

# SAFETY DATA SHEET



## Opteon™ XP40 (R-449A) Refrigerant

Version 11.1	Revision Date: 2025/03/05	SDS Number (Internal): 1349459-00055	MSDS number: AA00152-0000133420 Date of last issue: 2025/01/23 Date of first issue: 2017/02/27
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### 1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Opteon™ XP40 (R-449A) Refrigerant

SDS-Identcode : 130000133420

#### Recommended use of the chemical and restrictions on use

Recommended use : Refrigerant

Restrictions on use : Consumer use  
For professional users only.

#### Manufacturer or supplier's details

Company : Chemours Korea Inc.

Address : 12FL, Majestarcity Tower 1, 12, Seocho-daero 38-gil, Seocho-gu, Seoul 06655, Korea

Telephone : 82-2-2015-5000

Emergency telephone number : 080-880-0454

Telefax : 82-2-2015-5091

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### 2. HAZARDS IDENTIFICATION

#### GHS Classification

Gases under pressure : Liquefied gas

#### GHS label elements

Hazard pictograms :



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.

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### Other hazards which do not result in classification

Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing.

Misuse or intentional inhalation abuse may cause death without warning symptoms, due to cardiac effects.

Rapid evaporation of the product may cause frostbite.

May displace oxygen and cause rapid suffocation.

### 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

#### Components

Chemical name	Common Name	CAS-No.	Concentration (% w/w)
1,1,1,2-Tetrafluoroethane#	HFC-134a	811-97-2	25.7
2,3,3,3-Tetrafluoropropene#	No data available	754-12-1	25.1735
Pentafluoroethane#	1,1,1,2,2-Pentafluoroethane	354-33-6	24.7
Difluoromethane#	No data available	75-10-5	24.3

# Voluntarily-disclosed substance

### 4. FIRST AID MEASURES

General advice	: In the case of accident or if you feel unwell, seek medical advice immediately. When symptoms persist or in all cases of doubt seek medical advice.
In case of eye contact	: Get medical attention immediately.
In case of skin contact	: Thaw frosted parts with lukewarm water. Do not rub affected area. Get medical attention immediately.
If inhaled	: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
If swallowed	: Ingestion is not considered a potential route of exposure.
Most important symptoms and effects, both acute and delayed	: May cause cardiac arrhythmia. Other symptoms potentially related to misuse or inhalation abuse are Cardiac sensitisation Anaesthetic effects

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Light-headedness  
Dizziness  
confusion  
Lack of coordination  
Drowsiness  
Unconsciousness  
Skin contact may provoke the following symptoms:  
Irritation  
Swelling of tissue  
Itching  
Discomfort  
Redness  
Eye contact may provoke the following symptoms  
tearing  
Redness  
Discomfort  
Gas reduces oxygen available for breathing.  
Contact with liquid or refrigerated gas can cause cold burns and frostbite.

- Protection of first-aiders : No special precautions are necessary for first aid responders.
- Notes to physician : Because of possible disturbances of cardiac rhythm, catecholamine drugs, such as epinephrine, that may be used in situations of emergency life support should be used with special caution.

### 5. FIREFIGHTING MEASURES

#### Suitable and unsuitable extinguishing media

Suitable extinguishing media : Not applicable  
Will not burn

Unsuitable extinguishing media : Not applicable  
Will not burn

Specific hazards during fire-fighting : Exposure to combustion products may be a hazard to health.  
If the temperature rises there is danger of the vessels bursting due to the high vapor pressure.

Hazardous combustion products : Hydrogen fluoride  
carbonyl fluoride  
Carbon oxides  
Fluorine compounds

Specific extinguishing methods : Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.  
Fight fire remotely due to the risk of explosion.  
Use water spray to cool unopened containers.

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Remove undamaged containers from fire area if it is safe to do so.  
Evacuate area.

Special protective equipment for firefighters : Wear self-contained breathing apparatus for firefighting if necessary.  
Use personal protective equipment.

### 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures : Evacuate personnel to safe areas.  
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).

Environmental precautions : Avoid release to the environment.  
Prevent further leakage or spillage if safe to do so.  
Retain and dispose of contaminated wash water.

Methods and materials for containment and cleaning up : Ventilate the area.  
Local or national regulations may apply to releases and disposal of this material, as well as those materials and items employed in the cleanup of releases. You will need to determine which regulations are applicable.  
Sections 13 and 15 of this SDS provide information regarding certain local or national requirements.

