SECTION 1: Identification of the substance / mixture and of the company / undertaking

1.1 Product identifier

Product name: CH2F2 11 %;C3H2F4 30 %;CH2F2 59 %

Trade name: Opteon XP44

Other Identifier: R-452A

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

Identified uses: Industrial and professional. Perform risk assessment prior to use.
Refrigerant.

Uses advised against Consumer use.

1.3 Details of the supplier of the safety data sheet

Supplier

BOC
Priestley Road, Worsley
M28 2UT Manchester

Telephone: 0800 111 333

E-Mail: ReachSDS@boc.com

1.4 Emergency telephone number: 0800 111 333

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Directive 67 / 548 / EEC or 1999 / 45 / EC as amended

Not classified

Classification according to Regulation (EC) No 1272 / 2008 as amended

Physical hazards

Gases under pressure	Liquefied gas	H280: Contains gas under pressure; may explode if heated.

2.2 Label elements

Signal words: Warning

Hazard Statement(s): H280: Contains gas under pressure; may explode if heated.

Precautionary statement

Prevention: None.

Response: None.

Storage: P403: Store in a well-ventilated place.

Disposal: None.

Supplemental label information

EIGA-0783: Contains fluorinated greenhouse gases covered by the Kyoto protocol.
EIGA-As: Asphyxiant in high concentrations.

2.3 Other hazards: Contact with evaporating liquid may cause frostbite or freezing of skin.

SECTION 3: Composition / information on ingredients

3.2 Mixtures

Chemical name	Chemical formula	Concentration	CAS-No.	EC No.	REACH Registration No.	Notes
Pentafluoroethane	C2HF5	59 (% w / w)	354-33-6	206-557-8	01-2119485636-25	
2,3,3,3-Tetrafluoropropene	C3H2F4	30 (% w / w)	754-12-1	468-710-7	01-0000019665-61	
Difluoromethane	CH2F2	11 (% w / w)	75-10-5	200-839-4	01-2119471312-47	

All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in mol percent. All concentrations are nominal.
This substance has workplace exposure limit(s).
PBT: persistent, bioaccumulative and toxic substance.
vPvB: very persistent and very bioaccumulative substance.

Classification

Chemical name	Classification		Notes
Pentafluoroethane	DSD:	None	
	CLP:	Press. Gas Liquef. Gas; H280, Press. Gas Liquef. Gas; H280	
2,3,3,3-Tetrafluoropropene	DSD:	F+; R12	
	CLP:	Flam. Gas 1; H220, Press. Gas Compr. Gas; H280	
Difluoromethane	DSD:	F+; R12	
	CLP:	Flam. Gas 1; H220, Press. Gas Liquef. Gas; H280	

DSD: Directive 67 / 548 / EEC.
CLP: Regulation No. 1272 / 2008.

The full text for all R- and H-phrases is displayed in section 16.

SECTION 4: First Aid Measures

General: In high concentrations may cause asphyxiation. Symptoms may include loss of mobility / consciousness. Victim may not be aware of asphyxiation. Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.

4.1 Description of first aid measures

Inhalation: In high concentrations may cause asphyxiation. Symptoms may include loss of mobility / consciousness. Victim may not be aware of asphyxiation. Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.

Eye contact: Rinse the eye with water immediately. Remove contact lenses, if present and easy to do. Continue rinsing. Flush thoroughly with water for at least 15 minutes. Get immediate medical assistance. If medical assistance is not immediately available, flush an additional 15 minutes.

Skin contact: Contact with evaporating liquid may cause frostbite or freezing of skin.

Ingestion: Ingestion is not considered a potential route of exposure.

4.2 Most important symptoms and effects, both acute and delayed: Respiratory arrest. Contact with liquefied gas can cause damage (frostbite) due to rapid evaporative cooling. Symptoms may include: Anaesthetic effects. Dizziness. Irregular cardiac activity. Unconsciousness. Loss of co-ordination.

4.3 Indication of any immediate medical attention and special treatment needed

Hazards: Respiratory arrest. Contact with liquefied gas can cause damage (frostbite) due to rapid evaporative cooling.

