



411 HFE Solvent

MG Chemicals UK Limited

Version No: A-1.01

Safety Data Sheet (Conforms to Regulation (EU) No 2015/830)

Issue Date: 08/01/2020

Revision Date: 08/01/2020

L.REACH.GBR.EN

SECTION 1 IDENTIFICATION OF THE SUBSTANCE / MIXTURE AND OF THE COMPANY / UNDERTAKING

1.1. Product Identifier

Product name	411 HFE Solvent
Synonyms	SDS Code: 411-Aerosol; 411-300G
Other means of identification	Not Available

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

Relevant identified uses	Electronic cleaner
Uses advised against	Not Applicable

1.3. Details of the supplier of the safety data sheet

Registered company name	MG Chemicals UK Limited	MG Chemicals (Head office)
Address	Heame House, 23 Bilston Street, Sedgely Dudley DY3 1JA United Kingdom	9347 - 193 Street Surrey V4N 4E7 British Columbia Canada
Telephone	+(44) 1663 362888	+(1) 800-201-8822
Fax	Not Available	+(1) 800-708-9888
Website	Not Available	www.mgchemicals.com
Email	sales@mgchemicals.com	Info@mgchemicals.com

1.4. Emergency telephone number

Association / Organisation	CHEMTREC	Not Available
Emergency telephone numbers	+(44) 870-8200418	Not Available
Other emergency telephone numbers	+(1) 703-527-3887	Not Available

SECTION 2 HAZARDS IDENTIFICATION

2.1. Classification of the substance or mixture

Classification according to regulation (EC) No 1272/2008 [CLP] [1]	H229 - Non-flammable aerosol Category 3
Legend:	1. Classified by Chemwatch; 2. Classification drawn from EC Directive 67/548/EEC - Annex I ; 3. Classification drawn from EC Directive 1272/2008 - Annex VI

2.2. Label elements

Hazard pictogram(s)	Not Applicable
SIGNAL WORD	WARNING

Hazard statement(s)

H229	Pressurised container: May burst if heated.
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Supplementary statement(s)

Not Applicable

Precautionary statement(s) Prevention

P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P251	Do not pierce or burn, even after use.

Continued...

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Precautionary statement(s) Response

Not Applicable

Precautionary statement(s) Storage

P410+P412	Protect from sunlight. Do not expose to temperatures exceeding 50 °C/122 °F.
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Precautionary statement(s) Disposal

Not Applicable

2.3. Other hazards

Inhalation may produce health damage*.

Cumulative effects may result following exposure*.

May produce discomfort of the respiratory system*.

Limited evidence of a carcinogenic effect*.

Repeated exposure potentially causes skin dryness and cracking*.

Vapours potentially cause drowsiness and dizziness*.

REACH - Art.57-59: The mixture does not contain Substances of Very High Concern (SVHC) at the SDS print date.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS**3.1. Substances**

See 'Composition on ingredients' in Section 3.2

3.2. Mixtures

1.CAS No 2.EC No 3.Index No 4.REACH No	%[weight]	Name	Classification according to regulation (EC) No 1272/2008 [CLP]
1.163702-08-7 2.Not Available 3.Not Available 4.Not Available	35-40	<u>methoxy nonafluorobutanes</u>	Flammable Liquid Category 3, Chronic Aquatic Hazard Category 3; H226, H412 ^[1]
1.163702-07-6 2.Not Available 3.Not Available 4.Not Available	35-40	<u>methyl nonafluorobutylether</u>	Flammable Liquid Category 3, Chronic Aquatic Hazard Category 3; H226, H412 ^[1]
1.811-97-2 2.212-377-0 3.Not Available 4.01-2119459374-33-XXXX	30	<u>1,1,1,2-tetrafluoroethane</u>	Gas under Pressure (Liquefied gas); H280
Legend:	1. Classified by Chemwatch; 2. Classification drawn from EC Directive 67/548/EEC - Annex I ; 3. Classification drawn from EC Directive 1272/2008 - Annex VI 4. Classification drawn from C&L		

SECTION 4 FIRST AID MEASURES**4.1. Description of first aid measures**

Eye Contact	<p>If aerosols come in contact with the eyes:</p> <ul style="list-style-type: none"> ▶ Immediately hold the eyelids apart and flush the eye with fresh running water. ▶ Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids. ▶ Seek medical attention without delay; if pain persists or recurs seek medical attention. ▶ Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
Skin Contact	<p>If solids or aerosol mists are deposited upon the skin:</p> <ul style="list-style-type: none"> ▶ Flush skin and hair with running water (and soap if available). ▶ Remove any adhering solids with industrial skin cleansing cream. ▶ DO NOT use solvents. ▶ Seek medical attention in the event of irritation.
Inhalation	<p>If aerosols, fumes or combustion products are inhaled:</p> <ul style="list-style-type: none"> ▶ Remove to fresh air. ▶ Lay patient down. Keep warm and rested. ▶ Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures. ▶ If breathing is shallow or has stopped, ensure clear airway and apply resuscitation, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary. ▶ Transport to hospital, or doctor.
Ingestion	<ul style="list-style-type: none"> ▶ If swallowed do NOT induce vomiting. ▶ If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration. ▶ Observe the patient carefully. ▶ Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious. ▶ Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink. ▶ Seek medical advice. ▶ Avoid giving milk or oils. ▶ Avoid giving alcohol.

Continued...

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4.2 Most important symptoms and effects, both acute and delayed

See Section 11

4.3. Indication of any immediate medical attention and special treatment needed

for intoxication due to Freons/ Halons;

A: Emergency and Supportive Measures

- ▶ Maintain an open airway and assist ventilation if necessary
- ▶ Treat coma and arrhythmias if they occur. Avoid (adrenaline) epinephrine or other sympathomimetic amines that may precipitate ventricular arrhythmias. Tachyarrhythmias caused by increased myocardial sensitisation may be treated with propranolol, 1-2 mg IV or esmolol 25-100 microg/kg/min IV.
- ▶ Monitor the ECG for 4-6 hours

B: Specific drugs and antidotes:

- ▶ There is no specific antidote

C: Decontamination

- ▶ Inhalation; remove victim from exposure, and give supplemental oxygen if available.
- ▶ Ingestion; (a) Prehospital: Administer activated charcoal, if available. **DO NOT** induce vomiting because of rapid absorption and the risk of abrupt onset CNS depression. (b) Hospital: Administer activated charcoal, although the efficacy of charcoal is unknown. Perform gastric lavage only if the ingestion was very large and recent (less than 30 minutes)

D: Enhanced elimination:

- ▶ There is no documented efficacy for diuresis, haemodialysis, haemoperfusion, or repeat-dose charcoal.

POISONING and DRUG OVERDOSE, Californian Poison Control System Ed. Kent R Olson; 3rd Edition

- ▶ Do not administer sympathomimetic drugs unless absolutely necessary as material may increase myocardial irritability.
- ▶ No specific antidote.
- ▶ Because rapid absorption may occur through lungs if aspirated and cause systematic effects, the decision of whether to induce vomiting or not should be made by an attending physician.
- ▶ If lavage is performed, suggest endotracheal and/or esophageal control.
- ▶ Danger from lung aspiration must be weighed against toxicity when considering emptying the stomach.
- ▶ Treatment based on judgment of the physician in response to reactions of the patient

Treat symptomatically.

SECTION 5 FIREFIGHTING MEASURES**5.1. Extinguishing media****SMALL FIRE:**

- ▶ Water spray, dry chemical or CO₂

LARGE FIRE:

- ▶ Water spray or fog.
- ▶ Water spray or fog.
- ▶ Foam.
- ▶ Dry chemical powder.
- ▶ BCF (where regulations permit).
- ▶ Carbon dioxide.

