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

1.1 Product identifier

Trade name

R-448A

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

Relevant identified uses of the substance or mixture
Industrial Use
Professional use
Refrigerant

Uses advised against
No data available.

1.3 Details of the supplier of the safety data sheet

Address
TEGA - Technische Gase und Gasetechnik GmbH
Werner-von-Siemens-Straße 18
97076 Würzburg

Telephone no. +49 931 2093-220
Fax no. +49 931 2093-180
e-mail kaeltemittel@tega.de

Advice on Safety Data Sheet
sdb_info@umco.de

1.4 Emergency telephone number

For medical advice (in German and English):
+49 (0)551 192 40 (Giftinformationszentrum Nord)

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification in accordance with Regulation (EC) No 1272/2008 (CLP)
Press. Gas liq.; H280

Classification information
This product is assessed and classified using the methods and criteria below referred to in Article 9 of Regulation (EC) n° 1272/2008:
Physical hazards: determined through assessment data based on the methods or standards referred to in part 2 of Annex I to CLP
Health hazards and environmental hazards: determined through toxicological and ecotoxicological assessment data based on the methods or standards referred to in Part 3, 4 and 5 of Annex I to CLP.

2.2 Label elements

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

Hazard pictograms

GHS04

Signal word
Warning

Hazard statement(s)
H280 Contains gas under pressure; may explode if heated.

Precautionary statement(s)
P410+P403 Protect from sunlight. Store in a well-ventilated place.

Supplemental label elements
Contains fluorinated greenhouse gases.

2.3 Other hazards
High vapour concentrations can cause headaches, dizziness, drowsiness, nausea and even unconsciousness. May cause arrhythmia.

PBT assessment
The product is not considered to be a PBT.

vPvB assessment
The product is not considered to be a vPvB.

SECTION 3: Composition/information on ingredients

3.1 Substances
Not applicable. The product is not a substance.

3.2 Mixtures
Hazardous ingredients

No	Substance name		Additional information	
	CAS / EC / Index / REACH no	Classification (EC) 1272/2008 (CLP)	Concentration	%
1	**pentafluoroethane**			
	354-33-6 206-557-8 - 01-2119485636-25	Press. Gas liq.; H280	>= 25,00 - < 50,00	Vol%
2	**difluoromethane**			
	75-10-5 200-839-4 - 01-2119471312-47	Flam. Gas 1A; H220 Press. Gas liq.; H280	>= 25,00 - < 50,00	Vol%
3	**norflurane**			
	811-97-2 212-377-0 - 01-2119459374-33	Press. Gas liq.; H280	>= 10,00 - < 25,00	Vol%
4	**2,3,3,3-tetrafluoroprop-1-ene**			
	754-12-1 468-710-7 - 01-0000019665-61	Flam. Gas 1A; H220 Press. Gas liq.; H280	>= 10,00 - < 25,00	Vol%
5	**1,3,3,3-Tetrafluoropropene, (1E)-**			
	1645-83-6 471-480-0 - 01-0000019758-54	Press. Gas liq.; H280	>= 5,00 - < 10,00	Vol%

Full text of H- and EUH-phrases, if not already mentioned in section 2.2: see section 16.

SECTION 4: First aid measures

4.1 Description of first aid measures
General information
In high concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation. Remove affected person from danger area, lay him down. Seek medical advice immediately.

After inhalation

Remove affected persons from dangerous area by observing suitable respiratory protection measures. Ensure supply of fresh air. Irregular breathing/no breathing: artificial respiration. Call a doctor immediately.

After skin contact
In case of contact with skin wash off immediately with soap and water. Rinse with much water in case of frostbites. Remove chlothes only after unfreezing. Cover wounds with sterile dressing. Call a doctor immediately.

After eye contact
Remove contact lenses. Rinse eye thoroughly under running water keeping eyelids wide open and protecting the unaffected eye (at least 10 to 15 minutes). Seek medical assistance.

After ingestion
Rinse the mouth thoroughly with water. Do not induce vomiting. Never give anything by mouth to an unconscious person.

4.2 Most important symptoms and effects, both acute and delayed

Symptoms
The following symptoms may occur: respiratory arrest. Drowsiness; Unconsciousness; cardiac arrhytmia; Dizziness; headaches; Contact with liquefied gas can cause damage (frostbite) due to rapid evaporative cooling.

