

NATIONAL HISTORICAL INSTITUTE

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ALPHABETICAL LIST OF CHEMICALS

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Introduction to the second edition: 1990

The first edition of this guide grew out of a lecture SSCR arranged on chemical cancer hazards. Members requested further information, and the result was a compilation of the properties and hazards of chemicals used in conservation.

This edition includes some chemicals which are now not in general use. Their inclusion is deliberate, so that conservators can be advised of potential hazards that might arise from previous conservation treatments (eg. arsenic; DDT). Also included are a few chemicals whose use is not recommended because of their extreme hazard. Since they were referred to in some conservation literature, it was felt better to include them, and to let individuals use the information in this guide to help them in their assessment and to decide whether or not they should be used.

Health and safety at work: changes in UK legislation

Since the 1st edition of this guide was produced, there has been a major reconsideration of health and safety at work, and of the regulations that govern it. In the UK there have been changes in legal requirements, working practices and conditions. These are set out in the new COSHH Regulations, summarised below by Frank Howie of the Natural History Museum.

The Control of Substances Hazardous to Health Regulations, COSHH for short, came into force on 1st October 1989 in the United Kingdom. This important and comprehensive set of regulations determines the way hazardous materials can be handled in the workplace. The major requirements are as follows:-

1. The employer must make sure that any health risks arising from the use of substances are identified before work begins.
2. The employer must ensure that all necessary steps are taken to safeguard the health of everyone who is affected by work with chemicals and infectious agents.
3. Exposure to hazardous substances must be prevented or effectively controlled.
4. Control measures must be used, regularly tested and properly maintained.
5. The employer must carry out workplace monitoring and health surveillance where required.
6. Employees must be provided with information, instruction and training.

The primary aim of the regulations is for the employer to carry out an objective

assessment of the likely hazard offered by the specific mode of operation with substances. This may in some cases need to be carried out by a safety specialist. In many cases a written assessment will need to be kept on file. With many toxic substances it will be expected that these be eliminated from use or that less toxic substances be substituted.

Where the assessment demonstrates the need for a control system, this will need to be provided together, in the case of exhaust ventilation systems and protective clothing, with a record of examination, maintenance and regular tests. In the normal work place it is expected that exposure to hazardous substances will be prevented or controlled by means other than the use of personal protection, that is by engineering means such as fume cupboards and local exhaust ventilation.

The regulations apply to all substances including proprietary materials, infectious agents and all types of dust. Domestic cleaning agents, paint strippers, contaminants from air-conditioning systems, your own mixtures and concoctions, all these require assessment of risk before use and, if necessary, adoption of control measures. For a practical approach to COSHH see *COSHH in Laboratories* issued by the Royal Society of Chemistry.

The COSHH Regulations introduce new terminology for occupational exposure limits. The present HSE Recommended Limits (RL) generally become *Occupational Exposure Standards* (OES) and Control Limits (CL) become known as *Maximum Exposure Limits* (MEL). These limits are enforceable for the first time by legislation.

Both guide and index are arranged in alphabetical order. In the Index (pages 20-43) the left-hand column contains the alternative names (chemical, commercial and trade names) in alphabetical order: the right-hand column indicates in bold type the name under which that substance is described in the guide. Registered and trade names of commercial products are indicated by an asterisk (*). If a product consists of several components, you should look each one up in the guide.

The information for commercial products has been largely provided by the manufacturer or supplier (see 'Acknowledgements'), unless it consists almost entirely of one chemical eg. Genklene*. Care is advisable when checking products under their trade name, since they may vary from country to country and formulations may be changed from time to time. Always obtain the latest data from the supplier or manufacturer.

The amount of information available for each product or chemical varies greatly. As far as possible, each chemical or product has been described under the headings set out below. If no hazard data is given, do not assume that the material is safe; it may simply mean that its hazards have not been assessed, or they have not been made public. (In the UK suppliers are obliged by law to provide full health and safety information on their products).

Data on substances has been gleaned from several sources (see Bibliography). Whilst not intended to be exhaustive, this should give users sufficient information to enable them to determine safe storage, use and

disposal procedures. This information is arranged under a series of headings, as follows:

- Synonyms
- Normal State
- Uses
- Properties
- Flammability
- Fire extinguishers
- Incompatible with
- Spills
- Disposal
- Storage
- Handling
- Exposure Limits: TLVs, STELs, OESs and MELs
- Effects of exposure
- First Aid
- Preclude from exposure

These sections are described more fully below and the terms used are explained in the Glossary (p. 15). There are a number of blank pages at the back of the guide for you to complete, should you use a chemical that has not been included in this edition.

Explanation of headings used to describe chemicals and products used in conservation.

Synonyms lists alternative names, both trade and chemical names. Some chemicals are more commonly known by a traditional name, rather than by one which describes its components and structure: for example the name 'acetone' rather than dimethyl ketone; 'formic acid' rather than methanoic acid. All synonyms are listed in the left-hand column of the index.

Normal state describes the material's usual appearance (and concentration, if relevant) as supplied for use in a laboratory, or purchased as a commercial product.

Properties outlines miscellaneous information which might be of use to the conservator. eg. BP = Boiling Point; MP = melting point; SG = specific gravity. Other information includes: chemicals in which it is soluble/miscible; those in which it is insoluble/immiscible; whether it is hygroscopic or deliquescent; whether it is stable; whether it sublimates at low temperatures.

Flammability describes a chemical's potential fire hazard; the various terms

used are explained in the glossary (p. 15). The information here should also be considered when dealing with spills (see below). Many institutions require all laboratories to produce an easily-accessible file which details the type, quantity and location of all hazardous and flammable materials; this is invaluable for fire and security services in an emergency.

Fire extinguishers lists the type of extinguishers to use on fires involving this chemical. It must be emphasised that these should only be used by laboratory personnel when the fire is small and contained; leave fire-fighting to the experts. In a fire, water is usually safe to use on closed containers to keep them cool, but must not be used if they, or their contents are on fire; water will spread burning chemicals. Fire extinguishers are colour-coded; the UK colour-codes are:

Red: Water

Black: Carbon dioxide

Cream: Foam

Green: Vapourising liquid (BCF or Halon)

Blue : Dry powder.

Make sure you know which is which. Many UK Fire Brigades and commercial extinguisher suppliers run fire-fighting courses which give people valuable experience in using extinguishers in a 'safe' fire situation.

Incompatible with : This section indicates hazardous reactions or reaction products that may form under certain conditions, or where the material is in contact with certain chemicals. This information should be consulted when considering handling, storing or working with this chemical. For further information refer to Bretherick (1986).

Spills lists methods for dealing with small spillages up to a few litres. The emergency services should be consulted in the event of a larger spillage. Personnel dealing with a spillage must wear suitable protective clothing, including overalls, suitable respirator and protective footwear. If the spilled chemical liberates fumes or vapours, evacuation of personnel may be necessary immediately. If the chemical is flammable, switch off any apparatus that may cause ignition (electrical apparatus; hot radiators; hot light bulbs; refrigerators; ovens); ventilate the area thoroughly. Remember that the vapour of many highly flammable chemicals may be heavier than air, so it will tend to lie just above the floor level. A spark released into such a vapour cloud can ignite it, causing a flashfire that will travel rapidly back along the vapour trail to source.

Small spills of non-hazardous substances and some solvents can be mopped up with paper towels, and left to evaporate safely in a fume hood. Other absorbents recommended are sand, earth and soda ash; there are also several kinds of 'spillage granules' on the market suitable for different kinds of chemicals, as well as specialised kits for mercury, for example. Unless the spilled chemical is highly flammable, gives off toxic fumes, or evaporates very slowly, contaminated absorbents could be left in a fume cupboard to evaporate safely. Otherwise they should be stored in secure containers in a chemicals store and disposed via a competent contractor.

CAUTION: some chemicals (eg. oxidising agents and concentrated acids) are incompatible with organic materials, so it would be dangerous to mop them up with sawdust, rags or paper towels. Make sure you are familiar with the potential hazards of every chemical you use.

Spills of larger amounts of chemicals should be mopped up with a suitable absorbent, kept in secure containers in a chemical store and disposed of as soon as possible. You can obtain advice on the disposal of chemical waste from your local Cleansing Department; and your local Fire Brigade can advise on the emergency disposal of chemicals.

Small amounts of some chemicals can be neutralised and released to the sewer with plenty of water; there is however a long list of chemicals which must not be released to the sewer (including heavy metals, chlorinated organic compounds for example), so check with the local River Purification Board first.

Once a spill has been cleaned up, the contaminated area should be thoroughly washed with soap and water.

Storage These are general recommendations only, as many hazards reference books assume that industrial quantities are being used. Under current UK legislation the maximum amount of flammable solvents permitted in a laboratory is 50 litres, which must be kept in suitable closed containers, in a fire-resistant cupboard or bin. All containers must be clearly labelled with the contents and potential hazards (date of purchase/first use is often useful too). Small containers of chemicals must also be marked with the appropriate pictogram(s).

It is good practice to restrict working quantities to the amount needed for daily use, and to place the containers, however small, in a fire-resistant bin or store overnight. Do not use fume cupboards for storing chemicals. Make sure you are storing a chemical well away from anything that may cause a dangerous reaction: see 'Incompatibility' section. It should be noted that 'sources of ignition' include naked lights, static electricity from clothing/furnishings, hot light bulbs or any equipment that might generate 'hotspots' or sparks. For example, thermostats inside refrigerators are a source of sparks: laboratory refrigerators are designed so that sparks cannot be released into the atmosphere inside the fridge, but domestic refrigerators are not safeguarded in this way, and should never be used for storing chemicals.

Handling: For many substances there is no safe acceptable level of exposure. Only complete protection of the eyes against caustic or acid splashes is acceptable; skin must be protected from acids and agents such as neurotoxins. With volatile substances and dusts, dependent upon level of toxicity, exposures above the occupational exposure limit may be acceptable for short periods.

Wherever possible, volatile toxic substances and toxic dusts should be handled in forced ventilated enclosures. Fume cupboards and local exhaust ventilation systems (spot extractors, hoods, etc) are essential for all but the infrequent handling of small amounts of substances with Maximum Exposure Limits. Certain substances, ie. benzene, several fumigants and other EC, HSE or OSHA listed human carcinogens require handling in total containment systems or by operators protected in special suits with supplied air breathing

apparatus. Many chemicals require the operator to use protective clothing and eye protection.

Fume cupboards and Local Exhaust Ventilation: Any extract ventilation equipment used to handle hazardous substances must comply with current standards. Fume cupboards should meet BS DD80 (in UK) and LEV systems ANSI 29.2:1979 (in USA).

Protective Clothing: Any protective clothing used must meet the appropriate standard (BS, ANSI, HSE, OSHA etc.). Gloves, arm protection and apron manufacturers and suppliers will be able to advise on preferred products for protection against specific substances. All protective equipment must be subject to suitable cleaning, storage and maintenance procedures. Users must receive suitable training in use and care of protective clothing.

Gloves can be light or heavy weight, of natural rubber (latex), synthetic rubber (nitrile, butyl or neoprene) or of PVC or Viton. The appropriate materials is indicated, wherever possible for each chemical, but information is not always available.

Natural rubber (latex) has fairly good resistance to dilute acids, alkalis, alcohols and ketones.

Nitrile rubber (formed from co-polymers of butadiene with varying amounts of acrylonitrile) has a high resistance to oils, and is satisfactory for many purposes. It has good tackility, and good resistance to dilute acids and alkalis, alcohols, aromatic hydrocarbons and petroleum distillates.

Butyl rubber (produced by co-polymerising isobutylene with c. 2% of butadiene or isoprene) has good resistance to heat, oxygen, ozone, and many gases; to dilute and concentrated acids, alkalis, alcohols and ketones.

Neoprene rubber (polymerised chloroprene) Has a high melting range, resistance to low friction and is chemically inert; it performs better than PVC at low temperatures. It has good resistance to dilute and concentrated acids; alkalis, alcohols, ketones and petroleum distillates.

Viton manufacturers should be able to advise you on the most suitable gloves for different chemicals.

(To check for yourself, turn a glove inside out, fill one finger with the solvent, seal the finger, then check the glove after three or four hours, for any leaks or alteration in the rubber.)

If a chemical does leak into the glove, it cannot escape or evaporate, but is trapped on the surface of the skin. This would be similar in effect to keeping the hand immersed in a container of that chemical, and could result in chemical burns, or in a dangerous amount of the chemical entering the bloodstream via skin absorption.

Eye Protection: It is advisable when selecting eye protection to refer to the manufacturers' data to ensure that the eye protectors provide adequate protection against the hazard and conform to the British Standard. There are three basic types of eye protection.

(a) **Spectacles.** Usually have side-shields and are commonly used for protection against impact or low-velocity projectiles. Prescription lenses of hardened glass

conforming to BS2092 may be used, and tinted lenses for specific ultraviolet or infrared hazards are available. Safety spectacles do not give adequate protection from chemical splashes, dust or vapours.

(b) **Goggles.** A wide range of cup- and box-type goggles normally held in place by a head strap are obtainable with protected ventilation ports. Goggles provide protection against a wide variety of mechanical, chemical and radiation hazards.

(c) **Face shields.** May be hand-held or attached to helmets, but more often they are fixed independently to a rigid headpiece. Face shields provide eye protection against most hazards except irritant dust, gases and vapours.

Eye protectors should be included in the personal protection programme for the workplace. Facilities should be available for cleaning and storing the eye protectors, and procedures defined for maintenance and replacements. Supervision and training is an essential part of a protection programme.

Respiratory Protection: There are several basic types of respiratory protective equipment (RPE) which should be used where there is unavoidable risk of exposure to air-borne contaminants. Where oxygen deficient atmospheres are likely to be present compressed air fed or self-contained breathing apparatus (to BS 4667) must be used. RPE should never be the preferred method of protection but may be used in circumstances such as the following:-

- for infrequent or intermittent work of short duration with low-toxicity substances
- for work with nuisance (non-toxic) materials
- for certain types of emergency (eg. for spillages away from forced ventilated areas)
- where no other method of control is available (eg. asbestos removal or cleaning chemical tanks); only HSE approved equipment may be used in these circumstances

To select the most appropriate RPE for a particular situation the following information will be required:

- nature of contaminant
- its concentration in the working atmosphere and the occupational exposure standard (OES) for the contaminant
- type of work undertaken.

The degree of protection needed (normally <10% of OEL provided by a particular piece of RPE) is designated by reference to its nominal protection factor (NPF). The higher the NPF the greater the degree of protection. Cartridge type respirators for vapours have NPF around 20; self-contained breathing apparatus has an NPF of 2000. NPF is reduced substantially by poor fit, beard-growth or even stubble. There are BS, HSE and ANSI standards for RPE. Under the COSHH regulations only HSE-approved RPE may be used in the UK. RPE may be divided into two main categories:

1. Respirators purify the air via a filter that removes the contaminants. Respirators provide short duration protection against low levels of dusts (including mists and fumes), gases and vapours.
2. Breathing Apparatus provides air to the user from a cylinder or compressor to

provide protection against oxygen-deficient atmospheres, where high levels of toxic materials are present or for escape purposes.

A number of different types of respirator are currently available:

— Disposable face mask designed to cover the mouth; these should be worn only once and for not longer than a single shift, prior to disposal. These are used for protection against low levels of low toxicity particulate materials. Nuisance-dust masks should be used only for comfort purposes to exclude large particles of non-toxic materials (eg. to BS 6016).

— Half-mask (orinasal) respirators consist of a plastic or rubber mask designed to cover the nose and mouth and may be used for protection against dusts and vapours, depending upon the type of filter cartridge fitted.

— High-efficiency dust respirators (to BS 4555) consist of a rubber or plastic full face-piece which covers the eyes, nose and mouth; suitable for dusts, gases and vapours depending upon the type of replaceable cartridge or canister used. A list of cartridge and canister types for various gases (including duration times) is given in BS 2091 and in the HSE certificate of approval for 'canister gas respirators.'

— Positive-pressure powered respirators are those in which air is drawn through a filtration-medium by a battery-powered fan and supplied to the breathing zone. The powered filtration unit can be used to supply air into a half dust-mask, full face-piece, hood, blouse, half suit or full suit. The breathing zone is predominantly under 'positive pressure' and consequently any leakage of air is normally outward.

— Ventilated helmets and visors pass filtered air between the face and a visor. The fan and filters may be housed in a helmet or worn on a harness. Air-fed ventilated helmets are also available.

There are three types of breathing apparatus in use:

— Fresh-air hose apparatus where air is drawn along a hose by the breathing action of the wearer.

— Compressed airline apparatus, where air is supplied to the breathing zone by a compressed-air line (filtered).

— Self-contained apparatus provides air from pressurized gas cylinders on a harness.

Full training must be provided in the fitting, use, care and maintenance of all types of RPE.

Occupational Exposure Limits. TLVs, etc. In the UK, RLs (Recommended Limits) and CLs (Control Limits) were the standards approved by the Health and Safety Commission until 1989, when they were replaced by OESs (Occupational Exposure Standards) and MELs (Maximum Exposure Limits). Both of these are legally enforceable under the new Control of Substances Hazardous to Health Regulations. (COSHH).

TLV/TWAs (Threshold Limit Values/Time Weighted Average) TLV/STELs (Threshold Limit Values/Short Term Exposure Limits) are standards set for the USA by the American Conference of Governmental Hygienists, and

are the TLVs used in this text unless otherwise stated. Both British and American safety standards are reviewed annually. The two systems are not totally interchangeable, although the TLVs and OESs may be numerically the same. For a definition of these terms see below. Both systems refer to a normally time-dependent concentration of a chemical in air, which is felt to be 'acceptable' in a working environment. 'Acceptable' in this case meaning that for constant exposure at or below the specified concentration (i.e. TLV/TWA or OES) over the average working lifetime, there is no current evidence for this chemical having any ill effects on the health of most workers — provided this concentration is not exceeded. This does not mean that exposure up to this concentration is 'safe' and only becomes 'dangerous' above it: obviously the lower the concentration the better.

If a chemical does not have figures for TLVs or OESs, do not assume it is safe; this generally means that at the moment there is not enough information available on that chemical for acceptable concentrations to be calculated.

ppm: mg/m³ The British and American exposure limits use the same units to describe the concentration of a chemical in air: that is, in ppm (parts per million; eg. 100 ppm = 0.1%) or as mg/m³ (milligrams of chemical per cubic metre of air). If different sources recommend different exposure levels for the same chemical, this guide uses the lowest value.

Definitions: UK: (MEL) Maximum Exposure Limit applies in the UK from 1989 and is legally enforceable under the COSHH Regulations. It is the 'Maximum concentration of an airborne substance, averaged over a reference period, to which employees may be exposed by inhalation under any circumstances'. The MELs are divided into Long Term Exposure Limits (LTEL) which is when the concentration is averaged out over an 8-hour exposure period; and Short Term Exposure Limits where the exposure is averaged out over an average ten-minute exposure period, calculated by sampling throughout that exposure period. Short Term Exposure Limits should never be exceeded because of the risk to health above this concentration: indeed the aim should be to reduce exposure to a small fraction of the MEL, say 10% or 20% maximum.

UK: (OES) Occupational Exposure Standards apply in the UK from 1989 and are legally enforceable under the COSHH regulations. It is defined as 'the concentration of an airborne substance, averaged over a reference period (LTEL 18 hours; STEL over 10 minute period) at which, according to current knowledge, there is no evidence that it is likely to be injurious to employees if they are exposed by inhalation day after day at that concentration.' Every effort must be made to keep the OES below the specified concentration; failure to do so may result in prosecution. The MELs and OESs of some chemicals are still under review; this is noted in the text.

USA: (TLV) Threshold Limit Value is the basis of the American system, and is the recommended maximum average concentration in air of that chemical that may be considered to be without risk in a normal person's working life. The lower the TLV, the more toxic the chemical. The ACGIH uses a TLV/TWA designation: the TWA stands for Time Weighted Average and refers to the exposure averaged out over an 8-hour, 5-day working week.

USA: TLV/STEL (TLV, Short Term Exposure Limit) is the ACGIH system is the maximum concentration of that chemical in air for a maximum exposure of 10 minutes: there should be at least 60 minutes between each exposure, and no more than 4 exposures per day.

USA: CL Ceiling Limit is the concentration in air of a chemical that should not be exceeded.

N.B.: UK and US exposure standards/limits are not interchangeable.

Odour Threshold: Some sources indicate in ppm the concentration at which the chemical can be detected by the sense of smell. This is NOT an indication of concentration, since some people have a keener sense of smell than others, and since the sense of smell rapidly becomes less sensitive as the exposure continues (ie. 'olfactory fatigue'). This data therefore has no real value in health and safety terms, but is included as a warning, since in some cases the Odour Threshold is well above any of the recommended exposure limits.

Effects of Exposure: Indicates the way the chemical may affect the body, and how it can enter the system. Short exposure to high concentrations of some chemicals (due to splashes on skin/eyes; spillage, etc) may have acute effects such as burns, dermatitis, breathing difficulties, narcosis and so on. Long-term continued exposure even to low concentrations of a chemical will have chronic effects whose ultimate origin may not be immediately obvious, but which may be more serious than the short-term acute effects.

With certain chemicals (eg. xylene and aspirin; alcohol and styrene; alcohol and trichloroethylene) there is considerable evidence that where exposure to two or more chemicals occurs simultaneously, the combined toxic effect can be far greater than that of the individual chemicals (ie. synergism) because the body will find it far harder to break down and eliminate chemicals simultaneously, than two or more chemicals one after the other. Smoking or drinking before or after exposure to some chemicals can have the effect of enhancing the toxicity of both the chemicals and the nicotine or alcohol. Chemicals which can be absorbed through the skin can also be absorbed very easily if they are splashed into the eyes, which are very vascular. Absorption can also occur through the mucous membranes (of mouth and nose) and through the roof of the mouth when inhaling or talking.

Accidental swallowing of chemicals sometimes occurs if a beaker of chemicals is mistaken for a drink, when pipetting chemicals by mouth, or where personal hygiene is poor (eg. failure to wash hands after handling toxic materials) or where food and chemicals are not segregated. It may be a good idea to keep a personal record of exposures to different chemicals: the UK's COSHH regulations make this compulsory for some chemicals.

First Aid: These are only very simple, emergency treatments; medical aid is recommended if the victim feels at all unwell, even if this is not stated in the text, since some symptoms may take hours or even days to develop. Make sure that at least one person in the laboratory has first aid training. If you are going to the aid of a victim of a chemical accident, make sure that you have adequate

personal protection.

Splashes on the skin: should be washed off immediately with plenty of water; do not wait until that particular task is finished. Clothes which are soaked in the chemical should be removed, and well laundered before re-use.

Splashes/chemicals in the eye: the eyes should be irrigated with water; that is, the eyes should be flushed gently with running water for 15 or 20 minutes, using either an eyewash fountain or a tap with a rubber hose attached. Hold the eyelids apart if necessary. **NB.** Eye protection should always be worn when using chemicals that might damage the eye, or when there is a risk of splashes or airborne dusts.

If chemicals are inhaled: the patient should be kept still, and moved away from the source of the fumes as quickly as possible. Rescuers may need to wear breathing apparatus, gloves, etc. If breathing has stopped, give artificial respiration, wiping chemicals from the patient's face first. If the patient's clothes are saturated with the chemical, it may be necessary to remove those. If the patient's breathing is difficult, support them in an upright sitting position, and if possible have medical personnel administer oxygen. Call an ambulance, stating clearly the chemical(s) involved, if you know them. If you know there will be a long delay before medical aid can reach you, take the patient to the nearest medical centre, telephoning ahead to warn the medical staff and give details of the chemical involved. Do not allow the patient to move.

If chemicals have been swallowed: keep the patient as still as possible; and either call an ambulance **immediately**, or take them to a medical centre or hospital **immediately**. Telephone ahead to warn medical staff, giving details of the chemical involved, and the amount swallowed. If practicable, send the chemical's container to the hospital with the patient, particularly if the chemical is a commercial product. **If the patient is conscious**, give them plenty of water to drink, if that is recommended in the first aid notes for that particular chemical. **Do not induce vomiting** under any circumstances.

Preclude from exposure: people suffering from certain disorders should not be exposed to this chemical. Heavy drinkers and smokers are more susceptible to the effects of many chemicals.

Pesticides: UK Regulations

1986 saw the introduction in the UK of new regulations governing the use of pesticides: these include chemicals and commercial products used as fungicides, rodenticides, insecticides and algicides. Under these regulations, only those pesticides which have been approved may be supplied, stored or used and must be used strictly in accordance with the manufacturer's instructions.

