SAFETY DATA SHEET

R-470B (RS-51)

Issue: June 2024 Version 2.3 Date: 4.06.2024

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

1.1. Product identifier

Trade name: **R-470B (RS-51)**

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

Use of the substance/mixture: Refrigerant

Restrictions on use: For professional use only.

1.3. Details of the supplier of the safety data sheet

Name of supplier: GAS SERVEI S.A.
Address: C/ Motors, 151-155 nave nº 9
08038 Barcelona
SPAIN
Telephone: +34 (93) 2231377
Telefax: +34 (93) 2231479
www.gas-servei.com
E-mail address of person responsible for the SDS: gas-servei@gas-servei.com

1.4. Emergency telephone number

Gas-servei: + 34 619373605
(CHEMTREC – Recommended): +(44)-870-8200418

SECTION 2. Hazard identification

2.1. Classification of the substance or mixture

Criteria Regulation EC 1272/2008 (Classification, Labelling and Packaging):

Gases under pressure, Liquefied gas: H280: Contains gas under pressure; may explode if heated.

2.2. Label elements

Hazard pictograms: Symbols: GHS04

Signal word: Warning

Hazard statements: H280: Contains gas under pressure; may explode if heated.

Precautionary statements: Storage:
P410+P403: Protect from sunlight. Store in a well-ventilated place.

Additional labelling: Contains fluorinated greenhouse gases (HFC-125, HFC-227ea, HFC-134a, HFC-32, HFO-1234ze).

2.3. Other hazards

This substance/mixture does not contain components that are considered to be bioaccumulative and persistent toxic (PBT) or very bioaccumulative and very persistent (vPvB) at levels of 0.1% or higher.

Ecological information: The substance/mixture does not contain components that have endocrine disrupting properties based on Article 57(f) of REACH or Commission Delegated Regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

Toxicological information: The substance/mixture does not contain components that have endocrine disrupting properties based on Article 57(f) of REACH or Commission Delegated Regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

Vapours are heavier than air and can cause asphyxiation by reducing oxygen in the air breathed.
Misuse or intentional inhalation abuse can cause death without warning symptoms, due to cardiac effects.
Rapid evaporation of the product may cause freezing.
Can displace oxygen and cause rapid asphyxiation.

SECTION 3. Composition/information on ingredients

3.1. Substances

Not applicable

3.2. Mixtures

Components

Chemical name	Concentration (% by weight)	CAS NO	EC NO	REACH Registration No	Ranking EC Regulation No 1272/2008
1,1,1,1,2,2-Pentafluoroethane (HFC 125)	11,5	354-33-6	206-557-8	01-2119485636-25-XXXX	2.5 Press. Gas H280
1,1,1,2,3,3,3-Heptafluoropropane (HFC 227ea)	7,0	431-89-0	207-079-2	01-2119485489-18-XXXX	2.5 Press. Gas H280
1,1,1,1,2-Tetrafluoroethane (HFC 134a)	3,0	811-97-2	212-377-0	01-2119459374-33-XXXX	2.5 Press. Gas H280
Difluoromethane (HFC 32)	11,5	75-10-5	200-839-4	01-2119471312-47-XXXX	2.2/1 Flam. Gas 1 H221 2.5 Press. Gas H280
Carbon dioxide	10,0	124-38-9	204-696-9	Not applicable	2.5 Press. Gas H280
Trans-1,3,3,3,3-Tetrafluoroprop-1-ene (HFO 1234ze)	57,0	29118-24-9	471-480-0	01-0000019758-54-XXXX	2.5 Press. Gas H280

SECTION 4. First aid masures

4.1. Description of first aid measures

General recommendations: In case of accident or if you feel unwell, seek medical advice immediately.
If symptoms persist or if in doubt, seek medical advice.

Protection of first-aiders: No special precautions are required for lifeguards.

In case of inhalation: If inhaled, remove to fresh air.
If not breathing, give artificial respiration.
If breathing is difficult, give oxygen.
Consult a doctor immediately.

In case of skin contact: Thaw frozen parts with lukewarm water. Do not rub the affected part.
Consult a doctor immediately.

In case of eyes contact: Consult a doctor immediately.

In case of ingestion: Ingestion shall not be considered as a potential route of exposure.

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

May cause cardiac arrhythmia.
Other symptoms potentially related to inhalation misuse or abuse include:

Cardiac sensitisation	Anaesthetic effects
Mild dizziness	Dizziness
Confusion	Lack of coordination
Drowsiness	Unconsciousness

Gas reduces oxygen available for breathing.
Contact with liquid or refrigerated gas may cause cold burns and frostbite.

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

Treatment: Symptomatic treatment and supportive therapy as indicated.
Because of possible heart rhythm disturbances, catecholamines such as epinephrine, which may be used in emergency life support situations, should be used with special caution.

SECTION 5. Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media: Not applicable
Will not burn.

Unsuitable extinguishing media: Not applicable
Will not burn.

5.2. Specific hazards arising from the substance or mixture

Specific hazards during the firefighting: Exposure to combustion products may be a health hazard. Do not inhale fumes produced.
Due to the high vapour pressure, there is a danger that the containers may burst if the temperature rises.

