

FORANE ® 404A**1. PRODUCT AND COMPANY IDENTIFICATION****Company**

Arkema Inc.
900 First Avenue
King of Prussia, Pennsylvania 19406

Fluorochemicals

Customer Service Telephone Number: (800) 245-5858
(Monday through Friday, 8:30 AM to 5:30 PM EST)

Emergency Information

Transportation: CHEMTREC: (800) 424-9300
(24 hrs., 7 days a week)
Medical: Rocky Mountain Poison Center: (866) 767-5089
(24 hrs., 7 days a week)

Product Information

Product name: FORANE ® 404A
Synonyms: R-404A, HFC 404A, FORANE FX 70
Molecular formula: CHF₂CF₃/CH₃CF₃/CH₂FCF₃
Chemical family: Hydrofluorocarbon
Molecular weight: 97.6 g/mol
Product use: Refrigerant

2. HAZARDS IDENTIFICATION**Emergency Overview**

Color: Clear - colourless
Physical state: gas
Form: Liquefied gas
Odor: Slightly ether-like

CAUTION!
HIGH PRESSURE GAS.
LIQUID AND GAS UNDER PRESSURE.
OVERHEATING OR OVERPRESSURIZING MAY CAUSE GAS RELEASE OR VIOLENT CYLINDER BURSTING.
MAY DECOMPOSE ON CONTACT WITH FLAMES OR EXTREMELY HOT METAL SURFACES TO PRODUCE TOXIC AND CORROSIVE PRODUCTS.
VAPOR REDUCES OXYGEN AVAILABLE FOR BREATHING AND IS HEAVIER THAN AIR.
MAY CAUSE FROSTBITE.
MAY CAUSE HEADACHE, NAUSEA, DIZZINESS, DROWSINESS, LOSS OF CONSCIOUSNESS.
MAY CAUSE EFFECTS ON: HEART

Potential Health Effects

Primary routes of exposure:
Inhalation and skin contact.

Signs and symptoms of acute exposure:

FORANE ® 404A

Liquid : Rapid evaporation of the liquid may cause frostbite. Vapor: Vapor is heavier than air and can cause suffocation by reducing oxygen available for breathing. Central nervous system effects: headache, nausea, dizziness, drowsiness, loss of consciousness. Stress induced heart effects: irregular heart beat, rapid heart beat, (severity of effects depends on extent of exposure).

Inhalation:

Practically nontoxic. (based on components)

Medical conditions aggravated by overexposure:

Heart disease or compromised heart function.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS-No.	Wt/Wt	OSHA Hazardous
Ethane, 1,1,1-trifluoro-	420-46-2	52 %	Y
Ethane, pentafluoro-	354-33-6	44 %	Y
Ethane, 1,1,1,2-tetrafluoro-	811-97-2	4 %	Y

The substance(s) marked with a "Y" in the Hazard column above, are those identified as hazardous chemicals under the criteria of the OSHA Hazard Communication Standard (29 CFR 1910.1200).

This material is classified as hazardous under Federal OSHA regulation.

4. FIRST AID MEASURES

Inhalation:

If inhaled, remove victim to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Skin:

If on skin, flush exposed skin with lukewarm water (not hot), or use other means to warm skin slowly. Get medical attention if frostbitten by liquid or if irritation occurs. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eyes:

Immediately flush eye(s) with plenty of water.

Ingestion:

Ingestion is not applicable - product is a gas at ambient temperatures.

Notes to physician:

Do not give drugs from adrenaline-ephedrine group.

5. FIREFIGHTING MEASURES

Flash point	Not applicable
Auto-ignition temperature:	Not determined

Lower flammable limit (LFL): None.

Upper flammable limit (UFL): None.

Extinguishing media (suitable):

Use extinguishing measures to suit surroundings.

Protective equipment:

Fire fighters and others who may be exposed to products of combustion should wear full fire fighting turn out gear (full Bunker Gear) and self-contained breathing apparatus (pressure demand / NIOSH approved or equivalent). Fire fighting equipment should be thoroughly decontaminated after use.