Treatment: Thaw frosted parts with lukewarm water. Do not rub affected area. Get immediate medical advice / attention. 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.

SECTION 5: Firefighting Measures

General fire hazards: Heat may cause the containers to explode.

5.1 Extinguishing media

Suitable extinguishing media: Material will not burn. In case of fire in the surroundings: use appropriate extinguishing agent.

Unsuitable extinguishing media: None.

5.2 Special hazards arising from the substance or mixture:

Fire or excessive heat may produce hazardous decomposition products. The product is not flammable in air under ambient conditions of temperature and pressure. When pressurised with air or oxygen, the mixture may become flammable. Certain mixtures of HCFCs or HFCs with chlorine may become flammable or reactive under certain conditions.

Hazardous Combustion Products:

If involved in a fire the following toxic and / or corrosive fumes may be produced by thermal decomposition: Carbon oxides fluorocarbons Hydrogen fluoride

5.3 Advice for firefighters

Special fire fighting procedures:

In case of fire: Stop leak if safe to do so. Continue water spray from protected position until container stays cool. Use extinguishants to contain the fire. Isolate the source of the fire or let it burn out.

Special protective equipment for firefighters:

Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA. Guideline: EN 469 Protective clothing for firefighters. Performance requirements for protective clothing for firefighting. EN 15090 Footwear for firefighters. EN 659 Protective gloves for firefighters. EN 443 Helmets for fire fighting in buildings and other structures. EN 137 Respiratory protective devices - Self-contained open-circuit compressed air breathing apparatus with full face mask - Requirements, testing, marking.

SECTION 6: Accidental Release Measures

6.1 Personal precautions, protective equipment and emergency procedures:

Evacuate area. Provide adequate ventilation. Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe. EN 137 Respiratory protective devices - Self-contained open-circuit compressed air breathing apparatus with full face mask - Requirements, testing, marking.

6.2 Environmental precautions:

Prevent further leakage or spillage if safe to do so.

6.3 Methods and material for containment and cleaning up:

Provide adequate ventilation.

6.4 Reference to other sections:

Refer to sections 8 and 13.

SECTION 7: Handling and Storage:

7.1 Precautions for safe handling:

Only experienced and properly instructed persons should handle gases under pressure. Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Refer to supplier's handling instructions. The substance must be handled in accordance with good industrial hygiene and safety procedures. Protect containers from physical damage; do not drag, roll, slide or drop. Do not remove or deface labels provided by the supplier for the identification of the container contents. When moving containers, even for short distances, use appropriate equipment eg. trolley, hand truck, fork truck etc. Secure cylinders in an upright position at all times, close all valves when not in use. Provide adequate ventilation. Suck back of water into the container must be prevented. Do not allow backfeed into the container. Avoid suckback of water, acid and alkalis. Keep container below 50°C in a well ventilated place. Observe all regulations and local requirements regarding storage of containers. When using do not eat, drink or smoke. Store in accordance with local / regional / national / international regulations. Never use direct flame or electrical heating devices to raise the pressure of a container. Leave valve protection caps in place until the container has been secured against either a wall or bench or placed in a container stand and is ready for use. Damaged valves should be reported immediately to the supplier Close container valve after each use and when empty, even if still connected to equipment. Never attempt to repair or modify container valves or safety relief devices. Replace valve outlet caps or plugs and container caps where supplied as soon as container is disconnected from equipment. Keep container valve outlets clean and free from contaminates particularly oil and water. If user experiences any difficulty operating container valve discontinue use and contact supplier. Never attempt to transfer gases from one container to another. Container valve guards or caps should be in place.

7.2 Conditions for safe storage, including any incompatibilities:

Containers should not be stored in conditions likely to encourage corrosion. Stored containers should be periodically checked for general conditions and leakage. Container valve guards or caps should be in place. Store containers in location free from fire risk and away from sources of heat and ignition. Keep away from combustible material.

7.3 Specific end use(s):

None.

