1H,1H,2H,2H-Perfluorodecyltrichlorosilane

sc-259051

Material Safety Data Sheet

Hazard Alert Code Key:	EXTREME	HIGH	MODERATE	LOW

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

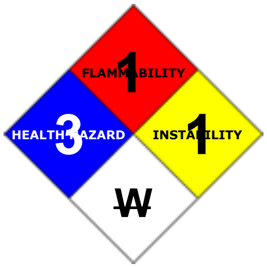
PRODUCT NAME

1H,1H,2H,2H-Perfluorodecyltrichlorosilane

STATEMENT OF HAZARDOUS NATURE

CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO OSHA 29 CFR 1910.1200.

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

C10-H4-Cl3-F17-Si, "(1H, 1H, 2H, 2H--heptadecafluorodecyl)trichlorosilane", "trichloro(3, 3, 4, 4, 5, 5, 6, 6, 7, 7, 8, 8, 9, 9, 10, 10, 10-", heptadecafluorodecyl)silane

Section 2 - HAZARDS IDENTIFICATION

CHEMWATCH HAZARD RATINGS

		Min	Max
Flammability:	1		
Toxicity:	0		
Body Contact:	4		
Reactivity:	1		
Chronic:	2		

Min/Nil=0
Low=1
Moderate=2
High=3
Extreme=4

CANADIAN WHMIS SYMBOLS


EMERGENCY OVERVIEW

RISK

Causes severe burns.
Risk of serious damage to eyes.
Harmful to aquatic organisms.
Cumulative effects may result following exposure*.
Limited evidence of a carcinogenic effect*.
* (limited evidence).

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

■ Ingestion of acidic corrosives may produce burns around and in the mouth, the throat and oesophagus. Immediate pain and difficulties in swallowing and speaking may also be evident. Swelling of the epiglottis may make it difficult to breathe which may result in suffocation. More severe exposure may result in vomiting blood and thick mucus, shock, abnormally low blood pressure, fluctuating pulse, shallow respiration and clammy skin, inflammation of stomach wall, and rupture of oesophageal tissue. Untreated shock may eventually result in kidney failure. Severe cases may result in perforation of the stomach and abdominal cavity with consequent infection, rigidity and fever. There may be severe narrowing of the oesophageal or pyloric sphincters; this may occur immediately or after a delay of weeks to years. There may be coma and convulsions, followed by death due to infection of the abdominal cavity, kidneys or lungs.

■ Chlorosilanes reacts with moisture in the air or water to produce hydrogen chloride, as such, swallowing these substances may cause severe corrosive burns of the mouth, gullet and stomach, potentially resulting in perforation and damage of the body cavities, resulting in inflammation of the affected areas and even death.

■ 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 (eg. 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.

EYE

■ The material can produce severe chemical burns to the eye following direct contact. Vapours or mists may be extremely irritating.

■ 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. Severe burns produce long-lasting and possibly irreversible damage. The appearance of the burn may not be apparent for several weeks after the initial contact. The cornea may ultimately become deeply opaque resulting in blindness.

■ Direct contact of chlorosilane liquid with the eyes causes severe corrosive damage that may result in total loss of sight. Vapour exposure to the eyes may result in significant irritation up to severe chemical burns that may result in total loss of sight.

SKIN

■ The material can produce severe chemical burns following direct contactwith the skin.

■ 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 (as classified under EC Directives); the material may still produce health damage following entry through wounds, lesions or abrasions.

■ Skin exposure to either chlorosilane vapour or its liquid can cause dose and duration dependent burns varying in severity from first to third degree.

■ Open cuts, abraded or irritated skin should not be exposed to this material.

■ 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. Swelling of the lungs can occur, either immediately or after a delay; symptoms of this include chest tightness, shortness of breath, frothy phlegm and cyanosis. Lack of oxygen can cause death hours after onset.

■ Inhalation of chlorosilane vapours or hydrochloric acid vapours or its mist may cause damage to the airways. Chlorosilane injury from inhalation primarily affects the upper airway, causing inflammation, oedema and corrosive burns of the oral, nasal and pharyngeal mucosa as well as the upper airway.