4.3 Indication of any immediate medical attention and special treatment needed
Treat symptomatically. Do not administer adrenaline or derivatives.

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Extinguishing measures to suit surroundings. recommended: alcohol resistant foam, CO2, powders, water spray/mist

Unsuitable extinguishing media
High power water jet

5.2 Special hazards arising from the substance or mixture
In the event of fire, the following can be released: Carbon monoxide and carbon dioxide; Hydrogen fluoride (HF); Carbonyl fluoride; fluorine compounds; Liquefied gas: Spilled liquid can cause cold burns. This gas is heavier than air and may accumulate in low areas. The product is not flammable.

5.3 Advice for firefighters
Use self-contained breathing apparatus. Wear full protective suit. Containers close to fire should be transferred to a safe place. Cool closed containers exposed to fire with water. Pressure increase, bursting and explosion hazard during heating. Fire residues and contaminated firefighting water must be disposed of in accordance with the local regulations.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

For non-emergency personnel
Refer to protective measures listed in sections 7 and 8. Provide good room ventilation even at ground level (vapours are heavier than air). Do not breathe gas. Keep away from ignition sources. Use personal protective clothing. Cordon and mark contaminated area. Remove persons to safety.

For emergency responders
No data available. Personal protective equipment (PPE) - see Section 8.

6.2 Environmental precautions
Avoid release in the environment. Suppress gases/vapours/mists with water spray jet.

6.3 Methods and material for containment and cleaning up
Ensure adequate ventilation. Dispose of absorbed material in accordance with the regulations.

6.4 Reference to other sections
Information regarding safe handling, see section 7. Information regarding personal protective measures, see section 8. Information regarding waste disposal, see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling
Only qualified and trained persons are authorised to handle. Provide good ventilation at the work area (local exhaust ventilation, if necessary). To be used only according to instructions for use. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose containers heat or sources of ignition. In case of accidental release: danger due to low temperature of the liquid product. The product should only be used in areas from which all naked lights and other sources of ignition have been excluded. Prevent the creation of flammable or explosive concentrations of vapour in air and avoid vapour concentration higher than the occupational exposure limits. Pressurized container: protect from sunlight and do not expose to temperatures exceeding 50 °C. Do not pierce or burn, even after use. Comply with the health and safety at work laws.

General protective and hygiene measures
Wash hands before breaks and after work. Do not inhale gases. Do not eat, drink or smoke during work time. Keep away from foodstuffs and beverages. Have emergency shower available.

Advice on protection against fire and explosion
The product is not combustible. Isolate from sources of heat, sparks and open flame. Take precautionary measures against electrostatic loading (earthing necessary during loading operations). Electrical equipment should be protected to the appropriate standard. Can form a combustible mixture with air at superatmospheric pressure.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures and storage conditions
Keep container tightly closed in a cool, well-ventilated place, open and handle carefully. Protect from heat and direct sunlight.

Recommended storage temperature

Value	<	50	°C

Requirements for storage rooms and vessels
Containers which are opened must be carefully closed and kept upright to prevent leakage. Always keep in containers of same material as the original.

Incompatible products
Substances to be avoided, see section 10.

Stoarge Class according TRGS 510

2A	Gases (except aerosol dispensers and lighters)

7.3 Specific end use(s)
No data available.

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Occupational exposure limit values

No	Substance name	CAS no.		EC no.	
1	**norflurane**	**811-97-2**		**212-377-0**	
	TRGS 900				
	Norfluran				
	WEL long-term (8-hr TWA reference period)	4200	mg/m³	1000	ml/m³
	Ceiling Limit Notes	8(II) Y			
2	**2,3,3,3-tetrafluoroprop-1-ene**	**754-12-1**		**468-710-7**	
	TRGS 900				
	2,3,3,3-Tetrafluorpropen				
	WEL long-term (8-hr TWA reference period)	950	mg/m³	200	ml/m³
	Ceiling Limit Notes	2 (II) Y			
3	**1,3,3,3-Tetrafluoropropene, (1E)-**	**1645-83-6**		**471-480-0**	