### 7. HANDLING AND STORAGE

Technical measures : Use equipment rated for cylinder pressure. Use a backflow preventative device in piping. Close valve after each use and when empty.

Local/Total ventilation : Use only with adequate ventilation.

Advice on safe handling : Avoid breathing gas.  
Handle in accordance with good industrial hygiene and safety practice, based on the results of the workplace exposure assessment  
Wear cold insulating gloves/ face shield/ eye protection.  
Valve protection caps and valve outlet threaded plugs must remain in place unless container is secured with valve outlet piped to use point.  
Prevent backflow into the gas tank.  
Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

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Use a pressure reducing regulator when connecting cylinder to lower pressure (<3000 psig) piping or systems.  
Close valve after each use and when empty. Do NOT change or force fit connections.  
Prevent the intrusion of water into the gas tank.  
Never attempt to lift cylinder by its cap.  
Do not drag, slide or roll cylinders.  
Use a suitable hand truck for cylinder movement.  
Keep away from heat and sources of ignition.  
Take precautionary measures against static discharges.  
Take care to prevent spills, waste and minimize release to the environment.

- Conditions for safe storage : Cylinders should be stored upright and firmly secured to prevent falling or being knocked over.  
Separate full containers from empty containers.  
Do not store near combustible materials.  
Avoid area where salt or other corrosive materials are present.  
Keep in properly labelled containers.  
Keep in a cool, well-ventilated place.  
Keep away from direct sunlight.  
Store in accordance with the particular national regulations.
- Materials to avoid : Do not store with the following product types:  
Strong oxidizing agents
- Recommended storage temperature : < 52 °C
- Storage period : > 10 yr
- Further information on storage stability : The product has an indefinite shelf life when stored properly.

## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

### Components with workplace control parameters

Contains no substances with occupational exposure limit values.

- Engineering measures** : Ensure adequate ventilation, especially in confined areas.  
Minimize workplace exposure concentrations.

**Personal protective equipment.** Among the following personal protective equipment, the PPEs which require safety certification need to be certified by KOSHA.

- Respiratory protection : Use a positive pressure air supplied respirator if there is any potential for uncontrolled release, exposure levels are unknown.
- Eye protection : Wear the following personal protective equipment:

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Chemical resistant goggles must be worn.  
Face-shield

Hand protection  
Material

: Low temperature resistant gloves

Remarks

: Choose gloves to protect hands against chemicals depending on the concentration and quantity of the hazardous substance and specific to place of work. For special applications, we recommend clarifying the resistance to chemicals of the aforementioned protective gloves with the glove manufacturer. Wash hands before breaks and at the end of workday. Breakthrough time is not determined for the product. Change gloves often!

Skin and body protection

: Skin should be washed after contact.

Protective measures

: Wear cold insulating gloves/ face shield/ eye protection.

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.

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### 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

: Liquefied gas

Colour

: clear

Odour

: slight, ether-like

Odour Threshold

: No data available

pH

: No data available

Melting point/freezing point

: No data available

Initial boiling point and boiling range

: -46 °C

Flash point

: Not applicable

Evaporation rate

: > 1

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(CCL4=1.0)

Flammability (solid, gas)	:	Will not burn
Upper explosion 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	:	12,748 hPa (25 °C)
Solubility(ies) Water solubility	:	No data available
Relative vapour density	:	3.07 (Air = 1.0)
Relative density	:	1.10 (25 °C)
Partition coefficient: n-octanol/water	:	Not applicable
Auto-ignition temperature	:	No data available
Decomposition temperature	:	No data available
Viscosity Viscosity, kinematic	:	Not applicable
Explosive properties	:	Not explosive
Oxidizing properties	:	The substance or mixture is not classified as oxidizing.
Molecular weight	:	No data available
Particle characteristics Particle size	:	Not applicable

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### 10. STABILITY AND REACTIVITY

Chemical stability and possibility of hazardous reactions	:	Reactivity: Not classified as a reactivity hazard. Chemical stability: Stable if used as directed. Follow precautionary advice and avoid incompatible materials and conditions. Possibility of hazardous reactions: Can react with strong oxidizing agents.
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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 can become combustible in the presence of an ignition source. This substance can also become combustible in an oxygen enriched environment (oxygen concentrations greater than that in air). Whether a mixture containing this substance and air, or this substance in an oxygen enriched atmosphere become combustible depends on the inter-relationship of 1) the temperature 2) the pressure, and 3) the proportion of oxygen in the mixture. In general, this substance should not be allowed to exist with air above atmospheric pressure 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. Heat, flames and sparks.
Incompatible materials	: Avoid impurities (e.g. rust, dust, ash), risk of decomposition. Incompatible with acids and bases. Incompatible with oxidizing agents. Oxygen Peroxides peroxide compounds Powdered metals
Hazardous decomposition products	: No hazardous decomposition products are known.

