

1,4-DIOXAN

GHS Safety Data Sheet

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Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME

1,4-DIOXAN

OTHER NAMES

C4-H8-O2, p-dioxane, p-dioxane, "diethylene dioxide", "1, 4-diethylene dioxide", "1, 4-diethylene dioxide", "diethylene ether", diokan, "1, 4-dioxacyclohexane", "1, 4-dioxacyclohexane", dioxane, dioxan, "dioxane-1, 4", "dioxyethylene ether", "glycoethylene ether", tetrahydro-p-dioxan, tetrahydro-p-dioxan, "tetrahydro-1, 4-dioxin", "tetrahydro-1, 4-dioxin", para-dioxane

PROPER SHIPPING NAME

DIOXANE

PRODUCT USE

Used as a solvent in high performance liquid chromatography. Solvent for cellulose acetate, benzyl cellulose, resins, oils, waxes, oil and spirit soluble dyes.

SUPPLIER

Company: S D FINE- CHEM LIMITED

Address:

315- 317, T.V. INDUSTRIAL ESTATE,
248, WORLI,

MUMBAI- 400030.INDIA.

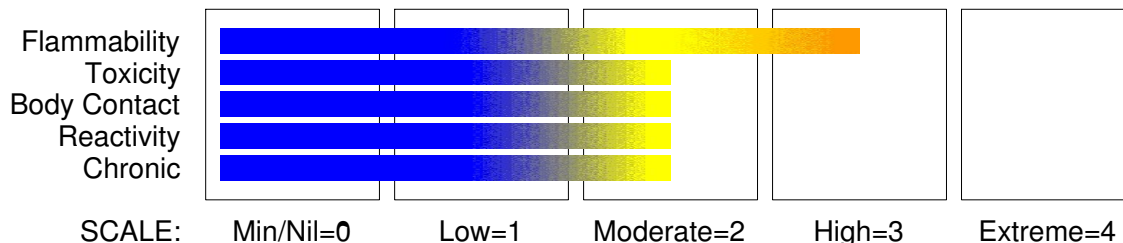
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Telephone: 91- 22- 24959898

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HAZARD RATINGS



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Section 2 - HAZARDS IDENTIFICATION

GHS Classification

Acute Toxicity (Oral) Category 4
Carcinogen Category 2
Eye Irritation Category 2A
Flammable Liquid Category 2
Respiratory Irritation Category 3
Skin Corrosion/Irritation Category 3



EMERGENCY OVERVIEW

HAZARD

DANGER

Determined using GHS criteria:

H335 H225 H302 H316 H319 H351

May cause respiratory irritation

Highly flammable liquid and vapour

Harmful if swallowed

Causes mild skin irritation

Causes serious eye irritation

Suspected of causing cancer

PRECAUTIONARY STATEMENTS

Prevention

Wash hands thoroughly after handling.

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

Ground/bond container and receiving equipment.

Use personal protective equipment as required.

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

Obtain special instructions before use.

Use only non-sparking tools.

Wear protective gloves and eye/face protection.

Keep container tightly closed.

Keep away from heat/sparks/open flame - No smoking.

Take precautionary measures against static discharge

Use explosion-proof electrical/ventilating/lighting/equipment

Response

If eye irritation persists, get medical advice/attention.

If skin irritation occurs, seek medical advice/attention.

Wear eye/face protection.

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Section 2 - HAZARDS IDENTIFICATION

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

If on skin or hair: remove/take off immediately all contaminated clothing. Rinse with water/shower.

Specific treatment: refer to Label or MSDS.

If exposed or concerned: Get medical attention advice.

Storage

Store locked up.

Disposal

Dispose of contents and container in accordance with relevant legislation.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
1, 4- dioxane inhibitors	123-91-1	> 99 < 1

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:

- Wash out immediately with fresh running water.
- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- If pain persists or recurs seek medical attention.
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN

If skin contact occurs:

- Immediately remove all contaminated clothing, including footwear.
- Flush skin and hair with running water (and soap if available).
- Seek medical attention in event of irritation.

