Silicon tetrachloride

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
Silicon tetrachloride

STATEMENT OF HAZARDOUS NATURE

NFPA

SUPPLIER
Santa Cruz Biotechnology, Inc.
2145 Delaware Avenue
Santa Cruz, California 95060
800.457.3801 or 831.457.3800

EMERGENCY
ChemWatch
Within the US & Canada: 877-715-9305
Outside the US & Canada: +800 2436 2255
(1-800-CHEMCALL) or call +613 9573 3112

SYNONYMS
Cl4-Si, SiCl4, "silicon (IV) chloride", "silicon (4) chloride", tetrachlorosilane, "silicon chloride", Extrema, Silane

Section 2 - HAZARDS IDENTIFICATION

CHEMWATCH HAZARD RATINGS

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flammability</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Toxicity</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Body Contact</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Reactivity</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Chronic</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Canadian WHMIS Symbols:

- Flammability: 0
- Toxicity: 2
- Body Contact: 3
- Reactivity: 2
- Chronic: 2
EMERGENCY OVERVIEW

RISK
Reacts violently with water.
Contact with water liberates toxic gas.
Irritating to eyes, respiratory system and skin.

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED
- Ingestion of acidic corrosives may produce burns around and in the mouth.
  the throat and esophagus.
- The material has NOT been classified as "harmful by ingestion".  
  This is because of the lack of corroborating animal or human evidence.

EYE
- This material can cause eye irritation and damage in some persons.
- If applied to the eyes, this material causes severe eye damage.
- Direct eye contact with acid corrosives may produce pain, tears, sensitivity to light and burns.
Mild burns of the epithelia generally recover rapidly and completely.

SKIN
- This material can cause inflammation of the skin on contact in some persons.
- Skin contact with acidic corrosives may result in pain and burns; these may be deep with distinct edges and 
  may heal slowly with the formation of scar tissue.
- Skin contact is not thought to have harmful health effects, however the material may still produce health 
  damage following entry through wounds, lesions or abrasions.
- Open cuts, abraded or irritated skin should not be exposed to this material.
- Solution of material in moisture on the skin, or perspiration, may markedly increase skin corrosion and 
  accelerate tissue destruction.
- 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.

INHALED
- The material can cause respiratory irritation in some persons.
- The body's response to such irritation can cause further lung damage.
- Corrosive acids can cause irritation of the respiratory tract, with coughing, choking and mucous membrane 
  damage.
There may be dizziness, headache, nausea and weakness.
- Inhalation of vapors or aerosols (mists, fumes), generated by the material during the course of normal handling, 
  may be damaging to the health of the individual.
- Inhalation of quantities of liquid mist may be extremely hazardous, even lethal due to spasm, extreme irritation 
  of larynx and bronchi, chemical pneumonitis and pulmonary edema.
- Hydrogen chloride (HCl) vapour or fumes present a hazard from a single acute exposure.
Exposures of 1300 to 2000 ppm have been lethal to humans in a few minutes.
- Material is highly volatile and may quickly form a concentrated atmosphere in confined or unventilated areas.
Vapor is heavier than air and may displace and replace air in breathing zone, acting as a simple asphyxiant.
- The use of a quantity of material in an unventilated or confined space may result in increased exposure and an 
  irritating atmosphere developing.
Before starting consider control of exposure by mechanical ventilation.

CHRONIC HEALTH EFFECTS
- Repeated or prolonged exposure to acids may result in the erosion of teeth, swelling and or ulceration of mouth 
  lining. Irritation of airways to lung, with cough, and inflammation of lung tissue often occurs.
Long-term exposure to respiratory irritants may result in disease of the airways involving difficult breathing and
related systemic problems.
Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems.
Chronic minor exposure to hydrogen chloride (HCl) vapour or fume may cause discolouration or erosion of the teeth, bleeding of the nose and gums; and ulceration of the nasal mucous membranes.
Repeated exposures of animals to concentrations of about 34 ppm HCl produced no immediate toxic effects.
Workers exposed to hydrochloric acid suffered from gastritis and a number of cases of chronic bronchitis have also been reported.
Repeated or prolonged exposure to dilute solutions of HCl may cause dermatitis.

### Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>NAME</th>
<th>CAS RN</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>silicon tetrachloride</td>
<td>10026-04-7</td>
<td>&gt;99</td>
</tr>
<tr>
<td>NOTE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reacts with moisture or water to produce</td>
<td></td>
<td></td>
</tr>
<tr>
<td>hydrogen chloride</td>
<td>7647-01-0</td>
<td></td>
</tr>
<tr>
<td>silicic acid</td>
<td>1343-98-2</td>
<td></td>
</tr>
</tbody>
</table>

### Section 4 - FIRST AID MEASURES

**SWALLOWED**
- For advice, contact a Poisons Information Center or a doctor at once.
- Urgent hospital treatment is likely to be needed.

**EYE**
- If this product comes in contact with the eyes
  - Immediately hold eyelids apart and flush the eye continuously with 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.

**SKIN**
- If skin or hair contact occurs
  - Immediately flush body and clothes with large amounts of water, using safety shower if available.
  - Quickly remove all contaminated clothing, including footwear.

**INHALED**
- If fumes or combustion products are inhaled remove from contaminated area.
  - Lay patient down. Keep warm and rested.
  - Inhalation of vapors or aerosols (mists, fumes) may cause lung edema. Corrosive substances may cause lung damage (e.g.

**NOTES TO PHYSICIAN**
- Treat symptomatically.
- For acute or short term repeated exposures to strong acids
  - Airway problems may arise from laryngeal edema and inhalation exposure. Treat with 100% oxygen initially.
  - Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling.

### Section 5 - FIRE FIGHTING MEASURES

<table>
<thead>
<tr>
<th>Vapor Pressure (mmHg)</th>
<th>193.966</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Explosive Limit (%)</td>
<td>Not available.</td>
</tr>
<tr>
<td>Specific Gravity (water=1)</td>
<td>1.483 at 20 C</td>
</tr>
</tbody>
</table>
Lower Explosive Limit (%) Not available.

**EXTINGUISHING MEDIA**
- DO NOT use water.

**FIRE FIGHTING**
- Alert Emergency Responders and tell them location and nature of hazard.
- May be violently or explosively reactive.
When any large container (including road and rail tankers) is involved in a fire, consider evacuation by 800 metres in all directions.

**GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS**
- Non combustible.
- Not considered to be a significant fire risk.
Decomposition may produce toxic fumes of hydrogen chloride, metal oxides. Contains low boiling substance Closed containers may rupture due to pressure buildup under fire conditions.

**FIRE INCOMPATIBILITY**
None known.
- Keep dry
- NOTE May develop pressure in containers; open carefully. Vent periodically.

**EXTINGUISHING MEDIA**
- DO NOT use water.

**FIRE FIGHTING**
- Alert Emergency Responders and tell them location and nature of hazard.
- May be violently or explosively reactive.
When any large container (including road and rail tankers) is involved in a fire, consider evacuation by 800 metres in all directions.

**GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS**
- Non combustible.
- Not considered to be a significant fire risk.
Decomposition may produce toxic fumes of hydrogen chloride, metal oxides. Contains low boiling substance Closed containers may rupture due to pressure buildup under fire conditions.

**FIRE INCOMPATIBILITY**
None known.
- Keep dry
- NOTE May develop pressure in containers; open carefully. Vent periodically.

### Section 6 - ACCIDENTAL RELEASE MEASURES

**MINOR SPILLS**
- Drains for storage or use areas should have retention basins for pH adjustments and dilution of spills before discharge or disposal of material.
- Check regularly for spills and leaks.
- Clean up all spills immediately.
- Avoid breathing vapors and contact with skin and eyes.

**MAJOR SPILLS**
- Clear area of personnel and move upwind.
- Alert Emergency Responders and tell them location and nature of hazard.

### Section 7 - HANDLING AND STORAGE

**PROCEDURE FOR HANDLING**
- Contains low boiling substance
Storage in sealed containers may result in pressure buildup causing violent rupture of containers not rated appropriately.
- Check for bulging containers.
Vent periodically
• DO NOT allow clothing wet with material to stay in contact with skin
• Avoid all personal contact, including inhalation.
• Wear protective clothing when risk of exposure occurs.

RECOMMENDED STORAGE METHODS
• DO NOT use aluminum or galvanized containers.
  Check regularly for spills and leaks.
Glass container,
• Lined metal can, Lined metal pail/drum
• Plastic pail
  For low viscosity materials
• Drums and jerricans must be of the non-removable head type.
• Where a can is to be used as an inner package, the can must have a screwed enclosure.

STORAGE REQUIREMENTS
• Bulk storages should be blanketed with nitrogen and equipped with absorptive type breather valve (to prevent vapor emissions).
• Store in original containers.
• Keep containers securely sealed.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

<table>
<thead>
<tr>
<th>Source</th>
<th>Material</th>
<th>TWA ppm</th>
<th>TWA mg/m³</th>
<th>STEL ppm</th>
<th>STEL mg/m³</th>
<th>Peak ppm</th>
<th>Peak mg/m³</th>
<th>TWA F/CC</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>US AIHA Workplace Environmental Exposure Levels (WEELs)</td>
<td>silicon tetrachloride (Tetrachlorosilane)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada - Alberta Occupational Exposure Limits</td>
<td>silicon tetrachloride (Hydrogen chloride)</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada - British Columbia Occupational Exposure Limits</td>
<td>silicon tetrachloride (Hydrogen chloride Revised 2003)</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US - Minnesota Permissible Exposure Limits (PELs)</td>
<td>silicon tetrachloride (Hydrogen chloride)</td>
<td></td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US ACGIH Threshold Limit Values (TLV)</td>
<td>silicon tetrachloride (Hydrogen chloride)</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US NIOSH Recommended Exposure Limits (RELs)</td>
<td>silicon tetrachloride (Hydrogen chloride)</td>
<td></td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants</td>
<td>silicon tetrachloride (Hydrogen chloride)</td>
<td></td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TLV Basis upper respiratory tract irritation
<table>
<thead>
<tr>
<th>Location</th>
<th>Permissible Exposure Limits</th>
<th>Chemical</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>US - Vermont</td>
<td>Permissible Exposure Limits Table Z-1-A</td>
<td>silicon tetrachloride (Hydrogen chloride)</td>
<td>(C)5</td>
<td>(C)7</td>
</tr>
<tr>
<td>US - Vermont</td>
<td>Final Rule Limits for Air Contaminants</td>
<td>silicon tetrachloride (Hydrogen chloride)</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>US - California</td>
<td>Permissible Exposure Limits for Chemical Contaminants</td>
<td>silicon tetrachloride (Hydrogen chloride; muriatic acid)</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>US - Idaho</td>
<td>Limits for Air Contaminants</td>
<td>silicon tetrachloride (Hydrogen chloride)</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>US - Hawaii Air Contaminant Limits</td>
<td></td>
<td>silicon tetrachloride (Hydrogen chloride)</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>US - Alaska</td>
<td>Limits for Air Contaminants</td>
<td>silicon tetrachloride (Hydrogen chloride)</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>US - Michigan</td>
<td>Exposure Limits for Air Contaminants</td>
<td>silicon tetrachloride (Hydrogen chloride)</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Canada - Yukon</td>
<td>Permissible Concentrations for Airborne Contaminant Substances</td>
<td>silicon tetrachloride (Hydrogen chloride)</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>US - Washington</td>
<td>Permissible exposure limits of air contaminants</td>
<td>silicon tetrachloride (Hydrogen chloride)</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>Canada - Saskatchewan</td>
<td>Occupational Health and Safety Regulations - Contamination Limits</td>
<td>silicon tetrachloride (Hydrogen chloride)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>US - Oregon</td>
<td>Permissible Exposure Limits (Z-1)</td>
<td>silicon tetrachloride (Hydrogen chloride)</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>US - Wyoming Toxic and Hazardous Substances Table Z1</td>
<td></td>
<td>silicon tetrachloride (Hydrogen chloride)</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Canada - Quebec</td>
<td>Permissible Exposure Values for Airborne Contaminants (English)</td>
<td>silicon tetrachloride (Hydrogen chloride)</td>
<td>5</td>
<td>7.5</td>
</tr>
<tr>
<td>Location</td>
<td>Substance</td>
<td>Limit</td>
<td>Notes</td>
<td></td>
</tr>
<tr>
<td>----------------------------------</td>
<td>----------------------------------------------</td>
<td>----------------</td>
<td>--------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>US OSHA Permissible Exposure</td>
<td>silicon tetrachloride (Hydrogen chloride)</td>
<td>5 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Levels (PELs) - Table Z1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada - Northwest Territories</td>
<td>silicon tetrachloride (Hydrogen chloride)</td>
<td>5 7.5</td>
<td>TLV Basis upper respiratory tract irritation</td>
<td></td>
</tr>
<tr>
<td>Occupational Exposure Limits</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>England</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada - Nova Scotia</td>
<td>silicon tetrachloride (Hydrogen chloride)</td>
<td>2</td>
<td>TLV Basis upper respiratory tract irritation</td>
<td></td>
</tr>
<tr>
<td>Occupational Exposure Limits</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada - Prince Edward Island</td>
<td>silicon tetrachloride (Hydrogen chloride)</td>
<td>2</td>
<td>TLV Basis upper respiratory tract irritation</td>
<td></td>
</tr>
<tr>
<td>Occupational Exposure Limits</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada - Ontario Occupational</td>
<td>silicic acid (Silica gel / Silice amorphe, gel)</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposure Limits</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada - British Columbia</td>
<td>silicic acid (Silica, Amorphous - Precipitated and gel)</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupational Exposure Limits</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US - Minnesota Permissible</td>
<td>silicic acid (Silica, amorphous, precipitated and gel)</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposure Limits (PELs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada - British Columbia</td>
<td>silicic acid (Silica, Amorphous - Precipitated and gel, Total)</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupational Exposure Limits</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada - British Columbia</td>
<td>silicic acid (Silica, Amorphous - Precipitated and gel, Respirable)</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupational Exposure Limits</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US - Idaho - Toxic and Hazardous</td>
<td>silicic acid (Silica, Amorphous, including natural diatomaceous earth)</td>
<td>80 mg/M3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Substances - Mineral Dust</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US - Vermont Permissible</td>
<td>silicic acid (Silica, amorphous, precipitated and gel)</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US - California Permissible</td>
<td>silicic acid (Silica, amorphous Precipitated and gel)</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposure Limits for Chemical</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contaminants</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US - Idaho - Limits for Air</td>
<td>silicic acid (Silica, amorphous, precipitated and gel.)</td>
<td>[3]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contaminants</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US - Alaska Limits for Air</td>
<td>silicic acid (Silica, precipitated)</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contaminants</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada - Saskatchewan</td>
<td>silicic acid (Silica Amorphous Precipitated silica and</td>
<td>10 20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupational Health</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7 of 15
and Safety
Regulations - Contamination Limits
silica gel)

<table>
<thead>
<tr>
<th>Location</th>
<th>Contaminant Description</th>
<th>Permissible Exposure Limits of Air Contaminants</th>
</tr>
</thead>
<tbody>
<tr>
<td>US - Washington</td>
<td>silicic acid (Silica, amorphous, precipitated and gel)</td>
<td>6 12</td>
</tr>
<tr>
<td>US - Michigan</td>
<td>silicic acid (Silica, amorphous, precipitated and gel)</td>
<td>6</td>
</tr>
<tr>
<td>Canada - Quebec</td>
<td>silicic acid (Silica - Amorphous, precipitated)</td>
<td>6</td>
</tr>
</tbody>
</table>

PERSONAL PROTECTION

RESPIRATOR
• Type B-P Filter of sufficient capacity. (AS/NZS 1716 & 1715, EN 1432000 & 1492001, ANSI Z88 or national equivalent)

EYE
• Chemical goggles.
• Full face shield.

HANDS/FEET
Elbow length PVC gloves.
• When handling corrosive liquids, wear trousers or overalls outside of boots, to avoid spills entering boots.
Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include
• frequency and duration of contact,
• chemical resistance of glove material,
• glove thickness and
dexterity
Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739, AS/NZS 2161.1 or national equivalent).
• When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374, AS/NZS 2161.10.1 or national equivalent) is recommended.
• When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374, AS/NZS 2161.10.1 or national equivalent) is recommended.
• Contaminated gloves should be replaced.
Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly.
Application of a non-perfumed moisturiser is recommended.
• Neoprene rubber gloves

OTHER
• Overalls.
• PVC Apron.

ENGINEERING CONTROLS
Local exhaust ventilation usually required. If risk of overexposure exists, wear an approved respirator.
Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL PROPERTIES

Liquid.
Corrosive.
Acid.
Contact with water liberates toxic gas.
Reacts violently with water.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>State</td>
<td>Liquid</td>
</tr>
<tr>
<td>Molecular Weight</td>
<td>169.9</td>
</tr>
<tr>
<td>Melting Range (°F)</td>
<td>-94</td>
</tr>
<tr>
<td>Boiling Range (°F)</td>
<td>136</td>
</tr>
<tr>
<td>Flash Point (°F)</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Decomposition Temp (°F)</td>
<td>Not Available</td>
</tr>
<tr>
<td>Autoignition Temp (°F)</td>
<td>Not Available</td>
</tr>
<tr>
<td>Upper Explosive Limit (%)</td>
<td>Not available.</td>
</tr>
<tr>
<td>Lower Explosive Limit (%)</td>
<td>Not available.</td>
</tr>
<tr>
<td>Volatile Component (%vol)</td>
<td>100</td>
</tr>
<tr>
<td>Viscosity</td>
<td>Not Available</td>
</tr>
<tr>
<td>Solubility in water (g/L)</td>
<td>Reacts violently</td>
</tr>
<tr>
<td>pH (1% solution)</td>
<td>Not available.</td>
</tr>
<tr>
<td>pH (as supplied)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Vapor Pressure (mmHg)</td>
<td>193.966</td>
</tr>
<tr>
<td>Specific Gravity (water=1)</td>
<td>1.483 at 20 C</td>
</tr>
<tr>
<td>Relative Vapor Density (air=1)</td>
<td>5.8</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>Not available.</td>
</tr>
</tbody>
</table>

APPEARANCE

Liquid with a suffocating odour. Reacts violently with water evolving hydrogen chloride gas and silicic acid. Its vapours produce smoke-like fumes in moist air. In the presence of moisture highly corrosive to most metals. Miscible with benzene, ether, chloroform.

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY

- Contact with alkaline material liberates heat

Product is considered stable under normal handling conditions.

STORAGE INCOMPATIBILITY

- Silicon tetrachloride
  - reacts with moisture in air, forming hydrogen chloride
  - reacts violently with water, steam, alcohols evolving heat and forming silicic acid and hydrogen chloride
  - hydrolyses exothermically with water to produce hydrogen chloride and gelled polysiloxanes.
  - reacts violently with strong oxidisers, alkalis, ammonia, dimethylsulfoxide, potassium, sodium, alkali metals
  - reacts, potentially violently, with ethylene oxide (causing explosive polymerisation), fluorine, silicon tetrahydride,
  - reacts exothermically with amines and alcohols
  - is incompatible with strong acids, aliphatic amines, alkanolamines, isocyanates, alkylene oxides, epichlorohydrin, halogenated compounds, nitrogen oxides
  - corrodes common metals in the presence of moisture, producing flammable hydrogen
  - should be stored under inert gas.
- Inorganic acids are generally soluble in water with the release of hydrogen ions. The resulting solutions have pH's of less than 7.0.
- Inorganic acids neutralize chemical bases (for example amines and inorganic hydroxides) to form salts.
  - Hydrogen chloride
    - reacts strongly with strong oxidisers (releasing chlorine gas), acetic anhydride, caesium cyanotridecyahydrodecaborate(2-), ethylidene difluoride, hexalithium disilicide, metal acetylide, sodium, silicon dioxide, tetrakiselenium tetratetraoxide, and many organic materials
    - is incompatible with alkaline materials, acetic anhydride, acetylides, aliphatic amines, alkanolamines, alkylene oxides, aluminium, aluminium-titanium alloys, aromatic amines, amines, amides, 2-aminoethanol, ammonia, ammonium hydroxide, borides, calcium phosphate, carbides, carbonates, cyanides, chlorosulfonic acid,
attacks most metals forming flammable hydrogen gas, and some plastics, rubbers and coatings
reacts with zinc, brass, galvanised iron, aluminium, copper and copper alloys
Reacts with water or steam to produce toxic and corrosive fumes
Segregate from alcohol, water.
NOTE May develop pressure in containers; open carefully. Vent periodically.
For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

silicon tetrachloride

TOXICITY AND IRRITATION
■ unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

HYDROGEN CHLORIDE

■ Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Key criteria for the diagnosis of RADS include the absence of preceding respiratory disease, in a non-atopic individual, with abrupt onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. A reversible airflow pattern, on spirometry, with the presence of moderate to severe bronchial hyperreactivity on methacholine challenge testing and the lack of minimal lymphocytic inflammation, without eosinophilia, have also been included in the criteria for diagnosis of RADS. RADS (or asthma) following an irritating inhalation is an infrequent disorder with rates related to the concentration of and duration of exposure to the irritating substance. Industrial bronchitis, on the other hand, is a disorder that occurs as result of exposure due to high concentrations of irritating substance (often particulate in nature) and is completely reversible after exposure ceases. The disorder is characterised by dyspnea, cough and mucus production.

SILICON TETRACHLORIDE

TOXICITY
Inhalation (rat) LC50 8000 ppm/4h
Skin (rabbit) 500 mg/24h-SEVERE
Eye (rabbit) 20 mg/24h-Moderate

■ The material may produce moderate eye irritation leading to inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.
The material may cause severe skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin. Repeated exposures may produce severe ulceration.

HYDROGEN CHLORIDE

Inhalation (human) LCLo 1300 ppm/30m

Inhalation (human) LCLo 3000 ppm/5m

Inhalation (rat) LC50 3124 ppm/60m
The material may be irritating to the eye, with prolonged contact causing inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

4701 ppm/30m

**SILICIC ACID**

For silica amorphous

When experimental animals inhale synthetic amorphous silica (SAS) dust, it dissolves in the lung fluid and is rapidly eliminated. If swallowed, the vast majority of SAS is excreted in the faeces and there is little accumulation in the body. Following absorption across the gut, SAS is eliminated via urine without modification in animals and humans. SAS is not expected to be broken down (metabolised) in mammals.

After ingestion, there is limited accumulation of SAS in body tissues and rapid elimination occurs. Intestinal absorption has not been calculated, but appears to be insignificant in animals and humans. SASs injected subcutaneously are subjected to rapid dissolution and removal. There is no indication of metabolism of SAS in animals or humans based on chemical structure and available data. In contrast to crystalline silica, SAS is soluble in physiological media and the soluble chemical species that are formed are eliminated via the urinary tract without modification.

Both the mammalian and environmental toxicology of SASs are significantly influenced by the physical and chemical properties, particularly those of solubility and particle size. SAS has no acute intrinsic toxicity by inhalation. Adverse effects, including suffocation, that have been reported were caused by the presence of high numbers of respirable particles generated to meet the required test atmosphere. These results are not representative of exposure to commercial SASs and should not be used for human risk assessment. Though repeated exposure of the skin may cause dryness and cracking, SAS is not a skin or eye irritant, and it is not a sensitiser.

Repeated-dose and chronic toxicity studies confirm the absence of toxicity when SAS is swallowed or upon skin contact.

Long-term inhalation of SAS caused some adverse effects in animals (increases in lung inflammation, cell injury and lung collagen content), all of which subsided after exposure.

Numerous repeated-dose, subchronic and chronic inhalation toxicity studies have been conducted with SAS in a number of species, at airborne concentrations ranging from 0.5 mg/m3 to 150 mg/m3. Lowest-observed adverse effect levels (LOAELs) were typically in the range of 1 to 50 mg/m3. When available, the no-observed adverse effect levels (NOAELs) were between 0.5 and 10 mg/m3. The difference in values may be explained by different particle size, and therefore the number of particles administered per unit dose. In general, as particle size decreases so does the NOAEL/LOAEL.

Neither inhalation nor oral administration caused neoplasms (tumours). SAS is not mutagenic in vitro. No genotoxicity was detected in in vivo assays. SAS does not impair development of the foetus. Fertility was not specifically studied, but the reproductive organs in long-term studies were not affected.

In humans, SAS is essentially non-toxic by mouth, skin or eyes, and by inhalation. Epidemiology studies show little evidence of adverse health effects due to SAS. Repeated exposure (without personal protection) may cause mechanical irritation of the eye and drying/cracking of the skin.

There is no evidence of cancer or other long-term respiratory health effects (for example, silicosis) in workers employed in the manufacture of SAS. Respiratory symptoms in SAS workers have been shown to correlate with smoking but not with SAS exposure, while serial pulmonary function values and chest radiographs are not adversely affected by long-term exposure to SAS.

The substance is classified by IARC as Group 3.
NOT classifiable as to its carcinogenicity to humans.
Evidence of carcinogenicity may be inadequate or limited in animal testing.

**CARCINOGEN**

<table>
<thead>
<tr>
<th>Name</th>
<th>Source</th>
<th>Group</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrochloric acid</td>
<td>International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Acid mists, strong inorganic</td>
<td>International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Hydrogen chloride</td>
<td>US ACGIH Threshold Limit Values (TLV) - Carcinogens</td>
<td>1</td>
<td>A4</td>
</tr>
<tr>
<td>hydrogen chloride</td>
<td>US - Rhode Island Hazardous Substance List</td>
<td>IARC</td>
<td></td>
</tr>
<tr>
<td>TWAPPMB~</td>
<td>US - Maine Chemicals of High Concern List</td>
<td>Carcinogen</td>
<td>A4</td>
</tr>
<tr>
<td>SILICA</td>
<td>US Environmental Defense Scorecard Recognized Carcinogens</td>
<td>Reference(s)</td>
<td>P65</td>
</tr>
<tr>
<td>SILICA</td>
<td>US Environmental Defense Scorecard Suspected Carcinogens</td>
<td>Reference(s)</td>
<td>P65</td>
</tr>
<tr>
<td>VPVB_(VERY~</td>
<td>US - Maine Chemicals of High Concern List</td>
<td>Carcinogen</td>
<td>CA Prop 65; NTP 11th ROC</td>
</tr>
</tbody>
</table>

**Section 12 - ECOLOGICAL INFORMATION**

This material and its container must be disposed of as hazardous waste.

**Section 13 - DISPOSAL CONSIDERATIONS**

**US EPA Waste Number & Descriptions**

A. General Product Information
Corrosivity characteristic: use EPA hazardous waste number D002 (waste code C)
Reactivity characteristic: use EPA hazardous waste number D003 (waste code R).

**Disposal Instructions**

All waste must be handled in accordance with local, state and federal regulations.
Puncture containers to prevent re-use and bury at an authorized landfill.
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.

A Hierarchy of Controls seems to be common - the user should investigate:
- Reduction
- Reuse
- Recycling
- Disposal (if all else fails)

This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. If it has been contaminated, it may be possible to reclaim the product by filtration, distillation or some other means. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate.

DO NOT allow wash water from cleaning equipment to enter drains. Collect all wash water for treatment before disposal.

For small quantities:
- Neutralize an aqueous solution of the material.
- Filter solids for disposal to approved land fill.
- Recycle wherever possible.
- Consult manufacturer for recycling options or consult Waste Management Authority for disposal if no suitable treatment or disposal facility can be identified.
### Section 14 - TRANSPORTATION INFORMATION

<table>
<thead>
<tr>
<th>DOT:</th>
<th>Symbols: None</th>
<th>Hazard class or Division: 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification Numbers: UN1818</td>
<td>PG: II</td>
<td></td>
</tr>
<tr>
<td>Label Codes: 8</td>
<td>Special provisions: A3, A6, B2, B6, T10, TP2, TP7, TP13</td>
<td></td>
</tr>
<tr>
<td>Packaging: Exceptions: None</td>
<td>Packaging: Non-bulk: 202</td>
<td></td>
</tr>
<tr>
<td>Packaging: Exceptions: None</td>
<td>Quantity limitations: Passenger aircraft/rail: 1 L</td>
<td></td>
</tr>
<tr>
<td>Quantity Limitations: Cargo aircraft only: 30 L</td>
<td>Vessel stowage: Location: C</td>
<td></td>
</tr>
<tr>
<td>Vessel stowage: Other: 40</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Hazardous materials descriptions and proper shipping names:**

Silicon tetrachloride

**Air Transport IATA:**

| UN/ID Number: 1818 | Packing Group: II |
| Special provisions: A1 |
| Cargo Only |
| Packing Instructions: 876 | Maximum Qty/Pack: 30 L |
| Passenger and Cargo |
| Packing Instructions: Forbidden | Maximum Qty/Pack: Forbidden |
| Passenger and Cargo Limited Quantity |
| Packing Instructions: Forbidden | Maximum Qty/Pack: Forbidden |

- Air transport may be forbidden if this material is flammable, corrosive or toxic gases may be released under normal conditions of transport.

**Shipping Name:** SILICON TETRACHLORIDE

**Maritime Transport IMDG:**

| IMDG Class: 8 | IMDG Subrisk: None |
| UN Number: 1818 | Packing Group: II |
| EMS Number: F-A,S-B | Special provisions: None |
| Limited Quantities: 0 |

**Shipping Name:** SILICON TETRACHLORIDE

### Section 15 - REGULATORY INFORMATION

Silicon tetrachloride (CAS: 10026-04-7) is found on the following regulatory lists:

- Canada - Saskatchewan Industrial Hazardous Substances
- Canada Ingredient Disclosure List (SOR/88-64)
- IMO MARPOL 73/78 (Annex II) - List of Noxious Liquid Substances Carried in Bulk
- International Council of Chemical Associations (ICCA) - High Production Volume List
- US - Massachusetts Oil & Hazardous Material List
- US - New Jersey Right to Know Hazardous Substances
- US AIHA Workplace Environmental Exposure Levels (WEELs)
- US Department of Homeland Security Chemical Facility Anti-Terrorism Standards - Chemicals of Interest
- US DOE Temporary Emergency Exposure Limits (TEELs)
- US EPA Acute Exposure Guideline Levels (AEGLs) - Interim
- US EPA High Production Volume Chemicals Additional List
- US Postal
silicic acid (CAS: 7647-01-0) is found on the following regulatory lists;


"US Air Toxics ""Hot Spots"" List (Assembly Bill 2588) Substances for which emissions must be quantified". 

Regulations for ingredients 

hydrogen chloride (CAS: 7647-01-0) is found on the following regulatory lists;

"Canada - Alberta Ambient Air Quality Objectives","Canada - Alberta Occupational Exposure Limits","Canada - British Columbia Occupational Exposure Limits","Canada - Northwestern Territories Occupational Exposure Limits (English)","Canada - Nova Scotia Occupational Exposure Limits","Canada - Prince Edward Island Occupational Exposure Limits","Canada - Prince Edward Island Occupational Exposure Limits - Carcinogens","Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)". 

14 of 15
LIMITED EVIDENCE

- Inhalation may produce health damage*.
- Cumulative effects may result following exposure*.
- Eye contact may produce serious damage*.
* (limited evidence).

Ingredients with multiple CAS Nos

<table>
<thead>
<tr>
<th>Ingredient Name</th>
<th>CAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>silicic acid</td>
<td>1343-98-2, 112926-00-8</td>
</tr>
</tbody>
</table>

Reasonable care has been taken in the preparation of this information, but the author makes no warranty of merchantability or any other warranty, expressed or implied, with respect to this information. The author makes no representations and assumes no liability for any direct, incidental or consequential damages resulting from its use. For additional technical information please call our toxicology department on +800 CHEMCALL.

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. A list of reference resources used to assist the committee may be found at: www.chemwatch.net/references.

The (M)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.

This document is copyright. Apart from any fair dealing for the purposes of private study, research, review or criticism, as permitted under the Copyright Act, no part may be reproduced by any process without written permission from CHEMWATCH. TEL (+61 3) 9572 4700.

www.chemwatch.net

Issue Date: Apr-26-2009
Print Date: Sep-30-2011