■ The material has NOT been classified by EC Directives or other classification systems as "harmful by inhalation". This is because of the lack of corroborating animal or human evidence. In the absence of such evidence, care should be taken nevertheless to ensure exposure is kept to a minimum and that suitable control measures be used, in an occupational setting to control vapours, fumes and aerosols.

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. Chronic exposure may inflame the skin or conjunctiva.

Long-term exposure to respiratory irritants may result in disease of the airways involving difficult breathing and related systemic problems.

There has been some concern that this material can cause cancer or mutations but there is not enough data to make an assessment.

Substance accumulation, in the human body, may occur and may cause some concern following repeated or long-term occupational exposure.

Repeated contact and/ or inhalation of dilute solutions of chlorosilane or hydrochloric acid mists will cause skin and airway swelling and reddening following irritation.

Long chain PCFAs 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 cause tumours and damage the immune system, and cause moderate to high toxicity in the medium term if given by mouth. Because they are cleared more slowly and have more potential to accumulate in the body, longer chain PFCAs are expected to be of greater concern than PFOA.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
1H,1H,2H,2H-perfluorodecyltrichlorosilane	78560-44-8	>98

Section 4 - FIRST AID MEASURES

SWALLOWED

- For advice, contact a Poisons Information Centre or a doctor at once.
- Urgent hospital treatment is likely to be needed.
- 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.
- Transport to hospital or doctor without delay.

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.
- Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes.
- Transport to hospital or doctor without delay.
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

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.
- Wash skin and hair with running water. Continue flushing with water until advised to stop by the Poisons Information Centre.
- Transport to hospital, or doctor.

INHALED

- If fumes or combustion products are inhaled remove from contaminated area.
- 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.
- 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.
- Transport to hospital, or doctor, without delay.
- Inhalation of vapours or aerosols (mists, fumes) may cause lung oedema.
- Corrosive substances may cause lung damage (e.g. lung oedema, fluid in the lungs).
- As this reaction may be delayed up to 24 hours after exposure, affected individuals need complete rest (preferably in semi-recumbent posture) and must be kept under medical observation even if no symptoms are (yet) manifested.
- Before any such manifestation, the administration of a spray containing a dexamethasone derivative or beclomethasone derivative may be considered.

This must definitely be left to a doctor or person authorised by him/her. (ICSC13719).

NOTES TO PHYSICIAN

■ 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
- Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.
- Strong acids produce a coagulation necrosis characterised by formation of a coagulum (eschar) as a result of the dessicating action of the acid on proteins in specific tissues.

INGESTION:

- Immediate dilution (milk or water) within 30 minutes post ingestion is recommended.
- DO NOT attempt to neutralise the acid since exothermic reaction may extend the corrosive injury.
- Be careful to avoid further vomit since re-exposure of the mucosa to the acid is harmful. Limit fluids to one or two glasses in an adult.
- Charcoal has no place in acid management.
- Some authors suggest the use of lavage within 1 hour of ingestion.

SKIN:

- Skin lesions require copious saline irrigation. Treat chemical burns as thermal burns with non-adherent gauze and wrapping.
- Deep second-degree burns may benefit from topical silver sulfadiazine.

EYE:

- Eye injuries require retraction of the eyelids to ensure thorough irrigation of the conjuctival cul-de-sacs. Irrigation should last at least 20-30 minutes. DO NOT use neutralising agents or any other additives. Several litres of saline are required.
- Cycloplegic drops, (1% cyclopentolate for short-term use or 5% homatropine for longer term use) antibiotic drops, vasoconstrictive agents or artificial tears may be indicated dependent on the severity of the injury.
- Steroid eye drops should only be administered with the approval of a consulting ophthalmologist).

[Ellenhorn and Barceloux: Medical Toxicology].

Section 5 - FIRE FIGHTING MEASURES

Vapour Pressure (mmHG):	Not Available
Upper Explosive Limit (%):	Not Available
Specific Gravity (water=1):	1.5
Lower Explosive Limit (%):	Not Available

EXTINGUISHING MEDIA

For chlorosilanes:

- Foam is the most effective agent overall for use on chlorosilane fires. However, a number of variables, most notably the chlorosilane involved, the foam concentrate, the concentration of the foam, the expansion ratio (final foam volume versus initial solution volume), the application equipment and the fire conditions, can have a significant impact on the effectiveness of foam on chlorosilane fires. Certain combinations of these variables can in fact produce less than satisfactory (and even adverse) results.
- In general, though, alcohol-(polar) compatible AFFF (Aqueous Film Forming Foam) has proven to be an extremely effective foam type, and medium-expansion foam has been found to be the most effective foam expansion. Other foam types and expansions, however, can produce satisfactory results, especially on fires involving dimethyldichlorosilane, trimethylchlorosilane and other heavily organic substituted chlorosilanes. For chlorosilanes containing Si-H (silicon-hydrogen) bonds, e.g., trichlorosilane and methyldichlorosilane, alcohol-compatible AFFF and medium-expansion foam are highly recommended for maximum effectiveness.
- Since foam solutions contain water, reaction with the chlorosilane will normally be observed when foam is applied. Be aware that application of foam will release significant amounts of corrosive vapours. In addition, hydrogen vapours can he released from hydrogen-containing chlorosilanes and may be trapped under the foam blanket. Extreme care should be taken not to disturb the foam blanket during and after foam application.
- Other extinguishing agents that may be effective on small fires include dry sand and carbon dioxide.
- (Caution: When using carbon dioxide in enclosed spaces without adequate ventilation, an asphyxiation hazard can be created.
- Due to its reactivity with chlorosilanes, water should NOT be used as an extinguishing agent for chlorosilane fires, except for very small fires. Water can also be used to protect exposures and personnel and on the vapour cloud to disperse and dilute the HCl vapour. (Care should be taken, however, to prevent any over-spray or runoff from contacting the chlorosilane.)
- Sodium- and potassium-bicarbonate-based dry chemical fire extinguishers have proven effective to extinguish small chlorosilane fires, except those involving hydrogen-containing chlorosilanes such as trichlorosilane and methyldichlorosilane, where success has been marginal at best. Expect to use much larger quantities of dry chemical than would be required to extinguish a similar hydrocarbon fire. Dry chemical is generally not effective on large fires because an adequate amount of agent cannot be delivered quickly enough. Use of dry chemical on hydrogen-containing chlorosilanes will release hydrogen, which may ignite explosively.
- Prevent extinguishing agents from entering a container or vessel that contains chlorosilane. The resulting release of hydrogen chloride vapours may over-pressurise the container or vessel, resulting in a sudden rupture of the container or vessel.

FIRE FIGHTING

- Alert Fire Brigade and tell them location and nature of hazard.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water course.
- 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 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.

Foam has proven to be the most effective extinguishing agent on chlorosilane fires. When using foam, the following guidelines should be followed.

- Apply foam as gently as possible. DO NOT 'PLUNGE' OR AIM FOAM STREAMS DIRECTLY INTO A CHLOROSILANE. This will result in severe reactions between the chlorosilane and the water contained in the foam solution.
- Wherever possible, aim foam streams in front of the chlorosilane or bounce off fixed objects (such as tanks or dike walls) to allow the foam to flow gently onto the liquid surface. Occasionally, however, it may he necessary to "lob" foam in order to deliver foam to the centre of a fire.
- Except in the case of very small fires, and where possible, use at least two nozzles to enhance distribution of the foam over the surface of the chlorosilane.
- Establish a relatively thick blanket of foam (e.g., 12 to 18 inches/30 - 50 cm minimum) over the entire liquid surface. Once this has been done, temporarily suspend foam application to allow extinguishing to take place. Reapply foam when the intensity of the fire and/or the evolution of smoke/vapours appear to stabilise or even increase. Repeat this process as often as necessary until extinguishing is effected or until other emergency measures can be initiated.
- It is theorised that the fire is extinguished through the gradual hydrolysis of the chlorosilane by the water draining from the foam. This hydrolysis reaction forms a layer of siloxanes (fluid or gel) on the surface of the chlorosilane, which inhibits vapour production and excludes oxygen, thereby extinguishing the fire.
- Exercise extreme caution when applying foam and when approaching the fire area. The hydrolysis layer formed in the extinguishing process can trap flammable vapours, and, if this layer is disturbed (e.g. by impinging foam-streams), subsurface ignitions and rapid flashovers may occur.

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

- Combustible.
- Slight fire hazard when exposed to heat or flame.
- Acids may react with metals to produce hydrogen, a highly flammable and explosive gas.
- Heating may cause expansion or decomposition leading to violent rupture of containers.
- May emit acrid smoke and corrosive fumes.