INHALED

- If fumes or combustion products are inhaled remove from contaminated area.

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Section 4 - FIRST AID MEASURES

- Lay patient down. Keep warm and rested.
- Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
- Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
- Transport to hospital, or doctor, without delay.

NOTES TO PHYSICIAN

Treat symptomatically.
Correct acidosis in the usual manner.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

- Water spray or fog.
- Alcohol stable foam.
- Dry chemical powder.
- Carbon dioxide.

FIRE FIGHTING

- Alert Fire Brigade and tell them location and nature of hazard.
- May be violently or explosively reactive.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or water course.
- Consider evacuation (or protect in place).
- Fight fire from a safe distance, with adequate cover.
- If safe, switch off electrical equipment until vapour fire hazard removed.
- Use water delivered as a fine spray to control the fire and cool adjacent area.
- Avoid spraying water onto liquid pools.
- Do not approach containers suspected to be hot.
- Cool fire exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.

FIRE/EXPLOSION HAZARD

- Liquid and vapour are highly flammable.
- Severe fire hazard when exposed to heat, flame and/or oxidisers.
- Vapour may travel a considerable distance to source of ignition.
- Heating may cause expansion or decomposition leading to violent rupture of containers.
- On combustion, may emit toxic fumes of carbon monoxide (CO).

Combustion products include: carbon dioxide (CO₂), other pyrolysis products typical of burning organic material.

WARNING: Long standing in contact with air and light may result in the formation of potentially explosive peroxides.

FIRE INCOMPATIBILITY

Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Personal Protective Equipment

Breathing apparatus.
Chemical splash suit.

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Section 6 - ACCIDENTAL RELEASE MEASURES

EMERGENCY PROCEDURES

MINOR SPILLS

- Remove all ignition sources.
- Clean up all spills immediately.
- Avoid breathing vapours and contact with skin and eyes.
- Control personal contact by using protective equipment.
- Contain and absorb small quantities with vermiculite or other absorbent material.
- Wipe up.
- Collect residues in a flammable waste container.

MAJOR SPILLS

- Clear area of personnel and move upwind.
- Alert Fire Brigade and tell them location and nature of hazard.
- May be violently or explosively reactive.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or water course.
- Consider evacuation (or protect in place).
- No smoking, naked lights or ignition sources.
- Increase ventilation.
- Stop leak if safe to do so.
- Water spray or fog may be used to disperse /absorb vapour.
- Contain spill with sand, earth or vermiculite.
- Use only spark-free shovels and explosion proof equipment.
- Collect recoverable product into labelled containers for recycling.
- Absorb remaining product with sand, earth or vermiculite.
- Collect solid residues and seal in labelled drums for disposal.
- Wash area and prevent runoff into drains.
- If contamination of drains or waterways occurs, advise emergency services.

EMERGENCY RESPONSE PLANNING GUIDELINES (ERPG)

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

life-threatening health effects is:

1,4-dioxane 500 ppm

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

1,4-dioxane 100 ppm

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

1,4-dioxane 100 ppm

The threshold concentration below which most people will experience no appreciable risk of health effects:

1,4-dioxane 100 ppm

American Industrial Hygiene Association (AIHA)

Ingredients considered according to the following cutoffs

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Section 6 - ACCIDENTAL RELEASE MEASURES

Very Toxic (T+)	$\geq 0.1\%$	Toxic (T)	$\geq 3.0\%$
R50	$\geq 0.25\%$	Corrosive (C)	$\geq 5.0\%$
R51	$\geq 2.5\%$		
else	$\geq 10\%$		

