

Product: FORANE® 404A

Page: 1 / 10

SDS No.: SB001741-001 (Version 1.0)

Date 2022/02/10

1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING**Identification of the mixture:** FORANE® 404A**Recommended use of the chemical and restrictions on use :****Use of the Substance/Mixture :** Refrigerant**Company/Undertaking Identification:**
ManufacturerArkema (Changshu) Fluorochemical Co., Ltd.
No.18 Haining Road, Advanced Materials Industrial Park
215522 Changshu, Jiangsu, China
Telephone: +86 512 5232 2688
Telefax: +86 512 5232 2788**Emergency telephone number** +1-703-741-5970 (CHEMTREC International emergency phone number)**2. HAZARDS IDENTIFICATION****2.1. Classification of the substance or mixture:**Gases under pressure, Liquefied gas, H280
Acute aquatic toxicity, Category 3, H402**Additional information:**

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2. Label elements:**GHS-Labeling**

Hazard pictograms:



Signal word:

Warning

Hazard statements:

H280 : Contains gas under pressure; may explode if heated.
H402 : Harmful to aquatic life.

Precautionary statements:

Prevention:

P273 : Avoid release to the environment.

Storage:

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

Disposal:

P502 : Refer to manufacturer/ supplier for information on recovery/ recycling.

2.3. Other hazards:**Potential health effects:**Inhalation: As with other volatile aliphatic halogenated compounds, through vapour accumulation and/or inhalation of large quantities, the product can cause : Loss of consciousness and cardiac disorders aggravated by stress and lack of oxygen, risk of mortality
Skin contact: Ejection of liquefied gas : frostbite possible**Environmental Effects:**

Not readily biodegradable. Not bioaccumulable.

Physical and chemical hazards:

Thermal decomposition giving toxic and corrosive products
Decomposition products: See chapter 10

3. COMPOSITION/INFORMATION ON INGREDIENTS

This product is a mixture.

Chemical nature of the mixture¹:

Fluorocarbons

Hazardous components:

Chemical name ¹	EC-No.	CAS-No.	Concentration	Classification
Pentafluoroethane	206-557-8	354-33-6	44 %	Press. Gas LG; H280
1,1,1 Trifluoroethane	206-996-5	420-46-2	52 %	Flam. Gas 1B; H221 Press. Gas LG; H280
1,1,1,2-Tetrafluoroethane	212-377-0	811-97-2	4 %	Press. Gas LG; H280

¹: See chapter 14 for Proper Shipping Name

4. FIRST AID MEASURES

4.1. Description of necessary first-aid measures:

General advice:

No hazards which require special first aid measures.

Inhalation:

Move patient from contaminated area to fresh air. Oxygen or artificial respiration if needed. In case of persistent problems : Consult a physician.

Skin contact:

Wash off with plenty of water. Frostbite : treat as thermal burns.

Eye contact:

Wash immediately, abundantly and thoroughly with water. If irritation persists, consult an ophthalmologist.

Ingestion:

No hazards which require special first aid measures.

Protection of first-aiders:

If entering a saturated atmosphere, wear a self contained breathing apparatus.

4.2. Most important symptoms/effects, acute and delayed: No data available.

4.3. Indication of immediate medical attention and special treatment needed, if necessary

Treatment: Do not administer catecholamines (because of the cardiac effect caused by the product).

5. FIREFIGHTING MEASURES

5.1. Extinguishing media:

Suitable extinguishing media:

Use extinguishing measures to suit surroundings.

5.2. Specific hazards arising from the chemical:

Thermal decomposition giving toxic and corrosive products :
Hydrogen fluoride, Carbon oxides
One of the components of this preparation gives flammable mixtures with air

5.3. Advice for firefighters:

Specific methods:

Prohibit all sources of sparks and ignition - Do not smoke. Ensure a system for the rapid emptying of containers. In case of fire, remove exposed containers. Cool containers/tanks with water spray.

Special protective actions for fire-fighters:
Wear self-contained breathing apparatus and protective suit.

