Tridecafluorohexane-1-sulfonic acid potassium salt

sc-237289

Material Safety Data Sheet

Hazard Alert Code Key: EXTREME HIGH MODERATE LOW

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

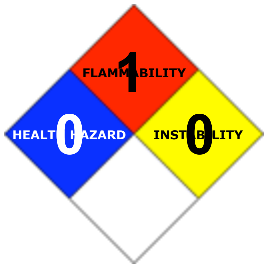
PRODUCT NAME

Tridecafluorohexane-1-sulfonic acid potassium salt

STATEMENT OF HAZARDOUS NATURE

CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO OSHA 29 CFR 1910.1200.

NFPA



SUPPLIER

Company: Santa Cruz Biotechnology, Inc.
Address:
2145 Delaware Ave
Santa Cruz, CA 95060
Telephone: 800.457.3801 or 831.457.3800
Emergency Tel: **CHEMWATCH: From within the US and Canada: 877-715-9305**
Emergency Tel: **From outside the US and Canada: +800 2436 2255 (1-800-CHEMCALL) or call +613 9573 3112**

PRODUCT USE

Fluorinated anionic surfactant.

SYNONYMS

C6-F13-K-O3-S, potassium, "1, 1, 2, 2, 3, 3, 4, 4, 5, 5, 6, 6, 6-tridecafluoro-1-hexanesulfonate", "1-hexanesulfonic acid, 1, 1, 2, 2, 3, 3, 4, 4, 5, 5, 6, 6, 6-trideca-, ", "fluoro-, potassium salt", "1-hexanesulfonic acid, tridecafluoro-, potassium salt", "potassium perfluorohexanesulfonate", "potassium perfluorohexylsulfonate"

Section 2 - HAZARDS IDENTIFICATION

CHEMWATCH HAZARD RATINGS

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

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

CANADIAN WHMIS SYMBOLS

EMERGENCY OVERVIEW

RISK

Toxic to bees.
Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

- Accidental ingestion of the material may be damaging to the health of the individual.
- Ingestion of anionic surfactants may produce diarrhea, bloated stomach,and occasional vomiting.

EYE

- There is some evidence to suggest that this material can causeeye irritation and damage in some persons.
- Direct eye contact with some anionic surfactants in high concentration can cause severe damage to the cornea. Low concentrations can cause discomfort, excess blood flow, and corneal clouding and swelling. Recovery may take several days.

SKIN

- 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.
- There is some evidence to suggest that this material can cause inflammation of the skin on contact in some persons.
- Anionic surfactants can cause skin redness and pain, as well as a rash. Cracking, scaling and blistering can occur.
- 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 is not thought to produce either adverse health effects or irritation of the respiratory tract following inhalation (as classified using animal models). Nevertheless, adverse 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 and that suitable control measures be used in an occupational setting.
- Persons with impaired respiratory function, airway diseases and conditions such as emphysema or chronic bronchitis, may incur further disability if excessive concentrations of particulate are inhaled.

CHRONIC HEALTH EFFECTS

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

Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems.

There is limited evidence that, skin contact with this product is more likely to cause a sensitization reaction in some persons compared to the general population.

Long term exposure to high dust concentrations may cause changes in lung function i.e. pneumoconiosis; caused by particles less than 0.5 micron penetrating and remaining in the lung. Prime symptom is breathlessness; lung shadows show on X-ray.

Prolonged or repeated skin contact may cause degreasing with drying, cracking and dermatitis following.

Perfluoroalkylsulfonyl fluoride-based products have included surfactants, paper and packaging treatments, surface protectants (e.g., for carpet, upholstery, textile) and are found in specialised fire-fighting foams (AFFF for example). Depending on the specific functional derivatisation or degree of polymerisation, such products may degrade or metabolize, to an undetermined degree, to perfluoroalkylsulfonates (such a perfluorooctanesulfonate - PFOS), which are stable and persistent end products that have the potential to bioaccumulate. Salts of PFOS are known to cause significant toxic effects, including mortality, in Cynomolgus monkeys (oral doses of 0.75 mg/ kg/ day),12 rabbits (oral doses of 3.75 mg kg/ day), rats (oral doses of 1.6 mg/ kg/day) and zooplankton (10 mg/l)

PFOS is persistent, bioaccumulative and toxic to mammalian species. There are species differences in the elimination half-life of PFOS; the half-life is 100 days in rats, 200 days in monkeys, and years in humans. The toxicity profile of PFOS is similar among rats and monkeys. Repeated exposure results in hepatotoxicity and mortality; the dose-response curve is very steep for mortality. This occurs in animals of all ages, although the neonate may be more sensitive. In addition, a 2-year bioassay in rats has shown that exposure to PFOS results in hepatocellular adenomas and thyroid follicular cell adenomas; the hepatocellular adenomas do not appear to be related to peroxisome proliferation.