Hazardous combustion products: Hydrogen fluoride
Carbonyl fluoride
Carbon oxides
Fluorinated compounds

5.3. Advice for firefighters

Special protective equipment for firefighters: If necessary, wear self-contained breathing apparatus for fire-fighting.
Use personal protective equipment.

Specific extinguishing methods:	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. Fight the fire from a distance due to the risk of explosion. Use water spray to cool closed containers. Remove undamaged containers from fire area if safe to do so. Evacuate the area.

SECTION 6. Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Evacuate personnel to safe areas.
Use self-contained breathing apparatus and appropriate personal protection during spill removal.
Avoid skin contact with leaking liquid (danger of frostbite).
Ventilate the area.
Follow safe handling advice (see section 7) and personal protective equipment recommendations (see section 8).

6.2. Environmental Precautions

Do not release into the environment.
Prevent the product from entering the soil/subsoil.
Do not allow to enter surface water or sewage system.
Prevent further leakage or spillage safely.
Retain and dispose of contaminated water.
In case of gas leakage or penetration into watercourses, soil or sewage system, inform the responsible authorities.

6.3. Methods and materials for containment and cleaning up

Methods for cleaning up:	Ventilate the area. Wash with plenty of water.
Materials of containment and clean-up:	Appropriate material for collection: absorbent material, organic, sand.

Local or national regulations may apply to the release and disposal of this material, and to the materials and items used in cleaning up the releases. You will need to determine which regulations apply.
Sections 13 and 15 of this safety data sheet provide information on certain local or national requirements.

6.4. Reference to other sections

See also paragraphs 7, 8, 11, 12 and 13.

SECTION 7. Handling and storage

7.1. Precautions for safe handling

Technical measures:	Use equipment rated for the cylinder pressure. Use a backflow prevention device in the pipeline. Close the valve after each use and after emptying.
Local/Total Ventilation:	Use only with adequate ventilation.
Tips for a safe handling:	Avoid contact with skin and eyes. Avoid inhalation of fluid vapours and mists. Do not use empty containers that have not been previously cleaned. Handle in accordance with good industrial hygiene and safety practice, based on the results of the workplace exposure assessment. Wear insulated gloves against cold and face/eye protection. Valve protection caps and valve outlet screw caps must remain in place unless the container is secured with the valve outlet connected to the point of use.

Use a check valve or trap (exhaust, siphon trap interceptor) in the discharge line to prevent dangerous reverse flow into the cylinder.
Before transfer operations, ensure that there are no incompatible materials and/or waste in the containers.
Prevent gas from flowing back into the gas container.
Use a pressure regulator when connecting the cylinder to lower pressure systems or piping.
Close the valve after each use and after emptying.
DO NOT change or force connections.
Prevent water from infiltrating into the gas container.
Never attempt to lift the cylinder by its cap.
Do not drag, slide or roll the cylinders.
Use a suitable hand truck to move the cylinder.
Keep away from heat and sources of ignition.
Transfer of liquid refrigerant from refrigerant containers to and from systems can result in the generation of static electricity. Ensure that proper grounding is in place.
Certain mixtures of HFCs and chlorine may be flammable or reactive under certain conditions. Avoid electrostatic charge build-up.
Pay attention to mitigating the risk of developing high pressures in systems, caused by temperature rise when liquid is trapped between closed valves or when containers have been overfilled.
Prevent spillage, disposal. Minimise release to the environment.

Hygiene measures:

If exposure to chemical is likely during typical use, provide eye flushing systems and safety showers close to the working place.
When using do not eat, drink or smoke.
Wash contaminated clothing before re-use.

7.2. Conditions for safe storage, including any incompatibilities

Technical requirements for storage areas and containers:

Keep cylinders in a well-ventilated place away from fire hazards.
Cylinders must be stored upright and securely fixed to prevent them from falling or being knocked over.
Separate full containers from empty containers.
Do not store near combustible materials.
Avoid areas where salt and other corrosive materials are present.
Store in properly labelled containers.
Keep in a cool, well-ventilated place.
Keep out of direct sunlight.
Store in accordance with particular national regulations.

Advice on common storage:

Do not store with the following types of products:
Self-reactive substances and mixtures
Organic peroxides
Oxidants
Flammable liquids
Flammable solids
Pyrophoric liquids
Pyrophoric solids
Substances and mixtures undergoing spontaneous heating.
Substances and mixtures which, in contact with water, give off flammable gases.
Explosives
Highly toxic mixtures and substances.
Very toxic mixtures and substances.
Mixtures and substances with chronic toxicity

Recommended storage temperature:	< 50 °C
Storage period:	> 10 years
Further information on storage stability:	The product has an indefinite shelf life when properly stored.

7.3. Specific end use(s)

Subject to Member State regulations, applicable uses are Refrigerant.

SECTION 8. Exposure controls/personal protection

8.1. Control parameters

Does not contain substances with occupational exposure limit values.