5.2. Special hazards arising from the substrate or mixture**Fire Incompatibility**

- ▶ Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result

5.3. Advice for firefighters

Fire Fighting	<ul style="list-style-type: none"> ▶ Alert Fire Brigade and tell them location and nature of hazard. ▶ May be violently or explosively reactive. ▶ Wear breathing apparatus plus protective gloves in the event of a fire. ▶ Prevent, by any means available, spillage from entering drains or water course. ▶ Consider evacuation (or protect in place). ▶ Fight fire from a safe distance, with adequate cover. ▶ If safe, switch off electrical equipment until vapour fire hazard removed. ▶ Use water delivered as a fine spray to control the fire and cool adjacent area. ▶ Avoid spraying water onto liquid pools. ▶ Do not approach containers suspected to be hot. ▶ Cool fire exposed containers with water spray from a protected location. ▶ If safe to do so, remove containers from path of fire.
Fire/Explosion Hazard	<p>WARNING: In use may form flammable/ explosive vapour-air mixtures.</p> <ul style="list-style-type: none"> ▶ Liquid and vapour are flammable. ▶ Moderate fire hazard when exposed to heat or flame. ▶ Vapour forms an explosive mixture with air. ▶ Moderate explosion hazard when exposed to heat or flame. ▶ Vapour may travel a considerable distance to source of ignition. ▶ Heating may cause expansion or decomposition leading to violent rupture of containers. ▶ On combustion, may emit toxic fumes of carbon monoxide (CO). <p>Combustion products include: carbon dioxide (CO₂) hydrogen fluoride other pyrolysis products typical of burning organic material.</p> <p>Contains low boiling substance: Closed containers may rupture due to pressure buildup under fire conditions.</p> <p>WARNING: Aerosol containers may present pressure related hazards.</p>

SECTION 6 ACCIDENTAL RELEASE MEASURES**6.1. Personal precautions, protective equipment and emergency procedures**

See section 8

6.2. Environmental precautions

See section 12

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6.3. Methods and material for containment and cleaning up

Minor Spills	<ul style="list-style-type: none"> ▶ Clean up all spills immediately. ▶ Avoid breathing vapours and contact with skin and eyes. ▶ Wear protective clothing, impervious gloves and safety glasses. ▶ Shut off all possible sources of ignition and increase ventilation. ▶ Wipe up. ▶ If safe, damaged cans should be placed in a container outdoors, away from all ignition sources, until pressure has dissipated. ▶ Undamaged cans should be gathered and stowed safely. 																																																																											
Major Spills	<p>Chemical Class: aliphatics, halogenated For release onto land: recommended sorbents listed in order of priority.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">SORBENT TYPE</th> <th style="text-align: left;">RANK</th> <th style="text-align: left;">APPLICATION</th> <th style="text-align: left;">COLLECTION</th> <th style="text-align: left;">LIMITATIONS</th> </tr> </thead> <tbody> <tr> <td colspan="5">LAND SPILL - SMALL</td> </tr> <tr> <td>cross-linked polymer - particulate</td> <td style="text-align: center;">1</td> <td></td> <td>shovel</td> <td>R, W, SS</td> </tr> <tr> <td>cross-linked polymer - pillow</td> <td style="text-align: center;">1</td> <td></td> <td>throw</td> <td>R, DGC, RT</td> </tr> <tr> <td>wood fiber - pillow</td> <td style="text-align: center;">2</td> <td></td> <td>throw</td> <td>R, P, DGC, RT</td> </tr> <tr> <td>treated wood fibre - particulate</td> <td style="text-align: center;">2</td> <td></td> <td>shovel</td> <td>R, W, DGC</td> </tr> <tr> <td>sorbent clay - particulate</td> <td style="text-align: center;">3</td> <td></td> <td>shovel</td> <td>R, I, P</td> </tr> <tr> <td>foamed glass - pillow</td> <td style="text-align: center;">3</td> <td></td> <td>throw</td> <td>R, P, DGC, RT</td> </tr> <tr> <td colspan="5">LAND SPILL - MEDIUM</td> </tr> <tr> <td>cross-linked polymer - particulate</td> <td style="text-align: center;">1</td> <td></td> <td>blower</td> <td>R,W, SS</td> </tr> <tr> <td>cross-linked polymer - pillow</td> <td style="text-align: center;">2</td> <td></td> <td>throw</td> <td>R, DGC, RT</td> </tr> <tr> <td>sorbent clay - particulate</td> <td style="text-align: center;">3</td> <td></td> <td>blower</td> <td>R, I, P</td> </tr> <tr> <td>polypropylene - particulate</td> <td style="text-align: center;">3</td> <td></td> <td>blower</td> <td>W, SS, DGC</td> </tr> <tr> <td>foamed glass - pillow</td> <td style="text-align: center;">3</td> <td></td> <td>throw</td> <td>R, P, DGC, RT</td> </tr> <tr> <td>expanded mineral - particulate</td> <td style="text-align: center;">4</td> <td></td> <td>blower</td> <td>R, I, W, P, DGC</td> </tr> </tbody> </table> <p>Legend DGC: Not effective where ground cover is dense R: Not reusable I: Not incinerable P: Effectiveness reduced when rainy RT: Not effective where terrain is rugged SS: Not for use within environmentally sensitive sites W: Effectiveness reduced when windy Reference: Sorbents for Liquid Hazardous Substance Cleanup and Control; R.W Melvold et al: Pollution Technology Review No. 150: Noyes Data Corporation 1988</p> <ul style="list-style-type: none"> ▶ Clear area of personnel and move upwind. ▶ Alert Fire Brigade and tell them location and nature of hazard. ▶ May be violently or explosively reactive. ▶ Wear breathing apparatus plus protective gloves. ▶ Prevent, by any means available, spillage from entering drains or water course. ▶ No smoking, naked lights or ignition sources. ▶ Increase ventilation. ▶ Stop leak if safe to do so. ▶ Water spray or fog may be used to disperse / absorb vapour. ▶ Contain spill with sand, earth or vermiculite. ▶ Use only spark-free shovels and explosion proof equipment. ▶ Collect recoverable product into labelled containers for recycling. ▶ Absorb remaining product with sand, earth or vermiculite. ▶ Collect solid residues and seal in labelled drums for disposal. ▶ Wash area and prevent runoff into drains. ▶ If contamination of drains or waterways occurs, advise emergency services. ▶ Clear area of personnel and move upwind. ▶ Alert Fire Brigade and tell them location and nature of hazard. ▶ May be violently or explosively reactive. ▶ Wear breathing apparatus plus protective gloves. ▶ Prevent, by any means available, spillage from entering drains or water course. ▶ Consider evacuation (or protect in place). ▶ No smoking, naked lights or ignition sources. ▶ Increase ventilation. ▶ Stop leak if safe to do so. ▶ Water spray or fog may be used to disperse /absorb vapour. ▶ Contain spill with sand, earth or vermiculite. ▶ Use only spark-free shovels and explosion proof equipment. ▶ Collect recoverable product into labelled containers for recycling. ▶ Absorb remaining product with sand, earth or vermiculite. ▶ Collect solid residues and seal in labelled drums for disposal. ▶ Wash area and prevent runoff into drains. ▶ If contamination of drains or waterways occurs, advise emergency services. ▶ Clear area of personnel and move upwind. ▶ Alert Fire Brigade and tell them location and nature of hazard. ▶ May be violently or explosively reactive. ▶ Wear breathing apparatus plus protective gloves. ▶ Prevent, by any means available, spillage from entering drains or water courses 	SORBENT TYPE	RANK	APPLICATION	COLLECTION	LIMITATIONS	LAND SPILL - SMALL					cross-linked polymer - particulate	1		shovel	R, W, SS	cross-linked polymer - pillow	1		throw	R, DGC, RT	wood fiber - pillow	2		throw	R, P, DGC, RT	treated wood fibre - particulate	2		shovel	R, W, DGC	sorbent clay - particulate	3		shovel	R, I, P	foamed glass - pillow	3		throw	R, P, DGC, RT	LAND SPILL - MEDIUM					cross-linked polymer - particulate	1		blower	R,W, SS	cross-linked polymer - pillow	2		throw	R, DGC, RT	sorbent clay - particulate	3		blower	R, I, P	polypropylene - particulate	3		blower	W, SS, DGC	foamed glass - pillow	3		throw	R, P, DGC, RT	expanded mineral - particulate	4		blower	R, I, W, P, DGC
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- ▶ No smoking, naked lights or ignition sources.
- ▶ Increase ventilation.
- ▶ Stop leak if safe to do so.
- ▶ Water spray or fog may be used to disperse / absorb vapour.
- ▶ Absorb or cover spill with sand, earth, inert materials or vermiculite.
- ▶ If safe, damaged cans should be placed in a container outdoors, away from ignition sources, until pressure has dissipated.
- ▶ Undamaged cans should be gathered and stowed safely.
- ▶ Collect residues and seal in labelled drums for disposal.