Further firefighting advice:

Keep containers cool by spraying with water if exposed to fire.
Water mist should be used to reduce vapor concentrations in air.

Fire and explosion hazards:

May decompose on contact with flames or extremely hot metal surfaces to produce toxic and corrosive products. Liquid and gas under pressure, overheating or overpressurizing may cause gas release and/or violent cylinder bursting.

Container may explode if heated due to resulting pressure rise.

Some mixtures of HCFCs and/or HFCs, and air or oxygen may be combustible if pressurized and exposed to extreme heat or flame.

When burned, the following hazardous products of combustion can occur:

Hydrogen fluoride

6. ACCIDENTAL RELEASE MEASURES

In case of spill or leak:

Use Halogen leak detector or other suitable means to locate leaks or check atmosphere. Keep upwind. Evacuate enclosed spaces and disperse gas with floor-level forced-air ventilation. Stop the leak if you can do so without risk. Consult a regulatory specialist to determine appropriate state or local reporting requirements, for assistance in waste characterization and/or hazardous waste disposal and other requirements listed in pertinent environmental permits.

7. HANDLING AND STORAGE

Handling

General information on handling:

Avoid breathing gas.

Keep container closed.

Use only with adequate ventilation.

Do not enter confined spaces unless adequately ventilated.

Use equipment rated for cylinder pressure.

Use a backflow preventative device in piping.

Wash thoroughly after handling.

Close valve after each use and when empty.

Emptied container retains vapor and product residue.

Observe all labeled safeguards until container is cleaned, reconditioned or destroyed.

Storage**General information on storage conditions:**

Store in well ventilated area away from heat and sources of ignition such as flame, sparks and static electricity.

Storage stability – Remarks:

Do not apply direct flame to cylinder. Do not store cylinder in direct sun or expose it to heat above 120 F (48.9 C.). Do not drop or refill this cylinder.

Storage incompatibility – General:

Keep away from oxidising agents and strongly acid or alkaline materials.

Temperature tolerance – Do not store above:

118 °F (48 °C)

8. EXPOSURE CONTROLS/PERSONAL PROTECTION**Airborne Exposure Guidelines:****Ethane, 1,1,1-trifluoro- (420-46-2)**

US. Workplace Environmental Exposure Level (WEEL) Guides

Time Weighted Average (TWA): 1,000 ppm (3,400 mg/m3)

Remarks: Listed

Ethane, 1,1,1,2-tetrafluoro- (811-97-2)

US. Workplace Environmental Exposure Level (WEEL) Guides

Time Weighted Average (TWA): 1,000 ppm (4,240 mg/m3)

Remarks: Listed

Ethane, 1,1,1-trifluoro- (420-46-2)

US. Workplace Environmental Exposure Level (WEEL) Guides

Time Weighted Average (TWA): 1,000 ppm (3,400 mg/m3)

Remarks: Listed

Ethane, 1,1,1,2-tetrafluoro- (811-97-2)

US. Workplace Environmental Exposure Level (WEEL) Guides

Time Weighted Average (TWA): 1,000 ppm (4,240 mg/m3)

Remarks: Listed

Only those components with exposure limits are printed in this section. Limits with skin contact designation above have skin contact effect. Air sampling alone is insufficient to accurately quantitate exposure. Measures to prevent significant cutaneous absorption may be required. Limits with a sensitizer designation above mean that exposure to this material may cause allergic reactions.

Engineering controls:

Investigate engineering techniques to reduce exposures below airborne exposure limits or to otherwise reduce exposures. Provide ventilation if necessary to minimize exposures or to control exposure levels to below airborne exposure limits (if applicable see above). Provide ventilation if necessary to control exposure levels below airborne exposure limits (see above). If practical, use local mechanical exhaust ventilation at sources of air contamination such as open process equipment.

