P313	IF exposed or concerned: Get medical advice/attention.

Storage Not assigned.

Disposal

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

Supplemental information on the label EUH066 - Repeated exposure may cause skin dryness or cracking.

2.3. Other hazards Hydrogen sulphide (H2S) can accumulate in the headspace of storage tanks and reach potentially hazardous concentrations.
This substance does not meet vPvB / PBT criteria of Regulation (EC) No 1907/2006, Annex XIII.
The substance is not included in the list established in accordance with REACH Article 59(1) for having endocrine disrupting properties.
The substance is not considered to have endocrine disrupting properties in accordance with the criteria set out in Commission Delegated Regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605.

SECTION 3: Composition/information on ingredients

3.1. Substances

General information

Chemical name	%	CAS-No. / EC No.	REACH Registration No.	Index No.	Notes
Fuel oil, residual	100	68476-33-5 270-675-6	01-2119474894-22-0089	649-024-00-9	

Classification: Acute Tox. 4;H332;(ATE: 11 mg/l), Carc. 1B;H350, Repr. 2;H361d, STOT RE 2;H373, Aquatic Acute 1;H400(M=1), Aquatic Chronic 1;H410(M=1)

List of abbreviations and symbols that may be used above

ATE: Acute toxicity estimate.
M: M-factor

Composition comments All concentrations are in percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume. The full text for all H-statements is displayed in section 16.
This product is registered under the REACH Regulation 1907/2006 as a UVCB.
Hydrogen sulphide (H2S) can accumulate in the headspace of storage tanks and reach potentially hazardous concentrations.

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SECTION 4: First aid measures

General information Get medical attention if any discomfort develops.

4.1. Description of first aid measures

Inhalation Move to fresh air. If breathing is difficult, give oxygen. Get medical attention if discomfort develops or persists.

If there is any suspicion of inhalation of H2S:
Rescuers must wear breathing apparatus, belt and safety rope, and follow rescue procedures.
Remove casualty to fresh air as quickly as possible.
Immediately begin artificial respiration if breathing has ceased.
Provision of oxygen may help.
Obtain medical advice for further treatment.

Skin contact Remove contaminated clothing. Wash with soap and water. In case of rashes, wounds or other skin disorders: Seek medical attention and bring along these instructions.

Eye contact Immediately flush with plenty of water for up to 15 minutes. Remove any contact lenses and open eyelids wide apart. Get medical attention if irritation develops or persists.

Ingestion Rinse the mouth. Do not induce vomiting or give anything to drink. Obtain immediate medical or poison-centre advice and arrange urgent medical assessment. Keep the casualty under observation. If vomiting occurs, keep the head low to reduce aspiration risk. Never give anything by mouth to an unconscious person. Take this SDS to the medical team.

4.2. Most important symptoms and effects, both acute and delayed Irritation of eyes and mucous membranes. Skin irritation. May cause damage to organs through prolonged or repeated exposure. Defats the skin. Dermatitis. Ingestion may cause irritation and malaise.

4.3. Indication of any immediate medical attention and special treatment needed Treat symptomatically. The effects might be delayed.

SECTION 5: Firefighting measures

General fire hazards The product is combustible, and heating may generate vapours which may form explosive vapour/air mixtures. Material will float and can be re-ignited on surface of water.

5.1. Extinguishing media

Suitable extinguishing media Water spray, foam, dry powder or carbon dioxide.

Unsuitable extinguishing media Do not use water jet as an extinguisher, as this will spread the fire.

5.2. Special hazards arising from the substance or mixture Thermal decomposition may produce smoke, oxides of carbon and lower molecular weight organic compounds whose composition have not been characterised. Sulfur Oxides (SOx). Nitrogen Oxides (NOx).

5.3. Advice for firefighters

Special protective equipment for firefighters Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

Special fire fighting procedures Move containers from fire area if you can do it without risk. Use water spray to cool unopened containers. Cool containers with flooding quantities of water until well after fire is out.

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SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

For non-emergency personnel

Stay upwind. Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Avoid contact with skin. Wear suitable protective clothing, gloves and eye/face protection. In case of spills, beware of slippery floors and surfaces.

For emergency responders

Keep unnecessary personnel away. Use personal protection recommended in Section 8 of the SDS.

6.2. Environmental precautions

Prevent spreading over a wide area (e.g. by containment or oil barriers). Do not contaminate water. Contact local authorities in case of spillage to drain/aquatic environment.

6.3. Methods and material for containment and cleaning up

Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible.

Large Spills: Remove with vacuum trucks or pump to storage/salvage vessels. Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal. Wash area with soap and water. Ensure that waste and contaminated materials are collected and removed from the work area as soon as possible in a suitably labelled container.

Small Spills: Absorb spillage with non-combustible, absorbent material.

6.4. Reference to other sections

For personal protection, see section 8 of the SDS. For waste disposal, see section 13 of the SDS.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Before entering storage tanks and commencing any operation in a confined area check the atmosphere for oxygen content and flammability. (Subject to applicability) If sulphur compounds are suspected to be present in the product, check the atmosphere for H2S content. Access to work area should be restricted to people handling the product only. Should be handled in closed systems, if possible. Avoid inhalation of vapours. Avoid contact with eyes, skin, and clothing. Wear appropriate personal protective equipment. Immediately change contaminated clothes. Do not eat, drink or smoke when using the product. Be aware of potential for surfaces to become slippery. Observe good industrial hygiene practices.

7.2. Conditions for safe storage, including any incompatibilities

Store in a cool, dry place with adequate ventilation. Keep away from incompatible materials, open flames and high temperatures. Keep away from food, drink and animal feeding stuffs. Store away from incompatible materials.

Directive 2012/18/EU on major accident hazards involving dangerous substances, as amended

ANNEX 1, PART 2 Named dangerous substances
- 34. Petroleum products and alternative fuels (Lower-tier requirements = 2 500 tonnes; Upper-tier requirements = 25 000 tonnes)

7.3. Specific end use(s)

For detailed information, see section 1.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Agent / reference	8-hour TWA	15-minute STEL / note
Residual fuel oil (hydrocarbons)	5 mg/m³	—
Hydrogen sulphide, CAS 7783-06-4	7 mg/m³ / 5 ppm	14 mg/m³ / 10 ppm

Statutory chemical-agent entries: Bulgarian Ordinance No 13, consolidated 2026 edition. Benzene: Bulgarian Ordinance No 10 and Directive (EU) 2022/431. The refinery DNELs/PNECs and other protective measures remain in Section 8 and the exposure annexes. An exposure limit is not a boundary between safe and harmful exposure. Control inhalation and skin contact and use the lower applicable risk-management value.

Hydrogen sulphide may accumulate in tank headspaces. Monitor the atmosphere before entry or opening. Odour is not a reliable warning. Air-purifying filters are unsuitable for oxygen-deficient atmospheres or uncontrolled H_2S concentrations; trained responders require suitable supplied-air protection.

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Biological limit values No biological exposure limits noted for the ingredient(s).

Recommended monitoring procedures Follow standard monitoring procedures.