The approved pesticides are listed in the book *Pesticides* (produced by the Ministry of Agriculture, Fisheries and Food with the Health and Safety Executive) published by HMSO at £8.95 (1989). Only 8 pure chemicals are approved for use as pesticides (ie. Alphachlorolose; Carbon tetrachloride; Ethylene dichloride; Formaldehyde; Methyl bromide; Strychnine; Sulphuric

acid; Seconal; Urea); but a very large number of commercial products have been approved for use; some of these consist almost entirely of one chemical. The lists are extensively cross-referenced, and all the active ingredients are given for each commercial product. UK users should note that it is illegal to use or store a pesticide that is not approved, so many chemicals that have previously been used in museums and laboratories as pesticides should be disposed of. These non-approved chemicals have been included in this guide partly because they have been used in the past and will therefore still be present in collections, and also because they are frequently the main constituent of many of the approved commercial products.

Glossary of terms used in the text

Allergen: a substance induces the formation of an antibody in the bloodstream of a susceptible person; the allergen and antibody combine to form histamine-like substances which cause the blood vessels to release fluids, giving symptoms similar to hayfever — ie. sneezing, swelling, oedema, rashes. Severe allergens may cause very serious conditions which could prove fatal.

Auto-ignition: the minimum temperature at which a substance will commence to burn at atmospheric pressure: an increase in atmospheric pressure or in oxygen concentration will alter the rate of burn, but not lower than the auto-ignition temperature.

Boiling point: = b.p. temperature at which the upward pressure of the molecules escaping from the surface (ie. vapour pressure) is equal to the external pressure (usually atmospheric pressure); the liquid boils freely at this temperature and pressure.

Butyl rubber: a synthetic rubber (see p. 8 of Introduction).

Carcinogen: a substance which will cause or promote cancerous tumours.

Caustic: a chemical that is corrosive towards organic matter; usually applied to an alkaline agent such as caustic soda (sodium hydroxide); caustic potash (potassium hydroxide).

Ceiling Limit: (CL) the concentration in air of a chemical which must not be exceeded, because of the dangers to health. (US definition).

Conjunctivitis: inflammation of the conjunctiva — the membrane connecting the inner eyelid and eyeball and covering the outer surface of the cornea.

Cyanosis: blue discolouration of the skin due to circulation of imperfectly oxygenated blood.

Deliquescent: tending to absorb moisture from the air; the chemical may liquify as a result of absorbing moisture until it dissolves in it.

Demulcent: a liquid used to soothe and relieve irritation, for example, after swallowing certain chemicals. Common demulcents are raw eggs with or without milk; milk, dried egg and milk and table oil.

Density: commonly used to denote the concentration of matter as mass per unit volume: ie. kilograms per cubic metre or grams per cubic centimetre. May be expressed simply as a number to indicate the density relative to that of water. See also Specific Gravity.

Dermatitis: inflammation of the skin; may be caused by chemical irritants.

Erythema: redness of the skin; sunburn; may be caused by chemical burns.

Explosive Limits: at the lower explosive limit (lel) the concentration in air of a

substance is too low to allow an explosion; at the upper explosive limit (uel) the concentration in air is too great for an explosion to take place. Explosions may occur if the concentration lies between the two. For the solvents in the guide, concentrations at the uels are all lethal.

Flammable Limits: if the concentration in air of a substance lies within these limits, and there is a source of ignition present, the substance may catch fire.

Flash Point: the minimum temperature at which a chemical will give off sufficient flammable vapour to ignite if a source of ignition is present.

FP = Freezing Point: the temperature, at atmospheric pressure, which marks the point of equilibrium between the solid state and the liquid state of a substance.

Haemorrhage: bleeding; may be internal or external depending on injury.

Halogen: one of a group of elements having some chemical properties in common: bromine, chlorine, fluorine and iodine.

Hygroscopic: tending to absorb moisture.

Ignition temperature: see auto-ignition temperature.

Keratitis: inflammation of the cornea — the front covering of the eye.

LTEL: Long Term Exposure Limit: maximum permitted level for exposure to a chemical over an 8-hour day. The UK and USA definitions are slightly different: see p. 11 of Introduction.

MEL: UK term standing for Maximum Exposure Limit, the maximum concentration of a chemical in air to which workers may be exposed: see p. 11 of Introduction.

Melting Point: = m.p. temperature at which the solid and liquid phases are in equilibrium, at a given pressure (usually atmospheric pressure). Above that temperature the substance is liquid, below it, solid.

Mutagen: a substance which causes modification of the DNA, affecting the hereditary characteristics transmitted by genes or chromosomes.

Myelotoxic agent: attacks the spinal chord or bone marrow; affects bone marrow's ability to produce white blood cells.

Narcosis/narcotic: a substance that induces narcosis produces sensations of dizziness, euphoria, drowsiness; may result in lack of co-ordination and unconsciousness.

Necrosis: death of living tissue.

Neoprene: a synthetic rubber; see p. 8 of Introduction.

Nitrile: a synthetic rubber; see p. 8 of Introduction.

Occupational Exposure Limits: a set of standards used in the U.K. and elsewhere (in the UK updated annually by the Health and Safety Executive)

which refer to a worker's exposure to toxic substances in the workplace. In the USA these are divided into TLV/TWAs and STELs; in the UK into MELs and OESs. See Introduction, pp. 10-12.

Odour Threshold: concentration in air at which a chemical can be detected by the sense of smell. N.B. the sense of smell rapidly becomes less sensitive. See note in Introduction, p. 12.

OEL: see Occupational Exposure Limits and p. 12 of the Introduction.

OES: Occupational Exposure Standard: UK standards set annually governing the 'acceptable' concentrations of chemicals in the air of the workplace. See p. 10 of Introduction.

Olfactory Fatigue: a term used to describe how the sense of smell becomes less able to detect the odour of a chemical after a period of exposure to it; the length of time before olfactory fatigue sets in varies with each chemical, and with individuals. The person affected may not realise that they may be working in a dangerously contaminated atmosphere. NB Some vapours will mask others: eg. ethanol masks formaldehyde.

Oxidising agent: a substance which brings about an oxidation reaction, by reacting with one or more other substances by giving up electrons and undergoing a reduction at the same time. The reaction may involve the release of oxygen or acidic-forming elements or radicals. The oxygen may be evolved at room temperature, or with slight heating. Examples are peroxides, permanganates, some nitrates. Containers should bear a warning label.

Pulmonary oedema: accumulation of fluid in the lungs.

Sensitiser: a chemical which on first contact may cause only a slight reaction in a worker, but which on subsequent contacts will cause more and more severe reactions — eg. blisters, burns, breathing difficulties.

Specific Gravity: = SG or Relative Density. The ratio of the mass of a body to the mass of an equal volume of water at 40°C (or other specified temperature). If heavier than 1, it is denser than water; if less than 1, less dense than water.

STEL: Short Term Exposure Limit — the maximum permitted concentration of a chemical in workplace air, where exposure is for a short period only. See p. 10 for USA and UK definitions.

Sublimation: when a solid is converted directly to a vapour on heating, without passing through a liquid phase.

Teratogen: substance which will cause malformation of the embryo.

TLV: Threshold Limit Value term established by the American Conference of Governmental Hygienist to define the maximum concentration of an airborne chemical to which most workers could be exposed throughout their working lives without coming to any discernible harm. See p.11 -12 of Introduction.

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Index to 1990 Edition of 'Chemicals in Conservation'.

To find information on a chemical or product, look it up in the left-hand column; the entry in capitals on the right tells you under which name it occurs in the text.

NB: An asterisk denotes a trade name or a commercial product.

- Ablebond 342-1* ABLEBOND 342-1*
- Abrasive powders ALUMINIUM OXIDE
DOLOMITE
SODIUM BICARBONATE
- Absolute alcohol ETHANOL
- Acetic acid ACETIC ACID
- Acetic ether ETHYL ACETATE
- Acetic acid ethyl ester ETHYL ACETATE
- Acetone ACETONE
- Acetone carboxylic acid ACETIC ACID
- Acetylene tetrabromide TETRABROMOETHANE
- Acrylic resin monomer METHYL METHACRYLATE
- Acrylic resin PARALOID* B48N; B72; B67; B57MT
- Activin* CHLORAMINE T*
- Aerosil* AEROSIL*
FUMED COLLOIDAL SILICA
- Aerotherne MM* METHYLENE DICHLORIDE
- Albigen A* POLYVINYL PYRROLIDONE
- Alcyl-amino-ethyl-glycin TEGO 51B*
- Alcohol N-AMYL ALCOHOL
n-BUTYL ALCOHOL
DIACETONE ALCOHOL
ETHANOL
ETHYLENE GLYCOL
GLYCERINE

METHANOL
 METHYLATED SPIRITS
 POLYVINYL ALCOHOL
 Algofluon*TEFLON*
 Alkyl-alkoxy silane DYNASYLAN BSM*
 Alumina ALUMINIUM OXIDE
 Aluminium oxide ALUMINIUM OXIDE
 Aluminium sesquioxide ALUMINIUM OXIDE
 Aminic acid FORMIC ACID
 Aminobenzene ANILINE
 Aminocyclohexane CYCLOHEXYLAMINE
 Amino pheniaryl amine ANILINE
 2-Amino pyrimidine 2-AMINO PYRIMIDINE
 Ammoniak AMMONIUM CHLORIDE
 Ammonia solution AMMONIA SOLUTION
 Ammonium acetate AMMONIUM ACETATE
 Ammonium chloride AMMONIUM CHLORIDE
 Ammonium hydroxide AMMONIA SOLUTION
 Amorphous silicon dioxide FUMED SILICA
 n-amyI acetate n-AMYL ACETATE
 AmyI acetate ester n-AMYL ACETATE
 n-AmyI alcohol n-AMYL ALCOHOL
 Aniline ANILINE
 Aniline oil ANILINE
 Aqua regia AQUA REGIA
 Araldite* ARALDITE* HARDENER
 ARALDITE*RESIN
 EPOXY RESINS
 Arcton* 113 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE
 Arklone* 1,1,2-TRICHLORO-1,1,2-TRIFLUOROETHANE
 Arsenic (crude) ARSENIC TRIOXIDE
 Arsenic trioxide ARSENIC TRIOXIDE
 Arsenious anhydride ARSENIC TRIOXIDE
 Arsenious oxide ARSENIC TRIOXIDE
 Aryl amine ANILINE
 Aspergillus sp. FUNGI
 A-trioscane FORMALDEHYDE

Auricome HYDROGEN PEROXIDE

AzidesAZIDES

Banana oil n-AMYL ACETATE

Barium hydrate BARIUM HYDROXIDE

Barium hydroxide BARIUM HYDROXIDE

Barium octohydrate BARIUM HYDROXIDE

Barium salts BARIUM HYDROXIDE

Barium sulphate BARIUM SULPHATE

Barium white PIGMENTS

BARIUM SULPHATE

Barytes BARIUM SULPHATE

Bavon* BAVON*

Bedacryl 122X*BEDACRYL 122X*

Benzene BENZENE

1,3 Benzenediol RESORCINOL

1,3,5 Benzenetriol PHLOROGLUCINOL

Benzidam* ANILINE

Benzol BENZENE

Benzole BENZENE

Bensophenol PHENOL

Benzotriazole BENZOTRIAZOLE

Beta ketopropane ACETONE

Beva 371* BEVA 371*

s-1,2 (bis(ethoxyl carbonyl)ethyl)-0 MALATHION

Black lead GRAPHITE

Bleach CHLORAMINE T*

HYDROGEN PEROXIDE

SODIUM HYPOCHLORITE

Bleaching powder CALCIUM HYPOCHLORITE

Borax SODIUM TETRABORATE DECAHYDRATE

Boric acid BORIC ACID

Brethane* BRETHANE*

Bromoform BROMOFORM

Bromomethane METHYL BROMIDE

Burnt umber PIGMENTS

IRON SALTS

Cyclohexanone polycondensate resin LAROPAL K80*
 Cyclohexatriene BENZENE
 Cyclohexylamine CYCLOHEXYLAMINE
 Dammar resin DAMMAR RESIN
 DBP DIBUTYL PHTHALATE
 DDT DDT
 DDVP 2,2-DICHLOROVINYL DIMETHYLPHOSPHATE
 Dechan* DICYCLOHEXYLAMINE NITRITE
 Dedevap* 2,2-DICHLOROVINYL DIMETHYLPHOSPHATE
 Dehybor* SODIUM TETRABORATE, ANHYDROUS
 Desolve* DESOLVE*
 Detarol* DETAROL*
 Diacetone alcohol DIACETONE ALCOHOL
 Dibasic lead carbonate LEAD CARBONATE
 1,2-dibromomethane ETHYLENE DIBROMIDE
 Dibutyl phthalate DIBUTYL PHTHALATE
 di-Chan DICYCLOHEXYLAMINE NITRITE
 p(1,4)-dichlorobenzene p-DICHLORO BENZENE
 Dichlorodiphenyltrichloroethane DDT
 1,2 dichloroethane 1,2-DICHLOROETHANE
 Dichloromethane METHYLENE DICHLORIDE
 Dichlorophene* 2,2 DIHYDROXY-5,5-DICHLORO DIPHENYLMETHANE
 2,2-Dichlorovinyl dimethyl phosphate 2,2-DICHLOROVINYLDIMETHYL
 PHOSPHATE
 Dichlorvos* 2,2-DICHLOROVINYLDIMETHYL PHOSPHATE
 Dicyclohexylamine nitrite DICYCLOHEXYLAMINE NITRITE
 Diethyl benzene DIETHYL BENZENE
 Diethylenimide oxide MORPHOLINE
 Diethyl ether DIETHYL ETHER
 Diethyl oxide DIETHYL ETHER
 Digallic acid TANNIC ACID
 m-Dihydroxybenzene RESORCINOL
 2,2-dihydroxy-5,5-dichlorodiphenyl methane 2,2-DIHYDROXY-5, 5-
 DICHLORODIPHENYL METHANE
 3,5-Dihydroxyphenol PHLOROGLUCINOL
 Di-isocyanto-diphenyl methane M.D.I.
 Dimethyl benzene XYLENE

Dimethyl carbinol ISOPROPANOL
 o-Dimethyldithiophosphate MALATHION
 Dimethylene oxide ETHYLENE OXIDE
 n-n-Dimethyl formamide n-n-DIMETHYLFORMAMIDE
 Dimethylhydantoin-formaldehyde resin DIMETHYLHYDANTOIN-FORMALDEHYDE RESIN

 Dimethylethylketal ACETONE
 Dimethyl ketone ACETONE
 Dimethyl sulphoxide DIMETHYL SULPHOXIDE
 Di-n-butylphthalate DIBUTYLPHTHALATE
 4,4 diphenylmethane isocyanate MDI
 Dipropylmethane HEPTANE
 Disodium EDTA EDTA
 Disodium tetraborate SODIUM TETRABORATE
 Dithiocarbonic anhydride CARBON DISULPHIDE
 DMF n-n-DIMETHYLFORMAMIDE
 Dodecahydrodiphenylamine nitrite DICYCLOHEXYLAMINE NITRITE
 Dolomite DOLOMITE
 Dowicide A* ; Dowicide 1* 0-PHENYL PHENOL
 Dowicide G* PENTACHLOROPHENOL
 Dowicide 7* SODIUM PENTACHLOROPHENATE
 Dowicide FC7* PENTACHLOROPHENOL
 Dowicide 25* 2,4,6-TRICHLOROPHENOL
 Dygon* DYGON*
 Dynasylan BSM* DYNASYLAN BSM*

 EDTA EDTA
 EG ETHYLENE GLYCOL
 Elvacite* METHYL METHACRYLATE
 EO ETHYLENE OXIDE
 1,2-Epoxyethane ETHYLENE OXIDE
 Epoxy resins EPOXY RESINS
 Ercalene Lacquer* ERCALENE REDUCER
 Ercalene Reducer* ERCALENE REDUCER
 Erinirit SODIUM NITRITE
 Ethane dichloride 1,2-DICHLOROETHANE
 Ethanedioic acid OXALIC ACID

Gasil* (matting agent) GASIL*
 Gelvatol 40/20* POLYVINYL ALCOHOL
 Genklene* 1,1,1-TRICHLOROETHANE
 Gipgloss Z 1523* GIPGLOSS Z 1523*
 Glacial acetic acid ACETIC ACID
 Glassfibre FIBREGLASS
 Glass wool FIBREGLASS
 Glutaraldehyde GLUTARALDEHYDE
 Glycerine GLYCERINE
 Glycerol GLYCERINE
 Glycol ETHYLENE GLYCOL
 Glycol alcohol ETHYLENE GLYCOL
 Glycol ethyl ether 2-ETHOXY ETHANOL
 Glyoxalin IMIDAZOLE
 Goddard's Silver Dip* SILVER DIP*
 Goddard's Long Term Brass & Copper Polish* GODDARD'S LONG
 TERM BRASS AND COPPER POLISH*
 Goddard's Long Term Foaming Silver Polish* GODDARD'S LONG
 TERM SILVER POLISH*
 Graphite GRAPHITE
 Gum elemi GUM ELEMI
 Gun cotton CELLULOSE NITRATE

 Halocarbon 13* 1,1,2-TRICHLORO-1,2,2 TRIFLUOROETHANE
 Halon* TEFLON*
 Hamp-oi Acid* DETAROL*
 HEDTA DETAROL*
 Heptane HEPTANE
 1,2,3,4,5,6 Hexachlorocyclohexane LINDANE*
 HexaFlor* LINDANE*
 Hexahydroaniline CYCLOHEXYLAMINE
 n-Hexane n-HEXANE
 Hexy hydride n-HEXANE
 HMG CELLULOSE NITRATE HMG
 Hydrated lime CALCIUM HYDROXIDE
 Hydrazine hydrate HYDRAZINE HYDROXIDE
 Hydrazine hydroxide HYDRAZINE HYDROXIDE

Hydrochloric acid HYDROCHLORIC ACID
Hydrofluoric acid HYDROFLUORIC ACID
Hydrogen carboxylic acid FORMIC ACID
Hydrogen chloride HYDROCHLORIC ACID
Hydrogen dioxide HYDROGEN PEROXIDE
Hydrogen fluoride HYDROFLUORIC ACID
Hydrogen peroxide HYDROGEN PEROXIDE
Hydroperoxide HYDROGEN PEROXIDE
Hydroxybenzene PHENOL
o-Hydroxy diphenyl o-PHENYL PHENOL
Hydroxy ether 2-ETHOXYETHANOL
n-Hydroxyethylethylene diaminetriacetic acid DETAROL*
4-Hydroxy-2-keto-4-methyl pentane DIACETONE ALCOHOL
4-Hydroxy-4-methyl-2-pentaone DIACETONE ALCOHOL
3-Hydroxy-p-cymene THYMOL
2-Hydroxy-1,2,3-propanetricarboic acid CITRIC ACID
2-Hydroxypropanoic acid LACTIC ACID
Hydroxy propionic acid LACTIC ACID
Hydroxy propyl cellulose KLUCEL*
p-Hypermanganate POTASSIUM PERMANGANATE
Hypochlorite CALCIUM HYPOCHLORITE

IBA ISOBUTYL ALCOHOL
Imidazole IMIDAZOLE
Iminazole IMIDAZOLE
IMS METHYLATED SPIRIT
Incralac* INCRALAC*
Industrial methylated spirits METHYLATED SPIRITS
Inhibisol* INHIBISOL*
IPA ISOPROPANOL
Iron salts IRON SALTS
Isoamylacetic ester n-AMYL ACETATE
Isobutanol ISOBUTYL ALCOHOL
Isobutyl alcohol ISOBUTYL ALCOHOL
Isobutyl methacrylate polymer PARALOID B67*
Isocyanates POLYURETHANE FOAM
MDI

Isopropanol ISOPROPANOL
Isopropyl alcohol ISOPROPANOL
Isopropyl benzene ISOPROPYL BENZENE
Isopropyl cresol THYMOL
Iso-propyl titanate SILANE CATALYST
Isotox* LINDANE*

Jasmolin 1* or 2* PYRETHRUM
Jenolite* JENOLITE*
Jeweller's rouge IRON SALTS (IRON III OXIDE)

Ketohexamethylene CYCLOHEXANONE
Ketone alcohol DIACETONE ALCOHOL
Ketone resin N LAROPAL K80*
Kochlight* POLYVINYL ALCOHOL
Kollidon POLYVINYL PYRROLIDINE
Klucel* KLUCEL*

Lactic acid LACTIC ACID
Laponite* LAPONITE*
Laropal K 80* LAROPAL K 80*
Latex RUBBER LATEX
Lauryl penta chlorophenol LAURYL PENTACHLOROPHENOL
Lead LEAD
Lead brown LEAD DIOXIDE
Lead carbonate LEAD CARBONATE
Lead dioxide LEAD DIOXIDE
Lead monoxide LEAD MONOXIDE
Lead orthoplumbate LEAD OXIDE
Lead oxide LEAD OXIDE
Lead peroxide LEAD DIOXIDE
Lead tetroxide LEAD OXIDE
Limbox* hydrated lime CALCIUM HYDROXIDE
Lime hydrate(d) CALCIUM HYDROXIDE
Limewater CALCIUM HYDROXIDE
Lindane* LINDANE*
Lissapol* SYNPERONIC NDB*

Litharge LEAD MONOXIDE
 Lithium hydroxide LITHIUM HYDROXIDE
 Lithium hydroxide monohydrate LITHIUM HYDROXIDE
 Loctite* LOCTITE*
 LPL LAURYL PENTACHLOROPHENOL
 Lye SODIUM HYDROXIDE

 Magnesium acetate MAGNESIUM ACETATE
 Magnesium bicarbonate MAGNESIUM CARBONATE
 Magnesium carbonate MAGNESIUM CARBONATE
 Magnesium silicate MAGNESIUM SILICATE
 Malathion MALATHION
 Massicot LEAD MONOXIDE
 MDI DIPHENYL METHANE ISOCYANATE; MDI
 MEK METHYL ETHYL KETONE
 Mercaptoacetic acid THIOGLYCOLIC ACID
 2-Mercaptoethanoic acid THIOGLYCOLIC ACID
 Mercuric chloride MERCURIC CHLORIDE
 Mercury MERCURY
 Metalolylene di-isocyanate TOLUENE DI-ISOCYANATE
 Methanal FORMALDEHYDE
 Methane carboxylic acid ACETIC ACID
 Methanoic acid FORMIC ACID
 Methanol METHANOL
 Methenyltribromide BROMOFORM
 Methenyltrichloride CHLOROFORM
 2-Methoxyethanol 2-METHOXYETHANOL
 Methyl acetal ACETONE
 Methyl alcohol METHANOL
 Methyl aldehyde FORMALDEHYDE
 Methylated spirits METHYLATED SPIRITS
 Methyl benzene TOLUENE
 Methyl bichloride METHYLENE DICHLORIDE
 Methyl bromide METHYL BROMIDE
 Methyl carbinol ETHANOL
 Methyl cellosolve 2-METHOXY ETHANOL
 Methyl chloroform 1,1,1-TRICHLOROETHANE

Nitrocotton CELLULOSE NITRATE
 Nitromors* METHYLENE CHLORIDE
 N.M.P. n-METHYL PYRROLIDONE
 Nogos* 2,2-DICHLOROVINYL DIMETHYL PHOSPHATE
 Nonyl phenol ethylene oxide condensate SYNPERONIC NDB*
 Nuvan* 2,2-DICHLOROVINYL DIMETHYL PHOSPHATE

Ochre IRON SALTS
 OCHRE (yellow lead) LEAD MONOXIDE
 Oil of turpentine TURPENTINE
 Orthoboric acid BORIC ACID
 Orthophenyl phenol o-PHENYL PHENOL
 Orthophosphoric acid o-PHOSPHORIC ACID
 Osmic acid OSMIUM TETROXIDE
 Osmium tetroxide OSMIUM TETROXIDE
 Oxalic acid OXALIC ACID
 Oxirane* ETHYLENE OXIDE
 Oxomethane FORMALDEHYDE
 Oxymethane FORMALDEHYDE
 Panacide* PANACIDE*
 Paracide* p-DICHLOROBENZENE
 Paradichlorobenzene p-DICHLOROBENZENE
 Paraformaldehyde FORMALDEHYDE
 Paraloid B48N* PARALOID B48N*
 Paraloid B67* PARALOID B67*
 Paraloid B67MT* PARALOID B67MT*
 Paraloid B72* PARALOID B72*
 Paris red (pigment) LEAD OXIDE
 P.C.P. PENTACHLOROPHENOL
 P.D.B. p-DICHLOROBENZENE
 Pear oil n-AMYL ACETATE
 P.E.G. POLYETHYLENE GLYCOL
 Pentacetate n-AMYL ACETATE
 Pentachlorophenol PENTACHLOROPHENOL
 1-Pentanol n-AMYL ACETATE
 1-Pentanol acetate n-AMYL ACETATE
 Penty acetate n-AMYL ACETATE

