

UNIFIX ZN 3-28 L PART A.

Chemwatch GHS Safety Data Sheet
Issue Date: 13-Jan-2012
C226LP

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Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME

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PROPER SHIPPING NAME

CORROSIVE LIQUID, N.O.S.(contains phosphoric acid, monomethyl ester and phosphoric acid)

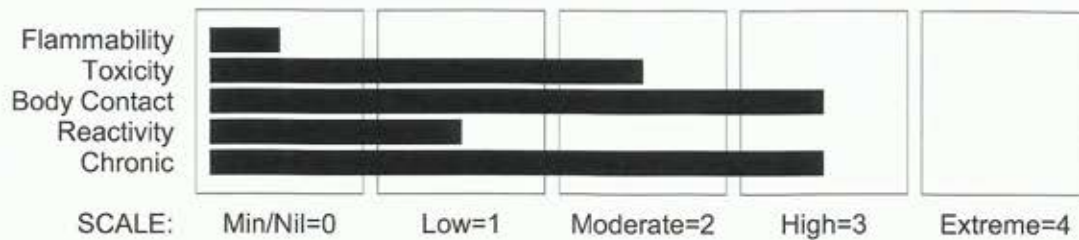
PRODUCT USE

Used in electroplating processes.

SUPPLIER

Section 2 - HAZARDS IDENTIFICATION

CHEMWATCH HAZARD RATINGS



GHS Classification

- Acute Aquatic Hazard Category 2
- Acute Toxicity Category 4
- Carcinogen Category 1B
- Chronic Aquatic Hazard Category 2
- Germ Cell Mutagen Category 2
- Metal Corrosion Category 1
- Respiratory Sensitizer Category 1
- Serious Eye Damage Category 1
- Skin Corrosion/Irritation Category 1C
- Skin Sensitizer Category 1



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Section 2 - HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

HAZARD DANGER

Determined by Chemwatch using GHS criteria

H290	May be corrosive to metals.
H302	Harmful if swallowed.
H314	Causes severe skin burns and eye damage.
H317	May cause an allergic skin reaction.
H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled.
H341	Suspected of causing genetic defects.
H350	May cause cancer.
H411	Toxic to aquatic life with long lasting effects.

PRECAUTIONARY STATEMENTS

Prevention

Code	Phrase
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P234	Keep only in original container.
P260	Do not breathe dust/fume/gas/mist/vapours/spray.
P261	Avoid breathing dust/fume/gas/mist/vapours/spray.
P264	Wash ... thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P272	Contaminated work clothing should not be allowed out of the workplace.
P273	Avoid release to the environment.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P281	Use personal protective equipment as required.
P285	In case of inadequate ventilation wear respiratory protection.

Response

Code	Phrase
P301+P312	IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell.
P301+P330+P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P302+P352	IF ON SKIN: Wash with plenty of soap and water.
P303+P361+P353	IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P304+P341	IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308+P313	IF exposed or concerned: Get medical advice/attention.
P310	Immediately call a POISON CENTER or doctor/physician.
P330	Rinse mouth.
P333+P313	If skin irritation or rash occurs: Get medical advice/attention.
P342+P311	If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician.
P363	Wash contaminated clothing before reuse.
P390	Absorb spillage to prevent material damage.
P391	Collect spillage.

Storage

Code	Phrase
P405	Store locked up.
P406	Store in corrosive resistant container or with a resistant inner liner.

Disposal

Code	Phrase
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Section 2 - HAZARDS IDENTIFICATION

P501 Dispose of contents/container to ...

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
chromic chloride	10025-73-7	10-24.9
phosphoric acid, monomethyl ester	812-00-0	2.5-9.9
cobalt(II) chloride	7646-79-9	2.5-4.9
phosphoric acid	7664-38-2	2.5-4.9
methanol	67-56-1	0-0.9
water	7732-18-5	

Section 4 - FIRST AID MEASURES

SWALLOWED

- For advice, contact a Poisons Information Centre or a doctor at once.
- Urgent hospital treatment is likely to be needed.
- 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.
- Transport to hospital or doctor without delay.

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:
 - Immediately flush body and clothes with large amounts of water, using safety shower if available.
 - Quickly remove all contaminated clothing, including footwear.
 - Wash skin and hair with running water. Continue flushing with water until advised to stop by the Poisons Information Centre.
 - Transport to hospital, or doctor.

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.

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Section 4 - FIRST AID MEASURES

NOTES TO PHYSICIAN

- For acute or short term repeated exposures to strong acids:
 - Airway problems may arise from laryngeal edema and inhalation exposure. Treat with 100% oxygen initially.
 - Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling
 - Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.
 - Strong acids produce a coagulation necrosis characterised by formation of a coagulum (eschar) as a result of the desiccating action of the acid on proteins in specific tissues.

INGESTION:

- Immediate dilution (milk or water) within 30 minutes post ingestion is recommended.
- DO NOT attempt to neutralise the acid since exothermic reaction may extend the corrosive injury.
- Be careful to avoid further vomit since re-exposure of the mucosa to the acid is harmful. Limit fluids to one or two glasses in an adult.
- Charcoal has no place in acid management.
- Some authors suggest the use of lavage within 1 hour of ingestion.

SKIN:

- Skin lesions require copious saline irrigation. Treat chemical burns as thermal burns with non-adherent gauze and wrapping.
- Deep second-degree burns may benefit from topical silver sulfadiazine.

EYE:

- Eye injuries require retraction of the eyelids to ensure thorough irrigation of the conjunctival cul-de-sacs. Irrigation should last at least 20-30 minutes. DO NOT use neutralising agents or any other additives. Several litres of saline are required.
- Cycloplegic drops, (1% cyclopentolate for short-term use or 5% homatropine for longer term use) antibiotic drops, vasoconstrictive agents or artificial tears may be indicated dependent on the severity of the injury.
- Steroid eye drops should only be administered with the approval of a consulting ophthalmologist).
[Ellenhorn and Barceloux: Medical Toxicology].

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

- The product contains a substantial proportion of water, therefore there are no restrictions on the type of extinguishing media which may be used. Choice of extinguishing media should take into account surrounding areas.

Though the material is non-combustible, evaporation of water from the mixture, caused by the heat of nearby fire, may produce floating layers of combustible substances.

In such an event consider:

- foam.
- dry chemical powder.
- carbon dioxide.

FIRE FIGHTING

- Alert Fire Brigade and tell them location and nature of hazard.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water course.
- 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.

When any large container (including road and rail tankers) is involved in a fire, consider evacuation by 800 metres in all directions.

