

Magnesium perchlorate

sc-211763



The Power is Question

Material Safety Data Sheet

Hazard Alert Code
Key:

EXTREME

HIGH

MODERATE

LOW

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME

Magnesium perchlorate

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

As a drying agent for gases. The article of commerce may contain an amount of water equivalent to a dihydrate, but even the trihydrate is said to be effective for drying gases.

SYNONYMS

Mg-Cl₂-O₈, Mg(ClO₄)₂, anhydron, dehydrite, "perchloric acid, magnesium salt", "magnesium perchlorate hydrate ACS drying agent"

Section 2 - HAZARDS IDENTIFICATION

CANADIAN WHMIS SYMBOLS



EMERGENCY OVERVIEW

RISK

Contact with combustible material may cause fire.

Reacts violently with water.

Irritating to eyes, respiratory system and skin.

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

Accidental ingestion of the material may be damaging to the health of the individual.

- Symptoms of exposure to perchlorates include shortness of breath, difficulty breathing and a bluish discoloration of the skin. The effects may be delayed for several hours following exposure. Nausea, vomiting, rashes, fever may occur; there may be anemia (which can be fatal), loss of platelets and white blood cells.
- Nausea and vomiting are almost always apparent after chlorate poisonings usually with upper stomach pain. Diarrhea may also occur. Chlorates are poisonous to the kidney and this can cause death. Healing can be slow and kidney symptoms last weeks. Often there is severe blood cell damage.
- Magnesium salts are generally absorbed so slowly that oral administration causes few toxic effects, as the dose is readily expelled via the bowel. If evacuation fails, mucosal irritation and absorption may result. This can result in nervous system depression, heart effects, loss of reflexes and death due to paralysis of breathing. These usually do not occur unless the bowel or kidneys are damaged.

EYE

- This material can cause eye irritation and damage in some persons.

SKIN

- This material can cause inflammation of the skin oncontact in some persons.
- The material may accentuate any pre-existing dermatitis condition.
- Skin contact with the material may damage the health of the individual; systemic effects may result following absorption.
- 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.
- 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

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

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

Based on experience with animal studies, there is a possibility that exposure to the material may result in toxic effects to the development of the fetus, at levels which do not cause significant toxic effects to the mother.

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.

Chronic and/or sub-lethal exposure to inorganic chlorate may have deleterious effects on human health, such as redness of the eyes and skin (including dermatitis), sore throat, abdominal pain, blue lips or skin, diarrhea, nausea, vomiting, shortness of breath, and unconsciousness. Sodium chlorate may damage the liver, kidneys, and blood cells of humans.

Subchronic chlorate exposure was associated with smaller body and organ weights, blood abnormalities and pituitary and thyroid abnormalities in one study using Sprague-Dawley rats.

Chlorate is a thyroid toxicant producing thyroid gland follicular cell hypertrophy in rats and mice following chronic exposures, and may produce follicular cell tumors in rats. The lack of mutagenicity indicates that the thyroid tumors are induced by a non-mutagenic mechanism and are therefore not likely to be carcinogenic. The effects may be attributed to changes in levels of thyroid hormones seen after administration of high doses of sodium chlorate. In female mice there was equivocal and marginal evidence of increased pancreatic islet carcinoma. Sodium chlorate was negative in most bacterial gene mutation assays and in several cytogenetics tests, including a hypoxanthineguanine phosphoribosyl-transferase (HGPRT) assay in Chinese hamster ovaries and a micronucleus assay.

Intramuscular administration of potassium chlorate to pregnant rats resulted in a prolonged gestation period in most cases, and reduced neonatal weight relative to the controls. According to the author, newborn rats also showed a "marked" increase of haematopoietic residue and lipid deposit over controls, and occasionally, exposure resulted in the appearance of hyaline droplets and casts in newborn kidneys. The number of animals per treatment group/number affected, duration of exposure, and information on dose levels was not available.

African green monkeys (five males and seven females) were used to study the thyroid effects of sodium chlorate when administered for 30-60 days as chlorate at concentrations of 4, 7.5, 15, 30 or 58.4 mg/kg bw per day. Chlorate did not induce thyroid depression. Chlorate did not induce a dose-dependent oxidative stress, as was observed in the case of chlorite.








Female rats were exposed to 1 or 10 mg chlorate/L in their drinking water for ten weeks. Fetuses were taken on the 20th day of gestation and examined for external, visceral and skeletal malformations. No significant adverse findings were reported.

