

CADMIUM STANDARD SOLUTION 1000 MG/L

GHS Safety Data Sheet

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Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME

CADMIUM STANDARD SOLUTION 1000 MG/L

OTHER NAMES

"Spectrosol standard solution"

PRODUCT USE

As a laboratory reagent;

SUPPLIER

Company: S D FINE - CHEM LIMITED

Address:

315- 317, T.V.IND.ESTATE,

248 WORLI ROAD,

MUMBAI- 400 030, INDIA

technical@sdfine.com

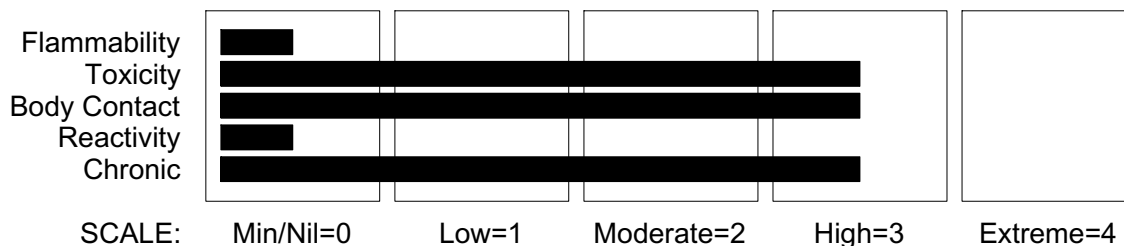
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Section 2 - HAZARDS IDENTIFICATION

HAZARD RATINGS



GHS Classification

Acute Aquatic Hazard Category 2

Acute Toxicity (Dermal) Category 4

Acute Toxicity (Inhalation) Category 3

Acute Toxicity (Oral) Category 4

Carcinogen Category 1B

Chronic Aquatic Hazard Category 3

Serious Eye Damage Category 1

Skin Corrosion/Irritation Category 1C

continued...

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Section 2 - HAZARDS IDENTIFICATION



EMERGENCY OVERVIEW

HAZARD

DANGER

Determined by using GHS criteria:

H331 H302 H312 H350 H314 H318 H412 H401 H318

Toxic if inhaled

Harmful if swallowed

Harmful in contact with skin

May cause CANCER

Causes severe skin burns and eye damage

Causes serious eye damage

Harmful to aquatic life with long lasting effects

Toxic to aquatic life

Causes serious eye damage

PRECAUTIONARY STATEMENTS

Prevention

Obtain special instructions before use.

Do not handle until all safety precautions have been read and understood.

Do not breathe dust/fume/gas/mist/vapours/spray.

Avoid breathing dust/fume/gas/mist/vapours/spray.

Wash thoroughly after handling.

Do not eat, drink or smoke when using this product.

Use only outdoors or in a well-ventilated area.

Avoid release to the environment.

Wear protective gloves/protective clothing/eye protection/face protection.

Use personal protective equipment as required.

Response

IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell.

IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.

IF ON SKIN: Wash with plenty of soap and water.

IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.

IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing.

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

IF exposed or concerned: Get medical advice/ attention.

Immediately call a POISON CENTER or doctor/physician.

Call a POISON CENTER or doctor/physician.

Call a POISON CENTER or doctor/physician if you feel unwell.

Rinse mouth.

Wash contaminated clothing before reuse.

Storage

Store in a well-ventilated place. Keep container tightly closed.

Store locked up.

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Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
cadmium nitrate	10325-94-7	0.1-1
nitric acid	7697-37-2	NOT SPEC
water	7732-18-5	NOT SPEC

Section 4 - FIRST AID MEASURES

SWALLOWED

- If poisoning occurs, contact a doctor or Poisons Information Centre.
 - IF SWALLOWED, REFER FOR MEDICAL ATTENTION, WHERE POSSIBLE, WITHOUT DELAY.
 - For advice, contact a Poisons Information Centre or a doctor.
- Where Medical attention is not immediately available or where the patient is more than 15 minutes from a hospital or unless instructed otherwise:
- Induce vomiting with fingers down the back of the 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:
- Immediately hold eyelids apart and flush the eye continuously with running water.
- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes.
- Transport to hospital or doctor without delay.
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN

- If skin 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.
- Prosthesis 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.

NOTES TO PHYSICIAN

- High acute exposure, to cadmium, produces delayed pulmonary oedema progressing to interstitial fibrosis.
- For acute inhalations, initial presentation simulates metal fume fever (fever, headache, dyspnoea, pleuritic chest pain, conjunctivitis, rhinitis, sore throat, cough) developing 4-12 hours post-exposure. Respiratory failure may ensue in 3-10 days.

