

Ammonium persulfate

sc-202946



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

Ammonium persulfate

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

Used as an oxidizer and bleacher; to remove sodium thiosulfate; reducer and retarder in photography; in dyeing, manufacture of aniline dyes; oxidizer for copper, etching zinc; decolourising and deodourising oils. Electroplating; washing infected yeast; removing pyrogallol stains; making soluble starch; depolarizer in electric batteries; in analytical chemistry for detection and determination of manganese.

SYNONYMS

N2-H8-S2-O8, (NH4)2-S2-O8, "ammonium peroxydisulphate", "peroxydisulphuric acid, diammonium salt", "ammonium peroxydisulfate", "diammonium peroxydisulfate", "ammonium persulphate", "peroxydisulfuric acid, diammonium salt"

Section 2 - HAZARDS IDENTIFICATION

CANADIAN WHMIS SYMBOLS



EMERGENCY OVERVIEW

RISK

Contact with combustible material may cause fire.

Harmful if swallowed.

May cause SENSITIZATION by inhalation and skin contact.

Irritating to eyes, respiratory system and skin.

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

- Accidental ingestion of the material may be harmful; animal experiments indicate that ingestion of less than 150 gram may be fatal or may produce serious damage to the health of the individual.
- Large doses of ammonia or injected ammonium salts may produce diarrhea and may be sufficiently absorbed to produce increased production of urine and systemic poisoning. Symptoms include weakening of facial muscle, tremor, anxiety, reduced muscle and limb control.

EYE

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

SKIN

- This material can cause inflammation of the skin on contact in some persons.
- The material may accentuate any pre-existing dermatitis condition.
- 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.

Inhaling this product is more likely to cause a sensitization reaction in some persons compared to the general population.

Skin contact with the material is more likely to cause a sensitization reaction in some persons compared to the general population.

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

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.






Persulfate exposure commonly manifests itself in the form of a skin rash, eczema and respiratory conditions such as asthma. Allergy may develop after repeated exposures.

A variety of central nervous system effects can occur following prolonged exposure to oxygen at partial pressures in excess of 200 kPa: these include dizziness, impaired coordination, visual and hearing disturbances, and seizures. Prolonged exposure at/ or normal elevated pressure may cause severe thickening and scarring of tissue.



Allergic reactions clear up readily if further contact is avoided.

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	%
ammonium persulfate	7727-54-0	>98
NOTE: Decomposes slowly in water to produce		
oxygen	7782-44-7.	^
ozone	10028-15-6	^

Section 4 - FIRST AID MEASURES

SWALLOWED

-
- IF SWALLOWED, REFER FOR MEDICAL ATTENTION, WHERE POSSIBLE, WITHOUT DELAY.
- Where Medical attention is not immediately available or where the patient is more than 15 minutes from a hospital or unless instructed otherwise:
 - For advice, contact a Poisons Information Center or a doctor.
 - Urgent hospital treatment is likely to be needed.
 - If conscious, give water to drink.
 - INDUCE vomiting with fingers down the back of the throat, ONLY IF CONSCIOUS. Lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.

NOTE: Wear a protective glove when inducing vomiting by mechanical means.

- In the mean time, qualified first-aid personnel should treat the patient following observation and employing supportive measures as indicated by the patient's condition.
- If the services of a medical officer or medical doctor are readily available, the patient should be placed in his/her care and a copy of the MSDS should be provided. Further action will be the responsibility of the medical specialist.
- If medical attention is not available on the worksite or surroundings send the patient to a hospital together with a copy of

the MSDS.

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

- Treat symptomatically.
Toxic myocarditis may follow ingestion of oxidizing agents such as peroxides.

BASIC TREATMENT

- Establish a patent airway with suction where necessary.
- Watch for signs of respiratory insufficiency and assist ventilation as necessary.
- Administer oxygen by non-rebreather mask at 10 to 15 l/min.
- Monitor and treat, where necessary, for pulmonary edema .
- Monitor and treat, where necessary, for shock.
- Anticipate seizures .
- DO NOT use emetics. Where ingestion is suspected rinse mouth and give up to 200 ml water (5 ml/kg recommended) for dilution where patient is able to swallow, has a strong gag reflex and does not drool.
- DO NOT attempt neutralization as exothermic reaction may occur.
- Skin burns should be covered with dry, sterile bandages, following decontamination.

ADVANCED TREATMENT

- Consider orotracheal or nasotracheal intubation for airway control in unconscious patient or where respiratory arrest has occurred.
- Positive-pressure ventilation using a bag-valve mask might be of use.
- Monitor and treat, where necessary, for arrhythmias.
- Start an IV D5W TKO. If signs of hypovolemia are present use lactated Ringers solution. Fluid overload might create complications.
- Drug therapy should be considered for pulmonary edema.
- Hypotension with signs of hypovolemia requires the cautious administration of fluids. Fluid overload might create complications.
- Treat seizures with diazepam.
- Proparacaine hydrochloride should be used to assist eye irrigation.

BRONSTEIN, A.C. and CURRANCE, P.L.

EMERGENCY CARE FOR HAZARDOUS MATERIALS EXPOSURE: 2nd Ed. 1994.

Section 5 - FIRE FIGHTING MEASURES

Vapour Pressure (mmHG):	Not available
Upper Explosive Limit (%):	Not applicable
Specific Gravity (water=1):	1.98
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 explosive reactive.
 - Wear full body protective clothing with breathing apparatus.
 - Prevent, by any means available, spillage from entering drains or water course.
 - Fight fire from a safe distance, with adequate cover.
 - 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.

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: nitrogen oxides (NOx), sulfur oxides (SOx).

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

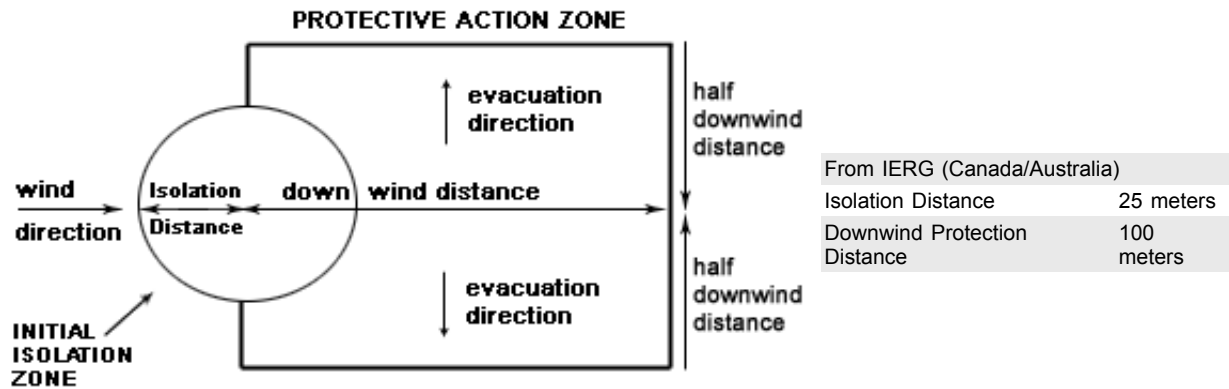
MINOR SPILLS

-
- 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 full body protective clothing with breathing apparatus.
- 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 all 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

- - 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 III should be stored in packages and be separated from buildings, tanks, and compounds containing other dangerous goods in tanks, and from property boundaries by a distance of at least 5 metres.

US NIOSH Recommended Exposure Limits (RELs)	ozone (Ozone)		0.1	0.2		
US ACGIH Threshold Limit Values (TLV)	ozone (Ozone - Moderate work)	0.08				TLV Basis: pulmonary function
US ACGIH Threshold Limit Values (TLV)	ozone (Ozone - Heavy work)	0.05				TLV Basis: pulmonary function
US ACGIH Threshold Limit Values (TLV)	ozone (Ozone - Light, mod., or heavy workload =/ \leq 2 hrs)	0.2				TLV Basis: pulmonary function
US ACGIH Threshold Limit Values (TLV)	ozone (Ozone - Light work)	0.1				TLV Basis: pulmonary function
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	ozone (Ozone)	0.1	0.2	0.3	0.6	
US - Idaho - Limits for Air Contaminants	ozone (Ozone)	0.1	0.2			
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	ozone (Ozone)	0.1	0.2	0.3	0.6	
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	ozone (Ozone)	0.1	0.2			
US - California Permissible Exposure Limits for Chemical Contaminants	ozone (Ozone)	0.1	0.2	0.3	0.6	
Canada - Ontario Occupational Exposure Limits	ozone (Ozone)	0.1	0.2	0.3	0.6	
Canada - British Columbia Occupational Exposure Limits	ozone (Ozone - Light, mod., or heavy workload =/ \leq 2 hrs)	0.2				
US - Minnesota Permissible Exposure Limits (PELs)	ozone (Ozone)	0.1	0.2	0.3	0.6	
US OSHA Permissible Exposure Levels (PELs) - Table Z1	ozone (Ozone)	0.1	0.2			
US - Oregon Permissible Exposure Limits (Z1)	ozone (Ozone)	0.1	0.2			
US - Michigan Exposure Limits for Air Contaminants	ozone (Ozone)	0.1	0.2	0.3	0.6	
Canada - Nova Scotia Occupational Exposure Limits	ozone (Ozone - Heavy work)	0.05				TLV Basis: pulmonary function
Canada - Northwest Territories Occupational Exposure Limits (English)	ozone (Ozone)	0.1	0.2	0.3	0.59	
US - Alaska Limits for Air Contaminants	ozone (Ozone)	0.1	0.2	0.3	0.6	
US - Washington Permissible exposure limits of air contaminants	ozone (Ozone)	0.1		0.3		
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	ozone (Ozone)	0.1	0.2	0.3	0.6	
US - Hawaii Air Contaminant Limits	ozone (Ozone)	0.1	0.2	0.3	0.6	
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	ozone (Ozone)	0.05		0.15		
Canada - Prince Edward Island Occupational Exposure Limits	ozone (Ozone - Light, mod., or heavy workload =/ \leq 2 hrs)	0.2				TLV Basis: pulmonary function

Canada - Prince Edward Island Occupational Exposure Limits	ozone (Ozone - Light work)	0.1			TLV Basis: pulmonary function
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	ozone (Ozone)		0.1	0.2	
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	ozone (Ozone)	0.1	0.2		
Canada - Prince Edward Island Occupational Exposure Limits	ozone (Ozone - Moderate work)	0.08			TLV Basis: pulmonary function
Canada - Nova Scotia Occupational Exposure Limits	ozone (Ozone - Light work)	0.1			TLV Basis: pulmonary function
Canada - Nova Scotia Occupational Exposure Limits	ozone (Ozone - Moderate work)	0.08			TLV Basis: pulmonary function
Canada - Prince Edward Island Occupational Exposure Limits	ozone (Ozone - Heavy work)	0.05			TLV Basis: pulmonary function
Canada - Nova Scotia Occupational Exposure Limits	ozone (Ozone - Light, mod., or heavy workload =/< 2 hrs)	0.2			TLV Basis: pulmonary function

MATERIAL DATA

AMMONIUM PERSULFATE:

■ For oxygen:

No exposure standards available.

NOTE: Detector tubes for oxygen, measuring in excess of 5 vol%, are commercially available. Persulfates produce irritation of the respiratory tract.

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.

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.

- 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.

Mixes with water.

State	Divided solid	Molecular Weight	228.19
Melting Range (°F)	248 (decomposes)	Viscosity	Not Applicable
Boiling Range (°F)	Not applicable	Solubility in water (g/L)	Miscible
Flash Point (°F)	Not Applicable	pH (1% solution)	2.3-4.0
Decomposition Temp (°F)	350.6	pH (as supplied)	Not applicable
Autoignition Temp (°F)	Not applicable	Vapour Pressure (mmHG)	Not available
Upper Explosive Limit (%)	Not applicable	Specific Gravity (water=1)	1.98
Lower Explosive Limit (%)	Not applicable	Relative Vapor Density (air=1)	7.9
Volatile Component (%vol)	Nil @ 38C	Evaporation Rate	Slow

APPEARANCE

Odourless, colourless, monoclinic crystals, or white granular powder. Stable when dry. In the presence of moisture, it decomposes slowly evolving oxygen and some ozone. Solubility in water @ 0 deg.C: 58 g/100 cc. @ 25 deg.C: 80 g/100 cc. @ 40 deg.C: 110 g/100 cc.

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.
- Many of the salts of peroxyacids are unstable or explosive and are capable of initiation by heat, friction or impact, and all are powerful oxidants.

BRETHERRICK L.: Handbook of Reactive Chemical Hazards.

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.

For persulfate salts:

- Segregate from organics and other readily oxidisable materials.
- Segregate from powdered metals, phosphorous, hydrides, halogens, acids and alkalis.
- Avoid contact with combustibles, organic matter.
- Avoid reaction with acids, alkalis, halides, heavy metals and combustible material (wood, cloth).
- Contact with metals such as lead, silver, copper, magnesium, zinc, cadmium, nickel, iron and cobalt can lead to catalytic decomposition.
- An explosion hazard when mixed with finely powdered organic matter, metal powders such as aluminium, or reducing agents.
- Avoid reaction with alkaline hydroxide and water.
- Reacts vigorously with hydrazine.
- Dry material may decomposes rapidly above 100 deg C liberating oxygen.
- Wet material may decomposes at 50 deg C with decomposition.
- Liberates oxygen on decomposition.

A vigorous self-sustaining fire resulted from the contact of two flakes of moist potassium hydroxide with potassium persulfate. The fire was extinguished with water but not CO₂ or dry powder.

- Avoid any contamination of this material as it is very reactive and any contamination is potentially hazardous
- Many of the salts of peroxyacids are unstable or explosive and are capable of initiation by heat, friction or impact, and all are powerful oxidants.

BRETHERRICK L.: Handbook of Reactive Chemical Hazards.

Avoid storage with reducing agents.

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

Section 11 - TOXICOLOGICAL INFORMATION

ammonium persulfate

TOXICITY AND IRRITATION

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

TOXICITY	IRRITATION
Oral (rat) LD50: 689 mg/kg	Nil Reported
Intravenous (dog) LD50: 2.5 mg/kg	

■ Contact allergies quickly manifest themselves as contact eczema, more rarely as urticaria or Quincke's edema. The pathogenesis of contact eczema involves a cell-mediated (T lymphocytes) immune reaction of the delayed type. Other allergic skin reactions, e.g. contact urticaria, involve antibody-mediated immune reactions. The significance of the contact allergen is not simply determined by its sensitization potential: the distribution of the substance and the opportunities for contact with it are equally important. A weakly sensitizing substance which is widely distributed can be a more important allergen than one with stronger sensitizing potential with which few individuals come into contact. From a clinical point of view, substances are noteworthy if they produce an allergic test reaction in more than 1% of the persons tested.

Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergic 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.

Allergic reactions involving the respiratory tract are usually due to interactions between IgE antibodies and allergens and occur rapidly. Allergic potential of the allergen and period of exposure often determine the severity of symptoms. Some people may be genetically more prone than others, and exposure to other irritants may aggravate symptoms. Allergy causing activity is due to interactions with proteins.

Attention should be paid to atopic diathesis, characterized by increased susceptibility to nasal inflammation, asthma and eczema.

Exogenous allergic alveolitis is induced essentially by allergen specific immune-complexes of the IgG type; cell-mediated reactions (T lymphocytes) may be involved. Such allergy is of the delayed type with onset up to four hours following exposure. Inhalation (rat) TCLo: 3.8 mg/m³/23H/7D-I

Section 12 - ECOLOGICAL INFORMATION

Refer to data for ingredients, which follows:

AMMONIUM PERSULFATE:

■ for persulfates:

Environmental fate:

Aqueous solutions of persulfates decompose at ordinary temperatures. Decomposition occurs under moist conditions or at higher temperatures, and when heated to decomposition (120 degree C) toxic fumes of SO_x are emitted. During use oxygen may be formed. Degradation produces sulfates and at elevated temperatures pyrosulfate.

In alkaline, neutral and dilute acid solutions persulfate decomposes according to reaction (1) while in strongly acid solutions reactions (2) and (3) occur:

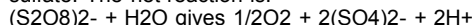
- $S_2O_8^{2-} + H_2O \rightarrow 2HSO_4^- + 1/2 O_2$
- $S_2O_8^{2-} + H_2O \rightarrow H_2SO_5 + H_2SO_4$
- $H_2SO_5 + H_2O \rightarrow H_2O_2 + H_2SO_4$

Since the decomposition (hydrolysis) rate is first order, the half life is independent of initial concentration. Half lives of potassium persulfate at 50 deg C, as a function of pH, were calculated from the following data:

The rates of decomposition in water for potassium persulfate at various pH's.

pH	1.0	1.6	3.0	7.0	10.0
Half-life (hrs)	20	65	125	130	210

The main kinetic mechanism begins with homolytic cleavage of persulfate to form sulfate ion radicals. These radicals initiate a series of propagating reactions producing hydroxyl radicals, which ultimately produce hydrogen peroxide and a solution of acid sulfate. The net reaction is:



The rate equation was described as having two terms once the solution became sufficiently acid:

$$-d[(S_2O_8)^{2-}]/dt = k_1(H_2O)((S_2O_8)^{2-}) + k_2(H^+)((S_2O_8)^{2-})$$

The rate constant for the acid-catalysed term, k₂, and it was determined to be 3.5 x 10⁻³ min⁻¹ (m/l)⁻¹. This term becomes dominant at low pH's.

Ecotoxicity:

For potassium persulfate

Fish LC50 (-): *Poecilia reticulata* 845 mg/l

Daphnia EC50: 92-251 mg/l

Tubificidae EC50 (-): 575 mg/l

Cyclops strenuus EC50 (-): 1175 mg/l.

■ In air ammonia is persistent whilst, in water, it biodegrades rapidly to nitrate, producing a high oxygen demand. Ammonia is strongly adsorbed to soil. Ammonia is non-persistent in water (half-life 2 days) and is moderately toxic to fish under normal temperature and pH conditions. Ammonia is harmful to aquatic life at low concentrations but does not concentrate in the food chain.

Drinking Water Standards:

0.5 mg/l (UK max.)

1.5 mg/l (WHO Levels)

Soil Guidelines: none available.

Air Quality Standards: none available.

■ Data from tap water studies with human volunteers indicate that sulfates produce a laxative effect at concentrations of 1000 - 1200 mg/litre, but no increase in diarrhoea, dehydration or weight loss. The presence of sulfate in drinking-water can also result in a noticeable taste; the lowest taste threshold concentration for sulfate is approximately 250 mg/litre as the sodium salt. Sulfate may also contribute to the corrosion of distribution systems. No health-based guideline value for sulfate in drinking water is proposed. However, there is an increasing likelihood of complaints arising from a noticeable taste as concentrations in water increase above 500 mg/litre.

Sulfates are removed from the air by both dry and wet deposition processes. Wet deposition processes including rain-out (a process that occurs within the clouds) and washout (removal by precipitation below the clouds) contribute to the removal of sulfate from the atmosphere.

In soil, the inorganic sulfates can adsorb to soil particles or leach into surface water and groundwater. Sulfates can be taken up by plants and be incorporated into the parenchyma of the plant.

Sulfate in water can also be reduced by sulfate bacteria (Thiobacilli) which use them as a source of energy.

■ DO NOT discharge into sewer or waterways.

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.

! Puncture containers to prevent re-use and bury at an authorized landfill.

Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.

A Hierarchy of Controls seems to be common - the user should investigate:

- Reduction
- Reuse
- Recycling
- Disposal (if all else fails)

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

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

For small quantities of oxidizing agent:

- Cautiously acidify a 3% solution to pH 2 with sulfuric acid.
- Gradually add a 50% excess of sodium bisulfite solution with stirring.
- Add a further 10% sodium bisulfite.
- If no further reaction occurs (as indicated by a rise in temperature) cautiously add more acid.
- 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.

For small spills and area cleanup:

To reduce ammonium persulfate, mix with an excess of concentrated sodium thiosulfate (hypo) solution (acidified with dil For large spills, consult State Land Waste Management Authority for disposal.

Section 14 - TRANSPORTATION INFORMATION



DOT:

Symbols:	None	Hazard class or Division:	5.1
Identification Numbers:	UN1444	PG:	III
Label Codes:	5.1	Special provisions:	A1, A29, IB8, IP3, T1, TP33
Packaging: Exceptions:	152	Packaging: Non-bulk:	213
Packaging: Exceptions:	152	Quantity limitations: Passenger aircraft/rail:	25 kg
Quantity Limitations: Cargo aircraft only:	100 kg	Vessel stowage: Location:	A
Vessel stowage: Other:	None		

Hazardous materials descriptions and proper shipping names:

Ammonium persulfate

Air Transport IATA:

ICAO/IATA Class:	5.1	ICAO/IATA Subrisk:	None
UN/ID Number:	1444	Packing Group:	III
Special provisions:	None		

Shipping Name: AMMONIUM PERSULPHATE

Maritime Transport IMDG:

IMDG Class:	5.1	IMDG Subrisk:	None
UN Number:	1444	Packing Group:	III
EMS Number:	F-A,S-Q	Special provisions:	None
Limited Quantities:	5 kg		
Shipping Name: AMMONIUM PERSULPHATE			

Section 15 - REGULATORY INFORMATION**ammonium persulfate (CAS: 7727-54-0) is found on the following regulatory lists;**

"Canada - Alberta Occupational Exposure Limits","Canada - Nova Scotia Occupational Exposure Limits","Canada - Prince Edward Island Occupational Exposure Limits","Canada Domestic Substances List (DSL)","Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (English)","Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (French)","International Council of Chemical Associations (ICCA) - High Production Volume List","OECD Representative List of High Production Volume (HPV) Chemicals","US - New Jersey Right to Know Hazardous Substances","US ACGIH Threshold Limit Values (TLV)","US Cosmetic Ingredient Review (CIR) Cosmetic ingredients found safe, with qualifications","US DOE Temporary Emergency Exposure Limits (TEELs)","US EPA High Production Volume Chemicals Additional List","US FDA Indirect Food Additives: Adhesives and Components of Coatings - Substances for Use Only as Components of Adhesives - Adhesives","US Food Additive Database","US NFPA 1 Annex B Typical Oxidizers","US Toxic Substances Control Act (TSCA) - Inventory"

Section 16 - OTHER INFORMATION**LIMITED EVIDENCE**

- Contact with air may produce sufficient heat to ignite combustible materials.*.
 - Cumulative effects may result following exposure*.
- * (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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