SAFETY DATA SHEET

Freon™ MO59 (R-417A) Refrigerant

SECTION 1. IDENTIFICATION

Product name : Freon™ MO59 (R-417A) Refrigerant

SDS-Identcode : 130000000132

Manufacturer or supplier’s details

Company name of supplier : The Chemours Company FC, LLC

Address : 1007 Market Street
             Wilmington, DE 19899 United States of America (USA)

Telephone : 1-844-773-CHEM (outside the U.S. 1-302-773-1000)


Recommended use of the chemical and restrictions on use

Recommended use : Refrigerant

Restrictions on use : For professional and industrial installation and use only.

SECTION 2. HAZARDS IDENTIFICATION

GHS classification in accordance with 29 CFR 1910.1200

Gases under pressure : Liquefied gas

Simple Asphyxiant

GHS label elements

Signal Word : Warning

Hazard Statements : H280 Contains gas under pressure; may explode if heated. May displace oxygen and cause rapid suffocation.

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

Other hazards

Vapors 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.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

Hazardous ingredients

<table>
<thead>
<tr>
<th>Chemical name</th>
<th>CAS-No.</th>
<th>Concentration (% w/w)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,1,1,2-Tetrafluoroethane</td>
<td>811-97-2</td>
<td>50</td>
</tr>
<tr>
<td>Pentafluoroethane*</td>
<td>354-33-6</td>
<td>46.6</td>
</tr>
<tr>
<td>Butane</td>
<td>106-97-8</td>
<td>3.4</td>
</tr>
</tbody>
</table>

* Voluntarily-disclosed non-hazardous substance

SECTION 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.

If inhaled : If inhaled, remove to fresh air. Get medical attention if symptoms occur.

In case of skin contact : Thaw frosted parts with lukewarm water. Do not rub affected area. Get medical attention immediately.

In case of eye contact : 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 sensitization Anaesthetic effects Light-headedness Dizziness confusion Lack of coordination Drowsiness Unconsciousness 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 : Treat symptomatically and supportively.
### SECTION 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 and personal protective equipment recommendations. |
| Environmental precautions | 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. |

### SECTION 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:
- Do not breathe 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.
- Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.
- Prevent backflow into the gas tank.
- 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 labeled 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:
  - Self-reactive substances and mixtures
  - Organic peroxides
  - Oxidizing agents
  - Flammable liquids
  - Flammable solids
  - Pyrophoric liquids
  - Pyrophoric solids
  - Self-heating substances and mixtures
  - Substances and mixtures which in contact with water emit flammable gases
  - Explosives
  - Acutely toxic substances and mixtures
  - Substances and mixtures with chronic toxicity

Recommended storage temperature:
- < 52 °C

Storage period:
- > 10 y
Further information on storage stability: The product has an indefinite shelf life when stored properly.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Ingredients with workplace control parameters

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>CAS-No.</th>
<th>Value type (Form of exposure)</th>
<th>Control parameters / Permissible concentration</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,1,1,2-Tetrafluoroethane</td>
<td>811-97-2</td>
<td>TWA</td>
<td>1,000 ppm</td>
<td>US WEEL</td>
</tr>
<tr>
<td>Pentfluoroethane</td>
<td>354-33-6</td>
<td>TWA</td>
<td>1,000 ppm</td>
<td>US WEEL</td>
</tr>
<tr>
<td>Butane</td>
<td>106-97-8</td>
<td>TWA</td>
<td>800 ppm / 1,900 mg/m³</td>
<td>NIOSH REL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>STEL</td>
<td>1,000 ppm</td>
<td>ACGIH</td>
</tr>
</tbody>
</table>

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

Personal protective equipment

Respiratory protection: General and local exhaust ventilation is recommended to maintain vapor exposures below recommended limits. Where concentrations are above recommended limits or are unknown, appropriate respiratory protection should be worn. Follow OSHA respirator regulations (29 CFR 1910.134) and use NIOSH/MSHA approved respirators. Protection provided by air purifying respirators against exposure to any hazardous chemical is limited. Use a positive pressure air supplied respirator if there is any potential for uncontrolled release, exposure levels are unknown, or any other circumstance where air purifying respirators may not provide adequate protection.