In one study which followed exposed workers for 37 years there was a statistically significant risk of death from bladder cancer. Neoplasms of the male reproductive system, of the gastrointestinal tract also appeared to be elevated. Risk ratios were highest in workers with highest and longest exposure to fluorochemicals. PFOS has not been shown to be genotoxic in a variety of assay systems.

Lower molecular weight homologues such as perfluorobutanesulfonate (PFBS) do not exhibit the levels of toxicity or bioaccumulation of the higher homologues. Studies show PFBS is highly bound to human albumin with indications of a saturated binding to albumin in serum and negligible binding to the other liver-manufactured proteins gamma globulin, alpha globulin, fibrinogen, alpha-2-macroglobulin, transferrin and beta lipoproteins

The results of two in vitro studies and a chromosomal aberration test show no evidence of mutagenicity due to potassium PFBS. Animal data to date does not indicate potassium PFBS is a developmental toxin nor a substance toxic to reproduction, fertility or lactation.

In humans PFBS has a much shorter half-life than PFOS (just over one month vs 5.5 years).

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
perfluoro-1-hexanesulfonic acid, potassium salt	3871-99-6	>98

Section 4 - FIRST AID MEASURES

SWALLOWED

■

- If swallowed do NOT induce vomiting.
- If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
- Observe the patient carefully.
- Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.
- Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink.
- Seek medical advice.

EYE

■ If this product comes in contact with the eyes:

- Wash out immediately with fresh running water.
- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- If pain persists or recurs seek medical attention.
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN

■ If skin contact occurs:

- Immediately remove all contaminated clothing, including footwear
- Flush skin and hair with running water (and soap if available).
- Seek medical attention in event of irritation.

INHALED

■

- If dust is inhaled, remove from contaminated area.
- Encourage patient to blow nose to ensure clear passage of breathing.
- If irritation or discomfort persists seek medical attention.

NOTES TO PHYSICIAN

■ Treat symptomatically.

Section 5 - FIRE FIGHTING MEASURES

Vapour Pressure (mmHG):	Negligible
Upper Explosive Limit (%):	Not available.
Specific Gravity (water=1):	Not available
Lower Explosive Limit (%):	Not available

EXTINGUISHING MEDIA

■

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

FIRE FIGHTING

■

- Alert Emergency Responders and tell them location and nature of hazard.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or water course.
- Use water delivered as a fine spray to control fire and cool adjacent area.
- 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.
- Equipment should be thoroughly decontaminated after use.

GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS

■

- Combustible solid which burns but propagates flame with difficulty.
- Avoid generating dust, particularly clouds of dust in a confined or unventilated space as dusts may form an explosive mixture with air, and any source of ignition, i.e. flame or spark, will cause fire or explosion. Dust clouds generated by the fine grinding of the solid are a particular hazard; accumulations of fine dust may burn rapidly and fiercely if ignited.

- Dry dust can be charged electrostatically by turbulence, pneumatic transport, pouring, in exhaust ducts and during transport.
- Build-up of electrostatic charge may be prevented by bonding and grounding.
- Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.

Combustion products include: carbon monoxide (CO), carbon dioxide (CO2), hydrogen fluoride, sulfur oxides (SOx), other pyrolysis products typical of burning organic material.
May emit poisonous fumes.
May emit corrosive fumes.

FIRE INCOMPATIBILITY

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

PERSONAL PROTECTION

Glasses:
Chemical goggles.
Gloves:
Respirator:
Particulate

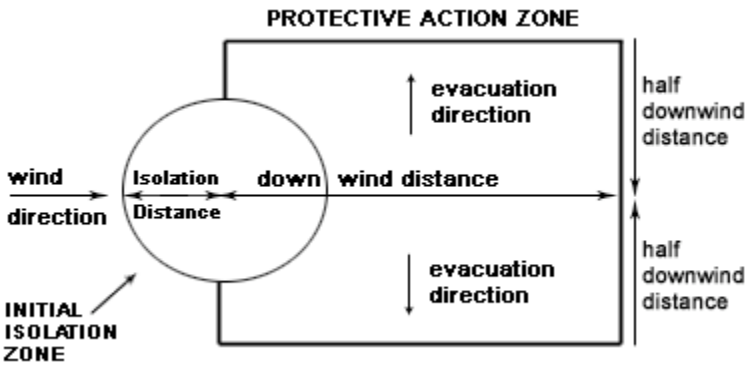
Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS
■ Environmental hazard - contain spillage.
- Remove all ignition sources.
- Clean up all spills immediately.
- Avoid contact with skin and eyes.
- Control personal contact by using protective equipment.
- Use dry clean up procedures and avoid generating dust.
- Place in a suitable, labelled container for waste disposal.