### 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure	: Inhalation Skin contact Eye contact
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#### Health hazard information

##### Acute toxicity

No data available

##### Components:

##### **1,1,1,2-Tetrafluoroethane:**

Acute oral toxicity	: Assessment: The substance or mixture has no acute oral toxicity
Acute inhalation toxicity	: LC50 (Rat): > 567000 ppm Exposure time: 4 h Test atmosphere: gas Method: OECD Test Guideline 403



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No observed adverse effect concentration (Dog): 40000 ppm  
Test atmosphere: gas  
Remarks: Cardiac sensitisation

Lowest observed adverse effect concentration (Dog): 80000 ppm  
Test atmosphere: gas  
Symptoms: May cause cardiac arrhythmia.

Cardiac sensitisation threshold limit (Dog): 334,000 mg/m<sup>3</sup>  
Test atmosphere: gas  
Symptoms: May cause cardiac arrhythmia.

Acute dermal toxicity : Assessment: The substance or mixture has no acute dermal toxicity

### **2,3,3,3-Tetrafluoropropene:**

Acute inhalation toxicity : LC50 (Rat): > 405800 ppm  
Exposure time: 4 h  
Test atmosphere: gas  
Method: OECD Test Guideline 403

No observed adverse effect concentration (Dog): 120000 ppm  
Test atmosphere: gas  
Remarks: Cardiac sensitisation

Lowest observed adverse effect concentration (Dog): > 120000 ppm  
Test atmosphere: gas  
Remarks: Cardiac sensitisation

Cardiac sensitisation threshold limit (Dog): > 559,509 mg/m<sup>3</sup>  
Test atmosphere: gas  
Remarks: Cardiac sensitisation

### **Pentafluoroethane:**

Acute inhalation toxicity : LC50 (Rat): > 800000 ppm  
Exposure time: 4 h  
Test atmosphere: gas  
Method: OECD Test Guideline 403

No observed adverse effect concentration (Dog): 75000 ppm  
Remarks: Cardiac sensitisation

Cardiac sensitisation threshold limit (Dog): 368.159 mg/m<sup>3</sup>  
Remarks: Cardiac sensitisation

### **Difluoromethane:**

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Acute oral toxicity : Assessment: The substance or mixture has no acute oral toxicity

Acute inhalation toxicity : LC50 (Rat): > 520000 ppm  
Exposure time: 4 h  
Test atmosphere: gas  
Method: OECD Test Guideline 403

No observed adverse effect concentration (Dog): 350000 ppm  
Test atmosphere: gas  
Remarks: Cardiac sensitisation

Lowest observed adverse effect concentration (Dog): > 350000 ppm  
Test atmosphere: gas  
Remarks: Cardiac sensitisation

Cardiac sensitisation threshold limit (Dog): > 735,000 mg/m<sup>3</sup>  
Test atmosphere: gas  
Remarks: Cardiac sensitisation

Acute dermal toxicity : Assessment: The substance or mixture has no acute dermal toxicity

### Skin corrosion/irritation

No data available

### Components:

#### 1,1,1,2-Tetrafluoroethane:

Result : No skin irritation

#### 2,3,3,3-Tetrafluoropropene:

Result : No skin irritation

#### Difluoromethane:

Result : No skin irritation

### Serious eye damage/eye irritation

No data available

### Components:

#### 1,1,1,2-Tetrafluoroethane:

Result : No eye irritation

#### 2,3,3,3-Tetrafluoropropene:

Result : No eye irritation

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### Difluoromethane:

Result : No eye irritation

### Respiratory or skin sensitisation

#### Respiratory sensitisation

No data available

#### Skin sensitisation

No data available

### Components:

#### 1,1,1,2-Tetrafluoroethane:

Exposure routes : Skin contact  
Result : negative

Exposure routes : Inhalation  
Species : Rat  
Result : negative

Exposure routes : Inhalation  
Species : Humans  
Result : negative

#### 2,3,3,3-Tetrafluoropropene:

Exposure routes : Skin contact  
Result : negative

### Difluoromethane:

Exposure routes : Skin contact  
Result : negative

### Carcinogenicity

No data available

### Components:

#### 1,1,1,2-Tetrafluoroethane:

No data available

Species : Rat  
Application Route : inhalation (gas)  
Exposure time : 2 Years  
Method : OECD Test Guideline 453  
Result : negative

Carcinogenicity - Assess- : Weight of evidence does not support classification as a car-

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ment

cinogen

### **2,3,3,3-Tetrafluoropropene:**

No data available

Result : negative

Carcinogenicity - Assessment : Weight of evidence does not support classification as a carcinogen

### **Pentafluoroethane:**

No data available

### **Difluoromethane:**

No data available

### **Germ cell mutagenicity**

No data available

### **Components:**

#### **1,1,1,2-Tetrafluoroethane:**

No data available

Genotoxicity in vitro : Test Type: Bacterial reverse mutation assay (AMES)  
Method: OECD Test Guideline 471  
Result: negative

Test Type: Chromosome aberration test in vitro  
Method: OECD Test Guideline 473  
Result: negative

Genotoxicity in vivo : Test Type: Mammalian erythrocyte micronucleus test (in vivo cytogenetic assay)  
Species: Mouse  
Application Route: inhalation (gas)  
Method: OECD Test Guideline 474  
Result: negative

Test Type: Unscheduled DNA synthesis (UDS) test with mammalian liver cells in vivo  
Species: Rat  
Application Route: inhalation (gas)  
Method: OECD Test Guideline 486  
Result: negative

Germ cell mutagenicity- Assessment : Weight of evidence does not support classification as a germ cell mutagen.

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### 2,3,3,3-Tetrafluoropropene:

No data available

- Genotoxicity in vitro : Test Type: Bacterial reverse mutation assay (AMES)  
Method: OECD Test Guideline 471  
Result: positive
- Test Type: Chromosome aberration test in vitro  
Method: OECD Test Guideline 473  
Result: negative
- Genotoxicity in vivo : Test Type: Mammalian erythrocyte micronucleus test (in vivo cytogenetic assay)  
Species: Mouse  
Application Route: inhalation (gas)  
Method: OECD Test Guideline 474  
Result: negative
- Test Type: In vivo mammalian alkaline comet assay  
Species: Rat  
Application Route: inhalation (gas)  
Method: OECD Test Guideline 489  
Result: negative
- Test Type: Mammalian erythrocyte micronucleus test (in vivo cytogenetic assay)  
Species: Rat  
Application Route: inhalation (gas)  
Method: OECD Test Guideline 474  
Result: negative
- Germ cell mutagenicity- Assessment : Weight of evidence does not support classification as a germ cell mutagen.

### Pentafluoroethane:

No data available

- Genotoxicity in vitro : Test Type: Bacterial reverse mutation assay (AMES)  
Method: OECD Test Guideline 471  
Result: negative
- Test Type: In vitro mammalian cell gene mutation test  
Result: negative  
Remarks: Based on data from similar materials
- Test Type: Chromosome aberration test in vitro  
Method: OECD Test Guideline 473  
Result: negative
- Genotoxicity in vivo : Test Type: Mammalian erythrocyte micronucleus test (in vivo

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cytogenetic assay)  
Species: Mouse  
Application Route: inhalation (gas)  
Method: OECD Test Guideline 474  
Result: negative

### Difluoromethane:

No data available

Genotoxicity in vitro : Test Type: Bacterial reverse mutation assay (AMES)  
Method: OECD Test Guideline 471  
Result: negative

Test Type: Chromosome aberration test in vitro  
Method: OECD Test Guideline 473  
Result: negative

Genotoxicity in vivo : Test Type: Mammalian erythrocyte micronucleus test (in vivo cytogenetic assay)  
Species: Mouse  
Application Route: inhalation (gas)  
Method: OECD Test Guideline 474  
Result: negative

Germ cell mutagenicity- Assessment : Weight of evidence does not support classification as a germ cell mutagen.