Pentyl alcohol n-AMYL ALCOHOL
 Perchloric acid PERCHLORIC ACID
 Perchloroethylene PERCHLOROETHYLENE
 Perchloromethane CARBON TETRACHLORIDE
 Perclene* PERCHLOROETHYLENE
 Perhydrol HYDROGEN PEROXIDE
 Periston* POLYVINYL PYRROLIDINE
 Permabond E27* EPOXY RESINS
 Perma Kleer Acid* E.D.T.A.
 Perosmic oxide OSMIUM TETROXIDE
 Peroxide HYDROGEN PEROXIDE
 Perspex* PERSPEX*
 Petroleum benzene MINERAL SPIRITS
 Petroleum ether MINERAL SPIRITS
 Phenachlor* 2,4,5 TRICHLOROPHENOL
 Phene BENZENE
 Phenic acid PHENOL
 Phenol PHENOL
 Phenol-formaldehyde resin PHENOL FORMALDEHYDE RESIN
 Phenoxin* CARBON TETRACHLORIDE
 2-Phenoxy-ethanol PROPYLENE PHENOXYTOL
 Phenylamine ANILINE
 Phenyl cellosolve PROPYLENE PHENOXYTOL
 Phenyl ethylene STYRENE MONOMER
 Phenyl hydrate PHENOL
 Phenyl hydride BENZENE
 Phenylic acid PHENOL
 Phenyl methane TOLUENE
 o-Phenyl phenol o-PHENYL PHENOL
 pHizz* pHIZZ*
 METHOXY MAGNESIUM METHYL CARBONATE
 Phloroglucine PHLOROGLUCINOL
 Phloroglucinol PHLOROGLUCINOL
 o-Phosphoric acid o-PHOSPHORIC ACID
 Phthoric acid HYDROFLUORIC ACID
 Pigment white 3 LEAD SULPHATE
 Pigments PIGMENTS

Rosin core solder ROSIN CORE SOLDER
 Rubber latex RUBBER LATEX
 Rutapox* RUTAPOX* R1210, R1200

 Sal ammoniac AMMONIUM CHLORIDE
 Salmiac AMMONIUM CHLORIDE
 Santobrite* PENTACHLOROPHENOL
 Santocel* FUMED (COLLOIDAL) SILICA
 Santophen* 20 PENTACHLOROPHENOL
 S.C.M.C. SODIUM CARBOXYMETHYL CELLULOSE
 Sebralit* SEBRALIT*
 Sepiolite* MAGNESIUM SILICATE
 S.E.Q.100* E.D.T.A.
 Sequestrene* E.D.T.A.
 Sequestrene Na²* E.D.T.A.
 Setamul N6525* POLYVINYL ACETATE
 Shellsol A*, E*, and T* SHELLSOL*
 Silane* DYNASYLAN BSM*;
 SILANE*
 TEGOVAKON V*
 WACKER STONE STRENGTHENER
 Silane stone consolidant-catalyst TETRA ISOPROPYL TITANATE
 Silica, fumed FUMED (COLLOIDAL) SILICA
 Silica gel SILICA GEL
 Silica gel, micronised GASIL 23C*
 Silver Dip* GODDARD'S SILVER DIP*
 Silver nitrate SILVER NITRATE
 Silver polish GODDARD'S LONG TERM SILVER POLISH*
 Slaked lime CALCIUM HYDROXIDE
 Soda ash SODIUM CARBONATE
 Soda niter SODIUM NITRATE
 Sodium bicarbonate SODIUM BICARBONATE
 Sodium bichromate SODIUM BICHROMATE
 Sodium bisulphite SODIUM HYDROSULPHITE
 Sodium borate 2,4,7 SODIUM TETRABORATE
 Sodium borohydride SODIUM BOROHYDRIDE
 Sodium carbonate SODIUM CARBONATE

Sodium carboxymethyl cellulose SODIUM CARBOXYMETHYL
CELLULOSE

Sodium chlorite SODIUM CHLORITE

Sodium chromate SODIUM CHROMATE

Sodium dichromate SODIUM BICHROMATE

Sodium disulphite SODIUM METABISULPHITE

Sodium dithionite SODIUM HYDROSULPHITE

Sodium fluoride SODIUM FLUORIDE

Sodium hexametaphosphate SODIUM HEXAMETAPHOSPHATE

Sodium hydrogencarbonate SODIUM BICARBONATE

Sodium hydrogen sulphite SODIUM HYDROSULPHITE

Sodium hydrosulphite SODIUM HYDROSULPHITE

Sodium hydroxide SODIUM HYDROXIDE

Sodium hypochlorite SODIUM HYPOCHLORITE

Sodium hyposulphite SODIUM THIOSULPHATE

Sodium metabisulphite SODIUM METABISULPHITE

Sodium nitrate SODIUM NITRATE

Sodium nitrite SODIUM NITRITE

Sodium orthophenyl phenate SODIUM ORTHOPHENYL PHENATE

Sodium pentachlorophenate SODIUM PENTACHLOROPHENATE

Sodium perborate SODIUM PERBORATE

Sodium peroxoborate SODIUM PERBORATE

Sodium pyroborate SODIUM TETRABORATE

Sodium sulphite SODIUM SULPHITE

Sodium tetraborate SODIUM TETRABORATE

Sodium thiosulphate SODIUM THIOSULPHATE

Sodium-p-toluene-sulphachloramine CHLORAMINE T*

Solder LEAD AND ITS SALTS
ROSIN CORE SOLDER

Soluble nylon SOLUBLE NYLON

Solvol Autosol* SOLVOL AUTOSOL*

Sorbitol SORBITOL

Spirit of Turpentine TURPENTINE (OIL)

Spirit of wine ETHANOL

Stoddard Solvent STODDARD SOLVENT

Styrene (monomer) STYRENE MONOMER

Styrol STYRENE MONOMER

Sulphuric acid SULPHURIC ACID
 Sulphuric oxyfluoride SULPHURYL DIFLUORIDE
 Sulphuryl fluoride SULPHURYL DIFLUORIDE
 sym-Tetrabromoethane TETRABROMOETHANE
 Synocryl 9045C* TRICHLOROETHYLENE (solvent)
 Synperonic NDB* SYNPERONIC NDB*

Tannic acid TANNIC ACID
 Tar camphor NAPHTHALENE
 Tarnprufe* TARNPRUFE*
 T.B.E. TETRABORMOETHANE
 T.C.P. 2,4,6-TRICHLOROPHENOL
 T.D.I. TOLUENE DI-ISOCYANATE
 Teflar* TEFLON*
 Teflon* TEFLON*
 Tego 51B* TEGO 51B*
 Tegovakon V* TEGOVAKON V*
 T.E.O.S. TETRAETHYL ORTHOSILICATE
 Tetrabromoethane TETRABROMOETHANE
 Tetrachloroethene PERCHLOROETHYLENE
 Tetrachloroethylene PERCHLOROETHYLENE
 Tetrachloromethane CARBON TETRACHLORIDE
 Tetraethyl orthosilicate TETRAETHYL ORTHOSILICATE
 Tetrahydrofuran TETRAHYDROFURAN
 1,4-Tetrahydro oxazine MORPHOLINE
 Tetraisopropyl titanate TETRA-ISO-PROPYL TITANATE
 Tetran* TEFLON*
 Tetrasodium pyrophosphate TETRASODIUM PYROPHOSPHATE
 Texicryl* METHYL METHACRYLATE
 T.H.F TETRAHYDROFURAN
 Thiocarbamide THIOUREA
 Thioglycolic acid THIOGLYCOLIC ACID
 Thyme camphor THYMOL
 Thymic acid THYMOL
 Thymol THYMOL
 Titania TITANIUM DIOXIDE
 Titanium dioxide TITANIUM DIOXIDE

Vapona* 2,2-DICHLOROVINYL DIMETHYLPHOSPHATE
 Versene acid* E.D.T.A.
 Versene NA* DISODIUM E.D.T.A.
 Versenic acid E.D.T.A.
 Vikane* SULPHURYL DIFLUORIDE
 Vinamold* VINAMOLD*
 Vinamul 6815* VINAMUL 6815*
 Vinamul N6525* POLYVINYL ACETATE
 Vinegar acid ACETIC ACID
 Vinyl benzene STYRENE MONOMER
 VM & P Naphtha VM & P NAPHTHA
 Vulpex* VULPEX*

Wacker Stone Strengthener OH* WACKER STONE STRENGTHENER
 OH*

Waxoyl* WAXOYL*

Wei T'o Spray* METHOXY MAGNESIUM METHYLCARBONATE
 pHizz*

White lead LEAD
 LEAD CARBONATE
 LEAD SULPHATE
 PIGMENTS

White arsenic ARSENIC TRIOXIDE

White spirit WHITE SPIRIT

Wintergreen oil METHYL SALICYLATE

Wood alcohol METHANOL

Wood dust WOOD DUST

Wood naphtha METHANOL

Wood spirit METHANOL

Wykamol Murosol 20* WYKAMOL MUROSOL 20*

Wykamol Plus* WYKAMOL PLUS*

Wykamol Woodworm Killer* WYKAMOL WOODWORM KILLER*

o-Xenol o-PHENYL PHENOL

Xylamon BV Spezial* XYLAMON BV SPEZIAL*

Xylamon Combi-S* XYLAMON COMBI-S*

Xylamon -LX Hardening-N* XYLAMON-LX-HARDENING-N

Xylamon Woodworm Killer* XYLAMON WOODWORM KILLER*

Xylene XYLENE

Xylol XYLENE

Yellow (lead) ochre LEAD MONOXIDE

Zapon CELLULOSE NITRATE

Zinc white PIGMENTS

Ablebond 342-1*

Synonyms

Epoxy resin.

Normal state

Clear, thin, light amber liquid. 2 Part : resin and hardener: diglycidyl ether of bisphenol A, and polyoxypropylene diamine.

Uses

Adhesive; retouching medium.

Properties

Slightly soluble in water; uncured resin soluble in acetone.

Flammability

Flash point (open cup) 124°C. Yield extremely toxic fumes if heated to decomposition.

Fire extinguishers

Foam; carbon dioxide.

Incompatible with

Strong oxidising agents.

Spills

Wipe up with solvent-saturated towelling; leave to evaporate in fume hood. Burn/ dispose of paper.

Storage

Keep cool.

Handling

Wear gloves; nitrile, neoprene or viton. Goggles; work in fume cupboard.

Effects of exposure

Skin: may be irritating; avoid skin contact.

Eyes: extremely irritating; may cause chemical burns.

Cured resin may contain residues of toxic amines from hardener: prepare resin accurately. Fully cured resins have little toxicity, but avoid inhaling resin dust.

FIRST AID

Skin: wash thoroughly.

Eyes: irrigate with water; seek medical attention.

Acetic acid CH_3COOH

Synonyms

Ethanoic acid; ethylic acid; glacial acetic acid (99% acetic acid); methane carboxylic acid; vinegar acid; acetone carboxylic acid.

Normal state

Colourless liquid with pungent vinegar-like odour. Glacial acetic acid is c.99% acetic acid.

Uses

Cellulose acetate manufacture; photographic chemicals; latex coagulant; dye fix; vellum repair.

Properties

b.p. 118°C.; m.p. 16.6°C. Miscible with water, alcohol, glycerin, ether, carbon tetrachloride.

Flammability

Flammable. Flash point 43°C. Flammable limits 5.4-16% in air. Vapours form explosive mixture with air.

Fire extinguishers

Water; dry chemical; carbon dioxide; alcohol foam.

Incompatible with

Strong oxidisers, chromic acid, sodium peroxide, nitric acid, strong caustics, hydrogen peroxide, potassium permanganate.

Spills

Ventilate area; remove all ignition sources. Cover with soda ash or sodium bicarbonate; mix, transfer to large beaker; add water. Pour into drain with copious water.

Storage

Detached or outdoor storage; separate from oxidising and combustible material; store above its freezing point (-16.6°C).

Handling

Chemical goggles; rubber, nitrile or vinyl gloves and protective clothing; fume cupboard.

USA: TLV/TWA: 10 ppm TLV/STEL: 15 ppm Odour threshold: 0.2-24 ppm.

UK: OES: 10ppm (LTEL); 15ppm (STEL)

Effects of exposure

Corrosive; lachrymator

Skin: irritation; dermatitis; blackening of skin; causes deep burns.

Eyes: severe irritation; conjunctivitis; erosion of cornea; may result in loss of sight./

Inhalation: irritation of respiratory tract, nose, throat; bronchitis; pharyngitis.

Ingestion: burning and ulceration of membranes; diarrhoea, vomiting; kidney and liver damage; death.

FIRST AID

Skin: Remove contaminated clothing; flush with water; wash thoroughly with soap and water, apply dry sterile dressing. **Medical attention** if burned.

Eyes: irrigate with water for 15 minutes. Seek medical attention. *Inhalation:* move patient to fresh air; resuscitate if necessary and **seek medical attention**.

Ingestion: if conscious give copious amounts of water; then dilute lime-water followed by demulcents. Do not induce vomiting. **Seek medical attention immediately**.

Acetone CH_3COCH_3

Synonyms

Dimethyl ketone; beta-Ketopropane; pyroacetic ether; 2-propanone; methylacetal; dimethylketal.

Normal state

Colourless liquid with sweetish odour.

Uses

Solvent dehydration of waterlogged material; solvent in some commercial adhesives.

Properties

b.p. 56.2°C, s.g. 0.792. Miscible with water, alcohol, ether, chloroform, oils.

Flammability

Highly flammable. Flash point -20°C. Explosive limits in air 2.5-13%.

Fire extinguishers

Carbon dioxide; dry chemical; alcohol foam.

Incompatible with

Reacts vigorously with oxidising materials; chromium oxides; chromium oxychlorides nitric and acetic acid; bromoform; nitric acid; activated charcoal; chloroform; sulphuric acid; hydrogen peroxide. Differences of opinion exist as to the advisability of mixing acetone with 1,1,1-trichloroethane.

Spills

Ventilate area; eliminate all ignition sources. Absorb onto paper; leave to evaporate in glass or iron dish in fume cupboard; burn the paper.

Disposal

Contractor; or by (safe) evaporation for small quantities.

Storage

In standard flammable chemicals room: no sources of sparks.

Handling

Rubber or neoprene gloves; goggles; organic vapour mask with organic vapour canister.

USA: TLV/TWA: 750 ppm TLV/STEL: 1000 ppm Odour threshold: 200-400 ppm.

UK: OES: 1000ppm (LTEL); 1250ppm (STEL) under review.

Effects of exposure

Skin: excessive exposure may cause dryness and dermatitis. Small amount may be absorbed through skin; may cause topical allergy.

Eyes: irritation; splash may cause serious damage.

Inhalation: commonest entry route; irritation and dryness of throat; cough; headache,

irritability and depression; nausea; drowsiness; loss of co-ordination; dizziness. Narcotic.

Ingestion: gastritis; nausea; vomiting; toxic.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with soap and water.

Eyes: irrigate for 15 minutes or more with water. **Seek medical attention.**

Inhalation: remove patient to fresh air; give O₂ and if necessary artificial respiration. **Seek medical attention.**

Ingestion: if patient is conscious administer large quantities of water. **Seek medical aid immediately.**

Aluminium oxide Al_2O_3

Synonyms

Alumina; corundum; aluminium sesquioxide.

Normal state

Fine white powder.

Uses

Powder for air-abrasive machine.

Properties

Insoluble in water; slowly soluble in inorganic acids and strong alkalis.

Flammability

Non-flammable.

Spills

Sweep up carefully; no special disposal requirements.

Handling

Dust mask: avoid exposure.

USA: TLV/TWA: 10 mg/m³ STEL/TLV: 20 mg/m³.

UK: OES 10mg/m³ (LTEL) 20mg/m³ (STEL) under review.

Effects of exposure

Experimental animal carcinogen.

Skin: may have drying effect.

Eyes: irritation.

Inhalation: irritates respiratory tract in high concentration. Constant very high exposure may cause increase in fibrous tissue in lungs and enlargement of air vessels in lungs.

FIRST AID

Skin: wash copiously with soap and water.

Eyes: do not allow to rub eyes; rinse. **Seek medical attention.**

Inhalation: make the patient blow his nose; remove from area; administer O_2 if difficulty in breathing. **Seek medical attention.**

Ingestion: **Seek medical attention.**

2-Amino pyrimidine $C_4H_5N_3$

Synonyms

α -aminopyridine.

Normal state

White: leaflets or coarse crystals.

Uses

Copper corrosion inhibitor.

Properties

Melting point: 127°C. Soluble in alcohol.

Flammability

No data.

Fire extinguishers

Water; carbon dioxide; powder; alcohol foam.

Incompatible with

Strong oxidisers.

Spills

Cover with 9:1 mixture of sand and soda ash. Mix and transfer to paper carbon stuffed with ruffled paper. Incinerate with utmost care.

Handling

Wear gloves; overall; goggles; self-contained breathing apparatus.

UK: OES 0.5 ppm (LTEL); 2.0 ppm (STEL)

Effects of exposure

Irritating to eyes, skin, mucous membranes and upper respiratory tract.

Skin: may be absorbed through skin, giving same symptoms as for inhalation.

Inhalation: headache, dizziness, flushing of skin, shortness of breath, hypertension, nausea, fits. May be fatal.

Ingestion: As above.

FIRST AID

Skin: wash thoroughly with soap and water.

Eyes: irrigate thoroughly with water.

Inhalation: move to fresh air at once; give artificial respiration.

Ingestion: **seek medical attention immediately.** Keep warm and at rest; give plenty of water to drink if conscious.

Ammonia solution NH_3

Synonyms

Ammonium hydroxide (NH_4OH).

Normal state

Ammonia gas usually supplied as 35% solution in water (max. 44%); sharp, irritating odour.

Uses

Removal of copper corrosion products; cleaning metal threads on textiles; general cleaning.

Properties

Gas very soluble in water, ether, methanol, ethanol, chloroform. In presence of water will vigorously attack copper, silver, zinc and other alloys. Reaction with halogens and chlorates, mercury, silver oxide, strong acids.

Flammability

Flammable gas. Flammable limits 16-25%. Ignition temperature 650°C.

Incompatible with

Halogens, chlorates, mercury, silver oxide, strong acids, auric chloride, silver compounds generally, germanium derivatives, calcium; hypochlorite bleaches.

Spills

Ventilate area. Dilute with plenty of water then neutralise with dilute hydrochloric acid; discharge to sewer with much water. Wear protective clothing, including self-contained breathing apparatus.

Storage

Keep away from sources of ignition, especially oxidising agents, chlorine, bromine, acids, halogens, chlorates, silver.

Handling

In fume cupboard; neoprene, nitrile or vinyl gloves; goggles. Do not wear contact lenses.

USA: TLV/TWA: 25 ppm TLV/STEL: 35 ppm Odour threshold: 1-5 ppm Complaint level: 20-25 ppm.

UK: OES: 25ppm (LTEL); 35ppm (STEL).

Effects of exposure

Skin: highly irritant and erosive to skin and mucous tissue; shock, burns, dermatitis.

Eyes: severe irritation; visual disorder; causes severe damage, including ulceration of conjunctiva and cornea. *Inhalation:* intolerable irritation of eyes, nose and throat; breathing difficulties; cough; bronchitis; chemical pneumonia; acute pulmonary oedema; sudden death. **Extremely destructive to mucous membranes and**

upper respiratory tract. Exposure to low concentrations may cause temporary throat paralysis.

Ingestion: corrosive to mouth, throat and stomach, nausea and vomiting of blood, stomach cramps, shock.

FIRST AID

Skin: remove contaminated clothing; flush skin with water immediately then wash thoroughly with soap and water till feeling of stickiness (due to corrosive nature of ammonia) disappears. **Seek medical attention.**

Eyes: irrigate with water. Seek medical aid immediately.

Inhalation: remove patient to fresh air; assist breathing if necessary with O₂. **Seek medical aid immediately.**

Ingestion: if conscious administer water; milk with raw egg; fruit juice or 1 part vinegar in 3 parts water. Ice will relieve pain in mouth. **Seek medical aid immediately** — do not induce vomiting.

PRECLUDE FROM EXPOSURE all persons with breathing or eye diseases.

Ammonium acetate $\text{CH}_3\text{COONH}_4$

Normal state

White crystals.

Uses

Removal of lead corrosion products.

Properties

m.p. 114°C. Not flammable, but decomposes on contact with sodium hypochlorite (common bleach). Decomposes to: carbon monoxide, carbon dioxide, nitrogen oxides. Hygroscopic.

Fire extinguishers

Water spray (with care); CO_2 , dry powder, alcohol or polymer foam.

Incompatible with

Strong oxidising agents; strong acids.

Spills

Sweep up and place in suitable container: dilute with plenty of water and release to sewer.

Storage

Keep container tightly closed; store in a cool dry place separate from incompatible materials.

Handling

Chemical safety goggles, respirator; work in fume hood or with breathing apparatus; rubber gloves. Avoid any skin contact; do not breathe dust.

Effects of exposure

Harmful by ingestion, inhalation or skin absorption; moderate to high toxicity.

FIRST AID

Skin: wash thoroughly with soap and water.

Eyes: flush immediately with water for about 15 mins. Seek medical aid.

Inhalation: move to fresh air; give artificial respiration if not breathing, O_2 if breathing difficult. Seek medical aid.

Ingestion: seek medical aid immediately.

Ammonium chloride NH_4Cl

Synonyms

Sal ammoniac; salmiac; ammoniak; ammonium muriate.

Normal state

White crystalline solid.

Uses

Stripping bronzes; soldering flux.

Properties

Sublimes at 338°C giving off toxic fumes. Soluble in water and glycerol.

Flammability

Not flammable.

Incompatible with

Reacts with strong acids giving hydrogen chloride gas; reacts with strong bases (including ammonia) giving ammonia; potassium chlorate.

Spills

Cover with sodium bicarbonate or 1:1 soda ash: calcium hydroxide mixture: mix to a slurry and release to sewer with copious amounts of water.

Handling

Wear goggles, neoprene, nitrile or vinyl gloves and work in a fume cupboard if NH_4Cl heated.

Ammonium chloride fumes:

USA: TLV/TWA: 10 mg/m³ TLV/STEL: 20 mg/m³

UK: OES: 10 mg/m³ (LTEL); 20 mg/m³ (STEL)

Effects of exposure

Moderate health hazard, but may irritate skin and respiratory tracts and eyes; fumes very toxic.

FIRST AID

Skin: remove contaminated clothing; wash skin with soap and water; if painful or blistered — **seek medical aid.**

Eyes: irrigate with water for about 15 minutes; seek medical aid. *Inhalation:* move patient to fresh air; if breathing affected — **seek medical aid.**

Ingestion: if conscious, give water to drink; **seek medical aid.**

n-Amyl acetate $\text{CH}_3\text{COOC}_5\text{H}_{11}$

Synonyms

Pentyl acetate; 1-pentanol acetate; amyl acetic ester; isoamylacetic ester; banana oil; pear oil; pentacetate.

Normal state

Clear, colourless liquid with fruity, banana-like odour.

Uses

Solvent; lacquer solvent.

Properties

b.p. 148°C. s.g. 0.879. Miscible with alcohol, ether, acetone. Slightly soluble in water.

Flammability

Serious fire risk. Flash point 25°C. Autoignition temperature 380°C. Flammable limits in air 1.0-7.5%.

Fire extinguishers

Carbon dioxide; dry chemical; alcohol-resistant foam.

Incompatible with

Strong oxidising agents.

Spills

Absorb on paper; leave to evaporate in glass or iron dish in fume cupboard; burn paper.

Storage

Flammable liquid storage room with good ventilation and no source of sparks.

Handling

Gloves of natural or nitrile rubber; goggles; fume hood.

USA: TLV/TWA: 100 ppm TLV/STEL: 150 ppm

UK: OES: 100 ppm (LTEL); 150 ppm (STEL)

Effects of exposure

Skin: mild irritation; dermatitis with very high exposures, blisters.

Eyes: conjunctivitis.

Inhalation: irritation of nose and throat; cough; headache; dizziness; nausea/vomiting

Ingestion: low toxicity.

FIRST AID

Skin: remove contaminated clothing; wash skin with soap and water; if painful or blistered — **seek medical aid.**

Eyes: irrigate with water for about 15 minutes; **seek medical aid.**

Inhalation: move patient to fresh air; if breathing affected — **seek medical aid.**

Ingestion: if conscious give water to drink; **seek medical aid.**

n-Amyl alcohol $\text{CH}_3(\text{CH}_2)_4\text{OH}$

Synonyms

1-pentanol; pentyl alcohol; n-butyl carbinol.