MAJOR SPILLS
■ Environmental hazard - contain spillage.
Moderate hazard.
- CAUTION: Advise personnel in area.
- Alert Emergency Responders and tell them location and nature of hazard.
- Control personal contact by wearing protective clothing.
- Prevent, by any means available, spillage from entering drains or water courses.
- Recover product wherever possible.
- IF DRY: Use dry clean up procedures and avoid generating dust. Collect residues and place in sealed plastic bags or other containers for disposal. IF WET: Vacuum/shovel up and place in labelled containers for disposal.
- ALWAYS: Wash area down with large amounts of water and prevent runoff into drains.
- If contamination of drains or waterways occurs, advise emergency services.

PROTECTIVE ACTIONS FOR SPILL

WARNING
MAY DECOMPOSE EXPLOSIVELY AT HIGH TEMPERATURES.



From IERG (Canada/Australia)	
Isolation Distance	-
Downwind Protection Distance	-

From US Emergency Response Guide 2000 Guide No guide found.

FOOTNOTES

1 PROTECTIVE ACTION ZONE is defined as the area in which people are at risk of harmful exposure. This zone assumes that random changes in wind direction confines the vapour plume to an area within 30 degrees on either side of the predominant wind direction, resulting in a crosswind protective action distance equal to the downwind protective action distance.
2 PROTECTIVE ACTIONS should be initiated to the extent possible, beginning with those closest to the spill and working away from the site in the downwind direction. Within

the protective action zone a level of vapour concentration may exist resulting in nearly all unprotected persons becoming incapacitated and unable to take protective action and/or incurring serious or irreversible health effects.
3 INITIAL ISOLATION ZONE is determined as an area, including upwind of the incident, within which a high probability of localised wind reversal may expose nearly all persons without appropriate protection to life-threatening concentrations of the material.
4 SMALL SPILLS involve a leaking package of 200 litres (55 US gallons) or less, such as a drum (jerrican or box with inner containers). Larger packages leaking less than 200 litres and compressed gas leaking from a small cylinder are also considered "small spills". LARGE SPILLS involve many small leaking packages or a leaking package of greater than 200 litres, such as a cargo tank, portable tank or a "one-tonne" compressed gas cylinder.
5 Guide No guide found. is taken from the US DOT emergency response guide book.
6 IERG information is derived from CANUTEC - Transport Canada.

ACUTE EXPOSURE GUIDELINE LEVELS (AEGL) (in ppm)

AEGL 1: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.
AEGL 2: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.
AEGL 3: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

■

- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.
- DO NOT enter confined spaces until atmosphere has been checked.
- DO NOT allow material to contact humans, exposed food or food utensils.
- 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.

Empty containers may contain residual dust which has the potential to accumulate following settling. Such dusts may explode in the presence of an appropriate ignition source.

- Do NOT cut, drill, grind or weld such containers.
- In addition ensure such activity is not performed near full, partially empty or empty containers without appropriate workplace safety authorisation or permit.

RECOMMENDED STORAGE METHODS

■

- Polyethylene or polypropylene container.
- Check all containers are clearly labelled and free from leaks.

STORAGE REQUIREMENTS

■

- 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.

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS

+	+	+	+	X	+

X: Must not be stored together
O: May be stored together with specific preventions
+: May be stored together

