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

1.1 Product identifier

Commercial name	DuPont™ Opteon® XP44 (R-452A)
Chemical description	Mixture of Pentafluoroethane (HFC R125), 2,3,3,3-Tetrafluoroprop-1-ene (HFO R1234yf), Difluoromethane (HFC R32) Chemical formula: C2HF5+C3H2F4+CH2F2

1.2 Relevant identified uses of substance or mixture and uses advised against

Industrial sector	Refrigeration
Relevant identified uses	Refrigerant gas for refrigeration systems
Application	Industrial and professional

1.3 Details of the supplier of the safety data sheet

REFRIGERANT BOYS S.R.L.
Corso XX Settembre
21052 - Busto Arsizio VA
tel: +39 329 1858456
mail: service@refrigerantboys.it

1.4 Emergency telephone number

CAV-CNIT Anti-Poison National Information Centre **+**39 0382 24444 Hours: 24 h / 24 h

2. Hazards identification

2.1 Classification of the substance or mixture

Classification under Regulation (EC) 1272/2008 (CLP)

H280: Contains gas under pressure; may explode if heated

2.2 Label elements

Dangerous pictogram

GHS04

Signal word	Warning	
Hazard statements (H)	H280	Contains gas under pressure; may explode if heated.
Precautionary statements (P)	P410	Protect from sunlight.
	P403	Store in a well-ventilated place.
Further data		Greenhouse fluorinated gas falling within Kyoto Protocol

2.3 Other hazards

Vapours are heavier than air and can cause rapid suffocation by reducing oxygen available for breathing.
Contact with liquid can cause frostbite and severe damage to the eyes.

3. Composition/information on ingredients

3.2 Mixtures

Substance name	%	CAS No.	EC No.	REACH No.	Classification Reg. (EC) 1272/2008 (CLP) and Directive 67/548/EEC
Pentafluoroethane	59%	354-33-6	206-557-8	01-2119485636-25	Not classified (DSD/DPD) Press. Gas Liq.; H280
2,3,3,3-Tetrafluoroprop-1-ene	30%	754-12-1	468-710-7	01-0000019665-61	F+; R12 Flam. Gas 1, H220 Press. Gas Liq., H280
Difluoromethane	11%	75-10-5	200-839-4	01-2119471312-47	F+; R12 Flam. Gas 1; H220 Press. Gas Liq.; H280

For more information, see section 8, 11, 12 and 16.

4. First aid measures

General information: If the person is unconscious, place it in the recovery position and get immediately medical attention. Do not give anything to an unconscious person. If breathing is irregular, give oxygen. If breathing stopped, administer artificial respiration. If symptoms persist, call a physician.

Notes to physician: Do not give adrenaline-ephedrine or similar drugs group.

4.1 Description of first aid measures

Inhalation	Remove patience from exposure to fresh air. Administer oxygen if necessary. Obtain immediate medical attention.
Skin contact	In case of contact with skin, wash immediately with plenty of water. Remove contaminated clothing. If irritation or blistering occurs, call a physician
Eye contact	Remove contact lenses, if present. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. If symptoms persist, call a physician.
Ingestion	Unlikely route of exposure. As this product is a gas, refer to the section “Inhalation”. Do not induce vomiting without medical advice. Obtain immediate medical attention
Notes to physician	Because of possible disturbances of cardiac rhythm, catecholamine drugs, such as epinephrine, should be considered only as a last resort in life-threatening emergencies. Treatment of overexposure should be directed at the control of symptoms and the clinical condition. If necessary, treat frostbite.

4.2. Most important symptoms and effects, both acute and delayed

In high concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation. In low concentrations may cause narcotic effects. Symptoms may include dizziness, headache, nausea and loss of co-ordination

5. Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media: Use water spray, alcohol-resistant foam, dry chemical and Carbon dioxide (CO2)
No suitable extinguishing media: None to our knowledge.

5.2 Special hazards arising from the substance or mixture

Specific hazards Contents under pressure.
On heating: heating will cause a rise in pressure with a risk of bursting.
Toxic and corrosive vapours are released.
Cool down the containers exposed to heat with a water spray.
Vapours are heavier than air and can cause rapid suffocation by reducing oxygen available for breathing.

5.3 Advice for firefighters

Wear self-contained positive pressure breathing apparatus (SCBA) and protective suit.
Avoid contact with skin and eyes. Do not breathe gas/fumes/vapour.

Other information

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

For further information to stability and reactivity, refer to section 10.