Normal state

Colourless liquid.

Uses

As solvent; in lacquers.

Properties

b.p. 138°C. s.g. 0.824. Slightly soluble in water; miscible with alcohol, ether.

Flammability

Moderate fire risk. Flash point 38°C. Explosive limit 1.2-10%.

Fire extinguishers

Dry powder; alcohol foam; carbon dioxide, or water

Incompatible with

No data.

Spills

Ventilate area; eliminate ignition sources. Absorb on paper, evaporate in glass or iron dish in fume hood; burn paper.

Handling

Goggles, nitrile or natural rubber gloves; fume hood.

USA: TLV/TWA: 100ppm.

UK: No OESs set.

Effects of exposure

Skin: frequent exposure causes dermatitis.

Eyes: irritation.

Inhalation: headache; dizziness, mental confusion, nausea; cough; shortness of breath; convulsions(rare).

Ingestion: highly toxic; stomach pains then headache, dizziness; nausea, delirium etc.

FIRST AID

Skin: remove contaminated clothing; wash skin promptly with soap and water.

Eyes: irrigate with water; **seek medical aid** if irritation persists.

Inhalation: remove patient to fresh air, give artificial respiration and O_2 if necessary. **Seek medical aid.**

Ingestion: Give plenty of water to drink if conscious; **Seek immediate medical attention.**

Aniline $C_6H_5NH_2$

Synonyms

Aminobenzene; phenylamine; aniline oil; aminophenylamine; benzidam; amine.

Normal state

Clear colourless oily liquid with characteristic odour.

Uses

In dyes, isocyanates, fungicides

Properties

b.p. 184.4°C. Miscible with most organic solvents; slightly soluble in water. May darken on exposure to light.

Flammability

Flammable. Flash point 76°C. Flammable limits in air 1.3-20%. Vapour forms explosive mixture with air.

Fire extinguishers

Alcohol foam; carbon dioxide; dry chemical.

Incompatible with

Strong acids (eg may ignite by violent reaction with nitric acid or perchloric acid); strong oxidisers; and many other substances including F_2 , O_3 , nitromethane, etc.

Spills

Ventilate area; eliminate all ignition sources. Mix with 9:1 mixture of sand and soda ash; mix well; transfer to paper carton stuffed with paper. Burn in open furnace with utmost care. Avoid breathing vapour.

Storage

In cool place, away from oxidising material

Handling

Nitrile, neoprene or vinyl gloves; goggles; mask; use only in fume cupboard. Avoid all skin contact.

USA: TLV/TWA: 2ppm (skin); TLV/STEL: 5ppm (skin); 5ppm Odour threshold: 1ppm.

UK: OES 2ppm (LTEL): 5ppm (STEL)

Effects of exposure

Experimental carcinogen

Skin: Extremely toxic when absorbed through skin; may cause rash; ulcers, necrosis.

Eyes: irritation and redness

Inhalation: **highly toxic**; acute symptoms headache, dizziness, nausea, palpitations, blue face, lips, hands; shock.

Ingestion: **highly toxic**; nausea, vomiting, diarrhoea. Toxic to blood, prevents haemoglobin from carrying O₂.

FIRST AID

Skin: remove contaminated clothing; wash skin promptly with soap and water.

Eyes: irrigate with water for 15 minutes.

Inhalation: remove patient to fresh air; give oxygen and artificial respirator if necessary; **seek medical aid**.

Ingestion: if patient is conscious administer large amounts of water; do not induce vomiting. **Seek medical aid immediately**.

Animal glues (aged)

Found on many items as adhesive; used during repair or original construction. Dust is irritant and may harbour toxic or irritant micro-organisms. (See 'FUNGI'), Wear a face mask; protective clothing. Wash and iron contaminated clothing before re-using.

Aqua regia

A 1:4 mixture of concentrated **nitric acid** and concentrated **hydrochloric acid** (see relevant entries). Dissolves gold — extremely powerful acid mixture. Turns orange-yellow due to formation of toxic nitrosyl chloride (NOCl), and free chlorine.

Araldite* (hardener)

Synonyms

Araldite is a registered trade-name of a series of 2-part epoxy resins manufactured by Ciba-Geigy. Modified polyamino-amide.

Normal state

Liquid; paste.

Flammability

Flash Point (Closed cup) 150°C

Fire extinguishers

Water spray

Spills

Absorb with (eg.) towels, earth, sand and set aside for disposal. Unused components should be mixed and only disposed of when the resin has cured.

Storage

Keep cool; keep containers tightly closed.

Handling

Absorbed through skin, or by inhalation; may be a sensitiser. Wear natural rubber gloves; work in well-ventilated area. Do not breathe the dust of the cured resin; wear goggles and dust mask. For further information see sheet on Araldite (Resin); and Epoxy resins.

Hardener is likely to be more toxic than the resin.

Araldite* resin

Registered trade-name of 2-part resin manufactured by Ciba Geigy

Component:

Bisphenol-A epoxy resin.

Normal state

Liquid at normal temperature.

Uses

Adhesive; gap filling; putty.

Properties

Insoluble in water.

Flammability

Flash point (closed cup) above 200°C. Carbon monoxide and carbon dioxide are combustion products.

Fire extinguishers

Water spray, foam, CO₂ or dry powder.

Incompatible with

No data.

Spills

Uncured resin can be removed with tissues soaked in acetone or cellulose thinners of 2-ethoxyethanol; leave to evaporate in fume hood then burn or dispose by usual method. Cured resin can be softened with methylene dichloride (see relevant sheet) then scraped off. Disposal: unused resin should be cured with hardener, then disposed of with normal waste.

Storage

In closed containers in a cool dry place.

Handling

Goggles. Avoid contact with skin or eyes; wear gloves of nitrile, or natural rubber, or polyethylene. The use of barrier cream may be advisable. Work in a well-ventilated area, or use a fume hood. Do not inhale the dust of cured epoxy resin.

TLV/OES: No data.

Effects of exposure

Some individuals may become sensitised to epoxy resins; skin contact may cause dermatitis. Do not inhale the dust of cured resin.

FIRST AID

Skin: remove contaminated clothing. Remove resin from skin with a resin-removing cream, eg. Stockhausen 'Cupron' or Kerocleanse or Rozalex. Wash thoroughly with water. Apply a skin reconditioning cream (Ciba Geigy recommended Stockhausen 'Stockolan' or Rozalex Lanolin Skin Cream) after drying. **Seek medical aid** if there is any irritation.

Eyes: irrigate with water and **seek medical aid**.

Inhalation: move to fresh air; **seek medical aid**.

Ingestion: rinse mouth repeatedly with water. If conscious, drink plenty of water and **seek medical aid promptly**.

Manufacturer's information. Ciba Geigy (Plastics) operate a 24-hour emergency advisory service on Cambridge (0223) 832121.

Arsenic trioxide As_2O_3

AVOID USE

Synonyms

White arsenic; crude arsenic; arsenious oxide; arsenious anhydride

Normal state

White or transparent glassy, amorphous lumps or crystal powder.

Uses

Pigment, textile mordant, insecticides, herbicide, preservatives. Has been used on old natural history specimens as a preservative/insecticide. (Until 1960s in UK, 1970s in USA). Not approved under UK's 1986 Pesticide Regulations. See note p. 13.

Properties

Soluble in water (with hydrolysis). Practically insoluble in alcohol ether, carbon disulphide, chloroform, benzene. m.p 146°C b.p. 465°C. Sublimes when heated slowly. May decompose on exposure to moist air or water, to toxic arsenic oxides.

Incompatible with

Heat; acids, oxidising agents, halogens.

Spills

Dissolve in minimal amount of hydrochloric acid. Add to water till white precipitate appears then dissolve this by adding 6M HCl. Saturate with hydrogen sulphide. Filter, wash and dry precipitate and return to suppliers.

Storage

Protect against physical damage and combustible materials. Keep container tightly closed.

Handling

Avoid handling; use remote handling cabinet. All exposed skin to be covered. Use wet methods where possible. All protective equipment and clothing must be carefully washed before re-use, or else disposed of. Wear rubber, nitrile or vinyl gloves.

USA: TLV/TWA: 0.2mg/m³

UK: MEL: 0.2mg/m³

Effects of exposure

Carcinogen. May be fatal if swallowed; toxic by inhalation and skin absorption.

Skin: caustic; highly toxic; absorbed into skin and may cause contact burn - up to 6 weeks later. Skin becomes dry and scaly and flakes off. Brittle nails, hair loss; loss

of muscle control and co-ordination; numbness in limbs.

Eyes: conjunctivitis; corneal necrosis.

Inhalation: nasal irritation; perforation of septum. Dry throat; shortness of breath; lung congestion.

Ingestion: nausea, vomiting, abdominal pain, convulsions, diarrhea, shock; liver and kidney damage. Hypoplastic anemia.

FIRST AID

Seek medical attention IMMEDIATELY if any contact occurs to skin or eyes or by inhalation or ingestion.

Skin: Remove all contaminated clothing; wash thoroughly in soap and water.

Eyes: irrigate thoroughly with water; seek medical aid. *Inhalation:* move to fresh air; keep at rest and seated upright to aid breathing. **Seek medical aid immediately.**

Ingestion: give plenty of water to drink if conscious; **seek medical aid IMMEDIATELY.** Keep warm and at rest.

Annual health check for workers; including urine analysis. Preclude from exposure: workers with disease of skin, blood, liver, kidney and central nervous system.

Arigal C

Melamine-formaldehyde product, water soluble; used as impregnating solution then catalyst added. Uncured resin an irritant.

Uses

Waterlogged wood; rot-proofing cotton textiles.

Cured resin insoluble.

No hazard data.

Azides

Normal state

Metal azides or hydrazoic acid.

Uses

Spot-tests to detect reducible sulphur (for silver tarnishing) or sulphides; in taxidermy; may be present naturally in dead specimens.

Properties

Sodium azide (NaN_3) and azoic acid (HN_3) are water-soluble, the others not. **All azides are unstable and explosive**

Flammability

Explosive

Incompatible with

Explosive reaction with: copper, lead, aluminium, nitric acid, benzoyl chloride.

Handling

Prevent salts accumulating in drain-pipes or fume cupboard on metal surfaces, especially copper. Never use with aluminium or other pressure vessels. Decontaminate such dry metal surfaces by covering with 10% sodium hydroxide for 16 hours.

Effects of exposure

Poisonous. Toxic by most routes.

Barium hydroxide $\text{Ba}(\text{OH})_2 \cdot 8\text{H}_2\text{O}$

Synonyms

Caustic baryta; barium hydrate; barium octahydrate.

Normal state

White crystalline solid.

Uses

In alkaline sulphite process of desalination of marine iron; de-acidification of paper as dilute solution in methanol.

Properties

Slightly soluble in water, methanol, ethanol. Readily soluble in dilute acid.

Incompatible with

Chlorinated rubber.

Barium compounds (soluble) as Barium:

USA: TLV/TWA : 0.5 mg/m³

UK: OES: 0.5 mg/m³ (LTEL).

Handling

Gloves, mask, goggles.

Spills:

If solid — sweep up, dilute with water; add soda ash and neutralise with 6M HCL in large buckets. Discharge to sewer with plenty of water. Small spills — discharge to sewer with plenty of water.

Effects of exposure

Skin: irritation from dusts; dermatitis.

Eyes: irritation from dusts; can cause severe burns.

Inhalation: nasal irritation from dusts.

Ingestion: toxic; may cause vomiting, stomach ache, bleeding of stomach, intestines and kidneys; slow pulse rate and irregular heartbeat.

FIRST AID

Skin: remove contaminated clothing; wash skin with plenty of soap and water; if irritation, seek medical aid.

Eyes: irrigate with water; medical attention immediately.

Inhalation: give O₂ if breathing difficult, artificial respiration if breathing stops. Seek medical aid.

Ingestion: if conscious give plenty of water to drink; seek medical aid immediately.

PRECLUDE FROM EXPOSURE any workers with lung diseases.

Barium sulphate BaSO_4

Synonyms

Barytes.

Normal state

White, heavy odourless powder.

Uses

Pigment; filler for (epoxy) putty.

Incompatible with

Phosphorus; aluminium with heat — explosive reaction. If heated to decomposition toxic fumes emitted.

USA: TLV/TWA: 10 mg/m³ (Dust)

UK: OES: 2 mg/m³ (LTEL). (Dust)

Bavon 2*

Synonyms

Emulsified hydrocarbon polymer.

Normal state

Liquid.

Uses

Leather waterproofing agent.

Properties

Melting point $<0^{\circ}\text{C}$; Boiling point $>100^{\circ}\text{C}$.

Soluble in White Spirit; emulsifies in water.

Flammability

Flash point (open cup) $>55^{\circ}\text{C}$.

Fire extinguishers

Water; foam; dry chemical; carbon dioxide.

Spills

Absorb on inert solid and dispose with flammable waste. (i.e. combustible waste).

Wash remainder to drain with much water.

Handling

Wear rubber or vinyl gloves; goggles and face mask. Have available eyewash bottle with clean water.

Effects of exposure

Skin: / *Eyes:* not classed as irritant but may cause irritation in some instances

FIRST AID

Skin: wash affected areas with water.

Eyes: wash immediately with water.

Bedacryl 122X*

Polymethacrylate ester; a consolidant for wood, fossils and some types of leather.

Supplied in a mixture of xylene and n-butanol, or xylene and cellosolve acetate, or a petroleum solvent.

See hazards attached to above solvents.

Benzene C_6H_6

NB: Avoid use: Cancer suspect agent. Substitutes available, e.g. Toluene, heptane, isopropyl benzene.

Synonyms

Benzol; phenyl hydride; phene; benzole; cyclohexatriene.

Normal state

Colourless liquid with characteristic odour. Commercial grade benzene has toluene, xylene, etc as impurities.

Uses

Organic solvent. Rarely used now as severe health hazard; avoid using.

Properties

Volatile. b.p. 80.1°C. s.g. 0.8794. Miscible with acetone, alcohol, ether, chloroform, carbon tetrachloride.

Flammability

Flash point 11.1°C. **Severe fire risk**; flammable limits in air 1.4-8%. **Vapour may travel considerable distance to an ignition source, and flash back.**

Fire extinguishers

Dry chemical; carbon dioxide; alcohol foam.

Incompatible with

Strong oxidisers; chlorine; perchlorates; bromine with iron; nitric acid; explodes on contact with diborane; forms explosive mixtures with silver perchlorate; nitric acid; ozone; liquid oxygen.

Spills

Absorb on paper; leave to evaporate in fume hood on glass or iron dish. Burn paper.

Storage

Flammable liquid stores; must have spark-resistant tools and floor.

Handling

Nitrile gloves; goggles; respirator; protective clothing. Avoid any contact with the liquid or vapour. Some research indicates ill effects at 1ppm.

USA: TLV/TWA: 10ppm: Odour threshold: 5ppm.

UK: OES: 10ppm (LTEL).

Effects of exposure

Benzene is a carcinogen that attacks the blood, bone marrow (causing leukaemia), eyes, respiratory system, and central nervous system. The effects of exposure to this chemical may not appear until several years after exposure. Foetotoxic effect on rats — but not teratogenic.

Skin: local irritation, some absorbed through skin; may lead to cracking. **Large splash may cause poisoning.**

Eyes: irritation; some absorbed; inflammation.

Inhalation: irritation; headache; dizziness; pulmonary oedema and haemorrhage; acute poisoning; **fatal intoxication possible over 60 ppm.** Chronic poisoning by inhaling small amount over long period.

Ingestion: toxic (see above).

FIRST AID

Skin: remove contaminated clothing; wash skin well with soap and water; if skin inflamed or painful; **seek medical aid.**

Eyes: irrigate with water; seek medical aid if necessary.

Inhalation: move victim to fresh air; administer oxygen if necessary; **seek medical aid.**

Ingestion: **seek medical aid** immediately; give one tablespoon mineral oil (Nujol) then glass of water with one tablespoon of magnesium or sodium sulphate dissolved in it

PRECLUDE FROM EXPOSURE workers with blood or lung diseases. If used frequently, annual medical checks and blood counts are recommended.

Benzotriazole $C_6H_5N_3$

Synonyms

Cobratec® 99*; 1,2 Aminoazophenylene; azmimidobenzene; benzisotriazole; benzene azimide.

Normal state

White to tan crystalline material.

Uses

Vapour phase inhibitor - corrosion inhibitor for copper and copper alloys.

Properties

Sublimes at 98°C, so do not heat and do not leave solutions to evaporate. Dissolves in alcohol, very slightly in water.

Flammability

Dust is a severe explosion hazard. May detonate at 220°C.

Some evidence it may cause tumours in mice at high dosages, so **treat as a potential carcinogen**. Do not allow skin contact (as may be absorbed through skin); do not inhale dust or vapours; do not heat or allow solutions to evaporate. Inhalation of dust may cause severe local respiratory damage.

Poison by intravenous route.

Causes irritation of skin, eyes, and mucous membranes.

Handling

Respirators; gloves; goggles.

Beva 371*

A heat-seal adhesive dissolved in a petroleum fraction.

Blend of ethylene-vinylacetate copolymers. Ketone Resin N(cyclohexanone*) AND paraffin*, dissolved in toluene*/white* spirit mixture. Non-aqueous.

* See relevant entries.

Boric acid H_3BO_3

Synonyms

Orthoboric acid; boracic acid.

Normal state

Colourless, odourless, white scales or powder.

Uses

With borax as fungicide for waterlogged wood; fire proofing agent for wood. Not approved under UK's 1986 Pesticide Regulations. See p. 13.

Properties

Soluble in water, alkalis, glycerin. Decomposes at 100 -160°C to form metaboric acid, then pyroboric, then finally boric anhydride.

Incompatible with

Potassium.

Spills

Cover with soda ash or 1:1 soda ash and slaked lime; discharge to sewer with copious amount of water.

Disposal

See 'Spills'.

Handling

Natural or nitrile rubber gloves; respirator or self-contained breathing apparatus.;

USA: TLV/TWA: No data.

UK: OES: No data.

Effects of exposure

Skin: Extremely toxic even in small amounts if enters bloodstream eg. in a cut or broken skin. May cause dryness, blisters; irritation. **Poisonous.**

Eyes: Conjunctivitis.

Inhalation: Fever; circulatory collapse; convulsions.

Ingestion: May be fatal after 3-5 days if large dose. Small dose: vomiting, diarrhoea, visual disturbance, pain, convulsions.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly in soap and water.

Eyes: irrigate thoroughly with running water.

Inhalation: give plenty of water to drink if conscious; seek medical aid.

Brethane* methyl-tri-methoxy-silane (catalysed silane)

Synonyms

Methyl Trimethoxy-silane; 'Silane' stone consolidant.

Normal state

3-part pack. Components: methyl-trimethoxy-silane; methylated spirits; water; 'lead' and catalyst.

Uses

Consolidation of stone and water repellent for masonry etc.

Properties

Methylated spirits. Boiling point 102°C. Insoluble in water (but reacts to liberate methanol). Also contains lead.

Flammability

Highly flammable/Explosive hazard.

Flash point (closed cup) 8°C.

Fire extinguishers

Dry chemical; carbon dioxide.

Spills

Absorb by sprinkling with sepiolite or other inert absorbent material. Ventilate area.

Storage

Cool, dry, frost-free.

Handling

Wear nitrile or vinyl gloves. Goggles; self-contained breathing apparatus; work in fume hood, or with (organic vapour) cartridge respirator.

USA: TLV/TWA: 5ppm.

Effects of exposure

Absorbed through skin and inhalation.

Skin: absorption through skin, slightly irritating.

Eyes: possible eye damage, if excessive.

Inhalation: headache in extreme cases, drowsiness and unconsciousness.

Ingestion: toxic if swallowed. De-oxidant (drunkenness). **Also contains lead.**

FIRST AID

Skin: wash off with water.

Eyes: wash out with water. **Seek medical advice.**

Inhalation: take to ventilated area. **Seek medical attention.**

Ingestion: note presence of methane and **seek medical advice.**

Bromoform CHBr_3

Synonyms

Tribromomethane; methenyl tribromide.

Normal state

Colourless volatile liquid with chloroform-like odour. Slowly decomposes (esp. in air and sunlight) and becomes yellow.

Uses

Fossil preparation; solvent.

Properties

BP 151.2°C; MP 7.5°C; SG 290. Slightly soluble in water; soluble in alcohol, ether, chloroform, benzene, petroleum ether, acetone, oil and fat.

Flammability

Non-flammable.

Incompatible with

Acetone; potassium hydroxide; chloroform; crown ethers; bases.

Spills

Absorb on paper, leave to evaporate in fume hood in glass dish; burn paper. Disposal: purify by distillation or return to supplier.

Storage

Keep containers closed: and in dark. Avoid contact with caustic alkali.

Handling

Chemical goggles, chemical respirator, rubber overalls. Fume hood.

USA: TLV/TWA: 0.5ppm (skin)

UK: OES: 0.5ppm (LTEL)

Effects of exposure

NB: May damage kidneys and liver; transfer casualty to hospital.

Skin: absorbed through skin: gives same symptoms as ingestion. Irritation and redness at site of contact.

Eyes: irritation; redness.

Inhalation: shortness of breath; 'tight' feeling in chest. Lung congestion; drowsiness, slurred speech, muscle weakness, and twitching, tremors, blurred vision; shock; unconsciousness and convulsions may occur.

Ingestion: nausea; vomiting; other symptoms as for inhalation. Moderately toxic; mutagen.

FIRST AID

Skin: remove all contaminated clothing; wash affected areas thoroughly with soap and plenty of water.

Eyes: irrigate thoroughly with water. If irritation persists after washing, **seek medical aid.**

Inhalation: move to fresh air. Keep warm and at rest. If breathing difficult, give O_2 and support in upright seated position. **Seek medical aid immediately.**

Ingestion: if conscious, give water to drink and **take casualty to hospital.**

Butanox *

Commercial product; mixture of methylethylketone peroxide (see relevant entry) in phthalate phlegmatisers.

Uses

Curing agent for polyester resins; catalyst.

Flammability

Highly flammable; keep away from ignition sources. **Explosive hazard with organic materials** (eg wood, paper); may ignite.

Fire extinguishers

Fight with copious amounts of water.

Incompatible with

Iron; copper; heavy metals; accelerators; acids. **Butanox is a strong oxidiser and contact with these may cause violent decomposition.**

Spills

Absorb with **vermiculite** (not organic materials); burn in open air in small amounts, and with great care.

Storage

In flammable materials storage area. No contact with heavy metals, organic materials, acids.

Handling

Goggles, PVC gloves and barrier cream. Contaminated clothes must be removed and washed.

Effects of exposure

Skin: prolonged contact causes blisters.

Eyes: may cause severe eye damage.

Inhalation: no data.

Ingestion: no data.

FIRST AID

Skin: remove contaminated clothing; wash off immediately.

Eyes: irrigate immediately with water; **seek medical attention**, if irritation persists.

Inhalation: administer large volumes of water, if conscious: keep warm and at rest; seek medical aid.

In emergency - telephone Medway (0634) 51141

n-Butyl alcohol $\text{CH}_3(\text{CH}_2)_2\text{CH}_2\text{OH}$

Synonyms

Propyl carbinol; NBA; butan-1-ol.

Uses

Component of de-watering fluids for iron; solvent for fats, waxes, shellac, resins, gums.

Properties

b.p. 117.7°C. s.g. 0.809. Miscible with alcohol, ether, most organic solvents. Slightly soluble in water.

Flammability

Dangerous fire risk. Flash point 34-38°C closed cup.

Explosive limits in air 1.4 - 11.2%.

Fire extinguishers

Dry chemical; carbon dioxide.

Incompatible with

Heat; explosives; oxidising materials; organic peroxides; aluminium; chromium trioxide.

Spills

Absorb on paper; leave to evaporate on glass or iron dish in fume hood. Burn paper.

Storage

Keep away from heat, ignition sources, etc (see Incompatibilities).

Handling

Natural, neoprene or nitrile rubber gloves; goggles; avoid breathing vapour — work in fume cupboard.

USA: TLV/CL: 50ppm (skin)

UK: OES: 50ppm (LTEL); 50ppm (STEL).

Odour threshold: 15ppm; irritating at 25ppm, objectionable at 50 ppm.

Effects of exposure

Can be absorbed through skin; **poisonous**.

Systematic effects: auditory nerve and vestibular injury; eye irritation; dizziness.

Frequent skin contact may cause cracking.

Skin: may cause cracking and dermatitis.

Eyes: irritation, conjunctivitis. Sensitivity to light.

Inhalation: irritation to eyes and nose; excitability; staggering and lack of co-ordination, mental confusion; nausea, vomiting, unconsciousness; death.