Derived no effect levels (DNELs)

General population

Product	Value	Assessment factor	Notes
Fuel oil, residual (CAS 68476-33-5)			
Long-term, Systemic, Oral	0,015 mg/kg bw/day	40	Repeated dose toxicity

Workers

Product	Value	Assessment factor	Notes
Fuel oil, residual (CAS 68476-33-5)			
Long-term, Systemic, Dermal	0,065 mg/kg bw/day	36	Developmental toxicity
Long-term, Systemic, Inhalation	0,18 mg/m3	22,5	Developmental toxicity
Short-term, Systemic, Inhalation	4716,8 mg/m3	7,5	Acute toxicity

Predicted no effect concentrations (PNECs)

Product	Value	Assessment factor	Notes
Fuel oil, residual (CAS 68476-33-5)			
Secondary poisoning	66,7 mg/kg		Oral

8.2. Exposure controls

Appropriate engineering controls Provide adequate ventilation and minimise the risk of inhalation of vapours and oil mist. Use explosion-proof equipment. Provide easy access to water supply and eye wash facilities.

Individual protection measures, such as personal protective equipment

General information Use personal protective equipment as required. Keep working clothes separately. Personal protective equipment should be chosen according to the CEN standards and in discussion with the supplier of the personal protective equipment.

Eye/face protection Wear goggles/face shield. Eye protection should meet standard EN 166.

Skin protection

- Hand protection Wear suitable gloves tested to EN374. Nitrile gloves are recommended, but be aware that the liquid may penetrate the gloves. Frequent change is advisable. Suitable gloves can be recommended by the glove supplier.

- Other Protection suit must be worn. Anti-static and flame-retardant protective clothing is recommended.

Respiratory protection In case of inadequate ventilation or risk of inhalation of oil mist, suitable respiratory equipment with combination filter (type A2/P2) can be used. Wear air-supplied mask in confined areas. Seek advice from local supervisor.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

Hygiene measures When using, do not eat, drink or smoke. Wash hands after handling. Launder contaminated clothing before reuse. Private clothes and working clothes should be kept separately. Handle in accordance with good industrial hygiene and safety practices. Follow up on any medical surveillance requirements.

Environmental exposure controls Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. Fume scrubbers, filters or engineering modifications to the process equipment may be necessary to reduce emissions to acceptable levels.

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SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	Liquid.
Form	Liquid.
Colour	Black.
Odour	Hydrocarbon-like.
Melting point/freezing point	< 30 °C (< 86 °F) (at 101,3 kPa)
Boiling point or initial boiling point and boiling range	150°C->750°C (302°F->1382°F)
Flammability	Will burn if involved in a fire.
Upper/lower flammability or explosive limits	
Explosive limit - lower (%)	Not determined.
Explosive limit – upper (%)	Not determined.
Flash point	> 60 °C (> 140 °F)
Auto-ignition temperature	> 220 - < 550 °C (> 428 - < 1022 °F) (at 101,3 kPa)
Decomposition temperature	Not determined.
pH	Not applicable.
Kinematic viscosity	>= 3 mm2/s (100 °C (212 °F))
Solubility	
Solubility (water)	Insoluble in water.
Partition coefficient (n-octanol/water) (log value)	Not applicable.
Vapour pressure	> 0,06 - < 0,86 kPa (at 150°C/302°F) > 0,02 - < 0,79 kPa (at 120°C/248°F)
Density and/or relative density	
Density	> 840 - < 1200 kg/m³ (at 15°C)
Vapour density	> 5 (Air = 1)
Particle characteristics	Not applicable, material is a liquid.

9.2. Other information

9.2.1. Information with regard to physical hazard classes	No relevant additional information available.
9.2.2. Other safety characteristics	
Pour point	> -2 - < 35 °C (> 28,4 - < 95 °F)
Surface tension	< 35 mN/m (25 °C (77 °F))

SECTION 10: Stability and reactivity

10.1. Reactivity	The product is non-reactive under normal conditions of use, storage and transport.
10.2. Chemical stability	Stable at normal conditions.
10.3. Possibility of hazardous reactions	Hazardous polymerisation does not occur.
10.4. Conditions to avoid	Heat, sparks, flames, elevated temperatures. Contact with incompatible materials.
10.5. Incompatible materials	Strong acids. Strong oxidising agents.
10.6. Hazardous decomposition products	Thermal decomposition or combustion may liberate carbon oxides and other toxic gases or vapours.

SECTION 11: Toxicological information

General information	Occupational exposure to the substance or mixture may cause adverse effects.

Information on likely routes of exposure

Inhalation	Harmful if inhaled. Breathing of high concentrations may cause dizziness, light-headedness, headache, nausea and loss of co-ordination. Continued inhalation may result in unconsciousness.

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Skin contact	Repeated exposure may cause skin dryness or cracking. May be absorbed through the skin.
Eye contact	May cause eye irritation on direct contact.
Ingestion	Ingestion may cause irritation and malaise.
Symptoms	Irritation of eyes and mucous membranes. Defatting of the skin. Skin irritation. May cause damage to organs through prolonged or repeated exposure. Dermatitis. Ingestion may cause irritation and malaise.

11.1. Information on hazard classes as defined in Regulation (EC) No 1272/2008

Acute toxicity	Harmful if inhaled. Breathing of high concentrations may cause dizziness, light-headedness, headache, nausea and loss of co-ordination. Continued inhalation may result in unconsciousness. May irritate and cause stomach pain, vomiting, diarrhoea and nausea. Hydrogen sulphide, a highly toxic gas, may be present. Signs and symptoms of overexposure to hydrogen sulphide include respiratory and eye irritation, dizziness, nausea, coughing, a sensation of dryness and pain in the nose, and loss of consciousness. Odour does not provide a reliable indicator of the presence of hazardous levels in the atmosphere.

Product	Species	Test Results
Fuel oil, residual (CAS 68476-33-5)		
Acute		
Dermal		
LD50	Rabbit	> 2000 mg/kg, 24 Hours
Inhalation		
Aerosol		
LC50	Rat	4100 mg/m3, 4 Hours
Oral		
LD50	Rat	4320 mg/kg

Skin corrosion/irritation	Causes mild skin irritation. Repeated exposure may cause skin dryness or cracking. Pre-existing skin conditions including dermatitis might be aggravated by exposure to this product.
Serious eye damage/eye irritation	May cause eye irritation on direct contact.
Respiratory sensitisation	Based on available data, the classification criteria are not met.
Skin sensitisation	Not a skin sensitiser.
Germ cell mutagenicity	Test data conclusive but not sufficient for classification.
Carcinogenicity	May cause cancer.
Reproductive toxicity	Suspected of damaging the unborn child.
Specific target organ toxicity - single exposure	Test data conclusive but not sufficient for classification.
Specific target organ toxicity - repeated exposure	May cause damage to the following organs through prolonged or repeated exposure: Liver.
Aspiration hazard	Based on available data, the classification criteria are not met.
Mixture versus substance information	Not available.

11.2. Information on other hazards

Endocrine disrupting properties	This substance does not have endocrine disrupting properties with respect to human health, as it does not meet the assessment criteria laid out in Regulations (EC) No 1907/2006, (EU) No 2017/2100 and (EU) 2018/605.
Other information	Components of the product may be absorbed into the body through the skin.

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SECTION 12: Ecological information

12.1. Toxicity Very toxic to aquatic life with long lasting effects.

Product		Species	Test Results
Fuel oil, residual (CAS 68476-33-5)			
Aquatic			
Algae	EL50	Pseudokirchneriella subcapitata	0,75 mg/l, 72 Hours
Crustacea	EL50	Daphnia magna	2 mg/l, 48 Hours
Fish	LL50	Oncorhynchus mykiss	79 mg/l, 96 Hours

12.2. Persistence and degradability The degradability of the product has not been stated.

12.3. Bioaccumulative potential No data available on bioaccumulation.

Partition coefficient n-octanol/water (log Kow) Not available.

Bioconcentration factor (BCF) Not available.

12.4. Mobility in soil No data available.

Mobility in general The product is insoluble in water. It will spread on the water surface while some of the components will eventually sediment in water systems. The volatile components of the product will spread in the atmosphere.

12.5. Results of PBT and vPvB assessment This substance does not meet vPvB / PBT criteria of Regulation (EC) No 1907/2006, Annex XIII.

12.6. Endocrine disrupting properties This substance does not have endocrine disrupting properties with respect to the environment, as it does not meet the assessment criteria laid out in Regulations (EC) No 1907/2006, (EU) No 2017/2100 and (EU) 2018/605.

12.7. Other adverse effects Oil spills are generally hazardous to the environment.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Residual waste Dispose in accordance with local regulations.

Contaminated packaging Since emptied containers may retain product residue, follow label warnings even after container is emptied.

EU waste code 05 01 06*
13 07 01*

Disposal methods/information Dispose in accordance with all applicable regulations. This material and/or its container must be disposed of as hazardous waste.

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SECTION 14: Transport information

ADR

14.1. UN number	UN3082
14.2. UN proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (Fuel oil, residual)
14.3. Transport hazard class(es)	
Class	9
Subsidiary risk	-
Label(s)	9
Hazard No. (ADR)	90
Tunnel restriction code	E
14.4. Packing group	III
14.5. Environmental hazards	Yes
14.6. Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

RID

14.1. UN number	UN3082
14.2. UN proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (Fuel oil, residual)
14.3. Transport hazard class(es)	
Class	9
Subsidiary risk	-
Label(s)	9
14.4. Packing group	III
14.5. Environmental hazards	Yes
14.6. Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

ADN

14.1. UN number	UN3082
14.2. UN proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (Fuel oil, residual)
14.3. Transport hazard class(es)	
Class	9
Subsidiary risk	-
Label(s)	9
14.4. Packing group	III
14.5. Environmental hazards	Yes

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14.6. Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

IATA

14.1. UN number	UN3082
14.2. UN proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (Fuel oil, residual)
14.3. Transport hazard class(es)	
Class	9
Subsidiary risk	-
14.4. Packing group	III
14.5. Environmental hazards	Yes
ERG Code	9L
14.6. Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

IMDG

14.1. UN number	UN3082
14.2. UN proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (Fuel oil, residual)
14.3. Transport hazard class(es)	
Class	9
Subsidiary risk	-
14.4. Packing group	III
14.5. Environmental hazards	
Marine pollutant	Yes
EmS	F-A, S-F
14.6. Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
14.7. Maritime transport in bulk according to IMO instruments	This product is considered to fall under the scope of Annex I to Marpol 73/78 and is subject to the requirements of that Annex if carried in bulk.

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations specific to the product
This supplier edition uses the REACH Regulation (EC) No 1907/2006, Annex II as amended by Regulation (EU) 2020/878, and the CLP Regulation (EC) No 1272/2008, as amended. Classification and composition are retained from the identified refinery SDS.

Bulgaria: apply Ordinance No 13 on protection against chemical agents at work, and Ordinance No 10 on carcinogens, mutagens and reprotoxic substances, as amended. The occupational limits and control references used in this edition appear in Section 8.1 and its continuation. Apply workplace risk assessment, exposure minimisation, appropriate medical surveillance and relevant national waste and environmental rules.

The source identifies carcinogenic and/or mutagenic substances. REACH Annex XVII restrictions and the applicable industrial/professional-use conditions must be observed. Worker protection under Directive 2004/37/EC, as amended, applies to relevant CMR exposure.

Observe national provisions implementing Directive 94/33/EC for young workers and Directive 92/85/EEC for pregnant, recently delivered or breastfeeding workers, including the required workplace risk assessment and restrictions.

Major-accident control: the petroleum-products provisions in Annex I, Part 2 of Directive 2012/18/EU (Seveso III) are relevant. Site obligations depend on the inventory and the applicable aggregation rules.

Transport instruments for road and sea carriage are identified in Section 14. This English edition accompanies international trade; a Bulgarian-language SDS is required for supply on the Bulgarian market.

15.2. Chemical safety assessment
The refinery source states that a chemical safety assessment has been carried out for the substance.

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SECTION 16: Other information

List of abbreviations

PBT: Persistent, bioaccumulative and toxic.
vPvB: Very Persistent and very Bioaccumulative.
LC50: Lethal Concentration, 50%.
LL50: Lethal level, 50%.
EL50: Effective level, 50%.

References

Chemical safety report.
IARC Monographs. Overall Evaluation of Carcinogenicity (Volumes 1-106)
CONCAWE compilation of selected physical-chemical properties of petroleum substances and sulfur, Brussels, November 2010
Rules for international transport of dangerous goods by railway (RID)
European Treaty for international road transport of dangerous goods (ADR)
International Maritime Code for the Transport of Dangerous Goods (IMDG)
European Treaty for international transport of dangerous goods by inland seas, rivers, streams (ADN)

Information on evaluation method leading to the classification of mixture

The classification for health and environmental hazards is derived by a combination of calculation methods and test data, if available.

Full text of any statements, which are not written out in full under sections 2 to 15

H332 Harmful if inhaled.
H350 May cause cancer.
H361d Suspected of damaging the unborn child.
H373 May cause damage to organs through prolonged or repeated exposure.
H410 Very toxic to aquatic life with long lasting effects.

This SDS contains revisions in the following section(s):

1, 2, 3, 8, 9, 11, 12, 14, 15, 16.

Training information

Follow training instructions when handling this material.

This information concerns the identified product and its safe handling. Product-source attribution and the supplier revision record appear in Section 16.

Document control

Supplier edition 1.2 | 20 March 2026 | English | Bulgaria

Product scope. Residual fuel oil AR, CAS 68476-33-5; refinery REACH registration 01-2119474894-22-0089. This document is not assigned to the separate 0.50% VLSFO grade.

Technical source. LUKOIL Neftohim Burgas AD, SDS 901071, version 01, 5 January 2023. Refinery source. The source technical data and exposure annexes, where provided, are retained.

Changes in this supplier edition. EU supplier and emergency contacts; English document control and product identification; Bulgarian exposure-limit references and national regulatory information; ingestion first-aid wording aligned with chemical-emergency guidance. Classification and composition are unchanged.

Emergency reference: Bulgarian Ministry of Environment and Water. Workplace limits: Ordinance No 13; Ordinance No 10. First aid: CDC chemical-emergency guidance.

The SDS describes health, safety and environmental precautions for the identified product. It is not a batch quality certificate. Read it together with the applicable cargo documents and exposure-scenario conditions.

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Annex to the extended Safety Data Sheet (eSDS)

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1 - Exposure Scenario Worker

1. Manufacture of substance

List of use descriptors

Sector(s) of Use	Manufacture of substance
Name of contributing environmental scenario and corresponding ERC	ERC1: Manufacture of the substance
List of names of contributing worker scenarios and corresponding PROCs	PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions PROC2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions PROC3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition PROC8a: Transfer of substance or mixture (charging/discharging) at non dedicated-facilities PROC8b: Transfer of substance or mixture (charging/discharging) at dedicated facilities PROC15: Use as laboratory reagent

2.1.1. Contributing scenario controlling environmental exposure for Manufacture of the substance

Product characteristics

Physical state	Liquid. Substance is complex UVCB. Predominantly hydrophobic

Amounts used

Regional use tonnage	0,1
Fraction of regional tonnage used locally	6700000 tonnes/year
Fraction of EU tonnage used in region	0,09
Annual site tonnage	600000 tonnes/year
Maximum daily site tonnage	2000000 kg/day

Frequency and duration of use

Batch process	Not applicable.
Continuous process	300 days/year

Environment factors not influenced by risk management

Local freshwater dilution factor:	10
Local marine water dilution factor:	100

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Other given operational conditions affecting environmental exposure

	Emission days	Emission factors			
Type	**(days/year)**	**Air**	**Soil**	**Water**	**Remarks**
initial release prior to RMM	300	0,0001	0,001	0,00001	

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release	Common practices vary across sites thus conservative process release estimates used.

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Air	Treat air emission to provide a typical removal efficiency of (%): 90
Soil	Not applicable.
Water	Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency of ≥ (%): 93.2. If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of ≥ (%): 0
Sediment	Not applicable.
Remarks	Not applicable.
Organisational measures to prevent/limit release from site	Risk from environmental exposure is driven by humans via indirect exposure (primarily ingestion). Prevent discharge of undissolved substance to or recover from onsite wastewater. If discharging to municipal sewage treatment plant, no onsite wastewater treatment required.

Conditions and measures related to municipal sewage treatment plant

Size of municipal sewage system/treatment plant (m3/d)

Type	Municipal Sewage Treatment Plant
Discharge rate	10000 m3/day
Treatment effectiveness	94,2 %
Sludge treatment technique	Do not apply industrial sludge to natural soils. Sludge should be incinerated, contained or reclaimed.
Remarks	Maximum allowable site tonnage (MSafe) based on release following total wastewater treatment removal 2,3e6 kg/d
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs (%)	94,2 %

Conditions and measures related to external treatment of waste for disposal

Fraction of used amount transferred to external waste treatment

Suitable waste treatment	During manufacturing no waste of the substance is generated.
Disposal methods	Not applicable.
Treatment effectiveness	Not available.
Remarks	Not applicable.

Conditions and measures related to external recovery of waste

Fraction of used amount transferred to external waste treatment

Suitable recover operations	During manufacturing no waste of the substance is generated.
Remarks	Not applicable.

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2.2.1. Contributing scenario controlling worker exposure for Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Product characteristics

Physical form of the product	Liquid.
vapour pressure	Liquid, vapour pressure < 0,5 kPa at Standard Temperature and Pressure

Amounts used

Covers percentage substance in the product up to 100 %.

Frequency and duration of use

Covers daily exposures up to 8 hours

Human factors not influenced by risk management

Other given operational conditions affecting workers exposure

Operation is carried out at elevated temperature (> 20°C above ambient temperature)

Other relevant operational conditions

Assumes a good basic standard of occupational hygiene is implemented

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release	General exposures (closed systems): Handle substance within a closed system.
Technical conditions and measures to control dispersion from source towards the worker	Process sampling Outdoor.: Sample via a closed loop or other system to avoid exposure. Avoid carrying out activities involving exposure for more than 15 minutes per day. Bulk product storage: Store substance within a closed system. Avoid carrying out activities involving exposure for more than 4 hours per day. Laboratory activities Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure. Marine vessel/barge Loading and unloading: Avoid carrying out activities involving exposure for more than 4 hours per day. Transfer via enclosed lines. Clear transfer lines prior to de-coupling. Retain drain downs in sealed storage pending disposal or for subsequent recycle. Road tanker/rail car loading: Ensure material transfers are under containment or extract ventilation.
Organizational measures to prevent/limit releases, dispersion and exposure	General measures (carcinogens): Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general/local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean/flush equipment, where possible, prior to maintenance. Where there is potential for exposure: restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. Equipment cleaning and maintenance: Drain down and flush system prior to equipment break-in or maintenance. Retain drain downs in sealed storage pending disposal or for subsequent recycle.
Conditions and measures related to personal protection, hygiene and health evaluations	General exposures (closed systems): Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training. Process sampling Outdoor.: Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training. Bulk product storage: Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training. marine vessel/barge (un)loading: Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.

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Laboratory activities: Wear suitable gloves tested to EN374.

Road tanker/rail car loading: Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.

Equipment cleaning and maintenance: Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.

3. Exposure Estimation

Environment

The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model.

Health

The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Environment

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. Required removal efficiency for wastewater can be achieved using onsite/offsite technologies, either alone or in combination. Required removal efficiency for air can be achieved using on-site technologies, either alone or in combination. Further details on scaling and control technologies are provided in SpERC factsheet (http://cefic.org/en/reach-for-industries-libraries.html).

Health

Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. Available hazard data do not enable the derivation of a DNEL for carcinogenic effects. Available hazard data do not support the need for a DNEL to be established for other health effects. Risk Management Measures are based on qualitative risk characterisation.

2 - Exposure Scenario Worker

1. Formulation & (re)packing of substances and mixtures

List of use descriptors	
Sector(s) of Use	SU10: Formulation [mixing] of preparations and/or re-packaging
Name of contributing environmental scenario and corresponding ERC	ERC2: Formulation into mixture
List of names of contributing worker scenarios and corresponding PROCs	PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions PROC2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions PROC3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition PROC8a: Transfer of substance or mixture (charging/discharging) at non dedicated-facilities PROC8b: Transfer of substance or mixture (charging/discharging) at dedicated facilities PROC15: Use as laboratory reagent

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2.1.1. Contributing scenario controlling environmental exposure for Formulation into mixture

Product characteristics

Physical state	Liquid. Substance is complex UVCB. Predominantly hydrophobic
Amounts used	
Regional use tonnage	0,1
Fraction of regional tonnage used locally	7500000 tonnes/year
Fraction of EU tonnage used in region	0,004
Annual site tonnage	30000 tonnes/year
Maximum daily site tonnage	100000 kg/day
Frequency and duration of use	
Batch process	Not applicable.
Continuous process	300 days/year
Environment factors not influenced by risk management	
Local freshwater dilution factor:	10
Local marine water dilution factor:	100

Other given operational conditions affecting environmental exposure

	Emission days	Emission factors			
Type	**(days/year)**	**Air**	**Soil**	**Water**	**Remarks**
initial release prior to RMM	300	0,001	0,0001	0,00002	

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release	Common practices vary across sites thus conservative process release estimates used.
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Air	Treat air emission to provide a typical removal efficiency of (%): 0
Soil	Not applicable.
Water	Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency of ≥ (%): 81.3. If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of ≥ (%): 0
Sediment	Not applicable.
Remarks	Not applicable.
Organisational measures to prevent/limit release from site	Risk from environmental exposure is driven by humans via indirect exposure (primarily ingestion). Prevent discharge of undissolved substance to or recover from onsite wastewater. If discharging to municipal sewage treatment plant, no onsite wastewater treatment required.

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Conditions and measures related to municipal sewage treatment plant

Size of municipal sewage system/treatment plant (m3/d)

Type	Municipal Sewage Treatment Plant
Discharge rate	2000 m3/day
Treatment effectiveness	94,2 %
Sludge treatment technique	Do not apply industrial sludge to natural soils. Sludge should be incinerated, contained or reclaimed.
Remarks	Maximum allowable site tonnage (MSafe) based on release following total wastewater treatment removal 1,1e5 kg/d
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs (%)	94,2 %

Conditions and measures related to external treatment of waste for disposal

Fraction of used amount transferred to external waste treatment

Suitable waste treatment	External treatment and disposal of waste should comply with applicable local and/or national regulations.
Disposal methods	Not applicable.
Treatment effectiveness	Not available.
Remarks	Not applicable.

Conditions and measures related to external recovery of waste

Fraction of used amount transferred to external waste treatment

Suitable recover operations	External recovery and recycling of waste should comply with applicable local and/or national regulations.
Remarks	Not applicable.

2.2.1. Contributing scenario controlling worker exposure for Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Product characteristics

Physical form of the product	Liquid.
vapour pressure	Liquid, vapour pressure < 0,5 kPa at Standard Temperature and Pressure

Amounts used

Covers percentage substance in the product up to 100 %.

Frequency and duration of use

Covers daily exposures up to 8 hours

Human factors not influenced by risk management

Other given operational conditions affecting workers exposure

Assumes use at not more than 20°C above ambient temperature.

Other relevant operational conditions

Assumes a good basic standard of occupational hygiene is implemented

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release	General exposures (closed systems): Handle substance within a closed system. Sample via a closed loop or other system to avoid exposure. Avoid carrying out activities involving exposure for more than 4 hours per day. General exposures (closed systems) Process sampling: Handle substance within a closed system. Sample via a closed loop or other system to avoid exposure. Avoid carrying out activities involving exposure for more than 15 minutes per day.

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Technical conditions and measures to control dispersion from source towards the worker	Bulk product storage: Store substance within a closed system. Avoid carrying out activities involving exposure for more than 4 hours per day. Product sampling: Sample via a closed loop or other system to avoid exposure. Avoid carrying out activities involving exposure for more than 15 minutes per day. Laboratory activities: Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure. Marine vessel/barge Loading and unloading: Transfer via enclosed lines. Avoid carrying out activities involving exposure for more than 4 hours per day. Clear transfer lines prior to de-coupling. Retain drain downs in sealed storage pending disposal or for subsequent recycle. Road tanker/rail car loading: Ensure material transfers are under containment or extract ventilation. Drum/batch transfers: Ensure material transfers are under containment or extract ventilation. Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). or Ensure operation is undertaken outdoors. Avoid carrying out activities involving exposure for more than 1 hour per day.
Organizational measures to prevent/limit releases, dispersion and exposure	General measures (carcinogens): Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general/local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean/flush equipment, where possible, prior to maintenance. Where there is potential for exposure: restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. Equipment cleaning and maintenance: Drain down and flush system prior to equipment break-in or maintenance. Retain drain downs in sealed storage pending disposal or for subsequent recycle.
Conditions and measures related to personal protection, hygiene and health evaluations	General exposures (closed systems): Wear chemically resistant gloves (tested to EN374) in combination with ‘basic’ employee training. General exposures (closed systems) Process sampling: Wear chemically resistant gloves (tested to EN374) in combination with ‘basic’ employee training. Bulk product storage: Wear chemically resistant gloves (tested to EN374) in combination with ‘basic’ employee training. Product sampling: Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training. marine vessel/barge (un)loading: Wear chemically resistant gloves (tested to EN374) in combination with ‘basic’ employee training. Laboratory activities: Wear suitable gloves tested to EN374. Road tanker/rail car loading: Wear chemically resistant gloves (tested to EN374) in combination with ‘basic’ employee training. Drum/batch transfers: Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training. Equipment cleaning and maintenance: Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.

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3. Exposure Estimation

Environment

The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model.

Health

The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Environment

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. Required removal efficiency for wastewater can be achieved using onsite/offsite technologies, either alone or in combination. Required removal efficiency for air can be achieved using on-site technologies, either alone or in combination. Further details on scaling and control technologies are provided in SpERC factsheet (http://cefic.org/en/reach-for-industries-libraries.html).

Health

Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. Available hazard data do not enable the derivation of a DNEL for carcinogenic effects. Available hazard data do not support the need for a DNEL to be established for other health effects. Risk Management Measures are based on qualitative risk characterisation.

3 - Exposure Scenario Worker

1. Use as an intermediate

List of use descriptors

Sector(s) of Use	SU8: Manufacture of bulk, large scale chemicals (including petroleum products) SU9: Manufacture of fine chemicals
Name of contributing environmental scenario and corresponding ERC	ERC6a: Use of intermediate
List of names of contributing worker scenarios and corresponding PROCs	PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions PROC2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions PROC3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition PROC8a: Transfer of substance or mixture (charging/discharging) at non dedicated-facilities PROC8b: Transfer of substance or mixture (charging/discharging) at dedicated facilities PROC15: Use as laboratory reagent

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2.1.1. Contributing scenario controlling environmental exposure for Use of intermediate

Product characteristics

Physical state	Liquid. Substance is complex UVCB. Predominantly hydrophobic
Amounts used	
Regional use tonnage	0,1
Fraction of regional tonnage used locally	1800000 tonnes/year
Fraction of EU tonnage used in region	0,0083
Annual site tonnage	15000 tonnes/year
Maximum daily site tonnage	50000 kg/day
Frequency and duration of use	
Batch process	Not applicable.
Continuous process	300 days/year
Environment factors not influenced by risk management	
Local freshwater dilution factor:	10
Local marine water dilution factor:	100

Other given operational conditions affecting environmental exposure

	Emission days	Emission factors			
Type	**(days/year)**	**Air**	**Soil**	**Water**	**Remarks**
initial release prior to RMM	300	0,0001	0,001	0,000003	

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release	Common practices vary across sites thus conservative process release estimates used.
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Air	Treat air emission to provide a typical removal efficiency of (%): 80
Soil	Not applicable.
Water	Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency of ≥ (%): 92.5. If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of ≥ (%): 0
Sediment	Not applicable.
Remarks	Not applicable.
Organisational measures to prevent/limit release from site	Risk from environmental exposure is driven by humans via indirect exposure (primarily ingestion). Prevent discharge of undissolved substance to or recover from onsite wastewater. If discharging to municipal sewage treatment plant, no onsite wastewater treatment required.

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Conditions and measures related to municipal sewage treatment plant

Size of municipal sewage system/treatment plant (m3/d)

Type	Municipal Sewage Treatment Plant
Discharge rate	2000 m3/day
Treatment effectiveness	94,2 %
Sludge treatment technique	Do not apply industrial sludge to natural soils. Sludge should be incinerated, contained or reclaimed.
Remarks	Maximum allowable site tonnage (MSafe) based on release following total wastewater treatment removal 6,4e4 kg/d
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs (%)	94,2 %

Conditions and measures related to external treatment of waste for disposal

Fraction of used amount transferred to external waste treatment

Suitable waste treatment	This substance is consumed during use and no waste of the substance is generated.
Disposal methods	Not applicable.
Treatment effectiveness	Not available.
Remarks	Not applicable.

Conditions and measures related to external recovery of waste

Fraction of used amount transferred to external waste treatment

Suitable recover operations	This substance is consumed during use and no waste of the substance is generated.
Remarks	Not applicable.

2.2.1. Contributing scenario controlling worker exposure for Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Product characteristics

Physical form of the product	Liquid.
vapour pressure	Liquid, vapour pressure < 0,5 kPa at Standard Temperature and Pressure

Amounts used

Covers percentage substance in the product up to 100 %.

Frequency and duration of use

Covers daily exposures up to 8 hours

Human factors not influenced by risk management

Other given operational conditions affecting workers exposure

Operation is carried out at elevated temperature (> 20°C above ambient temperature)

Other relevant operational conditions

Assumes a good basic standard of occupational hygiene is implemented

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release	General exposures (closed systems): Handle substance within a closed system. Sample via a closed loop or other system to avoid exposure. Avoid carrying out activities involving exposure for more than 4 hours per day. General exposures (closed systems) Process sampling: Handle substance within a closed system. Sample via a closed loop or other system to avoid exposure. Avoid carrying out activities involving exposure for more than 15 minutes per day.
Technical conditions and measures to control dispersion from source towards the worker	Bulk product storage: Store substance within a closed system. Avoid carrying out activities involving exposure for more than 4 hours per day. Laboratory activities: Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure.

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	Marine vessel/barge Loading and unloading: Transfer via enclosed lines. Avoid carrying out activities involving exposure for more than 4 hours per day. Clear transfer lines prior to de-coupling. Retain drain downs in sealed storage pending disposal or for subsequent recycle. Road tanker/rail car loading: Ensure material transfers are under containment or extract ventilation.
Organizational measures to prevent/limit releases, dispersion and exposure	General measures (carcinogens): Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general/local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean/flush equipment, where possible, prior to maintenance. Where there is potential for exposure: restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. Equipment cleaning and maintenance: Drain down and flush system prior to equipment break-in or maintenance. Retain drain downs in sealed storage pending disposal or for subsequent recycle.
Conditions and measures related to personal protection, hygiene and health evaluations	General exposures (closed systems): Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training. General exposures (closed systems) Process sampling: Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training. Bulk product storage: Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training. marine vessel/barge (un)loading: Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training. Laboratory activities: Wear suitable gloves tested to EN374. Road tanker/rail car loading: Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training. Equipment cleaning and maintenance: Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.

3. Exposure Estimation

Environment

The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model.

Health

The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Environment

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. Required removal efficiency for wastewater can be achieved using onsite/offsite technologies, either alone or in combination. Required removal efficiency for air can be achieved using on-site technologies, either alone or in combination. Further details on scaling and control technologies are provided in SpERC factsheet (http://cefic.org/en/reach-for-industries-libraries.html).

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Health

Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. Available hazard data do not enable the derivation of a DNEL for carcinogenic effects. Available hazard data do not support the need for a DNEL to be established for other health effects. Risk Management Measures are based on qualitative risk characterisation.

4 - Exposure Scenario Worker

1. Distribution of substance

List of use descriptors

Sector(s) of Use	Distribution of substance
Name of contributing environmental scenario and corresponding ERC	ERC4: Use of non-reactive processing aid at industrial site (no inclusion into or onto article) ERC5: Use at industrial site leading to inclusion into/onto article ERC6a: Use of intermediate ERC6b: Use of reactive processing aid at industrial site (no inclusion into or onto article) ERC6c: Use of monomer in polymerisation processes at industrial site (inclusion or not into/onto article) ERC6d: Use of reactive process regulators in polymerisation processes at industrial site (inclusion or not into/onto article) ERC7: Use of functional fluid at industrial site
List of names of contributing worker scenarios and corresponding PROCs	PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions PROC2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions PROC3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition PROC8a: Transfer of substance or mixture (charging/discharging) at non dedicated-facilities PROC8b: Transfer of substance or mixture (charging/discharging) at dedicated facilities PROC15: Use as laboratory reagent

2.1.1. Contributing scenario controlling environmental exposure for Use of non-reactive processing aid at industrial site (no inclusion into or onto article)

Product characteristics

Physical state	Liquid. Substance is complex UVCB. Predominantly hydrophobic

Amounts used

Regional use tonnage	0,1
Fraction of regional tonnage used locally	9300000 tonnes/year
Fraction of EU tonnage used in region	0,002
Annual site tonnage	19000 tonnes/year
Maximum daily site tonnage	62000 kg/day

Frequency and duration of use

Batch process	Not applicable.
Continuous process	300 days/year

Environment factors not influenced by risk management

Local freshwater dilution factor:	10
Local marine water dilution factor:	100

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Other given operational conditions affecting environmental exposure

	Emission days	Emission factors			
Type	**(days/year)**	**Air**	**Soil**	**Water**	**Remarks**
initial release prior to RMM	300	0,00014	0,00001	0,000001	

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release	Common practices vary across sites thus conservative process release estimates used.

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Air	Treat air emission to provide a typical removal efficiency of (%): 90
Soil	Not applicable.
Water	Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency of ≥ (%): 0. If discharging to municipal sewage treatment plant, provide the required onsite wastewater removal efficiency of ≥ (%): 0
Sediment	Not applicable.
Remarks	Not applicable.
Organisational measures to prevent/limit release from site	Risk from environmental exposure is driven by humans via indirect exposure (primarily ingestion). No wastewater treatment required.

Conditions and measures related to municipal sewage treatment plant

Size of municipal sewage system/treatment plant (m3/d)

Type	Municipal Sewage Treatment Plant
Discharge rate	2000 m3/day
Treatment effectiveness	94,2 %
Sludge treatment technique	Do not apply industrial sludge to natural soils. Sludge should be incinerated, contained or reclaimed.
Remarks	Maximum allowable site tonnage (MSafe) based on release following total wastewater treatment removal 8,0e4 kg/d
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs (%)	94,2 %

Conditions and measures related to external treatment of waste for disposal

Fraction of used amount transferred to external waste treatment

Suitable waste treatment	External treatment and disposal of waste should comply with applicable local and/or national regulations.
Disposal methods	Not applicable.
Treatment effectiveness	Not available.
Remarks	Not applicable.

Conditions and measures related to external recovery of waste

Fraction of used amount transferred to external waste treatment

Suitable recover operations	External recovery and recycling of waste should comply with applicable local and/or national regulations.
Remarks	Not applicable.

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2.2.1. Contributing scenario controlling worker exposure for Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Product characteristics

Physical form of the product	Liquid.
vapour pressure	Liquid, vapour pressure < 0,5 kPa at Standard Temperature and Pressure

Amounts used

Covers percentage substance in the product up to 100 %.

Frequency and duration of use

Covers daily exposures up to 8 hours

Human factors not influenced by risk management

Other given operational conditions affecting workers exposure

Assumes use at not more than 20°C above ambient temperature.

Other relevant operational conditions

Assumes a good basic standard of occupational hygiene is implemented

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release	General exposures (closed systems): Handle substance within a closed system. Sample via a closed loop or other system to avoid exposure. Avoid carrying out activities involving exposure for more than 4 hours per day.
Technical conditions and measures to control dispersion from source towards the worker	Process sampling Outdoor.: Sample via a closed loop or other system to avoid exposure. Avoid carrying out activities involving exposure for more than 15 minutes per day. Bulk product storage: Store substance within a closed system. Avoid carrying out activities involving exposure for more than 4 hours per day. Product sampling: Sample via a closed loop or other system to avoid exposure. Avoid carrying out activities involving exposure for more than 15 minutes per day. Laboratory activities: Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure. Marine vessel/barge Loading and unloading: Transfer via enclosed lines. Avoid carrying out activities involving exposure for more than 4 hours per day. Clear transfer lines prior to de-coupling. Retain drain downs in sealed storage pending disposal or for subsequent recycle. Road tanker/rail car loading: Ensure material transfers are under containment or extract ventilation.
Organizational measures to prevent/limit releases, dispersion and exposure	General measures (carcinogens): Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general/local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean/flush equipment, where possible, prior to maintenance. Where there is potential for exposure: restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. Equipment cleaning and maintenance: Drain down and flush system prior to equipment break-in or maintenance. Retain drain downs in sealed storage pending disposal or for subsequent recycle.
Conditions and measures related to personal protection, hygiene and health evaluations	General exposures (closed systems): Wear chemically resistant gloves (tested to EN374) in combination with ‘basic’ employee training. Process sampling Outdoor.: Wear chemically resistant gloves (tested to EN374) in combination with ‘basic’ employee training.

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Bulk product storage: Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.

Product sampling: Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.

marine vessel/barge (un)loading: Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.

Laboratory activities: Wear suitable gloves tested to EN374.

Road tanker/rail car loading: Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.

Equipment cleaning and maintenance: Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.

3. Exposure Estimation

Environment

The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model.

Health

The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Environment

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. Required removal efficiency for wastewater can be achieved using onsite/offsite technologies, either alone or in combination. Required removal efficiency for air can be achieved using on-site technologies, either alone or in combination. Further details on scaling and control technologies are provided in SpERC factsheet (http://cefic.org/en/reach-for-industries-libraries.html).

Health

Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. Available hazard data do not enable the derivation of a DNEL for carcinogenic effects. Available hazard data do not support the need for a DNEL to be established for other health effects. Risk Management Measures are based on qualitative risk characterisation.

5 - Exposure Scenario Worker

1. Use as a fuel, Industrial

List of use descriptors

Sector(s) of Use	Industrial uses
Name of contributing environmental scenario and corresponding ERC	ERC4: Use of non-reactive processing aid at industrial site (no inclusion into or onto article) ERC5: Use at industrial site leading to inclusion into/onto article ERC6a: Use of intermediate ERC6b: Use of reactive processing aid at industrial site (no inclusion into or onto article) ERC6c: Use of monomer in polymerisation processes at industrial site (inclusion or not into/onto article) ERC6d: Use of reactive process regulators in polymerisation processes at industrial site (inclusion or not into/onto article) ERC7: Use of functional fluid at industrial site

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List of names of contributing worker scenarios and corresponding PROCs	PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions PROC2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions PROC3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition PROC8a: Transfer of substance or mixture (charging/discharging) at non dedicated-facilities PROC8b: Transfer of substance or mixture (charging/discharging) at dedicated facilities PROC16: Use of fuels

2.1.1. Contributing scenario controlling environmental exposure for Use of non-reactive processing aid at industrial site (no inclusion into or onto article)

Product characteristics

Physical state	Liquid. Substance is complex UVCB. Predominantly hydrophobic
Amounts used	
Regional use tonnage	0,1
Fraction of regional tonnage used locally	5900000 tonnes/year
Fraction of EU tonnage used in region	0,29
Annual site tonnage	1500000 tonnes/year
Maximum daily site tonnage	5000000 kg/day
Frequency and duration of use	
Batch process	Not applicable.
Continuous process	300 days/year
Environment factors not influenced by risk management	
Local freshwater dilution factor:	10
Local marine water dilution factor:	100

Other given operational conditions affecting environmental exposure

	Emission days	Emission factors			
Type	**(days/year)**	**Air**	**Soil**	**Water**	**Remarks**
initial release prior to RMM	300	0,0002	0	0,000001	

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release	Common practices vary across sites thus conservative process release estimates used.

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Air	Treat air emission to provide a typical removal efficiency of (%): 95
Soil	Not applicable.
Water	Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency of ≥ (%): 92.5. If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of ≥ (%): 0
Sediment	Not applicable.
Remarks	Not applicable.
Organisational measures to prevent/limit release from site	Risk from environmental exposure is driven by humans via indirect exposure (primarily ingestion). No wastewater treatment required.

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Conditions and measures related to municipal sewage treatment plant

Size of municipal sewage system/treatment plant (m3/d)

Type	Municipal Sewage Treatment Plant
Discharge rate	2000 m3/day
Treatment effectiveness	94,2 %
Sludge treatment technique	Do not apply industrial sludge to natural soils. Sludge should be incinerated, contained or reclaimed.
Remarks	Maximum allowable site tonnage (MSafe) based on release following total wastewater treatment removal 5,4e6 kg/d
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs (%)	94,2 %

Conditions and measures related to external treatment of waste for disposal

Fraction of used amount transferred to external waste treatment

Suitable waste treatment	Combustion emissions limited by required exhaust emission controls. Combustion emissions considered in regional exposure assessment. External treatment and disposal of waste should comply with applicable local and/or national regulations.
Disposal methods	Not applicable.
Treatment effectiveness	Not available.
Remarks	Not applicable.

Conditions and measures related to external recovery of waste

Fraction of used amount transferred to external waste treatment

Suitable recover operations	This substance is consumed during use and no waste of the substance is generated.
Remarks	Not applicable.

2.2.1. Contributing scenario controlling worker exposure for Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Product characteristics

Physical form of the product	Liquid.
vapour pressure	Liquid, vapour pressure < 0,5 kPa at Standard Temperature and Pressure

Amounts used

Covers percentage substance in the product up to 100 %.

Frequency and duration of use

Covers daily exposures up to 8 hours

Human factors not influenced by risk management

Other given operational conditions affecting workers exposure

Assumes use at not more than 20°C above ambient temperature.

Other relevant operational conditions

Assumes a good basic standard of occupational hygiene is implemented

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release	General exposures (closed systems): Handle substance within a closed system. Sample via a closed loop or other system to avoid exposure. Avoid carrying out activities involving exposure for more than 4 hours per day. General exposures (closed systems) Product sampling: Handle substance within a closed system. Sample via a closed loop or other system to avoid exposure. Avoid carrying out activities involving exposure for more than 1 hour per day. Bulk closed unloading Outdoor.: Transfer via enclosed lines. Avoid carrying out activities involving exposure for more than 4 hours per day.

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Technical conditions and measures to control dispersion from source towards the worker	Drum/batch transfers: Ensure material transfers are under containment or extract ventilation. or Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Avoid carrying out activities involving exposure for more than 1 hour per day. Operation of solids filtering equipment: Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Avoid carrying out activities involving exposure for more than 4 hours per day. Bulk product storage: Store substance within a closed system. Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Avoid carrying out activities involving exposure for more than 4 hours per day.
Organizational measures to prevent/limit releases, dispersion and exposure	General measures (carcinogens): Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general/local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean/flush equipment, where possible, prior to maintenance. Where there is potential for exposure: restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. Equipment cleaning and maintenance: Drain down and flush system prior to equipment break-in or maintenance. Retain drain downs in sealed storage pending disposal or for subsequent recycle.
Conditions and measures related to personal protection, hygiene and health evaluations	General exposures (closed systems): Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training. General exposures (closed systems) Product sampling: Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training. Bulk closed unloading: Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training. Drum/batch transfers: Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training. Operation of solids filtering equipment: Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training. Bulk product storage: Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training. Use as a fuel (closed systems): Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training. Equipment cleaning and maintenance: Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.

3. Exposure Estimation

Environment

The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model.

Health

The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.

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4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Environment

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. Required removal efficiency for wastewater can be achieved using onsite/offsite technologies, either alone or in combination. Required removal efficiency for air can be achieved using on-site technologies, either alone or in combination. Further details on scaling and control technologies are provided in SpERC factsheet (http://cefic.org/en/reach-for-industries-libraries.html).

Health

Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. Available hazard data do not enable the derivation of a DNEL for carcinogenic effects. Available hazard data do not support the need for a DNEL to be established for other health effects. Risk Management Measures are based on qualitative risk characterisation.

6 - Exposure Scenario Worker

1. Use as a fuel, Professional

List of use descriptors	
Sector(s) of Use	SU22: Professional uses
Name of contributing environmental scenario and corresponding ERC	ERC9a: Widespread use of functional fluid (indoor) ERC9b: Widespread use of functional fluid (outdoor)
List of names of contributing worker scenarios and corresponding PROCs	PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions PROC2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions PROC3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition PROC8a: Transfer of substance or mixture (charging/discharging) at non dedicated-facilities PROC8b: Transfer of substance or mixture (charging/discharging) at dedicated facilities PROC16: Use of fuels

2.1.1. Contributing scenario controlling environmental exposure for Widespread use of functional fluid (indoor)

Product characteristics

Physical state	Liquid. Substance is complex UVCB. Predominantly hydrophobic
Amounts used	
Regional use tonnage	0,1
Fraction of regional tonnage used locally	1700000 tonnes/year
Fraction of EU tonnage used in region	0,0005
Annual site tonnage	850 tonnes/year
Maximum daily site tonnage	2300 kg/day
Frequency and duration of use	
Batch process	Not applicable.
Continuous process	Emission days (days/year): 365
Environment factors not influenced by risk management	
Local freshwater dilution factor:	10
Local marine water dilution factor:	100

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Other given operational conditions affecting environmental exposure

	Emission days	Emission factors			
Type	**(days/year)**	**Air**	**Soil**	**Water**	**Remarks**
initial release prior to RMM	365	0,00001	0,00001	0,0000001	

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release	Common practices vary across sites thus conservative process release estimates used.

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Air	Not applicable.
Soil	Not applicable.
Water	Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency of ≥ (%): 0. If discharging to municipal sewage treatment plant, provide the required onsite wastewater removal efficiency of ≥ (%): 0
Sediment	Not applicable.
Remarks	Not applicable.
Organisational measures to prevent/limit release from site	Risk from environmental exposure is driven by humans via indirect exposure (primarily ingestion). No wastewater treatment required.

Conditions and measures related to municipal sewage treatment plant

Size of municipal sewage system/treatment plant (m3/d)

Type	Municipal Sewage Treatment Plant
Discharge rate	2000 m3/day
Treatment effectiveness	94,2 %
Sludge treatment technique	Do not apply industrial sludge to natural soils. Sludge should be incinerated, contained or reclaimed.
Remarks	Maximum allowable site tonnage (MSafe) based on release following total wastewater treatment removal 3,0e3 kg/d
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs (%)	94,2 %

Conditions and measures related to external treatment of waste for disposal

Fraction of used amount transferred to external waste treatment

Suitable waste treatment	Combustion emissions limited by required exhaust emission controls. Combustion emissions considered in regional exposure assessment. External treatment and disposal of waste should comply with applicable local and/or national regulations.
Disposal methods	Not applicable.
Treatment effectiveness	Not available.
Remarks	Not applicable.

Conditions and measures related to external recovery of waste

Fraction of used amount transferred to external waste treatment

Suitable recover operations	This substance is consumed during use and no waste of the substance is generated.
Remarks	Not applicable.

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2.2.1. Contributing scenario controlling worker exposure for Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions

Product characteristics

Physical form of the product	Liquid.
vapour pressure	Liquid, vapour pressure < 0,5 kPa at Standard Temperature and Pressure

Amounts used

Covers percentage substance in the product up to 100 %.

Frequency and duration of use

Covers daily exposures up to 8 hours

Human factors not influenced by risk management

Other given operational conditions affecting workers exposure

Assumes use at not more than 20°C above ambient temperature.

Other relevant operational conditions

Assumes a good basic standard of occupational hygiene is implemented

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release	General exposures (closed systems): Handle substance within a closed system. Sample via a closed loop or other system to avoid exposure. Avoid carrying out activities involving exposure for more than 4 hours per day. Provide a good standard of controlled ventilation (10 to 15 air changes per hour). General exposures (closed systems) Product sampling: Handle substance within a closed system. Sample via a closed loop or other system to avoid exposure. Avoid carrying out activities involving exposure for more than 1 hour per day. Provide a good standard of controlled ventilation (10 to 15 air changes per hour). Bulk closed unloading: Provide a good standard of controlled ventilation (5 to 10 air changes per hour). Avoid carrying out activities involving exposure for more than 1 hour per day. or Ensure material transfers are under containment or extract ventilation.
Technical conditions and measures to control dispersion from source towards the worker	Drum/batch transfers: Ensure material transfers are under containment or extract ventilation. or Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Avoid carrying out activities involving exposure for more than 1 hour per day. Refuelling: Ensure material transfers are under containment or extract ventilation. Avoid carrying out activities involving exposure for more than 1 hour per day.
Organizational measures to prevent/limit releases, dispersion and exposure	General measures (carcinogens): Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general/local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean/flush equipment, where possible, prior to maintenance. Where there is potential for exposure: restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. Equipment cleaning and maintenance: Drain down and flush system prior to equipment break-in or maintenance. Retain drain downs in sealed storage pending disposal or for subsequent recycle.
Conditions and measures related to personal protection, hygiene and health evaluations	General exposures (closed systems): Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training. General exposures (closed systems) Product sampling: Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training. Bulk closed unloading: Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.

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Drum/batch transfers: Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.

Refuelling: Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.

Use as a fuel (closed systems): Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.

Equipment cleaning and maintenance: Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.

3. Exposure Estimation

Environment

The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model.

Health

The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Environment

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. Required removal efficiency for wastewater can be achieved using onsite/offsite technologies, either alone or in combination. Required removal efficiency for air can be achieved using on-site technologies, either alone or in combination. Further details on scaling and control technologies are provided in SpERC factsheet (http://cefic.org/en/reach-for-industries-libraries.html).

Health

Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. Available hazard data do not enable the derivation of a DNEL for carcinogenic effects. Available hazard data do not support the need for a DNEL to be established for other health effects. Risk Management Measures are based on qualitative risk characterisation.

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