6. Accidental release measure

6.1 Personal precautions, protective equipment and emergency procedures

Immediately contact emergency personnel.
Immediately evacuate personnel to safe areas. Unprotected persons must be kept away.
Wear personal protective equipment refer to section 8 "Exposure controls/personal protection".
Remove all sources of ignition.
Avoid contact with skin (possible frostbite).
Ventilate the area/local. In case of insufficient ventilation, wear self-contained breathing apparatus.

6.2 Environmental precautions

Do not allow product to spread into the environment. Avoid spillage and prevent possible losses.

6.3 Methods and material for containment and cleaning up

Ventilate / aerate the area/local.

6.4 Reference to other sections

For further on personal protection, refer to section 8.

7. Handling and storage

7.1 Precautions for safe handling

Technical measures
Handle with care. Caution when opening, pressurized container.
Protect from sunlight and do not expose to temperatures exceeding 50° C (122 °F).
Do not spray on a naked flame or any incandescent material.
Do not use in area without adequate ventilation.
Do not pierce or burn, even after use.
Do not remove seal unless immediately before use.
Follow the general precautions for handling, storing, and using compressed gases.

Industrial hygiene
Ensure adequate ventilation of the working area.
Do not drink, eat or smoke in the working area.

7.2 Conditions for safe storage, including any incompatibilities

Requirements for storage areas and containers
Keep containers tightly closed in a dry, cool and well-ventilated place, away from any ignition or heat sources.
Store in original container. Protect from sunlight and do not expose to temperatures exceeding 50° C (122 °F).

7.3 Specific end use(s)

For professional and industrial use only.

8. Exposure controls/personal protection

8.1 Control parameters

OEL (Occupational Exposure Limit): No available data.

Components	CAS No.	TLV-TWA	Parameters	Font	Year
Pentafluoroethane	354-33-6	8 h	4.900 mg/m³ 1,000 ppm	ACGIH (WEEL)	//
2,3,3,3-Tetrafluoroprop-1-ene	754-12-1	//	500 ppm	ACGIH (WEEL)	//
Difluoromethane	75-10-5	8 h	2.200 mg/m³ 1.000 ppm	ACGIH (WEEL)	1995-1996

DNEL			
Component	**CAS No.**	**Inhalation**	
Pentafluoroethane	354-33-6	DNEL- Workers DNEL – Consumers	16444 mg/m³(long-term exposure – systemic effects) 1753 mg/m³ (long-term exposure – systemic effects)
2,3,3,3-Tetrafluoroprop-1-ene	754-12-1	DNEL- Workers DNEL – Consumers	950 mg/m³ (long term exposure — systemic effects) 113,1 mg/m³ (long term exposure — systemic effects)
Difluoromethane	75-10-5	DNEL – Workers DNEL - Consumers	7035 mg/m³ (long-term exposure – systemic effects) 750 mg/m³ (long-term exposure – systemic effects)

PNEC			
Component	**N. CAS**	**PNEC values**	
Pentafluoroethane	354-33-6	0,1 mg/l 0,6 mg/kg dw*	Fresh water Fresh water sediment
2,3,3,3-Tetrafluoroprop-1-ene	754-12-1	> 0,1 mg/l > 0,01 mg/l > 0,178 mg/l* dw > 1,54 mg/Kg* dw	Freshwater Marine water Marine water sediment Soil
Difluoromethane	75-10-5	0,142 mg/l 0,534 mg/kg dw* 1,42 mg/l	Fresh water Fresh water sediment Intermittent release

*dry weight

8.2 Exposure controls

Ensure adequate ventilation. In case of insufficient ventilation, wear self-contained breathing apparatus.
Personal protective equipment must comply with EU directives: respiratory protective equipment EN 136, 140, 149; eye protection (protective goggles or safety glasses) EN 166; skin protection EN 340, 463, 468, 943-1, 943-2; hands protection (protective gloves) EN374, safety boots EN ISO 20345.

8.2.2 Individual protection measures, such as personal protective equipment

a) Eye/face protection Safety glasses with side-shields (according to directive EN 166).

b) Skin protection

i) Hand protection: Protective gloves resistant to chemical products (EN374).
The penetration time of the gloves must be greater than the period of expected use.
Gloves should be replaced immediately if they show signs of wear or deterioration.

ii) Other: Safety footwear recommended when handling cylinders.
Apron or protective clothing are not necessary.

c) Respiratory protection In case of insufficient ventilation, wear self-contained breathing apparatus. (EN133).
Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing.

