1. Identification of the substance / preparation and company / undertaking

Product name    HFO-1234yf, 2,3,3,3-Tetrafluoroprop-1-ene
REACH registration number  01-0000019665-61-0000
Company    Harp International Ltd
Gellihirion Industrial Estate
Pontypridd
Rhondda Cynon Taff
CF37 5SX
Tel: +44 (0) 1443 842255
Fax: +44 (0) 1443 841805
Email: harp@harpintl.com

Emergency phone number  +44 (0) 1270 502891 (24 hour)

Use    Refrigerant

2. Hazards identification

Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008/EC (CLP/GHS)
Flammable gases 1
H220 Extremely flammable gas
Gases under pressure, Liquified gas
H280 Contains gas under pressure; may explode if heated

Classification according to Directive 67/548/EEC & 1999/45/EC
F+ Extremely flammable
R12 Extremely flammable

Label elements

Labelling Pictograms

Signal word    Danger

Hazard statements
H220      Extremely flammable gas
H280      Contains gas under pressure; may explode if heated

Precautionary statements

P281    Use personal protective equipment as required
P210    Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P260    Do not breathe dust/fumes/gas/mist/vapours/spray
P308 + P313    If exposed or concerned: Get medical advice/attention
P410 + P403    Protect from sunlight. Store in a well-ventilated place
Potential health effects
Skin
Rapid evaporation of the liquid may cause frostbite
Eyes
May irritate eyes
Ingestion
Unlikely route of exposure
Inhalation
High vapour concentrations can cause headaches, dizziness, drowsiness and nausea and may lead to unconsciousness
Chronic exposure
None known
General advice
Warning. Container under pressure

Potential environmental effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal

3. Composition / information on ingredients

Substance / mixture: Substance
CAS number 754-12-1
EC No (from EINECS) 468-710-7

4. First aid measures

Description of first aid measures
General advice
First aider needs to protect himself. Take off all contaminated clothing immediately.

Inhalation
Remove to fresh air and seek medical aid. If breathing is irregular or stopped, administer artificial respiration. If unconscious place in recovery position and seek medical advice.

Skin contact
Rapid evaporation of the liquid may cause frostbite. In case of contact with liquid, thaw frosted parts with water, then remove clothing carefully. Wash with plenty of water. Wash contaminated clothing before reuse. Consult a physician.

Eye contact
Protect unharmed eye. Immediately flush eyes thoroughly with water for at least 15 minutes. Call a physician immediately.

Ingestion
Rinse mouth. Call a physician immediately.

Notes to physician
Treatment
Adrenaline derivatives are contra-indicated. Treat symptomatically.

5. Fire-fighting measures

Extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special hazards arising from the substance or mixture
Specific hazards
Extremely flammable. Some risk may be expected of corrosive and toxic decomposition products. In case of fire, hazardous decomposition products may be produced such as carbon monoxide, hydrogen halides, carbonyl halides, pyrolysis products containing fluoride. Cool closed containers exposed to fire with water spray. Heating will cause pressure rise with risk of bursting and subsequent explosion.
Advice for fire fighters
Special protective equipment
Wear full protective clothing and self-contained breathing apparatus
Further information
In case of fire, evacuate area. Fight remotely due to the risk of explosion.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures
Wear full protective clothing and self-contained breathing apparatus. Keep people away from and upwind of spill/leak. Ventilate the area.

Environmental precautions
The product evaporates readily. Prevent product from entering drains.

Methods and materials for containment and cleaning up
Use low-sparking hand tools and explosion proof electrical equipment. Allow to evaporate.

Additional advice
Inform the responsible authorities in case of gas leakage or of entry into waterways, soil or drains. Pay attention to the spread of gases especially at ground level (heavier than air) and to the direction of the wind.

Reference to other sections
See also sections 8 and 13.

7. Handling and storage

Precautions for safe handling
Exhaust ventilation at the object is necessary. Pressurised container: protect from sunlight and do not expose to temperatures exceeding 50°C. Do not pierce or burn, even after use. Use suitably rated equipment.