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

The following materials had no OELs on our records

- perfluoro-1-hexanesulfonic acid, potassium salt: CAS:3871-99-6

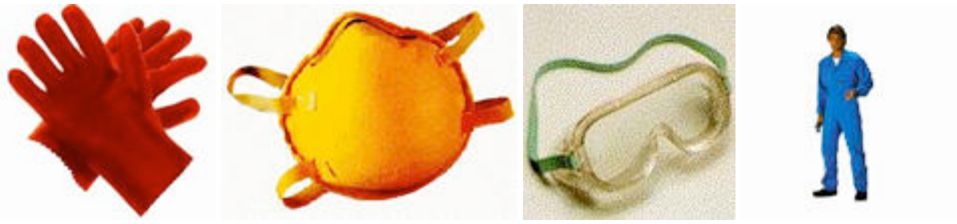
MATERIAL DATA

PERFLUORO-1-HEXANESULFONIC ACID, POTASSIUM SALT:
■ It is the goal of the ACGIH (and other Agencies) to recommend TLVs (or their equivalent) for all substances for which there is evidence of health effects at airborne concentrations encountered in the workplace.
At this time no TLV has been established, even though this material may produce adverse health effects (as evidenced in animal experiments or clinical experience). Airborne concentrations must be maintained as low as is practically possible and occupational exposure must be kept to a minimum.
NOTE: The ACGIH occupational exposure standard for Particles Not Otherwise Specified (P.N.O.S) does NOT apply.
Sensory irritants are chemicals that produce temporary and undesirable side-effects on the eyes, nose or throat. Historically occupational exposure standards for these irritants have been based on observation of workers' responses to various airborne concentrations. Present day expectations require that nearly every individual should be protected against even minor sensory irritation and exposure standards are established using uncertainty factors or safety factors of 5 to 10 or more. On occasion animal no-observable-effect-levels (NOEL) are used to determine these limits where human results are unavailable. An additional approach, typically used by the TLV committee (USA) in determining respiratory standards for this group of chemicals, has been to assign ceiling values (TLV C) to rapidly acting irritants and to assign short-term exposure limits (TLV STELs) when the weight of evidence from irritation, bioaccumulation and other endpoints combine to warrant such a limit. In contrast the MAK Commission (Germany) uses a five-category system based on intensive odour, local irritation, and elimination half-life. However this system is being replaced to be consistent with the European Union (EU) Scientific Committee for Occupational Exposure Limits (SCOEL); this is more closely allied to that of the USA.
OSHA (USA) concluded that exposure to sensory irritants can:

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

CEL TWA: 0.1 mg/m3 [3M - for similar products]

PERSONAL PROTECTION



Consult your EHS staff for recommendations

EYE

■

- Safety glasses with side shields.
- Chemical goggles.
- Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. DO NOT wear contact lenses.

HANDS/FEET

■ NOTE: The material may produce skin sensitization in predisposed individuals. Care must be taken, when removing gloves and other protective equipment, to avoid all possible skin contact.
Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:

- 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).

- 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) 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) 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.

Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present.

- polychloroprene
- nitrile rubber
- butyl rubber
- fluorocaoutchouc
- polyvinyl chloride

Gloves should be examined for wear and/ or degradation constantly.

OTHER

■

- Overalls.
- P.V.C. apron.
- Barrier cream.
- Skin cleansing cream.
- Eye wash unit.

RESPIRATOR

■

- Respirators may be necessary when engineering and administrative controls do not adequately prevent exposures.
- The decision to use respiratory protection should be based on professional judgment that takes into account toxicity information, exposure measurement data, and frequency and likelihood of the worker's exposure - ensure users are not subject to high thermal loads which may result in heat stress or distress due to personal protective equipment (powered, positive flow, full face apparatus may be an option).
- Published occupational exposure limits, where they exist, will assist in determining the adequacy of the selected respiratory . These may be government mandated or vendor recommended.
- Certified respirators will be useful for protecting workers from inhalation of particulates when properly selected and fit tested as part of a complete respiratory protection program.
- Use approved positive flow mask if significant quantities of dust becomes airborne.
- Try to avoid creating dust conditions.

RESPIRATOR

■

Protection Factor	Half-Face Respirator	Full-Face Respirator	Powered Air Respirator
10 x PEL	P1	-	PAPR-P1
	Air-line*	-	-
50 x PEL	Air-line**	P2	PAPR-P2
100 x PEL	-	P3	-
		Air-line*	-
100+ x PEL	-	Air-line**	PAPR-P3

* - Negative pressure demand ** - Continuous flow

Explanation of Respirator Codes:
Class 1 low to medium absorption capacity filters.
Class 2 medium absorption capacity filters.
Class 3 high absorption capacity filters.
PAPR Powered Air Purifying Respirator (positive pressure) cartridge.
Type A for use against certain organic gases and vapors.
Type AX for use against low boiling point organic compounds (less than 65ºC).
Type B for use against certain inorganic gases and other acid gases and vapors.
Type E for use against sulfur dioxide and other acid gases and vapors.
Type K for use against ammonia and organic ammonia derivatives
Class P1 intended for use against mechanically generated particulates of sizes most commonly encountered in industry, e.g. asbestos, silica.
Class P2 intended for use against both mechanically and thermally generated particulates, e.g. metal fume.
Class P3 intended for use against all particulates containing highly toxic materials, e.g. beryllium.

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required.