### Reproductive toxicity

No data available

### Components:

#### 1,1,1,2-Tetrafluoroethane:

No data available

Effects on fertility : Species: Mouse  
Application Route: Inhalation  
Result: negative

Effects on foetal development : Test Type: Combined repeated dose toxicity study with the reproduction/developmental toxicity screening test  
Species: Rabbit  
Application Route: inhalation (gas)  
Method: OECD Test Guideline 414  
Result: negative

Reproductive toxicity - Assessment : Weight of evidence does not support classification for reproductive toxicity

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### 2,3,3,3-Tetrafluoropropene:

No data available

- Effects on fertility : Test Type: Two-generation reproduction toxicity study  
Species: Rat  
Application Route: inhalation (gas)  
Method: OECD Test Guideline 416  
Result: negative
- Effects on foetal development : Test Type: Prenatal development toxicity study (teratogenicity)  
Species: Rat  
Application Route: inhalation (gas)  
Method: OECD Test Guideline 414  
Result: negative
- Reproductive toxicity - Assessment : Weight of evidence does not support classification for reproductive toxicity, No effects on or via lactation

### Pentafluoroethane:

No data available

- Effects on fertility : Test Type: One-generation reproduction toxicity study  
Species: Rat  
Application Route: inhalation (vapour)  
Result: negative  
Remarks: Based on data from similar materials
- Effects on foetal development : Test Type: Embryo-foetal development  
Species: Rat  
Application Route: inhalation (gas)  
Method: OECD Test Guideline 414  
Result: negative

### Difluoromethane:

No data available

- Effects on fertility : Species: Mouse  
Application Route: Inhalation  
Result: negative  
Remarks: Based on data from similar materials
- Effects on foetal development : Test Type: Combined repeated dose toxicity study with the reproduction/developmental toxicity screening test  
Species: Rat  
Application Route: inhalation (gas)  
Method: OECD Test Guideline 414  
Result: negative
- Test Type: Combined repeated dose toxicity study with the reproduction/developmental toxicity screening test

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Species: Rabbit  
Application Route: inhalation (gas)  
Method: OECD Test Guideline 414  
Result: negative

Reproductive toxicity - Assessment : Weight of evidence does not support classification for reproductive toxicity

### STOT - single exposure

No data available

#### Components:

##### **1,1,1,2-Tetrafluoroethane:**

Exposure routes : inhalation (gas)  
Assessment : No significant health effects observed in animals at concentrations of 20000 ppmV/4h or less

##### **2,3,3,3-Tetrafluoropropene:**

Exposure routes : inhalation (gas)  
Assessment : No significant health effects observed in animals at concentrations of 20000 ppmV/4h or less

##### **Difluoromethane:**

Exposure routes : inhalation (gas)  
Assessment : No significant health effects observed in animals at concentrations of 20000 ppmV/4h or less

### STOT - repeated exposure

No data available

#### Components:

##### **1,1,1,2-Tetrafluoroethane:**

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

##### **2,3,3,3-Tetrafluoropropene:**

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

##### **Difluoromethane:**

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



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### Repeated dose toxicity

#### Components:

##### **1,1,1,2-Tetrafluoroethane:**

Species	: Rat, male and female
NOAEL	: 50000 ppm
LOAEL	: >50000 ppm
Application Route	: inhalation (gas)
Exposure time	: 2 yr
Method	: OECD Test Guideline 453

##### **2,3,3,3-Tetrafluoropropene:**

Species	: Rat, male and female
NOAEL	: 50000 ppm
LOAEL	: >50000 ppm
Application Route	: inhalation (gas)
Exposure time	: 13 Weeks
Method	: OECD Test Guideline 413

##### **Pentafluoroethane:**

Species	: Rat
NOAEL	: $\geq$ 50000 ppm
Application Route	: inhalation (gas)
Exposure time	: 13 Weeks
Method	: OECD Test Guideline 413

##### **Difluoromethane:**

Species	: Rat, male and female
NOAEL	: 49100 ppm
LOAEL	: > 49100 ppm
Application Route	: inhalation (gas)
Exposure time	: 13 Weeks
Method	: OECD Test Guideline 413

### Aspiration toxicity

No data available

#### Components:

##### **1,1,1,2-Tetrafluoroethane:**

No aspiration toxicity classification

##### **2,3,3,3-Tetrafluoropropene:**

No aspiration toxicity classification

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### Difluoromethane:

No aspiration toxicity classification

### Experience with human exposure

No data available

### Toxicology, Metabolism, Distribution

No data available

### Neurological effects

No data available

### Further information

No data available

## 12. ECOLOGICAL INFORMATION

### Ecotoxicity

#### Components:

#### **1,1,1,2-Tetrafluoroethane:**

Toxicity to fish : LC50 (Oncorhynchus mykiss (rainbow trout)): 450 mg/l  
Exposure time: 96 h  
Method: Regulation (EC) No. 440/2008, Annex, C.1

Toxicity to daphnia and other aquatic invertebrates : EC50 (Daphnia magna (Water flea)): 980 mg/l  
Exposure time: 48 h  
Method: Regulation (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

#### **2,3,3,3-Tetrafluoropropene:**

Toxicity to fish : LC50 (Cyprinus carpio (Carp)): > 197 mg/l  
Exposure time: 96 h  
Method: OECD Test Guideline 203

Toxicity to daphnia and other aquatic invertebrates : EC50 (Daphnia magna (Water flea)): > 100 mg/l  
Exposure time: 48 h  
Method: OECD Test Guideline 202

Toxicity to algae/aquatic plants : EC50 (Selenastrum capricornutum (green algae)): > 100 mg/l  
Exposure time: 72 h  
Method: OECD Test Guideline 201

NOEC (Selenastrum capricornutum (green algae)): > 75 mg/l  
Exposure time: 3 d  
Method: OECD Test Guideline 201

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### 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 (Water 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): 1,507 mg/l  
Exposure time: 96 h  
Method: ECOSAR (Ecological Structure Activity Relationships)

Toxicity to daphnia and other aquatic invertebrates : EC50 (Daphnia (water flea)): 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)

### Persistence and degradability

#### Components:

##### **1,1,1,2-Tetrafluoroethane:**

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

##### **2,3,3,3-Tetrafluoropropene:**

Biodegradability : Result: Not readily biodegradable.  
Method: OECD Test Guideline 301F

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### Pentafluoroethane:

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

### Difluoromethane:

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

### Bioaccumulative potential

#### Components:

#### 1,1,1,2-Tetrafluoroethane:

Bioaccumulation : Remarks: Bioaccumulation is unlikely.

Partition coefficient: n-octanol/water : log Pow: 1.06

#### 2,3,3,3-Tetrafluoropropene:

Bioaccumulation : Remarks: Bioaccumulation is unlikely.

Partition coefficient: n-octanol/water : log Pow: 2 (25 °C)

### Pentafluoroethane:

Partition coefficient: n-octanol/water : Pow: 1.48  
Method: OECD Test Guideline 107

### Difluoromethane:

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

### Mobility in soil

No data available

### Other adverse effects

No data available

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## 13. DISPOSAL CONSIDERATIONS

### Disposal methods

Waste from residues : Dispose of contents and container according to wastes control act.

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Contaminated packaging : Empty containers should be taken to an approved waste handling site for recycling or disposal.  
Empty pressure vessels should be returned to the supplier.  
If not otherwise specified: Dispose of as unused product.

### Disposal precautions

Dispose of contents and container according to wastes control act.

## 14. TRANSPORT INFORMATION

### International Regulations

#### UNRTDG

UN number : UN 1078  
Proper shipping name : REFRIGERANT GAS, N.O.S.  
(1,1,1,2-Tetrafluoroethane, 2,3,3,3-Tetrafluoropropene)  
Class : 2.2  
Packing group : Not assigned by regulation  
Labels : 2.2  
Environmentally hazardous : no

#### IATA-DGR

UN/ID No. : UN 1078  
Proper shipping name : Refrigerant gas, n.o.s.  
(1,1,1,2-Tetrafluoroethane, 2,3,3,3-Tetrafluoropropene)  
Class : 2.2  
Packing group : Not assigned by regulation  
Labels : Non-flammable, non-toxic Gas  
Packing instruction (cargo aircraft) : 200  
Packing instruction (passenger aircraft) : 200

#### IMDG-Code

UN number : UN 1078  
Proper shipping name : REFRIGERANT GAS, N.O.S.  
(1,1,1,2-Tetrafluoroethane, 2,3,3,3-Tetrafluoropropene)  
Class : 2.2  
Packing group : Not assigned by regulation  
Labels : 2.2  
EmS Code : F-C, S-V  
Marine pollutant : no

### Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable for product as supplied.

### National Regulations

Refer to section 15 for specific national regulation.

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### Special precautions for user

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.