	TRGS 900				
	trans-1,3,3,3-Tetrafluorpropen				
	WEL long-term (8-hr TWA reference period)	4700	mg/m³	1000	ml/m³
	Ceiling Limit Notes	2 (II) Y			

Biological limit values

No	Substance name		
1	**pentafluoroethane**		
	TRGS 903		
	Fluorwasserstoff und anorganische Fluorverbindungen (Fluoride)		
	parameter	Fluorid	
	Value	7,0	mg/g Kreatinin
	sample material Sampling moment	U b	
	TRGS 903		
	Fluorwasserstoff und anorganische Fluorverbindungen (Fluoride)		
	parameter	Fluorid	
	Value	4,0	mg/g Kreatinin
	sample material Sampling moment	U d	

DNEL, DMEL and PNEC values

DNEL values (worker)

No	Substance name			CAS / EC no	
	Route of exposure	**Exposure time**	**Effect**	**Value**	
1	**pentafluoroethane**			**354-33-6 206-557-8**	
	inhalative	Long term (chronic)	systemic	16444	mg/m³
2	**difluoromethane**			**75-10-5 200-839-4**	
	inhalative	Long term (chronic)	systemic	7035	mg/m³
3	**norflurane**			**811-97-2 212-377-0**	
	inhalative	Long term (chronic)	systemic	13936	mg/m³
4	**2,3,3,3-tetrafluoroprop-1-ene**			**754-12-1 468-710-7**	
	inhalative	Long term (chronic)	systemic	950	mg/m³
5	**1,3,3,3-Tetrafluoropropene, (1E)-**			**1645-83-6 471-480-0**	
	inhalative	Long term (chronic)	systemic	3902	mg/m³

DNEL value (consumer)

No	Substance name			CAS / EC no	
	Route of exposure	**Exposure time**	**Effect**	**Value**	
1	**pentafluoroethane**			**354-33-6 206-557-8**	
	inhalative	Long term (chronic)	systemic	1753	mg/m³
2	**difluoromethane**			**75-10-5 200-839-4**	
	inhalative	Long term (chronic)	systemic	750	mg/m³
3	**norflurane**			**811-97-2 212-377-0**	
	inhalative	Long term (chronic)	systemic	2476	mg/m³
4	**2,3,3,3-tetrafluoroprop-1-ene**			**754-12-1 468-710-7**	
	inhalative	Long term (chronic)	systemic	186400	mg/m³

5	**1,3,3,3-Tetrafluoropropene, (1E)-**			**1645-83-6 471-480-0**	
	inhalative	Long term (chronic)	systemic	830	mg/m³

PNEC values

No	Substance name		CAS / EC no	
	ecological compartment	**Type**	**Value**	
1	**pentafluoroethane**		**354-33-6 206-557-8**	
	water	fresh water	0,1	mg/L
	water	fresh water sediment	0,6	mg/kg dry weight
2	**difluoromethane**		**75-10-5 200-839-4**	
	water	fresh water	0,142	mg/L
	water	Aqua intermittent	1,42	mg/L
	water	fresh water sediment	0,543	mg/kg dry weight
3	**norflurane**		**811-97-2 212-377-0**	
	water	fresh water	0,1	mg/L
	water	marine water	0,01	mg/L
	water	fresh water sediment	0,75	mg/kg dry weight
	sewage treatment plant	-	73	mg/L
4	**2,3,3,3-tetrafluoroprop-1-ene**		**754-12-1 468-710-7**	
	water	fresh water	0,1	mg/L
	water	Aqua intermittent	1	mg/L
5	**1,3,3,3-Tetrafluoropropene, (1E)-**		**1645-83-6 471-480-0**	
	water	fresh water	0,1	mg/L
	water	Aqua intermittent	1	mg/L

8.2 Exposure controls

Appropriate engineering controls
Ensure adequate ventilation, local exhaust at the work station if necessary. If these are not sufficient to maintain concentrations of particulates and solvent vapour below the OEL, suitable respiratory protection must be worn.

Personal protective equipment

Respiratory protection
Self-contained breathing apparatus. In case of insufficient ventilation or long-term effect use breathing apparatus. Danger of suffocation due to high concentrations in breathing air.

Eye / face protection
Tightly fitting safety glasses (EN 166).