8.2.3. Environmental exposure controls

Handling in accordance with good industrial hygiene and safety practice. Avoid leakage or spillage in the environmental. Avoid dispersion in the air. For more information refer to section 7 “Handling and storage”.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	**Appearance**	Liquefied gas
	Colour	Colourless
b)	**Odour**	Slightly ethereal

c)	**Odour threshold**	Odour threshold is subjective and inadequate to warn for overexposure.
d)	**pH**	n.a.
e)	**Melting point / Freezing point**	- 103 °C (- 154.4 °F) Pentafluoroethane - 136 °C (- 212.8 °F) Difluoromethane
f)	**Initial boiling point**	- 47 °C (- 52.60 °F)
g)	**Flash point**	n.a.
h)	**Evaporation rate**	n.d.a.
i)	**Flammability (solid, gas)**	Not flammable
j)	**Upper/lower flammability**	n.d.a.
k)	**Vapour pressure**	1,315 kPa (13,15 bar) @ 25 °C (77 °F)
l)	**Vapour density**	3,64 g/cm³ @ 25 °C (77 °F)
m)	**Relative density**	1,13 g/cm³ @ 25 °C (77 °F)
n)	**Solubility** (in the water)	Insoluble
o)	**Partition coefficient: n-Octanol/water**	1.48 log Pow Pentafluoroethane 2.15 log Pow 2,3,3,3-Tetrafluoroprop-1-ene 0.21 log Pow Difluoromethane
p)	**Auto-ignition temperature**	n.d.a.
q)	**Decomposition temperature**	n.d.a.
r)	**Viscosity**	n.a.
s)	**Explosive properties**	Not explosive according with EU criteria
t)	**Oxidising properties**	Not oxidising according with EU criteria

10. Stability and reactivity

10.1 Reactivity

Stable under normal handling and storage conditions.

10.2 Chemical stability

Stable under normal handling and storage conditions.

10.3 Possibility of hazardous reactions

The product is non-reactive under normal handling and storage conditions.

10.4 Conditions to avoid

Contains gas under pressure, may explode if heated.
Protect from sunlight and do not expose to temperatures exceeding 50 °C.
Keep away from heat, sparks, open flame or other sources of ignition. Do not smoke.
Do not pierce or burn, even after use. Do not spray on a naked flame or any incandescent material.

10.5 Incompatible materials

No reaction with common materials in dry or wet conditions.
Avoid contact with alkaline and caustic products, alkaline-earth metals (e.g. calcium, aluminum powder, zinc and magnesium).

10.6 Hazardous decomposition products

No hazardous decomposition under normal conditions.
In case of fire, for thermal decomposition, the following substances can be released: carbon oxides (CO, CO2) and fluorocarbons.

11. Toxicological information

11.1 Information on toxicological effects

a) Acute toxicity

Inhalation

Pentafluoroethane	LC50: 800 000 ppm (OECD 403) Exposition time: 4 h Animal species: Rat

2,3,3,3-Tetrafluoroprop-1-ene	LC50: > 400 000 ppm (OECD 403) Exposition time: 4 h Animal species: Rat
Difluoromethane	LC50: > 520 000 ppm (OECD 403) Exposition time: 4 h Animal species: Rat

b) Skin corrosion/Skin irritation Based on available data the classification criteria are not met.

c) Serious eye damage/irritation Based on available data the classification criteria are not met.

d) Respiratory sensitisation

Pentafluoroethane	LC50: 800 000 ppm (OECD 403) Exposition time: 4 h Animal species: Rat
Difluoromethane	LC50: > 520 000 ppm (OECD 403) Exposition time: 4 h Animal species: Rat

e) Germ cell mutagenicity

in vitro genotoxicity

Pentafluoroethane	In vitro test: Ames Result: Negative
2,3,3,3-Tetrafluoroprop-1-ene	In vitro test: Ames Results: 20% and more, positive at TA 100 and e. coli WP2 uvrA, negative at TA98, TA100 e TA1535
Difluoromethane	In vitro test: Ames Result: Negative

In vivo genotoxicity

2,3,3,3-Tetrafluoroprop-1-ene	Method: Mutagenicity (micronucleus test) Dose: until 200,000 ppm Exposition time: 4 h Result: Negative Animal species: Mouse
Difluoromethane	Exposed tissue: Bone marrow Method: Mutagenicity (micronucleus test) Result: Negative Animal species: Mouse

f) Carcinogenicity Based on available data the classification criteria are not met.