Combustion products include: carbon monoxide (CO), carbon dioxide (CO_2), hydrogen chloride, phosgene, silicon dioxide (SiO_2), other pyrolysis products typical of burning organic material.

The chlorosilanes (with the exception of trichlorosilane) burn in a manner similar to burning hydrocarbons, producing large amounts of grey or black smoke. However, the quantity of heat produced by burning chlorosilanes is typically lower than that of most flammable hydrocarbons. Generally speaking, the hydrocarbon-like character of chlorosilanes increases with the number of methyl groups present.

FIRE INCOMPATIBILITY

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

An accidental spill or release of chlorosilane results in a hydrogen chloride vapour fog, which should be minimised or controlled as quickly as possible.

- Full protective equipment is needed for individuals who must work in a chlorosilane vapour cloud.
- In the case of spills up to 5 litres, absorb the spill with dry inert absorbent material like dry sand, diatomaceous earth. The resulting material should then be properly packaged and its disposal should be supervised.
- Note: this material will react with water and must carry an appropriate warning label.
- Clear the affected area thoroughly with water.

MAJOR SPILLS

- Provide diking or other appropriate containment.
- Cover spill with medium expansion foam (alcohol resistant).
- Pump uncontaminated pure material into appropriate portable tanks, pressure cylinders or drums.
- Neutralise residual material with alkali base. Caution! Hydrogen gas may be evolved during hydrolysis and neutralisation with some chlorosilanes (UN1183, UN1242, UN1295, UN2988). By-products of hydrolysis could be insoluble liquids or solids.
- Hydrogen chloride vapours resulting from a large spill can be reduced by means of a water spray into the acid plume, being careful not to spray water directly into the spilled liquid chlorosilane pool. The resulting acidic waste water requires neutralisation prior to discharge to sewer systems.
- In the event of accidental spillage of chlorosilanes to surface waters or to a municipal sewer system, promptly notify the appropriate pollution control agencies.

Environmental hazard - contain spillage.

- 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 full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water course.
- Consider evacuation (or protect in place).
- Stop leak if safe to do so.
- Contain spill with sand, earth or vermiculite.
- Collect recoverable product into labelled containers for recycling.
- Neutralise/decontaminate residue (see Section 13 for specific agent).
- Collect solid residues and seal in labelled drums for disposal.
- Wash area and prevent runoff into drains.
- After clean up operations, decontaminate and launder all protective clothing and equipment before storing and re-using.
- If contamination of drains or waterways occurs, advise emergency services.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

- DO NOT allow clothing wet with material to stay in contact with skin

For chlorosilanes:

- Static electricity discharges can ignite flammable chlorosilane vapour. It is important to "inert" the whole system, in which chlorosilanes are transferred, with dry nitrogen.
- Static electricity may be generated when any of these compounds flow through or are discharged from a pipe or fall freely through space. Splash filling is particularly hazardous and should be avoided.
- To drain off static charges and avoid spark discharges, a continuous path from the point of generation to ground must be provided. This is best accomplished by electrically interconnecting (bonding) all vessels and piping and grounding all vessels and piping.
- Equipment, such as lines, pumps, valves, vessels, etc., must be thoroughly dried with no trace of water remaining before introducing any chlorosilane.
- Prior to operation, the system should be tested for leaks at or above operating pressure with dry nitrogen and each joint painted with soap solution and checked for bubbles.
- Totally enclosed systems should be used. Atmospheric openings or vents will allow moisture to enter the system causing the generation of hydrogen chloride, which will attack the equipment.
- Use only dry nitrogen, when any of the following is performed: pressurising vessels, priming pumps, blanketing tanks, and filling or withdrawing of tank contents. Operational vents from nitrogen blanketing systems should be directed to a vent recovery system, or a vent scrubber or both.
- Before withdrawing chlorosilanes from drums, the drum must be electrically grounded and bonded to the receiving container. Chlorosilanes can be withdrawn through a steel valve installed in the drum bung. Dry nitrogen (air or oxygen must not be used due to the flammability of chlorosilanes) should be introduced into the drum through the other bung to replace the volume of liquid. The nitrogen supply system should include a check valve, shut-off valve, pressure regulator and pressure relief valve. The system can be modified to withdraw chlorosilanes by gravity or to feed a pump. Application of pressure to a drum is not recommended.

Piping and Valves:

- Carbon steel piping is recommended.
- Welded and flanged piping connections are preferred in order to maintain a leak-tight system.
- Only flange gaskets which are stable to chlorosilanes (non-asbestos compressed materials, Teflon, graphite) must be used to provide a leak-tight joint. Spiral-wound metallic gaskets or metal/graphite gaskets are preferred when maximum fire resistance is desired.
- Valves of all sizes can be ductile iron, forged steel, or cast steel valves with stainless steel or steel trim.
- The interconnection of road / rail tank cars or portable tanks to permanent piping can be made with swing arm rotary joints (best solution) or seamless, braided flexible metal hose. Use flanged or union connections. Do not use quick disconnect couplings.
- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- WARNING: To avoid violent reaction, ALWAYS add material to water and NEVER water to material.
- Avoid smoking, naked lights or ignition sources.
- Avoid contact with incompatible materials.
- When handling, DO NOT eat, drink or smoke.
- Keep containers securely sealed when not in use.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately. Launder contaminated clothing before re-use.
- Use good occupational work practice.
- Observe manufacturer's storing and handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

RECOMMENDED STORAGE METHODS

- Check regularly for spills and leaks

For chlorosilanes:

- Non-ferrous metals and alloys such as aluminium, bronze, copper, zinc or magnesium should never be used. They are readily corroded and many, in case of fire, have low melting points.
- Cast iron, due to its brittleness, must not be used to contain chlorosilanes; cast steel and forged steel can be used.
- Plastics should not be used in chlorosilane service due to incompatibility and reactivity of this material.
- In the absence of water, carbon steel is satisfactory for piping and other equipment used to contain chlorosilanes

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.

For materials with a viscosity of at least 2680 cSt. (23 deg. C) and solids (between 15 C deg. and 40 deg C.):

- Removable head packaging;
- Cans with friction closures and
- low pressure tubes and cartridges

may be used.

-

Where combination packages are used, and the inner packages are of glass, porcelain or stoneware, there must be sufficient inert cushioning material in contact with inner and outer packages unless the outer packaging is a close fitting moulded plastic box and the substances are not incompatible with the plastic.

STORAGE REQUIREMENTS

- Despite the chlorosilanes reactivity with water, water sprinkler systems are the most effective means of protecting buildings, equipment and building contents from chlorosilane fires. Foam-water sprinkler systems can also be used to provide additional extinguishing capabilities (such systems, however, are likely to have only limited effectiveness on trichlorosilane and methyldichlorosilane fires).
- In tank farms and other areas where spilled chlorosilanes would be relatively confined, a permanently installed medium-expansion foam system can be provided to extinguish any chlorosilane fires.
- An adequate number of hydrants and, where appropriate, monitor nozzles should be provided wherever chlorosilanes are stored, handled or processed.
- Of critical importance is the provision of adequate spill control facilities to safely drain away burning chlorosilanes and prevent other important areas and property from being exposed to the fire. This may include such features as diking, curbs, sloped surfaces, drainage trenches and remote impounding areas. Spill control facilities should be designed to accommodate the largest anticipated release of chlorosilanes as well as the quantity of water expected from fire fighting operations (including sprinkler systems, hoses, monitor nozzles, etc.).
- In closed buildings CO2 may be an adequate extinguishing medium.

Vessels:

- Generally storage tanks should be completely vacuum resistant or should be equipped with automatic pressure controlled nitrogen supply and shut down systems which avoid dangerous under-pressure.
- Design pressure is dependent on the properties of the chlorosilanes stored.
- Generally vessels should have emergency vents. Rain hats" should be used over the ends of the vent pipe outlets
- Vessels equipped with pressure-relief valves, to relieve excess internal pressure due to fire or other causes, should employ a non-fragmenting-type rupture disk ahead of or after the relief valve, precautions must be taken to prevent the valve from being blocked with hydrolysis products due to chlorosilane contact with moisture in air. "
- Store in original containers.
- Keep containers securely sealed.
- Store in a cool, dry, well-ventilated area.
- Store away from incompatible materials and foodstuff containers.
- Protect containers against physical damage and check regularly for leaks.
- Observe manufacturer's storing and handling recommendations.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

The following materials had no OELs on our records

- 1H,1H,2H,2H-perfluorodecyltrichlorosilane: CAS:78560-44-8

PERSONAL PROTECTION

RESPIRATOR

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

EYE

- Safety glasses with unperforated side shields may be used where continuous eye protection is desirable, as in laboratories; spectacles are not sufficient where complete eye protection is needed such as when handling bulk-quantities, where there is a danger of splashing, or if the material may be under pressure
- Chemical goggles.whenever there is a danger of the material coming in contact with the eyes; goggles must be properly fitted
- Full face shield (20 cm, 8 in minimum) may be required for supplementary but never for primary protection of eyes; these afford face protection.
- Alternatively a gas mask may replace splash goggles and face shields.
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens 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]

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.

OTHER

For chlorosilanes:

- Viton and similar synthetic rubbers afford the best protection
- PVC and nitrile rubber may be used as a protective material (gloves, clothing and boots) for short term contacts in normal handling procedures to prevent skin burns.
- Latex rubber should not be used.
- The importance of water washing in the safety shower/eyewash for a minimum of 15 minutes after contact with chlorosilanes should be emphasised.
- Contaminated clothing and shoes must be removed before the person is washed under the safety shower. The assistance by another person to help remove clothing and, perhaps, to help hold eyes open in the eyewash may be necessary.

ENGINEERING CONTROLS

■ 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.

The basic types of engineering controls are:

Process controls which involve changing the way a job activity or process is done to reduce the risk.

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.

Employers may need to use multiple types of controls to prevent employee overexposure.

Local exhaust ventilation usually required. If risk of overexposure exists, wear approved respirator. Correct fit is essential to obtain adequate protection. Supplied-air type respirator may be required in special circumstances. Correct fit is essential to ensure adequate protection.

An approved self contained breathing apparatus (SCBA) may be required in some situations.

Provide adequate ventilation in warehouse or closed storage area. 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.

Type of Contaminant:	Air Speed:
solvent, vapours, degreasing etc., evaporating from tank (in still air).	0.25-0.5 m/s (50-100 f/min.)
aerosols, fumes from pouring operations, intermittent container filling, low speed conveyer transfers, welding, spray drift, plating acid fumes, pickling (released at low velocity into zone of active generation)	0.5-1 m/s (100-200 f/min.)

direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)	1-2.5 m/s (200-500 f/min.)
grinding, abrasive blasting, tumbling, high speed wheel generated dusts (released at high initial velocity into zone of very high rapid air motion).	2.5-10 m/s (500-2000 f/min.)

Within each range the appropriate value depends on:

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

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.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL PROPERTIES

Liquid.
Corrosive.
Acid.

State	Liquid	Molecular Weight	581.56
Melting Range (°F)	Not Available	Viscosity	Not Available
Boiling Range (°F)	435	Solubility in water (g/L)	Reacts
Flash Point (°F)	212	pH (1% solution)	Not Available
Decomposition Temp (°F)	Not Available	pH (as supplied)	Not Available
Autoignition Temp (°F)	Not Available	Vapour Pressure (mmHG)	Not Available
Upper Explosive Limit (%)	Not Available	Specific Gravity (water=1)	1.5
Lower Explosive Limit (%)	Not Available	Relative Vapour Density (air=1)	Not Available
Volatile Component (%vol)	Not Available	Evaporation Rate	Not Available

APPEARANCE

Liquid; reacts with water

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY

- Contact with alkaline material liberates heat

STORAGE INCOMPATIBILITY

■ Chlorosilanes:

- react with water to produce heat and toxic, corrosive fumes of hydrogen chloride and possibly H2.
- react vigorously with both organic and inorganic acids and with bases to generate toxic or flammable gases.
- react with primary alcohols (almost as rapidly as water) forming hydrogen chloride; secondary and tertiary alcohols react less rapidly
- react rapidly with ammonia and aliphatic amines generating heat and ammonium and amine salts
- (hydrogen-containing) react violent with chlorine
- Measurement of the autoignition temperatures of several series of mono-, di-, tri- and tetra- alkylsilanes showed the ease of oxidation decreases with increasing substitution.
- Some alkylsilanes are easily ignited or are pyrophoric.

BRETHERICK L.: Handbook of Reactive Chemical Hazards.

- Reacts with mild steel, galvanised steel / zinc producing hydrogen gas which may form an explosive mixture with air.
- Segregate from alkalies, oxidising agents and chemicals readily decomposed by acids, i.e. cyanides, sulfides, carbonates.
- NOTE: May develop pressure in containers; open carefully. Vent periodically.

For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

1H,1H,2H,2H-perfluorodecyltrichlorosilane

TOXICITY AND IRRITATION

1H,1H,2H,2H-PERFLUORODECYLTRICHLOROSILANE:

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

■ 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.

No significant acute toxicological data identified in literature search.

Section 12 - ECOLOGICAL INFORMATION

Harmful to aquatic organisms.

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

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
1H,1H,2H,2H-perfluorodecyltrichlorosilane	HIGH	No Data Available	LOW	LOW

Section 13 - DISPOSAL CONSIDERATIONS

US EPA Waste Number & Descriptions

A. General Product Information

Corrosivity characteristic: use EPA hazardous waste number D002 (waste code C)

Disposal Instructions

All waste must be handled in accordance with local, state and federal regulations.

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 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.
- Recycle wherever possible.
- Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
- Treat and neutralise at an approved treatment plant. Treatment should involve: Neutralisation with soda-ash or soda-lime followed by: burial in a land-fill specifically licenced to accept chemical and / or pharmaceutical wastes or Incineration in a licenced apparatus
- Decontaminate empty containers with 5% aqueous sodium hydroxide or soda ash, followed by water. Observe all label safeguards until containers are cleaned and destroyed.

Section 14 - TRANSPORTATION INFORMATION

DOT:

Symbols:	None	Hazard class or Division:	8
Identification Numbers:	UN2987	PG:	II
Label Codes:	8	Special provisions:	B2, T14, TP2, TP7, TP13, TP27
Packaging: Exceptions:	None	Packaging: Non-bulk:	206
Packaging: Exceptions:	None	Quantity limitations: Passenger aircraft/rail:	1 L
Quantity Limitations: Cargo aircraft only:	30 L	Vessel stowage: Location:	C
Vessel stowage: Other:	40		

Hazardous materials descriptions and proper shipping names:
Chlorosilanes, corrosive, n.o.s.

Air Transport IATA:

ICAO/IATA Class:	8	ICAO/IATA Subrisk:	None
UN/ID Number:	2987	Packing Group:	II
Special provisions:	A1		
Cargo Only			
Packing Instructions:	876	Maximum Qty/Pack:	30 L
Passenger and Cargo		Passenger and Cargo	
Packing Instructions:	Forbidden	Maximum Qty/Pack:	Forbidden
Passenger and Cargo Limited Quantity		Passenger and Cargo Limited Quantity	
Packing Instructions:	Forbidden	Maximum Qty/Pack:	Forbidden

Shipping name:CHLOROSILANES, CORROSIVE, N.O.S.(contains 1H,1H,2H,2H-perfluorodecyltrichlorosilane)

Maritime Transport IMDG:

IMDG Class:	8	IMDG Subrisk:	None
UN Number:	2987	Packing Group:	II
EMS Number:	F-A,S-B	Special provisions:	None
Limited Quantities:	0		

Shipping name:CHLOROSILANES, CORROSIVE, N.O.S.(contains 1H,1H,2H,2H-perfluorodecyltrichlorosilane)

Section 15 - REGULATORY INFORMATION

1H, 1H, 2H, 2H-perfluorodecyltrichlorosilane (CAS: 78560-44-8) is found on the following regulatory lists;
"Canada Non-Domestic Substances List (NDSL)", "US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory"

Section 16 - OTHER INFORMATION

LIMITED EVIDENCE

- Cumulative effects may result following exposure*.
- Limited evidence of a carcinogenic effect*.

* (limited evidence).

- 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.

- For detailed advice on Personal Protective Equipment, refer to the following U.S. Regulations and Standards:

OSHA Standards - 29 CFR:
1910.132 - Personal Protective Equipment - General requirements
1910.133 - Eye and face protection
1910.134 - Respiratory Protection
1910.136 - Occupational foot protection
1910.138 - Hand Protection
Eye and face protection - ANSI Z87.1
Foot protection - ANSI Z41
Respirators must be NIOSH approved.

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