## 15. REGULATORY INFORMATION

### National regulatory information

#### Regulation under the Occupational Safety and Health Act

##### Harmful Substances Prohibited from Manufacturing

Not applicable

##### Harmful Substances Required Permission for Manufacture

Not applicable

##### Harmful Agents to be kept below Occupational Exposure Limits

Not applicable

##### Harmful Agents Required to be kept below Permission Levels

Not applicable

##### Hazardous substances requiring management

Not applicable

##### Special Management Materials

Not applicable

##### Controlled Substances Subject to Environment Monitoring

Not applicable

##### Controlled Substances Subject to Health Examination

Not applicable

##### Hazardous Substances Subject to Process Safety Management (PSM) Reporting Obligation

Not applicable

##### K-OSHA Hazardous Substances (Occupational Safety and Health Regulations, Table 1)

Category
Flammable gas

##### K-OSHA Hazardous Substances (Occupational Safety and Health Regulations, Table 9)

Category	Manufacturing or handling quantity
Flammable gas	50 cubic metre

### Regulation under the Chemicals Control Act

#### Toxic Chemicals

Not applicable

#### Restricted Chemicals

Not applicable

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### Prohibited Chemicals

Not applicable

### Toxic Release Inventory

Chemical name	CAS-No.	Group	Threshold limits (%)
Hydrofluorocarbons	811-97-2	Group II	>= 1 %
Hydrofluorocarbons	354-33-6	Group II	>= 1 %
Hydrofluorocarbons	75-10-5	Group II	>= 1 %

### Accident Precaution Chemicals

Not applicable

### Dangerous Substances Safety Management Act

Not Applicable to Dangerous Materials

### Wastes Control Act

Industrial general wastes

Follow article 13 of the act to dispose the product waste

### Other requirements in domestic and other countries

Montreal Protocol : 1,1,1,2-Tetrafluoroethane  
Pentafluoroethane  
Difluoromethane

## 16. OTHER INFORMATION

Other information : Opteon™ and any associated logos are trademarks or copyrights of The Chemours Company FC, LLC.  
Chemours™ and the Chemours Logo are trademarks of The Chemours Company.  
Before use read Chemours safety information.  
For further information contact the local Chemours office or nominated distributors.

### Further information

Sources of key data used to compile the Safety Data Sheet : Internal technical data, data from raw material SDSs, OECD eChem Portal search results and European Chemicals Agency, <http://echa.europa.eu/>

Issuing date : 2017/02/27

### Revision number and date

Number of Revision : 54

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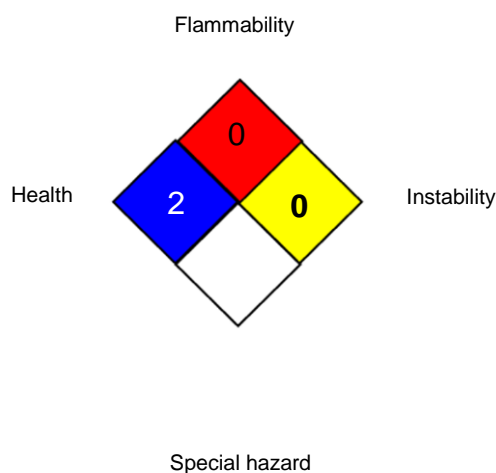
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Date format : yyyy/mm/dd

### NFPA:



### Full text of other abbreviations

AIIC - Australian Inventory of Industrial Chemicals; ANTT - National Agency for Transport by Land of Brazil; ASTM - American Society for the Testing of Materials; bw - Body weight; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; ERG - Emergency Response Guide; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; n.o.s. - Not Otherwise Specified; Nch - Chilean Norm; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NOM - Official Mexican Norm; NTP - National Toxicology Program; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation,



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tion, Authorisation and Restriction of Chemicals; SADT - Self-Accelerating Decomposition Temperature; SDS - Safety Data Sheet; TCSI - Taiwan Chemical Substance Inventory; TDG - Transportation of Dangerous Goods; TECI - Thailand Existing Chemicals Inventory; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative; WHMIS - Workplace Hazardous Materials Information System

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and shall not be considered a warranty or quality specification of any type. The information provided relates only to the specific material identified at the top of this SDS and may not be valid when the SDS material is used in combination with any other materials or in any process, unless specified in the text. Material users should review the information and recommendations in the specific context of their intended manner of handling, use, processing and storage, including an assessment of the appropriateness of the SDS material in the user's end product, if applicable.

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