FIRE/EXPLOSION HAZARD

- Non combustible.
- Not considered to be a significant fire risk.

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Section 5 - FIRE FIGHTING MEASURES

- Acids may react with metals to produce hydrogen, a highly flammable and explosive gas.
 - Heating may cause expansion or decomposition leading to violent rupture of containers.
 - May emit corrosive, poisonous fumes. May emit acrid smoke.
- Decomposition may produce toxic fumes of: carbon dioxide (CO₂), carbon monoxide (CO), hydrogen chloride, phosgene, phosphorus oxides (PO_x), other pyrolysis products typical of burning organic material.

FIRE INCOMPATIBILITY

- None known.

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS

- Clean up all spills immediately.
 - Avoid breathing vapours and contact with skin and eyes.
 - Control personal contact with the substance, 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.
- Environmental hazard - contain spillage.

MAJOR SPILLS

- Clear area of personnel and move upwind.
- Alert Fire Brigade and tell them location and nature of hazard.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water course.
- Consider evacuation (or protect in place).
- Stop leak if safe to do so.
- Contain spill with sand, earth or vermiculite.
- Collect recoverable product into labelled containers for recycling.
- Neutralise/decontaminate residue (see Section 13 for specific agent).
- Collect solid residues and seal in labelled drums for disposal.
- Wash area and prevent runoff into drains.
- After clean up operations, decontaminate and launder all protective clothing and equipment before storing and re-using.
- If contamination of drains or waterways occurs, advise emergency services.

Environmental hazard - contain spillage.

Chemical Class:acidic compounds, organic

For release onto land: recommended sorbents listed in order of priority.

SORBENT TYPE	RANK	APPLICATION	COLLECTION	LIMITATIONS
LAND SPILL - SMALL				
wood fiber - pillow	1	throw	pitchfork	R, P, DGC, RT
cross- linked polymer - particulate	1	shovel	shovel	R, W, SS
cross- linked polymer - pillow	1	throw	pitchfork	R, DGC, RT
sorbent clay - particulate	2	shovel	shovel	R, I, P

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Section 6 - ACCIDENTAL RELEASE MEASURES

foamed glass - pillow	2	throw	pitchfork	R, P, DGC, RT
wood fiber - particulate	3	shovel	shovel	R, W, P, DGC

LAND SPILL - MEDIUM

cross- linked polymer - particulate	1	blower	skiploader	R, W, SS
polypropylene - particulate	2	blower	skiploader	W, SS, DGC
sorbent clay - particulate	2	blower	skiploader	R, I, P
cross- linked polymer - pillow	3	throw	skiploader	R, DGC, RT
polypropylene - mat	3	throw	skiploader	W, SS, DGC
expanded mineral - particulate	3	blower	skiploader	R, I, W, P, DGC

Legend

DGC: Not effective where ground cover is dense

R; Not reusable

I: Not incinerable

P: Effectiveness reduced when rainy

RT: Not effective where terrain is rugged

SS: Not for use within environmentally sensitive sites

W: Effectiveness reduced when windy

Reference: Sorbents for Liquid Hazardous Substance Cleanup and Control;

R.W Melvold et al: Pollution Technology Review No. 150: Noyes Data Corporation 1988.

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

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Section 6 - ACCIDENTAL RELEASE MEASURES

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 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

- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Avoid contact with moisture.
- Avoid contact with incompatible materials.
- When handling, DO NOT eat, drink or smoke.
- Keep containers securely sealed when not in use.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately. Launder contaminated clothing before re-use.
- Use good occupational work practice.
- Observe manufacturer's storage and handling recommendations contained within this MSDS.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.
- DO NOT allow clothing wet with material to stay in contact with skin.

SUITABLE CONTAINER

- DO NOT use aluminium or galvanised containers.
- Lined metal can, lined metal pail/ can.
- Plastic pail.
- Polyliner drum.
- Packing as recommended by manufacturer.
- Check all containers are clearly labelled and free from leaks.

STORAGE INCOMPATIBILITY

- Reacts with mild steel, galvanised steel / zinc producing hydrogen gas which may form an explosive mixture with air.
- Inorganic acids are generally soluble in water with the release of hydrogen ions. The resulting solutions have pH's of less than 7.0.
- Inorganic acids neutralise chemical bases (for example: amines and inorganic hydroxides) to form salts - neutralisation can generate dangerously large amounts of heat in small spaces.
- The dissolution of inorganic acids in water or the dilution of their concentrated solutions with additional water may generate significant heat.
- The addition of water to inorganic acids often generates sufficient heat in the small region of mixing to cause some of the water to boil explosively. The resulting "bumping" can spatter the acid.
- Inorganic acids react with active metals, including such structural metals as aluminum and iron, to release

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Section 7 - HANDLING AND STORAGE

- hydrogen, a flammable gas.
- Inorganic acids can initiate the polymerisation of certain classes of organic compounds.
 - Inorganic acids react with cyanide compounds to release gaseous hydrogen cyanide.
 - Inorganic acids generate flammable and/or toxic gases in contact with dithiocarbamates, isocyanates, mercaptans, nitrides, nitriles, sulfides, and strong reducing agents. Additional gas-generating reactions occur with sulfites, nitrites, thiosulfates (to give H₂S and SO₃), dithionites (SO₂), and even carbonates.
 - Acids often catalyse (increase the rate of) chemical reactions.
 - Segregate from alkalies, oxidising agents and chemicals readily decomposed by acids, i.e. cyanides, sulfides, carbonates.

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 storage and handling recommendations contained within this MSDS.

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS



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

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

The following materials had no OELs on our records

- chromic chloride: CAS:10025- 73- 7 CAS:10060- 12- 5
- phosphoric acid, monomethyl ester: CAS:812- 00- 0
- cobalt(II) chloride: CAS:7646- 79- 9 CAS:1332- 82- 7 CAS:7791- 13- 1
- phosphoric acid: CAS:7664- 38- 2 CAS:16271- 20- 8
- methanol: CAS:67- 56- 1
- water: CAS:7732- 18- 5

EMERGENCY EXPOSURE LIMITS

Material	Revised IDLH Value (mg/m ³)	Revised IDLH Value (ppm)
chromic chloride 13565	25	
phosphoric acid 1805	1, 000	
methanol	7863	6, 000

MATERIAL DATA

PHOSPHORIC ACID, MONOMETHYL ESTER:

WATER:

- No exposure limits set by NOHSC or ACGIH.