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Section 4 - FIRST AID MEASURES

- For acute oral exposures, gastroenteritis results with sudden onset of vomiting, diarrhoea and abdominal pain.
- If vomiting is not prominent, use Ipecac/lavage/catharsis in usual manner.
- CaNa₂EDTA is the chelator of choice for acute cadmium exposure. British Anti-Lewisite increases nephrotoxicity and therefore is not indicated

[Ellenhorn and Barceloux: Medical Toxicology]

COMMENTS on HUMAN TOXICITY:

- Between 10 and 50% of inhaled cadmium is adsorbed, the adsorption being greater for smaller particles and fumes; absorption through skin is negligible.

- The half-life of cadmium in the human body is thought to be about around 30 years and it has no known biological function.

Blood and urine cadmium concentrations may be determined.

Normal concentrations

Blood <27 nmol/l (<3ug/l), non- smokers <54 nmol/l (<6 ug/l), smokers

Urine <18 nmol/l (<2 ug/l), non- smokers 0.4-1.3 nmol/mmol creatinine <45 nmol/l (<5 ug/l), smokers 10- 35 nmol/mmol creatinine

Hazardous concentrations

>180 nmol/l (>20 ug/l)

>180 nmol/l (>20 ug/l) >4- 13 nmol/mmol creatinine

BIOLOGICAL EXPOSURE INDEX (BEI)

These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

Determinant	Sampling time	Index	Comments
Cadmium in urine	Not critical	5 ug/g creatinine	B
Cadmium in blood	Not critical	5 ug/L	B

B: Background levels occur in specimens collected from subjects NOT exposed.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

- There is no restriction on the type of extinguisher which may be used.

FIRE FIGHTING

- Alert Fire Brigade and tell them location and nature of hazard.
- Wear breathing apparatus plus protective gloves for fire only.
- Prevent, by any means available, spillage from entering drains or water courses.
- Use fire fighting procedures suitable for surrounding area.
- DO NOT approach containers suspected to be hot.
- Cool fire exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.

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Section 5 - FIRE FIGHTING MEASURES

- Equipment should be thoroughly decontaminated after use.

FIRE/EXPLOSION HAZARD

- Non combustible liquid.

Will not burn, but heat produces highly toxic fumes/vapours.

FIRE INCOMPATIBILITY

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

PERSONAL PROTECTION

Glasses:

Safety Glasses.

Gloves:

When handling larger quantities:

Respirator:

Type AE- P Filter of sufficient capacity

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS

- Clean up all spills immediately.
- Avoid breathing vapours and contact with skin and eyes.
- Control personal contact by using protective equipment.
- Contain and absorb spill with sand, earth, inert material or vermiculite.
- Wipe up.
- Place in a suitable, labelled container for waste disposal.

MAJOR SPILLS

- Minor hazard.
- Clear area of personnel.
- Alert Fire Brigade and tell them location and nature of hazard.
- Control personal contact by using protective equipment as required.
- Prevent spillage from entering drains or water ways.
- Contain spill with sand, earth or vermiculite.
- Collect recoverable product into labelled containers for recycling.
- Absorb remaining product with sand, earth or vermiculite and place in appropriate containers for disposal.
- Wash area and prevent runoff into drains or waterways.
- If contamination of drains or waterways occurs, advise emergency services.

EMERGENCY RESPONSE PLANNING GUIDELINES (ERPG)

The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour WITHOUT experiencing or developing

life-threatening health effects is:

nitric acid 78ppm

irreversible or other serious effects or symptoms which could impair an individual's ability to take protective action is:

nitric acid 6ppm

other than mild, transient adverse effects without perceiving a clearly defined odour is:

nitric acid 1ppm

American Industrial Hygiene Association (AIHA)

Ingredients considered according to the following cutoffs

Very Toxic (T+) >= 0.1% Toxic (T) >= 3.0%

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Section 6 - ACCIDENTAL RELEASE MEASURES

R50	$\geq 0.25\%$	Corrosive (C)	$\geq 5.0\%$
R51	$\geq 2.5\%$		
else	$\geq 10\%$		

where percentage is percentage of ingredient found in the mixture

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

- Limit all unnecessary personal contact.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Avoid contact with incompatible materials.
- When handling, DO NOT eat, drink or smoke.
- Keep containers securely sealed when not in use.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately.
- Use good occupational work practice.
- Observe manufacturer's storing and handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

SUITABLE CONTAINER

- Packaging as recommended by manufacturer.
- Check that containers are clearly labelled.
- Glass container is suitable for laboratory quantities.