Ingestion: gastro-intestinal irritation as well as above symptoms.

FIRST AID

Skin: remove contaminated clothing; wash skin thoroughly with soap and water; treat as burn if inflamed and painful. **Seek medical attention.**

Eyes: irrigate with water; **seek medical aid.**

Inhalation: move to fresh air; give O₂ if necessary. **Seek medical aid.**

Ingestion: give copious amounts of water to drink if patient is conscious; keep warm and at rest and **seek medical aid.**

γ-Butyrolactone $\text{OCH}_2\text{CH}_2\text{CH}_2\text{CO}$

Normal state

Colourless, oily liquid.

Uses

Solvent.

Properties

Corrosive, produces acid on contact with water.

Flammability

Flash point 98° C (Open cup). Combustible.

Fire extinguishers

Dry chemical; CO_2 ; vapourising liquids, or foam.

Incompatible with

Explosion reported after heating with butanol and sodium hydroxide; may react with oxidising materials.

Spills

Absorb on paper; leave to evaporate in fume cupboard on glass or iron dish; burn paper. Large spill: absorb on dry earth or vermiculite. Put in bucket; leave outside in safe open area to evaporate.

Storage

Outside in secure flammable liquid store. No ignition source.

Handling

Avoid contact with liquid or vapour. Goggles, face shield; gloves, respirators; fume cupboard. Don't wear contact lenses.

Effects of exposure

Experimental carcinogen by skin.

Skin: corrosive burns.

Eyes: corrosive burns.

Inhalation: irritation; coughing.

Ingestion: moderately toxic; causes burns.

FIRST AID

Skin: wash thoroughly with water; remove contaminated clothing. If irritation persists, seek medical aid.

Eyes: irrigate thoroughly with water; seek medical aid if irritation persists.

Inhalation: fresh air; give oxygen if breathing difficult. Get medical attention.

Ingestion: medical attention immediately. If not available give large quantities water to drink if patient is conscious.

Calcium hydroxide $\text{Ca}(\text{OH})_2$

Synonyms

Slaked lime; calcium hydrate; lime hydrate; hydrated lime (lime water is aqueous solution).

Normal state

White crystalline powder; alkaline with acidic taste.

Uses

Cement; mortar; chemical spills.

Properties

Almost insoluble in water. Generates heat with acids, releasing carbon dioxide.

Spills

Sweep up, transfer to container, dilute with water, neutralise with 6M HCl, release to sewer with copious water.

Storage

Keep containers tightly closed.

Handling

Medium or heavy weight rubber or nitrile gloves, mask, goggles.

USA: TLV/TWA: 5 mg/m³.

UK: OES: 5mg/m³ (LTEL)

Effects of exposure

Dust : may irritate eyes, skin and respiratory tract: moderately caustic.

Skin: irritation; tingling.

Eyes: mechanical and chemical irritation; pain; watering. Risk of serious lesions of eye if remains closed.

Inhalation: irritation of eyes, nose, throat; coughing. Ingestion: burning sensation in mouth, stomach; pain in swallowing; stomach cramps, nausea and vomiting. Mildly toxic.

FIRST AID

Skin: remove contaminated clothing; wash skin thoroughly in water; if inflamed **seek medical aid**.

Eyes: rinse eyes 15 mins or till pH reads neutral and they are clean of dust. **Seek medical aid**.

Inhalation: blow nose, but discourage sniffing; **seek medical aid**. Inhale few drops ether or ethyl alcohol from a gauze pad.

Ingestion: if conscious rinse mouth; give cold water; or milk with 1 or 2 raw eggs, or fruit juice or 1:2 vinegar:water. **Seek medical aid**.

Calcium hypochlorite $\text{Ca}(\text{OCl})_2 \cdot 4\text{H}_2\text{O}$

Synonyms

Bleaching powder; chlorinated lime, calcium chloride hypochlorite; chloride of lime.

Normal state

White powder/crystals

Uses

Bleaching agent; oxidising agent.

Properties

S.G. 2.35 Decomposes at 100°C ; decomposed by water and alcohol; extremely hygroscopic; strong oxidiser. Can react vigorously with reducing materials. Moderate explosive hazard if heated when solid. Explosive when heated suddenly above 212°F . Contains up to 39% available chlorine.

Flammability

Readily ignites organic or combustible materials where in contact. Accelerated decomposition in heat, yielding oxygen.

Fire extinguishers

Water spray — but beware as chlorine will be released.

Incompatible with

Prone to violent chemical reaction; incompatible with acetic acid plus potassium cyanide; amines; anthracene, carbon, charcoal, ethanol, glycerol, iron or manganese oxides, rust, grease or oil, mercaptans, methyl carbinol, nitromethane, organic material, organic sulphides, phenol 1-propanethinol, sulphur, turpentine. Can explode with carbon tetrachloride. With HCl acid/acid fumes gives off highly toxic fumes and explodes. Highly toxic gases evolved when heated; may explode when heated.

Spills

Cover with weak reducing agents e.g. hypo; or else with bisulphites or ferrous salts with $3\text{M H}_2\text{SO}_4$ added. Use soda ash or dilute HCl to neutralise, then release to sewer with abundant water.

Disposal

As above.

Storage

Protect from damage: store in a cool, dry well-ventilated; place away from combustible material. Avoid prolonged storage, especially if at summer temperature. Bulk material may ignite or explode in storage — moisture may initiate the reaction.

Handling

Nitrile or medium/heavy rubber gloves; fume cupboard.

Effects of exposure

Skin: severe irritation.

Eyes: can cause severe irritation and burns.

Inhalation: **highly toxic**; severe irritation, muscle numbness; fumes can cause pulmonary oedema and death.

Ingestion: **moderately toxic**; irritation; pain; diarrhoea; vomiting.

FIRST AID

Skin: remove contaminated clothing; wash in water

Eyes: **seek medical aid immediately**. Irrigate thoroughly in water.

Inhalation: move to fresh air; give O₂ if breathing difficult; **seek medical aid**.

Ingestion: get medical aid immediately. Keep person warm and at rest. If conscious give pint of water to drink, followed by a pint of milk.

Carbon disulphide CS₂

This chemical is extremely dangerous: it should only be used by trained personnel under very carefully controlled conditions. Its use and storage in the average conservation laboratory is not recommended.

Synonyms

Carbon bisulphide; dithiocarbonic anhydride.

Normal state

Highly refractive flammable liquid. Pure form has sweet odour, but commercial grades are foul-smelling.

Uses

Fumigant; solvent for sulphur. See p. 13 for UK's 1986 Pesticide Regulations.

Properties

b.p. 46.3°C. s.g. 1.261. Slightly soluble in water; more soluble in organic solvents. Decomposes on standing with time and sunlight.

Flammability

Extremely flammable and explosive. Flash point -22°F. Flammable limits in air 1-50%. May ignite by friction, warm surface (eg hot plate, light bulb, radiator). **Vapours may travel considerable distance to ignition source and flash back.** May give explosive reaction with xenon arcs and other ultraviolet light sources; also with aluminium, potassium, sodium, zinc dust, chlorine, fluorine, azides, oxides. Rust can initiate an explosion in CS₂/air mixture.

Fire extinguishers

Water; carbon dioxide; dry chemicals.

Incompatible with

Strong oxidisers, chemically active materials (sodium, potassium, zinc); azides; organic amines; and see 'Flammability' section.

Spills

Absorb with vermiculite, sand or soda ash and cover with water. Transfer under water to open area and ignite with great care from a distance.

Storage

Avoid direct sunlight, electric installations or heating facilities.

Handling

Extremely toxic: avoid use.

USA: TLV/TWA: 10ppm. (ASTMS recently called for TLV to be reduced to 1ppm because of increased risk of coronary heart disease.) **Odour threshold: 0.002-7.7ppm.**

UK: MEL: 10ppm.

Effects of exposure

10 mg/m³ in air may cause foetal damage/malfunction.

Skin: is absorbed through skin; defatting; burns, blisters.

Eyes: corneal burns.

Inhalation: lower concentrations can cause irritability, indigestion, insomnia, excess fatigue, headache, possible anaesthesia. Very high exposures can cause severe damage to central nervous system including failure of vision, paralysis, conjunctivitis.

Extremely poisonous — may be fatal.

FIRST AID

Skin: remove contaminated clothing; wash skin promptly with soap and water.

Eyes: irrigate with water; seek medical aid.

Inhalation: move patient to fresh air; assist breathing if necessary; seek medical aid.

Ingestion: if conscious, give large quantity of water immediately. If unconscious, keep warm; seek medical aid immediately. Keep warm and at rest.

PRECLUDE FROM EXPOSURE pregnant women and any workers with a history of diseases of the central nervous system, liver, kidneys, skin, blood and gastro-intestinal tract.

Carbon tetrachloride CCl_4

Avoid using - CARCINOGEN.

Synonyms

Tetrachloromethane; perchloromethane; phenoxin.

Normal state

Colourless, non-flammable liquid with characteristic odour.

Uses

Dry-cleaning solvent; spot-test for some metals eg zinc. Seldom used now as **extremely toxic**. Avoid using. Approved for use as pesticide under UK's 1986 Pesticide Regulations. See p. 13.

Properties

B.P. 76.5°C. s.g. 1.597. Miscible with most organic solvents.

Flammability

Non-flammable but may decompose in a fire to hydrogen chloride and toxic phosgene gas.

Incompatible with

Chemically active metals eg sodium, potassium, magnesium; dimethyl formamide in presence of iron.

Spills

Absorb onto paper; leave to evaporate in a fume hood in a glass or iron dish; burn paper.

Storage

Keep away from sources of fire; avoid sunlight.

Handling

Nitrile or vinyl gloves; goggles; fume hood or self-contained breathing apparatus.

USA: TLV: 5ppm STEL: 30ppm (skin). Odour threshold: 50ppm.

UK: OES. 10ppm (LTEL); 20ppm (STEL). Under review.

Effects of exposure

Poison

Skin: irritant may be absorbed through inhalation and through the skin. Causes **cancer of the liver; acute liver and kidney necrosis**, with heavy drinkers more susceptible; depresses the central nervous system; can also cause nausea, vomiting, jaundice and enlarged, tender liver.

Eyes: pain; intense irritation; damage to conjunctiva.

Inhalation: moderately toxic; nausea, vomiting, tremors, unconsciousness; other systemic effects as above.

FIRST AID

Skin: remove contaminated clothing; wash skin with soap and water.

Eyes: irrigate with water; **seek medical aid.**

Inhalation: move patient to fresh air; give O₂ or artificial respiration if necessary. **Seek medical assistance.**

Ingestion: if conscious, give large quantities of water to drink. Keep warm and at rest. **Seek medical aid immediately.**

Carosil* vapourising capsules

Components

Organic ammonium nitrites etc.

Normal state

Small tablets in protective capsule

Uses

Prevention of tarnish in display cases for silver.

Properties

Soluble in water

Effects of exposure

Eyes: minor irritation

Ingestion: minor discomfort

Cellulose nitrate $C_6H_7O_2(ONO_2)_3$

Avoid using — highly flammable, explosive.

Synonyms

Nitrocellulose; cellulose trinitrate; nitrocotton; guncotton; collodion; celluloid; pyroxylin; HMG* adhesive; Zapon*.

Used mainly as ingredient in lacquer, adhesives and consolidants. Until 1951 used as film negative but unsatisfactory as unstable - **very flammable and explosive**; ignites easily, burns rapidly with intense heat.

Supplied normally as mixture with amyl acetate, acetone. If supplied in a powder form it is a fire hazard and potential explosive. May explode at 180°C.

Flashpoint 55°F.

Decomposed in time by ultra-violet light to give nitric acid.

Fight fire with copious amounts of water; alcohol foam. If in a solvent, use CO₂.

Chloral hydrate $\text{CCl}_3\text{CH}(\text{OH})_2$

Normal state

White crystalline solid; acrid odour and bitter taste.

Uses

Natural history preparations.

Properties

M.P. 57°C. b.p. 97.5°C. s.g. 1.9. Soluble in water. Combustible when exposed to heat or flame.

Spills

Brush/mop up with plenty of water; release to drain with large amount of water.

Handling

Face shield; rubber gloves.

Effects of exposure

Human mutagenic data.

Skin: irritation.

Eyes: irritation and redness.

Inhalation: toxic; may lead to severe respiratory damage. *Ingestion:* toxic, nausea, vomiting; coldness of extremities and unconsciousness.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with water. **Seek medical aid** if splash large or irritation persists.

Eyes: rinse thoroughly with running water if irritation persists, **seek medical aid**.

Ingestion: if patient is conscious, give plenty of water or milk to drink. Keep warm and at rest; transfer to hospital.

Chloramine T $\text{CH}_3\text{C}_6\text{H}_4\text{SO}_2\text{Na}:\text{NCl}\cdot 3\text{H}_2\text{O}$

= sodium-p-toluene-sulphachloramine/sodium p-toluene sulphon chloramide

Synonyms

Chlorazene; mianine; activin; tochlorine; chloroamine; tolamine.

Normal state

Supplied as white powder.

Uses

Water-soluble bleach for paper; parchment, textiles; disinfectant and antiseptic.

Fire extinguisher

Water, CO_2 , chemical, alcohol or polymer foam.

Incompatible with

Heat may decompose violently above 130°C or acid fumes (gives off chlorine and sulphur dioxide). Mixture with CaCO_3 + isonitriles explode when warmed.

Spills

Release to sewer with copious amounts of water.

Storage:

Avoid heat, reducing agents and acids; store in cool dry place; keep container tightly closed.

Handling

Avoid breathing dust or mist; wear rubber gloves; goggles; fume cupboard.

Effects of exposure

May cause immediate or delayed asthmatic reaction; allergen.

Skin: irritation from vapour or dust.

Eyes: irritation from vapour or dust.

Inhalation: irritation from vapour or dust; can cause asthma and vasomotor rhinitis.

Ingestion: moderately toxic; vomiting, cyanosis, frothing at mouth; respiratory failure can occur in a few minutes.

FIRST AID

Skin: wash thoroughly with water.

Eyes: irrigate with water; **seek medical aid.**

Inhalation: move to fresh air. Give O_2 if breathing difficult; **seek medical aid.**

Ingestion: **medical aid immediately;** keep warm and at rest; if conscious give large quantities water to drink.

Chloroform CHCl_3

Avoid use: suspect human carcinogen.

Synonyms

Trichloromethane; methenyltrichloride.

Uses

Lacquer solvent; solvent/adhesive for Perspex*.

Properties

Clear colourless liquid with characteristic odour. B.P. 61.2°C. Slightly soluble in water; miscible with alcohol, ether, benzene, solvent naphtha. Decomposes slowly in sunlight, **faster if high temperature with presence of iron, or in a fire.** Produces toxic phosgene gas, hydrochloric acid and chlorine.

Flammability

Non-flammable, but decomposes on contact with flame to phosgene, chlorine and hydrochloric acid.

Incompatible with

Strong alkalis; chemically active metals i.e. aluminium, magnesium, sodium or potassium; explosive reaction with acetone; sodium hydroxide with methanol. Explosive reaction with acetane plus alkali.

Spills

Absorb onto paper; leave to evaporate in fume hood on iron or glass dish; burn paper

Disposal

Purify by distillation (by experienced chemist only) or return to supplier.

Storage

Protect container against damage; keep closed and in a cool, dark, dry place.

Handling

Goggles, nitrile or rubber gloves; respirator/breathing apparatus.

USA: TLV/TWA: 10ppm **Odour threshold:** 200-300ppm OSHA PEL: CL 50 ppm.

UK: OES: 10ppm (LTEL); 50ppm (STEL) under review.

Effects of exposure

Suspect carcinogen. Teratogen

Skin: contact may cause burns; dermatitis, defatting

Eyes: may cause burns.

Inhalation: **suspect carcinogen; highly toxic by inhalation.** Potent anaesthetic at high concentrations. Exposure may cause lassitude, digestive disturbance, dizziness, mental dullness. Heavy drinkers affected sooner and more severely; liver and kidney damage

FIRST AID

Skin: remove contaminated clothing; wash skin thoroughly with soap and water; if irritation persists after washing, **seek medical aid**.

Eyes: irrigate promptly with water; **seek medical aid**

Inhalation: move to fresh air; give O₂ if necessary and seek medical aid.

Ingestion: keep warm and at rest; **seek medical aid** immediately. If conscious, give plenty of water to drink.

Chromic acid CrO_3

Synonyms

Chromic anhydride; chromic trioxide.

Normal state

Dark red crystals.

Uses

Taxidermy; cleaning analytical glassware.

Properties

MP 196°C. Decomposes to Cr_2O_3 and oxygen at 250°C. Easily soluble in water; is a strong oxidising agent, and will oxidise alcohols and other organics.

Flammability

Ignition and explosion with organic materials (see incompatibles). Containers may explode in fire.

Fire extinguishers

Water: but decomposition may form hot, viscous foams and may cause steam explosion.

Incompatible with

Contact with acetic acid, aniline, quinoline, alcohol, acetone; thinners and grease may cause ignition and explosion. Hazardous reaction with many organic or reductive materials; oxidants.

Spills

Cover with weak reducing agent, eg hypo or bisulphites or ferrous salts, with promoter of 3M H_2SO_4 . Transfer to large container, neutralise with soda ash, or diluted HCl — release to sewer with abundant water.

Storage

A storage hazard: may burst a sealed container due to CO_2 release. Avoid any contact with incompatible materials. Protect from physical damage; avoid storage on wooden or organic flooring.

Handling

Rubber gloves, mask, overalls, rubber apron; self-contained breathing apparatus.

USA: TLV/TWA: 0.05mg/m³.

UK: OES 0.5 mg/m³ (LTEL).

Effects of exposure:

Carcinogen. Extremely toxic; corrosive burns.

Skin: dermatitis; chrome ulcers; severe irritation.

Eyes: severe irritation; may cause blindness.

Inhalation: breathing difficulties; cough, sore throat, lung congestion; bronchio-asthma.

Ingestion: severe irritation of mouth and stomach; corrosive burns around mouth; gastric pain, nausea, vomiting.

FIRST AID

Skin: **seek medical aid.** Remove all contaminated clothing; wash affected area with soap and plenty of water.

Eyes: **seek medical aid immediately.** Irrigate thoroughly with water.

Inhalation: **seek medical aid immediately.** Move to fresh air, keep warm and at rest. Give O_2 if breathing difficult; support in upright sitting position to ease lung congestion.

Ingestion: keep warm and at rest. If conscious give 1 pint water to drink, then 1 pint milk — **seek medical aid immediately.**

Citric acid $\text{HO}_2\text{CC}(\text{OH})(\text{CH}_2\text{CO}_2\text{H})_2$

Major component of Biox ®

Synonyms

2-hydroxy-1,2,3-propanetricarboxylic acid.

Normal state

White crystalline solid.

Uses

Stripping bronze.

Properties

m.p. 153°C. Soluble in water.

Incompatible with

Metal nitrates

Fire extinguisher

Water; CO_2 ; dry powder, foam.

Incompatible with

Oxidising agents; bases; reducing agents; metal nitrates.

Spills

Solid: sweep up, place in large plastic container, and dilute with water; release to sewer. Liquid: mop up, dilute with large amounts of water and release to drain.

Storage

Keep container tightly closed; keep in cool dry place.

Handling

Any contact with skin, eyes, clothing; avoid breathing dust. Wear protective clothing, gloves, goggles; work in fume hood or wear respirator.

Effects of exposure

Harmful by ingestion, inhalation or skin contact; may cause allergic reaction.

Skin: irritation.

Eyes: irritation.

Inhalation: irritation

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with soap and water.

Eyes: irrigate with water; seek medical aid.

Inhalation: give plenty of water to drink; keep warm and at rest, and seek medical aid.

Colophony rosin

Normal state

Lumps of clear, pale yellow or orange resin.

Uses

Treatment for waterlogged wood.

Properties

m.p. 100-150°C. Consists mainly of abietic and dehydroabietic acids. Soluble in acetone, alcohols, esters, ketones, drying oils, aqueous alkalis.

Flammability

Flash point 180°C closed cup. Combustible; less fire risk in lump form, but fine dust may ignite.

Fire extinguishers

Carbon dioxide or dry chemical.

Incompatible with

Strong oxidants.

Low toxicity but may be allergenic. Avoid breathing dust.

Ages fast through air oxidation, changing colour from pale yellow to brown.

Copper Cu

Copper metal may have explosive reaction with ethylene oxide; oxidants; **violent reaction with acids.**

Copper corrosion products: if working with copper corrosive products wear skin and eye protection, and an efficient dust mask.

For dusts and mists:

USA: TLV/TWA: 1 mg/m³.

UK: OES: 1 mg/m³ (LTEL); 2 mg/m³ (STEL).

Effects of exposure

Copper and its salts are toxic by ingestion and inhalation; experimental tumorigen and teratogen.

Eyes: irritation (may cause ulceration); conjunctivitis.

Skin: itching eczema.

Ingestion: vomiting; gastric pain; diarrhoea.

Cosmolloid 80H wax* $C_m H_{2n+2}$

Normal state

Granules

Uses

Stone protective coating - microcrystalline wax.

Properties

Insoluble in water. Soluble in toluene, xylene, white spirit.

Flammability

Flash point (open cup) 22°C. Explosive limits in air not established. Non-volatile.

Fire extinguishers

Water, foam, dry chemical, carbon dioxide.

Incompatible with

Immiscible with water and polar solvents - no dangerous reaction.

Spills

Allow to solidify if molten, scrape up and treat as solid industrial waste.

Storage

Dry and cool.

Handling

Avoid contact with molten material.

Effects of exposure

Skin: thermal burns from molten wax.

Eyes: no special hazard.

Inhalation: fumes from molten wax can cause discomfort.

FIRST AID

Skin: if burn, cool with running cold water. Do not remove from skin before burn treatment. **Seek medical aid.**

Eyes: wash with copious amounts of water and consult doctor.

Inhalation: remove from contaminated atmosphere. If recovery not immediate consult doctor.

Creosote

Normal state

Brown liquid with pungent smell: contains naphthalene and anthracene.

Uses

Waterproofing/preserving outdoor woodwork.

Properties

Soluble in alcohol, benzene, toluene. Flash point 73.9°C. Oily product obtained by distillation from coaltar or wood. Contains phenol (see relevant entry) and cresol.

Flammability

Flammable. Auto-ignition temperature 335°C.

Incompatible with

Strong oxidisers.

Storage

Flammable liquid store.

Handling

Wear heavy duty rubber gloves; protect exposed skin. If use extensive, wear closed circuit breathing apparatus.

USA: TLV/TWA: 0.1 mg/m³.

Effects of exposure

May be absorbed through skin. (Anthracene an experimental animal carcinogen)

Skin: strong irritant; produces local patchy skin irritation, burning, itching, ulceration. Photosensitisation may occur. May cause skin cancer.

Eyes: may cause keratitis, conjunctivitis, permanent corneal scars.

Ingestion: Moderately toxic.

FIRST AID

Skin: remove contaminated clothing immediately. Flush skin with water then with solution of polyethylene glycol molecular weight 300 for at least 30 minutes, wearing protective gloves. **Seek medical aid.**

Eyes: wash with flowing water. Do not use polyethylene glycol 300 in eyes — **seek medical aid immediately.**

Inhalation: move to fresh air. Keep in upright seated position to aid breathing; **seek medical aid.**

Ingestion: if conscious, give 1 pint water to drink immediately, **transfer to hospital as soon as possible.**

Cyclohexanone $C_6H_{10}O$

Synonyms

Pimelic Ketone; Ketohexamethylene.

Normal state

Colourless to pale yellow, flammable liquid

Uses

In Beva 371.

Properties

S.G. 0.95; M.P. -45°C B.P. 115.6°C. Readily soluble in water; miscible with most organic solvents.

Flammability

Flash point 33°C (closed cup). Ignition temp 520-580°C. Explosive range 1.1-8.1% in air. May cause ignition by slight heat.

Fire extinguishers

Water spray, dry chemical, CO_2 or alcohol foam.

Incompatible with

Heat; hydrogen peroxide; nitric acid; oxidising agents.

Spills

Absorb on paper; evaporate in fume hood on glass or iron dish; burn paper.

Storage

Flammable liquid store.

Handling

Rubber or neoprene gloves, safety glasses, cartridge respirator.

USA: TLV/TWA: 25ppm (skin).

UK: OES: 25ppm (LTEL); 100ppm (STEL).

Effects of exposure

Severe irritant: toxic.

Skin: irritation

Eyes: irritation; conjunctivitis.

Inhalation: bronchitis, shortness of breath, congestion of lungs, convulsions.

Ingestion: nausea; vomiting; pain, diarrhoea

FIRST AID

Skin: remove contaminated clothing; wash skin with soap and water.