Derived no-effect level (DNEL) based on Regulation (EC) No. 1907/2006:

Substance name	CAS No.	End Use	Exposure routes	Potential health effects	Value (mg/m^3)
1,1,1,1,2-Tetrafluoroethane	811-97-2	Workers	Inhalation	Long-term - systemic effects	13.936
		Consumers	Inhalation		2.476
Difluoromethane	75-10-5	Workers	Inhalation	Long-term - systemic effects	7.035
		Consumers	Inhalation		750
1,1,1,1,2,2-Pentafluoroethane	354-33-6	Workers	Inhalation	Long-term - systemic effects	16.444
		Consumers	Inhalation		1.753
1,1,1,1,2,3,3,3,3-Heptafluoropropane	431-89-0	Workers	Inhalation	Long-term - systemic effects	61.279
		Consumers	Inhalation		6.533
Trans-1,3,3,3,3-Tetrafluoroprop-1-ene	29118-24-9	Workers	Inhalation	Long-term - systemic effects	3.902
		Consumers	Inhalation		830
Carbon dioxide	124-38-9	No data available			

Predicted no effect concentration (PNEC) based on Regulation (EC) No. 1907/2006:

Substance name	CAS No.	Environmental Compartment	Value
1,1,1,1,2-Tetrafluoroethane	811-97-2	Freshwater	0.1 mg/l
		Seawater	0.01 mg/l
		Discontinued release/use	1 mg/l
		Freshwater sediment (dry weight)	0.75mg/kg
		Wastewater treatment plant	73 mg/l
Difluoromethane	75-10-5	Freshwater	0.142 mg/l
		Discontinued release/use	1.42 mg/l
		Freshwater sediment (dry weight)	0,534 mg/kg

1,1,1,1,2,2-Pentafluoroethane	354-33-6	Freshwater	0.1 mg/l
		Freshwater - Intermittent	1 mg/l
		Freshwater sediment (dry weight)	0,6 mg/kg
1,1,1,1,2,3,3,3,3-Heptafluoropropane	431-89-0	Freshwater	0.1 mg/l
		Discontinued release/use	1 mg/l
		Freshwater sediment (dry weight)	1,3 mg/kg
		Wastewater treatment plant (dry weight)	1.73 mg/kg
Trans-1,3,3,3,3-Tetrafluoroprop-1-ene	29118-24-9	Freshwater	0.1 mg/l
Carbon dioxide	124-38-9	No data available	

8.2. Exposure controls

Occupational exposure controls

Personal protective equipment must comply with current UNE standards: Respiratory protection UNE 136, 140, 149; Protective goggles/eye protection UNE 166; Protective clothing UNE 340, 463, 469, 943-1, 943-2; Protective gloves CEN 374, 511; Protective shoes ISO 20345.
Do not breathe vapours.

Engineering measures

Ensure adequate ventilation, especially in confined areas.
Minimise exposure concentrations in the workplace.

Personal protection

Respiratory protection: If adequate exhaust ventilation is not available or exposure assessment shows exposure outside recommended limits, self-contained breathing apparatus or positive pressure airline and mask.
The equipment shall comply with UNE 14387.

Filter type: Organic gas and low boiling vapour (AX) type.

Skin protection and body: Wash skin after all contact with the product.
Protective shoes should be worn when handling containers.

Hand protection:

Material: Low temperature resistant gloves

Remarks: Choose chemical protective gloves taking into account the quantity and concentration of the hazardous substances to be handled at the workplace.
It is recommended to clarify with the manufacturer of the above-mentioned protective gloves whether they have the necessary resistance for applications with special chemicals.
Wash hands before breaks and after the end of the working day.
The breakthrough time is not determined for the product.
Change gloves often.

Eye protection: Wear the following personal protective equipment:
Chemical resistant goggles should be worn.
Face shield.
The equipment must comply with UNE 166.

SECTION 9. Physical and chemical properties

Appearance:	Liquefied gas
Colour:	Colourless
Odour:	Light, ether like
Odour threshold:	No data available
pH:	No data available
Melting/freezing point:	No data available
Initial boiling point and boiling range:	-61.45 °C (-78.6 °F)
Flash point:	Not applicable
Evaporation rate:	Not applicable
Flammability (solid, gas):	Will not burn
Upper explosive limit /Upper flammability limit:	Upper flammability limit Method: ASTM E681 None.
Lower explosion limit /Lower flammability limit:	Lower flammability limit Method: ASTM E681 None.
Vapour pressure:	17,075 hPa (247.7 psi) (25 °C)
Vapour density:	56.74 kg/m^3 (25 °C)
Relative density:	1,11 (25 °C)
Density:	1.107 g/cm^3 (25 °C) (as a liquid)
Solubility	
Water solubility:	Insoluble
Partition coefficient (noctanol/water):	Not applicable
Auto-ignition temperature:	No data available
Temperature of decomposition:	Not applicable
Viscosity:	Not applicable
Explosive properties:	Non-explosive
Oxidising properties:	The substance or mixture is not classified as an oxidiser.
Particle size:	Not applicable

Other information

Critical temperature:	94.29 °C (201.7 °F)
Critical pressure:	54.66 bar (792.8 psi)

SECTION 10. Stability and reactivity

10.1. Reactivity

Not classified as a reactivity hazard.

10.2. Chemical stability

Stable if used as directed. Follow precautionary advice and avoid incompatible materials and conditions.

10.3. Possibility of hazardous reactions

Certain HFC mixtures may be flammable or reactive under certain conditions.
May react with strong oxidising agents.

10.4. Conditions to avoid

This substance is not flammable in air at temperatures up to 100 °C (212 °F) at atmospheric pressure. However, mixtures of this substance with high concentrations of air at elevated pressure and/or temperature may become combustible in the presence of an ignition source.