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Not available

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CHROMIC CHLORIDE:

■ Sensory irritants are chemicals that produce temporary and undesirable side-effects on the eyes, nose or throat. Historically occupational exposure standards for these irritants have been based on observation of workers' responses to various airborne concentrations. Present day expectations require that nearly every individual should be protected against even minor sensory irritation and exposure standards are established using uncertainty factors or safety factors of 5 to 10 or more. On occasion animal no-observable-effect-levels (NOEL) are used to determine these limits where human results are unavailable. An additional approach, typically used by the TLV committee (USA) in determining respiratory standards for this group of chemicals, has been to assign ceiling values (TLV C) to rapidly acting irritants and to assign short-term exposure limits (TLV STELs) when the weight of evidence from irritation, bioaccumulation and other endpoints combine to warrant such a limit. In contrast the MAK Commission (Germany) uses a five-category system based on intensive odour, local irritation, and elimination half-life. However this system is being replaced to be consistent with the European Union (EU) Scientific Committee for Occupational Exposure Limits (SCOEL); this is more closely allied to that of the USA.

OSHA (USA) concluded that exposure to sensory irritants can:

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

It is the goal of the ACGIH (and other Agencies) to recommend TLVs (or their equivalent) for all substances for which there is evidence of health effects at airborne concentrations encountered in the workplace.

At this time no TLV has been established, even though this material may produce adverse health effects (as evidenced in animal experiments or clinical experience). Airborne concentrations must be maintained as low as is practically possible and occupational exposure must be kept to a minimum.

NOTE: The ACGIH occupational exposure standard for Particles Not Otherwise Specified (P.N.O.S) does NOT apply.

for chrome(II/III)-containing substances:

Because of the low toxicity of chromium metal and its divalent/ trivalent compounds the recommended TLV is thought to minimise the potential of pulmonary disease and other toxic effects. Some jurisdictions require that health surveillance be carried on workers occupationally exposed to inorganic chromium.

Such surveillance should emphasise

- demography, occupational and medical history and health advice
- physical examination with emphasis on the respiratory system and skin
- weekly skin inspection of hands and forearms by a "responsible person".

COBALT(II) CHLORIDE:

■ Epidemiological studies do not support a link between cobalt and abnormal growths (neoplasms) in humans.

In view of the serious effects seen in experimental animals after a relatively short exposure period at 0.1 mg/m³ the recommended TLV-TWA is thought to reduce the significant risk of material impairment of health posed by respiratory disease and pulmonary sensitization which have been shown to occur at higher levels of exposure. The value does not apply generally to cobalt compounds.

A significant increase in lung cancer risk was reported among workers involved in cobalt production (with concomitant exposure to nickel and arsenic) and hard-metal workers with documented exposure to cobalt-containing dusts. A significant increase in lung cancer risk has been observed in workers whose exposure began more than 20 years previously. A number of single cases of malignant tumours, mostly sarcomas, have been reported at the site, following implant of cobalt-containing orthopedic implants.

PHOSPHORIC ACID:

■ The saturated vapour concentration of phosphoric acid exceeds the TLV. The TLV-TWA is based by analogy from comparable experience and data for sulfuric acid. Exposure at or below this limit is thought to prevent throat irritation amongst unacclimatised workers.

Fumes of phosphorus pentoxide at concentrations between 0.8 and 5.4 mg/m³ were reported to be noticeable but not uncomfortable whilst concentrations between 3.6 and 11.3 mg/m³ produced coughing in unacclimatised

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Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

workers but were tolerable. Concentrations of 100 mg/m³ were unbearable except in inured workers.

METHANOL:

■ For methanol:

Odour Threshold Value: 4.2-5960 ppm (detection), 53.0-8940 ppm (recognition)

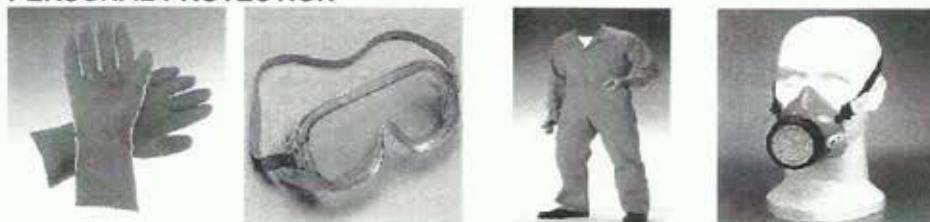
NOTE: Detector tubes for methanol, measuring in excess of 50 ppm, are commercially available.

Exposure at or below the recommended TLV-TWA is thought to substantially reduce the significant risk of headache, blurred vision and other ocular and systemic effects.

Odour Safety Factor (OSF)

OSF=2 (METHANOL).

PERSONAL PROTECTION



EYE

- Chemical goggles.
- Full face shield may be required for supplementary but never for primary protection of eyes
- 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], [AS/NZS 1336 or national equivalent].

HANDS/FEET

■ The selection of the suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.

The exact break through time for substances has to be obtained from the manufacturer of the protective gloves and

has to be observed when making a final choice.

Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include:

- 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, AS/NZS 2161.1 or national equivalent).

- 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, AS/NZS 2161.10.1 or national equivalent) 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, AS/NZS 2161.10.1 or national equivalent) 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.

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- Wear chemical protective gloves, eg. PVC.
- Wear safety footwear or safety gumboots, eg. Rubber.
- When handling corrosive liquids, wear trousers or overalls outside of boots, to avoid spills entering boots.

NOTE:

- The material may produce skin sensitisation in predisposed individuals. Care must be taken, when removing gloves and other protective equipment, to avoid all possible skin contact.
- Contaminated leather items, such as shoes, belts and watch-bands should be removed and destroyed.

OTHER

- Overalls.
- PVC Apron.
- PVC protective suit may be required if exposure severe.
- Eyewash unit.
- Ensure there is ready access to a safety shower.

RESPIRATOR

• Type BAX-P Filter of sufficient capacity. (AS/NZS 1716 & 1715, EN 143:2000 & 149:2001, ANSI Z88 or national equivalent)

■ 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.

Required minimum protection factor	Maximum gas/vapour concentration present in air p.p.m. (by volume)	Half- face Respirator	Full- Face Respirator
up to 10	1000	BAX- AUS / Class1 P	-
up to 50	1000	-	BAX- AUS / Class 1 P
up to 50	5000	Airline *	-
up to 100	5000	-	BAX- 2 P
up to 100	10000	-	BAX- 3 P
100+			Airline**

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

A(All classes) = Organic vapours, B AUS or B1 = Acid gasses, B2 = Acid gas or hydrogen cyanide(HCN), B3 = Acid gas or hydrogen cyanide(HCN), E = Sulfur dioxide(SO₂), G = Agricultural chemicals, K = Ammonia(NH₃), Hg = Mercury, NO = Oxides of nitrogen, MB = Methyl bromide, AX = Low boiling point organic compounds(below 65 degC).

