



# Isoflurane

## Novachem Pty Ltd

Version No: 1.1

Safety Data Sheet according to WHS Regulations (Hazardous Chemicals) Amendment 2020 and ADG requirements

Chemwatch Hazard Alert Code: 2

Issue Date: 28/11/2022

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S.GHS.AUS.EN

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

#### Product Identifier

|                               |                      |
|-------------------------------|----------------------|
| Product name                  | Isoflurane           |
| Chemical Name                 | isoflurane           |
| Synonyms                      | Isoflurane, racemate |
| Other means of identification | 099-06571,095-06573  |

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

|                          |                       |
|--------------------------|-----------------------|
| Relevant identified uses | For research use only |
|--------------------------|-----------------------|

#### Details of the manufacturer or supplier of the safety data sheet

|                         |  |  |
|-------------------------|--|--|
| Registered company name | Novachem Pty Ltd   | Novachem Pty Ltd   |
| Address                 | 25 Crissane Road, Heidelberg West Victoria 3081 Australia    | 25 Crissane Road, Heidelberg West Victoria 3081 Australia    |
| Telephone               | +61384151255   | +61384151255   |
| Fax                     | +61386250088   | +61386250088   |
| Website                 | <a href="http://www.novachem.com.au">www.novachem.com.au</a> | <a href="http://www.novachem.com.au">www.novachem.com.au</a> |
| Email                   | novachem@novachem.com.au                                     | novachem@novachem.com.au                                     |

#### Emergency telephone number

|                                   |                                      |                                      |
|-----------------------------------|--------------------------------------|--------------------------------------|
| Association / Organisation        | Victorian Poisons Information Centre | Victorian Poisons Information Centre |
| Emergency telephone numbers       | 13 11 26                             | 13 11 26                             |
| Other emergency telephone numbers | Not Available                        | Not Available                        |

### SECTION 2 Hazards identification

#### Classification of the substance or mixture

|                    |   |
|--------------------|---|
| Poisons Schedule   | Not Applicable  |
| Classification [1] | Serious Eye Damage/Eye Irritation Category 2A, Specific Target Organ Toxicity - Single Exposure (Narcotic Effects) Category 3, Acute Toxicity (Inhalation) Category 4, Specific Target Organ Toxicity - Single Exposure (Respiratory Tract Irritation) Category 3, Skin Corrosion/Irritation Category 2, Reproductive Toxicity Category 2 |
| Legend:            | 1. Classified by Chemwatch; 2. Classification drawn from HCIS; 3. Classification drawn from Regulation (EU) No 1272/2008 - Annex VI   |

#### Label elements

|                     |         |
|---------------------|---------|
| Hazard pictogram(s) |         |
| Signal word         | Warning |

#### Hazard statement(s)

|      |                                    |
|------|------------------------------------|
| H319 | Causes serious eye irritation.     |
| H336 | May cause drowsiness or dizziness. |
| H332 | Harmful if inhaled.                |
| H335 | May cause respiratory irritation.  |
| H315 | Causes skin irritation.            |

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|        |  |
|--------|--|
| H361fd | Suspected of damaging fertility. Suspected of damaging the unborn child. |
|--------|--|

## Precautionary statement(s) Prevention

|      |  |
|------|--|
| P201 | Obtain special instructions before use.  |
| P271 | Use only outdoors or in a well-ventilated area.                                  |
| P280 | Wear protective gloves, protective clothing, eye protection and face protection. |
| P261 | Avoid breathing mist/vapours/spray.  |

## Precautionary statement(s) Response

|                |  |
|----------------|--|
| P308+P313      | If exposed or concerned: Get medical advice/ attention.  |
| P305+P351+P338 | IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. |
| P312           | Call a POISON CENTER/doctor/physician/first aider/if you feel unwell.  |
| P337+P313      | If eye irritation persists: Get medical advice/attention.  |

## Precautionary statement(s) Storage

|           |  |
|-----------|--|
| P405      | Store locked up.   |
| P403+P233 | Store in a well-ventilated place. Keep container tightly closed. |

## Precautionary statement(s) Disposal

|      |  |
|------|--|
| P501 | Dispose of contents/container to authorised hazardous or special waste collection point in accordance with any local regulation. |
|------|--|