Eyes: irrigate for 15 mins; **seek medical aid.**

Inhalation: **seek medical aid immediately.** Move to fresh air. Give O_2 or artificial respiration if breathing difficult. Support in upright sitting position if lungs congested.

Ingestion: keep warm and at rest give plenty of water to drink if conscious; **seek medical aid.**

Cyclohexylamine $C_6H_{11}NH_2$

Synonyms

Hexahydroaniline; aminocyclohexane; CHA.

Normal state

Colourless liquid with strong pungent amine odour.

Uses

Vapour phase inhibitor for ferrous metals/alloys; insecticide. See p.13 for UK's 1986 Pesticide Regulations.

Properties

M.P. $-17.7^{\circ}C$. B.P. 134.5° . Miscible with water and most organic solvents.

Flammability

Flash point $90^{\circ}F$ ($32^{\circ}C$). Ignition temperature $239^{\circ}C$. Explosive hazard. May ignite at room temperature.

Fire extinguishers

Dry chemical; alcohol foam; carbon dioxide.

Incompatible with

Strong oxidants eg strong acids, nitric acid.

Spills

Spread with plenty of sodium bisulphate; sprinkle with water and release to sewer with copious amounts of water.

Storage

Protect container against physical damage; storage outside in detached storage if possible, or if inside in standard flammable liquids store.

Handling

Butyl rubber gloves; goggles; cartridge respirator.

USA: TLV/TWA: 10ppm (skin)

UK: OES: 10ppm (LTEL).

Effects of exposure

Possible carcinogen; mutagen; teratogen; embryotoxic. Corrosive; poisonous. Highly toxic via skin absorption or ingestion.

Skin: severe local irritation; may sensitise skin. May be absorbed through skin; prolonged contact may cause burns.

Eyes: local irritation.

Inhalation/Ingestion: may be fatal. Narcotic in high concentrations; causes pulmonary irritation, drowsiness, loss of appetite, nausea, vomiting. Extremely destructive to tissue of mucous membranes and respiratory tract.

FIRST AID

Skin: **seek medical aid immediately.** Remove contaminated clothing; wash off immediately with plenty of soap and water.

Eyes: **seek medical aid immediately.** Irrigate with water, holding eyelids apart if necessary.

Inhalation: move to fresh air.

Ingestion: **seek medical aid immediately.** Give water to drink; keep warm and at rest.

Dammar resin

Natural resin consisting of triterpenoid resin with small quantities of an essential oil.

Uses

Consolidant for waterlogged wood; component of varnish.

Properties

M.P. 90-200°C. Soluble in ether, white spirit, aryl and aliphatic hydrocarbons, terpenes, chlorinated solvents.

Flammability

Possible explosive hazard if in large quantity and in dust/powder form.

Effects of exposure

Main hazard — dust — probably just a nuisance particulate; wear a mask.

DDT (C₆H₄Cl)₂CH.Cl₃

DDT is now banned, but older collections may have been treated with it; check records before handling material. It is volatile, and may become redeposited. Breaks down to DDE in fats/lipids which has similar properties and effects.

Synonyms

ENT 1506; dicophane; chlorophenothane; Gesarol; Neocid; dichlorodiphenyl-trichloroethane.

Normal state

Waxy solid.

Uses

Used as insecticide — generally skins, leather, woollens, felts, etc. Not approved under UK's 1986 Pesticide Regulations: see p. 13.

Properties

Moderately soluble in water.

Spills/Disposal

Mix with 9:1 vermiculite: sodium bicarbonate mixture, or with 9:1 sand:soda ash mixture; burn in suitable incinerator.

Handling

Take great care to avoid any contamination - both inhalation and skin contact. Wear mask, gloves, protective clothing. Wash thoroughly if contaminated; induce vomiting if swallowed.

USA: TLV/TWA: 1 mg/m³

UK: OES: 1mg/m³ (LTEL); 3mg/m³ (STEL)

Effects of exposure

Experimental animal carcinogen. Moderate — acute toxicity to man Partial paralysis of contact areas, e.g. hands, tongue, lips and face: tremors; apprehension; dizziness; confusion; malaise; headaches, convulsions; irritation of eyes and skin. Affects central nervous system, liver, kidneys, skin, peripheral nervous system.

FIRST AID

Skin: wash immediately with soap and water.

Eyes: irrigate thoroughly with water.

Inhalation: move to fresh air immediately; **seek medical aid.**

Ingestion: if conscious give large quantities of water to drink and **seek medical aid.**

De-solve*

Disintegrator for epoxy and polyester resins.

Volatile, non-inflammable, low toxicity. Contains chlorinated hydrocarbons. (Manufacturer's data).

No analysis available, but probably based on methylene chloride — see relevant entry.

Detarol $\text{HOOCCH}_2\text{N}(\text{CH}_2\text{CH}_2\text{OH})\text{CH}_2\text{CH}_2\text{N}(\text{CH}_2\text{COOH})_2$

= n-hydroxyethylethylenediaminetriacetic acid (HEDTA); Hamp-ol acid; HEEDTA; Versenol.

Uses

Pre-treatment of waterlogged material.

When heated to decomposition emits toxic fumes.

Probably low toxicity oral and skin routes; poison by intraperoneal routes.

Diacetone alcohol $\text{CH}_3\text{COCH}_2\text{C}(\text{CH}_3)_2\text{OH}$

Synonyms

Ketone alcohol; 4-hydroxy-4-methyl-2-pentanone; 4-hydroxy-2-keto-4-methyl-pentane.

Normal state

Colourless liquid with fragrant odour.

Uses

Solvent for nitrocellulose lacquers, celluloid, oils, waxes, fat, resin. Reforming varnishes and resins.

Properties

B.P. 168°C.; S.G. 0.94. Miscible with alcohol, halogenated aromatic hydrocarbons, water, esters.

Flammability

Flammable — moderate fire hazard. Flash point 58°C. Flammable limits 1.8-6.9%. Acetone contamination may lower the flash point.

Fire extinguishers

Foam; carbon dioxide; dry chemical.

Storage

Store in secure flammable liquids store.

Incompatible with

Oxidising materials.

Spills

Absorb on paper; leave to evaporate in fume hood on iron or glass dish; burn paper.

Handling

Gloves (natural rubber, neoprene, nitrile or butyl rubber), always use goggles; chemical cartridge respirator.

USA: TLV/TWA: 50 ppm STEL: 75 ppm.

UK: OES: 50ppm (LTEL); 75ppm (STEL).

Effects of exposure

Skin: irritates mucous membranes; absorbed through skin.

Eyes: severe irritation.

Inhalation: narcotic at high concentrations; causes liver and kidney damage; may cause anaemia.

Ingestion: toxic; narcotic; may cause kidney and liver damage and anaemia.

FIRST AID

Skin: remove contaminated clothing; wash skin thoroughly in water.

Eyes: irrigate thoroughly in water. **Seek medical aid** if irritation persists.

Inhalation: move to fresh air; give O₂ if breathing difficult, artificial respiration if breathing stops. **Seek medical aid.**

Ingestion: **medical aid immediately.** Give plenty of water to drink if conscious. **Keep warm and at rest.**

Dibutylphthalate $C_6H_4(COOC_4H_9)_2$

Synonyms

DBP; di-n-butylphthalate.

Normal state

Colourless, oily liquid; very weak aromatic odour.

Uses

Plasticiser for (eg) polyvinyl butyrate and polyvinyl acetate, consolidants and adhesives. Insect repellent for impregnation of clothing.

Properties

B.P. 340°C. Miscible with most organic solvents. Low vapour pressure.

Flammability

Combustible. Flash point 171°C.

Fire extinguishers

Carbon dioxide; dry chemical.

Incompatible with

Nitrate; strong oxidisers; strong alkalis; strong acids; chlorine.

Spills

Absorb onto paper; leave to evaporate in fume hood in glass or iron dish; burn paper.

Handling

Neoprene gloves; goggles; fume cupboard.

USA: TLV/TWA: 5 mg/m³

UK: OES: 5gm/m³ (LTEL); 10mg/m³ (STEL)

Effects of exposure

Teratogen; mutagen.

Eyes: may cause conjunctivitis, iritis.

Inhalation: irritation of respiratory tract.

Ingestion: poisonous; may cause kidney and liver damage; systemic eye effects.

FIRST AID

Skin: wash thoroughly with soap and water.

Eyes: irrigate with water. If irritation persists after washing, **seek medical advice.**

Inhalation: move to fresh air. **Seek medical aid** if breathing at all affected.

Ingestion: keep warm and at rest. If conscious, give plenty of water to drink, and **seek medical aid immediately.**

PRECLUDE FROM EXPOSURE workers with kidney disease.

p-Dichlorobenzene $C_6H_4Cl_2$

AVOID USE.

Synonyms

'Mothballs'; 1,4-dichlorobenzene — one of 3 isomers; PDB; paracide; Santochlor

Normal state

White crystalline material.

Uses

Fungicide/insecticide; control of mould and mildew on leather/fabric. See p. 13 for note on UK's 1986 Pesticide Regulations.

Properties

M.P. 53°C. B.P. 174.4°C. Soluble in ether, benzene, chloroform, carbon disulphide. May dissolve plastic bags.

Flammability

Flammable. Flash point 67°C closed cup. Explosive range 2.2-9.2% in air.

Fire extinguishers

Water spray; dry chemical; foam; carbon dioxide.

Incompatible with

Oxidising materials; alkali metals, metal powders; aluminium.

Storage

Avoid heat/sources of ignition.

Handling

Avoid prolonged skin contact; wear gloves, mask if necessary.

USA: TLV/TWA: 75 ppm STEL: 110 ppm Odour threshold: 15-30 ppm.

UK: OES: 75ppm (LTEL); 110ppm (STEL).

Effects of exposure

Moderately toxic if inhaled; highly toxic if swallowed; may cause liver damage. Experimental carcinogen.

Skin: burning sensation; possible allergic reaction — red blotches on skin.

Eyes: irritation/swelling

Inhalation: irritation; headache; swelling round eyes; running nose; loss of appetite; nausea; vomiting.

Ingestion: toxic

FIRST AID

Skin: remove contaminated clothing; wash skin thoroughly with water.

Eyes: irrigate thoroughly with water.

Inhalation: fresh air; oxygen if breathing difficult. **Seek medical aid.**

Ingestion: **seek medical aid immediately;** give large amounts of water to drink immediately, if conscious. Keep warm and at rest.

1,2 Dichloro-ethane $\text{CH}_2\text{ClCH}_2\text{Cl}$

AVOID USE: CARCINOGEN.

Synonyms

Ethane dichloride; ethylene dichloride

Normal state

Colourless liquid with chloroform like odour

Uses

Solvent. Avoid use if possible.

Properties

S.G. 1.2596; B.P. 83-84°C. Flash point 13°C M.P. -35°C.

Stable to alkalis, acids or active chemicals. Miscible with most common solvents; slightly soluble in water.

Flammability

Flammable; flash point 13°C. Explosive limit 6.2 - 16%.

Decomposes to form: carbon monoxide, carbon dioxide, hydrogen chloride gas and phosgene gas.

Fire extinguishers

Dry chemical, CO_2 , foam or vapourising liquids.

Incompatible with

Strong oxidisers, strong caustics and chemically active metals (e.g. aluminium or magnesium powder); nitric acid.

Spills

Absorb on paper; leave to evaporate in fume hood on glass or iron dish; burn paper. Larger spills: absorb with earth or vermiculite; evaporate in secure area outside.

Storage

Small quantities in laboratory in fire-proof container or cupboard; larger amounts in outside flammables store.

Handling

Avoid contact with liquid and vapour; use fume cupboard, neoprene or nitrile rubber gloves, goggles. If working above TLV, self-contained breathing apparatus necessary. Don't wear contact lenses.

USA: TLV/TWA: 10 ppm Ceiling: 15 ppm.

UK: OES: 10ppm (LTEL); 15 ppm (STEL) under review

Effects of exposure

Suspect carcinogen

Skin: irritation; can cause dermatitis if absorbed through skin, with scaly fissured

skin.

Eyes: irritation; can cause severe damage.

Inhalation: irritation of respiratory tract. Drowsiness, headache, vomiting, convulsions. Pulmonary oedema, kidney and liver damage; may be fatal.

Ingestion: toxic

FIRST AID

Skin: wash thoroughly with soap and water; remove contaminated clothing.

Medical aid if irritation persists.

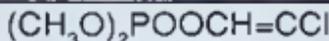
Eyes: irrigate thoroughly in water; **medical aid** if irritation persists.

Inhalation: move to fresh air; if breathing difficult give oxygen or artificial respiration; **seek medical aid** and keep warm and at rest.

Ingestion: **medical attention immediately.** If conscious, give water only. Keep warm and at rest.

Preclude from exposure; personnel with diseases of liver and kidneys. if used frequently, annual health check recommended, including liver and kidneys.

2,2-Dichlorovinyl dimethyl-phosphate



VERY TOXIC — AVOID USE.

Synonyms

DDVP; Dichlorvos*; Vapona*; Nogos*; Nuvan*; Dedevap*.

Normal state

Amber liquid.

Uses

Insecticide and fumigant. See note p.13 on UK's 1986 Pesticide Regulations.

Properties

B.P. 8.4°C; slightly soluble in water (1%), glycerine, alcohol. Miscible with aromatic and chlorinated hydrocarbons. Degrades rapidly in air.

Flammability

Non-flammable.

Spills

Absorb on paper; put in polythene bag; burn outdoors in open pan or in furnace with utmost care, with more flammable solvent if necessary.

Handling

Gloves, goggles; cartridge respirator.

USA: TLV/TWA: 0.1 ppm.

UK: OES: 0.1ppm (LTEL); 0.3ppm (STEL).

Effects of exposure

This chemical is cumulative and is a **suspect mutagenic agent and foetotoxin**. Mild exposure causes weakness, headaches, abdominal cramps, anorexia, blurred vision. **Poisonous by ingestion.**

Skin: can be absorbed through skin — will cause localised sweating and irritation in contaminated area, 15 mins - 4 hrs later.

Eyes: small pupils, aching in and behind eyes; blurred vision.

Inhalation: tightness of chest; wheeziness, bluish discolouration of skin; headache; salivation.

Ingestion: loss of appetite, nausea, vomiting, stomach cramps, diarrhoea. Can occur after 15 mins - 4 hours. Any form of severe intoxication by whatever route causes weakness, generalised twitching, paralysis; breathing may stop.

FIRST AID

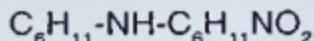
Skin: remove contaminated clothing; wash thoroughly with soap and water; **medical aid immediately.**

Eyes: immediately irrigate with water; **medical aid urgent.**

Inhalation: move to fresh air, give O₂ if breathing difficult; **seek medical aid.** Keep warm and at rest.

Ingestion: if conscious give large amounts water to drink; **medical aid immediately.** Keep warm and at rest.

Dicyclohexylamine nitrite



Synonyms

Dechan; di-Chan; dodecahydrodiphenylamine nitrite.

Normal State

Solid.

Uses

Vapour phase inhibitor for iron.

Properties

Volatile at room temperature and above.

Flammability

Disaster hazard.

Spills

Collect/absorb onto paper; burn carefully in open air or in a safe location (e.g. incinerator).

Storage

Flammable liquids store; no sources of ignition; well-ventilated; cool.

Handling

Goggles; butyl rubber gloves; self-contained breathing apparatus or use a fume hood.

Ceiling Limit

(USSR): 0.2mg/m₃. Neither USA or UK limits available.

Effects of exposure

Longterm exposure to vapour is reported to lead to changes in the central nervous system, blood and liver. Tumourgenic. **Poison by ingestion.**

Diethylbenzene $C_6H_4(C_2H_5)_2$

Normal state

Colourless liquid

Uses

Solvent for Paraloid B 72* varnish.

Properties

B.P. 179.8 - 184.8°C. S.G. 0.87. Soluble in alcohol, benzene; insoluble in water.

Flammability

Flammable; moderate fire hazard. Flash point 55.6°C. In fire decomposes to carbon monoxide, carbon dioxide.

Fire extinguishers

Carbon dioxide; dry chemical.

Incompatible with

Strong oxidising agents.

Spills

Absorb on paper; leave to evaporate in fume hood on glass or iron dish; burn paper.

Storage

Keep cool and dry; flammable liquids store.

Handling

Rubber or neoprene gloves, goggles. Work in fume hood, or with respirator.

TWA/OES data not available: treat as moderately toxic.

Effects of exposure

Moderately toxic.

Skin: irritation; blisters (rare)

Eyes: irritation and redness

Inhalation: cough; shortness of breath. Congestion of lungs.

Ingestion: nausea; vomiting, diarrhoea, pain; shallow breathing.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with water.

Eyes: irrigate thoroughly with water; if irritation persists, seek medical aid.

Inhalation: move to fresh air. Give O_2 if breathing difficult, artificial respiration, if breathing stops; if lungs congested, support in upright sitting position. Seek medical aid. Keep warm and at rest.

Ingestion: if conscious give water to drink — seek medical aid.

Diethyl ether $C_2H_5 \cdot O \cdot C_2H_5$

See also: Ether peroxides.

Synonyms

Ether; ethyl ether; diethyl oxide.

Normal state

Colourless, volatile liquid with sweet taste and aromatic odour.

Uses

Solvent.

Properties

B.P. 34.6°C. Slightly soluble in water; soluble in alcohol, chloroform, benzene, oils.

Flammability

Extremely flammable. Flash point - 45°C; flammable limits in air 1.9-48%. Auto-ignition temperature 160°C. Vapours are heavier than air so will lie near ground; may travel a considerable distance to ignition source then flash back. Can ignite from spark, heater, static electricity. May form explosive mixture with air. **Slow oxidation occurs on standing (over 6 months or so) or exposure to sunlight, producing unstable peroxides which may explode spontaneously on heating.**

Fire extinguishers

Dry chemical; foam; carbon dioxide.

Incompatible with

Ignites with nitric acid or fuming sulphuric acid; hazardous reaction with organic materials and oxidising materials, including bromine trifluoride; bromine pentafluoride; perchloric acid; wood pulp extract with heat; halogens; interhalogens; sulphur and sulphur compounds; air; bromozides; oxygen; chromates.

Spills

Absorb onto paper; leave to evaporate on iron or glass dish in fume hood. Burn paper.

Storage

A storage hazard. Explosive peroxides may form on standing (see Flammability section and Ether peroxides). Note date bottle was opened; any still in use over 1 month later should be checked for peroxides before any heating is carried out. **N.B.** **Should not be heated without supervision of experienced chemist.** Store in flammable liquids store; keep in brown glass bottle; avoid sparks, direct sunlight.

Handling

Neoprene or nitrile rubber gloves, goggles; cartridge respirator (discard cartridge after use).

USA: TLV/TWA: 400 ppm; TWA/STEL: 500 ppm

UK: OES: 400 ppm (LTEL); 500 ppm (STEL).

Effects of exposure

Skin: may cause dryness and cracking through removal of oils. Skin absorption in high exposures may cause disturbance of central nervous system.

Inhalation: loss of appetite; exhaustion; sleepiness; vertigo; severe irritation at 500 ppm. Narcosis and general anaesthesia at 3.6-3.5% volume in air; 10% can be fatal.

Ingestion: **Toxic;** may cause excitation, nausea and narcosis.

FIRST AID

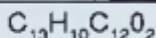
Skin: remove contaminated clothing; wash well with soap and water; apply lanolin or water soluble cream to help dryness.

Eyes: irrigate with water.

Inhalation: move patient to fresh air.

Ingestion: **medical aid immediately.** If conscious and medical aid not immediately available give large amounts of water to drink.

2,2'-Dihydroxy-5,5'-dichlorodiphenylmethane



Synonyms

Dichlorophene; 2,2 methylenebis(4 chlorophenol); Preventol® GD,G4,DDM, DDM.

Normal state

Commercial product light brown; pure compound colourless.

Uses

Fungicide/bactericide for cellulose, glue, paint, varnishes; microbiocide; corrosion inhibitor. In pure form not an approved pesticide under UK's 1986 Pesticide Regulations: see p.13.

Properties

Melting point: 177-8°C. Insoluble in water; soluble in ethyl alcohol, acetone. Alkali salt soluble in water.

Incompatible with

When heated to decomposition emits toxic chlorine gas.

Effects of exposure

Mutagenic data

Skin: irritation.

Eyes: irritation

Inhalation: may cause cramps and diarrhoea.

Ingestion: may cause cramps and diarrhoea.

2,2'-Dihydroxy- 5,5'-dichlorodiphenylmonosulphide

Synonyms

Fentichlor*.

Normal state

Colourless

Uses

Broad spectrum biocide for collagenic material. As a pure chemical not approved under UK's 1986 Pesticide Regulations: see p.13

Properties

Soluble in water; partly soluble in ethanol

Low toxicity.

n-n-Dimethylformamide $\text{HCON}(\text{CH}_3)_2$

Synonyms

DMF; formyldimethylamine.

Normal state

Colourless liquid with slight fishy odour.

Uses

Powerful solvent.

Properties

B.P. 153°C. S.G. 0.9445. Miscible with chloroform, carbon tetrachloride, benzene, acetone, ether. Soluble in water. Generates carbon monoxide if decomposed by heat. Slow rate of evaporation.

Flammability

Flammable; moderate fire risk. Flash point 58°C. Flammable limits in air 2.2-15%.

Fire extinguishers

Alcohol foam; dry chemical; carbon dioxide. **Do not use halogenated extinguishing media.**

Incompatible with

Chlorinated hydrocarbons; halogens; nitrates; carbon tetrachloride; strong oxidisers (may cause fires); alkyl aluminiums. Toxic gases and vapours given off in fire.

Spills

Place in a plastic bag or on paper; burn out of doors with great care, adding a more combustible solvent to aid combustion.

Storage

Store in flammable liquid store; keep cold and dark.

Handling

Rubber gloves; goggles; protective clothing. Work in fume hood. Do not wear contact lenses.

USA: TLV/TWA: 10 ppm (Skin) **Odour threshold:** 100 ppm.

UK: OES: 10 ppm (LTEL); 20 ppm (STEL)

Effects of exposure

Suspect human teratogen. Skin absorption main route of entry, even when below TLV. May cause stomach pain, cramps, nausea, vomiting; liver malfunction; high blood pressure.

Skin: irritation; rash, dermatitis.

Eyes: irritation; burns.

Inhalation: as for skin absorption.

Ingestion: **toxic**

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with water. **Seek medical aid immediately.**

Eyes: irrigate thoroughly in water; if irritation persists **seek medical aid.**

Inhalation: move to fresh air. Give O₂ or artificial respiration if breathing difficult; **get medical aid immediately.**

Ingestion: if conscious — give large amounts of water to drink, **get medical aid immediately.** Keep warm and at rest.

PRECLUDE FROM EXPOSURE any workers with skin, liver or gastric diseases and pregnant women as much as possible.

Dimethylhydantoin formaldehyde resin

Normal state

Colourless - yellow brittle lumps, faint caramel odour.

Properties

M.P. 60°C; S.G. 1.36.

Effects of exposure

Skin: allergenic

Eyes: allergenic

Inhalation: allergenic; (dust) irritation; cough, vomiting

Ingestion: vomiting

If you develop an allergic reaction to this chemical, avoid further contact.

FIRST AID

Skin: wash with water.

Eyes: irrigate with water.

Dimethylsulphoxide (CH₃)₂SO

Normal state

Colourless liquid with mild, garlic-like odour

Uses

Solvent.

Flammability

Combustible. Flash point 203°F (95°C). Explosive limits in air 2.6-28%.

Fire extinguishers

Water, dry chemical, CO₂ or foam.

Incompatible with

Bromomethane; perchloric acids; violent reaction with oxidising materials ie with metal salts of OXO acids. Poisonous gases released in fire.

Spills

Absorb on paper: leave to evaporate in fume hood on iron or glass dish; burn paper. Absorb larger spills with vermiculite and evaporate in secure open space.

Storage

Flammable liquids store. Avoid oxidising materials; ignition sources.

Handling

Avoid contact with liquid and vapour: use fume cupboard, butyl rubber gloves and goggles.

Effects of exposure

Suspect teratogen; human mutagenic data.

Skin: irritation: easily penetrates skin and is moderately toxic by this route: may also carry more toxic materials through skin. Allergenic.

Eyes: irritation; corneal opacity.

Inhalation: irritation of upper respiratory tract: allergenic.

Ingestion: harmful: nausea, vomiting, stomach cramps. Poisonous.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with soap and water. If irritation persists after washing, **seek medical aid.**

Eyes: irrigate thoroughly with water — if irritation persists **seek medical aid.**

Inhalation: move to fresh air: if breathing difficult give oxygen.

Ingestion: **Seek medical aid immediately;** keep person warm and at rest.

