SELENIUM STANDARD SOLUTION (1000MG/L)

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
SELENIUM STANDARD SOLUTION (1000MG/L)

OTHER NAMES
"selenium AAS standard", "standard solution of selenium for atomic absorption spectrophotometry"

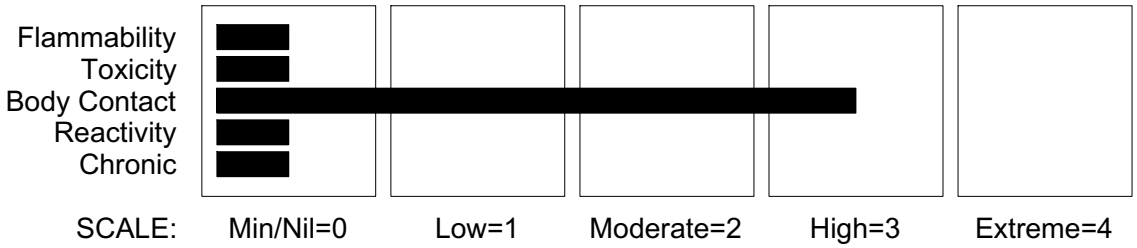
PROPER SHIPPING NAME
CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.(CONTAINS NITRIC ACID)

PRODUCT USE
As a laboratory reagent; spectroscopic calibration solution for selenium.
c(Se) = 1000 +/-2 mg/L (12.7 millimol/litre)

SUPPLIER
Company: S D FINE - CHEM LIMITED
Address:
315- 317, T.V.IND.ESTATE,
248 WORLI ROAD,
MUMBAI- 400 030, INDIA
technical@sdfine.com
Telephone: 91- 22 24959898
Telephone: 91- 22 24959899
Fax: 91- 22 24937232

Section 2 - HAZARDS IDENTIFICATION

HAZARD RATINGS



GHS Classification
Acute Toxicity (Inhalation) Category 3
Eye Irritation Category 2A
Metal Corrosion Category 1
Respiratory Irritation Category 3
Serious Eye Damage Category 1
Skin Corrosion/Irritation Category 2

continued...

EMERGENCY OVERVIEW

HAZARD
DANGER
Determined by using GHS criteria:
H335 H331 H315 H290 H315 H318 H319
May cause respiratory irritation
Toxic if inhaled
Causes skin irritation
May be corrosive to metals
Causes skin irritation
Causes serious eye damage
Causes serious eye irritation

PRECAUTIONARY STATEMENTS

Prevention
Keep only in original container.
Avoid breathing dust/fume/gas/mist/vapours/spray.
Wash thoroughly after handling.
Use only outdoors or in a well-ventilated area.
Wear protective gloves/protective clothing/eye protection/face protection.

Response
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.
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.
If eye irritation persists: Get medical advice/attention.
Absorb spillage to prevent material damage.

Storage
Store in a well-ventilated place. Keep container tightly closed.
Store locked up.
Store in corrosive resistant container or with a resistant inner liner.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
selenium dioxide	7446-08-4	0.1
nitric acid	7697-37-2	NOT SPEC
water	7732-18-5	NOT SPEC

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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:
• Immediately hold eyelids apart and flush the eye continuously with running water.
• Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
• Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes.
• Transport to hospital or doctor without delay.
• Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN
■ If skin or hair contact occurs:
• 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.
• Other measures are usually unnecessary.

NOTES TO PHYSICIAN
■ Treat symptomatically.

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.
• Equipment should be thoroughly decontaminated after use.

FIRE/EXPLOSION HAZARD
• Non combustible.
• Not considered to be a significant fire risk.
• Expansion or decomposition on heating may lead to violent rupture of containers.
• Decomposes on heating and may produce toxic fumes of carbon monoxide (CO).
• May emit acrid smoke.
Decomposes on heating and produces toxic fumes of nitrogen oxides (NOx).