6.4. Reference to other sections

Personal Protective Equipment advice is contained in Section 8 of the SDS.

SECTION 7 HANDLING AND STORAGE

7.1. Precautions for safe handling

Safe handling	<ul style="list-style-type: none"> ▶ Avoid all personal contact, including inhalation. ▶ Wear protective clothing when risk of exposure occurs. ▶ Use in a well-ventilated area. ▶ Prevent concentration in hollows and sumps. ▶ DO NOT enter confined spaces until atmosphere has been checked. ▶ Avoid smoking, naked lights or ignition sources. ▶ Avoid contact with incompatible materials. ▶ When handling, DO NOT eat, drink or smoke. ▶ DO NOT incinerate or puncture aerosol cans. ▶ DO NOT spray directly on humans, exposed food or food utensils. ▶ Avoid physical damage to containers. ▶ Always wash hands with soap and water after handling. ▶ Work clothes should be laundered separately. ▶ Use good occupational work practice. ▶ Observe manufacturer's storage and handling recommendations contained within this SDS. ▶ Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.
Fire and explosion protection	See section 5
Other information	

7.2. Conditions for safe storage, including any incompatibilities

Suitable container	<ul style="list-style-type: none"> ▶ For low viscosity materials (i) : Drums and jerry cans must be of the non-removable head type. (ii) : Where a can is to be used as an inner package, the can must have a screwed enclosure. ▶ For materials with a viscosity of at least 2680 cSt. (23 deg. C) ▶ For manufactured product having a viscosity of at least 250 cSt. (23 deg. C) ▶ Manufactured product that requires stirring before use and having a viscosity of at least 20 cSt (25 deg. C): (i) Removable head packaging; (ii) Cans with friction closures and (iii) low pressure tubes and cartridges may be used. ▶ Where combination packages are used, and the inner packages are of glass, there must be sufficient inert cushioning material in contact with inner and outer packages ▶ In addition, where inner packagings are glass and contain liquids of packing group I there must be sufficient inert absorbent to absorb any spillage, unless the outer packaging is a close fitting moulded plastic box and the substances are not incompatible with the plastic. ▶ Aerosol dispenser. ▶ Check that containers are clearly labelled.
Storage incompatibility	<p>Haloalkanes:</p> <ul style="list-style-type: none"> ▶ are highly reactive:some of the more lightly substituted lower members are highly flammable; the more highly substituted may be used as fire suppressants, not always with the anticipated results. ▶ may react with the lighter divalent metals to produce more reactive compounds analogous to Grignard reagents. ▶ may produce explosive compounds following prolonged contact with metallic or other azides ▶ may react on contact with potassium or its alloys - although apparently stable on contact with a wide range of halocarbons, reaction products may be shock-sensitive and may explode with great violence on light impact; severity generally increases with the degree of halocarbon substitution and potassium-sodium alloys give extremely sensitive mixtures . <p>BREThERICK L.: Handbook of Reactive Chemical Hazards</p> <ul style="list-style-type: none"> ▶ react with metal halides and active metals, eg. sodium (Na), potassium (K), lithium (Li),calcium (Ca), zinc (Zn), powdered aluminium (Al) and aluminium alloys, magnesium (Mg) and magnesium alloys. ▶ may react with brass and steel. ▶ may react explosively with strong oxidisers ▶ may degrade rubber, and plastics such as methacrylate polymers, polyethylene and polystyrene, paint and coatings ▶ Avoid strong bases.

7.3. Specific end use(s)

See section 1.2

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1. Control parameters

DERIVED NO EFFECT LEVEL (DNEL)

Not Available

PREDICTED NO EFFECT LEVEL (PNEC)

Not Available

OCCUPATIONAL EXPOSURE LIMITS (OEL)

INGREDIENT DATA

Continued...

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Source	Ingredient	Material name	TWA	STEL	Peak	Notes
UK Workplace Exposure Limits (WELs)	1,1,1,2-tetrafluoroethane	1,1,1,2-Tetrafluoroethane (HFC 134a)	4240 mg/m ³ / 1000 ppm	Not Available	Not Available	Not Available

EMERGENCY LIMITS

Ingredient	Material name	TEEL-1	TEEL-2	TEEL-3
methoxy nonafluorobutanes	Methyl nonafluorobutyl ether (40%) and Methyl nonafluoroisobutyl ether (60%) (ppm) (HFE-7100)	Not Available	Not Available	Not Available
methoxy nonafluorobutanes	Methyl nonafluorobutyl ether (40%) and Methyl nonafluoroisobutyl ether (60%) (ppm) (HFE-7100)	Not Available	Not Available	Not Available
methyl nonafluorobutylether	Methyl nonafluorobutyl ether (40%) and Methyl nonafluoroisobutyl ether (60%) (ppm) (HFE-7100)	Not Available	Not Available	Not Available
methyl nonafluorobutylether	Methyl nonafluorobutyl ether (40%) and Methyl nonafluoroisobutyl ether (60%) (ppm) (HFE-7100)	Not Available	Not Available	Not Available
1,1,1,2-tetrafluoroethane	HFC 134a; (Tetrafluoroethane, 1,1,1,2-)	Not Available	Not Available	Not Available

Ingredient	Original IDLH	Revised IDLH
methoxy nonafluorobutanes	Not Available	Not Available
methyl nonafluorobutylether	Not Available	Not Available
1,1,1,2-tetrafluoroethane	Not Available	Not Available


MATERIAL DATA

Sensory irritants are chemicals that produce temporary and undesirable side-effects on the eyes, nose or throat. Historically occupational exposure standards for these irritants have been based on observation of workers' responses to various airborne concentrations. Present day expectations require that nearly every individual should be protected against even minor sensory irritation and exposure standards are established using uncertainty factors or safety factors of 5 to 10 or more. On occasion animal no-observable-effect-levels (NOEL) are used to determine these limits where human results are unavailable. An additional approach, typically used by the TLV committee (USA) in determining respiratory standards for this group of chemicals, has been to assign ceiling values (TLV C) to rapidly acting irritants and to assign short-term exposure limits (TLV STELs) when the weight of evidence from irritation, bioaccumulation and other endpoints combine to warrant such a limit. In contrast the MAK Commission (Germany) uses a five-category system based on intensive odour, local irritation, and elimination half-life. However this system is being replaced to be consistent with the European Union (EU) Scientific Committee for Occupational Exposure Limits (SCOEL); this is more closely allied to that of the USA.

OSHA (USA) concluded that exposure to sensory irritants can:

- ▶ cause inflammation
- ▶ cause increased susceptibility to other irritants and infectious agents
- ▶ lead to permanent injury or dysfunction
- ▶ permit greater absorption of hazardous substances and
- ▶ acclimate the worker to the irritant warning properties of these substances thus increasing the risk of overexposure.