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required. For further information consult site specific CHEMWATCH data (if available), or your Occupational Health and Safety Advisor.

ENGINEERING CONTROLS

■ Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection.

The basic types of engineering controls are:

Process controls which involve changing the way a job activity or process is done to reduce the risk.

Enclosure and/or isolation of emission source which keeps a selected hazard "physically" away from the worker and ventilation that strategically "adds" and "removes" air in the work environment. Ventilation can remove or dilute an air contaminant if designed properly. The design of a ventilation system must match the particular process and chemical or contaminant in use.

Employers may need to use multiple types of controls to prevent employee overexposure.

Local exhaust ventilation usually required. If risk of overexposure exists, wear approved respirator. Correct fit is essential to obtain adequate protection. Supplied-air type respirator may be required in special

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Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

circumstances. Correct fit is essential to ensure adequate protection.
An approved self contained breathing apparatus (SCBA) may be required in some situations.
Provide adequate ventilation in warehouse or closed storage area.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE

Green or blue acidic liquid; mixes with water.

PHYSICAL PROPERTIES

Mixes with water.

Corrosive.

Acid.

State	LIQUID	Molecular Weight	Not Applicable
Melting Range (°C)	Not Available	Viscosity	Not Available
Boiling Range (°C)	>100	Solubility in water (g/L)	Miscible
Flash Point (°C)	Not Applicable	pH (1% solution)	Not Available
Decomposition Temp (°C)	Not Available	pH (as supplied)	<1
Autoignition Temp (°C)	Not Applicable	Vapour Pressure (kPa)	2.3 @ 20 degC
Upper Explosive Limit (%)	Not Applicable	Specific Gravity (water=1)	1.25
Lower Explosive Limit (%)	Not Applicable	Relative Vapour Density (air=1)	Not Available
Volatile Component (%vol)	Not Available	Evaporation Rate	Not Available

Section 10 - CHEMICAL STABILITY AND REACTIVITY INFORMATION

CONDITIONS CONTRIBUTING TO INSTABILITY

• Contact with alkaline material liberates heat.

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

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

■ Ingestion of acidic corrosives may produce burns around and in the mouth, the throat and oesophagus. Immediate pain and difficulties in swallowing and speaking may also be evident. Swelling of the epiglottis may make it difficult to breathe which may result in suffocation. More severe exposure may result in vomiting blood and thick mucus, shock, abnormally low blood pressure, fluctuating pulse, shallow respiration and clammy skin, inflammation of stomach wall, and rupture of oesophageal tissue. Untreated shock may eventually result in kidney failure. Severe cases may result in perforation of the stomach and abdominal cavity with consequent infection, rigidity and fever. There may be severe narrowing of the oesophageal or pyloric sphincters; this may occur immediately or after a delay of weeks to years. There may be coma and convulsions, followed by death due to infection of the abdominal cavity, kidneys or lungs.

■ 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.

■ In toxic doses soluble cobalt salts produce stomach pain and vomiting, flushing of the face and ears, rash, ringing in the ears, nervous deafness and reduced blood flow to the extremities.

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EYE

- Direct eye contact with acid corrosives may produce pain, tears, sensitivity to light and burns. Mild burns of the epithelia generally recover rapidly and completely. Severe burns produce long-lasting and possibly irreversible damage. The appearance of the burn may not be apparent for several weeks after the initial contact. The cornea may ultimately become deeply opaque resulting in blindness.
- 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.

SKIN

- Skin contact with acidic corrosives may result in pain and burns; these may be deep with distinct edges and may heal slowly with the formation of scar tissue.
- The material can produce chemical burns following direct contact with the skin.
- 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

- Corrosive acids can cause irritation of the respiratory tract, with coughing, choking and mucous membrane damage. There may be dizziness, headache, nausea and weakness. Swelling of the lungs can occur, either immediately or after a delay; symptoms of this include chest tightness, shortness of breath, frothy phlegm and cyanosis. Lack of oxygen can cause death hours after onset.
- Inhalation of vapours may cause drowsiness and dizziness. This may be accompanied by sleepiness, reduced alertness, loss of reflexes, lack of co-ordination, and vertigo.
- Organic phosphates are very stable and highly hazardous. There are a number of effects they can have on the body, including excitement of the central nervous system, and irritation of the skin and respiratory tract. Alkyl phosphates do not cause nerve damage, but they do excite the nervous system and irritate the respiratory tract, eye and skin, and can be absorbed through the skin.

CHRONIC HEALTH EFFECTS

- On the basis of epidemiological data, it has been concluded that prolonged inhalation of the material, in an occupational setting, may produce cancer in humans.
 - Repeated or prolonged exposure to acids may result in the erosion of teeth, swelling and/or ulceration of mouth lining. Irritation of airways to lung, with cough, and inflammation of lung tissue often occurs. Chronic exposure may inflame the skin or conjunctiva.
- Chromium (III) is an essential trace mineral. Chronic exposure to chromium (III) irritates the airways, malnourishes the liver and kidneys, causes fluid in the lungs, and adverse effects on white blood cells, and also increases the risk of developing lung cancer. Chromium (VI) can irritate the skin, eyes and airways. Allergic reactions can involve both the skin and airways, and the compounds can diminish taste and smell, discolour the skin and eyes, cause blood disorders and damage the liver, kidneys, digestive tract and lungs. It predisposes humans to cancers of the respiratory tract and digestive system. Ulceration to the skin can occur, and, chromium (VI) is one of the most allergenic substances known.
- Substance accumulation, in the human body, may occur and may cause some concern following repeated or long-term occupational exposure.
- Inhaling this product is more likely to cause a sensitisation reaction in some persons compared to the general population.
- Skin contact with the material is more likely to cause a sensitisation reaction in some persons compared to the general population.
- Exposure to the material for prolonged periods may cause physical defects in the developing embryo (teratogenesis).

TOXICITY AND IRRITATION

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

CHROMIC CHLORIDE:
PHOSPHORIC ACID, MONOMETHYL ESTER:
PHOSPHORIC ACID:

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■ 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.

CHROMIC CHLORIDE:

COBALT(II) CHLORIDE:

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- 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.
- Attention should be paid to atopic diathesis, characterised by increased susceptibility to nasal inflammation, asthma and eczema.
- 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.
- Contact allergies quickly manifest themselves as contact eczema, more rarely as urticaria or Quincke's oedema. 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 sensitisation potential: the distribution of the substance and the opportunities for contact with it are equally important. A weakly sensitising substance which is widely distributed can be a more important allergen than one with stronger sensitising 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.