No chromosomal abnormalities were seen in either the micronucleus test or a cytogenetic assay in mouse bone marrow cells following gavage dosing with chlorate.

Perchlorates may affect the use of iodine by the thyroid gland and chronic exposures may result in symptoms of thyroid dysfunction such as goiter.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

HAZARD RATINGS

	Min	Max	
Flammability:	0		
Toxicity:	2		
Body Contact:	2		
Reactivity:	2		
Chronic:	2		
			Min/Nil=0 Low=1 Moderate=2 High=3 Extreme=4
			 

NAME	CAS RN	%
magnesium perchlorate	10034-81-8	>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 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.

NOTES TO PHYSICIAN

- Magnesium is present in the blood, as a normal constituent, at concentrations between 1.6 to 2.2 meq/l. Some 30% is plasma bound. At serum magnesium levels of 3-4 meq/l, signs of CNS depression, loss of reflexes, muscular tone and power, and bradycardia occur. Cardiac arrest (sometimes fatal) and/or respiratory paralysis can occur at plasma levels of 10-15 meq/l. For acute or short term repeated exposures to magnesium:
 - Symptomatic hypermagnesemia appears rarely in the absence of intestinal or renal disease.
 - Elevated magnesium levels may cause hypocalcemia because of decreased parathyroid hormone activity and decreased end-organ responsiveness.
 - Patients with sever hypermagnesemia may develop sudden respiratory arrest and must be watched closely for apnea.
 - Use fluids, then vasopressors for hypotension. Frequently hypotension responds to calcium administration.
 - Induce emesis or administer lavage if patient presents within 4 hours of ingestion. Use sodium cathartics, with caution, in presence of cardiac or renal failure.
 - Activated charcoal is not useful.
 - Calcium is an antagonist of magnesium action and is an effective antidote when serum levels exceed 5MEg/L and the patient exhibits symptoms The adult dose of calcium gluconate is 10 ml of a 10% solution over several minutes.

[Ellenhorn and Barceloux: Medical Toxicology].

Antithyroid effects produced by the perchlorates may be reversed with iodine. Patients should be warned to report the development of sore throat, fever or rashes since the are indicative of blood abnormalities.

For chlorates:

For severe intoxication: Empty the stomach by lavage and aspiration or by emesis, give demulcents or sweetened drinks and maintain respiration. Pethidine may be given if required. A 1% solution of sodium thiosulfate may be used for lavage and may also be given by intravenous infusion. Haemodialysis, peritoneal dialysis or exchange perfusions may be of value in removing chlorate from the blood. Forced diuresis should not be attempted if there is inadequate urine input.

MARTINDALE: The Extra Pharmacopoeia, 27th Edition

The high sensitivity of glucose-6-phosphate dehydrogenase to denaturation by chlorate explains the inefficacy of methylene blue to reduce methaemoglobin formed, as the antidotal effect of methylene blue depends on NADPH formed mainly by the oxidation of glucose-6-phosphate. The observed changes occur only in the presence of methaemoglobin which forms a destabilising complex with chlorate. Methaemoglobin thus autocatalytically increases methaemoglobin formation and destruction of the erythrocyte.

Section 5 - FIRE FIGHTING MEASURES

Vapour Pressure (mmHG):	Not applicable.
Upper Explosive Limit (%):	Not Applicable
Specific Gravity (water=1):	2.21 @ 18 deg.C
Lower Explosive Limit (%):	Not Applicable

EXTINGUISHING MEDIA

- FOR SMALL FIRE:
 - USE FLOODING QUANTITIES OF WATER.
 - DO NOT use dry chemicals, CO2 or foam.

FOR LARGE FIRE:

- Flood fire area with water from a protected position.

FIRE FIGHTING

-
- Alert Emergency Responders and tell them location and nature of hazard.

- May be violently or explosively reactive.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or water course.
- Fight fire from a safe distance, with adequate cover.
- Extinguishers should be used only by trained personnel.
- 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.
- If fire gets out of control withdraw personnel and warn against entry.
- Equipment should be thoroughly decontaminated after use.
- Alert Emergency Responders 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.
- DO NOT use water on fires.
- Avoid spraying water onto liquid pools.
- Do not approach containers suspected to be hot.
- If safe to do so, remove containers from path of fire.
- Equipment should be thoroughly decontaminated after use.

GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS

-
- Will not burn but increases intensity of fire.
- Heating may cause expansion or decomposition leading to violent rupture of containers.
- Heat affected containers remain hazardous.
- Contact with combustibles such as wood, paper, oil or finely divided metal may cause ignition, combustion or violent decomposition.
- May emit irritating, poisonous or corrosive fumes.