8.2. Exposure controls

8.2.1. Appropriate engineering controls	<p>Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection.</p> <p>The basic types of engineering controls are:</p> <p>Process controls which involve changing the way a job activity or process is done to reduce the risk.</p> <p>Enclosure and/or isolation of emission source which keeps a selected hazard 'physically' away from the worker and ventilation that strategically 'adds' and 'removes' air in the work environment. Ventilation can remove or dilute an air contaminant if designed properly. The design of a ventilation system must match the particular process and chemical or contaminant in use.</p> <p>Employers may need to use multiple types of controls to prevent employee overexposure.</p> <p>General exhaust is adequate under normal conditions. If risk of overexposure exists, wear SAA approved respirator. Correct fit is essential to obtain adequate protection.</p> <p>Provide adequate ventilation in warehouse or closed storage areas.</p> <p>Air contaminants generated in the workplace possess varying 'escape' velocities which, in turn, determine the 'capture velocities' of fresh circulating air required to effectively remove the contaminant.</p> <table border="1" style="width: 100%;"> <thead> <tr> <th>Type of Contaminant:</th> <th>Speed:</th> </tr> </thead> <tbody> <tr> <td>aerosols, (released at low velocity into zone of active generation)</td> <td>0.5-1 m/s</td> </tr> <tr> <td>direct spray, spray painting in shallow booths, gas discharge (active generation into zone of rapid air motion)</td> <td>1-2.5 m/s (200-500 f/min.)</td> </tr> </tbody> </table> <p>Within each range the appropriate value depends on:</p> <table border="1" style="width: 100%;"> <thead> <tr> <th>Lower end of the range</th> <th>Upper end of the range</th> </tr> </thead> <tbody> <tr> <td>1: Room air currents minimal or favourable to capture</td> <td>1: Disturbing room air currents</td> </tr> <tr> <td>2: Contaminants of low toxicity or of nuisance value only.</td> <td>2: Contaminants of high toxicity</td> </tr> <tr> <td>3: Intermittent, low production.</td> <td>3: High production, heavy use</td> </tr> <tr> <td>4: Large hood or large air mass in motion</td> <td>4: Small hood-local control only</td> </tr> </tbody> </table> <p>Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 1-2 m/s (200-400 f/min.) for extraction of solvents generated in a tank 2 meters distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.</p>	Type of Contaminant:	Speed:	aerosols, (released at low velocity into zone of active generation)	0.5-1 m/s	direct spray, spray painting in shallow booths, gas discharge (active generation into zone of rapid air motion)	1-2.5 m/s (200-500 f/min.)	Lower end of the range	Upper end of the range	1: Room air currents minimal or favourable to capture	1: Disturbing room air currents	2: Contaminants of low toxicity or of nuisance value only.	2: Contaminants of high toxicity	3: Intermittent, low production.	3: High production, heavy use	4: Large hood or large air mass in motion	4: Small hood-local control only
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2: Contaminants of low toxicity or of nuisance value only.	2: Contaminants of high toxicity																
3: Intermittent, low production.	3: High production, heavy use																
4: Large hood or large air mass in motion	4: Small hood-local control only																
8.2.2. Personal protection																	
Eye and face protection	<p>No special equipment for minor exposure i.e. when handling small quantities.</p> <p>OTHERWISE: For potentially moderate or heavy exposures:</p> <ul style="list-style-type: none"> ▶ Safety glasses with side shields. ▶ NOTE: Contact lenses pose a special hazard; soft lenses may absorb irritants and ALL lenses concentrate them. 																

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	<ul style="list-style-type: none"> ▶ Safety glasses with side shields. ▶ Chemical goggles. ▶ Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lenses or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59], [AS/NZS 1336 or national equivalent]
Skin protection	See Hand protection below
Hands/feet protection	<p>Wear general protective gloves, eg. light weight rubber gloves.</p> <ul style="list-style-type: none"> ▶ Neoprene gloves ▶ No special equipment needed when handling small quantities. ▶ OTHERWISE: ▶ For potentially moderate exposures: ▶ Wear general protective gloves, eg. light weight rubber gloves. ▶ For potentially heavy exposures: ▶ Wear chemical protective gloves, eg. PVC. and safety footwear.
Body protection	See Other protection below
Other protection	<p>No special equipment needed when handling small quantities.</p> <p>OTHERWISE:</p> <ul style="list-style-type: none"> ▶ Overalls. ▶ Skin cleansing cream. ▶ Eyewash unit. ▶ Do not spray on hot surfaces.
Thermal hazards	Not Available

Respiratory protection

Type AX Filter of sufficient capacity. (AS/NZS 1716 & 1715, EN 143:2000 & 149:2001, ANSI Z88 or national equivalent)

Where the concentration of gas/particulates in the breathing zone, approaches or exceeds the 'Exposure Standard' (or ES), respiratory protection is required. Degree of protection varies with both face-piece and Class of filter; the nature of protection varies with Type of filter.

Required Minimum Protection Factor	Half-Face Respirator	Full-Face Respirator	Powered Air Respirator
up to 5 x ES	Air-line*	AX-2	AX-PAPR-2 ^
up to 10 x ES	-	AX-3	-
10+ x ES	-	Air-line**	-

* - Continuous Flow; ** - Continuous-flow or positive pressure demand

^ - Full-face

A(All classes) = Organic vapours, B AUS or B1 = Acid gasses, B2 = Acid gas or hydrogen cyanide(HCN), B3 = Acid gas or hydrogen cyanide(HCN), E = Sulfur dioxide(SO₂), G = Agricultural chemicals, K = Ammonia(NH₃), Hg = Mercury, NO = Oxides of nitrogen, MB = Methyl bromide, AX = Low boiling point organic compounds(below 65 degC)

▶ **Generally not applicable.**

Aerosols, in common with most vapours/ mists, should never be used in confined spaces without adequate ventilation. Aerosols, containing agents designed to enhance or mask smell, have triggered allergic reactions in predisposed individuals.

8.2.3. Environmental exposure controls

See section 12

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES**9.1. Information on basic physical and chemical properties**

Appearance	Colorless		
Physical state	Liquid	Relative density (Water = 1)	1.5
Odour	Not Available	Partition coefficient n-octanol / water	Not Available
Odour threshold	Not Available	Auto-ignition temperature (°C)	405
pH (as supplied)	Not Available	Decomposition temperature	Not Available
Melting point / freezing point (°C)	Not Available	Viscosity (cSt)	0.6
Initial boiling point and boiling range (°C)	60	Molecular weight (g/mol)	Not Available
Flash point (°C)	Not Available	Taste	Not Available
Evaporation rate	49 BuAC = 1	Explosive properties	Not Available
Flammability	Not Available	Oxidising properties	Not Available
Upper Explosive Limit (%)	Not Available	Surface Tension (dyn/cm or mN/m)	Not Available
Lower Explosive Limit (%)	Not Available	Volatile Component (%vol)	Not Available
Vapour pressure (kPa)	26.93	Gas group	Not Available
Solubility in water (g/L)	Not Available	pH as a solution (1%)	Not Available
Vapour density (Air = 1)	8.6	VOC g/L	Not Available

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9.2. Other information

Not Available

SECTION 10 STABILITY AND REACTIVITY

10.1. Reactivity	See section 7.2
10.2. Chemical stability	<ul style="list-style-type: none"> ▶ Elevated temperatures. ▶ Presence of open flame. ▶ Product is considered stable. ▶ Hazardous polymerisation will not occur.
10.3. Possibility of hazardous reactions	See section 7.2
10.4. Conditions to avoid	See section 7.2
10.5. Incompatible materials	See section 7.2
10.6. Hazardous decomposition products	See section 5.3