Dolomite $\text{CaMg}(\text{CO}_3)_2$

Calcium magnesium carbonate

Powder used in air-abrasive machine.

Incompatible with

Acids; alum; ammonium salts. Avoid inhaling dust - wear face mask.

USA: TLV/TWA: 10 mg/m³ (total dust)

Severe eye and moderate skin irritant.

Dygon*

Normal state

Yellowish crystalline solid with disagreeable odour.

Uses

Bleaching agent for textile dyes; some metal salt stains on stone.

Properties

pH10.

Flammability

Flammable.

Fire extinguishers

Water in large quantities.

Incompatible with

Decomposition with heat evolves toxic sulphur dioxide (TLV 2 ppm). Incompatible with — oxidizing material; acids; *small* quantities of water.

Spills

Flush away to drain with copious amounts of water.

Handling

Wear gloves. Goggles, dust mask; work in well-ventilated area.

USA: TLV/TWA: 2ppm for liberated sulphur dioxide.

Effects of exposure

Skin: prolonged exposure may have defatting effect.

Eyes: irritation.

Inhalation: irritation; cough.

Ingestion: irritation; nausea; vomiting.

FIRST AID

Skin: wash well with soap and water.

Eyes: irrigate with water; or rinse with 2% solution of sodium bicarbonate, then water; **seek medical aid.**

Inhalation: move to fresh air. Give oxygen if breathing difficult. **Seek medical aid at once.**

Ingestion: if conscious give plenty of water to drink, or a 2% solution (1 teaspoon/glass water) of sodium bicarbonate, and **seek medical aid.**

Dynasytan* BSM

Synonyms

Alkyl-alkoxy silane.

Normal state

Colourless, low viscosity liquid; available as 20%, 40% and 100% solution.

Uses

Water-repellant stone consolidant.

Properties

Solvent: Ethanol. S.G. 0.8. Freezing point <-30°C.

Flash point <21°C (20% and 40%) 40°C (100%).

Flammability

Flammable.

Fire extinguishers

Water, dry powder or carbon dioxide.

Storage

Keep cool and completely dry, do not expose to direct heat. Shelf life virtually unlimited if stored properly.

Handling

Avoid all sources of sparks and heat.

Effects of exposure

Toxic.

Skin: irritation.

Eyes: irritation (see 'ethanol' entry).

FIRST AID

Skin: wash thoroughly with water.

Eyes: irrigate with water; seek medical aid at once.

Manufacturer's information. N.B. for effects of (ethanol) solvent, see relevant entry.

EDTA $(\text{HOOCCH}_2)_2\text{NCH}_2\text{CH}_2\text{N}(\text{CH}_2\text{COOH})_2$

Synonyms

Ethylenediaminetetra-acetic acid; versenic acid. Often also applied to most commonly used salts, the disodium, tetrasodium, and pentasodium salts; detanates. Trade names include: Cheelox BF acid; PermaKleer acid; Questex 44; SEQ 100; Sequestrene AA; Versene acid.

Normal state

White crystals or powder.

Uses

Chelating agent to remove copper and iron salts. The lower the valency of the salt, the lower the pH.

Properties

Soluble in water. mp 252°C.

Fire extinguishers

Water; CO_2 ; dry chemical, alcohol foam.

Incompatible with

Strong oxidising agents, strong bases and copper; copper alloys; nickel. Emits toxic fumes when heated to decomposition.

Spills

Cover with excess sodium bicarbonate; mix well. Transfer to large container of water, stir well. When reaction ceases, pour down drain with large amount of water.

Storage

Keep tightly closed. Store in a cool dry place.

Handling

Gloves, goggles; respirator or work in fume hood.

Effects of exposure

May be harmful by ingestion (moderately toxic), inhalation or skin absorption. Irritating to eyes, skin and mucous membrane. Experimental teratogen; experimental reproductive effects.

FIRST AID

Skin: wash thoroughly with water.

Eyes: irrigate thoroughly with water.

Inhalation: move to fresh air. Give artificial respiration if not breathing, oxygen if breathing difficult; seek medical aid.

Ingestion: if conscious give plenty of water to drink, and seek medical aid.

Epoxy resins

Thermosetting synthetic resins. A typical resin would be made from epichlorohydrin and bisphenol A, set by catalysts like amines.

Setting agents violently irritate the skin and mucous membranes; cause conjunctivitis, rhinitis, asthma, allergic eczema; may be very toxic.

Handle with goggles, nitrile, neoprene or viton gloves; not rubber gloves.

Avoid any contact with hardener or uncured resin.

When heated to decomposition, cured and uncured resins yield extremely toxic fumes.

See also: Araldite; Ablebond.

PRECLUDE FROM EXPOSURE any workers with allergies, dermatitis, or any sensitisation.

Ercalene* reducer

Thinner for Ercalene* lacquer.

A mixture of organic solvents including *xylene, *n-butyl alcohol, *n-butyl acetate.
*See relevant entries.

Highly flammable. Flash point 23°C.

USA: TLV/TWA: 50 ppm.

Ethanol C_2H_5OH

Synonyms

Ethyl alcohol; absolute alcohol; spirit of wine; methyl carbinol; ethyl hydrate.

Normal state

Clear colourless liquid.

Uses

Solvent; dehydrating waterlogged material; cleaning very fragile material. Component of industrial methylated spirits. 70% solution as preserving fluid for natural history specimens.

Properties

Colourless liquid. B.P. 78.5°C., S.G. 0.80. Hygroscopic. Miscible with water, methyl alcohol, ether, chloroform, acetone. May contain methylalcohol.

Flammability

Highly flammable. Flash point 12.2°C. Flammable limits in air 3.3-19%. Flash back along vapour trail may occur.

Fire extinguishers

Dry chemical; alcohol foam; carbon dioxide.

Incompatible with

Perchlorates, peroxides, chromic acid, nitric acid, alkali metals, silver nitrate (especially with ammonia or an acid present). May react vigorously with oxidising agents. Reacts violently with dichloromethane plus sulphuric acid plus nitrate; forms explosive products by reaction with: ammonia + silver nitrate; magnesium perchlorate; nitric acid + silver; silver nitrate; silver (1) oxide + ammonia.

Spills

Evaporate in fume cupboard after absorbing on paper; then burn paper.

Storage

No sources ignition; keep away from incompatible chemicals (see above).

Handling

Fume cupboard, goggles; rubber, neoprene, nitrile or vinyl gloves. Do not wear contact lenses.

USA: TLV/TWA: 1000 ppm

UK: OES: 1000 ppm (LTEL).

Effects of exposure

May increase the toxicity of other inhaled, absorbed or ingested chemical agents. Irritates mucous membranes; can cause headaches, dizziness, nausea at very high concentrations. Experimental tumorigen and teratogen.

Skin: frequent exposure may cause dryness; harmful if absorbed through skin; severe irritant. Irritates mucous membranes.

Eyes: vapour can cause irritation; splashes cause stinging, sensation and burning and severe injury. Effects may be delayed several hours.

Inhalation: irritation of upper respiratory tract; headache, stupor, fatigue.

Ingestion: poisonous; dangerous if swallowed. (Dilute solutions used in alcoholic beverages). Chronic effects include: liver and heart damage.

FIRST AID

Skin: remove contaminated clothing; wash skin thoroughly with water; **seek medical aid** if irritation persists.

Eyes: irrigate thoroughly with water. **Seek medical aid** as soon as possible.

Inhalation: move to fresh air if breathing difficult, give O₂, or artificial respiration if breathing stops. **Seek medical aid.**

Ingestion: **seek medical attention:** keep person warm and at rest. Give water to drink if conscious.

Ether peroxides

Ether peroxides are formed in small quantities wherever ethers are stored, especially in light. They are also produced where ethers react with strong oxidising agents, eg. H_2O_2 .

Use

As ether phase after shaking diethyl ether with hydrogen peroxide for bleaching foxed paper.

Properties

Of ether/peroxide mixture - extremely unstable compound; explosive if subjected to heat or shock.

Storage

DO NOT STORE — DISPOSE IMMEDIATELY AFTER USE.

Disposal

Small quantities can be released slowly to drain with large amounts of water. Large amounts through specialised contractor. **DO NOT STORE**; dispose immediately after use.

Handling

Work in fume cupboard; impact-resistant goggles; neoprene or nitrile rubber gloves.

2-Ethoxyethanol $C_2H_5OCH_2CH_2OH$

Synonyms

Cellosolve*; ethylene glycol monoethyl ether; glycol ethyl ether; hydroxyether.

Normal state

Colourless liquid with sweetish odour.

Uses

In nitrocellulose lacquer; resin and oil solvent; inhibits curing of silane* monomer trimethoxymethylsilane (stone consolidant).

Properties

B.P. 135.6°C.

Flammability

Flammable. Flash point 45°C closed cup. Explosive range in air 1.8-14%. Moderate explosive hazard if vapour exposed to heat or flame.

Fire extinguishers

Carbon dioxide; dry chemical; water.

Incompatible with

Strong oxidants; strong acids or alkalis; nitrates; copper and its alloys.

Spills

Absorb with paper; leave in fume hood to evaporate in glass or iron dish; burn paper.

Storage

Avoid moisture, ignition sources; keep containers closed.

Handling

Rubber, nitrile or neoprene gloves; face shield; cartridge respirator or work in fume cupboard.

USA: TLV/TWA: 5 ppm (skin).

UK: MEL: 10 ppm (LTEL).

Effects of exposure

Can be absorbed through skin. Vapours irritate eyes and nose; may produce blood changes above 200 ppm and kidney damage on chronic exposure.

Poisonous to nervous system and blood.

Skin: redness, irritation.

Eyes: irritation.

Inhalation: breathing difficulties.

Ingestion: sore throat, nausea, pain, drowsiness, confusion. Damage to liver, blood cells and kidneys.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly in water.

Eyes: irrigate in water — **seek medical aid.**

Inhalation: move to fresh air; give O₂ if necessary. **Seek medical aid.**

Ingestion: if conscious give plenty of water to drink. Keep warm and at rest. **Seek medical aid.**

PRECLUDE FROM EXPOSURE workers with liver and kidney disease.

2-Ethoxyethanol acetate



Synonyms

Cellosolve[®] acetate; ethoxy acetate; ethylene glycol monoethyl ether acetate.

Hazards

see 2-ethoxyethanol

Handling

Wear goggles; and gloves of medium/heavy weight natural or nitrile rubber; work in fume hood or with respirator.

USA: TLV/TWA: 5 ppm (skin).

UK: MEL 10 ppm (LTEL).

Ethyl acetate $\text{CH}_3\text{COOC}_2\text{H}_5$

Synonyms

Acetic ether; acetic acid ethyl ester; ethyl ethanoate.

Normal state

Colourless, fragrant volatile liquid.

Uses

Solvent: solvent for nitrocellulose, varnishes; used in Pliantex* leather consolidant.

Properties

B.P. 77°C.; S.G. 0.90. Soluble in ethanol, acetone, ether, chloroform. Slightly soluble in water.

Flammability

Severe fire and explosion risk. Flash point -5°C. Flammable limits 2.2-11.5%. Moderate fire hazard when exposed to flame.

Fire extinguishers

Alcohol foam; dry chemical; carbon dioxide.

Incompatible with

Oxidising agents, bases, acids, moisture and heat.

Spills

Absorb onto paper; evaporate in fume cupboard on glass or iron dish; burn paper.

Storage

Keep containers closed; store in cool, well-ventilated place with no sources of ignition.

Handling

Goggles, neoprene or nitrile gloves. Avoid breathing vapour, work in fume hood. **Avoid all sources of sparks and open flame.**

USA: TLV/TWA: 400 ppm (1400 mg/m³) Odour threshold: 0.0056-50 ppm

UK: OES: 400 ppm (LTEL).

Effects of exposure

Moderately toxic if inhaled or absorbed through skin. Conjunctivitis; dermatitis; narcosis.

Skin: defatting agent — long exposure causes dryness and cracking.

Eyes: vapours — irritation. Splashes may cause severe irritation of conjunctiva.

Inhalation: irritation of upper respiratory tract. Severe overexposure may cause weakness, drowsiness, unconsciousness.

Ingestion: **toxic;** nausea and above symptoms; may cause kidney failure. Chronic poisoning can lead to anemia.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly in water. If irritation persists, **seek medical aid.**

Eyes: irrigate thoroughly in water — **seek immediate medical aid.**

Inhalation: move to fresh air. Give O₂ if breathing difficult, artificial respiration if breathing stops. **Seek medical aid.**

Ingestion: **seek medical aid immediately.**

Ethylene dibromide $\text{CH}_2\text{H}_4\text{Br}_2$

CARCINOGEN: AVOID ALL USE.

Synonyms

1,2 dibromomethane; ethylene bromide

Normal state

Colourless liquid or solid.

Uses

Solvent; fumigant. Not an approved pesticide under UK's 1986 Pesticide Regulations: see p.13.

Properties

S.G. 2.172; M.P. 9.1°C.; B.P. 131-132°C.

Flammability

Non-flammable.

Incompatible with

Slowly decomposes in presence of light to produce poisonous hydrogen bromide, bromine and carbon monoxide. Reacts violently with metals eg Al, Mg, Na, Zn, K, Ca; strong alkalis and oxidising agents, liquid ammonia.

Spills

Absorb on paper towel; leave to evaporate in fume hood in glass or iron dish. Burn paper.

Storage

Protect container from damage. Keep in a secure cool, dry, well-ventilated place away from any fire hazard. Avoid light, chemically active metals, liquid ammonia, strong oxidisers.

Handling

Neoprene or nitrile gloves; goggles, self-contained breathing apparatus, fume cupboard.

Odour threshold: 10 ppm.

USA: OSHA PEL; TWA: 20 ppm; CL 30 ppm

UK: MEL 1 ppm (LTEL)

Effects of exposure

Toxic: transfer patient to hospital for further treatment. Carcinogen.

Skin: severe irritation. Can be absorbed through skin; **poison** by skin absorption — can cause internal damage; symptoms similar to inhalation.

Eyes: irritation.

Inhalation: mild poisoning — shortness of breath. Severe poisoning — shortness of breath due to lung congestion. Drowsiness, slurred speech, tremors, blurred vision, shock. Unconsciousness and convulsions, kidney and liver failure may occur later.

Ingestion: **poison**; nausea and vomiting; other symptoms as for inhalation. May cause liver and kidney damage.

FIRST AID

Skin: remove contaminated clothing wash thoroughly with soap/mild detergent and water. If irritation persists, **seek medical aid**.

Eyes: irrigate thoroughly with water — **seek medical aid immediately**.

Inhalation: move to fresh air. If breathing difficult give O₂, artificial respiration if breathing stops. Keep warm and at rest, **seek medical aid** as soon as possible.

Ingestion: **medical aid immediately**. If conscious give water to drink. Keep warm and at rest.

PRECLUDE FROM EXPOSURE workers with diseases of liver and kidney.

Ethylene glycol $\text{CH}_2\text{OH}\cdot\text{CH}_2\text{OH}$

Synonyms

Glycol; 1,2-ethanediol; ethylene alcohol; glycol alcohol; EG.

Normal state

Colourless, odourless, viscous liquid with sweetish taste.

Uses

Solvent; substitute for glycerol; in conjunction with olein soap for softening ethnographical semi-tanned leather.

Properties

Hygroscopic. M.P. -13°C .; B.P. 197°C . Soluble in water, ethanol. Vapours only occur if heated. S.G. 1.113.

Flammability

Flammable. Flammable limits in air 3.2-5%. Flash point 116°C . Combustible if exposed to heat or flame.

Fire extinguishers

Dry chemical; carbon dioxide; alcohol foam; water spray.

Incompatible with

Perchloric acid; silvered copper wire; strong bases; strong oxidising agents; chromium trioxide; potassium permanganate; sulphuric acid.

Spills

Absorb onto paper; leave to evaporate in glass or iron dish in fume cupboard; burn paper.

Storage

In resin-coated steel or aluminium containers — corrodes iron and copper. Close tight to exclude moisture. Keep away from oxidising agents.

Handling

Rubber, nitrile, neoprene or vinyl gloves.

USA: TLV/TWA: 10 mg/m^3 (particulate) TLV: CL: 50 ppm for vapour (occurs only if heated).

UK: OES: particulate 10 mg/m^3 (LTEL); vapour 60 mg/m^3 (LTEL); 125 mg/m^3 (STEL).

Effects of exposure

Poisonous if swallowed or absorbed through skin.

Toxic concentrations unlikely to occur at room temperature. Readily absorbed through skin; may cause conjunctivitis and nausea, vomiting if swallowed. Anorexia; depression of central nervous system: respiratory, kidney and cardiac failure if swallowed.

Suspect carcinogen.

FIRST AID

Skin: wash thoroughly with soap and water.

Eyes: irrigate thoroughly with water; **seek medical attention.**

Inhalation: move to fresh air. Give artificial respiration if breathing stopped. O₂ if difficult.

PRECLUDE FROM EXPOSURE workers with diseases of the kidney, liver, lungs, or central nervous system.

Ethylene oxide $\text{CH}_2\text{CH}_2\text{O}$

EXTREMELY HAZARDOUS — AVOID ALL USE, EXCEPT BY FULLY TRAINED PERSONNEL.

Synonyms

1,2-epoxyethane; oxirane; dimethylene oxide; EO.

Normal state

Gas at room temperature.

Uses

Fumigant; rocket propellant. Not an approved pesticide under UK's 1986 Pesticide Regulations: see p.13.

Properties

B.P. 10.4°C. Gas at room temperature, liquid below 12°C. Soluble in water, methanol, benzene, diethylether, most organic solvents; blood.

Flammability

Highly dangerous fire and explosion risk. Flammable gas. Flammable limits in air 2-100%. Explosive mixture with air; flammable in liquid form. Flash point 20°C.

Fire extinguishers

Dry chemical; carbon dioxide for small fire only. Water spray from safe distance — automatic system preferred.

Incompatible with

Oxides, chlorides, acids, bromomethane, alcohols, ammonia; alkali hydroxides; covalent halides; iron oxide; silver, mercury, magnesium (or their alloys); organic bases, caustic alkalis, metallic sodium and all combustibles.*

Spills

Absorb with paper; leave to evaporate in glass or iron dish in fume hood; burn paper.

Storage

Protect container from physical damage; check frequently for leaks. Store in outside or distant secure storage out of direct sunlight. Keep cool with adequate refrigerator system (ie spark-free — thermostat and electrical system must be sealed off from chemicals), and water sprinkler system.

Do not store in same cupboard or storage cabin as: oxides, chlorides, acids, organic bases, caustic alkalin, metallic sodium or combustible material.

Handling

Neoprene gloves; goggles, self-contained breathing apparatus. Passive dosimeter badges recommended by NIOSH.

USA: TLV/TWA: 1 ppm (0.5 ppm in USSR) Ceiling: 5 ppm/10 mins. **Odour threshold:** 320 ppm (lower) 1700 ppm (upper).

UK: MEL: 5 ppm (LTEL).

Effects of exposure

Suspect human carcinogen. Mutagen.

Skin: may cause frostbite, then severe blistering; severe dermatitis.

Eyes: will cause corneal erosion.

Inhalation: severe irritation of respiratory tract; cough; breathing difficulties; nausea; palpitations. May affect liver and kidneys.

May be a human sensitiser. Frequent high doses may affect fertility.

FIRST AID

Skin: wash thoroughly with soap and water. For frostbite (indicated by white numb areas) restore circulation slowly by immersion in cool/slightly warm water, or by gentle friction. **Seek medical attention.**

Eyes: irrigate with water; **seek medical aid.**

Inhalation: move to fresh air; **seek medical aid.**

Ingestion: **seek medical aid immediately.** Keep warm and at rest.

* **HANDLING PROCEDURES** described in: Hess, L.G. et al, *Industrial Engineering Chemistry* 1950 (42) 1251.

Ferroclene P3 , Ferroclene 389

Commercial liquid designed to strip rust from iron work and leave a protective phosphate layer on the surface.

Based on phosphoric acid (see relevant entry) with chemical strippers.

Spills and disposal

Neutralise to pH 6-9; discharge to sewer with copious water.

Handling

Neoprene or vinyl gloves; goggles.

Ferromede

A de-watering fluid, designed for use with porous corroded iron, but also used with varying success on waterlogged wood.

A mixture of solvents, including hydrocarbons.

Flammability

Flammable. Flash point 46°C.

Fire extinguishers

Carbon dioxide; dry chemical.

No data on disposal, spillages, storage.

Handling

Avoid breathing vapours; protect eyes and skin from direct contact.

Effects of exposure

Skin and eyes : irritation; toxic if enters bloodstream e.g. through cut or wound.

Inhalation: irritation.

Ingestion: toxic.

No first aid data supplied.

Fibreglass

Synonyms

Glasswool; glass fibre; fibrous glass.

Uses

Reinforcing resin moulds, casts or supports.

Handling

Wear protective clothing; gloves, goggles, mask. Clean up with vacuum cleaner or wet cleaning methods - not a brush.

USA: TLV/TWA: 10 mg/m³ (dust).

Effects of exposure

Routes of entry; inhalation and skin contact.

Different dimensions of fibres produce different effects.

Large diameter fibres (ie. over 3.5 μm) cause skin, eye and upper respiratory tract irritation; relatively low frequency of fibrotic changes, but may aggravate a respiratory condition.

Small diameter fibres can penetrate the alveoli of the lungs.

Experimental carcinogen by inhalation.

Formaldehyde HCHO

AVOID USE

Synonyms

Oxomethane; formalin; oxymethane; methylene oxide; methanal; formic aldehyde; methyl aldehyde. Solid form: paraformaldehyde; A-trioscane.

Normal state

Colourless, pungent gas usually supplied as a 30-50% aqueous solution = formalin solution in water with 0-15% methanol, which is added to prevent polymerisation. Approved under UK's 1986 Pesticide Regulations see p.13.

Uses

Disinfectant; in production of melamine-formaldehyde resins, urea-formaldehyde resins. Residual formaldehyde may occur in some resins, in manufacture of chipboard, hardboard, adhesives, foam insulation. Preserving solution for natural history specimens.

Properties

Very soluble in water; soluble in most organic solvents. Gas boils at -19°C ; formalin solution at 98°C .

Flammability

Moderate explosive hazard if exposed to heat or flame.

Flammable. Flash point depends on amount of methanol in the solution: eg 36% formaldehyde solution with 6% methanol, flash point 72°C ; with 10% methanol, flash point 63.8°C ; with 15% methanol, flash point 50°C . Explosive limits in air 17-73% Vapour will burn.

Fire extinguishers

Carbon dioxide; foam; water spray; dry chemical.

Incompatible with

Strong oxidisers (e.g. hydrogen peroxide); magnesium carbonate; hydrogen peroxide; strong alkalis, acids, phenols, urea. Oxidising agents; **May form bis-chloromethyl ester (a powerful carcinogen with TLV 0.001 ppm) — with HCl.**

Spills

Absorb on paper or rags; leave to evaporate in a fume cupboard in a glass or iron dish; burn paper/rags.

Storage

In cool, well ventilated place; no static electricity, or sources of spark. Avoid oxidising or alkali materials.

Handling

Goggles, rubber, nitrile gloves. Use only in fume cupboard.

USA: TLV/TWA: 1 ppm; **TWA/STEL: Ceiling limit:** 2 ppm. Severe irritation of eyes and throat at 2-10 ppm; lachrimation c.4 ppm.

UK: MEL: 2 ppm (**LTEL** and **STEL**)

Effects of exposure

Listed as **animal carcinogen** but research has not yet confirmed this. **Use with caution.**

Skin: burns, dermatitis; hives; sensitiser; allergen.

Eyes: conjunctivitis; irritation; burns; eye damage.

Inhalation: loss of sense of smell; bronchitis; rhinitis; palpitations; jaundice; nosebleeds; may cause allergy in upper respiratory tract; unusual thirst.

Ingestion: Highly toxic. Nausea, vomiting, loss of consciousness.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with soap and water.

Eyes: irrigate with water; **seek medical aid.**

Inhalation: move to fresh air; **medical aid if necessary.** Give O₂ or artificial respiration if necessary.

Ingestion: **seek medical advice immediately;** if conscious give plenty of water to drink.

Formic acid HCOOH

Synonyms

Methanoic acid; hydrogen carboxylic acid; formylic acid; aminic acid.

Normal state

Colourless, flammable fuming liquid with pungent odour.

Uses

Stripping bronzes; removing copper corrosion from silver; decalcifier; strong reducing agent; latex coagulant.

Properties

M.P. 8.4°C .; B.P. 100.5°C . Strong acid; corrosive - attacks wood. Glass with high sodium content affected by long-term exposure to vapour. Miscible with water; alcohol.