SECTION 8: Exposure Controls / Personal Protection

8.1 Control parameters

Occupational Exposure Limits

None of the components have assigned exposure limits.

DNEL-Values

Critical component	Type	Value	Remarks
Pentafluoroethane	Worker - inhalative, long-term - systemic	16444 mg / m3	-
2,3,3,3-Tetrafluoropropene	Worker - inhalative, long-term - systemic	273 mg / m3	-
Difluoromethane	Worker - inhalative, long-term - systemic	7035 mg / m3	-

PNEC-Values

Critical component	Type	Value	Remarks
Pentafluoroethane	Aquatic (intermit. releases)	1 mg / l	-
	Aquatic (freshwater)	0,1 mg / l	-
	Sediment (freshwater)	0,6 mg / kg	-
2,3,3,3-Tetrafluoropropene	Aquatic (freshwater)	0,1 mg / l	-
	Aquatic (intermit. releases)	1 mg / l	-
Difluoromethane	Aquatic (freshwater)	0,142 mg / l	-
	Aquatic (intermit. releases)	1,42 mg / l	-
	Sediment (freshwater)	0,534 mg / kg	-

8.2 Exposure controls

Appropriate engineering controls: Consider a work permit system e.g. for maintenance activities. Ensure adequate air ventilation. Oxygen detectors should be used when asphyxiating gases may be released. Systems under pressure should be regularly checked for leakages. Preferably use permanent leak tight connections (eg. welded pipes). Do not eat, drink or smoke when using the product.

Individual protection measures, such as personal protective equipment

General information: A risk assessment should be conducted and documented in each work area to assess the risks related to the use of the product and to select the PPE that matches the relevant risk. The following recommendations should be considered. Keep self contained breathing apparatus readily available for emergency use. Personal protective equipment for the body should be selected based on the task being performed and the risks involved.

Eye / face protection: Safety eyewear, goggles or face-shield to EN166 should be used to avoid exposure to liquid splashes. Wear eye protection to EN 166 when using gases.
Guideline: EN 166 Personal Eye Protection.

Skin protection

Hand protection: Wear working gloves while handling containers
Guideline: EN 388 Protective gloves against mechanical risks.

Body protection: No special precautions.

Other: Wear safety shoes while handling containers
Guideline: ISO 20345 Personal protective equipment - Safety footwear.

Respiratory Protection:	Not required.
Thermal hazards:	No precautionary measures are necessary.
Hygiene measures:	Specific risk management measures are not required beyond good industrial hygiene and safety procedures. Do not eat, drink or smoke when using the product.
Environmental exposure controls:	For waste disposal, see section 13.

SECTION 9: Physical And Chemical Properties

9.1 Information on basic physical and chemical properties

Appearance	
Physical state:	Gas
Form:	Liquefied gas
Colour:	Colourless
Odour:	Ethereal odour
Odour Threshold:	Odour threshold is subjective and is inadequate to warn of over exposure.
pH:	Not applicable.
Melting Point:	No data available.
Boiling Point:	< -45 °C
Sublimation Point:	Not applicable.
Critical Temp. (°C):	No data available.
Flash Point:	Not applicable to gases and gas mixtures.
Evaporation Rate:	Not applicable to gases and gas mixtures.
Flammability (solid, gas):	This product is not flammable.
Flammability limit - upper (%)–:	Not applicable.
Flammability limit - lower(%)–:	Not applicable.
Vapour pressure:	13.200 hPa (25 °C)
Vapour density (air=1):	> 3,5 (25 °C)
Relative density:	> 1
Solubility(ies)	
Solubility in Water:	No data available.
Partition coefficient (n-octanol / water):	Not known.
Autoignition Temperature:	Not applicable.
Decomposition Temperature:	Not known.
Viscosity	
Kinematic viscosity:	No data available.
Dynamic Viscosity:	No data available.
Explosive properties:	Not applicable.
Oxidising Properties:	Not applicable.

9.2 Other information: Gas / vapour heavier than air. May accumulate in confined spaces, particularly at or below ground level.