Hand protection

Material: Heat resistant gloves

Remarks: Choose gloves to protect hands against chemicals depending on the concentration 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!

Eye protection: Wear the following personal protective equipment: Chemical resistant goggles must be worn. Face-shield

Skin and body protection: Skin should be washed after contact.

Protective measures: Wear cold insulating gloves/face shield/eye protection.
Hygiene measures: Ensure that eye flushing systems and safety showers are located close to the working place. When using do not eat, drink or smoke. Wash contaminated clothing before re-use.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Liquefied gas
Color: Colorless
Odor: Slight, ether-like
Odor Threshold: No data available
pH: No data available
Melting point/freezing point: No data available
Initial boiling point and boiling range: -39.1 °C
Flash point: Not applicable
Evaporation rate: Not applicable
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.
Vapor pressure: 9,835 hPa (25 °C)
Relative vapor density: 3.8
(Air = 1.0)
Relative density: 1.15 (25 °C)
Density: 1.2 g/cm³ (20 °C)
(as liquid)
Solubility(ies)
Water solubility: No data available
Partition coefficient: n-octanol/water: Not applicable
Autoignition 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.

Particle size: Not applicable

SECTION 10. STABILITY AND REACTIVITY

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.

Conditions to avoid: Heat, flames and sparks.

Incompatible materials: Oxidizing agents

Hazardous decomposition products: No hazardous decomposition products are known.

SECTION 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Inhalation
Skin contact
Eye contact

Acute toxicity
Not classified based on available information.

Ingredients:

1,1,1,2-Tetrafluoroethane:
Acute inhalation toxicity: LC50 (Rat): > 567000 ppm
Exposure time: 4 h
Test atmosphere: gas

No observed adverse effect concentration (Dog): 40000 ppm
Test atmosphere: gas
Symptoms: Cardiac sensitization

Lowest observed adverse effect concentration (Dog): 80000 ppm
Test atmosphere: gas
Symptoms: Cardiac sensitization
Cardiac sensitisation threshold limit (Dog): 334,000 mg/m³
Test atmosphere: gas
Symptoms: Cardiac sensitization

**Pentafluoroethane:**
Acute inhalation toxicity: LC0 (Rat): > 800000 ppm
Exposure time: 4 h
Test atmosphere: gas
Method: OECD Test Guideline 403

**Butane:**
Acute inhalation toxicity: LC50 (Rat): 658 mg/l
Exposure time: 4 h
Test atmosphere: vapor

**Skin corrosion/irritation**
Not classified based on available information.

**Ingredients:**

1,1,1,2-Tetrafluoroethane:
Species: Rabbit
Result: No skin irritation

**Serious eye damage/eye irritation**
Not classified based on available information.

**Ingredients:**

1,1,1,2-Tetrafluoroethane:
Species: Rabbit
Result: No eye irritation

**Respiratory or skin sensitization**

**Skin sensitization**
Not classified based on available information.

**Respiratory sensitization**
Not classified based on available information.

**Ingredients:**

1,1,1,2-Tetrafluoroethane:
Routes of exposure: Skin contact
Species: Guinea pig
Result: negative
Species: Rat
Result: negative
### Germ cell mutagenicity

Not classified based on available information.

### Ingredients:

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

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

**Pentafluoroethane:**

- Genotoxicity in vitro: 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

**Butane:**

- Genotoxicity in vitro: Test Type: Bacterial reverse mutation assay (AMES)
  Result: negative

- Genotoxicity in vivo: Test Type: Mammalian erythrocyte micronucleus test (in vivo cytogenetic assay)
  Species: Rat
  Application Route: inhalation (gas)
  Method: OECD Test Guideline 474
  Result: negative
  Remarks: Based on data from similar materials

### Carcinogenicity

Not classified based on available information.

### Ingredients:

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

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

**IARC**

No ingredient 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 on OSHA’s list of regulated carcinogens.

**NTP**

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

Not classified based on available information.