Use appropriate NIOSH-certified respirator based on informed professional judgement. In conditions where no reasonable estimate of exposure can be made, assume the exposure is in a concentration IDLH and use NIOSH-certified full face pressure demand SCBA with a minimum service life of 30 minutes, or a combination full facepiece pressure demand SAR with auxiliary self-contained air supply. Respirators provided only for escape from IDLH atmospheres shall be NIOSH-certified for escape from the atmosphere in which they will be used.

ENGINEERING CONTROLS

■

- Local exhaust ventilation is required where solids are handled as powders or crystals; even when particulates are relatively large, a certain proportion will be powdered by mutual friction.
- Exhaust ventilation should be designed to prevent accumulation and recirculation of particulates in the workplace.
- If in spite of local exhaust an adverse concentration of the substance in air could occur, respiratory protection should be considered. Such protection might consist of:

(a): particle dust respirators, if necessary, combined with an absorption cartridge;
(b): filter respirators with absorption cartridge or canister of the right type;
(c): fresh-air hoods or masks

- Build-up of electrostatic charge on the dust particle, may be prevented by bonding and grounding.
- Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.

Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to efficiently remove the contaminant.

Type of Contaminant:	Air Speed:
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 favorable 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 4-10 m/s (800-2000 f/min) for extraction of crusher dusts generated 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

Solid.
Does not mix with water.

State	Divided solid	Molecular Weight	439.22
Melting Range (°F)	Not available	Viscosity	Not Applicable
Boiling Range (°F)	Not available	Solubility in water (g/L)	Partly miscible
Flash Point (°F)	Not available	pH (1% solution)	Not applicable
Decomposition Temp (°F)	Not available.	pH (as supplied)	Not applicable
Autoignition Temp (°F)	Not available	Vapour Pressure (mmHG)	Negligible
Upper Explosive Limit (%)	Not available.	Specific Gravity (water=1)	Not available
Lower Explosive Limit (%)	Not available	Relative Vapor Density (air=1)	>1
Volatile Component (%vol)	Negligible	Evaporation Rate	Not applicable

APPEARANCE

Solid; does not mix well with water.

PFOS has a solubility of approximately 550 mg/l in pure water - the solubility decreases with increased salt content. For example the potassium salt of PFOS has a solubility of 370 mg/l in pure water. Due to surface active properties of PFOS, the log Kow cannot be measured. The potassium salt of PFOS has a low vapour pressure, 3.31 x 10-4 Pa at 20 C.

Material	Value

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY

■

- Presence of incompatible materials.
- Product is considered stable.
- Hazardous polymerization will not occur.

STORAGE INCOMPATIBILITY

■ Avoid reaction with oxidizing agents.

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

Section 11 - TOXICOLOGICAL INFORMATION

PERFLUORO-1-HEXANESULFONIC ACID, POTASSIUM SALT

TOXICITY AND IRRITATION

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

■ for perfluorinated sulfonates:

Toxicology studies of the C4 fluoroalkyl sulfonate (PFBS), the C8 fluoroalkyl sulfonate (PFOS) and the C8 fluorocarboxylic acid (PFOA) indicate that chain length is an important factor in toxicity, perhaps partially due to pharmacokinetic factors; toxicity and persistence appears to increase with increasing chain length. Human biomonitoring studies have shown that the C6 perfluorosulfonate, PFOS and PFOA are present in the serum of the general US population, and that the levels of the C6 perfluorosulfonate are quite high in children. Other chain lengths have not yet been monitored in the general population. Environmental monitoring studies have demonstrated the presence of the entire series of perfluorinated compounds, as well as some higher homologs. Current hazard and risk assessments have addressed individual chemicals. If there is a common mode of action for these chemicals the latter efforts are likely to underestimate potential hazard and risk to exposed populations.

Extensive pharmacokinetic information is available for PFOS (perfluorooctanesulfonate) and PFOA (perfluorooctanoic acid) and more limited information is available for PFBS (perfluorobutanesulfonate) The existing information for PFOS and PFOA suggest the following issues may be critical determinants of pharmacokinetics and blood dosimetry for other members of the class:

- These compounds are well absorbed.
- The carboxylic acids and sulfonates are cleared by urinary and biliary elimination in rodents with no evidence of metabolism, while the telomer alcohols are metabolised apparently to carboxylic acid derivatives. Extensive enterohepatic recirculation has been demonstrated for both PFOA and PFOS.
- Species and sex differences in clearance are most dramatic for PFOA (female rat (hrs)>>male rat (days)>mouse>monkey (weeks)>human (years)). PFOS demonstrates higher blood levels in female rats than males following repeated exposures and the clearance during week 105 was faster than older intravenous and oral studies would predict. PFBS is rapidly eliminated in several hours in rats. The mechanism(s) for species and sex variation in clearance is ill-defined but may in part be related to differential expression of renal transport proteins.
- Serum protein binding (generally albumin) is extensive resulting in high concentrations in serum. Liver has very high concentrations as well, followed by kidney. Other tissues have generally low concentrations (and the fluorination make this a non-lipophilic compound), but account for a significant fraction of the mass in the body.

There is extensive toxicology information available on PFBS, PFOS and PFOA. Studies of PFOS and PFOA have shown that the developing organism is a primary target. A two generation reproductive toxicity study of PFOS in rats, and several subsequent studies in rats and mice, have shown a very high incidence of mortality in the F1 offspring in the first few days following birth. A two-generation reproductive toxicity study of PFOA in rats has demonstrated mortality in the F1 offspring in the first few days following weaning, as well as a delay in sexual maturation. Preliminary studies of PFOA in mice have shown a mortality pattern very similar to that observed following exposure to PFOS in that mortality occurs in the first few days after birth.

In contrast, these effects were not noted in a two-generation reproductive toxicity study of PFBS in rats or a limited one-generation toxicity study of C6 perfluorosulfonate in rats. To date, there is no information on developmental effects following exposure to chain lengths greater than C8.

In addition, several of the compounds in the perfluorinated series are peroxisome proliferators, and PFOS and PFOA have been shown to be carcinogenic in rats. Chronic studies of PFOA in rats have shown the presence of hepatocellular, Leydig cell and pancreatic acinar cell tumors. PFOA is a demonstrated PPAR-alpha (peroxisome proliferator-activated receptor) agonist and this has been hypothesised to be the mode of action for the hepatocellular adenomas. Chronic exposure of PFOS in rats is also associated with hepatocellular adenomas. PFOS is also a peroxisome proliferator, but studies have not been conducted to firmly establish the role of PPAR-alpha agonism in the induction of the liver adenomas. Chronic exposure studies of PFBS have not yet been conducted. Although preliminary studies indicate that PFBS is a weak peroxisome proliferator at comparatively high doses, only very limited liver toxicity has been noted in a two-generation reproductive toxicity study, and no liver toxicity was noted in 28-day and 90-day studies at comparable doses.

Limited studies of the C9 and C10 perfluorocarboxylic acids indicate that both compounds are peroxisome proliferators. Thus, it is likely that liver adenomas may be expected following chronic exposures to many of the compounds in the proposed series. However, several scientific groups have concluded that PPAR-a agonist induced liver tumors in adult rodents are of questionable relevance to humans. Others have questioned whether chronic exposure to peroxisome proliferators would result in a different outcome if exposures were initiated prenatally rather than in adulthood.

No significant acute toxicological data identified in literature search.

Section 12 - ECOLOGICAL INFORMATION

Refer to data for ingredients, which follows:

PERFLUORO-1-HEXANESULFONIC ACID, POTASSIUM SALT:

■ Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

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

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

■ Toxic to bees.

■ For perfluorinated sulfonates (perfluoroalkylsulfonates (PFAS); fluoralkyl sulfonates; fluorinated surfactants):

The fluoroalkyl sulfonates (C6 - C12) and their derivatives were predominantly intermediates for the polymeric products used as water, oil, and stain treatments for carpet, paper, and textiles. A few product lines were developed to use the surfactant properties including metal working fluids, fire fighting foams, and photographic additives. The C6 and C8 product lines were the dominant materials manufactured. Some higher homologs as well as other residual organic fluorides have no commercial use but are components of the formulated final products. Ultimately the sulfonates may be the degradation chemicals from the corresponding polymeric products. The fluorocarboxylic acids have chemical properties that make them useful as additives and surfactants, the chief use being as a processing aid for the polymerisation of fluoropolymers (polytetrafluoroethylene - PTFE, Teflon, polyvinylidine fluoride). The 8:2 and 10:2 fluorotelomeric alcohols (perfluoroalkyl ethanols) are the building blocks (and the anticipated abiotic degradation products) for most of the polymeric products used as carpet, paper and textile coatings to impart water, oil, and soil repellency. The alcohols have no substantial market apart from chemical intermediates.

There is evidence that PFAS chemicals degrade back to perfluoroalkylsulfonic acid (PFASA), which exists in the anionic form in the environment, or to PFASA precursors. Further degradation of PFASA is not observed under normal environmental conditions. In fact, PFASA is highly persistent in the environment and has a tendency to bioaccumulate. PFASA can continue to be formed by any PFAS containing chemicals introduced into the environment. Studies have found PFAS chemicals containing five to fourteen carbons (C5-C14) in very small quantities in the blood of the general human population as well as in wildlife, indicating that exposure to the chemicals is widespread. Biological sampling has discovered the presence of certain perfluoroalkyl compounds in fish and in fish-eating birds across the United States and in locations in Canada, Sweden, and the South Pacific . The wide distribution of the chemicals in high trophic levels is strongly suggestive of the potential for bioaccumulation and/or bioconcentration. Based on currently available information, the US EPA believes that while all PFAS chemicals are expected to persist, the length of the perfluorinated chain may also have an effect on bioaccumulation and toxicity, which are also characteristics of concern for these chemicals. PFAS chemicals with longer carbon chain lengths may be of greater concern than those with shorter chain lengths

While most studies to date have focused primarily on PFOS (with eight carbons (C8)), structure-activity relationship analysis indicates that the results of those studies are applicable to the category of PFAS chemicals, which includes PFOS. Available test data have raised concerns about their potential developmental, reproductive, and systemic toxicity Toxicology studies show that PFOS, as measured in its anionic form, is well absorbed orally and distributes primarily to the serum and liver. It does not appear to be further metabolised. Elimination from the body is slow and occurs via both urine and faeces. The carbon chain length causes considerable differences in bioconcentration factors (BCFs) among PFAS formulations and perfluorinated carboxylic acids (the longer the chain length, the higher the BCF). By contrast C4 PFAS with 4 carbons (PFBS) is not bioaccumulative or toxic to aquatic organisms. As PFBS is persistent, levels may build up and be distributed widely in the environment over time. However, PFBS will stay mostly in the water column due to the much higher water solubility compared with higher PFAS homologues.

Environmental fate:

Perfluoroalkylsulfonates (PFAS) such as perfluorooctyl- and perfluorononyl- sulfonates (PFOS and PFNS) are substances which may cause long-term adverse effects to the environment. They are chemically and thermally resistant. For example trifluoromethanesulfonic acid (triflic acid; $CF3SO3H$; one of the strongest acids known) has great thermal stability and does not release fluoride in the presence of strong nucleophiles, and resists both oxidation and reduction. Similarly PFOSA has excellent chemical and thermal stability.

PFOS is persistent in the environment and has been shown to bioconcentrate in fish. It has been detected in a number of species of wildlife, including marine animals. Its persistence, presence in the environment and bioaccumulation indicate cause for concern. It appears to be of low to moderate toxicity to aquatic organisms but there is evidence of high acute toxicity to honey bees. Little information is available on effects on soil- and sediment-dwelling organisms.

PFOS has been detected in sediment downstream of a production site and in effluents and sludge from sewage treatment plants. PFOS and triflic acid are resistant to biological attack although some PFAS are partially degraded by Pseudomonad under aerobic and sulfur limiting conditions.While some of the perfluorinated organics undergo limited biotransformation, none undergo extensive defluorination

PFOS has a solubility of approximately 550 mg/l in pure water - the solubility decreases with increased salt content. For example the potassium salt of PFOS has a solubility of 370 mg/l in pure water. Due to surface active properties of PFOS, the log Kow cannot be measured. The potassium salt of PFOS has a low vapour pressure, 3.31 x 10-4 Pa at 20 C.

PFOS is persistent in the environment. It does not hydrolyse, photolyse or biodegrade under environmental conditions and is not expected to volatilise, based on an air/water partition coefficient of < 2E-6 Pa.m3/mol. PFOS has been shown to bioconcentrate in the tissues of bluegill sunfish and carp. In bluegill sunfish, BCF (BCFK) values between 1124 and 4013 were determined and PFOS depurated slowly with estimated 50% clearance times of up to 116 days. In carp, BCF values were determined to be between 200 and 1500.

Biodegradation The biodegradability of PFOS was examined in a MITI-I test . No significant degradation of PFOS was observed in 28 days, either as net oxygen demand from degradation of test substance (i.e., ultimate degradation), loss of total organic carbon (TOC; another way to measure ultimate degradation), or loss of parent compound identity (primary degradation). Average percentage biodegradation after 28 days was observed to be 0% by oxygen demand; 6% by removal of total organic carbon; and 3% by liquid chromatography-mass spectrometry (LC-MS; measures primary degradation). These values are indicative of no significant degradation.

The majority of PFOS-related chemicals are high molecular weight polymers of which PFOS represents a fraction of the total molecular weight. Degradation of these polymers to PFOS in the environment or within organism is of significant concern and strategies are in place, world-wide, to phase out the use and production of these substances.