where percentage is percentage of ingredient found in the mixture

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS



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

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.
 - Prevent concentration in hollows and sumps.
 - DO NOT enter confined spaces until atmosphere has been checked.
 - Avoid smoking, naked lights, heat or ignition sources.
 - When handling, DO NOT eat, drink or smoke.
 - Vapour may ignite on pumping or pouring due to static electricity.
 - DO NOT use plastic buckets.
 - Earth and secure metal containers when dispensing or pouring product.
 - Use spark-free tools when handling.
 - Avoid contact with incompatible materials.
 - Keep containers securely sealed.
 - Avoid physical damage to containers.
 - Always wash hands with soap and water after handling.
 - Work clothes should be laundered separately.
 - Use good occupational work practice.
 - Observe manufacturer's storing and handling recommendations.
 - Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
- DO NOT allow clothing wet with material to stay in contact with skin.
- The substance accumulates peroxides which may become hazardous only if it evaporates or is distilled or otherwise treated to concentrate the peroxides. The substance may concentrate around the container opening for example.
- Purchases of peroxidisable chemicals should be restricted to ensure that the chemical is used completely before it can become peroxidised.
- A responsible person should maintain an inventory of peroxidisable chemicals or annotate the general chemical inventory to indicate which chemicals are subject to peroxidation. An expiration date should be determined. The chemical should either be treated to remove peroxides or disposed of before this date.

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Section 7 - HANDLING AND STORAGE

- The person or laboratory receiving the chemical should record a receipt date on the bottle. The individual opening the container should add an opening date.
- Unopened containers received from the supplier should be safe to store for 18 months.
- Opened containers should not be stored for more than 12 months.

SUITABLE CONTAINER

- Packing as supplied by manufacturer.
- Plastic containers may only be used if approved for flammable liquid.
- Check that containers are clearly labelled and free from leaks.
- For low viscosity materials (i) : Drums and jerry cans must be of the non-removable head type. (ii) : Where a can is to be used as an inner package, the can must have a screwed enclosure.
- For materials with a viscosity of at least 2680 cSt. (23 deg. C)
- For manufactured product having a viscosity of at least 250 cSt. (23 deg. C)
- Manufactured product that requires stirring before use and having a viscosity of at least 20 cSt (25 deg. C)
 - (i) : Removable head packaging;
 - (ii) : Cans with friction closures and
 - (iii) : low pressure tubes and cartridges may be used.
- Where combination packages are used, and the inner packages are of glass, there must be sufficient inert cushioning material in contact with inner and outer packages
- In addition, where inner packagings are glass and contain liquids of packing group I there must be sufficient inert absorbent to absorb any spillage, unless the outer packaging is a close fitting moulded plastic box and the substances are not incompatible with the plastic.

STORAGE INCOMPATIBILITY

- Segregate from strong oxidisers.
- Avoid reaction with oxidising agents.

STORAGE REQUIREMENTS

Easily peroxidisable. Products formed as a result of peroxidation are not only safety hazards but may chemically alter the chemical behavior of the parent compound. Should have a warning label affixed bearing the date of receipt in the laboratory and the date on which the label was first opened. Store-room items should have the label affixed by the Store-room whilst for non- storeroom items or materials synthesised in the laboratory , an individual chemist should be responsible for warning labels.

WARNING: This product may form peroxides to a hazardous level by concentration (by distillation, evaporation, etc.) Should be evaluated every twelve months after opening, redated if safe or else discarded. The oxidation of iodide to iodine or the conversion of colourless ferrothiocyanate to red ferrithiocyanate by peroxides are simple and convenient tests for most peroxides. Before distilling or evaporating test for peroxides. Leave at least 10% bottoms. Use a shield when evaporating or distilling mixtures which may contain peroxidisable compounds. Store away from heat and light. Particular attention should be paid to the adequacy of the closure on storage containers.

Peroxides may be removed by;

- passing the material over a column of ordinary activated alumina (care should be taken in disposal of the activated alumina);
 - shaking with a concentrated solution of ferrous salt (provided the carrier solvent is water-insoluble);
 - agitation with an approximately equimolar mixture of ferrous sulfate and sodium bisulfate;
 - commercial quantities may be treated with a 5% solution of aqueous sodium carbonate.
- Jackson et al: Control of Peroxizable Compounds; Safety in the Chemical Laboratory,

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Section 7 - HANDLING AND STORAGE

Journal of Chemical Education; Vol 47, 1970, pp A175-A188

When solvents have been freed from peroxides by percolation through a column of activated alumina, the adsorbed peroxides must promptly be desorbed by treatment with polar solvents, methanol or water, which must in turn be discarded safely.