Hand protection
Low-temperature-resistant gloves (EN 511). Sufficient protection is given wearing suitable protective gloves checked according to i.e. EN 374, in the event of risk of skin contact with the product. Before use, the protective gloves should be tested in any case for its specific work-station suitability (i.e. mechanical resistance, product compatibility and antistatic properties). Adhere to the manufacturer's instructions and information relating to the use, storage, care and replacement of protective gloves. Protective gloves shall be replaced immediately when physically damaged or worn. Design operations thus to avoid permanent use of protective gloves.
Appropriate Material Leather

Other
Chemical-resistant work clothes. Protective shoes.

Environmental exposure controls
Information regarding waste disposal, see chapter 13.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

State of aggregation
gas

Form
liquified gas

Colour
colourless

Odour
slightly like ether

pH value	
Source	supplier
Comments	neutral

Boiling point / boiling range				
Value	-45,9	-	-39,8	°C
Source	supplier			

Melting point/freezing point
No data available

Decomposition temperature
No data available

Flash point	
Not applicable	
Source	supplier

Ignition temperature
No data available

Auto-ignition temperature			
Value	628	°C	
Source	supplier		

Explosive properties
The product is not explosive. Formation of explosive/highly flammable air-vapour mixtures is possible during/after use.

Flammability
The product is non-flammable.

Lower explosion limit
No data available

Upper explosion limit
No data available

Vapour pressure			
Value	1120	kPa	
Reference temperature	21,1	°C	
Source	supplier		
Value	2588	kPa	
Reference temperature	54,4	°C	
Source	supplier		

Relative vapour density	
Value	2,98
Source	supplier
Comments	Air = 1

Relative density
No data available

Density		
Value	1,11	g/cm³

Solubility
No data available

Partition coefficient n-octanol/water (log value)			
No	**Substance name**	**CAS no.**	**EC no.**
1	**pentafluoroethane**	**354-33-6**	**206-557-8**
log Pow		1,48	
Reference temperature		25	°C
with reference to	pH 6.34		
Method	OECD 107		
Source	ECHA		
2	**difluoromethane**	**75-10-5**	**200-839-4**
log Pow		0,21	
Reference temperature		25	°C
with reference to	pH 6,1		
Method	OECD 107		
Source	ECHA		
3	**norflurane**	**811-97-2**	**212-377-0**
log Pow		1,06	
Reference temperature		25	°C
with reference to	pH 6.0		
Method	OECD 107		
Source	ECHA		
4	**2,3,3,3-tetrafluoroprop-1-ene**	**754-12-1**	**468-710-7**
log Pow	appr.	2	
Reference temperature		25	°C
with reference to	pH 7		
Method	OECD 117		
Source	ECHA		
5	**1,3,3,3-Tetrafluoropropene, (1E)-**	**1645-83-6**	**471-480-0**
log Pow		1,6	
Reference temperature		25	°C
with reference to	pH 7		
Method	OECD 117		
Source	ECHA		

Kinematic viscosity
No data available

Particle characteristics
No data available

9.2 Other information

Other information
No data available.

SECTION 10: Stability and reactivity

10.1 Reactivity

Dangerous reactions are not expected if the product is handled according to its intended use.

10.2 Chemical stability

Stable under recommended storage and handling conditions (See section 7).

10.3 Possibility of hazardous reactions

Stable under recommended storage and handling conditions (See section 7). Hazardous polymerization will not occur under normal conditions.

10.4 Conditions to avoid
Temperatures > 50°C. Heat, naked flames and other ignition sources.

10.5 Incompatible materials
strong oxidizing agents; Metal as powder

10.6 Hazardous decomposition products
None, if handled according to intended use. In case of fire: see section 5.

SECTION 11: Toxicological information

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

Acute oral toxicity
No data available

Acute dermal toxicity
No data available

Acute inhalational toxicity					
No	**Substance name**		**CAS no.**		**EC no.**
1	**pentafluoroethane**		**354-33-6**		**206-557-8**
LC50		>	800000		ppmV
Duration of exposure			4		h
State of aggregation		Gas			
Species		rat			
Method		OECD 403			
Source		ECHA			
2	**2,3,3,3-tetrafluoroprop-1-ene**		**754-12-1**		**468-710-7**
LC50		>	405800		ppmV
Duration of exposure			4		h
State of aggregation		Gas			
Species		rat			
Method		OECD 403			
Source		ECHA			
3	**1,3,3,3-Tetrafluoropropene, (1E)-**		**1645-83-6**		**471-480-0**
LC50		>	207000		ppmV
Duration of exposure			4		h
State of aggregation		Gas			
Species		rat			
Method		OECD 403			
Source		ECHA			