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FIRE INCOMPATIBILITY
■ None known.

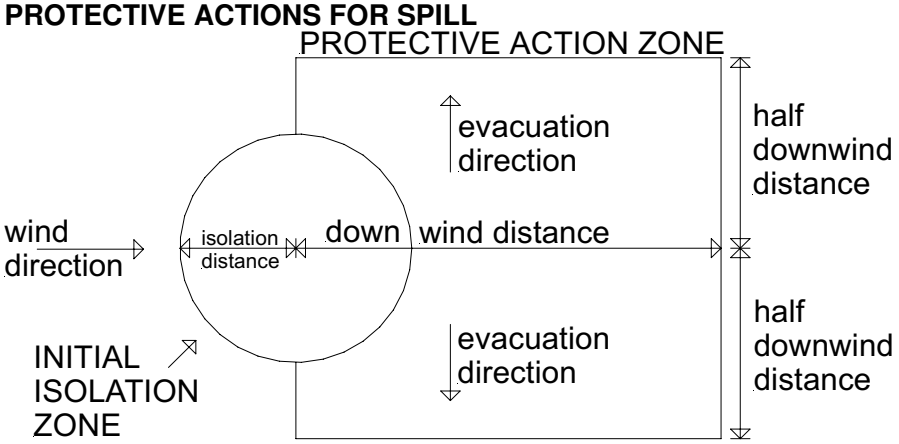
Personal Protective Equipment
Gas tight chemical resistant suit.

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS
■ Clean up all spills immediately.
Wipe up.
Place in clean drum then flush area with water.

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.

PROTECTIVE ACTIONS FOR SPILL



From IERG (Canada/Australia)

Isolation Distance	25 metres
Downwind Protection Distance	250 metres
IERG Number	37

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

continued...

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 154 is taken from the US DOT emergency response guide book.
6 IERG information is derived from CANUTEC - Transport Canada.

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.
• When handling DO NOT eat, drink or smoke.
• Always wash hands with soap and water after handling.
• Avoid physical damage to containers.
• Use good occupational work practice.
• Observe manufacturer's storing and handling recommendations.

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

STORAGE INCOMPATIBILITY
■ Segregate from strong acids and strong alkalis.

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	+

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

continued...

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

Source	Material	TWA ppm	TWA mg/m³	STEL ppm	STEL mg/m³
Australia Exposure Standards	selenium dioxide (Selenium compounds (as Se) excluding hydrogen selenide)		0.1		
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/m3)	Revised IDLH Value (ppm)
selenium dioxide	1	
nitric acid		25

MATERIAL DATA

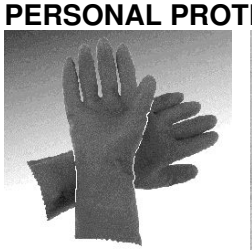
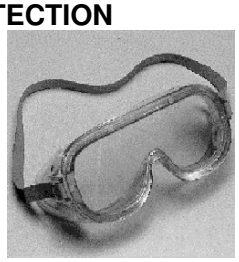
SELENIUM STANDARD SOLUTION (1000MG/L):
■ None assigned. Refer to individual constituents.

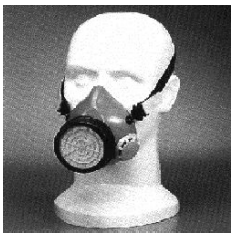
SELENIUM DIOXIDE:
■ There is extensive evidence of selenium poisoning as a result of ingestion of seleniferous grains and other foodstuffs. There have however been no reports of disabling disease or death from industrial exposures. The recommended TLV-TWA is thought to provide protection against systemic toxicity and minimise the potential for ocular and upper respiratory tract irritation.

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.

PERSONAL PROTECTION



EYE

■ No special equipment for minor exposure i.e. when handling small quantities.
• OTHERWISE:

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

HANDS/FEET

■ No special equipment needed when handling small quantities.
OTHERWISE: Wear general protective gloves, eg. light weight rubber gloves.