- Store in original containers in approved flame-proof area.
- No smoking, naked lights, heat or ignition sources.
- DO NOT store in pits, depressions, basements or areas where vapours may be trapped.
- Keep containers securely sealed.
- Store away from incompatible materials in a cool, dry well ventilated area.
- Protect containers against physical damage and check regularly for leaks.
- Observe manufacturer's storing and handling recommendations.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

The following materials had no OELs on our records

- 1, 4- dioxane:

CAS:123- 91- 1 CAS:54841- 74- 6 CAS:28347- 88- 8
CAS:39449- 24- 6 CAS:28347- 91- 3

EMERGENCY EXPOSURE LIMITS

Material	Revised IDLH Value (mg/m3)	Revised IDLH Value (ppm)
1, 4- dioxane		500

ODOUR SAFETY FACTOR (OSF)

OSF=0.83 ("1,4-DIOXANE")

Exposed individuals are NOT reasonably expected to be warned, by smell, that the Exposure Standard is being exceeded.

Odour Safety Factor (OSF) is determined to fall into either Class C, D or E.

The Odour Safety Factor (OSF) is defined as:

OSF= Exposure Standard (TWA) ppm/ Odour Threshold Value (OTV) ppm

Classification into classes follows:

Class	OSF	Description
A	550	Over 90% of exposed individuals are aware by smell that the Exposure Standard (TLV- TWA for example) is being reached, even when distracted by working activities
B	26- 550	As " A" for 50- 90% of persons being distracted
C	1- 26	As " A" for less than 50% of persons being distracted
D	0.18- 1	10- 50% of persons aware of being tested perceive by smell that the Exposure Standard is being reached
E	<0.18	As " D" for less than 10% of persons aware of being tested

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Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

MATERIAL DATA

NIOSH Ceiling: 1 ppm (30 minutes) - Potential Occupational Carcinogen
Odour Threshold Value: 0.80-172 ppm (detection), 1.8-278 ppm (recognition)
Because findings of both liver and lung tumours occur at high dietary levels (approximately 10000 ppm) and are not seen at inhalation exposures slightly above 100 ppm for 2 years, dioxane is classed by ACGIH as an animal carcinogen of such low potential as to be of little significance as an occupational carcinogen at the recommended TLV-TWA. This is not the view of NIOSH who recommends a 1 ppm ceiling with the belief that the derivation of a safe exposure limit is not now available. The TLV-TWA has been derived from data on the hepatotoxic and nephrotoxic effects in workers and has been set the value to one-tenth of that which is required to produce a significant increase in the occurrence of cancer in animal experiments. Even though it appears that controls can be initiated in plants manufacturing dioxane to reflect the limits set by NIOSH industrial experience indicates that such controls may not be practicable where the solvent is in use.

PERSONAL PROTECTION



EYE

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

OTHER

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

GLOVE SELECTION INDEX

Glove selection is based on a modified presentation of the:
"Forsberg Clothing Performance Index".

The effect(s) of the following substance(s) are taken into account in the

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Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

computer- generated selection: 1, 4- dioxane

Protective Material CPI *.

PE/EVAL/PE	A
PVA	A
TEFLON	A
BUTYL	B
SARANEX- 23	C
NATURAL RUBBER	C
NATURAL+NEOPRENE	C
NITRILE	C
NEOPRENE	C
VITON	C
VITON/NEOPRENE	C
PVC	C

A: Best Selection

B: Satisfactory; may degrade after 4 hours continuous immersion

C: Poor to Dangerous Choice for other than short term immersion

NOTE: As a series of factors will influence the actual performance of the glove, a final selection must be based on detailed observation. -

* Where the glove is to be used on a short term, casual or infrequent basis, factors such as "feel" or convenience (e.g. disposability), may dictate a choice of gloves which might otherwise be unsuitable following long-term or frequent use. A qualified practitioner should be consulted.