Decomposition may produce toxic fumes of: hydrogen chloride, metal oxides.

FIRE INCOMPATIBILITY

- Avoid storage with reducing agents.
- Avoid any contamination of this material as it is very reactive and any contamination is potentially hazardous

PERSONAL PROTECTION

Glasses:

Full face- shield.

Gloves:

Respirator:

Particulate

Section 6 - ACCIDENTAL RELEASE MEASURES

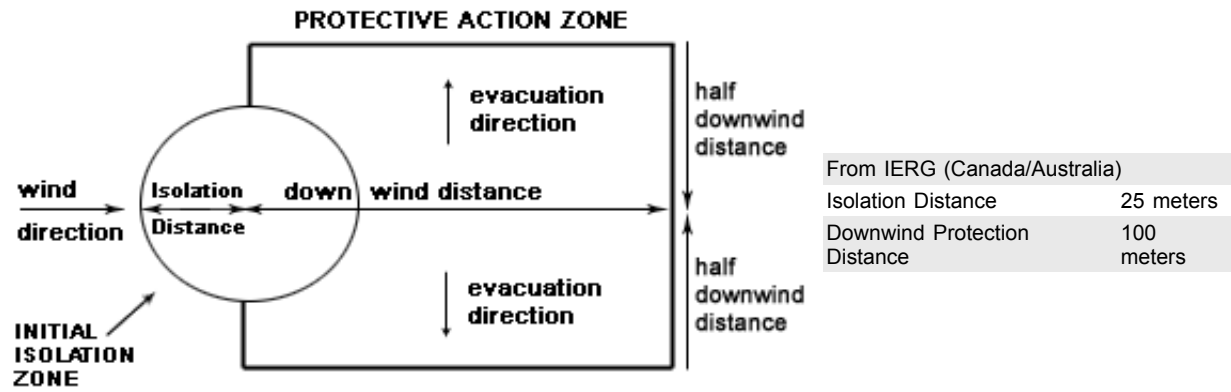
MINOR SPILLS

-
- Clean up all spills immediately.
- No smoking, naked lights, ignition sources.
- Avoid all contact with any organic matter including fuel, solvents, sawdust, paper or cloth and other incompatible materials; as ignition may result.
- Avoid breathing dust or vapors and all contact with skin and eyes.
- Control personal contact by using protective equipment.
- Contain and absorb spill with dry sand, earth, inert material or vermiculite
- DO NOT use sawdust as fire may result.
- Scoop up solid residues and seal in labeled drums for disposal.
- Neutralize/decontaminate area.

MAJOR SPILLS

-
- Clear area of personnel and move upwind.
- Alert Emergency Responders and tell them location and nature of hazard.
- May be violently or explosively reactive.
- Wear breathing apparatus and protective gloves.
- Prevent, by any means available, spillage from entering drains or water courses.
- No smoking, flames or ignition sources. Increase ventilation.
- Contain spill with sand, earth or other clean, inert materials.
- NEVER use organic absorbents such as sawdust, paper or cloth.
- Use spark-free and explosion-proof equipment.
- Collect any recoverable product into labeled containers for possible recycling.
- Avoid contamination with organic matter to prevent subsequent fire and explosion.
- DO NOT mix fresh with recovered material.
- Collect residues and seal in labeled drums for disposal.
- Wash area and prevent runoff into drains.
- Decontaminate equipment and launder protective clothing before storage and re-use.
- If contamination of drains or waterways occurs advise emergency services.

PROTECTIVE ACTIONS FOR SPILL



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 140 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 personal contact and inhalation of dust, mist or vapors.
- Provide adequate ventilation.
- Always wear protective equipment and wash off any spillage from clothing.
- Keep material away from light, heat, flammables or combustibles.
- Keep cool, dry and away from incompatible materials.
- Avoid physical damage to containers.
- DO NOT repack or return unused portions to original containers.
- Withdraw only sufficient amounts for immediate use.
- Contamination can lead to decomposition leading to possible intense heat and fire.
- When handling NEVER smoke, eat or drink.
- Always wash hands with soap and water after handling.
- Use only good occupational work practice.
- Observe manufacturer's storing and handling directions.

RECOMMENDED STORAGE METHODS

■ Glass container.

- DO NOT repack. Use containers supplied by manufacturer only.

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:

- Removable head packaging and
- cans with friction closures may be used.