STORAGE INCOMPATIBILITY

- Avoid contamination of water, foodstuffs, feed or seed.

STORAGE REQUIREMENTS

- Store in original containers.
- Keep containers securely sealed.
- Store in a cool, dry, well-ventilated area.
- Store away from incompatible materials and foodstuff containers.
- Protect containers against physical damage and check regularly for leaks.
- Observe manufacturer's storing and handling recommendations.

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS



X



X



+



X



X



+

+: May be stored together

O: May be stored together with specific precautions

X: Must not be stored together

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Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

Source	Material	TWA ppm	TWA mg/m ³	STEL ppm	STEL mg/m ³
Australia Exposure Standards	cadmium nitrate (Cadmium and compounds (as Cd))		0.01		
Australia Exposure Standards	nitric acid (Nitric acid)	2	5.2	4	10

The following materials had no OELs on our records

• water:

CAS:7732- 18- 5

EMERGENCY EXPOSURE LIMITS

Material	Revised IDLH Value (mg/m ³)	Revised IDLH Value (ppm)
nitric acid		25

MATERIAL DATA

CADMIUM STANDARD SOLUTION 1000 MG/L:

- None assigned. Refer to individual constituents.

CADMIUM NITRATE:

■ The adopted TLVs were recommended to prevent proteinuria, pulmonary oedema and emphysema. Evidence for added risk of carcinoma of the lung and prostate has been reported amongst smelter workers but exposure to other toxic fumes, gases and dusts is a confounding factor. Most of the data on cadmium levels responsible for these observed effects indicated exposures above the former TLV ceiling of 0.1 mg/m³ for cadmium fume. It is anticipated that the total dust recommendation will prevent the development of preclinical kidney dysfunction and that the respirable fraction recommendation will protect the lower respiratory tract from the accumulation of cadmium burden that might directly act on the lung as a carcinogen. It is also expected that the recommendations will protect workers from metal fume fever. The concentration of respirable dust for application of this limit is to be determined from the fraction that penetrates a separator whose size collection efficiency is described by a cumulative log normal function with a median aerodynamic volume of 4.0 µm (+-) 0.3 µm and with a geometric standard deviation of 1.5 µm (+-) 0.1 µm, i.e. less than 5 µm. Some jurisdictions require that health surveillance be conducted on occupationally exposed workers.

Such surveillance should emphasise

- demography, occupational and medical history
- health advice, including counselling on additional cadmium burden from smoking
- physical examination with emphasis on the respiratory system
- completion of a standardised respiratory questionnaire
- standardised respiratory function tests such as FEV₁, FVC and FEV₁/FVC
- urinary cadmium and beta2-microglobulin
- records of personal exposure.

NITRIC ACID:

- For nitric acid:

Odour Threshold Value: 0.27 ppm (detection)

NOTE: Detector tubes for nitric acid, measuring in excess of 5 ppm, are commercially available.

The TLV-TWA is protective against corrosion of the skin, tissue and other membranes, against irritation to the eyes and mucous membranes, and against acute pulmonary oedema or chronic obstructive lung disease. It is not clear whether the TLV-TWA and STEL values will prevent potentiation of the toxicity of inhaled nitrogen dioxide.

WATER:

- No exposure limits set by NOHSC or ACGIH.

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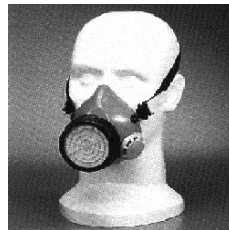
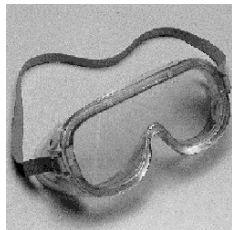
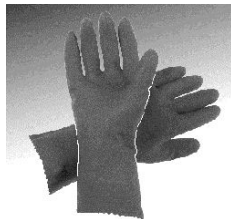
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Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

PERSONAL PROTECTION



EYE

- Safety glasses.
- Safety glasses with side shields.
- Chemical goggles.
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

HANDS/FEET

- PVC gloves.

OTHER

- No special equipment needed when handling small quantities

OTHERWISE:

- Overalls
- Eyewash unit.

RESPIRATOR

- Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.

Breathing Zone Level ppm (volume)	Maximum Protection Factor	Half- face Respirator	Full- Face Respirator
1000	10	AE- AUS P	-
1000	50	-	AE- AUS P
5000	50	Airline *	-
5000	100	-	AE- 2 P
10000	100	-	AE- 3 P
	100+		Airline**

* - Continuous Flow ** - Continuous-flow or positive pressure demand.