OTHER

■ Laboratory coat.
- 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. If risk of overexposure exists, wear SAA approved respirator. Correct fit is essential to 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.)

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

Within each range the appropriate value depends on:

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

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

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE

Clear, colourless, odourless liquid; mixes with water.
Dilute acid solution containing a known amount of selenium oxide such that its concentration is 1000 parts per million as Se.
Solution pH low to maintain solution stability.
Solute is selenium oxide, matrix is nitric acid.

PHYSICAL PROPERTIES

Liquid.
Mixes with water.
Corrosive.

State	Liquid	Molecular Weight	Not applicable
Melting Range (°C)	Not applicable	Boiling Range (°C)	Not applicable
Solubility in water (g/L)	Miscible	Flash Point (°C)	Not available
pH (1% solution)	Not available	Decomposition Temp (°C)	Not available
pH (as supplied)	<1	Autoignition Temp (°C)	Not available.
Vapour Pressure (kPa)	Not available	Upper Explosive Limit (%)	Not available
Specific Gravity (water=1)	Not applicable	Lower Explosive Limit (%)	Not available
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
■ Although ingestion is not thought to produce harmful effects (as classified under EC Directives), the material may still be damaging to the health of the individual, following ingestion, especially where pre-existing organ (e.g. liver, kidney) damage is evident. Present definitions of harmful or toxic substances are generally based on doses producing mortality rather than those producing morbidity (disease, ill-health). Gastrointestinal tract discomfort may produce nausea and vomiting. In an occupational setting however, ingestion of insignificant quantities is not thought to be cause for concern.
■ Considered an unlikely route of entry in commercial/industrial environments.

EYE
■ This material can cause eye irritation and damage in some persons.
■ The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

SKIN
■ This material can cause inflammation of the skin oncontact in some persons.
■ Skin contact is not thought to have harmful health effects (as classified under EC Directives); the material may still produce health damage following entry through wounds, lesions or abrasions.
■ The material may cause 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.

INHALED
■ If inhaled, this material can irritate the throat andlungs of some persons.
■ Although inhalation is not thought to produce harmful effects (as classified under EC Directives), the material may still produce health damage, especially where pre-existing organ (e.g. liver, kidney) damage is evident. Present definitions of harmful or toxic substances are generally confined to doses producing mortality rather than those producing morbidity (disease, ill-health).
■ Not normally a hazard due to non-volatile nature of product.
■ The material may produce respiratory tract irritation, and result in damage to the lung including reduced lung function.

CHRONIC HEALTH EFFECTS
■ Primary route of exposure is usually by skin contact/eye contact.
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.

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

TOXICITY	IRRITATION

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Oral (rat) LD50: 68.1 mg/kg
Intraperitoneal (rat) LD50: 3.6 mg/kg
Intravenous (rat) LD50: 2.71 mg/kg
Inhalation (rabbit) LCLo: 5890 mg/m³/20m
IARC Group 3 [MDL OHS]
Bacterial cell mutagen
Reproductive effector in rats.

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

IRRITATION
Nil Reported

■ 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]

WATER:
■ No significant acute toxicological data identified in literature search.

CARCINOGEN

Selenium and selenium compounds	International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs	Group	3

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Section 12 - ECOLOGICAL INFORMATION

Refer to data for ingredients, which follows:

NITRIC ACID:
SELENIUM DIOXIDE:
■ DO NOT discharge into sewer or waterways.