- Where combination packages are used, and the inner packages are of glass, there must be sufficient inert cushioning material in contact with inner and outer packages * . - In addition, where inner packagings are glass and contain liquids of packing group I and II there must be sufficient inert absorbent to absorb any spillage *. - * unless the outer packaging is a close fitting molded plastic box and the substances are not incompatible with the plastic.

STORAGE REQUIREMENTS

- In addition, Goods of Class 5.1, packing group II should be:
 - stored in piles so that

- the height of the pile does not exceed 1 metre
- the maximum quantity in a pile or building does not exceed 1000 tonnes unless the area is provided with automatic fire extinguishers
- the maximum height of a pile does not exceed 3 metres where the room is provided with automatic fire extinguishers or 2 meters if not.
- the minimum distance between piles is not less than 2 metres where the room is provided with automatic fire extinguishers or 3 meters if not.
- the minimum distance to walls is not less than 1 metre.
- Plastic bag
- NOTE: Bags should be stacked, blocked, interlocked, and limited in height so that they are stable and secure against sliding or collapse.

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS



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

Source	Material	TWA ppm	TWA mg/m ³	STEL ppm	STEL mg/m ³	Peak ppm	Peak mg/m ³	TWA F/CC	Notes
US - Oregon Permissible Exposure Limits (Z3)	magnesium perchlorate (Inert or Nuisance Dust: (d) Total dust)		10						*
US OSHA Permissible Exposure Levels (PELs) - Table Z3	magnesium perchlorate (Inert or Nuisance Dust: (d) Respirable fraction)		5						
US OSHA Permissible Exposure Levels (PELs) - Table Z3	magnesium perchlorate (Inert or Nuisance Dust: (d) Total dust)		15						
US - Hawaii Air Contaminant Limits	magnesium perchlorate (Particulates not other wise regulated - Total dust)		10						
US - Hawaii Air Contaminant Limits	magnesium perchlorate (Particulates not other wise regulated - Respirable fraction)		5						
US - Oregon Permissible Exposure Limits (Z3)	magnesium perchlorate (Inert or Nuisance Dust: (d) Respirable fraction)		5						*
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	magnesium perchlorate (Particulates not otherwise regulated Respirable fraction)		5						
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	magnesium perchlorate (Particulates not otherwise regulated (PNOR)(f)- Respirable fraction)		5						
US - Michigan Exposure Limits for Air Contaminants	magnesium perchlorate (Particulates not otherwise regulated, Respirable dust)		5						

MATERIAL DATA

MAGNESIUM PERCHLORATE:

■ 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.

PERSONAL PROTECTION



Consult your EHS staff for recommendations

EYE

- Chemical goggles.
- Full face shield.
- Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

HANDS/FEET

Wear chemical protective gloves, eg. PVC.

Wear safety footwear or safety gumboots, eg. Rubber.

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.

- DO NOT wear cotton or cotton-backed gloves.
- DO NOT wear leather gloves.
- Promptly hose all spills off leather shoes or boots or ensure that such footwear is protected with PVC over-shoes.

OTHER

- Overalls.
- PVC Apron.
- PVC protective suit may be required if exposure severe.
- Eyewash unit.
- Ensure there is ready access to a safety shower.
- Some plastic personal protective equipment (PPE) (e.g. gloves, aprons, overshoes) are not recommended as they may produce static electricity.
- For large scale or continuous use wear tight-weave non-static clothing (no metallic fasteners, cuffs or pockets), non sparking safety footwear.
- 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 65°C).
 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 usually required. If risk of overexposure exists, wear an approved respirator. Correct fit is essential to obtain 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, vapors, 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 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 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

Solid.

Reacts violently with water.

State	Divided solid	Molecular Weight	223.21
Melting Range (°F)	Decomposes @482	Viscosity	Not Applicable
Boiling Range (°F)	Not available.	Solubility in water (g/L)	Reacts violently
Flash Point (°F)	Not Applicable	pH (1% solution)	Not available.
Decomposition Temp (°F)	Not Applicable	pH (as supplied)	Not applicable
Autoignition Temp (°F)	Not Applicable	Vapour Pressure (mmHG)	Not applicable.
Upper Explosive Limit (%)	Not Applicable	Specific Gravity (water=1)	2.21 @ 18 deg.C
Lower Explosive Limit (%)	Not Applicable	Relative Vapor Density (air=1)	Not applicable.
Volatile Component (%vol)	Not applicable.	Evaporation Rate	Not applicable

APPEARANCE

White, very hygroscopic, granular or flaky powder. Soluble in alcohol. Solubility in water @ 25 deg.C: 99.3 g/100 cc. A saturated aqueous solution is Dangerous Goods Class 5.1, Packing Group II ref. UN Code 34.4.2.5

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY

-
- Presence of incompatible materials.
- Product is considered stable under normal handling conditions.
- Prolonged exposure to heat.
- Hazardous polymerization will not occur.