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	A- AUS	-
1000	50	-	A- AUS
5000	50	Airline *	-
5000	100	-	A- 2
10000	100	-	A- 3
	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

For flammable liquids and flammable gases, local exhaust ventilation or a process enclosure ventilation system may be required. Ventilation equipment should be explosion-resistant.

Air contaminants generated in the workplace possess varying "escape" velocities which, in

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Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

turn, determine the "capture velocities" of fresh circulating air required to effectively remove the contaminant.

Type of Contaminant:

solvent, vapours, degreasing etc., evaporating from tank (in still air).

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)

direct spray, spray painting in shallow booths,

drum filling, conveyer loading, crusher dusts,

gas discharge (active generation into zone of rapid air motion)

Air Speed:

0.25- 0.5 m/s (50- 100 f/min.)

0.5- 1 m/s (100- 200 f/min.)

1- 2.5 m/s (200- 500 f/min.)

Within each range the appropriate value depends on:

Lower end of the range

1: Room air currents minimal or favourable to capture

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

3: Intermittent, low production.

4: Large hood or large air mass in motion

Upper end of the range

1: Disturbing room air currents

2: Contaminants of high toxicity

3: High production, heavy use

4: Small hood- local control only

Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 1-2 m/s (200-400 f/min.) for extraction of 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

Material is hygroscopic, absorbs moisture from surrounding air.

Clear colourless, highly flammable liquid; soluble in water.

Faint ethereal odour.

Unstabilised material may form explosive peroxides in the presence of air.

PHYSICAL PROPERTIES

Liquid.

Mixes with water.

Molecular Weight: 88.12

Melting Range (°C): 11.8

Solubility in water (g/L): Miscible

pH (1% solution): Not available

Volatile Component (%vol): 100

Boiling Range (°C): 101.3

Specific Gravity (water=1): 1.03 @ 20C/4C

pH (as supplied): Not applicable

Vapour Pressure (kPa): 3.59 @ 20C

Evaporation Rate: Not available

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Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

Relative Vapour Density (air=1): 3
Lower Explosive Limit (%): 2.0
Autoignition Temp (°C): 180
State: Liquid

Flash Point (°C): 12.2 (TCC)
Upper Explosive Limit (%): 22.0
Decomposition Temp (°C): Not Available
Viscosity: Not Available

log Kow (Prager 1995): - 0.27
log Kow (Sangster 1997): - 0.27
log Kow: -0.27- -0.42

Section 10 - CHEMICAL STABILITY AND REACTIVITY INFORMATION

CONDITIONS CONTRIBUTING TO INSTABILITY

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

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

Accidental ingestion of the material may be damaging to the health of the individual. Ingestion of certain dioxanes has produced liver hypertrophy and enlargement (hepatomegaly). An aspiration hazard may exist.

EYE

Evidence exists, or practical experience predicts, that the material may cause severe eye irritation in a substantial number of individuals and/or may produce significant ocular lesions which are present twenty-four hours or more after instillation into the eye(s) of experimental animals. Eye contact may cause significant inflammation with pain. Corneal injury may occur; permanent impairment of vision may result unless treatment is prompt and adequate. Repeated or prolonged exposure to irritants may cause inflammation characterised by a temporary redness (similar to windburn) of the conjunctiva (conjunctivitis); temporary impairment of vision and/or other transient eye damage/ulceration may occur.

SKIN

Skin contact with the material may damage the health of the individual; systemic effects may result following absorption.

The material may produce mild skin irritation; limited evidence or practical experience suggests, that the material either:

- produces mild inflammation of the skin in a substantial number of individuals following direct contact, and/or
- produces significant, but mild, inflammation when applied to the healthy intact skin of animals (for up to four hours), such inflammation being present twenty-four hours or more after the end of the exposure period.