6. ACCIDENTAL RELEASE MEASURES

6.1. Personal precautions, protective equipment and emergency procedures:

Avoid contact with the skin and the eyes. Avoid inhalation of vapours. In enclosed areas : ventilate or wear a self-contained breathing apparatus (risk of anoxia). Remove all sources of ignition. Do not smoke. Evacuate non-essential staff and those not equipped with individual protection apparatus.

6.2. Environmental precautions:

Do not release into the environment.

6.3. Methods and materials for containment and cleaning up:

Recovery:

Ensure adequate ventilation.

Elimination: See chapter 13

6.4. Reference to other sections: None.

7. HANDLING AND STORAGE

7.1. Precautions for safe handling:

Technical measures/Precautions:

Storage and handling precautions applicable to products:
pressurised liquified gas

Provide appropriate exhaust ventilation at machinery. Provide self-contained breathing apparatus nearby. Provide showers, eye-baths. Well ventilate empty vats and tanks before entering.

Safe handling advice:

Prohibit ignition sources and contact with hot surfaces - DO NOT SMOKE.

Hygiene measures:

Avoid contact with the skin and the eyes. Avoid exposure to vapour. When using do not eat, drink or smoke.
Wash hands after handling. Remove contaminated clothing and protective equipment before entering eating areas.

7.2. Conditions for safe storage, including any incompatibilities: None.

Incompatible products:

Strong oxidizing agents Alkaline hydroxides Alkaline earth metals Finely divided metals

Packaging material:

Recommended: Ordinary steel

To be avoided: Alloys containing more than 2% of magnesium, Plastic materials

7.3. Specific end use(s): None.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Control parameters:

Exposure Limit Values Not relevant

8.2. Exposure controls:

General protective measures: Provide sufficient air exchange and/or exhaust in work rooms.

Personal protective equipment:

Respiratory protection:	In case of insufficient ventilation, wear suitable respiratory equipment.
Hand protection:	Leather gloves
Eye/face protection:	Safety glasses with side-shields
Skin and body protection:	Protective clothing (cotton)

Environmental exposure controls: See chapter 6

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1. Information on basic physical and chemical properties

Appearance:

Physical state (20°C): gaseous
Form: Liquefied gas
Colour: colourless
Odour: Slightly ether-like
Olfactory threshold: No data available
pH: Not applicable

1,1,1,2-TETRAFLUOROETHANE :

Melting point/range : -108 °C

PENTAFLUOROETHANE :

Melting point/range : -103 °C

1,1,1 TRIFLUOROETHANE :

Melting point/range : -111 °C

Boiling point/boiling range : -45,8 °C

Flash point: Not applicable

Evaporation rate: No data available.

Flammability (solid, gas):

Flammability: Non flammable product (Standard NF EN 378-1)

Vapour pressure: 3,53 MPa , at 70 °C

2,33 MPa , at 50 °C

1,27 MPa , at 25 °C

Vapour density: 5,39 kg/m³ At the boiling point

Density: 1.041 kg/m³ , at 25 °C Liquefied gas

Water solubility: No data available.

Partition coefficient: n-octanol/water: 1,1,1 TRIFLUOROETHANE :

log Kow : 1,06 , at 25 °C, (Results obtained on a similar product). (OECD Test Guideline 107)

PENTAFLUOROETHANE :

log Kow : 1,48 , at 25 °C (OECD Test Guideline 107)

1,1,1,2-TETRAFLUOROETHANE :

log Kow : 1,06 , at 25 °C (OECD Test Guideline 107)

Auto-ignition temperature : 1,1,1 TRIFLUOROETHANE :

750 °C at 1.013 hPa

PENTAFLUOROETHANE :

Not applicable

1,1,1,2-TETRAFLUOROETHANE :

> 743 °C at 1.013 hPa

Decomposition temperature: No data available.

Viscosity, kinematic: Not applicable

Explosive properties:

Explosivity: Not relevant (due to its chemical structure)

Oxidizing properties: Not relevant (due to its chemical structure)

9.2. Other data:

Critical point: Critical pressure: 3,74 MPa, Critical temperature: 72 °C

10. STABILITY AND REACTIVITY

10.1. Reactivity: No data available.

10.2. Chemical stability:

The product is stable under normal handling and storage conditions.