g) Reproductive toxicity

2,3,3,3-Tetrafluoroprop-1-ene	Inhalation (OECD 414) NOAEL: 50 000 mg/m³ Animal species: Rat
Difluoromethane	Inhalation NOAEL: 208 000 mg/m³ Animal species: Rat

Other information

Pentafluoroethane	Cardiac sensitization NOAEC: 75 000 ppm LOAEC: 100 000 ppm Animal Species: Dog
2,3,3,3-Tetrafluoroprop-1-ene	Cardiac sensitization No effect detected on exposures up to 12% (120, 189 ppm) Animal species: Dog
Difluoromethane	Cardiac sensitization NOAEC: > 350 000 ppm LOAEC: 350 000 ppm Animal Species: Dog

12. Ecological information

12.1 Toxicity

Fish

Pentafluoroethane	LC50: > 100 mg/l Exposition time: 96 h
2,3,3,3-Tetrafluoroprop-1-ene	LC50: > 197 mg/l (OECD 203) Exposition time: 96 h Species: Cyprinus carpio (Carp) Note: No toxic effect at aquatic saturation solution
Difluoromethane	LC50: 1.045 mg/l Exposure time: 96 h Species: Pimephales promelas Remarks: QSAR, supporting study

Aquatic invertebrates

Pentafluoroethane	EC50: > 100 mg/l Exposition time: 48 h Species: Daphnia magna (Water flea)
2,3,3,3-Tetrafluoroprop-1-ene	EC50: > 83 mg/l (OECD 202) Exposition time: 48 h Species: Daphnia magna (Water flea)
Difluoromethane	EC50: 1.573 mg/l Exposure time: 48 h Species: Daphnia magna (Water flea) Remarks: QSAR, supporting study

Seaweed

Pentafluoroethane	EC50: > 114 mg/l Exposition time: 72 h Species: Selenastrum capricornutum (Freshwater seaweed)
2,3,3,3-Tetrafluoroprop-1-ene	EC50: > 100 mg/l Species: Scenedesmus capricornutum (Freshwater seaweed)
Difluoromethane	EC50: 142 mg/l Exposure time: 96 h Species: Algae

12.2 Persistence and degradability

The mixture is not easily biodegradable

Pentafluoroethane	Water: 5% of biodegradation after 28 days - Air: Average life of 28.3 years (estimated value)
2,3,3,3-Tetrafluoroprop-1-ene	Not easily biodegradable
Difluoromethane	Water: 5% of biodegradation after 28 days - Air: Average life of 4 years

12.3 Bioaccumulative potential

Pentafluoroethane	1,48 Log Pow
2,3,3,3-Tetrafluoroprop-1-ene	2,15 Log Pow
Difluoromethane	0,21 Log Pow

12.4 Mobility in soil

Pentafluoroethane	1,30 – 1,70 Log Koc
2,3,3,3-Tetrafluoroprop-1-ene	No data available
Difluoromethane	No data available

12.5 Results of PBT and vPvB assessment

Not classified as PBT and vPvB.

12.6 Other adverse effects

Ozone Depletion Potential	ODP (R11=1) = 0
Global Warming Potential	GWP (CO2=1) = 2.141 IPCC AR4
	1.945 IPCC AR5

13. Disposal consideration

13.1 Waste treatment methods

Product	Take all necessary measures to prevent the production of residuals, value the possible methods of regeneration or recycling. Dispose in accordance with local, state, and federal regulations. Do not discharge into drains or environment.
Packaging	Reuse and recycle the packaging after its reclaim. Dispose of non-reusable packaging in accordance with local, state, and federal regulations.

European Waste Code (EWC)

Product 14 06 01: organic solvents, refrigerants and foam / aerosol propellants of waste-chlorofluorocarbons, HCFC, HFC.
Packaging 15 01 11: metallic packaging containing a hazardous solid porous matrix (for example asbestos), including empty pressure containers.

Additional information

Waste directives and regulations: Directive 2006/12/CE, Directive 91/689/CE, Regulation (EC) no. 1013/2006.
Dispose of waste product in compliance with EC, state and/or local regulations.
For more information, see section 8.