SELENIUM STANDARD SOLUTION (1000MG/L)
Marine Pollutant: Not Determined

SELENIUM DIOXIDE:
■ Hazardous Air Pollutant: Yes

■ 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 heath 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.
■ Feeding of plants from seleniferous rocks has been the cause of toxic effects in livestock. Environmental redistribution of selenium due to man's activity is due to copper smelting; lead, zinc, phosphate, and uranium mining; manufacture of glass ceramics and pigments; and burning of fuels.
Early concerns about selenium toxicity have given way to recognition of certain beneficial properties. Selenium is thought to possess some anti-carcinogenic activity and to protect against the toxicity of heavy metals such as cadmium, mercury and silver.
Sediment micro-organisms produce dimethyl selenide and dimethyl diselenide from both inorganic and organic sources and contribute to its biogeochemical cycling. Bacteria and cyanobacteria have two possible mechanisms for the uptake and transformation of selenate. The uptake mechanism involves the reduction of selenate to elemental selenium that will be physically held within the biological mat. The microorganisms are also found to cause the transformation of soluble selenium into volatile alkyl selenium compounds. Aquatic organisms can convert selenium to both inert and soluble forms. Duckweed, phytoplankton,bacteria, and fungi have been demonstrated to synthesise selenoamino acids from absorbed inorganic selenium compounds. These selenoamino acids are not likely to be found at significant dissolved concentrations in water, however, because amino acids are rapidly catabolised by bacteria. Benthic bacteria and fungi are capable of methylating elemental and inorganic selenium salts
Hydrogen selenide can be formed in a reducing environment. Both hydrogen selenide and the methylated forms of selenium are unstable in water and would be expected to rapidly volatilise to the atmosphere
The behavior of selenium in the environment is influenced to a large degree by its oxidation state and the consequent differences in the behavior of its different chemical compounds. The oxidation state of selenium in the environment is dependent on ambient conditions, particularly on pH, pE, and biological activity. The