Respiratory protection:

Avoid breathing gas. Where airborne exposure is likely or airborne exposure limits are exceeded (if applicable, see above), use NIOSH approved respiratory protection equipment appropriate to the material and/or its components (full facepiece recommended). Consult respirator manufacturer to determine appropriate type equipment for a given application. Observe respirator use limitations specified by NIOSH or the manufacturer. For emergency and other conditions where there may be a potential for significant exposure or where exposure limit may be significantly exceeded, use an approved full face positive-pressure, self-contained breathing apparatus or positive-pressure airline with auxiliary self-contained air supply. Respiratory protection programs must comply with 29 CFR § 1910.134.

Skin protection:

Wear appropriate chemical resistant protective clothing and chemical resistant gloves to prevent skin contact. Consult glove manufacturer to determine appropriate type glove material for given application. Rinse immediately if skin is contaminated. Wash contaminated clothing and clean protective equipment before reuse. Wash thoroughly after handling.

Eye protection:

Use good industrial practice to avoid eye contact.

9. PHYSICAL AND CHEMICAL PROPERTIES
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Color:	Clear - colourless
Physical state:	gas
Form:	Liquefied gas
Odor:	Slightly ether-like
pH:	not applicable
Density:	not determined
Specific Gravity (Relative density):	1.05 (77 °F (25 °C))
Vapor pressure:	8,445 mmHg (70.0 °F (21.1 °C))

Vapor density:	3.39 kg/m ³
Boiling point/boiling range:	-54.0 °F (-47.8 °C)
Freezing point:	not determined
Melting point:	not determined
Solubility in water:	negligible
% Volatiles:	100 %
Molecular weight:	97.6 g/mol

10. STABILITY AND REACTIVITY**Stability:**

This material is chemically stable under normal and anticipated storage, handling and processing conditions.

Materials to avoid:

Strong oxidizing agents
Strong acids
Alkaline materials

Conditions / hazards to avoid:

Heat.

Hazardous decomposition products:

Thermal decomposition giving toxic and corrosive products :
Hydrogen fluoride
Carbon monoxide
Carbon dioxide (CO₂)
Carbonyl halides

11. TOXICOLOGICAL INFORMATION

Data on this material and/or its components are summarized below.

Data for Ethane, 1,1,1-trifluoro- (420-46-2)**Acute toxicity****Inhalation:**

Practically nontoxic. (rat) 4 h LC₀ > 540,000 ppm.

Sensitization:

Causes cardiac sensitization. Inhalation. (dog) Stress induced heart effects: irregular heart beat, rapid heart beat, in some cases, sudden death (Reaction may occur in response to stress (natural adrenaline release) or administration of epinephrine.)

Repeated dose toxicity

Repeated inhalation administration to rat and guinea pig / affected organ(s): lung / signs: irritation, bronchitis, pneumonia

Chronic oral administration to rat / No adverse effects reported.

Carcinogenicity

Chronic oral administration to rat / No increase in tumor incidence was reported.

Genotoxicity**Assessment in Vitro:**

No genetic changes were observed in laboratory tests using: animal cells

Both positive and negative responses for genetic changes were observed in laboratory tests using: bacteria

Genotoxicity**Assessment in Vivo:**

No genetic changes were observed in laboratory tests using: mice

Developmental toxicity

Exposure during pregnancy. inhalation (rat and rabbit) / No birth defects were observed.

Data for Ethane, pentafluoro- (354-33-6)**Acute toxicity****Inhalation:**

Practically nontoxic. (rat) 4 h LC50 > 3,900 mg/l (> 800000 ppm).

Sensitization:

Causes cardiac sensitization. inhalation. (dog) Stress induced heart effects: irregular heart beat, rapid heart beat, in some cases, sudden death (Reaction may occur in response to stress (natural adrenaline release) or administration of epinephrine.)

Repeated dose toxicity

Subchronic inhalation administration to rat / No adverse systemic effects reported.