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required. For further information consult your Occupational Health and Safety Advisor.

ENGINEERING CONTROLS

- General exhaust is adequate under normal operating conditions. Local exhaust ventilation may be required in specific circumstances. If risk of overexposure exists, wear approved respirator. Correct fit is essential to

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Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

obtain adequate protection. Provide adequate ventilation in warehouse or closed storage areas. Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to effectively remove the contaminant.

Type of Contaminant:	Air Speed:
solvent, vapours, degreasing etc., evaporating from tank (in still air).	0.25- 0.5 m/s (50- 100 f/min)
aerosols, fumes from pouring operations, intermittent container filling, low speed conveyer transfers, welding, spray drift, plating acid fumes, pickling (released at low velocity into zone of active generation)	0.5- 1 m/s (100- 200 f/min.)
direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)	1- 2.5 m/s (200- 500 f/min.)
grinding, abrasive blasting, tumbling, high speed wheel generated dusts (released at high initial velocity into zone of very high rapid air motion).	2.5- 10 m/s (500- 2000 f/min.)

Within each range the appropriate value depends on:

Lower end of the range	Upper end of the range
1: Room air currents minimal or favourable to capture	1: Disturbing room air currents
2: Contaminants of low toxicity or of nuisance value only.	2: Contaminants of high toxicity
3: Intermittent, low production.	3: High production, heavy use
4: Large hood or large air mass in motion	4: Small hood- local control only

Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 1-2 m/s (200-400 f/min) for extraction of solvents generated in a tank 2 meters distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.

Special ventilation requirements apply for processes which result in the generation of beryllium or cadmium fume.

The use of mechanical ventilation by local exhaust systems is required as a minimum in all circumstances (including outdoor work). Personal respirators and special glove boxes afford additional protection

(In confined spaces always check that oxygen has not been depleted by excessive rusting of steel or snowflake corrosion of aluminium) Local exhaust systems must be designed to provide a minimum capture velocity at the fume source, away from the worker, of 0.5 metre/sec. 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:
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welding, brazing fumes (released at relatively low velocity into moderately still air)

0.5- 1.0 m/s (100- 200 f/min.)

Within each range the appropriate value depends on:

Lower end of the range

1: Room air currents minimal or favourable to capture

2: Contaminants of low toxicity or of nuisance value only.

3: Intermittent, low production.

4: Large hood or large air mass in motion

Upper end of the range

1: Disturbing room air currents

2: Contaminants of high toxicity

3: High production, heavy use

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 welding or brazing fumes generated 2 meters distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE

Colourless, odourless liquid; mixes with water. Dilute acid solution containing a known amount of cadmium such that its concentration is 1000 parts per million as Cd. Solution pH low to maintain stability. Solute is cadmium nitrate, matrix is nitric acid.

PHYSICAL PROPERTIES

Liquid.

Mixes with water.

Toxic or noxious vapours/gas.

State	Liquid	Molecular Weight	Not applicable.
Melting Range (°C)	Not available	Boiling Range (°C)	100 approx
Solubility in water (g/L)	Miscible	Flash Point (°C)	Not applicable
pH (1% solution)	< 1	Decomposition Temp (°C)	Not available.
pH (as supplied)	< 1	Autoignition Temp (°C)	Not available.
Vapour Pressure (kPa)	as water	Upper Explosive Limit (%)	Not applicable.
Specific Gravity (water=1)	1 approx	Lower Explosive Limit (%)	Not applicable.
Relative Vapour Density (air=1)	Not available	Volatile Component (%vol)	Not available
Evaporation Rate	Not available		

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Section 10 - CHEMICAL STABILITY AND REACTIVITY INFORMATION

CONDITIONS CONTRIBUTING TO INSTABILITY

- Product is considered stable and hazardous polymerisation will not occur.
For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

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.
- The material can produce chemical burns within the oral cavity and gastrointestinal tract following ingestion.
- Considered an unlikely route of entry in commercial/industrial environments.
- Ingestion may result in nausea, abdominal irritation, pain and vomiting.
- Ingestion of cadmium salts rarely results in poisoning as vomiting rejects the dose. Ingestion may cause excessive salivation, nausea, persistent vomiting, diarrhoea and abdominal pain.

EYE

- The material can produce chemical burns to the eye following direct contact. Vapours or mists may be extremely irritating.
- If applied to the eyes, this material causes severe eye damage.
- Eye contact is extremely painful and may cause rapid corneal damage.

SKIN

- Skin contact with the material may be harmful; systemic effects may result following absorption.
- The material can produce chemical burns following direct contact with the skin.