CHROMIC CHLORIDE:

TOXICITY

Oral (rat) LD50:1790 mg/kg

Oral (rat) LD50:1870 mg/kg

Inhalation (mouse) LC50:31.5 mg/m³/2h

Intraperitoneal (mouse) LD50:434 mg/kg

Intramuscular (mouse) LD50:40 mg/kg

Intravenous (Rabbit) LD:288 mg/kg

Intraperitoneal (Guinea pig) LD:200 mg/kg

Intraperitoneal (Mouse) LD50:143 mg/kg

Subcutaneous (Mouse) LD:800 mg/kg

Intravenous (Mouse) LD:400 mg/kg

■ On skin and inhalation exposure, chromium and its compounds (except hexavalent) can be a potent sensitiser, as particulates. Studies show that they have a complex toxicity mechanism with hexavalent chromium associated with an increased risk of lung damage and respiratory cancers (primarily bronchogenic and nose cancers). However, there is no evidence that elemental, divalent, or trivalent chromium compounds causes cancer or genetic toxicity.

Exposure to the material for prolonged periods may cause physical defects in the developing embryo (teratogenesis).

The substance is classified by IARC as Group 3:

NOT classifiable as to its carcinogenicity to humans.

Evidence of carcinogenicity may be inadequate or limited in animal testing.

IRRITATION

Nil Reported

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for hexahydrate:
for anhydrous form:
Human cell mutagen
Paternal effect, effects on fertility, effects on embryo (extra embryonic structures, foetotoxicity), specific developmental abnormalities (central nervous system, eye, ear) recorded.

PHOSPHORIC ACID, MONOMETHYL ESTER:

TOXICITY

Oral (None) rat:LD(?) >250 mg/kg

■ The material may be irritating to the eye, with prolonged contact causing 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.

Alkyl esters of phosphoric acid exhibit a low to moderate acute toxicity and metabolised. From studies done on mice, they are not likely to cause gene damage or affect reproduction. However, 2-ethylhexanoic acid produced an effect on newborn rats at high doses to the pregnant female.

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.

IRRITATION

Nil Reported

COBALT(II) CHLORIDE:

TOXICITY

Oral (rat) LD50:80 mg/kg

Oral (child) LDLo:1500 mg/kg

■ **WARNING:** This substance has been classified by the IARC as Group 2B: Possibly Carcinogenic to Humans. Investigated as a tumorigen, mutagen and reproductive effector.

Classified by EEC Directive as Category 2 Carcinogen.

IRRITATION

Nil Reported

PHOSPHORIC ACID:

TOXICITY

Unreported (human) LDLo:220 mg/kg

Oral (rat) LD50:1530 mg/kg

Oral (rat) LD50:3500 mg/kg* [Monsanto]*

Dermal (rabbit) LD50:>1260 mg/kg*

Inhalation (Rat) LC50:25.5 mg/m³/4h

Inhalation (Mouse) LC50:25.5 mg/m³/4h

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

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.

phosphoric acid (85%)

IRRITATION

Skin (rabbit):595 mg/24h - SEVERE

Eye (rabbit):119 mg - SEVERE

METHANOL:

TOXICITY

Oral (human) LDLo:143 mg/kg

Oral (man) LDLo:6422 mg/kg

Oral (man) TDLo:3429 mg/kg

Oral (rat) LD50:5628 mg/kg

Inhalation (human) TClO:86000 mg/m³

Inhalation (human) TClO:300 ppm

Inhalation (rat) LC50:64000 ppm/4h

Dermal (rabbit) LD50:15800 mg/kg

■ 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.

IRRITATION

Skin (rabbit):20 mg/24 h- Moderate

Eye (rabbit):40 mg- Moderate

Eye (rabbit):100 mg/24h- Moderate

WATER:

■ No significant acute toxicological data identified in literature search.

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CARCINOGEN

chromic chloride	International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs	Group	3
cobalt(II) chloride	International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs	Group	2B
phosphoric acid	International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs	Group	1

SKIN

phosphoric acid	GESAMP/EHS Composite List - GESAMP Hazard Profiles	D1: skin irritation/corrosion	3
methanol	GESAMP/EHS Composite List - GESAMP Hazard Profiles	D1: skin irritation/corrosion	2
methanol	GESAMP/EHS Composite List - GESAMP Hazard Profiles	D1: skin irritation/corrosion	0

Section 12 - ECOLOGICAL INFORMATION

chromic chloride 96 hr LC50 (7.5) mg/L Red Tongue Sole Fish Source:

PHOSPHORIC ACID, MONOMETHYL ESTER:

COBALT(II) CHLORIDE:

PHOSPHORIC ACID:

METHANOL:

CHROMIC CHLORIDE:

- DO NOT discharge into sewer or waterways.

PHOSPHORIC ACID:

PHOSPHORIC ACID, MONOMETHYL ESTER:

- For Phosphate: The principal problems of phosphate contamination of the environment relates to eutrophication processes in lakes and ponds. Phosphorus is an essential plant nutrient and is usually the limiting nutrient for blue-green algae.

Aquatic Fate: Lakes overloaded with phosphates is the primary catalyst for the rapid growth of algae in surface waters. Planktonic algae cause turbidity and flotation films. Shore algae cause ugly muddying, films and damage to reeds. Decay of these algae causes oxygen depletion in the deep water and shallow water near the shore. The process is self-perpetuating because an anoxic condition at the sediment/water interface causes the release of more adsorbed phosphates from the sediment. The growth of algae produces undesirable effects on the treatment of water for drinking purposes, on fisheries, and on the use of lakes for recreational purposes.

- May cause long-term adverse effects in the aquatic environment.

COBALT(II) CHLORIDE:

PHOSPHORIC ACID:

PHOSPHORIC ACID, MONOMETHYL ESTER:

- 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.

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PHOSPHORIC ACID, MONOMETHYL ESTER:

PHOSPHORIC ACID:

CHROMIC CHLORIDE:

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

- Ecotoxicity:

The tolerance of water organisms towards pH margin and variation is diverse. Recommended pH values for test species listed in OECD guidelines are between 6.0 and almost 9. Acute testing with fish showed 96h-LC50 at about pH 3.5.