STORAGE INCOMPATIBILITY

-
- Inorganic oxidising agents can react with reducing agents to generate heat and products that may be gaseous (causing pressurization of closed containers). The products may themselves be capable of further reactions (such as combustion in the air).
- Organic compounds in general have some reducing power and can in principle react with compounds in this class. Actual reactivity varies greatly with the identity of the organic compound.
- Inorganic oxidising agents can react violently with active metals, cyanides, esters, and thiocyanates.
- Inorganic reducing agents react with oxidizing agents to generate heat and products that may be flammable, combustible, or otherwise reactive. Their reactions with oxidizing agents may be violent.
- Incidents involving interaction of active oxidants and reducing agents, either by design or accident, are usually very energetic and examples of so-called redox reactions.

Metals and their oxides or salts may react violently with chlorine trifluoride. Chlorine trifluoride is a hypergolic oxidizer. It ignites on contact (without external source of heat or ignition) with recognized fuels - contact with these materials, following an ambient or slightly elevated temperature, is often violent and may produce ignition. The state of subdivision may affect the results.

NOTE: May contain traces of perchloric acid or may, on contact with acids, produce an anhydrous perchloric acid an extremely reactive and explosive species. Many of the reported explosions involving perchlorate may result its ability to form unstable perchlorate esters or salts of the anhydrous acid.

WARNING:

- On the basis of experience with cobalt(III) perchlorate, attention is drawn to the possibility of stable metal perchlorates being converted by unintentional dehydration to unstable (endothermic) lower hydrates capable of explosive decomposition in the absence of impurities. Great care must be taken to avoid dehydration or desolvation of perchlorates.
- Metal perchlorates may be explosively reactive with finely divided aluminium, magnesium and zinc and other metals, calcium and strontium hydrides, glycol (on heating), sulfuric acid (with the formation of unstable perchloric acid), and trifluoromethanesulfonic acid.
- The perchlorate salts of the complexes of divalent cobalt, nickel and particularly iron ([tetramethyl[14]-N8 complexes) are potentially explosive and storage for more than 4 weeks is inadvisable

Segregate from alcohol, water.

- Segregate chlorates from organic matter, acids, poisonous gases, flammables, corrosives, aluminium and ammonium salts and any other combustible material.
- Mixtures of chlorates with fibrous and absorbent organic materials such as wood, paper, leather, flour, sawdust, sugar, shellac, may be ignited or caused to explode by static sparks, friction or shock.
- The extreme hazardous nature of mixtures of metal chlorates with phosphorus or sulfur, apart from being powerful explosives, are dangerously sensitive to friction or shock; spontaneous ignition occasionally occurs.
- Mixtures with sucrose, lactose, chromium, sulfur dioxide, sodium amide, zirconium, germanium and titanium explode on heating.
- Forms incompatible sometimes explosive mixtures with thorium dicarbide, strontium hydride, hydrogen iodide, fluorine, cyanoguanidine, cyanides, dinickel trioxide, powdered carbon, aqua regia and ruthenium, nitric acid, manganese dioxide and potassium hydroxide or boron.
- Chlorates should not be allowed to come into contact with ammonium salts, aluminium and other powdered metals, phosphorous, silicon, sulfur, sulfides, sulfuric acid, nitrobenzene, iodides and tartaric acid
- Mixtures with hydrocarbons, metal phosphides (Zn, Ag, Al, Cu, Hg, Mg, etc), metal thiocyanates, metal sulfides, arsenic, carbon, phosphorous, sulfur, ammonium salts, powdered metals, arsenic trioxide, phosphorous, silicon, sulfur, sulfides, sulfites and hyposulfites are easily ignited (by friction impact or heat) and are potentially explosive.
- Metal chlorates in contact with strong acids liberate explosive chlorine dioxide gas. With concentrated sulfuric acid a violent explosion can occur unless effective cooling is used. Mixing potassium chlorate and concentrated sulfuric acid results in an explosion with optimum temperature range being 120-130. Heating a moist mixture of metal chlorate and a dibasic organic acid (tartaric or citric acid) liberates chlorine dioxide diluted with carbon dioxide.
- Fusion of chlorates with metal cyanides may lead to an explosion.
- Chlorates containing 1-2% bromate or sulfur are liable to spontaneous explosion.
- Chlorates releases oxygen, chlorine and chlorine dioxide when heated above 300 deg. C..
- In presence of moisture may release oxygen and ozone
- Intimate mixtures of chlorates, bromates or iodates of barium, cadmium, calcium, magnesium, potassium, sodium or zinc, with finely divided aluminium, arsenic, copper, carbon, phosphorus, sulfur, hydrides of alkali- and alkaline earth-metals; sulfides of antimony, arsenic, copper or tin; metal cyanides, thiocyanates; or impure manganese dioxide may react explosively or violently, either spontaneously (especially in the presence of moisture) or on initiation by heat, impact or friction, sparks or addition of sulfuric acid.