Flammability

Flammable; explosive. Flash point 68.9°C . Explosive range in air 14-33%.

Fire extinguishers

Carbon dioxide; dry chemical; foam.

Incompatible with

Sulphuric acid; strong oxidisers; hydrogen peroxide; strong caustics.

Spills

Mix with soda ash or sodium bicarbonate, add plenty of water and release to drain.

Storage

In cool, dry, well-ventilated place. No direct heat or sunlight. 98-100% formic acid may deteriorate in storage, releasing carbon dioxide. Periodically loosen container's cap to release pressure and prevent rupture.

Handling

Goggles, rubber, neoprene or nitrile gloves; cartridge respirator or fume hood.

USA: TWA/TLV: 5 ppm. Highly toxic and irritating.

UK: OES: 5 ppm (LTEL)

Effects of exposure

Suspect carcinogen; highly corrosive.

Skin: absorbed through skin; corrosive liquid causes severe local burns; dermatitis; keratosis.

Eyes: conjunctivitis; burns.

Inhalation: rhinitis; cough; bronchitis; breathing difficulties.

Ingestion: ulcerative stomatitis; kidney damage; corrosion of glottis, oesophagus, stomach; vertigo; vomiting; diarrhoea.

FIRST AID

Skin: remove contaminated clothing; wash off skin with plenty of water, or 5% aqueous solution sodium carbonate initially, then plenty of water.

Eyes: as for skin; **seek medical aid.**

Inhalation: move to fresh air; **seek medical aid.**

Ingestion: give plenty of water to drink; do not induce vomiting. **Seek medical aid.**

Frigilene lacquer*

Commercial nitrocellulose lacquer in mixture of xylene, n-butyl acetate, n-butyl alcohol.

Flammability

Highly flammable; vapour forms explosive mixture with air.

Fire extinguishers

Foam; carbon dioxide; dry chemical.

USA: TLV: 50 ppm. (Supplier's information).

See information under: xylene; n-butyl alcohol.

Frigilene* reducer

Commercial thinner for Frigilene* lacquer; mixture of organic solvents including xylene, n-butyl alcohol.

Flammability

Highly flammable. Flash point 25°C. Gives off flammable vapours at room temperature.

Fire extinguishers

Foam; carbon dioxide; dry chemical.

USA: TLV: 50 ppm (Supplier's information).

Fumed silica SiO_2

Synonyms

Amorphous silicon dioxide; pyrogenic silica; colloidal silica; silica aerogel. Aerosil*; Cab-O-Sil*; Tullanox*.

Normal state

Very fine white flakes.

Uses

Thickening agent; filler.

Properties

Melting point: 1700°C.

Spills

Spray gently with water and sweep up; release to drain with plenty of water. Wear dust mask.

Handling

Absorbed through inhalation. Wear gloves and goggles.

USA: OSHA PEL: 80mg/m³ as respirable dust.

UK: OES: 3 gm/m³ (LTEL).

Effects of exposure

Skin: dehydration.

Inhalation: harmful. May cause some irritation; particle size is smaller than that associated with lung damage, so is not expected to cause silicosis.

Ingestion: moderately toxic.

FIRST AID

Inhalation: move to fresh air.

Fungi

All fungi mentioned below have been found in archival and ethnographic material.

Some fungi and micro-organisms may produce substances that are toxic or carcinogenic; **some species of *Aspergillus* and especially *Aspergillus flavus*, produce highly carcinogenic metabolites — the Aflatoxins.** Aflatoxins can be degraded by sodium hypochlorite with an alkaline or oxidising reagent.

When handling mouldy specimens or material that has been a long time in storage, wear gloves and suitable high efficiency dust respirators. Wash thoroughly afterwards; remove contaminated clothing and wash and iron before re-use.

Soft, dirty paper with a porous, irregular surface, is more capable of carrying microbial growth.

A worker can be infected by fungal materials by inhalation, ingestion, or contact with skin or mucous surfaces. Mycotoxins (ie toxins from fungi) can have acute and chronic effects on liver, kidneys, lungs and nervous system. Commonest spores found on cellulosic materials are *Aspergillus fumigatum*, followed by *Aspergillus flavus*, *Aspergillus niger*, *Aspergillus terreus* etc. Symptoms are similar to tuberculosis and fungal material can also affect the eyes. *Aspergillus niger* is the commonest agent of skin and ear infections. In very serious cases some forms of *Aspergillus* can cause liver necrosis, and kidney damage; abscesses in lungs, heart, liver and other organs. Some natural adhesives may contain carcinogenic metabolites produced by (eg.) *Aspergillus flavin*.

Mucous membranes and intestines may be seriously affected by *Stochybotrys* (common in archive material).

Destroy by fumigation.

Reference: Kowalik, R.: 'The Problems of the Toxicity of cellulosic micro-organisms causing damage to library materials'. *Restaurator* Vol.6 1984 p.106-115.

Furfural C_4H_3OCHO

Synonyms

2-furaldehyde; pyromucic aldehyde; fural; 2-furalcarbonal; furfurole(e).

Normal state

Colourless liquid that may become reddish-brown by partial oxidation or polymerisation on exposure to light and air.

Uses

Corrosion inhibitor for metals in alkaline solutions; corrosion cleaners; solvent.

Properties

M.P. 86.5°C; B.P. 161.8°C.; S.G. 1.159. Slightly soluble in water; soluble in alcohol, ether, benzene.

Flammability

Flammable; ignition temperature 391.3°C. Flashpoint 60°C. Auto-ignition temperature 315°C. **Explosive hazard:** explosive limits in air 2.1-19.3%. Explosive hazard if exposed to heat or flame.

Fire extinguishers

Water spray; carbon dioxide; dry chemical; alcohol foam.

Incompatible with

Acids; mineral oils - violent reaction, perhaps with ignition; oxidising materials.

Spills

Absorb with rags or paper; leave to evaporate in fume cupboard; burn paper.

Storage

Avoid contact with heat, flame, acids and mineral oils; store in standard flammable liquids store — outside/detached store preferable.

Handling

Goggles, rubber gloves, breathing apparatus or fume cupboard.

USA: TLV/TWA: 2 ppm.

UK: OES: 2 ppm (LTEL); 10 ppm (STEL).

Effects of exposure

Can be absorbed through skin. Poisonous to central nervous system.

Skin: irritation; severe burns may occur.

Eyes: irritation; watering; burns may occur.

Inhalation: shortness of breath; coughing; congestion of lungs; unconsciousness.

Ingestion: toxic; severe headache; loss of sense of taste; breathing difficulties vomiting, nausea. Blood may be vomited.

FIRST AID

Skin: remove contaminated clothing; wash skin thoroughly with soap and water if irritation persists after washing, **seek medical aid.**

Eyes: rinse thoroughly with water; **seek medical aid immediately.**

Inhalation: move to fresh air. Support in upright position if lungs congested; **seek medical aid** as soon as possible.

Ingestion: If conscious give 1 pint water to drink immediately then 1 pint milk; **seek medical aid.** Keep warm and at rest.

Furniture cleaner/renovator (Joel's)

Emulsion of organic solvents and vegetable oil containing very dilute organic acids. Includes methylated spirits and turpentine.

Flammable — flash point 25°C.

see: turpentine; ethanol.

Gasil* matting agent SiO_2

Colourless to grey, odourless powder.

Synthetic amorphous silica.

Silica

USA: TLV 3 mg/m³ total dust, 1 mg/m³ respirable dust.

UK: OES 3 mg/m³ (LTEL).

Handling

Wear dust mask. Some grades of dust can cause silicosis.

Effects of exposure

Skin and Eye contact: highly absorbent; may have drying effect.

See also: Fumed silica.

Gip GLoss Z 1523

Thinner for polyurethane; undisclosed composition. Treat as though moderately toxic and highly flammable.

Glutaraldehyde $\text{OHC}(\text{CH}_2)_3\text{CHO}$

Synonyms

1,5 pentanedial; glutaric dialdehyde.

Normal state

Supplied as 99%, 50% and 25% solution in water. 'Activated' glutaraldehyde contains sodium bicarbonate.

Uses

Disinfectant; sterilization of medical instruments; biological fixative; embalming fluid; leather tanning; treatment of fungal infections.

Properties

Colourless liquid with pungent odour.

Incompatible with

Violent reaction with oxidising materials.

Spills

Discharge to sewer with copious amounts of water.

Handling

In fume cupboard only. Gloves must be viton or nitrile rubber, *not* ordinary rubber; goggles.

USA: TLV/TWA: 0.2 ppm. **Ceiling:** 0.2 ppm. **Odour threshold:** can be as low as 0.04 ppm; above 0.5 ppm 'intolerably irritating'.

UK: OES: 0.2 ppm (LTEL); 0.2 ppm (STEL).

Effects of exposure

Suspect carcinogen; experimental teratogen; mutagenic data. Little known about long-term effects.

Irritation as low as 0.3 ppm. Activated type is more irritating.

Skin: can be absorbed through skin. Will cause severe irritation and redness, dermatitis; sensitiser.

Eyes: severe irritation, redness, pain; splashes can cause permanent corneal damage.

Inhalation: irritation even at a low concentration; allergic asthma, headaches, dizziness, slowed reactions; lung congestion; unconsciousness at high levels.

Ingestion: Very toxic by ingestion. Symptoms as for inhalation; also nausea, vomiting, diarrhoea, convulsions, loss of consciousness.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with water. If irritation persists, **seek medical aid**.

Eyes: irrigate thoroughly with water and **seek medical aid** immediately.

Inhalation: move to fresh air; give O₂ if breathing difficult. **Seek medical aid**.

Ingestion: keep warm and at rest; if conscious, rinse mouth with water; give large amounts of water to drink. **Seek medical aid** immediately.

If sensitised to this chemical, avoid further use.

Glycerine $\text{CH}_2\text{OH}.\text{CHOH}.\text{CH}_2\text{OH}$

Synonyms

Glycerol; 1,2,3-propanetriol.

Normal state

Clear, colourless, viscous liquid.

Uses

Soap manufacture; rinsing fragile wool and silk — to restore flexibility; in alkaline glycerol for stripping bronzes; plant preservation; adjusting hygroscopticity of PEG; mountant for microscope work.

Properties

M.P. 17.8°C.; S.G. 1.27.; B.P. 290°C. Soluble in water and alcohol; slightly soluble in ethyl acetate.

Flammability

Flash point 160°C. Combustible if exposed to heat or flame.

Fire extinguishers

Water; carbon dioxide; dry chemical

Incompatible with

Highly explosive with hydrogen peroxide.

May be explosive in contact with strong oxidisers eg bichromate, potassium chlorate, potassium permanganate (ignites on contact), calcium hypochlorite; nitric acid; perchloric acid with lead oxide; acetic anhydride; ethylene oxide with heat.

Spills

Absorb on paper; leave to evaporate in fume hood in glass or iron dish; burn paper.

Storage

Store in flammable chemicals store. Keep away from strong oxidisers.

Handling

Medium/heavy weight natural or nitrile rubber gloves.

USA: TLV/TWA: mist 10 mg/m³. UK: OES: 10 mg/m³ (LTEL); as mist.

Effects of exposure

Mildly toxic by ingestion; mist is irritant to skin and eyes. If swallowed systematic effects are insomnia, nausea, vomiting, fever. Very high dosages may have toxic effect on kidneys. Experimental reproductive effects; human mutagenic data.

FIRST AID

Skin: remove contaminated clothing; local contamination — wash off with soap and water.

Eyes: irrigate with water.

Ingestion: give plenty of water to drink, if patient conscious.

Goddard's long term brass & copper polish

Normal state

Free-flowing brown liquid: a suspension of polishing powders, fatty acids, tarnish inhibitor, ammonia and hydrocarbon solvent.

Uses

Cleaner/polisher for copper-based metals.

Properties

Insoluble in water.

Flammability

Flammable. Flash point (open cup): 35°C.

Fire extinguishers

Dry chemical/carbon dioxide.

Incompatible with

None

Spills

Absorb on sand. Incinerate. Swill area with hot detergent solution.

Storage

Store away from naked flame; keep cool.

Handling

Wear gloves — natural, rubber or vinyl.

Effects of exposure

Skin: moderate irritant

Eyes: irritant

Inhalation: over exposure to ammonia may cause nausea and affect breathing (see relevant sheet) but unlikely in normal use.

Ingestion: moderately toxic.

FIRST AID

Skin: wash with soap and water

Eyes: irrigate with water; **seek medical advice.**

Inhalation: remove to fresh air.

Ingestion: do not induce vomiting. **Obtain medical advice.**

Suppliers (Johnson Wax) information. Supplier operates 7 day, 24 hour emergency telephone advisory service. Camberley 0276 63456.

Goddard's long term foaming silver polish

Normal state

Red/brown firm paste with a sweet/chemical odour. Aqueous dispersion of surfactants, jeweller's rouge, diatomaceous earth, tarnish inhibitor, perfume and allowed preservative.

Properties

Soluble in water

pH 7.2

Flammability

Non combustible

Spills

Wipe up and swill area with copious water.

Storage

Avoid extremes of temperature — do not freeze. 2 year shelf life.

Handling

Wear: gloves — if repeated contact.

Effects of exposure

Skin: mild irritant.

Eyes: mild irritant.

Inhalation: no hazard.

Ingestion: practically non toxic.

FIRST AID

Skin: wash with soap and water.

Eyes: irrigate with water.

Inhalation: remove to fresh air.

Ingestion: obtain medical advice. Johnson Wax operates a 7 day 24 hour telephone emergency advisory service.

Goddard's long term silver polish

Normal state

Viscous pink liquid with sweet chemical odour. Consists of a dispersion of diatomaceous earth, mineral abrasives, jeweller's rouge, tarnish inhibitor, surfactants and perfume in water/alcohol mixture.

Uses

Cleaner/polish/protector for silver and silverplate.

Properties

Partly soluble in water.

pH 7.0. SG 1.068

Flammability

Non-combustible.

Spills

Absorb with sand or sawdust; dispose as non-toxic waste. Swill spill area with water.

Storage

Do not freeze. 2 year shelf-life.

Handling

Wear: gloves for prolonged or repeated contact.

Effects of exposure

Skin: mild irritant.

Eyes: mild irritant.

Inhalation: no hazard.

Ingestion: practically non-toxic.

FIRST AID

Skin: wash with soap and water.

Eyes: irrigate with water; **obtain medical advice.**

Inhalation: remove to fresh air.

Ingestion: obtain medical advice.

Suppliers (Johnson Wax) information. Supplier operates 7 day 24 hr emergency telephone advisory service.

Goddard's Silver Dip

Normal state

Clear liquid with slight smell of rotten eggs.

Uses

Cleaning of badly tarnished (modern) silver.

Properties

Aqueous solution of a mineral acid, surfactant, and organic complexing agent, with a trace of alcohol and perfume. pH 1.0; SG 1.03. Soluble in water.

Flammability

Non-combustible.

Incompatible with

Bleach or alkaline cleaners; stainless steel, copper, brass, bronze.

Spills

Absorb with sand. Swill area with water.

Storage

Store away from bleach, alkalis, etc. Do not allow to freeze. 2 year shelf life.

Handling

Gloves, goggles, fumehood, Toxic hydrogen sulphide gas evolved during use (RL 10 ppm, though smell is nauseating at 2 ppm).

USA: TLV: No data: See above.

Effects of exposure

Skin: mild irritant.

Eyes: mild irritant.

Inhalation: fresh product presents no hazard but hydrogen sulphide released in use.

Ingestion: "practically non-toxic".

FIRST AID

Skin: wash with soap and water.

Eyes: irrigate with water; seek medical advice.

Inhalation: move to fresh air; seek medical advice.

Ingestion: obtain medical advice.

Supplier's Information. Supplier (Johnson's Wax) also operates a 24 hr emergency telephone advisory service. 7 days a week. Camberley (0276) 63456.

Graphite C

Synonyms

Black lead; plumbago; mineral carbon.

Normal state

Soft, black solid.

Uses

Mould release agent; colouring agent in waxes for iron coating.

Properties

m.p. 3650°C (sublimes)

Flammability

May induce explosion in powdered state.

Incompatible with

Oxides, peroxides, oxosalts, halogens and other oxidising species; silver nitrate, potassium permanganate; unsaturated (drying) oils — e.g. linseed oil.

Handling

Dust mask.

USA: TLV/TWA: 10mg/m³

UK: OES: 5 mg/m³ (LTEL) respirable dust.

Effects of exposure

Dust hazard.

Inhalation: cough; bronchitis; breathing difficulties.

FIRST AID

Eyes: irrigate with water; if not restored seek medical aid.

Inhalation: move to fresh air; seek medical aid if necessary.

Gum elemi

Natural gum; no known hazards.

Solvents: aryl hydrocarbons, ethers.

Heptane $\text{CH}_3(\text{CH}_2)_5\text{CH}_3$

Synonyms

Dipropylmethane

Normal state

Colourless, transparent, volatile liquid with aromatic odour.

Uses

Can be used to replace benzene

Properties

S.G. 0.68; B.P. 98.4°C.; Soluble in alcohol, ether, chloroform. Insoluble in water. Very volatile.

Flammability

Highly flammable. Flash point -4°C (open cup); (-22°C closed cup) Ignition temp. 223°C. Flammable limits 1.25-6.9% in air. Moderately explosive if exposed to heat or flame.

Fire extinguishers

Carbon dioxide, dry chemical; or alcohol foam.

Incompatible with

Oxidising agents.

Spills

Absorb onto paper; evaporate on iron dish in fume cupboard; burn paper.

Storage

Cool, dark place, well-ventilated. Avoid physical shocks, ignition sources. Container may develop pressure: keep cool.

Handling

Rubber gloves. Face and eye protection; use in fume cupboard. Do not breathe vapour. Avoid ignition sources.

USA: TLV/TWA: 400 ppm. **STEL:** 500 ppm.

UK: OES: 400 ppm (LTEL); 500 ppm (STEL).

Effects of exposure

Irritant to central nervous system.

Skin: irritation; blistering.

Eyes: irritation; redness.

Inhalation: irritation of trachea; exposure to high concentrations may cause narcosis paralysis or convulsions (rare).

Ingestion: severe irritation of throat; nausea; vomiting.

FIRST AID

Skin: remove contaminated clothing; wash affected skin with water. If irritation persists, **seek medical aid.**

Eyes: irrigate thoroughly with water; **seek medical aid.**

Inhalation: fresh air, **medical aid if necessary.**

Ingestion: keep warm and at rest. If conscious, give water to drink and **seek medical aid immediately.**

n-Hexane $\text{CH}_3(\text{CH}_2)_4\text{CH}_3$

Synonyms

Caproyl hydride; hexyl hydride.

Normal state

Colourless volatile liquid. Commercial grades — impurities cyclopentane and up to 6% benzene.

Users

Solvent; especially for fats, rubber adhesive. Contained in low-boiling naphtha, petroleum ether, and mixtures of boiling range 35-80°C.

Properties

b.p. 69°C. s.g. 0.66. Insoluble in water; soluble in alcohol, chloroform, acetone, ether.

Flammability

Highly flammable-severe fire risk. Flash point -23°C. Flammable limits 1.1-7.5%. Flash back may occur.

Fire extinguishers

Carbon dioxide; dry chemical; alcohol foam.

Incompatible with:

Strong oxidizers.

Spills

Absorb on paper; leave in fume hood to evaporate in glass or iron dish; burn paper.

Storage

Keep in closed container in cool dark place; no ignition sources.

Handling

Neoprene or nitrile rubber gloves, goggles. Work in fume cupboard.

USA: TLV/TWA: 50 ppm

UK: OES: 100 ppm (LTEL); 125 ppm (STEL) under review

Effects of exposure

Highly toxic; suspect carcinogen; experimental teratogen.

Causes irritation of the bronchus; vertigo; numbness of the extremities.

Skin: delatting agent — over exposure may cause cracking and dermatitis.

Eyes: irritation.

Inhalation: irritation of upper respiratory tract. Lightheadedness, giddiness, nausea, headache. Very high exposure may cause unconsciousness and death.

Ingestion: toxic; irritation, numbness, muscular weakness.

FIRST AID

Skin: wash thoroughly in soap and water; remove contaminated clothing. If irritation persists, **seek medical aid.**

Eyes: irrigate thoroughly in water; if irritation persists, **seek medical aid.**

Inhalation: move to fresh air. Give O_2 if breathing difficult, and artificial respiration if stopped. **Get medical aid as soon as possible.**

Ingestion: do not give water — **seek medical aid immediately.** Keep warm and at rest.

HMG adhesive

Cellulose nitrate adhesive; also used in consolidation.

Plasticised cellulose nitrates in a blend of ketones, esters, and alcohols. Flash point -15°C, highly flammable. Lower explosive limit 2-6% in air.

Fire extinguisher:

Carbon dioxide; dry powder or inert material eg. sand.

Spillage

Mop up with inert material or tissues and allow to evaporate in fume hood. Dispose as non-toxic waste.

Handling:

USA: TLV: see (for example) amyl nitrate, acetone, ethanol.

Effects of exposure:

May cause nausea, but unlikely in normal use.

Skin: prolonged exposure may cause dermatitis as a result of defatting.

Eyes: irritation.

Inhalation: may cause drowsiness.

Ingestion: do not induce vomiting. Keep warm and at rest; if conscious give water to drink, and seek medical aid.

See also: Cellulose nitrate.

Hydrazine hydroxide N_2H_5OH

Synonyms

Hydrazine hydrate.

Normal state

Anhydrous form is colourless, oily fuming liquid; ammoniacal odour.

Uses

Aqueous solution for removal of brown staining on medieval glass; component of urethane resins.

Properties

B.P. 118.5°C., M.P. 2.0°C. Strong reducing agent; weak base. Miscible with water. Soluble in ethanol; insoluble in ether, chloroform.

Flammability

Flash point 52°C.

Incompatible with

Dinitrochlorobenzene; mercuric oxide; sodium; heating; readily oxidisable materials. Attacks glass, rubber and cork.

Spills/Disposal

Cover with a mixture of equal parts (by weight) soda ash or calcium carbonate, clay cat litter (bentonite) and sand. Scoop into container in fume cupboard, slowly add to water — allow 20ml water per gm of hydrazine. Filter off clay and sand: for each gm hydrazine place 38ml (c. 25% excess) of commercial laundry bleach (5.25% sodium hypochlorite) into a 3-necked flask equipped with thermometer, stirrer and dropper. Add hydrazine solution drop by drop with stirring: do not allow temperature to exceed 45-50°C. Continue stirring till temperature falls to room temperature (May take 2 hours). Release to drain with excess water.

Storage

No flame/ignition sources. Outdoor storage preferred; otherwise standard flammable liquids store.

Handling

Avoid contact with eyes and skin: face shield, goggles, rubber gloves, cartridge respirator or self-contained breathing apparatus.

USA: NIOSH REL: CL 0.04 mg/m³. Animal carcinogen.

UK: No data.

Effects of exposure:

Extremely toxic: violent poison; experimental carcinogen.

Skin: burns, sensitizer, blisters; dermatitis.

Eyes: burns.

Inhalation: severe irritation, excitement, convulsions.

Ingestion: severe internal irritation and damage e.g. to liver and kidneys.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with soap and water. **Seek medical aid.**

Eyes: irrigate thoroughly with water; **seek medical aid.**

Inhalation: move to fresh air. If convulsions occur, lay casualty on side. **Seek medical aid.**

Ingestion: if conscious, give plenty of water to drink. Keep warm and at rest; **seek medical aid immediately.**

Hydrochloric acid HCl

Synonyms

Hydrogen chloride.

Normal state

Aqueous solution of hydrogen chloride gas — up to 38% HCl.

Uses

Removal of calcareous salts from pottery, etc; pre-treatment of waterlogged wood and leather.

Properties

B.P. (of gas) -85.03°C.

Incompatible with

Ethylene — explosive reaction on contact. On reaction with strong oxidants can release toxic chlorine. Explosive reactions with potassium permanganate; ammonium hydroxide; sodium hydroxide; sulphuric acid; aluminium.

Spills

Cover with sodium carbonate or 1:1 soda ash and slaked lime. Add large amounts of water and release to drain.

Handling

Work in fume cupboard; use goggles or full face shield, and vinyl, neoprene, nitrile or natural rubber gloves.

USA: TLV/TWA: for HCl gas 5 ppm: (Ceiling). Odour threshold: 1-35 + ppm.

UK: OES: 5 ppm (LTEL & STEL)

Effects of exposure

Extremely irritant and corrosive to mucous membranes.

Skin: severely corrosive; severe burns. Repeated exposure to low concentration may result in dermatitis.

Eyes: severely corrosive; eye irritation, severe burns, loss of sight.

Inhalation: irritation — burns, with cough and choking. