

# Safety Data Sheet

Safety Data Sheet according to Regulation (EC) No.  
1907/2006 (REACH)



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

### 1.1. Product identifier

<b>Substance name:</b>	<b>Atmospheric Tower Residues</b>
<b>Safety Data Sheet Number:</b>	<b>814585</b>
<b>MARPOL Annex I Category</b>	Fuel and Residual Oils, including Ship's Bunkers
<b>REACH Registration Number:</b>	01-2119485975-17-0010

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

<b>Relevant identified uses</b>	Refinery Stream Feedstock Fuel for Industrial Furnaces
<b>Uses advised against</b>	Uses other than those covered by the exposure scenarios appended to this Safety Data Sheet are not supported.

### 1.3. Details of the supplier of the safety data sheet

<b>Manufacturer/Supplier</b>	Irving Oil Whitegate Refinery Limited Whitegate, Midleton, Co. Cork, Ireland
<b>SDS Information</b>	Email: esds@irvingoil.com

<b>1.4. Emergency telephone number</b>	+ 353 21 4622 200
----------------------------------------	-------------------

## SECTION 2: Hazard identification

### 2.1. Classification of the substance or mixture

#### CLP Classification (EC No 1272/2008)

H332 -- Acute toxicity, Inhalation -- Category 4  
H350 -- Carcinogenicity -- Category 1B  
H361d -- Reproductive toxicity -- Category 2  
H373 -- Specific target organ toxicity (repeated exposure) -- Category 2  
H400 -- Hazardous to the aquatic environment, acute toxicity -- Category 1  
H410 -- Hazardous to the aquatic environment, chronic toxicity -- Category 1

### 2.2. Label elements



#### **DANGER**

**Repeated exposure may cause skin dryness or cracking**  
**Harmful if inhaled**  
**May cause cancer**  
**Suspected of damaging the unborn child**  
**May cause damage to organs through prolonged or repeated exposure**  
**Very toxic to aquatic life with long lasting effects**

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  
P308 + P313 - IF exposed or concerned: Get medical advice/attention  
P501 - Dispose of contents/ container to an approved waste disposal plant

### 2.3. Other hazards

May contain or release poisonous hydrogen sulfide gas.  
Does not meet the criteria for persistent, bioaccumulative and toxic (PBT) or very persistent, very bioaccumulative (vPvB) substances.

## SECTION 3: Composition/information on ingredients

### 3.1. Substances

Chemical Name	CASRN	EINECS	REACH Registration No.	Concentration <sup>1</sup>	Classification <sup>2</sup>
Residues, petroleum, atmospheric tower	64741-45-3	265-045-2	01-2119485975-17	100	H332,H350,H361d,H373,H400, H410
Hydrogen sulfide	7783-06-4	231-977-3	Not applicable	Variable (<1)	H220,H330,H400

<sup>1</sup> All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

<sup>2</sup> Regulation EC 1272/2008.

## SECTION 4: First aid measures

### 4.1. Description of first aid measures

**Eye Contact:** If irritation or redness develops from exposure, flush eyes with clean water. If symptoms persist, seek medical attention.

**Skin Contact:** Remove contaminated shoes and clothing and cleanse affected area(s) thoroughly by washing with mild soap and water or a waterless hand cleaner. If irritation or redness develops and persists, seek medical attention.

**Inhalation:** If respiratory symptoms or other symptoms of exposure develop, move victim away from source of exposure and into fresh air in a position comfortable for breathing. If symptoms persist, seek immediate medical attention. If victim is not breathing, clear airway and immediately begin artificial respiration. If breathing difficulties develop, oxygen should be administered by qualified personnel. Seek immediate medical attention.

**Ingestion:** First aid is not normally required; however, if swallowed and symptoms develop, seek medical attention.

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

While significant vapour concentrations are not likely, exposure can cause minor respiratory irritation, headache, dizziness and nausea. Ingestion can cause irritation of the digestive tract, nausea and vomiting. Prolonged or repeated contact may dry skin and cause irritation.

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

**Notes to Physician:** At high concentrations hydrogen sulfide may produce pulmonary edema, respiratory depression, and/or respiratory paralysis. The first priority in treatment should be the establishment of adequate ventilation and the administration of 100% oxygen. Animal studies suggest that nitrites are a useful antidote, however, documentation of the efficacy of nitrites in humans is lacking. If the diagnosis of hydrogen sulfide poisoning is confirmed and if the patient does not respond rapidly to supportive care, the use of nitrites may be an effective antidote if delivered within the first few minutes of exposure. Amyl nitrite inhalers (found in the cyanide antidote kit) can be used for 30 seconds every minute until an I.V line is established. For adults the dose is 10 mL of a 3% NaNO<sub>2</sub> solution (0.5 gm NaNO<sub>2</sub> in 15 mL water) I.V. over 2-4 minutes. The dosage should be adjusted in children or in the presence of anaemia, and methemoglobin levels, arterial blood gases, and electrolytes should be monitored closely.

**Other Comments:** Before attempting rescue, first responders should be alert to the possible presence of hydrogen sulfide, a poisonous gas with the smell of rotten eggs, and should consider the need for respiratory protection (see Section 8). Remove casualty to fresh air as quickly as possible. Immediately begin artificial respiration if breathing has ceased. Consider whether

oxygen administration is needed. Obtain medical advice for further treatment.

## SECTION 5: Firefighting measures

### 5.1. Extinguishing media

Dry chemical, carbon dioxide, foam, or water spray is recommended. Water or foam may cause frothing of materials heated above 212°F / 100°C. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

### 5.2. Special hazards arising from the substance or mixture

**Unusual Fire & Explosion Hazards:** This material may burn, but will not ignite readily. If container is not properly cooled, it can rupture in the heat of a fire. Hazardous combustion/decomposition products, including hydrogen sulfide, may be released by this material when exposed to heat or fire. Use caution and wear protective clothing, including respiratory protection.

**Hazardous Combustion Products:** Combustion may yield smoke, carbon monoxide, and other products of incomplete combustion. Hydrogen sulfide and oxides of nitrogen and sulphur may also be formed.

### 5.3. Special protective actions for fire-fighters

For fires beyond the initial stage, emergency responders in the immediate hazard area should wear protective clothing. When the potential chemical hazard is unknown, in enclosed or confined spaces, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8) Isolate the hazard area and deny entry to unnecessary and unprotected personnel Stop spill/release if it can be done safely Move undamaged containers from immediate hazard area if it can be done safely Water spray may be useful in minimizing or dispersing vapours and to protect personnel Avoid spreading burning liquid with water used for cooling purposes Cool equipment exposed to fire with water, if it can be done safely

See Section 9 for Flammable Properties including Flash Point and Flammable (Explosive) Limits

## SECTION 6: Accidental release measures

### 6.1. Personal precautions, protective equipment and emergency procedures

This material may burn, but will not ignite readily. Keep all sources of ignition away from spill/release. May contain or release poisonous hydrogen sulfide gas. If the presence of dangerous amounts of H<sub>2</sub>S around the spilled product is suspected, additional or special actions may be warranted, including access restrictions and use of protective equipment. Stay upwind and away from spill/release. Avoid direct contact with material. For large spillages, notify persons down wind of the spill/release, isolate immediate hazard area and keep unauthorised personnel out. Wear appropriate protective equipment, including respiratory protection, as conditions warrant (see Section 8). See Sections 2 and 7 for additional information on hazards and precautionary measures.

### 6.2. Environmental precautions

Stop and contain spill/release if it can be done safely. Prevent spilled material from entering sewers, storm drains, other unauthorised drainage systems, and natural waterways. Use water sparingly to minimize environmental contamination and reduce disposal requirements. If spill occurs on water notify appropriate authorities and advise shipping of any hazard.

### 6.3. Methods and material for containment and cleaning up

Notify relevant authorities in accordance with all applicable regulations. Immediate cleanup of any spill is recommended. Dike far ahead of spill for later recovery or disposal. Absorb spill with inert material such as sand or vermiculite, and place in suitable container for disposal. If spilled on water remove with appropriate methods (e.g. skimming, booms or absorbents). In case of soil contamination, remove contaminated soil for remediation or disposal, in accordance with local regulations.

Recommended measures are based on the most likely spillage scenarios for this material; however local conditions and regulations may influence or limit the choice of appropriate actions to be taken.

## SECTION 7: Handling and storage

### 7.1. Precautions for safe handling

Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Keep away from flames and hot surfaces. May contain or release dangerous levels of hydrogen sulfide. Do not breathe vapour or mist. Use

only outdoors or in a well-ventilated area. Wash thoroughly after handling. Use good personal hygiene practices and wear appropriate personal protective equipment (see section 8).

Do not wear contaminated clothing or shoes. Do not enter confined spaces such as tanks or pits without following proper entry procedures.

The use of hydrocarbon fuel in an area without adequate ventilation may result in hazardous levels of incomplete combustion products (e.g. carbon monoxide, oxides of sulphur and nitrogen, benzene and other hydrocarbons) and/or dangerously low oxygen levels.

**7.2. Conditions for safe storage, including any incompatibilities**

Keep container(s) tightly closed and properly labeled. Store only in approved containers. This material may contain or release poisonous hydrogen sulfide gas. In a tank, barge, or other closed container, the vapour space above this material may accumulate hazardous concentrations of hydrogen sulfide. Check atmosphere for oxygen content, H2S, and flammability prior to entry. Use and store this material in cool, dry, well-ventilated area away from heat and all sources of ignition. Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage.

"Empty" containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. "Empty" drums should be completely drained, properly bunged, and promptly shipped to the supplier or a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations. Before working on or in tanks which contain or have contained this material, refer to appropriate guidance pertaining to cleaning, repairing, welding, or other contemplated operations. Outdoor or detached storage is preferred. Indoor storage should meet Country or Committee standards and appropriate fire codes.

**7.3. Specific end use(s)**

Refer to supplemental exposure scenarios if attached.

**SECTION 8: Exposure controls/personal protection**

**8.1. Control parameters**

Chemical Name	Occupational Exposure Limits	
	ACGIH	Ireland
Hydrogen sulfide	TWA: 1 ppm STEL: 5 ppm	TWA: 5 ppm TWA: 7 mg/m <sup>3</sup> STEL: 14 mg/m <sup>3</sup> STEL: 10 ppm

STEL = Short Term Exposure Limit (15 minutes); TWA = Time Weighted Average (8 hours); --- = No Occupational Exposure Limit

**Relevant DNEL and PNEC:**

**Worker Derived No-Effect Level (DNEL)**

**Inhalation:** 0.12 mg/m<sup>3</sup>  
**Dermal:** 0.06 mg/kgbw/day

**Consumer Derived No-Effect Level (DNEL)**

**Inhalation:** Not applicable  
**Dermal:** Not applicable  
**Ingestion:** 0.015 mg/kgbw/day

**Environmental Predicted No-Effect Concentration (PNEC):** No information available

**8.2. Exposure controls**

**Engineering controls:** If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits, additional engineering controls may be required.

**Eye/Face Protection:** The use of eye protection that meets or exceeds EN 166 is recommended to protect against potential eye contact, irritation, or injury. Depending on conditions of use, close fitting eye protection and a face shield may be necessary.

**Skin/Hand Protection:** The use of gloves impervious to the specific material handled that comply with EN 374 is advised to prevent skin contact. Users should check with manufacturers to confirm the breakthrough performance of their products. Suggested protective materials: Nitrile

**Respiratory Protection:** Where there is potential for airborne exposure to hydrogen sulfide (H<sub>2</sub>S) above exposure limits, an approved, self-contained breathing apparatus (SCBA) or equivalent operated in a pressure demand or other positive pressure mode should be used. Emergencies or conditions that could result in significant airborne exposures may require the use of approved respiratory protection. An industrial hygienist or other appropriate health and safety professional should be consulted for specific guidance under these situations.

A respiratory protection programme that follows recommendations for the selection, use, care and maintenance of respiratory protective devices in EN 529:2005 should be followed whenever workplace conditions warrant a respirator's use. Air purifying respirators provide limited protection and cannot be used in atmospheres that exceed the maximum use concentration (as directed by regulation or the manufacturer's instructions), in oxygen deficient (less than 19.5 percent oxygen) situations, or under conditions that are immediately dangerous to life and health.

**Environmental Exposure Controls:** Refer to Sections 6, 7, 12 and 13.

**Suggestions provided in this section for exposure control and specific types of protective equipment are based on readily available information. Users should consult with the specific manufacturer to confirm the performance of their protective equipment. Specific situations may require consultation with industrial hygiene, safety, or engineering professionals.**

## SECTION 9: Physical and chemical properties

### 9.1. Information on basic physical and chemical properties

Data represent typical values and are not intended to be specifications. N/A = Not Applicable; N/D = Not Determined

<b>Appearance:</b>	dark brown. Very viscous liquid at ambient temperature.
<b>Physical Form:</b>	Liquid
<b>Odour:</b>	Hydrocarbon
<b>Odour Threshold:</b>	N/D
<b>pH:</b>	N/A
<b>Melting/Freezing Point:</b>	N/D
<b>Initial Boiling Point/Range:</b>	350 - 550 °C
<b>Flash Point:</b>	> 110 °C
<b>Evaporation Rate (nBuAc=1):</b>	Relatively nonvolatile
<b>Flammability (solid, gas):</b>	N/A
<b>Upper Explosive Limits (vol % in air):</b>	6.0
<b>Lower Explosive Limits (vol % in air):</b>	1.0
<b>Vapour Pressure:</b>	<0.1 kPa @40°C
<b>Relative Vapour Density (air=1):</b>	N/D
<b>Relative Density (water=1):</b>	0.92-0.96 @ 15°C
<b>Solubility (ies):</b>	N/D
<b>Partition Coefficient (n-octanol/water) (K<sub>ow</sub>):</b>	N/D
<b>Auto-ignition Temperature:</b>	>350 °C
<b>Decomposition Temperature:</b>	N/D
<b>Viscosity:</b>	N/D
<b>Explosive Properties:</b>	N/D
<b>Oxidising Properties:</b>	N/D

### 9.2. Other information

<b>Pour Point:</b>	N/D
--------------------	-----

## SECTION 10: Stability and reactivity

<b>10.1. Reactivity</b>	Not chemically reactive.
<b>10.2. Chemical stability</b>	Stable under normal ambient and anticipated conditions of use.
<b>10.3. Possibility of hazardous reactions</b>	Hazardous reactions not anticipated.
<b>10.4. Conditions to avoid</b>	Avoid all possible sources of ignition.
<b>10.5. Incompatible materials</b>	Avoid contact with strong oxidizing agents and strong reducing agents.
<b>10.6. Hazardous decomposition products</b>	Not anticipated under normal conditions of use.

## SECTION 11: Toxicological information

### 11.1. Information on toxicological effects

#### Substance / Mixture

Acute Toxicity	Hazard	Additional Information	LC50/LD50 Data
Inhalation	Harmful if inhaled	May contain or release poisonous hydrogen sulfide gas - see Other Comments.	2.2 mg/L (mist, estimated)
Dermal	Unlikely to be harmful		>2 g/kg (rabbit)
Oral	Unlikely to be harmful		>5 g/kg (rat)

**Aspiration Hazard:** Not expected to be an aspiration hazard.

**Skin Corrosion/Irritation:** Causes mild skin irritation. Repeated exposure may cause skin dryness or cracking.

**Serious Eye Damage/Irritation:** Causes mild eye irritation.

**Skin Sensitisation:** Not expected to be a skin sensitizer.

**Respiratory Sensitisation:** No information available.

**Specific Target Organ Toxicity (Single Exposure):** Not expected to cause organ effects from single exposure.

**Specific Target Organ Toxicity (Repeated Exposure):** May cause damage to organs through prolonged or repeated exposure. Application of various heavy fuel oils to mouse and rat skin, five times a week for 10 - 13 weeks or by gavage at 1000 mg/kg/day for 10 weeks, resulted in treatment-related effects in the liver (necrosis), bone marrow (erythroid hypoplasia and anaemia), and thymus (atrophy). Limited evidence of toxicity was seen in the lymph nodes (reactive hyperplasia), and kidney (tubular degeneration).

**Carcinogenicity:** May cause cancer. Repeated application of heavy fuel oils containing high polycyclic aromatic hydrocarbon content has been shown to cause an increased incidence of skin tumours in mice.

**Germ Cell Mutagenicity:** Inadequate information available.

**Reproductive Toxicity:** Suspected of damaging the unborn child. Repeated dermal application of various heavy fuel oils with high polycyclic aromatic hydrocarbon content fuel oils to pregnant rats demonstrated maternal toxicity, decreased fetal body weights and decreased fetal survival. Some fetal abnormalities and decreased sperm count were also observed in some of the studies.

**Other Comments:** This material may contain or liberate hydrogen sulfide, a poisonous gas with the smell of rotten eggs. The smell disappears rapidly because of olfactory fatigue so odour may not be a reliable indicator of exposure. Effects of overexposure include irritation of the eyes, nose, throat and respiratory tract, blurred vision, photophobia (sensitivity to light), and pulmonary edema (fluid accumulation in the lungs). Severe exposures can result in nausea, vomiting, muscle weakness or cramps, headache, disorientation and other signs of nervous system depression, irregular heartbeats, convulsions, respiratory failure, and death.

This material may contain varying concentrations of polycyclic aromatic hydrocarbons (PAHs) which have been known to produce a phototoxic reaction when contaminated skin is exposed to sunlight. The effect is similar in appearance to an exaggerated sunburn, and is temporary in duration if exposure is discontinued. Continued exposure to sunlight can result in more serious skin problems including pigmentation (discolouration), skin eruptions (pimples), and possible skin cancers.

## SECTION 12: Ecological information

### 12.1. Toxicity

Acute aquatic toxicity studies on samples of heavy fuel oil components show acute toxicity values less than 1 mg/L. These tests were carried out on water accommodated fractions. Results are consistent with the predicted aquatic toxicity of these substances based on their hydrocarbon composition. Heavy fuel oils components should be regarded as very toxic to aquatic

organisms with long lasting effects.

#### 12.2. Persistence and degradability

The hydrocarbons in this material are not readily biodegradable but are regarded as inherently biodegradable since their hydrocarbon components can be degraded by microorganisms.

**Persistence per IOPC Fund definition:** Persistent

#### 12.3. Bioaccumulative potential

Log Kow values measured for the hydrocarbon components of this material are between 2.7 and 6 and therefore would be regarded as having the potential to bioaccumulate. In practise, metabolic processes may reduce bioconcentration.

#### 12.4. Mobility in soil

Releases to water will result in films of hydrocarbons floating and spreading on the surface, although some components may be heavier than water. Dissolution in water will be limited, but losses through sediment adsorption will be significant. For the lighter components, volatilisation is an important loss process and reduces the hazard to aquatic organisms. In air, the hydrocarbon vapours react readily with hydroxyl radicals with half lives of less than one day.

#### 12.5. Results of PBT and vPvB assessment

Not a PBT or vPvB substance.

#### 12.6. Other adverse effects

None anticipated.

### SECTION 13: Disposal considerations

#### 13.1. Waste treatment methods

**European Waste Code:** 13 07 03\* other fuels (including mixtures)

This material, if discarded as produced, would be considered as hazardous waste pursuant to Directive 2008/98/EC on hazardous waste, and subject to the provisions of that Directive unless Article 1(5) of that Directive applies. This code has been assigned based upon the most common uses for this material and may not reflect contaminants resulting from actual use. Waste generators/producers are responsible for assessing the actual process used when generating the waste and its contaminants in order to assign the proper waste disposal code.

Disposal must be in accordance with Directive 2008/98/EC and other applicable national or regional provisions, and based upon material characteristics at time of disposal. For incineration of waste, follow Directive 2000/76/EC. For landfill of waste, follow Directive 1999/31/EC.

**Empty Containers:** Container contents should be completely used and containers emptied prior to discard. Empty drums should be properly sealed and promptly returned to a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with applicable regulations.

### SECTION 14: Transport information

14.1. UN number	UN3082
14.2. UN proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. ( PETROLEUM DISTILLATES )
14.3. Transport hazard class(es)	9
14.4. Packing group	III
14.5. Environmental hazards	Marine pollutant - Environmentally Hazardous
14.6. Special precautions for user	<i>Assumes material is not heated and transported above 100° C. . Contact your Dangerous Goods Safety Advisor for</i>

additional information. . If transported in bulk by marine vessel in international waters, product is being carried under the scope of MARPOL Annex I.

14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not applicable

## SECTION 15: Regulatory information

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

EC 1272/2008 - Classification, labelling and packaging of substances and mixtures  
EN166:2002 Eye Protection  
EN 529:2005 Respiratory Protective devices  
BS EN 374-1:2003 Protective gloves against chemicals and micro-organisms  
Occupational Exposure Limits, Health and Safety Authority  
Directive 2008/98/EC (Waste Framework Directive)  
Directive 2000/76/EC on incineration of waste  
Directive 1999/31/EC on landfill of waste

Export Rating: NLR (No Licence Required)

### 15.2. Chemical safety assessment

A chemical safety assessment has been carried out for the substance/mixture.

## SECTION 16: Other information

Issue Date: 09-Sep-2016  
Status: FINAL  
Previous Issue Date: 22-Sep-2011  
Revised Sections or Basis for Revision: New SDS  
Safety Data Sheet Number: 814585  
Language: BE

### List of Relevant Hazard Statements:

H332 - Harmful if inhaled  
H350 - May cause cancer  
H361 - Suspected of damaging fertility or the unborn child  
H373 - May cause damage to organs through prolonged or repeated exposure  
H400 - Very toxic to aquatic life  
H410 - Very toxic to aquatic life with long lasting effects  
H220 - Extremely flammable gas  
H330 - Fatal if inhaled  
EUH066 - Repeated exposure may cause skin dryness or cracking

### Regulatory Basis of Classification

CLP Classification (EC No 1272/2008)	Regulatory Basis
H332 -- Acute toxicity, Inhalation -- Category 4	Based on component information.
H350 -- Carcinogenicity -- Category 1B	Based on component information.
H361d -- Reproductive toxicity -- Category 2	Based on component information.
H373 -- Specific target organ toxicity (repeated exposure) -- Category 2	Based on component information.
H400 -- Hazardous to the aquatic environment, acute toxicity -- Category 1	Based on component information.
H410 -- Hazardous to the aquatic environment, chronic toxicity -- Category 1	Based on component information.

### Guide to Abbreviations:

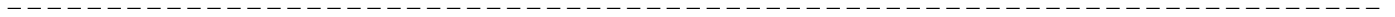
ACGIH = American Conference of Governmental Industrial Hygienists; ADR = Agreement on Dangerous Goods by Road; BMGV = Biological Monitoring Guidance Value; CASRN = Chemical Abstracts Service Registry Number; CEILING = Ceiling Limit; EINECS - European Inventory of Existing Commercial Chemical Substances; EPA = [US] Environmental Protection Agency; Germany-TRGS = Technical Rules for Dangerous Substances; IARC = International Agency for Research on Cancer; ICAO/IATA = International Civil Aviation Organisation / International Air Transport Association; INSHT = National Institute for Health and Safety at Work; IMDG = International Maritime Dangerous Goods; Ireland-HSA = Ireland's National Health and Safety Authority; LEL = Lower Explosive Limit; MARPOL = Marine Pollution; N/A = Not Applicable; N/D = Not Determined; NTP = [US] National Toxicology Programme; PBT = Persistent, Bioaccumulative and Toxic; RID = Regulations Concerning the International Transport of Dangerous Goods by Rail; STEL = Short Term Exposure Limit; TLV = Threshold Limit Value; TRGS 903 = Technical



rules for hazardous substances; TWA = Time Weighted Average; UEL = Upper Explosive Limit; UK-EH40 = United Kingdom EH40/2005 OEL; vPvB = very Persistent, very Bioaccumulative

**Disclaimer of Expressed and implied Warranties:**

The information presented in this Safety Data Sheet is based on data believed to be accurate as of the date this Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorisation is given nor implied to practice any patented invention without a licence.





## Heavy Fuel Oil Components (R45)

### 1 Manufacture of substance - Industrial

<b>Section 1 Exposure Scenario</b>	
Heavy Fuel Oil Components	
<b>Title</b>	Manufacture of substance
<b>Use Descriptor</b>	
Sector(s) of use	3, 8, 9
Process category(ies)	1, 2, 3, 8a, 8b, 15
Environmental release category(ies)	1, 4
Specific Environmental Release Category	ESVOC SpERC 1.1.v1
<b>Processes, tasks, activities covered</b>	
Manufacture of the substance or use as a process chemical or extraction agent within closed or contained systems. Includes incidental exposures during recycling/recovery, material transfers, storage, sampling, associated laboratory activities, maintenance and loading (including marine vessel/barge, road/rail car and bulk container)	
<b>Section 2 Operational conditions and risk management measures</b>	
<b>2.1 Control of worker exposure</b>	
<b>Product characteristics</b>	
Physical form of product	Liquid, vapour pressure < 0.5 kPa at STP
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently).
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently)
Other operational conditions affecting exposure	Operation is carried out at elevated temperature (>20°C above ambient temperature). Assumes a good basic standard of occupational hygiene is implemented
<b>Contributing Scenarios / Product Category</b>	
<b>Specific Risk Management Measures &amp; Operating Conditions</b>	
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.
General exposures (closed systems)	Handle substance within a closed system Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
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 Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Bulk product storage	Store substance within a closed system Avoid carrying out activities involving exposure for more than 4 hours Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Laboratory activities	Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure. Wear suitable gloves tested to EN374.

marine vessel/barge (un)loading	Avoid carrying out activities involving exposure for more than 4 hours Transfer via enclosed lines Clear transfer lines prior to de-coupling Retain drain downs in sealed storage pending disposal or for subsequent recycle Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
road tanker/rail car loading	Ensure material transfers are under containment or extract ventilation Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Equipment cleaning and maintenance	Drain down and flush system prior to equipment break-in or maintenance Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. Retain drain downs in sealed storage pending disposal or for subsequent recycle
<p>Heavy Fuel Oil Components exhibits carcinogenic effects and is classified R45 (May cause cancer) accordingly. The available data for this adverse effect do not provide quantitative dose-response information for a D(M)NEL to be derived. Instead, the toxicity data triggers a qualitative risk characterisation and the RMMs in section 2 of the SDS aims to define the appropriate RMMs necessary to protect from these adverse effects consistent with Directive 2004/37/E. Heavy Fuel Oil Components is classified R66 (Repeated exposure may cause skin dryness or cracking). The available data for this adverse effect do not provide quantitative dose-response information for a D(M)NEL to be derived. Instead, the toxicity data triggers a qualitative risk characterisation and the RMMs in section 2 of the SDS aims to define the appropriate RMMs necessary to protect from this adverse effect.</p>	
<b>2.2 Control of environmental exposure</b>	
<b>Product characteristics</b>	
Substance is complex UVCB Predominantly hydrophobic	
<b>Amounts used</b>	
Fraction of EU tonnage used in region	0.1
Regional use tonnage (tonnes/year)	1.1e7
Fraction of regional tonnage used locally	5.2e-2
<b>Frequency and duration of use</b>	
Continuous release	
Emission days (days/year)	300
<b>Environmental factors not influenced by risk management</b>	
Local freshwater dilution factor	10
Local marine water dilution factor	100
<b>Other given operational conditions affecting environmental exposure</b>	
Release fraction to air from process (initial release prior to RMM)	1.0e-4
Release fraction to wastewater from process (initial release prior to RMM)	3.0e-6
Release fraction to soil from process (initial release prior to RMM)	0.0001
<b>Technical conditions and measures at process level (source) to prevent release</b>	
Common practices vary across sites thus conservative process release estimates used	
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b>	
Risk from environmental exposure is driven by humans via indirect exposure (primarily ingestion) Onsite wastewater treatment required Prevent discharge of undissolved substance to or recover from onsite wastewater	
Treat air emission to provide a typical removal efficiency of (%):	90
Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency >= (%):	85.9
If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of >= (%):	0.0
<b>Organisation measures to prevent/limit release from site</b>	
Do not apply industrial sludge to natural soils Sludge should be incinerated, contained or reclaimed	
<b>Conditions and measures related to municipal sewage treatment plant</b>	
Estimated substance removal from wastewater via domestic sewage treatment (%):	88.8
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs (%):	88.8
Maximum allowable site tonnage (Msafe) based on release following total wastewater treatment removal (kg/d):	2.3e6
Assumed domestic sewage treatment plant flow (m <sup>3</sup> /d):	10000
<b>Conditions and measures related to external treatment of waste for disposal</b>	
During manufacturing no waste of the substance is generated	
<b>Conditions and measures related to external recovery of waste</b>	
During manufacturing no waste of the substance is generated	

<b>Section 3 Exposure Estimation</b>
<b>3.1 Health</b>
The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated
<b>3.2 Environment</b>
The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model
<b>Section 4 Guidance to check compliance with the Exposure Scenario</b>
<b>4.1 Health</b>
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 does not enable the derivation of a DNEL for carcinogenic effects Available hazard data does not support the need for a DNEL to be established for other health effects Risk management measures are based on qualitative risk characterization
<b>4.2 Environment</b>
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 ( <a href="http://cefic.org/en/reach-for-industries-libraries.html">http://cefic.org/en/reach-for-industries-libraries.html</a> ) Scaled local assessments for EU refineries have been performed using site-specific data and are attached in PETRORISK file – “Site-Specific Production” worksheet

## 2 Use of substance as an intermediate - Industrial

<b>Section 1 Exposure Scenario</b>	
Heavy Fuel Oil Components	
<b>Title</b>	Use as an intermediate
<b>Use Descriptor</b>	
Sector(s) of use	3, 8, 9
Process category(ies)	1, 2, 3, 8a, 8b, 15
Environmental release category(ies)	6a
Specific Environmental Release Category	ESVOC SpERC 6.1a.v1
<b>Processes, tasks, activities covered</b>	
Use of substance as an intermediate (not related to Strictly Controlled Conditions). Includes recycling/recovery, material transfers, storage, sampling, associated laboratory activities, maintenance and loading (including marine vessel/barge, road/rail car and bulk container)	
<b>Section 2 Operational conditions and risk management measures</b>	
<b>2.1 Control of worker exposure</b>	
<b>Product characteristics</b>	
Physical form of product	Liquid, vapour pressure < 0.5 kPa at STP
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently).
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently)
Other operational conditions affecting exposure	Operation is carried out at elevated temperature (>20°C above ambient temperature). Assumes a good basic standard of occupational hygiene is implemented
<b>Contributing Scenarios / Product Category</b>	
<b>Specific Risk Management Measures &amp; Operating Conditions</b>	
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.
General exposures (closed systems)	Handle substance within a closed system Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
General exposures (closed systems) Process sampling Outdoor	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 Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Bulk product storage	Store substance within a closed system Avoid carrying out activities involving exposure for more than 4 hours Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Laboratory activities	Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure. Wear suitable gloves tested to EN374.
marine vessel/barge (un)loading	Avoid carrying out activities involving exposure for more than 4 hours Transfer via enclosed lines Clear transfer lines prior to de-coupling Retain drain downs in sealed storage pending disposal or for subsequent recycle Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
road tanker/rail car loading	Avoid carrying out activities involving exposure for more than 1 hour or Ensure material transfers are under containment or extract ventilation Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Equipment cleaning and maintenance	Drain down and flush system prior to equipment break-in or maintenance Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. Retain drain downs in sealed storage pending disposal or for subsequent recycle

Heavy Fuel Oil Components exhibits carcinogenic effects and is classified R45 (May cause cancer) accordingly. The available data for this adverse effect do not provide quantitative dose-response information for a D(M)NEL to be derived. Instead, the toxicity data triggers a qualitative risk characterisation and the RMMs in section 2 of the SDS aims to define the appropriate RMMs necessary to protect from these adverse effects consistent with Directive 2004/37/E. Heavy Fuel Oil Components is classified R66 (Repeated exposure may cause skin dryness or cracking). The available data for this adverse effect do not provide quantitative dose-response information for a D(M)NEL to be derived. Instead, the toxicity data triggers a qualitative risk characterisation and the RMMs in section 2 of the SDS aims to define the appropriate RMMs necessary to protect from this adverse effect.

**2.2 Control of environmental exposure**

**Product characteristics**

Substance is complex UVCB Predominantly hydrophobic

**Amounts used**

Fraction of EU tonnage used in region	0.1
Regional use tonnage (tonnes/year)	1.3e5
Fraction of regional tonnage used locally	1.2e-1

**Frequency and duration of use**

Continuous release

Emission days (days/year)	300
---------------------------	-----

**Environmental factors not influenced by risk management**

Local freshwater dilution factor	10
Local marine water dilution factor	100

**Other given operational conditions affecting environmental exposure**

Release fraction to air from process (initial release prior to RMM)	1.0e-5
Release fraction to wastewater from process (initial release prior to RMM)	1.0e-5
Release fraction to soil from process (initial release prior to RMM)	0.001

**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**

Risk from environmental exposure is driven by freshwater sediment If discharging to domestic sewage treatment plant, no onsite wastewater treatment required Prevent discharge of undissolved substance to or recover from onsite wastewater

Treat air emission to provide a typical removal efficiency of (%):	80
--------------------------------------------------------------------	----

Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency >= (%):	54.0
If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of >= (%):	0
<b>Organisation measures to prevent/limit release from site</b>	
Do not apply industrial sludge to natural soils Sludge should be incinerated, contained or reclaimed	
<b>Conditions and measures related to municipal sewage treatment plant</b>	
Estimated substance removal from wastewater via domestic sewage treatment (%):	88.8
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs (%):	88.8
Maximum allowable site tonnage (Msafe) based on release following total wastewater treatment removal (kg/d):	1.9e5
Assumed domestic sewage treatment plant flow (m <sup>3</sup> /d):	2000
<b>Conditions and measures related to external treatment of waste for disposal</b>	
This substance is consumed during use and no waste of the substance is generated	
<b>Conditions and measures related to external recovery of waste</b>	
This substance is consumed during use and no waste of the substance is generated	
<b>Section 3 Exposure Estimation</b>	
<b>3.1 Health</b>	
The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated	
<b>3.2 Environment</b>	
The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model	
<b>Section 4 Guidance to check compliance with the Exposure Scenario</b>	
<b>4.1 Health</b>	
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 does not enable the derivation of a DNEL for carcinogenic effects Available hazard data does not support the need for a DNEL to be established for other health effects Risk management measures are based on qualitative risk characterization	
<b>4.2 Environment</b>	
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 ( <a href="http://cefic.org/en/reach-for-industries-libraries.html">http://cefic.org/en/reach-for-industries-libraries.html</a> )	

### 3 Distribution of substance - Industrial

<b>Section 1 Exposure Scenario</b>	
Heavy Fuel Oil Components	
<b>Title</b>	Distribution of substance
<b>Use Descriptor</b>	
Sector(s) of use	3
Process category(ies)	1, 2, 3, 8a, 8b, 15
Environmental release category(ies)	1, 2, 3, 4, 5, 6a, 6b, 6c, 6d, 7
Specific Environmental Release Category	ESVOC SpERC 1.1b.v1
<b>Processes, tasks, activities covered</b>	
Bulk loading (including marine vessel/barge, rail/road car and IBC loading) of substance within closed or contained systems, including incidental exposures during its sampling, storage, unloading, maintenance and associated laboratory activities	
<b>Section 2 Operational conditions and risk management measures</b>	
<b>2.1 Control of worker exposure</b>	
<b>Product characteristics</b>	
Physical form of product	Liquid, vapour pressure < 0.5 kPa at STP
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently).
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently)
Other operational conditions affecting exposure	Assumes use at not more than 20°C above ambient temperature, unless stated differently Assumes a good basic standard of occupational hygiene is implemented

Contributing Scenarios / Product Category	Specific Risk Management Measures & Operating Conditions
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.
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 Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
General exposures (closed systems)	Handle substance within a closed system Avoid carrying out activities involving exposure for more than 4 hours Sample via a closed loop or other system to avoid exposure Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Bulk product storage	Store substance within a closed system Avoid carrying out activities involving exposure for more than 4 hours Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Product sampling	Sample via a closed loop or other system to avoid exposure Avoid carrying out activities involving exposure for more than 15 minutes Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Laboratory activities	Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure. Wear suitable gloves tested to EN374.
marine vessel/barge (un)loading	Avoid carrying out activities involving exposure for more than 4 hours Transfer via enclosed lines Clear transfer lines prior to de-coupling Retain drain downs in sealed storage pending disposal or for subsequent recycle Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
road tanker/rail car loading	Ensure material transfers are under containment or extract ventilation Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Equipment cleaning and maintenance	Drain down and flush system prior to equipment break-in or maintenance Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. Retain drain downs in sealed storage pending disposal or for subsequent recycle

Heavy Fuel Oil Components exhibits carcinogenic effects and is classified R45 (May cause cancer) accordingly. The available data for this adverse effect do not provide quantitative dose-response information for a D(M)NEL to be derived. Instead, the toxicity data triggers a qualitative risk characterisation and the RMMs in section 2 of the SDS aims to define the appropriate RMMs necessary to protect from these adverse effects consistent with Directive 2004/37/E. Heavy Fuel Oil Components is classified R66 (Repeated exposure may cause skin dryness or cracking). The available data for this adverse effect do not provide quantitative dose-response information for a D(M)NEL to be derived. Instead, the toxicity data triggers a qualitative risk characterisation and the RMMs in section 2 of the SDS aims to define the appropriate RMMs necessary to protect from this adverse effect.

**2.2 Control of environmental exposure**  
**Product characteristics**



Substance is complex UVCB Predominantly hydrophobic	
<b>Amounts used</b>	
Fraction of EU tonnage used in region	0.1
Regional use tonnage (tonnes/year)	1.1e7
Fraction of regional tonnage used locally	2.0e-3
<b>Frequency and duration of use</b>	
Continuous release	
Emission days (days/year)	300
<b>Environmental factors not influenced by risk management</b>	
Local freshwater dilution factor	10
Local marine water dilution factor	100
<b>Other given operational conditions affecting environmental exposure</b>	
Release fraction to air from process (initial release prior to RMM)	1.0e-4
Release fraction to wastewater from process (initial release prior to RMM)	1.0e-7
Release fraction to soil from process (initial release prior to RMM)	0.00001
<b>Technical conditions and measures at process level (source) to prevent release</b>	
Common practices vary across sites thus conservative process release estimates used	
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b>	
Risk from environmental exposure is driven by humans via indirect exposure (primarily ingestion) No wastewater treatment required	
Treat air emission to provide a typical removal efficiency of (%):	90
Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency >= (%):	0
If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of >= (%):	0
<b>Organisation measures to prevent/limit release from site</b>	
Do not apply industrial sludge to natural soils Sludge should be incinerated, contained or reclaimed	
<b>Conditions and measures related to municipal sewage treatment plant</b>	
Estimated substance removal from wastewater via domestic sewage treatment (%):	88.8
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs (%):	88.8
Maximum allowable site tonnage (Msafe) based on release following total wastewater treatment removal (kg/d):	3.8e5
Assumed domestic sewage treatment plant flow (m <sup>3</sup> /d):	2000
<b>Conditions and measures related to external treatment of waste for disposal</b>	
External treatment and disposal of waste should comply with applicable local and/or national regulations	
<b>Conditions and measures related to external recovery of waste</b>	
External recovery and recycling of waste should comply with applicable local and/or national regulations	
<b>Section 3 Exposure Estimation</b>	
<b>3.1 Health</b>	
The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated	
<b>3.2 Environment</b>	
The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model	
<b>Section 4 Guidance to check compliance with the Exposure Scenario</b>	
<b>4.1 Health</b>	
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 does not enable the derivation of a DNEL for carcinogenic effects Available hazard data does not support the need for a DNEL to be established for other health effects Risk management measures are based on qualitative risk characterization	
<b>4.2 Environment</b>	
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 ( <a href="http://cefic.org/en/reach-for-industries-libraries.html">http://cefic.org/en/reach-for-industries-libraries.html</a> )	

## 4 Formulation & (Re)packing of substance - Industrial

### Section 1 Exposure Scenario

Heavy Fuel Oil Components	
<b>Title</b>	Formulation & (re)packing of substances and mixtures
<b>Use Descriptor</b>	
Sector(s) of use	3, 10
Process category(ies)	1, 2, 3, 8a, 8b, 15
Environmental release category(ies)	2
Specific Environmental Release Category	ESVOC SpERC 2.2.v1
<b>Processes, tasks, activities covered</b>	
Formulation of the substance and its mixtures in batch or continuous operations within closed or contained systems, including incidental exposures during storage, materials transfers, mixing, maintenance, sampling and associated laboratory activities	
<b>Section 2 Operational conditions and risk management measures</b>	
<b>2.1 Control of worker exposure</b>	
<b>Product characteristics</b>	
Physical form of product	Liquid, vapour pressure < 0.5 kPa at STP
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently).
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently)
Other operational conditions affecting exposure	Assumes use at not more than 20°C above ambient temperature, unless stated differently Assumes a good basic standard of occupational hygiene is implemented
<b>Contributing Scenarios / Product Category</b>	
<b>Specific Risk Management Measures &amp; Operating Conditions</b>	
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.
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 Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
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 Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Bulk product storage	Store substance within a closed system Avoid carrying out activities involving exposure for more than 4 hours Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Product sampling	Sample via a closed loop or other system to avoid exposure Avoid carrying out activities involving exposure for more than 15 minutes Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Laboratory activities	Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure. Wear suitable gloves tested to EN374.
marine vessel/barge (un)loading	Transfer via enclosed lines Avoid carrying out activities

	involving exposure for more than 4 hours Clear transfer lines prior to de-coupling Retain drain downs in sealed storage pending disposal or for subsequent recycle Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
road tanker/rail car loading	Ensure material transfers are under containment or extract ventilation Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
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 Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Equipment cleaning and maintenance	Drain down and flush system prior to equipment break-in or maintenance Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. Retain drain downs in sealed storage pending disposal or for subsequent recycle
<p>Heavy Fuel Oil Components exhibits carcinogenic effects and is classified R45 (May cause cancer) accordingly. The available data for this adverse effect do not provide quantitative dose-response information for a D(M)NEL to be derived. Instead, the toxicity data triggers a qualitative risk characterisation and the RMMs in section 2 of the SDS aims to define the appropriate RMMs necessary to protect from these adverse effects consistent with Directive 2004/37/E. Heavy Fuel Oil Components is classified R66 (Repeated exposure may cause skin dryness or cracking). The available data for this adverse effect do not provide quantitative dose-response information for a D(M)NEL to be derived. Instead, the toxicity data triggers a qualitative risk characterisation and the RMMs in section 2 of the SDS aims to define the appropriate RMMs necessary to protect from this adverse effect.</p>	
<b>2.2 Control of environmental exposure</b>	
<b>Product characteristics</b>	
Substance is complex UVCB Predominantly hydrophobic	
<b>Amounts used</b>	
Fraction of EU tonnage used in region	0.1
Regional use tonnage (tonnes/year)	1.1e7
Fraction of regional tonnage used locally	2.6e-3
<b>Frequency and duration of use</b>	
Continuous release	
Emission days (days/year)	300
<b>Environmental factors not influenced by risk management</b>	
Local freshwater dilution factor	10
Local marine water dilution factor	100
<b>Other given operational conditions affecting environmental exposure</b>	
Release fraction to air from process (initial release prior to RMM)	2.2e-3
Release fraction to wastewater from process (initial release prior to RMM)	5.0e-6
Release fraction to soil from process (initial release prior to RMM)	0.0001
<b>Technical conditions and measures at process level (source) to prevent release</b>	
Common practices vary across sites thus conservative process release estimates used	
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b>	
Risk from environmental exposure is driven by humans via indirect exposure (primarily ingestion) If discharging to domestic sewage treatment plant, no onsite wastewater treatment required Prevent discharge of undissolved substance to or recover from onsite wastewater	
Treat air emission to provide a typical removal efficiency of (%):	0
Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency >= (%):	54.0
If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of >= (%):	0
<b>Organisation measures to prevent/limit release from site</b>	
Do not apply industrial sludge to natural soils Sludge should be incinerated, contained or reclaimed	
<b>Conditions and measures related to municipal sewage treatment plant</b>	
Estimated substance removal from wastewater via domestic sewage treatment (%):	88.8
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs (%):	88.8

Maximum allowable site tonnage (Msafe) based on release following total wastewater treatment removal (kg/d):	1.1e5
Assumed domestic sewage treatment plant flow (m <sup>3</sup> /d):	2000
<b>Conditions and measures related to external treatment of waste for disposal</b>	
External treatment and disposal of waste should comply with applicable local and/or national regulations	
<b>Conditions and measures related to external recovery of waste</b>	
External recovery and recycling of waste should comply with applicable local and/or national regulations	
<b>Section 3 Exposure Estimation</b>	
<b>3.1 Health</b>	
The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated	
<b>3.2 Environment</b>	
The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model	
<b>Section 4 Guidance to check compliance with the Exposure Scenario</b>	
<b>4.1 Health</b>	
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 does not enable the derivation of a DNEL for carcinogenic effects Available hazard data does not support the need for a DNEL to be established for other health effects Risk management measures are based on qualitative risk characterization	
<b>4.2 Environment</b>	
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 ( <a href="http://cefic.org/en/reach-for-industries-libraries.html">http://cefic.org/en/reach-for-industries-libraries.html</a> )	

## 5 Use of substance as a Fuel - Industrial

<b>Section 1 Exposure Scenario</b>	
Heavy Fuel Oil Components	
<b>Title</b>	Use as a fuel
<b>Use Descriptor</b>	
Sector(s) of use	3
Process category(ies)	1, 2, 3, 8a, 8b, 16
Environmental release category(ies)	7
Specific Environmental Release Category	ESVOC SpERC 7.12a.v1
<b>Processes, tasks, activities covered</b>	
Covers the use as a fuel (or fuel additives and additive components) within closed or contained systems, including incidental exposures during activities associated with its transfer, use, equipment maintenance and handling of waste	
<b>Section 2 Operational conditions and risk management measures</b>	
<b>2.1 Control of worker exposure</b>	
<b>Product characteristics</b>	
Physical form of product	Liquid, vapour pressure < 0.5 kPa at STP
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently).
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently)
Other operational conditions affecting exposure	Assumes use at not more than 20°C above ambient temperature, unless stated differently Assumes a good basic standard of occupational hygiene is implemented
<b>Contributing Scenarios / Product Category</b>	
General measures (carcinogens)	<b>Specific Risk Management Measures &amp; Operating Conditions</b> 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.
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 Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
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 Provide a good standard of controlled ventilation (10 to 15 air changes per hour) Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
bulk closed unloading Outdoor	Transfer via enclosed lines Avoid carrying out activities involving exposure for more than 4 hours Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
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 Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
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 Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
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 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	Drain down and flush system prior to equipment break-in or maintenance Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. Retain drain downs in sealed storage pending disposal or for subsequent recycle

Heavy Fuel Oil Components exhibits carcinogenic effects and is classified R45 (May cause cancer) accordingly. The available data for this adverse effect do not provide quantitative dose-response information for a D(M)NEL to be derived. Instead, the toxicity data triggers a qualitative risk characterisation and the RMMs in section 2 of the SDS aims to define the appropriate RMMs necessary to protect from these adverse effects consistent with Directive 2004/37/E. Heavy Fuel Oil Components is classified R66 (Repeated exposure may cause skin dryness or cracking). The available data for this adverse effect do not provide quantitative dose-response information for a D(M)NEL to be derived. Instead, the toxicity data triggers a qualitative risk characterisation and the RMMs in section 2 of the SDS aims to define the appropriate RMMs necessary to protect from this adverse effect.