This substance can also become combustible in an oxygen-enriched environment (oxygen concentrations higher than those in air). Therefore, if a mixture containing air and this substance, or if this substance is in an oxygen-enriched environment, it can become combustible. This will depend on the relationship between 1) the temperature, 2) the pressure and 3) the proportion of oxygen in the mixture. In general, this substance should not be mixed with air at pressures above atmospheric or at high temperatures; or in an oxygen-enriched environment. For example, this substance should NOT be mixed with air under pressure for leak testing or other purposes.
Avoid heat, flames and sparks.

10.5. Incompatible materials

Strong oxidising agents, alkali and alkaline earth metals, other metals and transition metals, aluminium powder, zinc, etc...

10.6. Hazardous decomposition products

Halogen compounds, hydrogen fluoride by thermal decomposition and hydrolysis.

SECTION 11. Toxicological information

11.1. Information on toxicological effects as defined in Regulation (EC) No 1272/2008

Information on likely routes of exposure: Inhalation
Skin contact
Eye contact

a. Acute toxicity

Not classified based on available information.

Components:

Trans-1,3,3,3-Tetrafluoroprop-1-ene:

Acute inhalation toxicity: LC0 (Rat): > 207,000 ppm
Exposure time: 4 h
Test atmosfhere: gas
Method: OECD 403 Test Guidelines

1,1,1,2,2-Pentafluoroethane:

Acute inhalation toxicity: LC50 (Rat): > 3,927,000mg/m^3 (800,000 ppm)
Exposure time: 4 h
Test atmosfhere: gas
Method: OECD 403 Test Guidelines

No observed Adverse Effect Concentration (Dog): 368,159 mg/m^3
Remarks: Cardiac sensitisation
Threshold limit for cardiac sensitisation (Dog): > 368,159 mg/m^3.
Remarks: Cardiac sensitisation

Difluoromethane:

Acute oral toxicity: Assessment: The substance or mixture does not exhibit acute oral toxicity.

Acute Inhalation Toxicity: LC50 (Rat): > 520,000 ppm
Exposure time: 4 h
Test atmosfhere: gas
Method: OECD 403 Test Guidelines

No observed Adverse Effect Concentration (Dog): 350,000 ppm
Test atmosfhere: gas
Remarks: Cardiac sensitisation
Low observed Adverse Effect Concentration (Dog) : > 350,000 ppm
Test atmosfhere: gas
Remarks: Cardiac sensitisation

Cardiac sensitisation threshold limit (Dog): > 735,000 mg/m^3.
Test atmosfhere: gas
Remarks: Cardiac sensitisation

1,1,1,2-Tetrafluoroethane:

Acute oral toxicity:	Assessment: The substance or mixture does not exhibit acute oral toxicity.
Acute inhalation toxicity:	LC50 (Rat): > 567,000 ppm Exposure time: 4 h Test atmosfhere: gas Method: OECD 403 Test Guidelines No Observed Adverse Effect Concentration (Dog): 40,000 ppm Test atmosfhere: gas Remarks: Cardiac sensitisation Low Observed Adverse Effect Concentration (Dog): 80,000 ppm Test atmosfhere: gas Symptoms: May cause cardiac arrhythmia. Threshold limit for cardiac sensitisation (Dog): 334,000 mg/m³. Test atmosfhere: gas Symptoms: May cause cardiac arrhythmia.
Acute dermal toxicity:	Assessment: The substance or mixture does not exhibit any acute dermal toxicity.

1,1,1,2,3,3,3-Heptafluoropropane:

Acute oral toxicity:	Assessment: The substance or mixture does not exhibit acute oral toxicity.
Acute Inhalation Toxicity:	LC50 (Rat): > 788,696 ppm Exposure time: 4 h Test atmosfhere: gas Method: OECD 403 Test Guidelines No Observed Adverse Effect Concentration (Dog): 35,000 ppm Test atmosfhere: gas Low Observed Adverse Effect Concentration (Dog): 90,000 ppm Test atmosfhere: gas Cardiac sensitisation threshold limit (Dog): 625,877 mg/m³. Test atmosfhere: gas
Acute dermal toxicity:	Assessment: The substance or mixture does not exhibit any acute dermal toxicity.

b. Skin corrosion/irritation

Not classified based on available information.

Components:

Trans-1,3,3,3-Tetrafluoroprop-1-ene:

Species: Rabbit
Method: OECD 404 Test Guidelines
Result: Does not irritate the skin.

1,1,1,2,2-Pentafluoroethane:

Result: Does not irritate the skin.

Difluoromethane:

Result: Does not irritate the skin.

1,1,1,2-Tetrafluoroethane:

Result: Does not irritate the skin.

1,1,1,2,3,3,3-Heptafluoropropane:

Result: Does not irritate the skin.

c. Serious eye damage/irritation

Not classified based on available information.

Components:

Trans-1,3,3,3-Tetrafluoroprop-1-ene:

No data availableThe study is not technically feasible.

1,1,1,2,2-Pentafluoroethane:

Not tested on animals.

Classification: Not classified as irritant.
Result: Non-irritating to the eyes.

Difluoromethane:

Result: Non-irritating to the eyes.

1,1,1,2-Tetrafluoroethane:

Species: Rabbit
Classification: Not classified as irritant.
Result: Non-irritating to the eyes.

1,1,1,2,3,3,3-Heptafluoropropane:

Result: Non-irritating to the eyes.

d. Respiratory or skin sensitisation

Skin sensitisation

Not classified based on available information.

Respiratory sensitisation

Not classified based on available information.

Components:

Trans-1,3,3,3-Tetrafluoroprop-1-ene:

Species: Human
Result: Does not cause skin sensitisation.

1,1,1,2,2-Pentafluoroethane:

Not tested on animals.

Classification: Not a skin sensitiser.
Result: Does not cause skin sensitisation.

No reports of respiratory sensitisation in humans.

1,1,1,2-Tetrafluoroethane:

Routes of exposure: Skin contact
Result: Negative
Routes of exposure: Inhalation
Species: Rat
Result: Negative
Routes of exposure: Inhalation
Species: Human
Result: Negative

Difluoromethane:

Routes of exposure: Skin contact
Result: Negative

1,1,1,2,3,3,3-Heptafluoropropane:

Routes of exposure: Skin contact
Result: Negative

e.Germ cell mutagenicity

Not classified based on available information.

Components:

Trans-1,3,3,3-Tetrafluoroprop-1-ene:

In vitro genotoxicity:

Test type: Bacterial reverse mutation assay (Ames test).
Method: OECD Test Guidelines 471
Result: Negative
Test Type: In vitro chromosomal aberration test
Method: OECD Test Guidelines 473
Result: Negative

Genotoxicity in vivo:

Test type: Mammalian bone marrow mutagenesis, chromosome analysis (in vivo cytogenetic assay).
Species: Mouse
Cell type: Micronuclei
Route of application: inhalation (gas)
Method: OECD Test Guidelines 474
Result: Negative

1,1,1,2,2-Pentafluoroethane:

In vitro genotoxicity:	Test type: Bacterial reverse mutation assay (Ames test). Method: OECD Test Guidelines 471 Result: Negative Remarks: Based on data from similar materials.
	Type of test: In vitro chromosome aberration test Method: OECD Test Guidelines 473 Result: Negative
Genotoxicity in vivo:	Test type: Mammalian erythrocyte micronucleus test (in vivo cytogenetic assay). Species: Mouse Route of application: inhalation (gas) Method: OECD 474 Test Guidelines Result: Negative

Difluoromethane:

In vitro genotoxicity:	Test Type: Bacterial Reverse Mutation Assay (Ames Test) Method: OECD 471 Test guidelines Result: Negative
	Test Type: In vitro chromosomal aberration test Method: OECD Test Guidelines 473 Result: Negative
Genotoxicity in vivo:	Test Type: Mammalian erythrocyte micronucleus test (in vivo cytogenetic assay) Species: Mouse Route of application: inhalation (gas) Method: OECD Test Guidelines 474 Result: Negative

1,1,1,2-Tetrafluoroethane:

In vitro genotoxicity:	Test type: Bacterial reverse mutation assay (Ames test). Method: OECD Test Guidelines 471 Result: Negative Test Type: In vitro chromosomal aberration test Method: OECD Test Guidelines 473 Result: Negative
Genotoxicity in vivo:	Test type: Mammalian erythrocyte micronucleus test (in vivo cytogenetic assay). Species: Mouse Route of application: inhalation (gas) Method: OECD Test Guidelines 474 Result: Negative
	Test type: Unscheduled DNA synthesis test (UDS) with cells from mammalian liver in vivo. Species: Rat Route of application: inhalation (gas) Method: OECD Test Guidelines 486 Result: Negative

1,1,1,2,3,3,3-Heptafluoropropane:

In vitro genotoxicity:	Test Type: Bacterial reverse mutation test (Ames test) Method: OECD Test Guidelines 471 Result: Negative
	Type of test: In vitro chromosomal aberration test. Method: OECD Test Guidelines 473 Result: Negative
	Test type: In vivo mammalian cell gene mutation test Method: OECD Test Guidelines 476 Result: Negative

Genotoxicity in vivo:	Test type: Mammalian erythrocyte micronucleus test (in vivo cytogenetic assay). Species: Mouse Route of application: inhalation (gas) Method: OECD 474 Test Guidelines Result: Negative
Mutagenicity in germ cells:	Assessment: The weight of evidence does not support classification as a germ cell mutagen.

f. Carcinogenicity

Not classified based on available information.

g. Reproductive toxicity

Not classified based on available information.

Components:

Trans-1,3,3,3-Tetrafluoroprop-1-ene:

Effects on fertility:	Type of test: Two-generation reproductive toxicity study. Species: Rat Route of application: Inhalation Method: OECD 416 Test Guidelines Parental general toxicity: NOEL: > 20,000 ppm General toxicity F1: NOEL: > 20,000 ppm
Effects on foetal development:	Species: Rat Route of application: Inhalation Method: OECD 414 Test Guidelines General Maternal Toxicity: NOEC: 15,000 ppm Developmental toxicity: NOAEC: 15,000 ppm

1,1,1,2,2-Pentafluoroethane:

Effects on fertility:	Type of test: One-generation reproductive toxicity study. Species: Rat Route of application: inhalation (vapour) Result: Negative Remarks: Based on data from similar materials.
Effects on foetal development:	Type of test: Embryonic and foetal development. Species: Rat Route of application: inhalation (gas) Method: OECD 414 Test Guidelines Result: Negative

Difluoromethane:

Effects on fertility:	Species: Mouse Route of application: Inhalation Result: Negative Remarks: Based on data from similar materials.
Fetal developmental effects:	Type of test: Repeated dose toxicity study combined with reproductive/ developmental toxicity screening test. Species: Rat Route of application: inhalation (gas) Method: OECD 414 Test Guidelines Result: Negative
	Type of test: Repeated dose toxicity study combined with reproductive/ developmental toxicity screening test. Species: Rabbit Route of application: inhalation (gas) Method: OECD 414 Test Guidelines Result: Negative

1,1,1,2-Tetrafluoroethane:

Effects on fertility:	Species: Mouse Route of application: Inhalation Result: Negative
Foetal developmental effects:	Type of test: Repeated dose toxicity study combined with reproductive/ developmental toxicity screening test. Species: Rabbit Route of application: inhalation (gas) Method: OECD Test Guidelines OECD 414 Result: Negative

1,1,1,2,3,3,3-Heptafluoropropane:

Effects on fertility:	Type of test: One-generation reproductive toxicity study. Species: Rat Route of application: inhalation (vapour) Method: OECD 415 Test Guidelines Result: Negative Remarks: Based on data from similar materials.
Effects on foetal development:	Type of test: Prenatal developmental toxicity (teratogenicity) study. Species: Rat Route of application: inhalation (gas) Method: OECD 414 Test Guidelines Result: Negative Type of test: Prenatal developmental toxicity (teratogenicity) study. Species: Rabbit Route of application: inhalation (gas) Method: OECD 414 Test Guidelines Result: Negative
Reproductive toxicity:	Assessment: The weight of evidence does not support classification for reproductive toxicity.

h. Specific target organ toxicity (STOT) - single exposure

Not classified based on available information.

Components:

Trans-1,3,3,3-Tetrafluoroprop-1-ene:

Not classified based on available information.

1,1,1,2,2-Pentafluoroethane:

Not classified based on available information.

Difluoromethane:

Routes of exposure: inhalation (gas)
Assessment: No significant health effects were observed in animals at concentrations of 20,000 ppmV/4h or less.

1,1,1,2-Tetrafluoroethane:

Routes of exposure: inhalation (gas)
Assessment: No significant health effects were observed in animals at concentrations of 20,000 ppmV/4h or less.

1,1,1,2,3,3,3-Heptafluoropropane:

Routes of exposure: inhalation (gas)
Assessment: No significant health effects were observed in animals at concentrations of 20,000 ppmV/4h or less.

i. Specific target organ toxicity (STOT) - repeated exposures

Not classified based on available information.

Components:

Trans-1,3,3,3-Tetrafluoroprop-1-ene:

Not classified based on available information.

1,1,1,2,2-Pentafluoroethane:

Routes of exposure: inhalation (gas)
Assessment: No significant health effects were observed in animals at concentrations of 250 ppmV/6h/d or less.

Difluoromethane:

Routes of exposure: inhalation (gas)
Assessment: No significant health effects were observed in animals at concentrations of 250 ppmV/6h/d or less.

1,1,1,2-Tetrafluoroethane:

Routes of exposure: inhalation (gas)
Assessment: No significant health effects were observed in animals at concentrations of 250 ppmV/6h/d or less.

1,1,1,2,3,3,3-Heptafluoropropane:

Routes of exposure: inhalation (gas)
Assessment: No significant health effects were observed in animals at concentrations of 250 ppmV/6h/d or less.

j. Aspiration toxicity

Not classified based on available information.

11.2. Information concerning other hazards

a.Endocrine disrupting properties

Assessment: The substance/mixture does not contain components that have endocrine disrupting properties based on Article 57(f) of REACH or Commission Delegated Regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1 % or higher.

SECTION 12. Ecological information

12.1. Toxicity

Components:

Trans-1,3,3,3-Tetrafluoroprop-1-ene:

Toxicity to fish: LC0 (Cyprinius carpio (Carp): > 117 mg/l
Exposure time: 96 h
Method: OECD Test Guidelines 203

Toxicity to daphnia and other aquatic invertebrates: EC50 (Daphnia magna (large sea flea): > 160 mg/l
Exposure time: 48 h
Method: OECD Test Guidelines 202

Toxicity to algae/aquatic plants: ErC50 (green algae): > 170 mg/l
Exposure time: 72 h
Method: OECD Test Guideline 201

NOEC (green algae): > 1 mg/l
Exposure time: 72 h
Method: OECD Test Guideline 201

1,1,1,2,2-Pentafluoroethane:

Toxicity to fish: LC50 (Oncorhynchus mykiss (rainbow trout): > 100 mg/l
Exposure time: 96 h
Remarks: Based on data from similar materials

Toxicity to daphnia and other aquatic invertebrates: EC50 (Daphnia magna (large sea flea): > 100 mg/l
Exposure time: 48 h
Remarks: Based on data from similar materials

Toxicity to algae/aquatic plants:	ErC50 (Pseudokirchneriella subcapitata (green algae): > 100 mg/l Exposure time: 72 h Method: OECD Test Guideline 201 Remarks: Based on data from similar materials
	NOEC (Pseudokirchneriella subcapitata (green algae): > 1 mg/l Exposure time: 72 h Method: OECD Test Guideline 201 Remarks: Based on data from similar materials