**Ingredients:**

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

Reproductive toxicity - Assessment:

Weight of evidence does not support classification for reproductive toxicity

**Pentafluoroethane:**

Effects on fertility:

Test Type: One-generation reproduction toxicity study
Species: Rat
Application Route: inhalation (vapor)
Result: negative
Remarks: Based on data from similar materials

Effects on fetal development:

Test Type: Embryo-fetal development
Species: Rat
Application Route: inhalation (gas)
Method: OECD Test Guideline 414
Result: negative

**Butane:**

Effects on fertility:

Test Type: Combined repeated dose toxicity study with the reproduction/developmental toxicity screening test
Species: Rat
Application Route: inhalation (gas)
Method: OECD Test Guideline 422
Result: negative

Effects on fetal development:

Test Type: Combined repeated dose toxicity study with the reproduction/developmental toxicity screening test
Application Route: inhalation (gas)
Method: OECD Test Guideline 422
Result: negative

**STOT-single exposure**

Not classified based on available information.

**Ingredients:**

**Butane:**

Assessment: May cause drowsiness or dizziness.

**STOT-repeated exposure**

Not classified based on available information.

**Ingredients:**

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

Assessment: No significant health effects observed in animals at concentrations of 250 ppmV/6h/d or less.
Repeated dose toxicity

**Ingredients:**

**1,1,1,2-Tetrafluoroethane:**
Species: Rat
NOAEL: 50000 ppm
LOAEL: > 50000 ppm
Application Route: inhalation (gas)
Exposure time: 90 d
Method: OECD Test Guideline 413
Remarks: No significant adverse effects were reported

**Pentafluoroethane:**
Species: Rat
NOAEL: >= 50000 ppm
Application Route: inhalation (gas)
Exposure time: 13 Weeks
Method: OECD Test Guideline 413

**Butane:**
Species: Rat
NOAEL: 9000 ppm
Application Route: inhalation (gas)
Exposure time: 6 Weeks
Method: OECD Test Guideline 422

Aspiration toxicity
Not classified based on available information.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

**Ingredients:**

**1,1,1,2-Tetrafluoroethane:**
Toxicity to fish: LC50 (Oncorhynchus mykiss (rainbow trout)): 450 mg/l
Exposure time: 96 h

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

Toxicity to algae: ErC50 (algae): 142 mg/l
Exposure time: 96 h
Remarks: Based on data from similar materials

NOEC (Pseudokirchneriella subcapitata (green algae)): 13.2 mg/l
Exposure time: 72 h
Remarks: Based on data from similar materials
Pentafluoroethane:

Toxicity to fish: LC50 (Oncorhynchus mykiss (rainbow trout)): 450 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)): 980 mg/l
Exposure time: 48 h
Remarks: Based on data from similar materials

Toxicity to algae: EC50 (Pseudokirchneriella subcapitata (green algae)): > 114 mg/l
Exposure time: 72 h
Method: OECD Test Guideline 201
Remarks: Based on data from similar materials

NOEC (Pseudokirchneriella subcapitata (green algae)): 13.2 mg/l
Exposure time: 72 h
Method: OECD Test Guideline 201
Remarks: Based on data from similar materials

Persistence and degradability

Ingredients:

1,1,1,2-Tetrafluoroethane:

Biodegradability: Result: Not readily biodegradable.

Pentafluoroethane:

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

Butane:

Biodegradability: Result: Readily biodegradable.
Biodegradation: 100 %
Exposure time: 385.5 h
Remarks: Based on data from similar materials

Bioaccumulative potential

Ingredients:

1,1,1,2-Tetrafluoroethane:

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

Pentafluoroethane:

Partition coefficient: n-octanol/water: Pow: 1.48 (25 °C)
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Freon™ MO59 (R-417A) Refrigerant

SECTION 10. PHYSICAL AND CHEMICAL PROPERTIES

octanol/water

Butane:
Partition coefficient: n-octanol/water: log Pow: 2.31

Mobility in soil
No data available

SECTION 11. TOXICOLOGICAL INFORMATION

Other adverse effects

Product:
Results of PBT and vPvB assessment: This mixture contains no substance considered to be persistent, bioaccumulating and toxic (PBT). This mixture contains no substance considered to be very persistent and very bio-accumulating (vPvB).

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues: Dispose of in accordance with local regulations.