<b>2.2 Control of environmental exposure</b>	
<b>Product characteristics</b>	
Substance is complex UVCB Predominantly hydrophobic	
<b>Amounts used</b>	
Fraction of EU tonnage used in region	0.1
Regional use tonnage (tonnes/year)	1.1e7
Fraction of regional tonnage used locally	1.4e-1
<b>Frequency and duration of use</b>	
Continuous release	
Emission days (days/year)	300

<b>Environmental factors not influenced by risk management</b>	
Local freshwater dilution factor	10
Local marine water dilution factor	100
<b>Other given operational conditions affecting environmental exposure</b>	
Release fraction to air from process (initial release prior to RMM)	7.0e-4
Release fraction to wastewater from process (initial release prior to RMM)	4.4e-7
Release fraction to soil from process (initial release prior to RMM)	0
<b>Technical conditions and measures at process level (source) to prevent release</b>	
Common practices vary across sites thus conservative process release estimates used	
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b>	
Risk from environmental exposure is driven by freshwater sediment Onsite wastewater treatment required Prevent discharge of undissolved substance to or recover from onsite wastewater	
Treat air emission to provide a typical removal efficiency of (%):	95
Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency >= (%):	87.7
If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of >= (%):	0
<b>Organisation measures to prevent/limit release from site</b>	
Do not apply industrial sludge to natural soils Sludge should be incinerated, contained or reclaimed	
<b>Conditions and measures related to municipal sewage treatment plant</b>	
Estimated substance removal from wastewater via domestic sewage treatment (%):	88.8
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs (%):	88.8
Maximum allowable site tonnage (Msafe) based on release following total wastewater treatment removal (kg/d):	5.2e6
Assumed domestic sewage treatment plant flow (m <sup>3</sup> /d):	2000
<b>Conditions and measures related to external treatment of waste for disposal</b>	
Combustion emissions limited by required exhaust emission controls Combustion emissions considered in regional exposure assessment	
<b>Conditions and measures related to external recovery of waste</b>	
This substance is consumed during use and no waste of the substance is generated	
<b>Section 3 Exposure Estimation</b>	
<b>3.1 Health</b>	
The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated	
<b>3.2 Environment</b>	
The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model	
<b>Section 4 Guidance to check compliance with the Exposure Scenario</b>	
<b>4.1 Health</b>	
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 does not enable the derivation of a DNEL for carcinogenic effects Available hazard data does not support the need for a DNEL to be established for other health effects Risk management measures are based on qualitative risk characterization	
<b>4.2 Environment</b>	
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 ( <a href="http://cefic.org/en/reach-for-industries-libraries.html">http://cefic.org/en/reach-for-industries-libraries.html</a> )	

## 6 Use of substance as a Fuel - Professional

<b>Section 1 Exposure Scenario</b>	
Heavy Fuel Oil Components	
<b>Title</b>	Use as a fuel
<b>Use Descriptor</b>	
Sector(s) of use	22
Process category(ies)	1, 2, 3, 8a, 8b, 16
Environmental release category(ies)	9a, 9b
Specific Environmental Release Category	ESVOC SpERC 9.12b.v1

<b>Processes, tasks, activities covered</b>	
Covers the use as a fuel (or fuel additives and additive components) within closed or contained systems, including incidental exposures during activities associated with its transfer, use, equipment maintenance and handling of waste	
<b>Section 2 Operational conditions and risk management measures</b>	
<b>2.1 Control of worker exposure</b>	
<b>Product characteristics</b>	
Physical form of product	Liquid, vapour pressure < 0.5 kPa at STP
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently).
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently)
Other operational conditions affecting exposure	Assumes use at not more than 20°C above ambient temperature, unless stated differently Assumes a good basic standard of occupational hygiene is implemented
<b>Contributing Scenarios / Product Category</b>	
<b>Specific Risk Management Measures &amp; Operating Conditions</b>	
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.
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 Provide a good standard of controlled ventilation (10 to 15 air changes per hour) Wear chemically resistant gloves (tested to EN374) in combination with specific activity training.
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 1 hour Provide a good standard of controlled ventilation (10 to 15 air changes per hour) Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
bulk closed unloading	Provide a good standard of controlled ventilation (10 to 15 air changes per hour) Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training. Avoid carrying out activities involving exposure for more than 1 hour or Ensure material transfers are under containment or extract ventilation
Drum/batch transfers	Provide a good standard of controlled ventilation (10 to 15 air changes per hour) Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training. Avoid carrying out activities involving exposure for more than 1 hour or Ensure material transfers are under containment or extract ventilation
Refuelling	Ensure material transfers are under containment or extract ventilation Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training. Avoid carrying out activities involving exposure for more than 1 hour

Use as a fuel (closed systems)	Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.
Equipment cleaning and maintenance	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. Drain down system prior to equipment break-in or maintenance Retain drain downs in sealed storage pending disposal or for subsequent recycle Clear spills immediately
<p>Heavy Fuel Oil Components exhibits carcinogenic effects and is classified R45 (May cause cancer) accordingly. The available data for this adverse effect do not provide quantitative dose-response information for a D(M)NEL to be derived. Instead, the toxicity data triggers a qualitative risk characterisation and the RMMs in section 2 of the SDS aims to define the appropriate RMMs necessary to protect from these adverse effects consistent with Directive 2004/37/E. Heavy Fuel Oil Components is classified R66 (Repeated exposure may cause skin dryness or cracking). The available data for this adverse effect do not provide quantitative dose-response information for a D(M)NEL to be derived. Instead, the toxicity data triggers a qualitative risk characterisation and the RMMs in section 2 of the SDS aims to define the appropriate RMMs necessary to protect from this adverse effect.</p>	
<b>2.2 Control of environmental exposure</b>	
<b>Product characteristics</b>	
Substance is complex UVCB Predominantly hydrophobic	
<b>Amounts used</b>	
Fraction of EU tonnage used in region	0.1
Regional use tonnage (tonnes/year)	3.3e5
Fraction of regional tonnage used locally	5.0e-4
<b>Frequency and duration of use</b>	
Continuous release	
Emission days (days/year)	365
<b>Environmental factors not influenced by risk management</b>	
Local freshwater dilution factor	10
Local marine water dilution factor	100
<b>Other given operational conditions affecting environmental exposure</b>	
Release fraction to air from process (initial release prior to RMM)	1.0e-4
Release fraction to wastewater from process (initial release prior to RMM)	0.00001
Release fraction to soil from process (initial release prior to RMM)	0.00001
<b>Technical conditions and measures at process level (source) to prevent release</b>	
Common practices vary across sites thus conservative process release estimates used	
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b>	
Risk from environmental exposure is driven by humans via indirect exposure (primarily ingestion) No wastewater treatment required	
Treat air emission to provide a typical removal efficiency of (%):	N/A
Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency >= (%):	0
If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of >= (%):	0
<b>Organisation measures to prevent/limit release from site</b>	
Do not apply industrial sludge to natural soils Sludge should be incinerated, contained or reclaimed	
<b>Conditions and measures related to municipal sewage treatment plant</b>	
Estimated substance removal from wastewater via domestic sewage treatment (%):	88.8
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs (%):	88.8
Maximum allowable site tonnage (Msafe) based on release following total wastewater treatment removal (kg/d):	2.3e3
Assumed domestic sewage treatment plant flow (m <sup>3</sup> /d):	2000
<b>Conditions and measures related to external treatment of waste for disposal</b>	
Combustion emissions limited by required exhaust emission controls Combustion emissions considered in regional exposure assessment	
<b>Conditions and measures related to external recovery of waste</b>	
This substance is consumed during use and no waste of the substance is generated	
<b>Section 3 Exposure Estimation</b>	
<b>3.1 Health</b>	
The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated	



---

**3.2 Environment**

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

**Section 4 Guidance to check compliance with the Exposure Scenario**

**4.1 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 does not enable the derivation of a DNEL for carcinogenic effects Available hazard data does not support the need for a DNEL to be established for other health effects Risk management measures are based on qualitative risk characterization

**4.2 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>)