14. Transport information

14.1 UN Number UN 1078

14.2 UN proper shipping name Refrigerant gas, N.O.S. (R452A)

Hazard labels
ADR/RID, IMDG, IATA/ICAO

2.2 Non-flammable non-toxic gas

Transport by road (ADR) / Transport by rail (RID)

14.3 Transport hazard class(es)	2
Classification code	2A
Kemler code	20
14.4 Packing group	n.a.
Packing instruction	P200
14.5 Environmental hazards	No
Additional information	
Tunnel restriction code of total load	Code C/E - Tank carriage: Passage forbidden through tunnels of category C, D & E Code E (Other carriage): Passage forbidden through tunnels of category E

Transport by air (IATA/ICAO)

14.3 Transport hazard class(es)	2
Class/Division	2.2
14.4 Packing group	n.a.
Passengers and Cargo flights	200
Only Cargo flights	200
14.5 Environmental hazards	No
Additional information	
Passenger aircraft maximum net quantity (IATA)	75 Kg
Cargo aircraft maximum net quantity (IATA)	150 Kg

Transport by sea (IMDG)

14.3 Transport hazard class(es)	2
Class/Division	2.2
Emergency Schedule (EmS)	F-C, S-V
14.4 Packing group	n.a.
Packing instruction	P200
14.5 Environmental hazards	No

14.6 Special precautions for user

Avoid transport on vehicles where the load space is not separated from the driver's compartment.
Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency.
Ensure that containers are firmly secured.
Before transporting product containers: - Ensure there is adequate ventilation.

14.7 Transport in bulk according to Annex II of MARPOL the IBC Code

Not applicable.

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15. Regulatory information

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

Ozone Depletion Potential ODP (R11=1) = 0
Global Warming Potential GWP (CO2=1) = 2.141 IPCC AR4
1.945 IPCC AR5

Additional regulations/legislations

Regulation (UE) n. 517/2014
Seveso Directive: 2012/18/UE (Seveso III): Not included

15.2 Chemical safety assessment

A Chemical Safety Assessment (CSA) has not been carried out.

16. Other information

This Material Safety Data Sheet has been made according European Directive in force.

Text of H and P statements in section 2 and 3

H220	Extremely flammable gas
H280	Contains gas under pressure; may explode if heated
P410 + P403	Protect from sunlight. Store in a well-ventilated place.

Text of "Security Code" under Regulation (EC) 1272/2008 (CLP) and Classification 67/548/EEC, in section 2 and 3

Flam. Gas 1	Flammable gas – Classification: Category 1
Press. Gas Liq.	Gases under pressure - Compressed gas – Classification: Liquefied gas
F+	Extremely flammable
R12	Extremely flammable: liquids having a boiling point lower or equal to 35 °C

History	Version 2	Version 1
	Date of revision: 05/2019	Date: 09/2017

b) Abbreviations and acronyms

ADR	Accord Dangerous Route
CAS	Chemical Abstracts Service
CE / EC	European Community
CLP	Classification, Labelling and Packaging
CSA	Chemical Safety Assessment
DNEL	Derived No-Effect Level

EC50	Effective Concentration 50%
EmS	Emergency Schedule
EWC	European Waste Code
GHS	Globally Harmonised System
GWP	Global Warming Potential
HCFC	Hydro-Chloro-Fluoro-Carbons
HFC	Hydro-Fluoro-Carbons
HFO	Hydro-Fluoro-Olefine
IATA	International Air Transport Association
IBC code	International Bulk Chemical code
ICAO	International Civil Aviation Organization
IMDG code	International Maritime Dangerous Goods code
IPCC	Intergovernmental Panel on Climate Change
LC50	Lethal Concentration 50%
LOAEC	Lowest Observed Adverse Effect Concentration
MARPOL	MARitime POLlution
Log Koc	Logarithm Partition coefficient Soil/Water
Log Kow (Pow)	Logarithm Partition coefficient n-Octanol/Water
n.a.	not applicable
n.d.a.	no data available
NOAEC	No Observed Adverse Concentration Level
NOAEL	No Observed Adverse Effect Level
ODP	Ozone Depleting Potential
OECD	Organisation for Economic Cooperation and Development
OEL	Occupational Exposure Limit
PBT	Persistent Bio-accumulative Toxic
PNEC	Predicted No Effect Concentration
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RID	Rail International Dangerous Goods
STOT-RE	Specific Target Effect Concentration - repeated exposure
STOT-SE	Specific Target Effect Concentration - single exposure
TLV	Threshold Limit Value
TWA	Time Weighted Average
UE / EU	European Union
vPvB	very Persistent very Bioaccumulative
WEEL	Workplace Environmental Exposure Level

Notice of liability

This information should not constitute a guarantee for any specific product properties. This information are only a guidance for safe handling, use, processing, storage, transportation, disposal and release and are not to be considered a warranty or a quality specification.