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.

SECTION 14. TRANSPORT INFORMATION

International Regulations

UNRTDG
UN number: UN 1078
Proper shipping name: REFRIGERANT GAS, N.O.S.
(1,1,1,2-Tetrafluoroethane, Pentafluoroethane)

Class: 2.2
Packing group: Not assigned by regulation
Labels:

IATA-DGR
UN/ID No.: UN 1078
Proper shipping name: Refrigerant gas, n.o.s.
(1,1,1,2-Tetrafluoroethane, Pentafluoroethane)

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

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SAFETY DATA SHEET

Freon™ MO59 (R-417A) Refrigerant

UN number: UN 1078
Proper shipping name: REFRIGERANT GAS, N.O.S.
(1,1,1,2-Tetrafluoroethane, Pentafluoroethane)

<table>
<thead>
<tr>
<th>Class</th>
<th>2.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packing group</td>
<td>Not assigned by regulation</td>
</tr>
<tr>
<td>Labels</td>
<td>2.2</td>
</tr>
<tr>
<td>EmS Code</td>
<td>F-C, S-V</td>
</tr>
<tr>
<td>Marine pollutant</td>
<td>no</td>
</tr>
</tbody>
</table>

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
Not applicable for product as supplied.

Domestic regulation

49 CFR
UN/ID/NA number: UN 1078
Proper shipping name: Refrigerant gases, n.o.s.
(1,1,1,2-Tetrafluoroethane, Pentafluoroethane)

<table>
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</tr>
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<tbody>
<tr>
<td>Packing group</td>
<td>Not assigned by regulation</td>
</tr>
<tr>
<td>Labels</td>
<td>NON-FLAMMABLE GAS</td>
</tr>
<tr>
<td>ERG Code</td>
<td>126</td>
</tr>
<tr>
<td>Marine pollutant</td>
<td>no</td>
</tr>
</tbody>
</table>

SECTION 15. REGULATORY INFORMATION

EPCRA - Emergency Planning and Community Right-to-Know

CERCLA Reportable Quantity
This material does not contain any components with a CERCLA RQ.

SARA 304 Extremely Hazardous Substances Reportable Quantity
This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity
This material does not contain any components with a section 302 EHS TPQ.

SARA 311/312 Hazards: Gases under pressure
Simple Asphyxiant

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.

US State Regulations

Pennsylvania Right To Know

1,1,1,2-Tetrafluoroethane 811-97-2
Pentafluoroethane 354-33-6
Butane 106-97-8

California Prop. 65
This product does not contain any chemicals known to the State of California to cause cancer, birth, or any other reproductive defects.
California List of Hazardous Substances
- Butane 106-97-8

California Permissible Exposure Limits for Chemical Contaminants
- Butane 106-97-8

SECTION 16. OTHER INFORMATION

Further information

NFPA:
- Flammability: 0
- Health: 3
- Instability: 0

HMIS® IV:
- HEALTH: 0
- FLAMMABILITY: 0
- PHYSICAL HAZARD: 3

HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. The "***" represents a chronic hazard, while the "/" represents the absence of a chronic hazard.

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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.
All chemical substances in this material are included on or exempted from listing on the TSCA Inventory of Chemical Substances.

Full text of other abbreviations
- ACGIH: USA, ACGIH Threshold Limit Values (TLV)
- NIOSH REL: USA, NIOSH Recommended Exposure Limits
- US WEEL: USA, Workplace Environmental Exposure Levels (WEEL)
- ACGIH / STEL: Short-term exposure limit
- NIOSH REL / TWA: Time-weighted average concentration for up to a 10-hour workday during a 40-hour workweek
- US WEEL / TWA: 8-hr TWA

AICS - Australian Inventory of Chemical Substances; ASTM - American Society for the Testing of Materials; bw - Body weight; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DOT - Department of Transportation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; EHS - Extremely Hazardous Substance; 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; HMIS - Hazardous Materials Identification System; IARC -
Sources of key data used to compile the Material Safety Data Sheet:

Revision Date: 11/09/2017

Items where changes have been made to the previous version are highlighted in the body of this document by two vertical lines.

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.