Genotoxicity**Assessment in Vitro:**

No genetic changes were observed in laboratory tests using: bacteria, animal cells

Genotoxicity**Assessment in Vivo:**

No genetic changes were observed in laboratory tests using: mice

Developmental toxicity

Exposure during pregnancy. inhalation (rat and rabbit) / No birth defects were observed.

Data for Ethane, 1,1,1,2-tetrafluoro- (811-97-2)

Acute toxicity**Inhalation:**

Practically nontoxic. (rat) 4 h LC50 approximately 2,360 mg/l (~ 567000 ppm).

Practically nontoxic. (rat) 0.5 h LC50 approximately 3,122 mg/l (~ 750000 ppm).

Signs/effects reported after acute exposure. (mouse, dog, cat, monkey) signs: anesthetic effects

Skin Irritation:

Slightly irritating. (rabbit) (24 h)

Eye Irritation:

Slightly irritating. (rabbit)

Sensitization:

Causes cardiac sensitization. inhalation. (dog) Stress induced heart effects: irregular heart beat, rapid heart beat, in some cases, sudden death (Reaction may occur in response to stress (natural adrenaline release) or administration of epinephrine.)

Skin Sensitization:

Repeated skin exposure. (guinea pig) No skin allergy was observed

Repeated dose toxicity

Repeated inhalation administration to rat / No adverse systemic effects reported.

Carcinogenicity

Chronic inhalation administration to male rat / affected organ(s): testes / signs: tumors were benign. / Increase in tumor incidence was reported.

Chronic inhalation administration to female rat / No increase in tumor incidence was reported.

1 year oral gavage administration to rat / No increase in tumor incidence was reported.

Genotoxicity**Assessment in Vitro:**

No genetic changes were observed in laboratory tests using: bacteria, animal cells

Genotoxicity**Assessment in Vivo:**

No genetic changes were observed in laboratory tests using: animals

Developmental toxicity

Exposure during pregnancy. inhalation (rat and rabbit) / No birth defects were observed. (delays in development, at doses that produce effects in mothers)

12. ECOLOGICAL INFORMATION**Chemical Fate and Pathway**

Data on this material and/or its components are summarized below.

Data for Ethane, 1,1,1-trifluoro- (420-46-2)**Octanol Water Partition Coefficient:**

log Pow = 1.73 (calculated)

Global Warming Potential:GWP 3,800 (Global warming potential with respect to CO₂ (time horizon 100 years))**Ozone Depletion Potential:**

ODP 0 (Ozone depletion potential; ODP; (R-11 = 1))

Data for Ethane, pentafluoro- (354-33-6)**Biodegradation:**

Not readily biodegradable. (Closed Bottle test, 28 d) biodegradation 5 %

Octanol Water Partition Coefficient:

log Pow = 1.48

Global Warming Potential:

GWP 0.84 (Halocarbon global warming potential; HGWP; (R-11 = 1))

Ozone Depletion Potential:

ODP < 0.001 (Ozone depletion potential; ODP; (R-11 = 1))

Data for Ethane, 1,1,1,2-tetrafluoro- (811-97-2)**Biodegradation:**

Not readily biodegradable. (28 d) biodegradation 3 %

Octanol Water Partition Coefficient:

log Pow = 1.06

Photodegradation:Degradation in the atmosphere Half-life direct photolysis: = 9.6 - 16.7 y
(in atmosphere)**Global Warming Potential:**

GWP = 0.3 (Halocarbon global warming potential.)

Ozone Depletion Potential:

ODP = 0

Data for Hydrochloric acid (7647-01-0)**Octanol Water Partition Coefficient:**

log Pow = 0.25 (calculated)

Ecotoxicology

Data on this material and/or its components are summarized below.