INHALED

- If inhaled, this material can irritate the throat and lungs of some persons.
- Inhalation hazard is increased at higher temperatures.
- Cadmium fume may cause acute irritation of the respiratory passages, bronchitis, chemical pneumonia or excessive fluid in the lungs. There may be a latent period of several hours between exposure and onset of symptoms. The initial effects of over-exposure may resemble metal fume fever. A single exposure to very high levels of fume may be fatal.

CHRONIC HEALTH EFFECTS

- There is ample evidence that this material can be regarded as being able to cause cancer in humans based on experiments and other information.
 - Principal routes of exposure are usually by skin contact/eye contact with the liquid.
- Chronic cadmium poisoning causes softening of the bones, reduced bone density, kidney stones and increased blood pressure. There may be cardiovascular disease and a yellow ring in the tooth structure. Repeated or prolonged exposure can lead to loss of smell, ulcers in the nose, emphysema and mild anaemia. The risk of prostate, respiratory, bowel and genito-urinary cancers may be increased in humans.
- As with any chemical product, contact with unprotected bare skin; inhalation of vapour, mist or dust in work place atmosphere; or ingestion in any form, should be avoided by observing good occupational work practice.

TOXICITY AND IRRITATION

- Not available. Refer to individual constituents.

CADMIUM NITRATE:

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

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Section 11 - TOXICOLOGICAL INFORMATION

TOXICITY

Oral (rat) LD50: 300 mg/kg

■ **WARNING:** This substance has been classified by the IARC as Group 2A: Probably Carcinogenic to Humans. Tenth Annual Report on Carcinogens: Substance anticipated to be Carcinogen [National Toxicology Program: U.S. Dep. of Health & Human Services 2002].

IRRITATION

Nil Reported

NITRIC ACID:

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

TOXICITY

Oral (human) LDLo: 430 mg/kg

Inhalation (rat) LC50: 2500 ppm/1h * * DuPont

Unreported (man) LDLo: 110 mg/kg

Inhalation (Cat) LC: 500 mg/m³/4h

Inhalation (Rat) LC50: 130 mg/m³/4h

Oral (Human) LD: 430 mg/kg

Inhalation (Cat) TCLo: 300 mg/m³/2h

■ 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. The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

The material may produce respiratory tract irritation, and result in damage to the lung including reduced lung function.

The material may cause severe skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin. Repeated exposures may produce severe ulceration.

Oral (?) LD50: 50-500 mg/kg *

[Various Manufacturers]

IRRITATION

Nil Reported

WATER:

■ No significant acute toxicological data identified in literature search.

CARCINOGEN

Nitrate or nitrite (ingested) under conditions that result in endogenous nitrosation

International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs

Group

2A

Cadmium and cadmium compounds

International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs

Group

1

CAS~

Australia Exposure Standards - Carcinogens

Carcinogen Category

2

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Section 12 - ECOLOGICAL INFORMATION

cadmium nitrate 96 hr LC50 (4.35) mg/L Zebra danio Fish Source:

Refer to data for ingredients, which follows:

NITRIC ACID:

CADMIUM NITRATE:

- DO NOT discharge into sewer or waterways.

CADMIUM STANDARD SOLUTION 1000 MG/L:

No data.

CADMIUM NITRATE:

- | | |
|--------------------------------------|------------|
| ■ Hazardous Air Pollutant: | Yes |
| ■ Fish LC50 (96hr.) (mg/l): | 41.9 (48hr |
| ■ Daphnia magna EC50 (48hr.) (mg/l): | 56 |

- Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
 - Do NOT allow product to come in contact with surface waters or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment wash-waters. Wastes resulting from use of the product must be disposed of on site or at approved waste sites.
 - Metal-containing inorganic substances generally have negligible vapour pressure and are not expected to partition to air. Once released to surface waters and moist soils their fate depends on solubility and dissociation in water. Environmental processes (such as oxidation and the presence of acids or bases) may transform insoluble metals to more soluble ionic forms. Microbiological processes may also transform insoluble metals to more soluble forms. Such ionic species may bind to dissolved ligands or sorb to solid particles in aquatic or aqueous media. A significant proportion of dissolved/ sorbed metals will end up in sediments through the settling of suspended particles. The remaining metal ions can then be taken up by aquatic organisms.
- When released to dry soil most metals will exhibit limited mobility and remain in the upper layer; some will leach locally into ground water and/ or surface water ecosystems when soaked by rain or melt ice. Environmental processes may also be important in changing solubilities. Even though many metals show few toxic effects at physiological pHs, transformation may introduce new or magnified effects.

A metal ion is considered infinitely persistent because it cannot degrade further.