SECTION 10: Stability and Reactivity

10.1 Reactivity: No reactivity hazard other than the effects described in sub-section below.

10.2 Chemical stability: Stable under normal conditions.

10.3 Possibility of hazardous reactions: None.

10.4 Conditions to avoid: Avoid heat, sparks, flame and high pressure. The product is not flammable in air under ambient conditions of temperature and pressure. When pressurised with air or oxygen, the mixture may become flammable. Certain mixtures of HCFCs or HFCs with chlorine may become flammable or reactive under certain conditions.

10.5 Incompatible materials: Strong bases Alkalis, alkaline earth metals (e.g., powdered aluminium, sodium, potassium, zinc)

10.6 Hazardous decomposition products: Under normal conditions of storage and use, hazardous decomposition products should not be produced. If involved in a fire the following toxic and / or corrosive fumes may be produced by thermal decomposition: Carbon oxides fluorocarbons Hydrogen fluoride ; Carbonyl difluoride

SECTION 11: Toxicological Information

General information: None.

11.1 Information on toxicological effects

Acute Toxicity - Oral
Product Based on available data, the classification criteria are not met.

Acute Toxicity - Dermal
Product Based on available data, the classification criteria are not met.

Acute Toxicity - Inhalation
Product Not classified for acute toxicity based on available data.

Component information

Pentafluoroethane	LC Lo (Rat, 4 h): > 800000 ppm
2,3,3,3-Tetrafluoropropene	LC 50 (Rat): > 405000 ppm
Difluoromethane	LC 0 (Rat, 4 h): > 520000 ppm

Repeated dose toxicity
Component information

Pentafluoroethane	NOEC (Rabbit(Male)): 500 ppm NOEC (Rabbit(Female)): 1000 ppm

Skin corrosion / irritation
Product Based on available data, the classification criteria are not met.

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

Respiratory or skin sensitisation
Product Based on available data, the classification criteria are not met.

Germ cell mutagenicity
Product Based on available data, the classification criteria are not met.

In vitro
Component information

2,3,3,3-Tetrafluoropropene	Ames test in vitro: (OECD Guideline 471 (Bacterial Reverse Mutation Test)): Mutagenic

In vivo
Component information

2,3,3,3-Tetrafluoropropene	Chromosome aberration (OECD Guideline 474 (Mammalian Erythrocyte Micronucleus Test)): Negative.

Carcinogenicity
Product Based on available data, the classification criteria are not met.

Reproductive toxicity
Product Based on available data, the classification criteria are not met.

Reproductive toxicity (Fertility)
Component information

2,3,3,3-Tetrafluoropropene	Rat NOAEL - No Observable Adverse Effect Level: 50.000 ppm

Developmental Toxicity (Teratogenicity)
Component information

2,3,3,3-Tetrafluoropropene	Rat Inhalation (OECD Guideline 414 (Prenatal Developmental Toxicity Study))

Specific target organ toxicity - single exposure
Product Based on available data, the classification criteria are not met.

Specific target organ toxicity - repeated exposure
Product Based on available data, the classification criteria are not met.

Aspiration hazard

Product Not applicable to gases and gas mixtures..

Other Relevant Toxicity Information

Component information

Pentafluoroethane	No Observed Adverse Effect Concentration / Dog : 100000 ppm Cardiac sensitization Low Observed Adverse Effect Concentration (LOAEC) / Dog : 75000 ppm Cardiac sensitization
2,3,3,3-Tetrafluoropropene	Low Observed Adverse Effect Concentration (LOAEC) / Dog :> 120000 ppm Cardiac sensitization No Observed Adverse Effect Concentration / Dog : 120000 ppm Cardiac sensitization
Difluoromethane	Low Observed Adverse Effect Concentration (LOAEC) / Dog :> 350000 ppm Cardiac sensitization No Observed Adverse Effect Concentration / Dog : 350000 ppm Cardiac sensitization

SECTION 12: Ecological Information

12.1 Toxicity

Acute toxicity

Product No ecological damage caused by this product.

Acute toxicity - Fish

Component information

Pentafluoroethane	LC 50 (Rainbow trout (Oncorhynchus mykiss), 96 h): 450 mg/l
2,3,3,3-Tetrafluoropropene	LC 50 (Carp (Cyprinus carpio), 96 h): > 197 mg/l
Difluoromethane	LC 50 (Fish, 96 h): 1.507 mg/l

Acute toxicity - Aquatic invertebrates

Component information

Pentafluoroethane	EC50 (48 h): > 200 mg/l
2,3,3,3-Tetrafluoropropene	EC50 (Water flea (Daphnia magna), 48 h): > 100 mg/l
Difluoromethane	EC50 (Water flea (Daphnia), 48 h): 652 mg/l

Toxicity to aquatic plants
Component information

Pentafluoroethane	EC50 (Green algae, 96 h): 142 mg/l
2,3,3,3-Tetrafluoropropene	NOEC (Algae (Pseudokirchneriella subcapitata), 72 h): > 75 mg/l (OECD Guideline 201 (Freshwater Alga and Cyanobacteria, Growth Inhibition Test))
Difluoromethane	EC50 (Alga, 96 h): 142 mg/l

12.2 Persistence and degradability
Product Not applicable to gases and gas mixtures..

Biodegradation
Component information

2,3,3,3-Tetrafluoropropene	< 5 % (28 d, OECD 301F/ ISO 9408/ EEC 92/69/V, C.4-D)

12.3 Bioaccumulative potential
Product The product is expected to biodegrade and is not expected to persist for long periods in an aquatic environment.

12.4 Mobility in soil
Product Because of its high volatility, the product is unlikely to cause ground or water pollution.

12.5 Results of PBT and vPvB assessment
Product Not classified as PBT or vPvB.

12.6 Other adverse effects:

Global Warming Potential

Global warming potential: 2141
Contains fluorinated greenhouse gases covered by the Kyoto protocol. When discharged in large quantities may contribute to the greenhouse effect.
For GWP value of mixture and quantities, refer to container label.

SECTION 13: Disposal Considerations

13.1 Waste treatment methods

General information: Do not discharge into any place where its accumulation could be dangerous. Vent to atmosphere in a well ventilated place.

Disposal methods: Refer to the EIGA code of practice (Doc.30 "Disposal of Gases", downloadable at http://www.eiga.org) for more guidance on suitable disposal methods. Dispose of container via supplier only. Discharge, treatment, or disposal may be subject to national, state, or local laws.

European Waste Codes

Container: 14 06 01: chlorofluorocarbons, HCFC, HFC

SECTION 14: Transport Information

ADR

14.1 UN number:	UN 3163
14.2 UN proper shipping name:	LIQUEFIED GAS, N.O.S.(Pentafluoroethane, Difluoromethane)
14.3 Transport hazard class(es)	
Class:	2
Label(s):	2.2
Hazard No. (ADR):	20
Tunnel restriction code:	(C / E)
Emergency Action Code:	2TE
14.4 Packing group:	–
14.5 Environmental hazards:	Not applicable
14.6 Special precautions for user:	–

RID

14.1 UN number:	UN 3163
14.2 UN proper shipping name	LIQUEFIED GAS, N.O.S.(Pentafluoroethane, Difluoromethane)
14.3 Transport hazard class(es)	
Class:	2
Label(s):	2.2
14.4 Packing group:	–
14.5 Environmental hazards:	Not applicable
14.6 Special precautions for user:	–

IMDG

14.1 UN number:	UN 3163
14.2 UN proper shipping name:	LIQUEFIED GAS, N.O.S.(Pentafluoroethane, Difluoromethane)
14.3 Transport hazard class(es)	
Class:	2.2
Label(s):	2.2
EmS No.:	F-C, S-V
14.3 Packing group:	–
14.5 Environmental hazards:	Not applicable
14.6 Special precautions for user:	–

IATA

14.1	UN number:	UN 3163
14.2	Proper Shipping Name:	Liquefied gas, n.o.s.(Pentafluoroethane, Difluoromethane)
14.3	Transport hazard class(es):	
	Class:	2.2
	Label(s):	2.2
14.4	Packing group:	–
14.5	Environmental hazards:	Not applicable
14.6	Special precautions for user:	–
	Other information	
	Passenger and cargo aircraft:	Allowed.
	Cargo aircraft only:	Allowed.