BRETHEKICKS HANDBOOK OF REACTIVE CHEMICAL HAZARDS, 4th Edition.

- NOTE: May develop pressure in containers; open carefully. Vent periodically.

Avoid storage with reducing agents.

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

Section 11 - TOXICOLOGICAL INFORMATION

magnesium perchlorate

TOXICITY AND IRRITATION

- 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

Refer to data for ingredients, which follows:

MAGNESIUM PERCHLORATE:

■ Perchlorate poses a human health concern because this contaminant has the same ionic size as iodide, and can compete with iodide for uptake into the thyroid gland, causing changes in thyroid hormone levels and possibly thyroid disorders. Although the long-term effects on humans are currently being debated, public concerns have generated considerable legislation designed to minimise potential damage. The environmental impacts of perchlorate have been less well studied, but the pollutant is clearly being transferred between abiotic and biotic ecosystem components.

Perchlorate consists of four-double covalent bonds between chlorine and oxygen (tetrahedral coordination), making this highly soluble oxyanion very stable and nonreactive in aqueous environments. Perchlorate salts also have a very low volatility. Although a strong oxidizing agent, the perchlorate anion is stable in the environment, due to the high activation energy associated with its abiotic reduction to chlorate (ClO₃⁻). Moreover, given its relatively low charge density, perchlorate does not form complexes with metals in the same manner as other anions, and it does not readily sorb to environmental media. This combination of perchlorate solubility, stability, and mobility creates the potential for both localised and area-wide potential effects of ecotoxicological interest. As such, it is a relatively non-reactive and kinetically a very stable contaminant, with very low biodegradation rates under many natural conditions. Biodegradation of perchlorate in the natural environment (e.g., sediments) will not occur unless significant levels of organic carbon are present, oxygen and nitrate are depleted, and perchlorate-degrading anaerobic bacteria are present.

Perchlorate (ClO₄⁻) is a highly toxic compound that is stable and persistent in the environment. Once perchlorate gets into the food chain or water supply, it does not break down easily. It has been detected in surface and ground water, soils and food (lettuce, bottled water, milk, meat, kelp, animal feed). It is stable, water soluble and persistent; it is not volatile and does not readily adhere to soil. It is also found in plants because its solubility in water allows it be taken up by their roots. The populations considered to be most sensitive to perchlorate exposure are nursing infants, children, post-menopausal women, and people with hypothyroidism. Perchlorate interferes with thyroid functioning and is especially dangerous to fetuses, babies, and children. It causes thyroid iodine deficiency that in turn limits the gland's ability to produce a hormone essential to neurological development. "On average, children of iodine-deficient mothers have 5-to-13 fewer IQ points compared to children of mothers with iodine-sufficient diets," according to a report issued by the Environment California Research and Policy Center. "Reduced thyroid levels in the first few weeks of life for pre-term and low birth-weight babies are associated with increased risk of neurological disorders, including the need for special education by age nine."

Little is known about how perchlorate affects other species and the environment.

Until perchlorate affects on the human body are better understood a human reference dose of 0.0007 mg/kg per day has been suggested by the US EPA. The human reference dose is the daily exposure level below which EPA believes there would be no serious negative effects to a human over their lifetime. The EPA added that it considers drinking water safe if it contains no more than 24.5 parts per billion (ppb) of perchlorate.

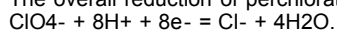
Perchlorate has contaminated ground and surface waters that are currently being used for irrigation in food production. Physical processes including mixing and dispersion control the distribution of perchlorate in groundwater.