10.3. Possibility of hazardous reactions: No data available.

10.4. Conditions to avoid:

Keep away from heat and sources of ignition. Protect from light. Avoid contact with flames and red hot metallic surfaces

10.5. Incompatible materials to avoid:

Alkaline hydroxides, Alkaline earth metals, Strong oxidizing agents, Finely divided metals

10.6. Hazardous decomposition products:

Thermal decomposition giving very toxic and corrosive products, Hydrogen fluoride, Carbon oxides

11. TOXICOLOGICAL INFORMATION

All available and relevant data on this product and/or the components quoted in section 3 and/or the analogue substances/metabolites have been taken into account for the hazard assessment.

11.1. Information on toxicological effects:

Acute toxicity:

Inhalation: According to its composition, can be considered as Slightly harmful by inhalation

1,1,1 TRIFLUOROETHANE :

As with other volatile aliphatic halogenated compounds, through vapour accumulation and/or inhalation of large quantities, the product can cause : , Loss of consciousness and cardiac disorders aggravated by stress and lack of oxygen, risk of mortality

• In animals :

No mortality/4 h/Rat: 591000 ppm (Method: OECD Test Guideline 403)

PENTAFLUOROETHANE :

Effects of breathing high concentrations of vapour may include: , headache, Dizziness, Drowsiness
As with other volatile aliphatic halogenated compounds, through vapour accumulation and/or inhalation of large quantities, the product can cause : , Loss of consciousness and cardiac disorders aggravated by stress and lack of oxygen, risk of mortality

• In animals :

No mortality/4 h/Rat: 800000 ppm (Method: OECD Test Guideline 403)

1,1,1,2-TETRAFLUOROETHANE :

As with other volatile aliphatic halogenated compounds, through vapour accumulation and/or inhalation of large quantities, the product can cause : , Loss of consciousness and cardiac disorders aggravated by stress and lack of oxygen, risk of mortality

• In animals :

No mortality/4 h/Rat: 567000 ppm (Method: OECD Test Guideline 403)

Central nervous system depression, narcosis

Local effects (Corrosion / Irritation / Serious eye damage):

Skin contact:

Ejection of liquefied gas : frostbite possible

Eye contact:

Ejection of liquefied gas : frostbite possible

Respiratory or skin sensitisation:

Inhalation:

1,1,1 TRIFLUOROETHANE :

• In animals :

No-observed-effect level (cardiac sensitization, Dog) (< 30 %)

PENTAFLUOROETHANE :

• In animals :

No-observed-effect level 7 % (cardiac sensitization, Dog)

1,1,1,2-TETRAFLUOROETHANE :

• In animals :

No-observed-effect level 5 % (cardiac sensitization, Dog)

Skin contact:

Not relevant (gas)

CMR effects :

Mutagenicity:

According to its composition : Not genotoxic

In vitro

1,1,1 TRIFLUOROETHANE :

Ames test: Inactive (Method: OECD Test Guideline 471)
In vitro chromosomal abnormality test on human lymphocytes: Inactive
In vitro gene mutations test on mammalian cells: Inactive (Method: OECD Test Guideline 490)

PENTAFLUOROETHANE :

Ames test: Inactive (Method: OECD Test Guideline 471)
In vitro test for chromosomal abnormalities on CHO cells: Inactive (Method: OECD Test Guideline 473)
In vitro chromosomal abnormality test on human lymphocytes: Inactive (Method: OECD Test Guideline 476)

1,1,1,2-TETRAFLUOROETHANE :

Ames test in vitro: Inactive (Method: OECD Test Guideline 471)
In vitro chromosomal abnormality test on human lymphocytes: Inactive (Method: OECD Test Guideline 473)
In vitro gene mutations test on mammalian cells: Inactive

In vivo

1,1,1 TRIFLUOROETHANE :

Micronucleus test in vivo mouse: Inactive

PENTAFLUOROETHANE :

Micronucleus test in vivo mouse: Inactive (Method: OECD Test Guideline 474)

1,1,1,2-TETRAFLUOROETHANE :

Micronucleus test in vivo mouse: Inactive (Method: OECD Test Guideline 474)
DNA repair test on rats hepatocytes: Inactive

Carcinogenicity:

1,1,1 TRIFLUOROETHANE :

• In animals : According to available experimental data:
No effect maximum concentration
(Rat, 1 year, By oral route)

1,1,1,2-TETRAFLUOROETHANE :

• In animals : Absence of carcinogenic effects (Rat, 2 years, By inhalation)
No Observed Adverse Effect Level (NOAEL): 10.000 ppm

Absence of carcinogenic effects (Rat, 1 year, By oral route)
No Observed Adverse Effect Level (NOAEL): 300 mg/kg bw/day

Reproductive toxicity:

Fertility:

Based on the available data, the substance is not suspected of having reprotoxic potential.

1,1,1,2-TETRAFLUOROETHANE :

• In animals : Two-generation study
NOAEL (Parental toxicity): 50.000 ppm
NOAEL (Fertility): 50.000 ppm
NOAEL (Developmental Toxicity): 50000 ppm
(rat, By inhalation)

Foetal development:

Based on the available data, the substance is not suspected of having developmental toxicity potential.

1,1,1 TRIFLUOROETHANE :

• In animals : NOAEL (Developmental Toxicity): 137 mg/l
NOAEL (Maternal Toxicity): 137 mg/l
(Method: OECD Test Guideline 414, rat, rabbit, By inhalation)

PENTAFLUOROETHANE :

• In animals : Absence of toxic effects for foetal development.
NOAEL (Developmental Toxicity): 245 mg/l
NOAEL (Maternal Toxicity): 245 mg/l
(Method: OECD Test Guideline 414, rat, rabbit, By inhalation)

1,1,1,2-TETRAFLUOROETHANE :

• In animals : Absence of toxic effects for foetal development.
NOAEL (Developmental Toxicity): 40.000 ppm
NOAEL (Maternal Toxicity): 2.500 ppm
(Method: OECD Test Guideline 414, Rabbit, By inhalation)
Absence of toxic effects for foetal development.
NOAEL (Developmental Toxicity): 50.000 ppm
NOAEL (Maternal Toxicity): 50.000 ppm
(Method: OECD Test Guideline 414, Rat, By inhalation)

Specific target organ toxicity :

Single exposure :

No data available.

Repeated exposure:

The substance or mixture is not classified as specific target organ toxicant, repeated exposure.

1,1,1 TRIFLUOROETHANE :

• In animals :

Studies of prolonged inhalation in animals have not shown sub-chronic toxic effects
Inhalation: No specific toxic effects
NOAEL= 40000ppm (Method: OECD Test Guideline 413, Rat, 3 Months)

PENTAFLUOROETHANE :

• In animals :

Studies of prolonged inhalation in animals have not shown sub-chronic toxic effects
Inhalation: NOAEL= 50000ppm (Method: OECD Test Guideline 413, Rat, 3 Months)

1,1,1,2-TETRAFLUOROETHANE :

• In animals :

Inhalation: No adverse effects reported.
NOAEL= 50000ppm (Rat, Several years)

Aspiration hazard:

Not relevant

12. ECOLOGICAL INFORMATION

Ecotoxicology Assessment:

All available and relevant data on this product and/or the components quoted in section 3 and/or the analogue substances/metabolites have been taken into account for the hazard assessment.

12.1. Acute toxicity :

Fish:

From its composition, it must be considered as: Slightly harmful to fish

1,1,1 TRIFLUOROETHANE :

LC50 : 109 mg/l (Method: calculated)

PENTAFLUOROETHANE :

May be considered as comparable to a similar product for which experimental results are:

1,1,1,3,3-PENTAFLUOROPROPANE :

LC50, 96 h (Danio rerio (zebra fish)) : > 200 mg/l (Method: OECD Test Guideline 203)

1,1,1,2-TETRAFLUOROETHANE :

LC50, 96 h (Salmo gairdneri) : 450 mg/l (Method: OECD Test Guideline 203)