Ecotoxicity:

Perfluorosulfonated molecules have a chemical "head" and a chemical "tail" of a carbon and fluorine chain. Studies of those with different "head" and "tail" features revealed that the longer the "tail" the greater the accumulation in fish. Toxic effects in aquatic invertebrates, fish and aquatic plants varied depending on the "head" type and the length of the "tail" of the substance. Plants were sensitive more to the short and long chain materials and in general were more sensitive than aquatic invertebrates, except for one particularly sensitive invertebrate species. The longer "tail" substances tended to be more persistent in the aquatic environment. They are found in very low levels (1 in one trillion) in lakes, rivers, rainwater and air PFOS shows moderate acute toxicity to aquatic organisms, the lowest LC50 for fish is a 96-hour LC50 of 4.7 mg/l to the fathead minnow Pimephales promelas for the lithium salt. For aquatic invertebrates, the lowest EC50 for freshwater species is a 48-hour EC50 of 27 mg/l for Daphnia magna and for saltwater species, a 96-hour LC50 value of 3.6 mg/l for the Mysid shrimp Mysidopsis bahia. Both tests were conducted on the potassium salt. For algae, the potassium salt gave a 96h NOEC of >3.2 mg/l with Skeletonema costatum.

Long-term toxicity data is available for fish and aquatic invertebrates. The lowest NOEC for fish is a 42 day NOEC (survival) of 0.3 mg/l in an early life stage test with Pimephales promelas using the potassium salt. The lowest NOEC for aquatic invertebrates is a 35-day NOEC reproduction of 0.25 mg/l for Mysidopsis bahia using the potassium salt. For freshwater species, there is a 28-day NOEC reproduction of 7 mg/l for Daphnia magna, also using the potassium salt.

PFOS does not appear to be toxic to sewage sludge microorganisms. In an activated sludge respiration inhibition test, the 3-hour IC50 value for PFOS (potassium salt) was >905 mg/l (nominal concentration). No data are available for effects on soil-dwelling or sediment-dwelling species.

PFOS has been tested on two species of bird, the Mallard duck, Anas platyrhynchos, and the Northern Bobwhite quail, Colinus virginianus. The lowest acute dietary LC50 value of 220 mg/kg of food was determined in the test with the quail. The lowest NOEC of 37 mg/kg of food for effects on body weight was, in contrast, obtained in the test with the duck.

There are data available from acute oral and contact toxicity tests on the Honey bee (Apis mellifera) using PFOS potassium salt. These studies indicate moderate and high orders of toxicity of PFOS to bees when administered via these routes. The acute oral test yielded a 72-hour LD50 for ingestion of PFOS of 0.40 ug/bee and a 72-hour NOEL of 0.21 ug/bee. The contact test yielded a 96-hour LD50 of 4.78 ug/bee and a 96-hour NOEL of 1.93 ug/bee.

The results of an amphibian teratogenesis study carried out with Xenopus laevis (African clawed frog) show PFOS potassium salt to be acutely toxic to (96-hour LC50 = 13.8 mg/l), and cause malformations in (96-hour EC50 = 12.1 mg/l), frog embryos. The minimum concentration that inhibited growth of the embryos was determined to be 7.97 mg/l. A teratogenic index of 1.1 was determined from the ratio of the 96-hour LC50 to the 96-hour EC50, indicating a low potential for PFOS to be a developmental hazard in this species.

■ DO NOT discharge into sewer or waterways.

Section 13 - DISPOSAL CONSIDERATIONS

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. 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.

- 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.
- Dispose of by: Burial in a licensed land-fill or Incineration in a licensed apparatus (after admixture with suitable combustible material)
- Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

Section 14 - TRANSPORTATION INFORMATION

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS: DOT, IATA, IMDG

Section 15 - REGULATORY INFORMATION

REGULATIONS

perfluoro-1-hexanesulfonic acid, potassium salt (CAS: 3871-99-6) is found on the following regulatory lists;

"Canada Domestic Substances List (DSL)","US Toxic Substances Control Act (TSCA) - Inventory","US TSCA Section 12(b) - List of Chemical Substances Subject to Export Notification Requirements","US TSCA Section 5(a)(2) - Significant New Use Rules (SNURs)"

Section 16 - OTHER INFORMATION

LIMITED EVIDENCE

■ Ingestion may produce health damage*.
■ Cumulative effects may result following exposure*.
■ May produce discomfort of the eyes and skin*.
■ Limited evidence of a carcinogenic effect*.
■ Possible skin sensitizer*.
■ Repeated exposure potentially causes skin dryness and cracking*.
* (limited evidence).

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■ Classification of the mixture 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.

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