SECTION 11 TOXICOLOGICAL INFORMATION

11.1. Information on toxicological effects

Inhaled	<p>Inhalation of vapours may cause drowsiness and dizziness. This may be accompanied by narcosis, reduced alertness, loss of reflexes, lack of coordination and vertigo.</p> <p>Inhalation of aerosols (mists, fumes), generated by the material during the course of normal handling, may be damaging to the health of the individual. Limited evidence or practical experience suggests that the material may produce irritation of the respiratory system, in a significant number of individuals, following inhalation. In contrast to most organs, the lung is able to respond to a chemical insult by first removing or neutralising the irritant and then repairing the damage. The repair process, which initially evolved to protect mammalian lungs from foreign matter and antigens, may however, produce further lung damage resulting in the impairment of gas exchange, the primary function of the lungs. Respiratory tract irritation often results in an inflammatory response involving the recruitment and activation of many cell types, mainly derived from the vascular system.</p> <p>Exposure to high concentrations of fluorocarbons may produce cardiac arrhythmias or cardiac arrest due sensitisation of the heart to adrenalin or noradrenalin. Deaths associated with exposures to fluorocarbons (specifically halogenated aliphatics) have occurred in occupational settings and in inhalation of bronchodilator drugs.</p> <p>Bronchospasm consistently occurs in human subjects inhaling fluorocarbons. At a measured concentration of 1700 ppm of one of the commercially available aerosols there is a biphasic change in ventilatory capacity, the first reduction occurring within a few minutes and the second delayed up to 30 minutes. Most subjects developed bradycardia (reduced pulse rate).</p> <p>Bradycardia is encountered in dogs when administration is limited to upper respiratory tract (oropharyngeal and nasal areas). Cardiac arrhythmias can be experimentally induced in animals (species dependency is pronounced with dogs and monkeys requiring lesser amounts of fluorocarbon FC-11 than rats or mice). Sensitivity is increased by injection of adrenalin or cardiac ischaemia/necrosis or pulmonary thrombosis/bronchitis. The cardiotoxic effects of the fluorocarbons originate from irritation of the respiratory tract which in turn reflexively influences the heart rate (even prior to absorption of the fluorocarbon) followed by direct depression of the heart after absorption.</p> <p>Exposure to fluorocarbon thermal decomposition products may produce flu-like symptoms including chills, fever, weakness, muscular aches, headache, chest discomfort, sore throat and dry cough. Complete recovery usually occurs within 24 hours of exposure.</p> <p>Common, generalised symptoms associated with toxic gas inhalation include:</p> <ul style="list-style-type: none"> ▶ central nervous system effects such as depression, headache, confusion, dizziness, progressive stupor, coma and seizures; ▶ respiratory system complications may include acute pulmonary oedema, dyspnoea, stridor, tachypnoea, bronchospasm, wheezing and other reactive airway symptoms, and respiratory arrest; ▶ cardiovascular effects may include cardiovascular collapse, arrhythmias and cardiac arrest; ▶ gastrointestinal effects may also be present and may include mucous membrane irritation, nausea and vomiting (sometimes bloody), and abdominal pain. <p>WARNING: Intentional misuse by concentrating/inhaling contents may be lethal.</p>
Ingestion	<p>Swallowing of the liquid may cause aspiration of vomit into the lungs with the risk of haemorrhaging, pulmonary oedema, progressing to chemical pneumonitis; serious consequences may result.</p> <p>Signs and symptoms of chemical (aspiration) pneumonitis may include coughing, gasping, choking, burning of the mouth, difficult breathing, and bluish coloured skin (cyanosis).</p> <p>The material has NOT been classified by EC Directives or other classification systems as 'harmful by ingestion'. This is because of the lack of corroborating animal or human evidence. The material may still be damaging to the health of the individual, following ingestion, especially where pre-existing organ (e.g liver, kidney) damage is evident. Present definitions of harmful or toxic substances are generally based on doses producing mortality rather than those producing morbidity (disease, ill-health). Gastrointestinal tract discomfort may produce nausea and vomiting. In an occupational setting however, ingestion of insignificant quantities is not thought to be cause for concern.</p>
Skin Contact	<p>The material is not thought to produce adverse health effects or skin irritation following contact (as classified by EC Directives using animal models). Nevertheless, good hygiene practice requires that exposure be kept to a minimum and that suitable gloves be used in an occupational setting. Repeated exposure may cause skin cracking, flaking or drying following normal handling and use. Spray mist may produce discomfort</p> <p>In common with other halogenated aliphatics, fluorocarbons may cause dermal problems due to a tendency to remove natural oils from the skin causing irritation and the development of dry, sensitive skin. They do not appear to be appreciably absorbed.</p> <p>Open cuts, abraded or irritated skin should not be exposed to this material</p> <p>Entry into the blood-stream through, for example, cuts, abrasions, puncture wounds or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.</p>
Eye	<p>Although the liquid is not thought to be an irritant (as classified by EC Directives), direct contact with the eye may produce transient discomfort characterised by tearing or conjunctival redness (as with windburn).</p>
Chronic	<p>On the basis, primarily, of animal experiments, concern has been expressed by at least one classification body that the material may produce carcinogenic or mutagenic effects; in respect of the available information, however, there presently exists inadequate data for making a satisfactory assessment. Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems.</p> <p>It is generally accepted that the fluorocarbons are less toxic than the corresponding halogenated aliphatic based on chlorine. Repeated inhalation exposure to the fluorocarbon FC-11 does not produce pathologic lesions of the liver and other visceral organs in experimental animals. There has been conjecture in</p>

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non-scientific publications that fluorocarbons may cause leukemia, cancer, sterility and birth defects; these have not been verified by current research. The high incidence of cancer, spontaneous abortion and congenital anomalies amongst hospital personnel, repeatedly exposed to fluorine-containing general anaesthetics, has caused some scientists to call for a lowering of the fluorocarbon exposure standard to 5 ppm since some are mutagens.

Long chain perfluorinated carboxylic acid (PFCAs) are present in the environment of most developed countries and have the potential to adversely affect animal and human health. In tests on laboratory animals, one PFOA (perfluorooctanoic acid, PFOA) has been shown to be tumourigenic and immunotoxic and to elicit moderate reproductive or developmental toxicity and moderate-to-high subchronic oral toxicity. It has been assumed that despite the absence of robust toxicity results for longer chain PFCAs, these substances are reasonably expected to be of greater concern than PFOA, as a result of their known slower clearance rates and higher bioaccumulation potential.

PFOS (perfluorooctanesulfonic acid) and PFOA are weakly lipophilic, very water soluble, and bind preferentially to proteins. The principle binding partner is albumin however, they also binds to beta-lipoproteins or fatty acid binding proteins in the liver [L-FABP]. As far as it is known, PFOS and PFOA are not metabolized in mammals. Thus, PFOA is not subject to defluorination nor to phase-II metabolism of biotransformation.

Available studies provide consistent evidence of a weakly positive association of the PFOA concentration in serum with cholesterol and the uric acid levels, whereby the magnitude of the effect on cholesterol level is not correlated with the extent of exposure.

An increasing risk of attention deficit hyperactivity disorder (ADHD) in children with elevated perfluorinated compounds (PFCs) serum concentrations. There are a few but inconsistent indications of a weakly positive correlation with the activities of liver enzymes.

The results from these studies examining reproductive effects are inconsistent, and the observed adverse effects are weak. It is therefore concluded that the information provided by the results from previous epidemiological studies is limited and the data is inadequate to allow unambiguous conclusions to be drawn about the role of PFOA in the development of particular diseases [

In animal models, PFOS and PFOA demonstrate a moderate acute toxicity. The lethal dose with 50% lethality [LD50] for PFOS is 251 mg/kg BW for a single oral dose in rats. LD50 values for PFOA range from 430 to 680 mg/kg BW with an average of 540 mg/kg BW per day. The lethal concentration with 50% lethality [LC50] for 1 h inhalation of airborne dust contaminated with PFOS was 5.2 mg/L for rats. An LC50 of 0.98 mg/L has been reported for inhalation of PFOA. Inhalation of this concentration over one 4-hour period resulted in enlargement of the liver and corneal opacity in rats.

Studies have shown that the primary effects of subacute and/or subchronic toxicities induced by repetitive applications of PFOS and PFOA varied according to species: hypertrophy and vacuolization of the liver, reduction of serum cholesterol, reduction of triglycerides in serum, reduction in body weight gain or body weight, and increased mortality.

The most sensitive target organs for repetitive oral application of PFOS over a period of 4 weeks to 2 years in rats and cynomolgus monkeys were the liver and thyroid. The liver was also the most sensitive target organ for repetitive applications of PFOA in mice, rats, and primates. Hepatotoxic and carcinogenic effects were observed in the rats after PFOS exposure. Based on the hepatotoxic effects, a NOAEL of 2 mg/kg feed or 0.14 mg/kg BW/day was calculated for male and female rats.

Chronic exposure to PFOA produced an increased incidence of Leydig cell adenomas.

It has been suggested that possible impairment of fertility correlates to PFOS and PFOA blood concentrations measured in the general population. The time until pregnancy was longer in the group with higher PFOA and PFOS contaminations.

In animal studies PFOS and PFOA neither interfered with reproduction nor did they lead to any appreciable teratogenic effects. Both substances did, however, show developmental toxicity when the mother animal was exposed during pregnancy, i.e., they led to a reduced increase in body weight after birth and reduced the number of live births and the viability of the progeny in the first five days after birth.

PFOS can have an influence on the neuroendocrine system in rats. Reduced food intake and body weight, influence on the ovarian cycle, increased corticosterone concentration, and decreasing leptin concentration in serum appear to be the effects of PFOS exposure. In addition, noradrenaline concentrations in the paraventricular nucleus of the hypothalamus are elevated.

PFOA appears to stimulate the development of mammary glands in C57B1/6 mice by promoting steroid hormone production in the ovaries and by increasing the concentration of a number of growth factors in the mammary glands. This suggests an indirect oestrogen effect of PFOA.

The immunotoxic potential of PFOA in mice has been demonstrated. A high dose of 0.02% PFOA to the feed for 7 to 10 days led to a loss of body weight and reduced mass of the thymus and the spleen.