Aquatic invertebrates:

From its composition, it must be considered as: Slightly harmful to daphnia

1,1,1 TRIFLUOROETHANE :

EC50, 48 h (Daphnia magna (Water flea)) : 300 mg/l (Method: OECD Test Guideline 202)

PENTAFLUOROETHANE :

May be considered as comparable to a similar product for which experimental results are:

1,1,1,3,3-PENTAFLUOROBUTANE :

EC50, 48 h (Daphnia magna (Water flea)) : > 200 mg/l (Method: OECD Test Guideline 202)

1,1,1,2-TETRAFLUOROETHANE :

EC50, 48 h (Daphnia magna (Water flea)) : 980 mg/l (Method: OECD Test Guideline 202)

Aquatic plants:

From its composition, it must be considered as: Slightly harmful to algae

1,1,1 TRIFLUOROETHANE :

May be considered as comparable to a similar product for which experimental results are:

PENTAFLUOROETHANE :

May be considered as comparable to a similar product for which experimental results are:

1,1,1,2-TETRAFLUOROETHANE :

May be considered as comparable to a similar product for which experimental results are:

1,1,1,3,3-PENTAFLUOROPROPANE :

ErC50, 72 h (Pseudokirchneriella subcapitata) : > 118 mg/l (Method: OECD Test Guideline 201)

Microorganisms:

1,1,1 TRIFLUOROETHANE :

May be considered as comparable to a similar product for which experimental results are:

1,1,1,2-TETRAFLUOROETHANE :

EC10, 6 h (Pseudomonas putida) : > 730 mg/l

12.2. Persistence and degradability :

Biodegradation (In water): All the products and/or main components quoted in section 3 and/or analogue substances/metabolites are not readily biodegradable.

1,1,1 TRIFLUOROETHANE : May be considered as comparable to a similar product for which experimental results are:

1,1,1,2-TETRAFLUOROETHANE : Not readily biodegradable.: 3 % after 28 d (Method: OECD Test Guideline 301D)

PENTAFLUOROETHANE : Not readily biodegradable.: 5 % after 28 d (Method: OECD Test Guideline 301 D)

Photodegradation (In air):

1,1,1 TRIFLUOROETHANE : Degradation by radicals OH: Direct photolysis (Half-life) : 9.600 d

1,1,1,2-TETRAFLUOROETHANE : Degradation by radicals OH: Direct photolysis (Half-life) : 9,7 y

12.3. Bioaccumulative potential :

Bioaccumulation: None of the product and /or main component quoted in section 3 and/or analogue substance/metabolite is expected to bioaccumulate.

1,1,1 TRIFLUOROETHANE : Partition coefficient: n-octanol/water: log Kow : 1,06 , at 25 °C, (Results obtained on a similar product). (Method: OECD Test Guideline 107)

PENTAFLUOROETHANE : Partition coefficient: n-octanol/water: log Kow : 1,48 , at 25 °C (Method: OECD Test Guideline 107)

1,1,1,2-TETRAFLUOROETHANE : Partition coefficient: n-octanol/water: log Kow : 1,06 , at 25 °C (Method: OECD Test Guideline 107)

12.4. Mobility in soil - Distribution among environmental compartments:

Substance : 1,1,1,2-TETRAFLUOROETHANE :
Water: 0,07 %
Air: 99,93 %
(Method: Calculation according Mackay, Level I)

Vapor pressure: 3,53 MPa, 70 °C
2,33 MPa, 50 °C
1,27 MPa, 25 °C

Absorption / desorption:

PENTAFLUOROETHANE : log Koc: 1,3 - 1,7 (Method: calculated)

1,1,1,2-TETRAFLUOROETHANE : log Koc: 1,57 (Method: calculated)

12.5. Results of PBT and vPvB assessment :

According to REACH regulation, annex XIII, this mixture contains no substance meeting PBT and vPvB criteria.