Data for Ethane, 1,1,1-trifluoro- (420-46-2)**Aquatic toxicity data:**No more than slightly toxic. Oncorhynchus mykiss (rainbow trout) 96 h LC₅₀ > 40 mg/l

Aquatic invertebrates:

Practically nontoxic. Daphnia magna (Water flea) 48 h LC50 = 300 mg/l

Data for Ethane, 1,1,1,2-tetrafluoro- (811-97-2)

Aquatic toxicity data:

Practically nontoxic. Oncorhynchus mykiss (rainbow trout) 96 h LC50 = 450 mg/l

Aquatic invertebrates:

Practically nontoxic. Daphnia magna (Water flea) 48 h EC50 = 930 mg/l

Microorganisms:

Practically nontoxic. Bacteria 16 h EC10 > 730 mg/l

13. DISPOSAL CONSIDERATIONS

Waste disposal:

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 reclaimer 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. Dispose of in accordance with federal, state and local regulations. Consult a regulatory specialist to determine appropriate state or local reporting requirements, for assistance in waste characterization and/or hazardous waste disposal and other requirements listed in pertinent environmental permits. Note: Chemical additions to, processing of, or otherwise altering this material may make this waste management information incomplete, inaccurate, or otherwise inappropriate. Furthermore, state and local waste disposal requirements may be more restrictive or otherwise different from federal laws and regulations.

14. TRANSPORT INFORMATION

US Department of Transportation (DOT)

UN Number : 3337
 Proper shipping name : Refrigerant gas R 404A
 Class : 2.2
 Marine pollutant : no

International Maritime Dangerous Goods Code (IMDG)

UN Number : 3337
 Proper shipping name : REFRIGERANT GAS R 404A
 Class : 2.2
 Marine pollutant : no

15. REGULATORY INFORMATION

Chemical Inventory Status

EU. EINECS EINECS Conforms to

FORANE ® 404A

US. Toxic Substances Control Act	TSCA	The components of this product are all on the TSCA Inventory.
Australia. Industrial Chemical (Notification and Assessment) Act	AICS	Conforms to
Canada. Canadian Environmental Protection Act (CEPA). Domestic Substances List (DSL). (Can. Gaz. Part II, Vol. 144)	DSL	All components of this product are on the Canadian DSL list.
Japan. Kashin-Hou Law List	ENCS (JP)	Conforms to
Korea. Existing Chemicals Inventory (KECI)	KECI (KR)	Conforms to
Philippines. The Toxic Substances and Hazardous and Nuclear Waste Control Act	PICCS (PH)	Conforms to
China. Inventory of Existing Chemical Substances	IECSC (CN)	Conforms to
New Zealand. Inventory of Chemicals (NZIoC), as published by ERMA New Zealand	NZIOC	Conforms to

United States – Federal Regulations

SARA Title III – Section 302 Extremely Hazardous Chemicals:

The components in this product are either not SARA Section 302 regulated or regulated but present in negligible concentrations.

SARA Title III - Section 311/312 Hazard Categories:

Acute Health Hazard, Sudden Release of Pressure Hazard

SARA Title III – Section 313 Toxic Chemicals:

SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) - Reportable Quantity (RQ):

The components in this product are either not CERCLA regulated, regulated but present in negligible concentrations, or regulated with no assigned reportable quantity.

OSHA Regulated Carcinogens (NTP, IARC, OSHA Listed):

NTP:

No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

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IARC:

No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

OSHA:

No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

United States – State Regulations

New Jersey Right to Know

<u>Chemical Name</u>	<u>CAS-No.</u>
Ethane, 1,1,1-trifluoro-	420-46-2

Pennsylvania Right to Know

<u>Chemical Name</u>	<u>CAS-No.</u>
Ethane, 1,1,1,2-tetrafluoro-	811-97-2
Ethane, pentafluoro-	354-33-6
Ethane, 1,1,1-trifluoro-	420-46-2

California Prop. 65

This product does not contain any chemicals known to the State of California to cause cancer, birth defects, or any other reproductive defects.

16. OTHER INFORMATION

Latest Revision(s):

Revised Section(s):	Revised section 15.
Reference number:	000000057859
Date of Revision:	06/21/2012
Date Printed:	12/27/2012

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