Skin irritation may also be present after prolonged or repeated exposure; this may result in a form of contact dermatitis (non allergic). The dermatitis is often characterised by

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Section 11 - TOXICOLOGICAL INFORMATION

skin redness (erythema) and swelling (oedema) which may progress to blistering (vesiculation), scaling and thickening of the epidermis. At the microscopic level there may be intercellular oedema of the spongy layer of the skin (spongiosis) and intracellular oedema of the epidermis.

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.

Absorption of some dioxanes through the skin has resulted in damage to the liver, kidney and brain.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterised by skin redness (erythema) and swelling epidermis. Histologically there may be intercellular oedema of the spongy layer (spongiosis) and intracellular oedema of the epidermis.

INHALED

Evidence shows, or practical experience predicts, that the material produces irritation of the respiratory system, in a substantial number of individuals, following inhalation. In contrast to most organs, the lung is able to respond to a chemical insult by first removing or neutralising the irritant and then repairing the damage. The repair process, which initially evolved to protect mammalian lungs from foreign matter and antigens, may however, produce further lung damage resulting in the impairment of gas exchange, the primary function of the lungs. Respiratory tract irritation often results in an inflammatory response involving the recruitment and activation of many cell types, mainly derived from the vascular system.

The material is not thought to produce adverse health effects following inhalation (as classified by EC Directives using animal models). Nevertheless, adverse systemic effects have been produced following exposure of animals by at least one other route and good hygiene practice requires that exposure be kept to a minimum and that suitable control measures be used in an occupational setting.

CHRONIC HEALTH EFFECTS

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

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.

On the basis, primarily, of animal experiments, concern has been expressed that the material may produce carcinogenic or mutagenic effects; in respect of the available information, however, there presently exists inadequate data for making a satisfactory assessment.

Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes. [PATTYS].

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Section 11 - TOXICOLOGICAL INFORMATION

Chronic exposure to dioxanes may produce injury to the liver, kidney and brain. Repeated or prolonged exposures may result in the formation of tumours, typically of the liver and gall-bladder.

The material may accumulate in the human body and progressively cause tissue damage.

The substance may be tumorigenic. Rats given repeated oral doses developed

liver and kidney damage at ulceration of the stomach at low dose rates

(90-200 mg/kg per day for 2 years). Higher doses, 1200 mg/kg per day for

13 months resulted also in hepatomas and carcinoma of the nasal cavity.

TOXICITY AND IRRITATION

TOXICITY

Oral (rat) LD50: 4200 mg/kg

Inhalation (human) TClO: 470 ppm.

Inhalation (human) LCLo: 470ppm/3 d

Dermal (rabbit) LD50: 7600 mg/kg

IRRITATION

Skin(rabbit): 515 mg (open)- Mild

Eye(human): 300 ppm/15m

Eye(rabbit): 21 mg (int)- Irritant

WARNING: This substance has been classified by the IARC as Group 2B: Possibly Carcinogenic to Humans.

Brain degenerative changes, kidney tubule changes, urine volume changes, lymphoma including Hodgkin's disease recorded.

Section 12 - ECOLOGICAL INFORMATION

Hazardous Air Pollutant:	Yes
Fish LC50 (96hr.) (mg/l):	1000- 6700
Algae IC50 (72hr.) (mg/l):	575
log Kow (Prager 1995):	- 0.27
log Kow (Sangster 1997):	- 0.27
log Pow (Verschueren 1983):	- 0.42
Half- life Soil - High (hours):	4320
Half- life Soil - Low (hours):	672
Half- life Air - High (hours):	81
Half- life Air - Low (hours):	8.1
Half- life Surface water - High (hours):	4320
Half- life Surface water - Low (hours):	672
Half- life Ground water - High (hours):	8640
Half- life Ground water - Low (hours):	1344
Aqueous biodegradation - Aerobic - High (hours):	4320
Aqueous biodegradation - Aerobic - Low (hours):	672
Aqueous biodegradation - Anaerobic - High (hours):	17280
Aqueous biodegradation - Anaerobic - Low (hours):	2688
Photooxidation half- life water - High (hours):	8.00E+04
Photooxidation half- life water - Low (hours):	1608
Photooxidation half- life air - High (hours):	81
Photooxidation half- life air - Low (hours):	8.1

DO NOT discharge into sewer or waterways.

log Kow: -0.27- -0.42

Koc: 1.23

Half-life (hr) air: 6.69-9.6

Henry's atm m³ /mol: 4.88E-06

BOD 5 if unstated: 10 nil

Bioaccumulation: sig

Anaerobic effects: no degrd.