Effects on the liver have often been observed in toxicological studies. For example, liver enlargement was seen in connection with hypertrophy and vacuolization of the liver cells and an increase in liver weight in studies on subchronic and chronic toxicity. Most generally, rodents and nonhuman primates have been exposed to perfluorinated compounds (PFCs). In addition, hepatocellular adenomas occurred in rats. In particular, liver tumours have been traced to the activation of PPARa.

PPARa from mice, rats, and humans can be activated by PFOS and PFOA. Rats have a higher susceptibility to the PPARa-based mechanism than humans. However, hepatocarcinogenicity can also be only partially attributed to this mechanism.

Certain studies indicate correlations between PFC concentrations and diabetes and thyroid disease, as well as blood lipid and uric acid levels; however, these cannot be considered proven and will need to be confirmed.

Higher PFOA and PFOS serum concentrations are associated with a thyroid disease in adults.

Elevated PFOA serum concentrations were also associated with a higher prevalence of hyperuricemia. The uric acid level increased by 0.2 to 0.3 mg/dL, from the lowest to the highest decile of PFOA or PFOS concentration.

There appears to be correlation between PFCs and glucose homeostasis, as well as other indicators of metabolic syndrome.

Increasing PFOA serum concentrations increased the beta-cell function. Elevated PFOS serum concentrations increased the insulin level in the blood, insulin resistance, and beta-cell function and was negatively correlated with serum HDL cholesterol values. One study a study established an increased diabetes mortality rate in PFOA-exposed workers. Confounding factors however produced ambiguous results.

411-Aerosol HFE Solvent	TOXICITY	IRRITATION
	Not Available	Not Available
methoxy nonafluorobutanes	TOXICITY	IRRITATION
	Inhalation (rat) LC50: >11986.308 mg/l/4h*Skinmild*[2] Oral (rat) LD50: >5000 mg/kg[2]	Not Available
methyl nonafluorobutylether	TOXICITY	IRRITATION
	Inhalation (rat) LC50: >11986.308 mg/l/4h*Skinmild*[2] Oral (rat) LD50: >5000 mg/kg[2]	Eye (rabbit): non-irritating * Skin: minimally irritating *
1,1,1,2-tetrafluoroethane	TOXICITY	IRRITATION
	Inhalation (rat) LC50: 1500 mg/l/4h[2]	Not Available

Legend:

1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2. * Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances

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METHYL NONAFLUOROBUTYLETHER	Inhalation (rat) LC50>12000: None ppm/4h* Skin: mild** NOEL (Inhalation rat) 90day: None 7500 ppm * Developmental Toxicity: No abnormal effects observed Mutagenicity: Not a mutagen in reverse mutation or chromosomal assay *(based on structurally similar chemical, perfluoromethyl ether) (3M Company) * (DuPont) Not a skin sensitiser in guinea pigs.
1,1,1,2- TETRAFLUOROETHANE	* with added oxygen - Zhong-Hao New Chemical Materials MSDS Excessive concentration can have a narcotic effect; inhalation of high concentrations of decomposition products can cause lung oedema.
411-Aerosol HFE Solvent & METHOXY NONAFLUOROBUTANES	No significant acute toxicological data identified in literature search.
411-Aerosol HFE Solvent & 1,1,1,2- TETRAFLUOROETHANE	<p>Disinfection by products (DBPs) re formed when disinfectants such as chlorine, chloramine, and ozone react with organic and inorganic matter in water. The observations that some DBPs such as trihalomethanes (THMs), di-/trichloroacetic acids, and 3-chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone (MX) are carcinogenic in animal studies have raised public concern over the possible adverse health effects of DBPs. To date, several hundred DBPs have been identified.</p> <p>Numerous haloalkanes and haloalkenes have been tested for carcinogenic and mutagenic activities. In general, the genotoxic potential is dependent on the nature, number, and position of halogen(s) and the molecular size of the compound. Short-chain monohalogenated (excluding fluorine) alkanes and alkenes are potential direct-acting alkylating agents, particularly if the halogen is at the terminal end of the carbon chain or at an allylic position. Dihalogenated alkanes are also potential alkylating or cross-linking agents (either directly or after GSH conjugation), particularly if they are vicinally substituted (e.g., 1,2-dihaloalkane) or substituted at the two terminal ends of a short to medium-size (e.g., 2-7) alkyl moiety (i.e., alpha, omega-dihaloalkane). Fully halogenated haloalkanes tend to act by free radical or nongenotoxic mechanisms (such as generating peroxisome-proliferative intermediates) or undergo reductive dehalogenation to yield haloalkenes that in turn could be activated to epoxides.</p> <p>Haloalkenes are of concern because of potential to generate genotoxic intermediates after epoxidation. The concern for haloalkenes may be diminished if the double bond is internal or sterically hindered.</p> <p>The cancer concern levels of the 14 haloalkanes and haloalkenes, have been rated based on available screening cancer bioassay (pulmonary adenoma assay) and genotoxicity data. Five brominated and iodinated methane and ethane derivatives are given a moderate rating. Beyond the fact that bromine and iodine are better leaving groups than chlorine, there is also evidence that brominated THMs may be preferentially activated by a theta-class glutathione S-transferase (GSTT1-1) to mutagens in Salmonella even at low substrate concentrations. Furthermore, there are human carcinogenicity implications because of polymorphism in GSTT1-1. Human subpopulations with expressed GSTT1-1 may be at a greater risk to brominate THMs than humans who lack the gene.</p> <p>Six, two, and one haloalkanes/ haloalkene(s) are given low-moderate, marginal, and low concern, respectively.</p>

Acute Toxicity	☹	Carcinogenicity	☹
Skin Irritation/Corrosion	☹	Reproductivity	☹
Serious Eye Damage/Irritation	☹	STOT - Single Exposure	☹
Respiratory or Skin sensitisation	☹	STOT - Repeated Exposure	☹
Mutagenicity	☹	Aspiration Hazard	☹

Legend: ✘ - Data available but does not fill the criteria for classification
✔ - Data available to make classification
☹ - Data Not Available to make classification

SECTION 12 ECOLOGICAL INFORMATION

12.1. Toxicity

411-Aerosol HFE Solvent	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	Not Available	Not Available	Not Available	Not Available	Not Available

methoxy nonafluorobutanes	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	Not Available	Not Available	Not Available	Not Available	Not Available

methyl nonafluorobutylether	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	Not Available	Not Available	Not Available	Not Available	Not Available

1,1,1,2-tetrafluoroethane	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
	LC50	96	Fish	450mg/L	2
	EC50	48	Crustacea	980mg/L	5
	EC50	72	Algae or other aquatic plants	>114mg/L	2
	NOEC	72	Algae or other aquatic plants	ca.13.2mg/L	2

Legend: *Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 3. EPIWIN Suite V3.12 (QSAR) - Aquatic Toxicity Data (Estimated) 4. US EPA, Ecotox database - Aquatic Toxicity Data 5. ECETOC Aquatic Hazard Assessment Data 6. NITE (Japan) - Bioconcentration Data 7. METI (Japan) - Bioconcentration Data 8. Vendor Data*

Toxic to aquatic organisms.

Do NOT allow product to come in contact with surface waters or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment wash-waters.

Wastes resulting from use of the product must be disposed of on site or at approved waste sites.

For perfluorinated carboxylic acids (PFCAs):

Due to the strength of the carbon/fluorine bond, PFCAs are chemically very stable and are highly resistant to biological degradation; therefore, they belong to a class of compounds that tend to persist in the environment. These compounds can bioaccumulate and also undergo biomagnification.

PFCAs can be detected almost ubiquitously, e.g., in water, plants, different kinds of foodstuffs, in animals such as fish, birds, in mammals, as well as in human breast milk and blood. PFCAs are proposed as a new class of 'persistent organic pollutants'. Numerous publications allude to the negative effects of PFCAs on human health.

Perfluorinated compounds(PFCs) can be divided into the groups of perfluorinated sulfonic acids, perfluorinated carboxylic acids (PFCA), fluorotelomer alcohols, high-molecular weight

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fluoropolymers and low-molecular weight perfluoroalkanamides. Perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA), often referred to as reference or key substances for the first two groups, have been most intensively studied from a toxicological standpoint.