12.6. Other adverse effects:

Global warming potential: 1,1,1-TRIFLUOROETHANE , Global warming potential with respect to CO2 (time horizon 100 years) , Value: 4.470
PENTAFLUOROETHANE , Global warming potential with respect to CO2 (time horizon 100 years) , Value: 3.500
NORFLURANE , Global warming potential with respect to CO2 (time horizon 100 years) , Value: 1.430

Ozone depletion potential: 1,1,1-TRIFLUOROETHANE , Ozone depletion potential; ODP; (R-11 = 1) , Value: 0
PENTAFLUOROETHANE , Ozone depletion potential; ODP; (R-11 = 1) , Value: 0
NORFLURANE , Ozone depletion potential; ODP; (R-11 = 1) , Value: 0

13. DISPOSAL CONSIDERATIONS

13.1. Waste treatment:

Disposal of product: Recycle or incinerate at an approved waste disposal site. In accordance with local and national regulations.
Do not vent the container contents, or product residuals, to the atmosphere. Recover and reclaim unused contents or residuals as appropriate. Recovered/reclaimed product can be returned to an approved certified reclaiming or back to the seller depending on the material. Completely emptied disposable containers can be disposed of as recyclable steel. Returnable cylinders must be returned to seller.

14. TRANSPORT INFORMATION

Regulation	14.1. UN number	14.2. UN proper shipping name	14.3. Class*	Label	14.4. PG*	14.5. Environmental hazards	14.6. Special precautions for user
IATA Cargo	3337	Refrigerant gas R 404A	2.2	2.2		no	
IATA Passenger	3337	Refrigerant gas R 404A	2.2	2.2		no	
IMDG	3337	REFRIGERANT GAS R 404A	2.2	2.2		no	EmS Number: F-C, S-V

*Description: 14.3. Transport hazard class(es)
14.4. Packing group

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

15. REGULATORY INFORMATION

Not listed	Stockholm Convention on Persistent Organic Pollutants (POPs)
This product contains one or more component(s) listed on:	Kyoto Protocol to the United Nations Framework Convention on Climate Change, Annex A, Greenhouse Gases
Not listed	Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade
Not listed	International Chemical Weapons Convention (CWC) Schedules of Toxic Chemicals and Precursors

INVENTORIES:

EINECS:	Conforms to
TSCA:	Conforms to
DSL:	All components of this product are on the Canadian DSL
IECSC (CN):	Conforms to
ENCS (JP):	Conforms to
ISHL (JP):	Conforms to
KECI (KR):	Conforms to
PICCS (PH):	Conforms to
AICS:	Conforms to
NZIOC:	Conforms to

16. OTHER INFORMATION

Full text of H, EUH-phrases referred to under sections 2 and 3

H221	Flammable gas.
H280	Contains gas under pressure; may explode if heated.
H402	Harmful to aquatic life.

Further information A significant new activity notice (SNAC notice) has been issued for 1,1,1-Trifluoroethane (HFC-143A) and Pentafluoroethane (HFC-125). It is the responsibility of the users of the substance to be aware of and comply with the SNAC notice and to submit a SNAC notification to Environment Canada prior to the commencement of a significant new activity associated with the substance.

Thesaurus:

NOAEL : No Observed Adverse Effect Level (NOAEL)
LOAEL : Lowest Observed Adverse Effect Level (LOAEL)
bw : Body weight
food : oral feed
dw : Dry weight

This information applies to the PRODUCT AS SUCH and conforming to specifications of ARKEMA. In case of formulations or mixtures, it is necessary to ascertain that a new danger will not appear. The information contained is based on our knowledge of the product, at the date of publishing and it is given quite sincerely. Users are advised of possible additional hazards when the product is used in applications for which it was not intended. This sheet shall only be used and reproduced for prevention and security purposes. The references to legislative, regulatory and codes of practice documents cannot be considered as exhaustive. It is the responsibility of the person receiving the product to refer to the totality of the official documents concerning the use, the possession and the handling of the product. It is also the responsibility of the handlers of the product to pass on to any subsequent persons who will come into contact with the product (usage, storage, cleaning of containers, other processes) the totality of the information contained within this safety data sheet and necessary for safety at work, the protection of health and the protection of environment.

NB: In this document the numerical separator of the thousands is the "." (point), the decimal separator is "," (comma).