Soil is not expected to naturally contain perchlorate. Perchlorate does not adsorb onto inorganic surfaces, including hydrous ferric oxide, smectite, and manganese oxide. These are characterised by net-negative surface charges at pH of 6.5 to 9.0. The inorganic perchlorate compounds introduced into soils are readily soluble and are not strongly adsorbed by other soil components. In soils, perchlorate is chemically stable and is expected to behave in a manner similar to dissolved minerals. While perchlorate is subject to leaching, its content in the soil is expected to approach steady state equilibrium in irrigated crop production system.

Perchlorate has been shown to be absorbed into crops from irrigation water or other sources. Reports show that raw materials and ingredients used to formulate fertilizers may contain significant amounts of perchlorate. Sodium nitrate imported from Chile is manufactured from Chilean caliche ores that are known to contain considerable amounts of perchlorate. Plants absorb nutrients and pollutants from solutions in the soil. Evidence shows that plants take up perchlorate from soils by processes similar to those of pertechnetate (TcO₄⁻) and nitrate. Based on the basic principles of ion transport processes, plants exposed to perchlorate in the growing media are expected to accumulate perchlorate. The extent of the accumulation, however, may be influenced by external factors such as plant species and maturity, nutrient concentrations, and consumptive use of water. perchlorate uptake increased linearly in proportion to the perchlorate concentration in the growth media and the plant biomass. While there is evidence that a portion of the absorbed perchlorate may be reduced inside the plant through biochemical pathways similar to reductive microbial metabolic mechanisms, the majority of the absorbed perchlorate will translocate to and concentrate in the leaf tissue. Since oxygen is always present in the leaf tissue, plant mediated perchlorate reductions are not likely to be efficient or complete. The slow rate of phytodegradation of the perchlorate fraction taken up by plants during the growing season explains the detection of higher perchlorate concentrations in leaves collected later in the growing season (autumn) and in senesced leaves compared to younger, live leaves. This proves that the leaves of senesced plant potentially recycle perchlorate back into the soil on which plant litter collects. To minimise the potential recycling of perchlorate during phytoremediation, it is recommended that senesced leaves be collected and composted or phytoremediation be designed to enhance rapid rhizodegradation (rhizoremediation)

The fate of perchlorate (ClO₄⁻) in streambed sediments is becoming a concern due to the increasing number of groundwater and surface water contamination sites. Results indicated that the spatial and temporal ClO₄⁻ penetration into sediments could be affected by numerous factors, such as temperature, microbial degradation, ClO₄⁻ surface water concentration, and sediment physico-geological properties. In general, maximum ClO₄⁻ penetration into sediments at the studied sites was 30 cm below the sediment-water surface. The vertical sequential depletion of electron acceptors in sediments suggested that microbial reduction was responsible for ClO₄⁻ depletion in stream sediments. Biodegradation of ClO₄⁻ occurred over a seasonally variable active depth zone of 1-10 cm. Results implied that there was a rapid natural attenuation potential of perchlorate in near-surface sediments. Perchlorate may be rapidly attenuated in saturated near-surface sediments.

The overall reduction of perchlorate to chloride is given by the following half reaction:



This reaction has relevance to natural systems such as wetlands and other microbially-active environments with plentiful and diverse electron donors. Perchlorate is reduced to intermediate compounds (chlorate [Cl(V)] and chlorite [Cl(III)]) and eventually to chloride in anaerobic environments by serving as a terminal electron acceptor during oxidation of acetate and

other forms of reactive organic carbon. Perchlorate reduction is both thermodynamically and microbially enhanced under denitrifying conditions. Perchlorate has been shown to serve as a terminal electron acceptor for energy and growth. Reductase enzymes catalyse the reduction of perchlorate to chlorate and then to chlorite (ClO₂⁻). A fairly unique enzyme, a dismutase, then facilitates the disproportionation of ClO₂⁻ to Cl⁻ and O₂. There are numerous strains of micro-organisms capable of reducing both chlorate and perchlorate under anoxic conditions. The chlorite dismutase enzyme is present in all dissimilatory perchlorate- and chlorate reducing bacteria. Under anaerobic conditions, perchlorate and chlorate- are first converted to chlorite (ClO₂⁻) by the enzyme chlorate reductase, which is present in perchlorate- and chlorate-reducing bacteria. In the second step, chlorite is disproportionated to chloride (Cl⁻) and molecular oxygen (O₂) by the non-respiratory enzyme chlorite dismutase, which catalyses the reaction. The presence of chlorite dismutase is a prerequisite for the growth of perchlorate- and chlorate reducing bacteria as chlorite is toxic due to its high reactivity.