COBALT(II) CHLORIDE:

CHROMIC CHLORIDE:

- For Chloride: Although inorganic chloride ions are not normally considered toxic they can exist in effluents at acutely toxic levels. Incidental exposure to inorganic chloride may occur in occupational settings where chemicals management policies are improperly applied. The toxicity of chloride salts depends on the counter-ion (cation) present; that of chloride itself is unknown. Chloride toxicity has not been observed in humans except in the special case of impaired sodium chloride metabolism, e.g. in congestive heart failure. Healthy individuals can tolerate the intake of large quantities of chloride provided that there is an intake of fresh water following ingestion. Although excessive intake of drinking-water containing sodium chloride at concentrations above 2.5 g/L has been reported to produce hypertension, this effect is believed to be related to the sodium ion concentration. Chloride concentrations in excess of about 250 mg/L can give rise to detectable taste in water. Consumers can, however, become accustomed to concentrations in excess of 250 mg/L. No health-based guideline value is proposed for chloride in drinking-water. Chloride is almost completely absorbed in normal individuals. In metal pipes, chloride reacts with metal ions to form soluble salts thus increasing levels of metals in drinking-water. Chloride enhances galvanic corrosion in lead pipes and can also increase the rate of pitting corrosion of metal pipes.

Aquatic Fate: Inorganic chlorine eventually finds its way into aquatic systems and becomes bio-available. Chloride increases the electrical conductivity of water and thus increases its corrosivity.

Ecotoxicity: When excessive inorganic chloride ions are introduced to aquatic environments, the resulting salinity can exceed the tolerances of most freshwater organisms.

- For Metal:

Atmospheric Fate - Metal-containing inorganic substances generally have negligible vapour pressure and are not expected to partition to air.

Environmental Fate: Environmental processes, such as oxidation, the presence of acids or bases and microbiological processes, may transform insoluble metals to more soluble ionic forms. Environmental processes may enhance bioavailability and may also be important in changing solubilities.

Aquatic/Terrestrial Fate: 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. A metal ion is considered infinitely persistent because it cannot degrade further. Once released to surface waters and moist soils their fate depends on solubility and dissociation in water. 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. Ionic species may bind to dissolved ligands or sorb to solid particles in water.

Ecotoxicity: Even though many metals show few toxic effects at physiological pH levels, transformation may introduce new or magnified effects.

CHROMIC CHLORIDE:

- Harmful to aquatic organisms.

For Chromium: Chromium is poorly absorbed by cells found in microorganisms, plants and animals. Hexavalent chromate anions are readily transported into cells and toxicity is closely linked to the higher oxidation state.

Ecotoxicity - Toxicity in Aquatic Organisms: Chromium is harmful to aquatic organisms in very low concentrations. Organisms consumed by fish species are very sensitive to low levels of chromium. Chromium is toxic to fish although less so in warm water. Marked decreases in toxicity are found with increasing pH or water hardness; changes in salinity have little if any effect. Chromium appears to make fish more susceptible to infection. High concentrations can damage and/or accumulate in various fish tissues and in invertebrates such as snails and worms. Reproduction of water fleas is affected by exposure to 0.01 mg/kg hexavalent chromium/L. Toxicity of chromium in fresh-water organisms resulted in mortality rates of 50%. The most sensitive species to the hexavalent chromium anion are invertebrates, scud, fathead minnow, rainbow trout,

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cladoceran and water flea vertebrate species and guppy.

Toxicity in Microorganisms: In general, toxicity for most microorganisms occurs in the range of 0.05 -5 mg chromium/kg. Trivalent chromium is less toxic than the hexavalent form. The main signs of toxicity are inhibition of growth and the inhibition of photosynthesis or protein synthesis. Gram-negative soil bacteria are generally more sensitive to hexavalent chromium (1-12 mg/kg) than the gram-positive types. Toxicity to trivalent chromium is not observed at similar levels. Soil microbial transformation processes such as nitrification may be affected by low levels of hexavalent chromium (1 mg/kg). Chromium should not be introduced to municipal sewage treatment facilities.

Toxicity in Plants: Chromium in high concentrations can be toxic for plants. The main feature of chromium intoxication is chlorosis, which is similar to iron deficiency. Chromium affects carbohydrate metabolism and leaf chlorophyll concentration decreases with hexavalent chromium concentration (0.01-1 mg/L). The hexavalent form appears to more toxic than the trivalent species.

Water Standards: Chromium is identified as a hazardous substance in the Federal (U.S.) Water Pollution Control Act and further regulated by Clean Air Water Act Amendments (US). These regulations apply to discharge. The US Primary drinking water Maximum Contaminant Level (MCL), for chromium, is 0.05 mg/L. (total chromium).

For chromium:

Aquatic Fate - Most chromium released into water will be deposited in the sediment. A small percentage of chromium can be found in soluble and insoluble forms with soluble chromium making up a very small percentage of the total chromium. Most of the soluble chromium is present as chromium (VI) and soluble chromium (III) complexes. In the aquatic phase, chromium (III) occurs mostly as suspended solids adsorbed onto clayish materials, organics, or iron oxide present in water. Soluble forms and suspended chromium can undergo intramedia transport. Chromium (VI) in water will eventually be reduced to chromium (III) by organic matter in the water. This process may be slower depending on the type and amount of organic material present and on the redox condition of the water. The reaction was generally faster under anaerobic than aerobic conditions. The oxidation of chromium (III) to chromium (VI) during chlorination of water was highest in the pH range of 5.5 - 6.0.

Atmospheric Fate: Transport of chromium from water to the atmosphere is not likely, except by transport in windblown sea sprays.

Terrestrial Fate: Ecotoxicity - Bioaccumulation is not expected to occur in rainbow trout. Bioaccumulation in bottom feeder bivalves, such as the oyster, blue mussel, and soft shell clam is low. Chromium ranges from slightly toxic to highly toxic in water fleas. Chromium is not expected to biomagnify in the aquatic food chain. Chromium (III) has very low solubility and low mobility in the environment and low toxicity in I organisms. In these forms, chromium is relatively soluble, mobile, and toxic to living organisms. Plants - Bioaccumulation of chromium from soil to above-ground parts of plants is unlikely. There is no indication of biomagnification of chromium along the terrestrial food chain (soil-plant-animal). Chromium concentration in plants may vary with geographic location. Soil - Chromium (VI) may be present in soil as chromate and chromic acid. The fate of chromium in soil is dependent upon the chromium species, which is a function of redox potential and soil pH. Most commonly, soil chromium is in the chromium (III) state. In deeper, anaerobic soils, chromium (VI) will be reduced to chromium (III) by disulfur and ferrous sulfate in soil. The reduction of chromium (VI) to chromium (III) is possible in aerobic soils that contain appropriate organic energy sources. The reduction of chromium (VI) to chromium (III) is facilitated by low pH. Chromium (VI) may exist in the aerobic zone of some natural soil. The oxidation of chromium (III) to chromium (VI) is facilitated by the presence of low oxidisable organic substances, oxygen, manganese dioxide, and moisture. However, when availability of mobile chromium (III) is low, a large portion of chromium in soil will not be oxidized to chromium (VI), even in the presence of magnesium dioxide and favorable pH. Organic forms of chromium (III) are more easily oxidized than insoluble oxides. Factors affecting the microbial reduction of chromium (VI) to chromium (III) include biomass concentration, initial chromium (VI) concentration, temperature, pH, carbon source, oxidation-reduction potential and the presence of both oxyanions and metal cations. Although high levels of chromium (VI) are toxic to most microbes, several resistant bacterial species have been identified which could ultimately be employed in remediation strategies. Most soil chromium is present mainly as insoluble chromium oxide and nH_2O and is not very mobile. Chromium was not found in leachate from soil, possibly because it formed complexes with organic matter. The leachability of chromium (VI) increases as soil pH increases. A small percentage of total chromium in soil exists as soluble chromium (VI) and chromium (III), which are more mobile in soil. Sorption depends primarily on the clay content of the soil and, to a lesser extent, on the amount of iron oxide and the organic content. Ecotoxicity: Chromium irreversibly sorb soil will not be bio-available to plants and animals under any condition.

Atmospheric Fate: Chromium in soil may be transported to the atmosphere as an aerosol. The low pH of acid rain may facilitate leaching of acid-soluble chromium (III) and (VI) into soil. In the atmosphere, chromium

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(VI) may be reduced to chromium (III) at a significant rate if vanadium (V²⁺, V³⁺ and VO⁺), ferrous sulfate, bicarbonate ions and arsenic are present. The estimated half life of atmospheric chromium (VI) reduction to chromium (III) has been reported to be from 16 hrs to about 5 days. Aquatic Fate: Surface runoff can transport soluble and bulk precipitates of chromium to surface water. Soluble and unadsorbed chromium (III) and (VI) complexes in soil may leach into groundwater.

PHOSPHORIC ACID, MONOMETHYL ESTER:

■ For Alky Esters of Phosphoric Acid:

Environmental Fate: The chemicals in this category have low melting points, high boiling points or decomposition temperatures, and low vapor pressures.

Terrestrial Fate: If released into the environment, these chemicals will exist predominantly in the soil or the aquatic environment depending on the environmental compartment that they first contact. In tests, tris (2-ethylhexyl) phosphate exhibited 0% biodegradation after 28 days.

Aquatic Fate: The tri-esters are slightly soluble and the others are moderately soluble to soluble in water and are hydrolytically stable.

Ecotoxicity: Alky esters of phosphoric acid are not expected to bioconcentrate and are moderately degradable if soluble and will not persist in the environment. None of the members are highly toxic to aquatic species.

Alky esters of phosphoric acid are not acutely toxic to killifish, *Daphnia magna* water fleas or algae.

COBALT(II) CHLORIDE:

Marine Pollutant Yes

Hazardous Air Pollutant: Yes

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

For Cobalt Compounds:

Environmental Fate: The sources of cobalt in the atmosphere are both natural and man-made. The primary man-made sources of cobalt are the burning of fossil fuels, phosphate fertilizers, mining/smelting/processing of cobalt containing ores, etc.

Atmospheric Fate: Cobalt does not vaporize thus; it enters the air in particulate form. The transport of cobalt, in air, depends on its particle size and density, as well as weather conditions; it can be returned to land or surface water by rain or, it may settle to the ground by dry deposition.

Terrestrial Fate: Soil – Cobalt is a naturally occurring substance in the Earth's crust. Cobalt may be retained by mineral oxides such as iron and manganese oxide, crystalline materials, and natural organic substances, in soil. Sorption of cobalt to soil occurs rapidly, (within 1-2 hours). Clay minerals sorb relatively small amounts of cobalt. Adsorption of cobalt onto iron and manganese increases with pH. As pH increases, insoluble hydroxides, or carbonates, may form, reducing mobility. Plants – Plants take-up cobalt compounds from the soil and plant surfaces. However, the translocation, (movement), of cobalt from roots to above-ground parts of plants is not significant in most soils.

Aquatic Fate: Cobalt strongly binds to humic substances naturally present in aquatic environments. Cobalt may sorb to particles/sediment, however; the binding of cobalt to dissolved organic substances can significantly reduce sorption. The adsorption of cobalt by particulate matter decreases as pH decreases. In low oxygen, seawater sediment systems, Cobalt-60 is 250 times more mobile than it is in freshwater sediment systems, in the presence of oxygen. In oxygenated waters, 98% of cobalt-60 is permanently "fixed" to sediment.

Ecotoxicity: Cobalt-60 is taken up by phytoplankton and unicellular algae, (*Senenastrium capricornutum*), which may result in transfer of the substance up the food chain, however; cobalt levels generally diminish with increasing levels in the food chain. Cobalt largely accumulates in the viscera and on the skin, as opposed to the edible parts of the fish. Uptake of ⁶⁰Co is very low in whitefish. Much of the cobalt taken up by mollusks and crustaceae is adsorbed to the shell or exoskeleton - very little cobalt is generally accumulated in the edible parts. Vitamin B12, (cobalamins), which contains cobalt, is synthesized by 58 species of bacteria, as well as blue-green algae and actinomycetes, (mold-like bacteria). Consequently, vitamin B12 levels in marine water range from very low levels, in some open ocean water, to much higher levels, in some coastal waters. Freshwater environments have comparable levels of vitamin B12. Some female birds sequester metals into their eggs under certain conditions, which may jeopardize the developing embryos.

PHOSPHORIC ACID:

Fish LC50 (96hr.) (mg/l): 138

■ On the basis of available evidence concerning either toxicity, persistence, potential to accumulate and or observed environmental fate and behaviour, the material may present a danger, immediate or long-term and /or delayed, to the structure and/ or functioning of natural ecosystems.

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Section 12 - ECOLOGICAL INFORMATION

METHANOL:

■ For Methanol: Log Kow: -0.82 to -0.66; Koc: 1; Henry's Law Constant: 4.55×10^{-6} atm-cu m/mole; Vapor Pressure: 127 mm Hg; BCF: < 10.

Atmospheric Fate: Methanol is expected to exist solely as a vapor in the ambient atmosphere. Vapor-phase methanol is broken down in the atmosphere by reactions with hydroxyl radicals; the half-life for this reaction in air is estimated to be 17 days.