Advice on protection against fire and explosion
Keep product and empty container away from heat and sources of ignition. Fire or intense heat may cause violent rupture of packages. Use suitably rated equipment.

Hygiene measures
Provide adequate ventilation. Do not smoke. When using, do not eat or drink.

Conditions for safe storage, including any incompatibilities
Keep containers tightly closed in a cool, well-ventilated place. Containers should be protected against falling down. Protect from warmth. Do not store at temperatures exceeding 50°C. Keep away from direct sunlight.

8. Exposure controls / personal protection

Occupational exposure limits

<table>
<thead>
<tr>
<th>Components</th>
<th>Basis</th>
<th>Value type</th>
<th>Control parameters</th>
<th>Exceeding factor</th>
<th>Form of exposure</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,3,3,3-Tetrafluoroprop-1-ene</td>
<td>WEL</td>
<td>Time weighted average</td>
<td>500 ppm</td>
<td></td>
<td></td>
<td>We are not aware of any national exposure limit</td>
</tr>
</tbody>
</table>

Occupational exposure controls
The Personal Protective Equipment must be in accordance with EN standards: respirator EN 136, 140, 149; safety glasses EN 166; protective suit EN 340,463, 468, 943-1, 943-2; gloves EN 374; safety shoes EN-ISO 20345.

Environmental exposure controls
Handle in accordance with local environmental regulations and good industrial practices.
Engineering measures

Highly effective exhaust ventilation.

Personal protective equipment

Respiratory protection

Remarks: In case of insufficient ventilation, wear suitable respiratory equipment.

Hand protection

Wear suitable gloves. Heat insulating gloves.

Eye protection

Goggles

Skin and body protection

Wear suitable protective equipment

9. Physical and chemical properties

Form

Compressed liquefied gas

Appearance/colour

Colourless

Odour

Slight, original odour

Molecular weight

114 g/mol

Melting point

No data available

Boiling point

-29.4°C

Flash point

Not applicable

Flammability (solid, gas)

Extremely flammable gas. Method: Flammability (gases)

Auto-ignition temperature

405°C

Lower explosion limit

6.2 % (V) lower flammability limit

Upper explosion limit

12.3 % (V) upper flammability limit

Vapour pressure

6.067 hPa at 21.1°C

Vapour pressure

14.203 hPa at 54.4°C

Density

1.1 g/cm³ at 25°C

pH

No data available

Solubility in water

198.2 mg/l at 24°C Method: 92/69/EEC, A.6

Partition coefficient (n-octanol/water)

log Pow 2,15 Method: 92/69/EEC, A.8

Relative vapour density

4

Evaporation rate

Not determined

10. Stability and reactivity

Conditions to avoid

Do not pierce or burn, even after use. Do not spray on a naked flame or any incandescent material. Avoid heat, flames and sparks.

Materials to avoid


Hazardous decomposition products

Risk of formation of toxic pyrolysis products containing fluorine. Carbon monoxide, carbon dioxide, carbonyl halides, hydrogen halides.

11. Toxicological information

Information on toxicological effects

Acute oral toxicity

Not applicable

Acute dermal toxicity

Not applicable

Acute inhalation toxicity

LC50/rat, value: >400000 ppm. Exposure time: 4 h

Skin irritation

Slight irritation

Eye irritation

Slight irritation

Sensitisation

No data available

Repeated dose toxicity

Rat, exposure route: inhalation, NOEL:233 mg/kg, NOEL:50000 ppm

Further information

Concentration above the admissible concentration at the workplace may cause dizziness, headache and inebriation. 2,3,3,3-tetrafluoropropene: Mouse Micronucleus (4-hour): No toxicological significant signs reported. No increase in the frequency of micronuclei. Cardiac sensitisation: no effects for exposures up to 12% (120, 189ppm).
12. Ecological information