14.7 Transport in bulk according to Annex II of MARPOL73 / 78 and the IBC Code: Not applicable

Additional identification: 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. Before transporting product containers ensure that they are firmly secured. Ensure that the container valve is closed and not leaking. Container valve guards or caps should be in place. Ensure adequate air ventilation.

SECTION 15: Regulatory information

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

National Regulations

Management of Health and Safety at Work Regulations (1999 No. 3242) The Regulatory Reform (Fire Safety) Order 2005 (2005 No. 1541) Control of Substances Hazardous to Health Regulations (COSHH, 2002 No. 2677) Provision and Use of Work Equipment Regulations (PUWER, 1998 No. 2306) Personal Protective Equipment Regulations (1992 No. 2966) Control of Major Accident Hazards Regulations (COMAH, 1999 No. 743) Chemical Hazards Information and Packaging for Supply (CHIP, 1994 No. 3247) Pressure Systems Safety Regulations (PSSR, 2000 No. 128) Only products that comply with the food regulations (EC) No. 1333 / 2008 and (EU) No. 231 / 2012 and are labelled as such may be used as food additives.
This Safety Data Sheet has been produced to comply with Regulation (EU) 453 / 2010.

15.2 Chemical safety assessment: No Chemical Safety Assessment has been carried out.

SECTION 16: Other Information

Revision Information: Not relevant.

Key literature references and sources for data:

Various sources of data have been used in the compilation of this SDS, they include but are not exclusive to:
Agency for Toxic Substances and Diseases Registry (ATSDR) (http: / /www.atsdr.cdc.gov/).
European Chemical Agency: Guidance on the Compilation of Safety Data Sheets.
European Chemical Agency: Information on Registered Substances http: / /apps.echa.europa.eu/registered/registered-sub.aspx#search
European Industrial Gases Association (EIGA) Doc. 169 Classification and Labelling guide.
International Programme on Chemical Safety (http: / /www.inchem.org/)
ISO 10156:2010 Gases and gas mixtures - Determination of fire potential and oxidizing ability for the selection of cylinder valve outlets.
Matheson Gas Data Book, 7th Edition.
National Institute for Standards and Technology (NIST) Standard Reference Database Number 69.
The ESIS (European chemical Substances 5 Information System) platform of the former European Chemicals Bureau (ECB) ESIS (http: / /ecb.jrc.ec.europa.eu/esis/).
The European Chemical Industry Council (CEFIC) ERICards.
United States of America's National Library of Medicine's toxicology data network TOXNET (http: / /toxnet.nlm.nih.gov/index.html)
Threshold Limit Values (TLV) from the American Conference of Governmental Industrial Hygienists (ACGIH).
Substance specific information from suppliers.
Details given in this document are believed to be correct at the time of publication.
EH40 (as amended) Workplace exposure limits.

Wording of the R-phrases and H-statements in sections 2 and 3

H220	Extremely flammable gas.
H280	Contains gas under pressure; may explode if heated.
R12	Extremely flammable.

Training information:

Users of breathing apparatus must be trained. The hazard of asphyxiation is often overlooked and must be stressed during operator training. Ensure operators understand the hazards.

Classification according to Regulation (EC) No 1272/2008 as amended

Press. Gas Liq. Gas, H280

Other information:

Before using this product in any new process or experiment, a thorough material compatibility and safety study should be carried out. Ensure adequate air ventilation. Ensure all national/local regulations are observed. Whilst proper care has been taken in the preparation of this document, no liability for injury or damage resulting from its use can be accepted. 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).

Revision date: 09.10.2014

Disclaimer: This information is provided without warranty. The information is believed to be correct. This information should be used to make an independent determination of the methods to safeguard workers and the environment.