The current state of science does not allow for an unambiguous interpretation of various measures of bioaccumulation.

The counter-ion may also create health and environmental concerns once isolated from the metal. Under normal physiological conditions the counter-ion may be essentially insoluble and may not be bioavailable.

Environmental processes may enhance bioavailability.

- The nitrates are of environmental concern because of their high water solubility and consequent leaching, diffusion, and environmental mobility in soil and water. Nitrate can contaminate groundwater to unacceptable levels. Nitrite is formed from nitrate or ammonium ion by micro-organisms in soil, water, sewage and the alimentary tract. The concern with nitrate in the environment is related to its conversion to nitrite.

Methaemoglobinaemia is caused following exposure to high levels of nitrite and produces difficulties in oxygen transport in the blood. Thousands of cases involving poisoning of infants, particularly in rural areas, have been reported as a result of drinking nitrate rich well-water.

Other concerns deriving from exposure to environmental nitrates relate to the production of nitrosamines following the reaction of food nitrites and secondary amines. Other nitroso-compounds may result following reaction with nitrites and amides, ureas, carbamates and other nitrogenous compounds. Nitrosamines produce liver damage, haemorrhagic lung lesions, convulsions and coma in rats, and teratogenic effects in experimental animals.

The N-nitroso class of compounds include potent carcinogens and mutagens: induction of tumors by single doses of N-nitroso compounds testify to this.

- The importance of cadmium in environmental disease is illustrated in the outbreak of itai-itai disease caused by the contamination of rice paddies in Japan by smelter waste. Cadmium toxicity affected the skeletal system of inhabitants of the region resulting in severe bony deformities and chronic renal disease. Although cadmium exposure has been implicated in the pathogenesis of the syndrome, vitamin D deficiencies and other

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CADMIUM STANDARD SOLUTION 1000 MG/L

nutritional deficiencies are also thought to be implicated. ("Itai-itai" translates to "ouch-ouch" reflecting the accompanying bone pain). Sewage sludge and phosphate fertilisers are often contaminated with cadmium which then concentrates in plants grown on contaminated soils. Compared with other heavy metals cadmium is mobile in the aqueous environment and may exist as the hydrated ion, as complexes with carbonate, chloride or sulfate or with humic acids. Cadmium thus tends to move in the environment and is widely distributed. It is taken up by organisms and is bioaccumulated. Bioconcentration in the aquatic environment is greatest in invertebrates such as mollusks and crustaceans, followed by fish and plants. However, under reducing conditions, cadmium forms the insoluble sulfide and precipitates in the sediment. The biological production of sulfide also promotes the formation of cadmium sulfide. Cadmium is one of the most readily absorbed metals in plants grown on contaminated soils and the potential for bioaccumulation is substantial. Zinc and calcium are also thought to bioaccumulate with cadmium with a resultant protective action against its toxic effects. Significant compartments for soluble cadmium salts are likely to be soil and water. Cadmium(II) adsorbs to sediments. Once in an aquatic environment cadmium is highly mobile; its dissolved species are highly labile and are first to be released, for example, when salinity is increased in estuaries. In fresh water, cadmium toxicity is influenced by water hardness (the harder the water, the lower the toxicity). Cadmium can bioaccumulate and bioconcentrate in the food chain. Biomagnification in terrestrial food chains is not expected.

Cadmium is more mobile in aquatic environments than most other heavy metals (e.g., lead). In most natural surface waters, the affinities of complexing ligands for cadmium generally follow the order of humic acids > CO_3^{2-} > OH^- > Cl^- > SO_4^{2-} . In unpolluted natural waters, most cadmium transported in the water column will exist in the dissolved state as the hydrated ion $\text{Cd}(\text{H}_2\text{O})_6^{2+}$. Minor amounts of cadmium are transported with the coarse particulates, and only a small fraction is transported with the colloids. In unpolluted waters, cadmium can be removed from solution by exchange of cadmium for calcium in the lattice structure of carbonate minerals. In polluted organic-rich waters, adsorption of cadmium by humic substances and other organic complexing agents plays a dominant role in transport, partitioning, and remobilization of cadmium. Cadmium concentration in water is inversely related to the pH and the concentration of organic material in the water. Because cadmium exists only in the +2 oxidation state in water, aqueous cadmium is not strongly influenced by the oxidizing or reducing potential of the water. However, under reducing conditions, cadmium may form cadmium sulfide, which is poorly soluble and tends to precipitate. Free (ionic) cadmium seems to be the toxic form and becomes much more prevalent at low salinity. Cadmium has a relatively long residence time in aquatic systems. In Lake Michigan, a mean residence time of 4-10 years was calculated for cadmium compared to 22 years calculated for mercury.

Precipitation and sorption to mineral surfaces, hydrous metal oxides, and organic materials are the most important processes for removal of cadmium to bed sediments. Humic acid is the major component of sediment responsible for adsorption. Sorption increases as the pH increases.

Sediment bacteria may also assist in the partitioning of cadmium from water to sediments. Both cadmium-sensitive and cadmium-resistant bacteria reduced the cadmium concentration in the water column from 1 ppm to between 0.2 and 0.6 ppm, with a corresponding increase in cadmium concentration in the sediments in the simulated environment. Studies indicate that concentrations of cadmium in sediments are at least one order of magnitude higher than in the overlying water. The mode of sorption of cadmium to sediments is important in determining its disposition to remobilize. Cadmium associated with carbonate minerals, precipitated as stable solid compounds or co-precipitated with hydrous iron oxides, is less likely to be mobilized by resuspension of sediments or biological activity. Cadmium that is adsorbed to mineral surfaces such as clay, or to organic materials, is more easily bioaccumulated or released in the dissolved state when the sediment is disturbed. Cadmium may redissolve from sediments under varying ambient conditions of pH, salinity, and redox potential. Cadmium is not known to form volatile compounds in the aquatic environment, so partitioning from water to the atmosphere does not occur.

In soils, pH, oxidation-reduction reactions, and formation of complexes are important factors affecting the mobility of cadmium. Cadmium can participate in exchange reactions on the negatively charged surface of clay minerals. In acid soils, the reaction is reversible. However, adsorption increases with pH and may become irreversible. Cadmium also may precipitate as insoluble cadmium compounds, or form complexes or chelates by interaction with organic matter. Available data suggest that organic matter is more effective than inorganic constituents in keeping cadmium unavailable. Examples of cadmium compounds found in soil are $\text{Cd}_3(\text{PO}_4)_2$, CdCO_3 , and $\text{Cd}(\text{OH})_2$. These compounds are formed as the pH rises. It has been found that about 90% of cadmium in soils remains in the top 15 cm.

Aquatic and terrestrial organisms bioaccumulate cadmium. Cadmium concentrates in freshwater and marine animals to concentrations hundreds to thousands of times higher than in the water. Reported bioconcentration factors (BCFs) range from 113 to 18,000 for invertebrates, from 3 to 4,190 for fresh water aquatic organisms, and from 5 to 3,160 for saltwater aquatic organisms. Bioconcentration in fish depends on the pH and the humus

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Section 12 - ECOLOGICAL INFORMATION

content of the water. Cadmium (not an estrogen mimic) has also been shown to cause increased vitellogenesis in female Atlantic croaker (*Micropogonias undulatus*), but this is thought to be caused by direct toxic action on the pituitary, leading to altered secretion of gonadotropin hormone. Because of their high ability to accumulate metals, some aquatic plants have been suggested for use in pollution control. For example, it has been suggested that the rapidly-growing water hyacinth *Eichhornia crassipes* could be used to remove cadmium from domestic and industrial effluents. The data indicate that cadmium bioaccumulates in all levels of the food chain. Cadmium accumulation has been reported in grasses and food crops, and in earthworms, poultry, cattle, horses, and wildlife. The metal burden of a crop depends on uptake by the root system, direct foliar uptake and translocation within the plant, and surface deposition of particulate matter. In general, cadmium accumulates in the leaves of plants and, therefore, is more of a risk in leafy vegetables grown in contaminated soil than in seed or root crops.

Since cadmium accumulates largely in the liver and kidneys of vertebrates and not in the muscle tissue and intestinal absorption of cadmium is low, biomagnification through the food chain may not be significant. In a study of marine organisms from the Tyrrhenian Sea, no evidence of cadmium biomagnification was found along pelagic or benthic food webs. Although some data indicate increased cadmium concentrations in animals at the top of the food chain, comparisons among animals at different trophic levels are difficult, and the data available on biomagnification are not conclusive. Nevertheless, uptake of cadmium from soil by feed crops may result in high levels of cadmium in beef and poultry (especially in the liver and kidneys). This accumulation of cadmium in the food chain has important implications for human exposure to cadmium, whether or not significant biomagnification occurs.

Drinking water standards:

5 ug/l (UK max.)

3 ug/l (WHO guideline)

Soil Guidelines: Dutch Criteria:

0.8 mg/kg (target)

12 mg/kg (intervention)

Air Quality Standards:

<1-5 ng/m³ (rural areas)

10-20 ng/m³ (urban and industrial areas) (WHO Guidelines).

■ The material is classified as an ecotoxin* because the Fish LC₅₀ (96 hours) is less than or equal to 0.1 mg/l

* Classification of Substances as Ecotoxic (Dangerous to the Environment)

Appendix 8, Table 1

Compiler's Guide for the Preparation of International Chemical Safety Cards: 1993 Commission of the European Communities.

May contain up to 12.5% cadmium.

NITRIC ACID:

■ For oxides of nitrogen:

Environmental fate

Oxides of nitrogen are part of the biogeochemical cycling of nitrogen, and are found in air, soil and water. In the atmosphere, oxides of nitrogen are rapidly oxidised to nitrogen dioxide (half-life about 50 days), which dissolves in water to produce dilute nitric acid and precipitates in rain. An increased rate of formation of oxides of nitrogen therefore contributes to 'acid rain'.

In the stratosphere, oxides of nitrogen play a crucial role in maintaining the level of ozone. Ozone is formed through the photochemical reaction of nitrogen dioxide and oxygen. However, too little nitrogen dioxide results in too little ozone being formed. On the other hand, too much nitric oxide reduces the level of ozone because of an increase in the reaction of ozone to convert nitric oxide to nitrogen dioxide.

In the lower atmosphere, oxides of nitrogen play a major role in the formation of photochemical smog in a complex set of reactions that lead to the formation of a variety of nitrated organic compounds (from volatile organic matter) and excessive levels of ozone.

Environmental transport The oxides of nitrogen travel as gases through soil and the atmosphere, and in solution in water in soils, rivers and lakes, and rain and snow.

■ Prevent, by any means available, spillage from entering drains or water courses.

Ecotoxicity

Ingredient

Persistence:
Water/Soil

Persistence: Air

Bioaccumulation

Mobility

continued...

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Section 12 - ECOLOGICAL INFORMATION

cadmium nitrate		LOW	
nitric acid		LOW	
water	LOW	LOW	HIGH

Section 13 - DISPOSAL CONSIDERATIONS

- Recycle wherever possible or consult manufacturer for recycling options.
- Consult State Land Waste Management Authority for disposal.
- Treat and neutralise at an effluent treatment plant.
- Recycle containers if possible, or dispose of in an authorised landfill.

Section 14 - TRANSPORTATION INFORMATION

HAZCHEM:

☐ None

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

Section 15 - REGULATORY INFORMATION

REGULATIONS

Regulations for ingredients

cadmium nitrate (CAS: 10325-94-7,10022-68-1,55371-70-5) is found on the following regulatory lists;

"Australia Inventory of Chemical Substances (AICS)", "OECD Representative List of High Production Volume (HPV) Chemicals"

nitric acid (CAS: 7697-37-2) is found on the following regulatory lists;

"Australia Exposure Standards", "Australia Hazardous Substances", "Australia High Volume Industrial Chemical List (HVICL)", "Australia Inventory of Chemical Substances (AICS)", "Australia National Pollutant Inventory", "Australia Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP) - Appendix E (Part 2)", "Australia Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP) - Appendix F (Part 3)", "Australia Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP) - Schedule 5", "Australia Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP) - Schedule 6", "GESAMP/EHS Composite List - GESAMP Hazard Profiles", "IMO IBC Code Chapter 17: Summary of minimum requirements", "IMO MARPOL 73/78 (Annex II) - List of Noxious Liquid Substances Carried in Bulk", "International Council of Chemical Associations (ICCA) - High Production Volume List", "OECD Representative List of High Production Volume (HPV) Chemicals"

water (CAS: 7732-18-5) is found on the following regulatory lists;

"Australia Inventory of Chemical Substances (AICS)", "IMO IBC Code Chapter 18: List of products to which the Code does not apply", "OECD Representative List of High Production Volume (HPV) Chemicals"

No data for Cadmium Standard Solution 1000 mg/L (8507-14)

Section 16 - OTHER INFORMATION

INGREDIENTS WITH MULTIPLE CAS NUMBERS

Ingredient Name	CAS
cadmium nitrate	10325- 94- 7, 10022- 68- 1, 55371- 70- 5

EXPOSURE STANDARD FOR MIXTURES

- "Worst Case" computer-aided prediction of spray/ mist or fume/ dust components and concentration:

continued...

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Section 16 - OTHER INFORMATION

- Composite Exposure Standard for Mixture (TWA) :100 mg/m³.
- Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by using available literature 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.

The above information is believed to be accurate and represent the best information currently available to us, but does not represent any warranty expressed or implied of the properties of the product. User should make their own investigation to determine the suitability of the information for their particular purpose.

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