Persistence and degradability
Biodegradability Result: Not readily biodegradable

Ecotoxicity effects

<table>
<thead>
<tr>
<th>Species</th>
<th>Value</th>
<th>Exposure time</th>
<th>Method</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxicity to fish</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LC50 Cyprinus carpio (Carp)</td>
<td>&gt;197 mg/l</td>
<td>96 h</td>
<td>OECD test guideline 203</td>
<td>No demonstrable toxic effect in saturated solution</td>
</tr>
<tr>
<td>Toxicity to aquatic plants</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC50 Scenedesmus capricornutum (fresh water algae)</td>
<td>&gt;100 mg/l</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute toxicity to aquatic invertebrates</td>
<td>EC50</td>
<td></td>
<td>OECD test guideline 202</td>
<td></td>
</tr>
<tr>
<td>Daphnia magna (water flea)</td>
<td>&gt;83 mg/l</td>
<td>48 h</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Further information
Additional ecological information: An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

13. Disposal considerations

Product Dispose according to legal requirements
Packaging Legal requirements are to be considered in regard of reuse or disposal of used packaging materials

14. Transport information

ADR/RID
Class 2
Classification code 2F
UN number 3161
Labels 2.1
Proper shipping name LIQUIFIED GAS, FLAMMABLE, N.O.S. (2,3,3,3-TETRAFLUOROPROP-1-ENE)
Hazard number 23
Environmentally hazardous No

IATA
Class 2.1
UN number 3161
Hazard labels 2.1
Proper shipping name LIQUIFIED GAS, FLAMMABLE, N.O.S. (2,3,3,3-TETRAFLUOROPROP-1-ENE)

IMDG
Class 2.1
UN number 3161
Hazard labels 2.1
Proper shipping name LIQUIFIED GAS, FLAMMABLE, N.O.S. (2,3,3,3-TETRAFLUOROPROP-1-ENE)
EmS number F-D,S-U
Marine pollutant No
15. Regulatory information

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

Other inventory information

<table>
<thead>
<tr>
<th>Country</th>
<th>Legislation</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>Toxic Substances Control Act</td>
<td>On TSCA inventory</td>
</tr>
<tr>
<td>Australia</td>
<td>Industrial Chemical (Notification &amp; Assessment) Act</td>
<td>Not in compliance with inventory</td>
</tr>
<tr>
<td>Canada</td>
<td>Canadian Environmental Protection Act (CEPA)</td>
<td>This product contains the following components that are not on the</td>
</tr>
<tr>
<td></td>
<td>Domestic Substances List (DSL) (Can. Gaz. Part II, Vol.144)</td>
<td>Canadian DSL or NDSL lists</td>
</tr>
<tr>
<td>Japan</td>
<td>Kashin-Hou Law List</td>
<td>On the inventory or in compliance with the inventory</td>
</tr>
<tr>
<td>Korea</td>
<td>Existing Chemicals Inventory (KECI)</td>
<td>On the inventory or in compliance with the inventory</td>
</tr>
<tr>
<td>Philippines</td>
<td>The Toxic Substances and Hazardous and Nuclear Waste Control Act</td>
<td>Not in compliance with inventory</td>
</tr>
<tr>
<td>China</td>
<td>Inventory of Existing Chemical Substances</td>
<td>Not in compliance with inventory</td>
</tr>
<tr>
<td>New Zealand</td>
<td>Inventory of Chemicals (NZIoC), as published by ERMA</td>
<td>Not in compliance with inventory</td>
</tr>
</tbody>
</table>

16. Other information

Abbreviations
EC European Community
CAS Chemical Abstract Service
WEL Workplace Exposure Limit
MAK Maximale Arbeitsplatz-Konzentration
AGW Arbeitsplatzgrenzwert
STEL Short Term Exposure Limit

Note
When using this document care should be taken as the decimal sign and its position complies with rules for the structure and drafting of international standards and is a comma on the line. As an example 2,000 is two (to three decimal places) and not two thousand, whilst 1.000 is one thousand and not one (to three decimal places).

This datasheet was prepared in accordance with Regulation (EC) No. 1907/2006.

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