Terrestrial Fate: Methanol is expected to have very high mobility in soil. Evaporation of methanol from moist/dry soil surfaces is expected to be an important fate process. Biological breakdown in soil is expected to be an important fate process for methanol based on half-lives of 1 day, in sandy silt loam, and 3.2 days in sandy loam.

Aquatic Fate: Methanol is not expected to adsorb to suspended solids and sediment and the substance mixes in water. The substance is expected to evaporate from water surfaces with half-lives, for a model river, of 3 days, and 35 days, for a model lake. Concentration of the substance in aquatic organisms is expected to be low. Breakdown by water and sunlight are not expected to be an important environmental fate processes. The substance is expected to be broken down by microorganisms in water.

Ecotoxicity: Methanol is non-toxic to fish, including fathead minnow, rainbow trout, bluegill sunfish, and guppy. The substance is also non-toxic to aquatic invertebrates, including Daphnia pulex water fleas, brine and brown shrimp. The substances are non-toxic to shellfish, including mussels, marine bacterium, including Photobacterium phosphoreum, and the protozoan Tetrahymena pyriformis.

Marine Pollutant

Yes

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
chromic chloride	No Data Available	No Data Available		
phosphoric acid, monomethyl ester	HIGH	No Data Available	LOW	HIGH
cobalt(II) chloride	HIGH	No Data Available	LOW	HIGH
phosphoric acid	HIGH	No Data Available	LOW	HIGH
methanol	LOW	No Data Available	LOW	HIGH

Section 13 - DISPOSAL CONSIDERATIONS

- Recycle wherever possible.
- Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
- Treat and neutralise at an approved treatment plant. Treatment should involve: Neutralisation with soda-ash or soda-lime followed by: burial in a land-fill specifically licenced to accept chemical and / or pharmaceutical wastes or Incineration in a licenced apparatus (after admixture with suitable combustible material).
- Decontaminate empty containers with 5% aqueous sodium hydroxide or soda ash, followed by water. Observe all label safeguards until containers are cleaned and destroyed.
- Containers may still present a chemical hazard/ danger when empty.
- Return to supplier for reuse/ recycling if possible.

Otherwise:

- If container can not be cleaned sufficiently well to ensure that residuals do not remain or if the container cannot be used to store the same product, then puncture containers, to prevent re-use, and bury at an authorised landfill.
- Where possible retain label warnings and MSDS and observe all notices pertaining to the product.

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Section 14 - TRANSPORTATION INFORMATION



Labels Required: CORROSIVE

HAZCHEM:
2X

Land Transport UNDG:

Class or division:	8	Subsidiary risk:	None
UN No.:	1760	UN packing group:	III
Shipping Name: CORROSIVE LIQUID, N.O.S. (contains phosphoric acid, monomethyl ester and phosphoric acid)			

Air Transport IATA:

ICAO/IATA Class:	8	ICAO/IATA Subrisk:	None
UN/ID Number:	1760	Packing Group:	III
Special provisions:	A3A803		

Shipping name: CORROSIVE LIQUID, N.O.S. (contains phosphoric acid, monomethyl ester and phosphoric acid)

Maritime Transport IMDG:

IMDG Class:	8	IMDG Subrisk:	None
UN Number:	1760	Packing Group:	III
EMS Number:	F- A, S- B	Special provisions:	223 274
Limited Quantities:	5 L	Marine Pollutant:	Yes
Shipping name: CORROSIVE LIQUID, N.O.S. (contains phosphoric acid, monomethyl ester and phosphoric acid)			

Section 15 - REGULATORY INFORMATION

REGULATIONS

Regulations for ingredients

chromic chloride (CAS: 10025-73-7, 10060-12-5) is found on the following regulatory lists;

"International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs", "WHO Guidelines for Drinking-water Quality - Chemicals for which guideline values have not been established"

cobalt(II) chloride (CAS: 7646-79-9, 1332-82-7, 7791-13-1) is found on the following regulatory lists;

"International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs", "International Chemical Secretariat (ChemSec) SIN List ("Substitute It Now!)", "OECD List of High Production Volume (HPV) Chemicals", "WHO Guidelines for Drinking-water Quality - Chemicals for which guideline values have not been established"

phosphoric acid (CAS: 7664-38-2, 16271-20-8) is found on the following regulatory lists;

"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 Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs", "International Council of Chemical Associations (ICCA) - High Production Volume List", "OECD List of High Production Volume (HPV) Chemicals", "OSPAR National List of Candidates for Substitution - United Kingdom"

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Section 15 - REGULATORY INFORMATION

methanol (CAS: 67-56-1) is found on the following regulatory lists;

"GESAMP/EHS Composite List - GESAMP Hazard Profiles", "IMO IBC Code Chapter 17: Summary of minimum requirements", "IMO MARPOL 73/78 (Annex II) - List of Other Liquid Substances", "International Council of Chemical Associations (ICCA) - High Production Volume List", "OECD List of High Production Volume (HPV) Chemicals", "OSPAR National List of Candidates for Substitution - Norway", "United Nations Consolidated List of Products Whose Consumption and/or Sale Have Been Banned, Withdrawn, Severely Restricted or Not Approved by Governments"

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

"IMO IBC Code Chapter 18: List of products to which the Code does not apply", "International Fragrance Association (IFRA) Survey: Transparency List", "OECD List of High Production Volume (HPV) Chemicals", "OSPAR National List of Candidates for Substitution - Norway"

No data for Unifix ZN 3-28 L Part A. (CW: 6608-01)

No data for phosphoric acid, monomethyl ester (CAS: , 812-00-0)

Section 16 - OTHER INFORMATION

INGREDIENTS WITH MULTIPLE CAS NUMBERS

Ingredient Name	CAS
chromic chloride	10025- 73- 7, 10060- 12- 5
cobalt(II) chloride	7646- 79- 9, 1332- 82- 7, 7791- 13- 1
phosphoric acid	7664- 38- 2, 16271- 20- 8

REPRODUCTIVE HEALTH GUIDELINES

Ingredient	ORG	UF	Endpoint	CR	Adeq TLV
methanol	262 mg/m ³	NA	NA	NA	Yes

■ These exposure guidelines have been derived from a screening level of risk assessment and should not be construed as unequivocally safe limits. ORGS represent an 8-hour time-weighted average unless specified otherwise.

CR = Cancer Risk/10000; UF = Uncertainty factor:

TLV believed to be adequate to protect reproductive health:

LOD: Limit of detection

Toxic endpoints have also been identified as:

D = Developmental; R = Reproductive; TC = Transplacental carcinogen

Jankovic J., Drake F.: A Screening Method for Occupational Reproductive

American Industrial Hygiene Association Journal 57: 641-649 (1996).

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 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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