In addition to drinking water, PFC accumulation in fish is also of particular importance for the internal contamination of humans. The consumption of salt water and fresh water, fish accounts for approximately 90% of the total dietary exposure to PFOS. The fact that fish are often highly contaminated is a result of the pronounced biomagnification of these substances via the aquatic food chain.

Bio-persistence screening studies that have been conducted on perfluorohexanoate and short-chain fluorotelomer indicate that the clearance time for the C6 compounds is dramatically less than longer-chain homologues. Moreover, published studies have shown that PFCAs with less than eight total carbon atoms, including perfluorohexanoic acid (PFHxA), are not bioaccumulative. When coming into contact with foods, paper and cardboard packaging are protected from softening by treatment with, among other things, water- and oil-resistant perfluoro chemicals.

Fluorotelomer alcohols (FTOH) may be present as contaminants in the coatings. About 1% of the FTOH can be converted to PFOA in the body. Furthermore, PFOA is used in the production of polytetrafluoroethylene (PTFE) nonstick surface coatings for cooking utensils or paper coatings and may therefore be present in residual amounts.

PFC exposure of the foetus (prenatal) and nursing infants (postnatal) has also been shown in studies of mother-child pairs. The presence of PFOS and PFOA in human breast milk has been demonstrated.

<https://enveurope.springeropen.com/articles/10.1186/2190-4715-23-38>

Environmental fate:

PFCAs are chemicals that can be unintentionally formed through the transformation of fluorotelomer-based substances. Fluorotelomer-based substances are commonly used as water and grease repellents for materials such as paper, fabric, leather and carpets. Substances that can be sources of PFCAs are referred to as precursors.

The degradation potential of substances differing only in the number of carbons in the perfluorinated carbon chain has been analysed in some studies which indicate that long chain PFCAs are resistant to degradation in the environment.

Abiotic degradation

The data on C8-PFCA (perfluorooctanoic acid) indicate that abiotic degradation in the atmosphere is expected to be slow

(atmospheric lifetime = 130 days). The hydrolytic half-life of C8-PFCA at 25 deg C is greater than 92 years, with the most likely value of 235 years under relevant environmental conditions

Biotic degradation

No biodegradation at all has been detected for C14-PFOA within 28 days. For C8-PFCA test results differ from "no biodegradation" to 13% biodegradation of the ammonium salt. Thus, it can be concluded that C8,14-PFCAs are not readily biodegradable.

The stability of organic fluorine compounds has been described. When all valences of a carbon chain are satisfied by fluorine, the zig-zag-shaped carbon skeleton is twisted out of its plane in the form of a helix. This situation allows the electronegative fluorine substituents to envelope the carbon skeleton completely and shield it from chemical attack. Several other properties of the carbon-fluorine bond contribute to the fact that highly fluorinated alkanes are the most stable organic compounds. These include polarizability and high bond energies, which increase with increasing substitution by fluorine. The influence of fluorine is greatest in highly fluorinated and perfluorinated compounds.

Bioaccumulation

Bioaccumulative substances are defined as those with a bioconcentration factor (BCF) >2000. If substances have a BCF >5000 they fulfil the criteria of being very bioaccumulative.

Accumulation in fat tissue is not relevant for assessing the bioaccumulation potential of perfluorinated compounds. Perfluorinated compounds bind to proteins, in particular in blood and liver. The log KoW is only indicative of binding to lipids, not for binding to proteins and does not provide an indication on bioaccumulation potential of perfluorinated compounds. To illustrate, the log KoW of PFOA (2.69) is far below the screening criterion for bioaccumulation. Still, elevated levels of PFOA in human blood and excretion via breast milk are observed widely. In addition, biomagnification factors in the terrestrial food chain exceed the value of 1.

It is unclear which substance properties determine the protein binding potential, but possibly the number of perfluorinated carbon atoms is crucial for protein binding.

For C14-PFCA reported BCFs are well above the trigger value of 5000

Biomagnification factors (BMFs) Besides bioconcentration also biomagnification describes the potential of a chemical to

bioaccumulate through the food chain. Field studies investigating the biomagnification potential between different predator/prey-relationships showed BMFs well above one indicating biomagnification

Ecotoxicity:

C6 perfluoroalkyl compounds generally present a low concern level with respect to potential toxicity to organisms in the environment.

Perfluorooctanesulfonic acid (PFOS) was shown to be more toxic than perfluorooctanoic acid (PFOA, C8-PFCA) in studies of fresh water organisms such as water flea, water snails, shrimp, and planaria. It is suggested that the toxicity of PFOS 10 times higher than PFOA in such organisms. The lowest PFOS LC50 for fish is a 96-h LC50 of 4.7 mg/L to the fathead minnow *Pimephales promelas* for the lithium salt

The effect of PFCAs on the green alga *Chlorella vulgaris*, the diatom *Skeletonema marinoi* and the blue-green algae *Geitlerinema amphibia*, which are species representative of the algal flora was determined.

The EC50 values obtained range from 0.28 mM to 12.84 mM. A distinct relationship between hydrophobicity and toxicity is demonstrated. For every extra perfluoromethylene group in the alkyl chain, the toxicity increases twofold. Log EC50 values are very well correlated linearly with both the number of carbon atoms in the perfluoroalkyl chain and the partition coefficients. The results also indicate that there are clear differences between the responses of particular taxonomic groups of algae: blue-green algae and diatoms are far more sensitive to PFCAs than green algae, probably because of differences in cell wall structure

Discussion:

PFCAs are chemicals that can be unintentionally formed through the transformation of fluorotelomer-based substances. Fluorotelomer-based substances are commonly used as water and grease repellents for materials such as paper, fabric, leather and carpets. Substances that can be sources of PFCAs are referred to as precursors.

PFCA precursors can enter the environment through two routes:

- Through their release, because they are present as 'residual' unreacted building blocks of fluorotelomer-based substances; and
- Through their release upon degradation of fluorotelomer-based substances. There are uncertainties regarding mechanisms and rates of degradation; consequently, the relative contribution of this source to environmental levels of PFCAs is uncertain. To address this uncertainty, degradation of fluorotelomer-based substances is the focus of ongoing research activity.

The PFCAs formed from fluorotelomer-based substances contain a range of carbon chain lengths. Many governments produce Action Plans to limit entry of PFCAs into the environment. These plans focus on the long chain PFCAs, i.e. those with nine or more carbons. However, consideration may be given to the inclusion of other chain lengths if information that justifies it becomes available. The short-chain perfluorinated carboxylic acids (including the immediate short-chain homologue, perfluorohexanoic acid (PFHxA)) are not bioaccumulative and not toxic based on the available information, and they are considered to pose lower overall concerns for the environment than their long-chain homologues. It is not currently clear whether the environmental hazards for the intermediate chain-length acids are comparable to the homologous long-chain or to the short-chain perfluorinated carboxylic acids in this series.

Long chain PFCAs are present in the environment of most developed countries and have the potential to adversely affect animal and human health. In tests on laboratory animals, one PFCA (perfluorooctanoic acid, PFOA) has been shown to be tumourigenic and immunotoxic and to elicit moderate reproductive or developmental toxicity and moderate-to-high subchronic oral toxicity. It has been assumed that despite the absence of robust toxicity results for longer chain PFCAs, these substances are reasonably expected to be of greater concern than PFOA, as a result of their known slower clearance rates and higher bioaccumulation potential. Although the current environmental concentrations of PFCAs are low, concern arises from the evidence indicating a rapid upward trend in the levels observed in the environment.

Furthermore, available evidence indicates that PFCAs are environmentally persistent and the longer chain PFCAs (= 9 carbons) bioaccumulate. PFCAs are present in the environment as a result of human activity.

DO NOT discharge into sewer or waterways.

12.2. Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air
methoxy nonafluorobutanes	HIGH	HIGH
methyl nonafluorobutylether	HIGH	HIGH
1,1,1,2-tetrafluoroethane	HIGH	HIGH

12.3. Bioaccumulative potential

Ingredient	Bioaccumulation
methoxy nonafluorobutanes	MEDIUM (LogKOW = 3.931)
methyl nonafluorobutylether	MEDIUM (LogKOW = 3.931)
1,1,1,2-tetrafluoroethane	LOW (LogKOW = 1.68)

Continued...