## SECTION 3 Composition / information on ingredients

## Substances

See section below for composition of Mixtures

## Mixtures

| CAS No         | %[weight]  | Name       |
|----------------|--|------------|
| 26675-46-7     | 98   | isoflurane |
| <b>Legend:</b> | 1. Classified by Chemwatch; 2. Classification drawn from HCIS; 3. Classification drawn from Regulation (EU) No 1272/2008 - Annex VI; 4. Classification drawn from C&L; * EU IOELVs available |            |

## SECTION 4 First aid measures

## Description of first aid measures

|                     |   |
|---------------------|---|
| <b>Eye Contact</b>  | <p>If this product comes in contact with the eyes:</p> <ul style="list-style-type: none"> <li>▶ Wash out immediately with fresh running water.</li> <li>▶ 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.</li> <li>▶ Seek medical attention without delay; if pain persists or recurs seek medical attention.</li> <li>▶ Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.</li> </ul>   |
| <b>Skin Contact</b> | <p>If skin contact occurs:</p> <ul style="list-style-type: none"> <li>▶ Immediately remove all contaminated clothing, including footwear.</li> <li>▶ Flush skin and hair with running water (and soap if available).</li> <li>▶ Seek medical attention in event of irritation.</li> </ul>   |
| <b>Inhalation</b>   | <ul style="list-style-type: none"> <li>▶ If fumes or combustion products are inhaled remove from contaminated area.</li> <li>▶ Lay patient down. Keep warm and rested.</li> <li>▶ Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.</li> <li>▶ Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.</li> <li>▶ Transport to hospital, or doctor, without delay.</li> </ul>  |
| <b>Ingestion</b>    | <p>If poisoning occurs, contact a doctor or Poisons Information Centre.</p> <ul style="list-style-type: none"> <li>▶ Avoid giving milk or oils.</li> <li>▶ Avoid giving alcohol.</li> <li>▶ <b>If swallowed do NOT induce vomiting.</b></li> <li>▶ If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.</li> <li>▶ Observe the patient carefully.</li> <li>▶ Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.</li> <li>▶ Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink.</li> <li>▶ Seek medical advice.</li> </ul> |

## Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

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 microgm/kg/min IV.
- ▶ Monitor the ECG for 4-6 hours

B: Specific drugs and antidotes:

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- 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

## SECTION 5 Firefighting measures

### Extinguishing media

- Foam.
- Dry chemical powder.
- BCF (where regulations permit).
- Carbon dioxide.

### Special hazards arising from the substrate or mixture

|                             |  |
|-----------------------------|--|
| <b>Fire Incompatibility</b> | ‣ Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result |
|-----------------------------|--|

### Advice for firefighters

|                              |  |
|------------------------------|--|
| <b>Fire Fighting</b>         | <ul style="list-style-type: none"> <li>‣ Alert Fire Brigade and tell them location and nature of hazard.</li> <li>‣ Wear full body protective clothing with breathing apparatus.</li> <li>‣ Prevent, by any means available, spillage from entering drains or water course.</li> <li>‣ Use water delivered as a fine spray to control fire and cool adjacent area.</li> </ul>  |
| <b>Fire/Explosion Hazard</b> | <p>Combustion products include:<br/>carbon dioxide (CO<sub>2</sub>)<br/>hydrogen chloride<br/>phosgene<br/>hydrogen fluoride<br/>other pyrolysis products typical of burning organic material.</p> <p><b>Contains low boiling substance:</b> Closed containers may rupture due to pressure buildup under fire conditions.<br/>May emit poisonous fumes.<br/>May emit corrosive fumes.</p> <ul style="list-style-type: none"> <li>‣ Non flammable liquid.</li> <li>‣ However vapour will burn when in contact with high temperature flame.</li> <li>‣ Ignition ceases on removal of flame.</li> <li>‣ May form a flammable / explosive mixture in an oxygen enriched atmosphere</li> <li>‣ Heating may cause expansion/vapourisation with violent rupture of containers</li> <li>‣ Decomposes on heating and produces corrosive fumes of hydrochloric acid, carbon monoxide and small amounts of toxic phosgene.</li> </ul> |
| <b>HAZCHEM</b>               | Not Applicable   |

## SECTION 6 Accidental release measures

### Personal precautions, protective equipment and emergency procedures

See section 8

### Environmental precautions

See section 12

### Methods and material for containment and cleaning up

|                     |  |
|---------------------|--|
| <b>Minor Spills</b> | <ul style="list-style-type: none"> <li>‣ Remove all ignition sources.</li> <li>‣ Clean up all spills immediately.</li> <li>‣ Avoid breathing vapours and contact with skin and eyes.</li> <li>‣ Control personal contact with the substance, by using protective equipment.</li> </ul> |
| <b>Major Spills</b> | <p>Moderate hazard.</p> <ul style="list-style-type: none"> <li>‣ Clear area of personnel and move upwind.</li> <li>‣ Alert Fire Brigade and tell them location and nature of hazard.</li> <li>‣ Wear breathing apparatus plus protective gloves.</li> </ul>                            |

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

## SECTION 7 Handling and storage

### Precautions for safe handling

|                      |  |
|----------------------|--|
| <b>Safe handling</b> | <p><b>Contains low boiling substance:</b><br/>Storage in sealed containers may result in pressure buildup causing violent rupture of containers not rated appropriately.</p> |
|----------------------|--|

Continued...

## Isoflurane

|                   |   |
|-------------------|---|
|                   | <ul style="list-style-type: none"> <li>▶ Check for bulging containers.</li> <li>▶ Vent periodically</li> <li>▶ Always release caps or seals slowly to ensure slow dissipation of vapours</li> <li>▶ Avoid all personal contact, including inhalation.</li> <li>▶ Wear protective clothing when risk of exposure occurs.</li> <li>▶ Use in a well-ventilated area.</li> <li>▶ Prevent concentration in hollows and sumps.</li> <li>▶ <b>DO NOT allow clothing wet with material to stay in contact with skin</b></li> </ul>  |
| Other information | <ul style="list-style-type: none"> <li>▶ Store in original containers.</li> <li>▶ Keep containers securely sealed.</li> <li>▶ Store in a cool, dry area protected from environmental extremes.</li> <li>▶ Store away from incompatible materials and foodstuff containers. <ul style="list-style-type: none"> <li>Do NOT store halogenated aliphatics in areas containing alkali or alkaline earth metals such as powdered aluminum, zinc, or beryllium</li> </ul> </li> <li>▶ Store in original containers.</li> <li>▶ Keep containers securely sealed.</li> <li>▶ No smoking, naked lights or ignition sources.</li> <li>▶ Store in a cool, dry, well-ventilated area.</li> </ul> |

## Conditions for safe storage, including any incompatibilities

|                         |   |
|-------------------------|---|
| Suitable container      | <ul style="list-style-type: none"> <li>▶ <b>DO NOT use aluminium or galvanised containers</b></li> <li>▶ Metal can or drum</li> <li>▶ Packaging as recommended by manufacturer.</li> <li>▶ Check all containers are clearly labelled and free from leaks.</li> </ul>  |
| Storage incompatibility | <p>Segregate from:</p> <ul style="list-style-type: none"> <li>▶ powdered metals such as aluminium, zinc and</li> <li>▶ alkali metals such as sodium, potassium and lithium.</li> </ul> <p>May attack, soften or dissolve rubber, many plastics, paints and coatings</p> <p>Haloethers react with nucleophilic groups such as -OH (hydroxyls), -NH (amides) and -SH (thiols)</p> <p>The reactivity of haloethers is expected to depend on several factors, such as the number and position of H atoms in the molecule, the strength of the C-H bonds, the degree and position of halogen substitution, as well as the overall molecular geometry. In addition, the ether linkage, -O-, is expected to play a key role in the reactivity of these compounds.</p> <p>It is accepted that, in general, the ether linkage, -O-, activates the neighboring C-H bonds since the reaction rates for the haloethers are higher than those of the corresponding haloalkanes. The fundamental assumption in this comparison is that the reactions of Cl atoms or OH radicals with alkanes and ethers proceed via a similar H abstraction reaction. Very little information is currently available on the effects of halogenation on the rates of reaction of ethers with Cl atoms.</p> |

## SECTION 8 Exposure controls / personal protection

## Control parameters

## Occupational Exposure Limits (OEL)

## INGREDIENT DATA

Not Available

## Emergency Limits

| Ingredient | TEEL-1 | TEEL-2  | TEEL-3  |
|------------|--------|---------|---------|
| isoflurane | 21 ppm | 230 ppm | 610 ppm |

| Ingredient | Original IDLH | Revised IDLH  |
|------------|---------------|---------------|
| isoflurane | Not Available | Not Available |


## Occupational Exposure Banding

| Ingredient | Occupational Exposure Band Rating | Occupational Exposure Band Limit |
|------------|-----------------------------------|----------------------------------|
| isoflurane | E                                 | ≤ 0.1 ppm                        |

## Notes:

Occupational exposure banding is a process of assigning chemicals into specific categories or bands based on a chemical's potency and the adverse health outcomes associated with exposure. The output of this process is an occupational exposure band (OEB), which corresponds to a range of exposure concentrations that are expected to protect worker health.

## Exposure controls

|                                  |  |
|----------------------------------|--|
| 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.</p> |
| Personal protection              |   |
| Eye and face protection          | <ul style="list-style-type: none"> <li>▶ Safety glasses with side shields.</li> <li>▶ Chemical goggles.</li> <li>▶ 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.</li> </ul>  |

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|                              |  |
|------------------------------|--|
| <b>Skin protection</b>       | See Hand protection below  |
| <b>Hands/feet protection</b> | <ul style="list-style-type: none"> <li>▸ Butyl rubber gloves <ul style="list-style-type: none"> <li>· Butyl rubber gloves should be used when handling halogenated aliphatics .</li> <li>· Nitrile, PVC-coated nitrile, and PVC protective equipment are not recommended</li> </ul> </li> </ul> <p>The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.</p> <p>The exact break through time for substances has to be obtained from the manufacturer of the protective gloves and has to be observed when making a final choice.</p> <p>Personal hygiene is a key element of effective hand care.</p> |
| <b>Body protection</b>       | See Other protection below   |
| <b>Other protection</b>      | <ul style="list-style-type: none"> <li>· Halogen-selective detectors use a specialized sensor that allows the monitor to detect compounds containing fluorine, chlorine, bromine, and iodine with-out interference from other species. These detectors are typically easy to use, feature higher sensitivity than the nonselective detectors (detection limits are typically &lt;5 ppm when used as an area monitor and &lt;1.4 gm/yr [&lt;0.05 oz/yr] when used as a leak pinpointer).</li> <li>· Compound-Specific Detectors are typically capable of detecting the presence of a single compound without interference from other compounds.</li> </ul> <ul style="list-style-type: none"> <li>▸ Overalls.</li> <li>▸ P.V.C apron.</li> <li>▸ Barrier cream.</li> <li>▸ Skin cleansing cream.</li> </ul>   |

**Respiratory protection**

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

Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.

| Required minimum protection factor | Maximum gas/vapour concentration present in air p.p.m. (by volume) | Half-face Respirator | Full-Face Respirator |
|------------------------------------|--|----------------------|----------------------|
| up to 10                           | 1000   | AX-AUS / Class1      | -                    |
| up to 50                           | 1000   | -                    | AX-AUS / Class 1     |
| up to 50                           | 5000   | Airline *            | -                    |
| up to 100                          | 5000   | -                    | AX-2                 |
| up to 100                          | 10000  | -                    | AX-3                 |
| 100+                               |  |                      | Airline**            |

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

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(SO<sub>2</sub>), G = Agricultural chemicals, K = Ammonia(NH<sub>3</sub>), Hg = Mercury, NO = Oxides of nitrogen, MB = Methyl bromide, AX = Low boiling point organic compounds(below 65 degC)

- Cartridge respirators should never be used for emergency ingress or in areas of unknown vapour concentrations or oxygen content.
- The wearer must be warned to leave the contaminated area immediately on detecting any odours through the respirator. The odour may indicate that the mask is not functioning properly, that the vapour concentration is too high, or that the mask is not properly fitted. Because of these limitations, only restricted use of cartridge respirators is considered appropriate.
- Cartridge performance is affected by humidity. Cartridges should be changed after 2 hr of continuous use unless it is determined that the humidity is less than 75%, in which case, cartridges can be used for 4 hr. Used cartridges should be discarded daily, regardless of the length of time used

Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.

| Required minimum protection factor | Maximum gas/vapour concentration present in air p.p.m. (by volume) | Half-face Respirator | Full-Face Respirator |
|------------------------------------|--|----------------------|----------------------|
| up to 10                           | 1000   | AX-AUS / Class 1     | -                    |
| up to 50                           | 1000   | -                    | AX-AUS / Class 1     |
| up to 50                           | 5000   | Airline *            | -                    |
| up to 100                          | 5000   | -                    | AX-2                 |
| up to 100                          | 10000  | -                    | AX-3                 |
| 100+                               |  | -                    | Airline**            |

\*\* - Continuous-flow or positive pressure demand.

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(SO<sub>2</sub>), G = Agricultural chemicals, K = Ammonia(NH<sub>3</sub>), Hg = Mercury, NO = Oxides of nitrogen, MB = Methyl bromide, AX = Low boiling point organic compounds(below 65 deg C)

**SECTION 9 Physical and chemical properties****Information on basic physical and chemical properties**

|                         |   |  |               |
|-------------------------|---|--|---------------|
| <b>Appearance</b>       | Hydrochlorofluoroethers (HCFE) are generally low boiling liquids with ethereal odour. They do not mix well with water.<br>clear colourless liquid |  |               |
| <b>Physical state</b>   | Liquid  | <b>Relative density (Water = 1)</b>            | 1.501-1.507   |
| <b>Odour</b>            | Not Available   | <b>Partition coefficient n-octanol / water</b> | Not Available |
| <b>Odour threshold</b>  | Not Available   | <b>Auto-ignition temperature (°C)</b>          | Not Available |
| <b>pH (as supplied)</b> | Not Available   | <b>Decomposition temperature (°C)</b>          | Not Available |

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|   |                 |   |               |
|---|-----------------|---|---------------|
| <b>Melting point / freezing point (°C)</b>          | Not Available   | <b>Viscosity (cSt)</b>                  | Not Available |
| <b>Initial boiling point and boiling range (°C)</b> | 50              | <b>Molecular weight (g/mol)</b>         | 184.49        |
| <b>Flash point (°C)</b>                             | Not Available   | <b>Taste</b>                            | Not Available |
| <b>Evaporation rate</b>                             | Not Available   | <b>Explosive properties</b>             | Not Available |
| <b>Flammability</b>                                 | Not Available   | <b>Oxidising properties</b>             | Not Available |
| <b>Upper Explosive Limit (%)</b>                    | Not Available   | <b>Surface Tension (dyn/cm or mN/m)</b> | Not Available |
| <b>Lower Explosive Limit (%)</b>                    | Not Available   | <b>Volatile Component (%vol)</b>        | Not Available |
| <b>Vapour pressure (kPa)</b>                        | Not Available   | <b>Gas group</b>                        | Not Available |
| <b>Solubility in water</b>                          | Partly miscible | <b>pH as a solution (1%)</b>            | Not Available |
| <b>Vapour density (Air = 1)</b>                     | Not Available   | <b>VOC g/L</b>                          | Not Available |

## SECTION 10 Stability and reactivity

|   |  |
|---|--|
| <b>Reactivity</b>                         | See section 7  |
| <b>Chemical stability</b>                 | <ul style="list-style-type: none"> <li>▶ Unstable in the presence of incompatible materials.</li> <li>▶ Product is considered stable.</li> <li>▶ Hazardous polymerisation will not occur.</li> </ul> |
| <b>Possibility of hazardous reactions</b> | See section 7  |
| <b>Conditions to avoid</b>                | See section 7  |
| <b>Incompatible materials</b>             | See section 7  |
| <b>Hazardous decomposition products</b>   | See section 5  |

## SECTION 11 Toxicological information

## Information on toxicological effects

|                     |   |                 |                   |               |               |
|---------------------|---|-----------------|-------------------|---------------|---------------|
| <b>Inhaled</b>      | <p>Inhalation of vapours or aerosols (mists, fumes), generated by the material during the course of normal handling, may be harmful. The material can cause respiratory irritation in some persons. The body's response to such irritation can cause further lung damage. Inhalation of vapours may cause drowsiness and dizziness. This may be accompanied by sleepiness, reduced alertness, loss of reflexes, lack of co-ordination, and vertigo.</p> <p>Exposure to fluorocarbons can produce non-specific flu-like symptoms such as chills, fever, weakness, muscle pain, headache, chest discomfort, sore throat and dry cough with rapid recovery. High concentrations can cause irregular heartbeats and a stepwise reduction in lung capacity.</p> <p>Material is highly volatile and may quickly form a concentrated atmosphere in confined or unventilated areas. The vapour may displace and replace air in breathing zone, acting as a simple asphyxiant. This may happen with little warning of overexposure. Acute intoxication by halogenated aliphatic hydrocarbons appears to take place over two stages. Signs of a reversible narcosis are evident in the first stage and in the second stage signs of injury to organs may become evident, a single organ alone is (almost) never involved. Depression of the central nervous system is the most outstanding effect of most halogenated aliphatic hydrocarbons. Inebriation and excitation, passing into narcosis, is a typical reaction. In severe acute exposures there is always a danger of death from respiratory failure or cardiac arrest due to a tendency to make the heart more susceptible to catecholamines (adrenalin)</p> |                 |                   |               |               |
| <b>Ingestion</b>    | The material is not thought to produce adverse health effects following ingestion (as classified by EC Directives using animal models). Nevertheless, adverse systemic effects have been produced following exposure of animals by at least one other route and good hygiene practice requires that exposure be kept to a minimum.  |                 |                   |               |               |
| <b>Skin Contact</b> | <p>This material can cause inflammation of the skin on contact in some persons.</p> <p>The material may accentuate any pre-existing dermatitis condition</p> <p>Fluorocarbons remove natural oils from the skin, causing irritation, dryness and sensitivity.</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 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>   |                 |                   |               |               |
| <b>Eye</b>          | This material can cause eye irritation and damage in some persons.  |                 |                   |               |               |
| <b>Chronic</b>      | <p>Repeated or long-term occupational exposure is likely to produce cumulative health effects involving organs or biochemical systems.</p> <p>Long-term exposure to respiratory irritants may result in airways disease, involving difficulty breathing and related whole-body problems.</p> <p>Ample evidence from experiments exists that there is a suspicion this material directly reduces fertility.</p> <p>Fluorocarbons can cause an increased risk of cancer, spontaneous abortion and birth defects.</p>  |                 |                   |               |               |
| <b>Isoflurane</b>   | <table border="1" style="width: 100%;"> <tr> <td><b>TOXICITY</b></td> <td><b>IRRITATION</b></td> </tr> <tr> <td>Not Available</td> <td>Not Available</td> </tr> </table>  | <b>TOXICITY</b> | <b>IRRITATION</b> | Not Available | Not Available |
| <b>TOXICITY</b>     | <b>IRRITATION</b>   |                 |                   |               |               |
| Not Available       | Not Available   |                 |                   |               |               |

## Isoflurane

| isoflurane | TOXICITY   | IRRITATION    |
|------------|--|---------------|
|            | Inhalation(Rat) LC50: 58.5 mg/L4h <sup>[2]</sup> | Not Available |
|            | Oral (Rat) LD50; 4770 mg/kg <sup>[2]</sup>       |               |

**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

|                                    |  |
|------------------------------------|--|
| <b>ISOFLURANE</b>                  | <p>The volatile halogenated anaesthetics are very soluble in fats but not in water. Their metabolites do not have anaesthetic or sleep-inducing properties. The addition of chlorine and bromine to these species increases the anaesthetic effects and renders them less flammable and less volatile, but also less stable. Fluorine, on the other hand, makes these species stable but increases volatility and makes them less toxic to the heart and liver.</p> <p>Halogenated ether anaesthetics have caused immune-mediated inflammation of the liver, and rarely, a malignant, extreme fever. In contact with certain absorbents such as dry soda-lime, they may break down to form carbon monoxide, which is toxic in very low concentrations. Fluoroxene, but not the other members of this group, has been shown to cause mutations.</p> <p>IARC Cancer Review: Animal Inadequate Evidence. Foetotoxicity, effects on newborn, specific developmental abnormalities involving musculoskeletal system and urogenital system, respiratory depression, decrease body temperature, somnolence, excitement recorded.</p>  |
| <b>Isoflurane &amp; ISOFLURANE</b> | <p>Asthma-like symptoms may continue for months or even years after exposure to the material ends. This may be due to a non-allergic condition known as reactive airways dysfunction syndrome (RADS) which can occur after exposure to high levels of highly irritating compound. Main criteria for diagnosing RADS include the absence of previous airways disease in a non-atopic individual, with sudden onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. Other criteria for diagnosis of RADS include a reversible airflow pattern on lung function tests, moderate to severe bronchial hyperreactivity on methacholine challenge testing, and the lack of minimal lymphocytic inflammation, without eosinophilia.</p> <p>For hydrochlorofluoroether anaesthetic (HCFE) agents (fluranes):</p> <p>In the workplace, people may be exposed to enflurane by breathing it in as a waste anaesthetic gas, swallowing it, eye contact, or skin contact. During the past decade the fluranes have become the inhalation anaesthetics of choice in most developed countries</p> <p>Halothane was intensively used in the 1960s and 1970s but has been replaced in developed countries due to its potential for liver injuries ("halothane hepatitis") Methoxyflurane (1960s and 1970s) was the first halogenated ether used in anesthesiology but was also phased out due to medical side effects. Enflurane was used from the 1970s to the 1990s and was replaced by isoflurane (early 1980s), which is presently still used, in particular in veterinary anesthesia]. Desflurane (1992) and sevoflurane (mid 1990s) are the most recently introduced inhalation anaesthetics. The rates of in vivo metabolism are small, 0.2%, &lt;0.02%, and 5%, for isoflurane, desflurane, and sevoflurane, respectively, and with ~20% somewhat larger for halothane</p> <p>The National Institute for Occupational Safety and Health (NIOSH) has set a recommended exposure limit (REL) for exposure to waste anaesthetic gas of 2 ppm (15.1 mg/m<sup>3</sup>) over a 60-minute period.</p> <p>Clinically, enflurane produces a dose-related depression of myocardial contractility with an associated decrease in myocardial oxygen consumption. Between 2% and 5% of the inhaled dose is oxidised in the liver, producing fluoride ions and difluoromethoxy-difluoroacetic acid.</p> |

|  |   |                                 |   |
|--|---|---------------------------------|---|
| <b>Acute Toxicity</b>                    | ✓ | <b>Carcinogenicity</b>          | ✗ |
| <b>Skin Irritation/Corrosion</b>         | ✓ | <b>Reproductivity</b>           | ✓ |
| <b>Serious Eye Damage/Irritation</b>     | ✓ | <b>STOT - Single Exposure</b>   | ✓ |
| <b>Respiratory or Skin sensitisation</b> | ✗ | <b>STOT - Repeated Exposure</b> | ✗ |
| <b>Mutagenicity</b>                      | ✗ | <b>Aspiration Hazard</b>        | ✗ |

**Legend:** ✗ – Data either not available or does not fill the criteria for classification  
 ✓ – Data available to make classification

## SECTION 12 Ecological information

## Toxicity

| Isoflurane | Endpoint      | Test Duration (hr) | Species       | Value         | Source        |
|------------|---------------|--------------------|---------------|---------------|---------------|
|            | Not Available | Not Available      | Not Available | Not Available | Not Available |

| isoflurane | Endpoint  | Test Duration (hr) | Species | Value      | Source |
|------------|-----------|--------------------|---------|------------|--------|
|            | NOEC(ECx) | 0.42h              | Fish    | 56.595mg/L | 4      |

**Legend:** Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 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

For hydrochlorofluoroether (HCFE) anaesthetics (fluranes)

Currently, the 3 most commonly used halogenated inhalational anaesthetics used for surgery, isoflurane ((RS)-2-chloro-2-(difluoromethoxy)-1,1,1-trifluoroethane, CF<sub>3</sub>CHClOCHF<sub>2</sub>, HCFE-235da2), sevoflurane ((1,1,1,3,3,3-hexafluoro-2-fluoromethoxy)propane, (CF<sub>3</sub>)<sub>2</sub>CHOCH<sub>2</sub>F, HFE-347 isomer), and desflurane (1,2,2,2-tetrafluoroethylidifluoromethyl ether, CF<sub>3</sub>CHFOCHF<sub>2</sub>, HFE-236ea2), are recognized greenhouse gases. All volatile anaesthetics are halogenated chlorofluorocarbons (halothane (2-bromo-2-chloro-1,1,1-trifluoroethane, CF<sub>3</sub>CHClBr, halon 2311), enflurane (2-chloro-1,1,2-trifluoroethyltrifluoromethyl ether, HCFE-235ca2, a structural isomer of isoflurane and isoflurane) or fluorinated hydrocarbons (sevoflurane and desflurane) and are thus potentially damaging to the earth's ozone layer. They also contribute to global warming. The bromide-containing agent halothane is the most destructive against ozone, although it is rarely used Isoflurane and enflurane (which contains only chloride and fluoride ion substitutions) have a lesser impact.

**NOTE:** The material is a greenhouse gas and may contribute to global warming.

**DO NOT discharge into sewer or waterways.**

## Persistence and degradability

| Ingredient | Persistence: Water/Soil | Persistence: Air |
|------------|-------------------------|------------------|
| isoflurane | HIGH                    | HIGH             |

## Bioaccumulative potential

Continued...

## Isoflurane

| Ingredient | Bioaccumulation     |
|------------|---------------------|
| isoflurane | LOW (LogKOW = 2.06) |

## Mobility in soil

| Ingredient | Mobility          |
|------------|-------------------|
| isoflurane | LOW (KOC = 46.28) |

## SECTION 13 Disposal considerations

## Waste treatment methods

|                                     |  |
|-------------------------------------|--|
| <b>Product / Packaging disposal</b> | <p>Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.</p> <p>A Hierarchy of Controls seems to be common - the user should investigate:</p> <ul style="list-style-type: none"> <li>▶ Reduction</li> <li>▶ Reuse</li> <li>▶ Recycling</li> <li>▶ Disposal (if all else fails)</li> </ul> <p>This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use.</p> <ul style="list-style-type: none"> <li>▶ <b>DO NOT allow wash water from cleaning or process equipment to enter drains.</b></li> <li>▶ It may be necessary to collect all wash water for treatment before disposal.</li> <li>▶ In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.</li> <li>▶ Where in doubt contact the responsible authority.</li> <li>▶ Recycle wherever possible or consult manufacturer for recycling options.</li> <li>▶ Consult State Land Waste Authority for disposal.</li> <li>▶ Bury or incinerate residue at an approved site.</li> <li>▶ Recycle containers if possible, or dispose of in an authorised landfill.</li> </ul> |
|-------------------------------------|--|

## SECTION 14 Transport information

## Labels Required

|                         |                |
|-------------------------|----------------|
| <b>Marine Pollutant</b> | NO             |
| <b>HAZCHEM</b>          | Not Applicable |

**Land transport (ADG): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS**

**Air transport (ICAO-IATA / DGR): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS**

**Sea transport (IMDG-Code / GGVSee): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS**

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

Not Applicable

**Transport in bulk in accordance with MARPOL Annex V and the IMSBC Code**

| Product name | Group         |
|--------------|---------------|
| isoflurane   | Not Available |

**Transport in bulk in accordance with the ICG Code**

| Product name | Ship Type     |
|--------------|---------------|
| isoflurane   | Not Available |

## SECTION 15 Regulatory information

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

## isoflurane is found on the following regulatory lists

Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Schedule 2  
Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Schedule 4

Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Schedule 6  
International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs

## National Inventory Status

| National Inventory                               | Status          |
|--|-----------------|
| Australia - AIIIC / Australia Non-Industrial Use | No (isoflurane) |
| Canada - DSL                                     | No (isoflurane) |
| Canada - NDSL                                    | No (isoflurane) |
| China - IECSC                                    | No (isoflurane) |
| Europe - EINEC / ELINCS / NLP                    | Yes             |
| Japan - ENCS                                     | No (isoflurane) |
| Korea - KECI                                     | No (isoflurane) |
| New Zealand - NZIoC                              | Yes             |

Continued...



## Isoflurane

| National Inventory  | Status          |
|---------------------|-----------------|
| Philippines - PICCS | No (isoflurane) |
| USA - TSCA          | No (isoflurane) |
| Taiwan - TCSI       | Yes             |
| Mexico - INSQ       | No (isoflurane) |
| Vietnam - NCI       | No (isoflurane) |
| Russia - FBEPH      | No (isoflurane) |

**Legend:** Yes = All CAS declared ingredients are on the inventory  
No = One or more of the CAS listed ingredients are not on the inventory. These ingredients may be exempt or will require registration.

## SECTION 16 Other information

|               |            |
|---------------|------------|
| Revision Date | 28/11/2022 |
| Initial Date  | 28/11/2022 |

## Other information

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.

## 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  
 ES: Exposure Standard  
 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  
 AIIIC: Australian Inventory of Industrial Chemicals  
 DSL: Domestic Substances List  
 NDSL: Non-Domestic Substances List  
 IECSC: Inventory of Existing Chemical Substance in China  
 EINECS: European INventory of Existing Commercial chemical Substances  
 ELINCS: European List of Notified Chemical Substances  
 NLP: No-Longer Polymers  
 ENCS: Existing and New Chemical Substances Inventory  
 KECI: Korea Existing Chemicals Inventory  
 NZIoC: New Zealand Inventory of Chemicals  
 PICCS: Philippine Inventory of Chemicals and Chemical Substances  
 TSCA: Toxic Substances Control Act  
 TCSI: Taiwan Chemical Substance Inventory  
 INSQ: Inventario Nacional de Sustancias Químicas  
 NCI: National Chemical Inventory  
 FBEPH: Russian Register of Potentially Hazardous Chemical and Biological Substances

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