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volatile selenium compounds that partition into the atmosphere include the inorganic compounds, selenium dioxide and hydrogen selenide, and the organic compounds, dimethyl selenide and dimethyl diselenide. Hydrogen selenide is highly reactive in air and is rapidly oxidised to elemental selenium and water, but the other compounds can persist in air. Selenium compounds released to the atmosphere can be removed by dry or wet deposition to soils or to surface water. The forms of selenium expected to be found in surface water and the water contained in soils are the salts of selenic and selenious acids. Selenic acid (H2SeO4) is a strong acid. The soluble selenate salts of this acid are expected to occur in alkaline waters. Sodium selenate is one of the most mobile selenium compounds in the environment because of its high solubility and inability to adsorb onto soil particles. Selenious acid (H2SeO3) is a weak acid, and the diselenite ion predominates in waters between pH 3.5 and 9. Most selenites are less soluble in water than the corresponding selenates.
Selenium in an aquatic environment is bioaccumulated by aquatic organisms; bioconcentration factors of 150-1,850 and bioaccumulation factors (BAFs) of 1,746-,975 have been reported for selenium in freshwater. The degree of bioaccumulation of selenium exhibited a stable pattern over several years, with selenium concentrations (wet weight) as follows: fish (6-35 mg/kg) > benthic insects (12-15 mg/kg) > annelids (10-12 mg/kg) > molluscs and crustaceans (5-9 mg/kg) > periphyton (4-6 mg/kg). In fish, selenium was concentrated in visceral tissue (25-35 mg/kg wet weight) more than in skeletal muscle (6-11 mg/kg wet weight). The BCFs and BAFs for selenium in visceral tissue (i.e., heart, hepatopancreas, spleen, and gonads) of fish have been estimated to range from 35 to 1,850 and from 1,058 to 3,980, respectively. Selenite was more concentrated than selenate for algae and daphnids, whereas bluegills concentrated both inorganic species about equally . Selenium accumulation from selenomethionine occurred more readily than from selenite or selenate. Some evidence indicates that selenium might biomagnify in aquatic organisms under natural conditions. Biomagnification is evidenced by progressively higher concentrations of an element or substance in organisms at successively higher trophic levels. More than 50% of the selenium contained in sediments in ponds and reservoirs appears to occurs in organic forms, resulting from the synthesis and bioaccumulation of organic selenium before the plants die and decay on the bottom.
In soils, pH and Eh are determining factors in the transport and partitioning of selenium. Elemental selenium is essentially insoluble and may represent a major inert "sink" for selenium introduced into the environment under anaerobic conditions. Heavy metal selenides and selenium sulfides, which are also insoluble, predominate in acidic (low pH) soils and in soils with high amounts of organic matter. Selenium in this form is immobile and will remain in the soil. The selenides of other metals such as copper and cadmium are of low solubility. Sodium and potassium selenites dominate in neutral, well-drained mineral soils, where some soluble metal selenites may be found as well. In alkaline (pH>7.5), well-oxidized soil environments, selenates are the major selenium species. Because of their high solubility and low tendency to adsorb onto soil particles, the selenates are very mobile and are readily taken up by biological systems or leached through the soil. The reported Kd values (distribution coefficient = [concentration of selenium sorbed on soil or rock]/[concentration of selenium in solution]) are 14.9 mL/g for sandy loam and 5.91 mL/g for sludge treated sandy soils. Selenite forms stable ferric oxide-selenite adsorption complexes in acid or neutral soils.
When environments favor the soluble forms of selenium (alkaline and oxidizing conditions), these forms can be accumulated by plants. In addition, although both selenite (Se4+) and selenate (Se6+) are soluble forms of selenium, selenate was found to be the preferred form of selenium taken up by plants. Preferential uptake of selenate may be caused by its tendency to be less strongly adsorbed to soil particles and organic matter than selenite. Selenium uptake by plants is influenced by many factors including soil type, pH, colloidal content, concentration of organic material, oxidation-reduction potentials in the root-soil environment, and total level of selenium in the soil. In acidic soils (pH 4.5-6.5) and under high moisture conditions, selenium is in the form of selenite and is bound to colloids as iron hydroxide selenium complexes. These complexes are insoluble and generally not bioavailable to plants. In basic soils (pH 7.5-8.5), selenium is present as soluble selenate. The use of lime and plant ash as fertilizers, which would raise the pH of the soil and favor the formation of selenate, has been implicated as a contributing factor in the accumulation of selenium in crops grown in high selenium soil found in certain regions of China.
Ecotoxicity data:
Fish toxicity LC50 (96 h): fathead minnow (Pimephales promelas): 2.9 mg/L
Invertebrate toxicity (96 h): Green mussel Perna viridis 1.0mg/L

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),

continued...

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
selenium dioxide	HIGH		LOW	HIGH
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

Labels Required: CORROSIVE

HAZCHEM:
2X

Land Transport UNDG:

Class or division:	8	Subsidiary risk:	None
UN No.:	3264	UN packing group:	III

Shipping Name:CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S. (CONTAINS NITRIC ACID)

Air Transport IATA:

ICAO/IATA Class:	8	ICAO/IATA Subrisk:	None
UN/ID Number:	3264	Packing Group:	III
Special provisions:	A3		

Shipping Name: CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
*(CONTAINS NITRIC ACID)

continued...

Maritime Transport IMDG:

IMDG Class:	8	IMDG Subrisk:	None
UN Number:	3264	Packing Group:	III
EMS Number:	F- A, S- B	Special provisions:	223 274 944
Limited Quantities:	5 L	Marine Pollutant:	Not Determined

Shipping Name: CORROSIVE LIQUID, ACIDIC,INORGANIC, N.O.S.(CONTAINS NITRIC ACID)

Section 15 - REGULATORY INFORMATION

REGULATIONS

Regulations for ingredients

selenium dioxide (CAS: 7446-08-4) is found on the following regulatory lists;

"Australia Inventory of Chemical Substances (AICS)"

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 Selenium Standard Solution (1000MG/L)

Section 16 - OTHER INFORMATION

EXPOSURE STANDARD FOR MIXTURES

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

■ 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

■ 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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