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12.4. Mobility in soil

Ingredient	Mobility
methoxy nonafluorobutanes	LOW (KOC = 518.4)
methyl nonafluorobutylether	LOW (KOC = 518.4)
1,1,1,2-tetrafluoroethane	LOW (KOC = 96.63)

12.5. Results of PBT and vPvB assessment

	P	B	T
Relevant available data	Not Available	Not Available	Not Available
PBT Criteria fulfilled?	Not Available	Not Available	Not Available

12.6. Other adverse effects

No data available


SECTION 13 DISPOSAL CONSIDERATIONS

13.1. Waste treatment methods

Product / Packaging disposal	<ul style="list-style-type: none"> ▶ DO NOT allow wash water from cleaning or process equipment to enter drains. ▶ It may be necessary to collect all wash water for treatment before disposal. ▶ In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first. ▶ Where in doubt contact the responsible authority. ▶ Consult State Land Waste Management Authority for disposal. ▶ Discharge contents of damaged aerosol cans at an approved site. ▶ Allow small quantities to evaporate. ▶ DO NOT incinerate or puncture aerosol cans. ▶ Bury residues and emptied aerosol cans at an approved site.
Waste treatment options	Not Available
Sewage disposal options	Not Available

SECTION 14 TRANSPORT INFORMATION

Labels Required

	
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Land transport (ADR)

14.1. UN number	1950										
14.2. UN proper shipping name	AEROSOLS										
14.3. Transport hazard class(es)	<table border="1"> <tbody> <tr> <td>Class</td> <td>2.2</td> </tr> <tr> <td>Subrisk</td> <td>Not Applicable</td> </tr> </tbody> </table>	Class	2.2	Subrisk	Not Applicable						
Class	2.2										
Subrisk	Not Applicable										
14.4. Packing group	Not Applicable										
14.5. Environmental hazard	Not Applicable										
14.6. Special precautions for user	<table border="1"> <tbody> <tr> <td>Hazard identification (Kemler)</td> <td>Not Applicable</td> </tr> <tr> <td>Classification code</td> <td>5A</td> </tr> <tr> <td>Hazard Label</td> <td>2.2</td> </tr> <tr> <td>Special provisions</td> <td>190 327 344 625</td> </tr> <tr> <td>Limited quantity</td> <td>1 L</td> </tr> </tbody> </table>	Hazard identification (Kemler)	Not Applicable	Classification code	5A	Hazard Label	2.2	Special provisions	190 327 344 625	Limited quantity	1 L
Hazard identification (Kemler)	Not Applicable										
Classification code	5A										
Hazard Label	2.2										
Special provisions	190 327 344 625										
Limited quantity	1 L										

Air transport (ICAO-IATA / DGR)

14.1. UN number	1950						
14.2. UN proper shipping name	Aerosols, non-flammable						
14.3. Transport hazard class(es)	<table border="1"> <tbody> <tr> <td>ICAO/IATA Class</td> <td>2.2</td> </tr> <tr> <td>ICAO / IATA Subrisk</td> <td>Not Applicable</td> </tr> <tr> <td>ERG Code</td> <td>2L</td> </tr> </tbody> </table>	ICAO/IATA Class	2.2	ICAO / IATA Subrisk	Not Applicable	ERG Code	2L
ICAO/IATA Class	2.2						
ICAO / IATA Subrisk	Not Applicable						
ERG Code	2L						
14.4. Packing group	Not Applicable						

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14.5. Environmental hazard	Not Applicable	
14.6. Special precautions for user	Special provisions	A98 A145 A167 A802
	Cargo Only Packing Instructions	203
	Cargo Only Maximum Qty / Pack	150 kg
	Passenger and Cargo Packing Instructions	203
	Passenger and Cargo Maximum Qty / Pack	75 kg
	Passenger and Cargo Limited Quantity Packing Instructions	Y203
	Passenger and Cargo Limited Maximum Qty / Pack	30 kg G

Sea transport (IMDG-Code / GGVSee)

14.1. UN number	1950	
14.2. UN proper shipping name	AEROSOLS	
14.3. Transport hazard class(es)	IMDG Class	2.2
	IMDG Subrisk	Not Applicable
14.4. Packing group	Not Applicable	
14.5. Environmental hazard	Not Applicable	
14.6. Special precautions for user	EMS Number	F-D, S-U
	Special provisions	63 190 277 327 344 381 959
	Limited Quantities	1000ml

Inland waterways transport (ADN)

14.1. UN number	1950	
14.2. UN proper shipping name	AEROSOLS	
14.3. Transport hazard class(es)	2.2	Not Applicable
14.4. Packing group	Not Applicable	
14.5. Environmental hazard	Not Applicable	
14.6. Special precautions for user	Classification code	5A
	Special provisions	190; 327; 344; 625
	Limited quantity	1 L
	Equipment required	PP
	Fire cones number	0

14.7. Transport in bulk according to Annex II of MARPOL and the IBC code

Not Applicable

SECTION 15 REGULATORY INFORMATION

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

METHOXY NONAFLUOROBUTANES(163702-08-7) IS FOUND ON THE FOLLOWING REGULATORY LISTS

European Customs Inventory of Chemical Substances ECICS (English)

European List of Notified Chemical Substances (ELINCS)

METHYL NONAFLUOROBUTYLETHER(163702-07-6) IS FOUND ON THE FOLLOWING REGULATORY LISTS

European Customs Inventory of Chemical Substances ECICS (English)

European List of Notified Chemical Substances (ELINCS)

1,1,1,2-TETRAFLUOROETHANE(811-97-2) IS FOUND ON THE FOLLOWING REGULATORY LISTS

European Customs Inventory of Chemical Substances ECICS (English)

UK Workplace Exposure Limits (WELs)

European Union - European Inventory of Existing Commercial Chemical Substances (EINECS) (English)

This safety data sheet is in compliance with the following EU legislation and its adaptations - as far as applicable - : 98/24/EC, 92/85/EC, 94/33/EC, 91/689/EEC, 1999/13/EC, Commission Regulation (EU) 2015/830, Regulation (EC) No 1272/2008 and their amendments

15.2. Chemical safety assessment

For further information please look at the Chemical Safety Assessment and Exposure Scenarios prepared by your Supply Chain if available.

National Inventory	Status
Australia - AICS	Y

Continued...

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Canada - DSL	Y
Canada - NDSL	N (methyl nonafluorobutylether; 1,1,1,2-tetrafluoroethane; methoxy nonafluorobutanes)
China - IECSC	Y
Europe - EINEC / ELINCS / NLP	Y
Japan - ENCS	Y
Korea - KECI	N (methyl nonafluorobutylether; methoxy nonafluorobutanes)
New Zealand - NZIoC	Y
Philippines - PICCS	Y
USA - TSCA	Y
Legend:	Y = All ingredients are on the inventory N = Not determined or one or more ingredients are not on the inventory and are not exempt from listing(see specific ingredients in brackets)

SECTION 16 OTHER INFORMATION

Full text Risk and Hazard codes

H226	Flammable liquid and vapour.
H280	Contains gas under pressure; may explode if heated.
H412	Harmful to aquatic life with long lasting effects.

Other information

Ingredients with multiple cas numbers

Name	CAS No
methoxy nonafluorobutanes	163702-07-6, 163702-08-7

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

The SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

For detailed advice on Personal Protective Equipment, refer to the following EU CEN Standards:

EN 166 Personal eye-protection

EN 340 Protective clothing

EN 374 Protective gloves against chemicals and micro-organisms

EN 13832 Footwear protecting against chemicals

EN 133 Respiratory protective devices

Definitions and abbreviations

PC – TWA: Permissible Concentration-Time Weighted Average

PC – STEL: Permissible Concentration-Short Term Exposure Limit

IARC: International Agency for Research on Cancer

ACGIH: American Conference of Governmental Industrial Hygienists

STEL: Short Term Exposure Limit

TEEL: Temporary Emergency Exposure Limit,

IDLH: Immediately Dangerous to Life or Health Concentrations

OSF: Odour Safety Factor

NOAEL :No Observed Adverse Effect Level

LOAEL: Lowest Observed Adverse Effect Level

TLV: Threshold Limit Value

LOD: Limit Of Detection

OTV: Odour Threshold Value

BCF: BioConcentration Factors

BEI: Biological Exposure Index

Reason For Change

A-1.01 - Change to section 3 and supplemental hazards.