Perchlorate is not likely to come out of solution given its low vapor pressure. Droplet size during showering would likely preclude significant inhalation of perchlorate-contaminated water as an aerosol.

In perchlorate-contaminated lakes and streams, perchlorate is detected infrequently in fish heads, fillets, and whole bodies, but may be detected more often depending on species and seasonal trends, and always at concentrations higher in the fish than in the water. Perchlorates may perturb thyroid-hormone concentration in fish; this may affect growth and neurological development. Data from fish indicates that perchlorate can also disrupt sexual development. Certain have been so dramatic that female fish have been mistaken for males. Several females displayed male-courtship behavior and produced sperm. This is suggestive of the fact that perchlorate may act as an androgen (male sex hormone). The concentration of perchlorate used in these studies were at least a 1000 times the US EPA limit (24.5 parts per billion in natural bodies of water).

■ DO NOT discharge into sewer or waterways.

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
magnesium perchlorate			LOW	

Section 13 - DISPOSAL CONSIDERATIONS

US EPA Waste Number & Descriptions

A. General Product Information

Ignitability characteristic: use EPA hazardous waste number D001 (waste code I)

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.

FOR DISPOSAL OF SMALL QUANTITIES:

- Cautiously acidify a 3% solution or a suspension of the material to pH 2 with sulfuric acid.
- Gradually add a 50% excess of aqueous sodium bisulfite with stirring at room temperature. (Other reducers such as thiosulfate or ferrous salts may substitute; do NOT use carbon, sulfur or other strong reducing agents). An increase in temperature indicates reaction is taking place. If no reaction is observed on the addition of about 10% of the sodium bisulfite solution, initiate it by cautiously adding more acid.
- If manganese, chromium or molybdenum are present adjust the pH of the solution to 7 and treat with sulfide to precipitate for burial as a hazardous waste. Destroy excess sulfide, neutralize and flush the solution down the drain (subject to State and Local Regulation).

[Sigma/Aldrich].

- Recycle wherever possible or consult manufacturer for recycling options.
- Consult Waste Management Authority for disposal.
- Bury residue in an authorized landfill.
- Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - TRANSPORTATION INFORMATION



DOT:

Symbols:	None	Hazard class or Division:	5.1
Identification Numbers:	UN1475	PG:	II
Label Codes:	5.1	Special provisions:	IB6, IP2, T3, TP33
Packaging: Exceptions:	152	Packaging: Non-bulk:	212
Packaging: Exceptions:	152	Quantity limitations: Passenger aircraft/rail:	5 kg
Quantity Limitations: Cargo aircraft only:	25 kg	Vessel stowage: Location:	A

Vessel stowage: Other: 56, 58

Hazardous materials descriptions and proper shipping names:

Magnesium perchlorate

Air Transport IATA:

ICAO/IATA Class:	5.1	ICAO/IATA Subrisk:	None
UN/ID Number:	1475	Packing Group:	II
Special provisions:	None		

Shipping Name: MAGNESIUM PERCHLORATE

Maritime Transport IMDG:

IMDG Class:	5.1	IMDG Subrisk:	None
UN Number:	1475	Packing Group:	II
EMS Number:	F-H,S-Q	Special provisions:	None

Limited Quantities: 1 kg

Shipping Name: MAGNESIUM PERCHLORATE

Section 15 - REGULATORY INFORMATION

magnesium perchlorate (CAS: 10034-81-8,13446-19-0,64010-42-0) is found on the following regulatory lists;

"Canada - Saskatchewan Industrial Hazardous Substances","Canada Domestic Substances List (DSL)","Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (English)","US - New Jersey Right to Know Hazardous Substances","US - Pennsylvania - Hazardous Substance List","US - Rhode Island Hazardous Substance List","US DOE Temporary Emergency Exposure Limits (TEELs)","US NFPA 1 Annex B Typical Oxidizers","US Toxic Substances Control Act (TSCA) - Inventory"

Section 16 - OTHER INFORMATION

LIMITED EVIDENCE

- Skin contact and/or ingestion may produce health damage*.
 - Cumulative effects may result following exposure*.
 - May possibly be harmful to the fetus/ embryo*.
- * (limited evidence).

Ingredients with multiple CAS Nos

Ingredient Name	CAS
magnesium perchlorate	10034-81-8, 13446-19-0, 64010-42-0

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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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