Difluoromethane:

Toxicity to fish:	LC50 (Fish): 1.51 mg/l Exposure time: 96 h Method: ECOSAR (Ecological Structure Activity Relationships)
Toxicity to daphnia and other aquatic invertebrates:	EC50 (Daphnia (Daphnia): 652 mg/l Exposure time: 48 h Method: ECOSAR (Ecological Structure Activity Relationships)
Toxicity to algae/aquatic plants:	EC50 (green algae): 142 mg/l Exposure time: 96 h Method: ECOSAR (Ecological Structure Activity Relationships)

1,1,1,2-Tetrafluoroethane:

Toxicity to fish:	LC50 (Oncorhynchus mykiss (rainbow trout): 450 mg/l Exposure time: 96 h Method: Standard (EC) No 440/2008, Annex, C.1
Toxicity to daphnia and other aquatic invertebrates:	EC50 (Daphnia magna (large sea flea): 980 mg/l Exposure time: 48 h Method: Standard (EC) No 440/2008, annex, C.2
Toxicity to algae/aquatic plants:	ErC50 (green algae): > 100 mg/l Exposure time: 96 h Remarks: Based on data from similar materials.

1,1,1,2,3,3,3-Heptafluoropropane:

Toxicity to fish:	LC50 (Fish): > 100 mg/l Exposure time: 96 h Method: OECD Test Guidelines 203 Remarks: Based on data from similar materials
Toxicity to daphnia and other aquatic invertebrates:	EC50 (Daphnia magna (large sea flea): > 100 mg/l Exposure time: 48 h Method: OECD Test Guideline 202 Remarks: Based on data from similar materials
Toxicity to algae/aquatic plants:	EC50 (Pseudokirchneriella subcapitata (green algae): > 114 mg/l Exposure time: 72 h Method: OECD Test Guideline 201 Remarks: Based on data from similar materials. NOEC (Pseudokirchneriella subcapitata (green algae): 13.2 mg/l Exposure time: 3 d Method: OECD Test Guideline 201 Remarks: Based on data from similar materials

12.2. Persistence and degradability

Components:

Trans-1,3,3,3-Tetrafluoroprop-1-ene:

Biodegradability:	Result: Not readily biodegradable.

1,1,1,2,2-Pentafluoroethane:

Biodegradability: Result: Not readily biodegradable.
Biodegradation: 5 %
Exposure time: 28 d
Method: OECD Test Guidelines 301D

Difluoromethane:

Biodegradability: Result: Not readily biodegradable.
Method: OECD Test Guidelines 301D

1,1,1,2-Tetrafluoroethane:

Biodegradability: Result: Not readily biodegradable.
Method: OECD Test Guidelines 301D

1,1,1,2,3,3,3-Heptafluoropropane:

Biodegradability: Result: Not readily biodegradable.
Method: OECD Test Guidelines 301D

12.3. Bioaccumulative potential

Components:

Trans-1,3,3,3-Tetrafluoroprop-1-ene:

Bioaccumulation: Remarks: Bioaccumulation is unlikely.
Partition coefficient
(n-octanol/water): log Pow: ≤ 4

1,1,1,2,2-Pentafluoroethane:

Partition coefficient
(n-octanol/water): Pow: 1.48
Method: OECD 107 Test Guidelines

Difluoromethane:

Partition coefficient
(n-octanol/water): log Pow: 0.714

1,1,1,2-Tetrafluoroethane:

Bioaccumulation : Remarks: Bioaccumulation is unlikely.
Partition coefficient
(n-octanol/water): log Pow: 1.06

1,1,1,2,3,3,3-Heptafluoropropane:

Partition coefficient
(n-octanol/water): log Pow: 2.289

12.4. Mobility in soil

No data available.

12.5. Results of PBT and vPvBm assessment

Assessment: This mixture contains no components considered to be either bioaccumulative, persistent and toxic (PBT) or very bioaccumulative and very persistent (vPvB) at levels of 0.1% or higher.

12.6. Endocrine disrupting properties

Assessment: The mixture does not contain components considered to have endocrine disrupting properties acording to Article 57(f) of REACH or Commission Delegated Regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

12.7. Other adverse effects

Global Warming Potential

Regulation (EU) 2024/573 on fluorinated greenhouse gases

Product:

100-year global warming potentia: 749

SECTION 13. Disposal considerations

13.1. Waste treatment methods

Product: Dispose of in accordance with local regulations. However, this product should be recycled or reclaimed whenever possible.

Contaminated packaging: Empty containers should be returned to the supplier. Operate in accordance with local and national regulations.

13.2. Other information

Provisions relating to waste:

Directive 2006/12/EC; Directive 2008/98/EC
EC Regulation No. 1013/2006

Personal protective equipment, see section 8.

SECTION 14. Transport information

14.1. UN number

DNA:	1078
ADR:	1078
RID:	1078
IATA:	1078
IMDG:	1078

14.2. United Nations proper shipping name

ADR/ADN/RID: REFRIGERANT GAS, N.O.S. R-470B (RS-51) (1,1,1,1,2-TRETRAFLUOROETHANE/ PENTAFLUOROETHANE/ DIFLUOROMETHANE/ 1,1,1,2,3,3,3-HEPTAFLUOROPROPANE/ TRANS-1,3,3,3,3- TETRAFLUOROPROP-1-ENE/ CARBON DIOXIDE)

IMDG: REFRIGERANT GAS, N.O.S. R-470B (RS-51) (1,1,1,1,2-TRETRAFLUOROETHANE/ PENTAFLUOROETHANE/ DIFLUOROMETHANE/ 1,1,1,2,3,3,3-HEPTAFLUOROPROPANE/ TRANS-1,3,3,3,3- TETRAFLUOROPROP-1-ENE/ CARBON DIOXIDE)

IATA: Refrigerant gas, N.O.S. R-470B (RS-51) (1,1,1,1,2-Tetrafluoroethane/ Pentafluoroethane/ Difluoromethane/ 1,1,1,2,3,3,3-Heptafluoropropane/ Trans-1,3,3,3,3,3-Tetrafluoroprop-1-ene/ Carbon dioxide)

14.3. Transport hazard class(es)

	Class	Subsidiary risks	Classification code	Hazard identification no.
ADR:	2	2.2	2A	20
DNA:	2	2.2	2A	20
RID:	2	2.2, (13)	2A	20
IMDG:	2.2			
IATA:	2.2			

14.4. Packing group

Not assigned by regulation.

Labels

ADR/ADN/RID/IMDG: 2.2

IMDG / IATA:	Non-flammable. Non-toxic Gas
Packaging instruction	
IATA (Cargo):	200
IATA (Passenger):	200
Tunnel Restrictions Code	
ADR:	(C/E)
EmS Code	
IMDG:	F-C, S-V

14.5. Environmental hazards

No : (ADR/ADN/RID/IMDG)

14.6. Special precautions for users

The transport classification(s) provided herein are for informational purposes only, and solely based upon the properties of the unpackaged material as it is described within this Safety Data Sheet. Transportation classifications may vary by mode of transportation, package sizes, and variations in regional or country regulations.

14.7. Maritime transport in bulk according to IMO instruments

Not applicable for product as suplied.

SECTION 15. Regulatory information

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

REACH-Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles (Annex XVII):
Not applicable

REACH-Candidate list of substances of particular concern for Authorisation (Article 59):
This product does not contain substances of very high concern above the relevant legal concentration limit (≥ 0.1 % w/w).

Regulation (EC) 1005/2009 on substances that deplete the ozone layer:
Not applicable

Regulation (EU) 2019/1021 on persistent organic pollutants (recast):
Not applicable

Regulation (EC) 649/2012 of the European Parliament and of the Council concerning the export and import of dangerous chemicals:
Not applicable

REACH-List of substances subject to authorisation (Annex XIV):
Not applicable

Seveso III: Directive 2012/18/EU of the European Parliament and of the Council on the control of major-accident hazards involving dangerous substances:
Not applicable

Regulation (EC) 2024/573 of the European Parliament and of the Council on certain fluorinated greenhouse gases:
Fluorinated greenhouse gas R-470B (RS-51) must be supplied in returnable containers (drums/cylinders). The container contains fluorinated greenhouse gases regulated under the Kyoto Protocol. Fluorinated greenhouse gases in containers or cylinders may not be vented to the atmosphere.

15.2. Chemical safety assessment

A chemical safety assessment has not been conducted for this product.

SECTION 16. Other information

This sheet cancels and replaces all previous editions.

Date of issue : June 4, 2024
Version: 2.3

This Safety Data Sheet has been prepared in accordance with:
Regulation (EC) No 1907/2006 and its subsequent amendments: Regulation (EU) No 2015/830 and Regulation (EU) No 2020/878.

Text of phrases used in section 3:

H221: Flammable gas.
H280: Contains gas under pressure; may explode if heated.

This document has been prepared by a competent person who has received appropriate training.
The information given here is based on our knowledge up to the date stated above. It refers exclusively to the product indicated and does not constitute a guarantee of particular qualities.

The user must satisfy himself as to the suitability and accuracy of such information in relation to his specific use of the product.

The information is believed to be correct, but is not exhaustive and shall be used only as guidance, which is based on current knowledge of the chemical or mixture and is applicable to the appropriate safety precautions for the product.
The list of risks, legal, regulatory and administrative texts are not exhaustive, and it is the sole responsibility of the recipient or user of the product to refer to the official regulations for storage, handling and use of these products.

Glossary of abbreviations

ADN: European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways.
ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road.
CMR: Carcinogenic, mutagenic or toxic for reproduction.
DIN: Standard of the German standardisation institute.
ECx: Concentration associated with x% response.
EmS: Emergency procedure.
GHS: Globally Harmonised System of Classification and Labelling of Chemicals.
IATA: International Air Transport Association.
IBC: International Code for the Construction and Equipment of Ships Carrying Goods.
Hazardous Chemicals in bulk.
IMDG: International Maritime Dangerous Goods Code.
LC50: Lethal concentration in 50% of a test population.
NOAEL: No Observed Adverse Effect Level.
NOEL: No Observable Effect Level.
NOELR: No Observable Effect Loading Ratio.
IMO: International Maritime Organisation.
RID: Regulations concerning the International Carriage of Dangerous Goods by Rail (COTIF).
UN: United Nations.
ELV: Environmental Limit Values.
UNRTDG: United Nations Recommendations on the Transport of Dangerous Goods.