Skin corrosion/irritation			
No	**Substance name**	**CAS no.**	**EC no.**
1	**1,3,3,3-Tetrafluoropropene, (1E)-**	**1645-83-6**	**471-480-0**
Species		rabbit	
Method		OECD 404	
Source		ECHA	
Evaluation/classification		Based on available data, the classification criteria are not met.	

Serious eye damage/irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity			
No	**Substance name**	**CAS no.**	**EC no.**
1	**pentafluoroethane**	**354-33-6**	**206-557-8**

Type of examination	in vitro gene mutation study in bacteria
Species	Salmonella typhimurium / Escherichia coli
Method	OECD 471
Source	ECHA
Evaluation/classification	Based on available data, the classification criteria are not met.
Type of examination	In vitro Mammalian Chromosomal Aberration Test
Species	Chinese hamster Ovary (CHO)
Method	OECD 473
Source	ECHA
Evaluation/classification	Based on available data, the classification criteria are not met.
Route of exposure	inhalational
Type of examination	Mammalian Erythrocyte Micronucleus Test, In vivo
Species	mouse
Method	OECD 474
Source	ECHA
Evaluation/classification	Based on available data, the classification criteria are not met.
2 difluoromethane	**75-10-5 200-839-4**
Type of examination	in vitro gene mutation study in bacteria
Species	Salmonella typhimurium / Escherichia coli
Method	OECD 471
Source	ECHA
Evaluation/classification	Based on available data, the classification criteria are not met.
Type of examination	In vitro Mammalian Chromosomal Aberration Test
Species	Human Lymphocyte
Method	OECD 473
Source	ECHA
Evaluation/classification	Based on available data, the classification criteria are not met.
3 norflurane	**811-97-2 212-377-0**
Type of examination	Genotoxicity in vitro
Species	Salmonella typhimurium
Method	OECD 471
Source	ECHA
Evaluation/classification	Based on available data, the classification criteria are not met.
Type of examination	Genotoxicity in vitro
Species	Human Lymphocyte
Method	OECD 473
Source	ECHA
Evaluation/classification	Based on available data, the classification criteria are not met.
Route of exposure	inhalational
Type of examination	Genotoxicity in vivo
Species	mouse
Method	EPA
Source	ECHA
Evaluation/classification	Based on available data, the classification criteria are not met.
4 2,3,3,3-tetrafluoroprop-1-ene	**754-12-1 468-710-7**
Type of examination	Genotoxicity in vitro
Source	ECHA
Evaluation/classification	Based on available data, the classification criteria are not met.
Type of examination	Genotoxicity in vivo
Source	ECHA
Evaluation/classification	Based on available data, the classification criteria are not met.
5 1,3,3,3-Tetrafluoropropene, (1E)-	**1645-83-6 471-480-0**
Type of examination	Genotoxicity in vitro
Species	Human Lymphocyte
Method	OECD 473
Source	ECHA
Evaluation/classification	Based on available data, the classification criteria are not met.
Type of examination	Genotoxicity in vivo
Species	mouse
Method	OECD 474

Source	ECHA
Evaluation/classification	Based on available data, the classification criteria are not met.

Reproduction toxicity			
No	**Substance name**	**CAS no.**	**EC no.**
1	**pentafluoroethane**	**354-33-6**	**206-557-8**
Route of exposure		inhalational	
Type of examination		Prenatal Developmental Toxicity Study	
Species		rabbit	
Method		OECD 414	
Source		ECHA	
Evaluation/classification		Based on available data, the classification criteria are not met.	
2	**norflurane**	**811-97-2**	**212-377-0**
Route of exposure		inhalational	
Species		mouse	
Source		ECHA	
Evaluation/classification		Based on available data, the classification criteria are not met.	
3	**2,3,3,3-tetrafluoroprop-1-ene**	**754-12-1**	**468-710-7**
Type of examination		2 generation study	
Method		OECD 416	
Source		ECHA	
Evaluation/classification		Based on available data, the classification criteria are not met.	
Type of examination		Prenatal Developmental Toxicity Study	
Method		OECD 414	
Source		ECHA	
Evaluation/classification		Based on available data, the classification criteria are not met.	