Effects on algae and plankton: algae BCF 28500

continued...

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Section 12 - ECOLOGICAL INFORMATION

Degradation Biological: rapid in aerobic processes
Abiotic: v slow hydrol, some photol.

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.
 - Dispose of by: Burial in a licenced land-fill or Incineration in a licenced apparatus (after admixture with suitable combustible material).
 - Decontaminate empty containers. 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.

WASTE DISPOSAL PROCEDURES

- Containers of dioxane that are one year old and opened may contain peroxides. Screw cap containers should not be opened and disposed of by the appropriate authorities. If the container can be opened safely, the presence of peroxides can be checked by the following procedure. Wear protective clothing, butyl rubber gloves and eye protection to control personal contact. Dissolve 100mg of potassium iodide in 1mL of glacial acetic acid. Add this to 1mL of dioxane. A pale yellow colour indicates a low peroxide concentration and a bright yellow colour indicates a high peroxide concentration in the sample. To remove peroxides, wear butyl rubber gloves, protective clothing and eye protection.

Add

100mL of dioxane to a 50% aqueous solution of sodium metabisulfite (20mL).

Shake

the contents for three minutes. Release the pressure and separate the aqueous layer. Retest the dioxane for continued presence of peroxides, that are not reduced by the metabisulphite treatment. If peroxides are absent, dry the dioxane for reuse, or package for incineration. If peroxides are still present, place the ether in a solution of 100mg potassium iodide, 5mL of glacial acetic acid and one drop of concentrated hydrochloric acid. Heat the contents under reflux for one hour. Package the ether for incineration [Armour 1996].

SPILLAGE DISPOSAL

- Shut off all ignition sources and clear area of personnel. Wear breathing apparatus, eye protection, protective clothing and butyl rubber gloves to control personal contact from dioxane. Cover the spill with a 1:1:1 mixture by weight of soda ash, bentonite and sand. Transfer to a labelled container for incineration. Ventilate the area of the spill, to evaporate remaining liquid and dispel vapours [Armour 1996].

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Section 14 - TRANSPORTATION INFORMATION



Labels Required: FLAMMABLE LIQUID
HAZCHEM: 2YE

UNDG:

Dangerous Goods Class: 3
UN Number: 1165
Shipping Name: DIOXANE

Subrisk: None
Packing Group: II

Air Transport IATA:

ICAO/IATA Class: 3
UN/ID Number: 1165
ERG Code: 3L
Shipping name: DIOXANE

ICAO/IATA Subrisk: None
Packing Group: II

Maritime Transport IMDG:

IMDG Class: 3
UN Number: 1165
EMS Number: F- E, S- D
Shipping name: DIOXANE

IMDG Subrisk: None
Packing Group: II

Section 15 - REGULATORY INFORMATION

REGULATIONS

1,4-dioxane (CAS: 123-91-1) is found on the following regulatory lists;
IMO MARPOL 73/78 (Annex II) - List of Noxious Liquid Substances Carried in Bulk
International Agency for Research on Cancer (IARC) Carcinogens
OECD Representative List of High Production Volume (HPV) Chemicals

No data available for 1,4-dioxane as CAS: 54841-74-6, CAS: 28347-88-8, CAS: 39449-24-6,
CAS: 28347-91-3.

Section 16 - OTHER INFORMATION

continued...

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Section 16 - OTHER INFORMATION

INGREDIENTS WITH MULTIPLE CAS NUMBERS

Ingredient Name	CAS
1, 4- dioxane	123- 91- 1, 54841- 74- 6, 28347 - 88- 8, 39449- 24- 6, 28347- 91- 3

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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