Carcinogenicity			
No	**Substance name**	**CAS no.**	**EC no.**
1	**norflurane**	**811-97-2**	**212-377-0**
Route of exposure		inhalational	
Species		rat	
Source		ECHA	
Evaluation/classification		Based on available data, the classification criteria are not met.	

STOT - single exposure
No data available

STOT - repeated exposure			
No	**Substance name**	**CAS no.**	**EC no.**
1	**pentafluoroethane**	**354-33-6**	**206-557-8**
Route of exposure		inhalational	
Species		rat	
Method		OECD 413	
Source		ECHA	
Evaluation/classification		Based on available data, the classification criteria are not met.	
2	**difluoromethane**	**75-10-5**	**200-839-4**
Route of exposure		inhalational	
Species		rat	
Source		ECHA	
Evaluation/classification		Based on available data, the classification criteria are not met.	
3	**norflurane**	**811-97-2**	**212-377-0**
Route of exposure		inhalational	
Species		rat	
Method		OECD 453	
Source		ECHA	
Evaluation/classification		Based on available data, the classification criteria are not met.	
4	**2,3,3,3-tetrafluoroprop-1-ene**	**754-12-1**	**468-710-7**
Route of exposure		inhalational	
Species		rat	

Method	OECD 413
Source	ECHA
Evaluation/classification	Based on available data, the classification criteria are not met.

5	**1,3,3,3-Tetrafluoropropene, (1E)-**	**1645-83-6**	**471-480-0**
Route of exposure	inhalational		
Species	rat		
Method	OECD 413		
Source	ECHA		
Evaluation/classification	Based on available data, the classification criteria are not met.		

Aspiration hazard
No data available

Endocrine disrupting properties
No data available

11.2 Information on other hazards

Other information
No data available.

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish (acute)			
No	**Substance name**	**CAS no.**	**EC no.**
1	**norflurane**	**811-97-2**	**212-377-0**

LC50		450	mg/l
Duration of exposure		96	h
Species	Salmo gairdneri		
Method	EU C.1		
Source	ECHA		
Evaluation/classification	Based on available data, the classification criteria are not met.		

2	**2,3,3,3-tetrafluoroprop-1-ene**	**754-12-1**	**468-710-7**
LC50	>	197	mg/l
Duration of exposure		96	h
Species	Cyprinus carpio		
Method	OECD 203		
Source	ECHA		

3	**1,3,3,3-Tetrafluoropropene, (1E)-**	**1645-83-6**	**471-480-0**
LC50	>	117	mg/l
Duration of exposure		96	h
Species	Cyprinus carpio		
Method	OECD 203		
Source	ECHA		
Evaluation/classification	Based on available data, the classification criteria are not met.		

Toxicity to fish (chronic)
No data available

Toxicity to Daphnia (acute)			
No	**Substance name**	**CAS no.**	**EC no.**
1	**norflurane**	**811-97-2**	**212-377-0**

EC50		980	mg/l
Duration of exposure		48	h
Species	Daphnia magna		
Method	EU C.2		
Source	ECHA		
Evaluation/classification	Based on available data, the classification criteria are not met.		

2	**2,3,3,3-tetrafluoroprop-1-ene**	**754-12-1**	**468-710-7**
EC50	>	83	mg/l

Duration of exposure		48	h
Species	Daphnia magna		
Method	OECD 202		
Source	ECHA		
3 1,3,3,3-Tetrafluoropropene, (1E)-	**1645-83-6**		**471-480-0**
EC50	>	160	mg/l
Duration of exposure		48	h
Species	Daphnia magna		
Method	OECD 202		
Source	ECHA		
Evaluation/classification	Based on available data, the classification criteria are not met.		

Toxicity to Daphnia (chronic)
No data available

Toxicity to algae (acute)			
No	**Substance name**	**CAS no.**	**EC no.**
1	**2,3,3,3-tetrafluoroprop-1-ene**	**754-12-1**	**468-710-7**
EC50	>	100	mg/l
Duration of exposure		72	h
Species	Pseudokirchneriella subcapitata		
Method	OECD 201		
Source	ECHA		
2	**1,3,3,3-Tetrafluoropropene, (1E)-**	**1645-83-6**	**471-480-0**
EC50	>	170	mg/l
Duration of exposure		72	h
Species	Pseudokirchneriella subcapitata		
Method	OECD 201		
Source	ECHA		
Evaluation/classification	Based on available data, the classification criteria are not met.		

Toxicity to algae (chronic)
No data available

Bacteria toxicity
No data available

12.2 Persistence and degradability

Biodegradability			
No	**Substance name**	**CAS no.**	**EC no.**
1	**pentafluoroethane**	**354-33-6**	**206-557-8**
Type	aerobic biodegradation		
Value	appr.	5	%
Duration		28	d
Method	Closed Bottle Test (OECD 301D)		
Source	ECHA		
Evaluation	not readily biodegradable		
2	**difluoromethane**	**75-10-5**	**200-839-4**
Type	aerobic biodegradation		
Value		5	%
Duration		28	d
Method	OECD 301 D		
Source	ECHA		
Evaluation	not readily biodegradable		
3	**norflurane**	**811-97-2**	**212-377-0**
Type	aerobic biodegradation		
Value	appr.	3	%
Duration		28	d
Method	OECD 301 D		
Source	ECHA		
Evaluation	not readily biodegradable		

4	2,3,3,3-tetrafluoroprop-1-ene	754-12-1		468-710-7
Type		aerobic biodegradation		
Value		<	5	%
Duration			28	d
Method		OECD 301 F		
Source		ECHA		
Evaluation		not readily biodegradable		
5	**1,3,3,3-Tetrafluoropropene, (1E)-**	**1645-83-6**		**471-480-0**
Type		aerobic biodegradation		
Value			0	%
Duration			28	d
Method		OECD 301 D		
Source		ECHA		
Evaluation		not readily biodegradable		

12.3 Bioaccumulative potential

Partition coefficient n-octanol/water (log value)				
No	**Substance name**	**CAS no.**		**EC no.**
1	**pentafluoroethane**	**354-33-6**		**206-557-8**
log Pow			1,48	
Reference temperature			25	°C
with reference to		pH 6.34		
Method		OECD 107		
Source		ECHA		
2	**difluoromethane**	**75-10-5**		**200-839-4**
log Pow			0,21	
Reference temperature			25	°C
with reference to		pH 6,1		
Method		OECD 107		
Source		ECHA		
3	**norflurane**	**811-97-2**		**212-377-0**
log Pow			1,06	
Reference temperature			25	°C
with reference to		pH 6.0		
Method		OECD 107		
Source		ECHA		
4	**2,3,3,3-tetrafluoroprop-1-ene**	**754-12-1**		**468-710-7**
log Pow		appr.	2	
Reference temperature			25	°C
with reference to		pH 7		
Method		OECD 117		
Source		ECHA		
5	**1,3,3,3-Tetrafluoropropene, (1E)-**	**1645-83-6**		**471-480-0**
log Pow			1,6	
Reference temperature			25	°C
with reference to		pH 7		
Method		OECD 117		
Source		ECHA		

12.4 Mobility in soil

No data available.

12.5 Results of PBT and vPvB assessment

Results of PBT and vPvB assessment	
Product Name	
R-448A	
PBT assessment	The product is not considered to be a PBT.
vPvB assessment	The product is not considered to be a vPvB.

12.6 Endocrine disrupting properties
No data available.

12.7 Other adverse effects

Other adverse effects
Contains fluorinated greenhouse gases. global warming potential within a 100 year period: 1386

12.8 Other information

Other information
Do not discharge product unmonitored into the environment.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
dispose of in accordance with local regulation.
Allocation of a waste code number, according to the European Waste Catalogue, should be carried out in agreement with the regional waste disposal company.

Packaging
Compressed gas packaging under pressure. Do not open by force. Do not heat above 50°C. Dispose of compressed gas packagings only if completely discharged. Do not burn empty compressed gas packagings. Do not pierce, cut or weld uncleaned containers.

SECTION 14: Transport information

14.1 UN number or ID number

ADR/RID/ADN	UN3163
IMDG	UN3163
ICAO-TI / IATA	UN3163

14.2 UN proper shipping name

ADR/RID/ADN	LIQUEFIED GAS, N.O.S.
Technical name	pentafluoroethane difluoromethane
IMDG	LIQUEFIED GAS, N.O.S.
Technical name	pentafluoroethane difluoromethane
ICAO-TI / IATA	Liquefied gas, n.o.s.
Technical name	pentafluoroethane difluoromethane

14.3 Transport hazard class(es)

ADR/RID/ADN - Class	2
Label	2.2 RID: (+13)
Classification code	2A
Tunnel restriction code	C/E
Hazard identification no.	20
IMDG - Class	2.2
Label	2.2
ICAO-TI / IATA - Class	2.2
Label	2.2

14.4 Packing group
Not classified as dangerous in the meaning of transport regulations.

14.5 Environmental hazards

EmS	F-C, S-V

14.6 Special precautions for user

To be transported always in closed, upright and safe containers. Make sure that persons handling these containers are aware of the rules of conduct in case of incident or spillage.

14.7 Maritime transport in bulk according to IMO instruments

Not relevant

SECTION 15: Regulatory information

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

EU regulations

Regulation (EC) No 1907/2006 (REACH) Annex XIV (List of substances subject to authorisation)
According to the data available and/or specifications supplied by upstream suppliers, this product does not contain any substances considered as substances requiring authorisation as listed on Annex XIV of the REACH regulation (EC) 1907/2006.

REACH candidate list of substances of very high concern (SVHC) for authorisation
According to available data and the information provided by preliminary suppliers, the product does not contain substances that are considered substances meeting the criteria for inclusion in annex XIV (List of Substances Subject to Authorisation) as laid down in Article 57 and article 59 of REACH (EC) 1907/2006.

Regulation (EC) No 1907/2006 (REACH) Annex XVII: RESTRICTIONS ON THE MANUFACTURE, PLACING ON THE MARKET AND USE OF CERTAIN DANGEROUS SUBSTANCES, MIXTURES AND ARTICLES
According to the data available and/or specifications supplied by upstream suppliers, this product does not contain any substances subject to restriction as listed in Annex XVII of the REACH regulation (EC) 1907/2006.

Directive 2012/18/EU on the control of major-accident hazards involving dangerous substances
This product is not subject to Part 1 or 2 of Annex I.

Other regulations
REGULATION (EU) No 2024/573 on fluorinated greenhouse gases Adhere to the national sanitary and occupational safety regulations when using this product.

National regulations

Water Hazard Class (Germany)

Class	1
Source	Classification according to AwSV (Regulation on facilities for handling substances that are hazardous to water).

Other regulations

Take into account: TRGS 510 "Storage of hazardous substances in non-stationary containers"

15.2 Chemical safety assessment

Chemical safety assessments have been conducted for the substances in this mixture. For a mixture a chemical safety assessment according to (EC) 1907/2006 is not mandatory.

SECTION 16: Other information

Sources of key data used to compile the data sheet:

Regulation (EC) No 1907/2006 (REACH), 1272/2008 (CLP) as amended in each case.
Directives 2000/39/EC, 2006/15/EC, 2009/161/EU, (EU) 2017/164.
National Threshold Limit Values of the corresponding countries as amended in each case.
Transport regulations according to ADR, RID, IMDG, IATA as amended in each case.
The data sources used to determine physical, toxic and ecotoxic data, are indicated directly in the corresponding section.

Full text of the H- and EUH- phrases drawn up in sections 2 and 3 (provided not already drawn up in these sections)

H220	Extremely flammable gas.

Creation of the safety data sheet
UMCO GmbH

This information is based on our present knowledge and experience.
The safety data sheet describes products with a view to safety requirements.
It does not however, constitute a guarantee for any specific product properties and shall not establish a legally valid contractual relationship.

Alterations/supplements:
Alterations to the previous edition are marked in the left-hand margin.

This document is an English translation of the legally compliant safety data sheet of the region Germany. This document, including UFI and emergency telephone number, may only be used for placing on the market in the region Germany.

Prod-ID 758221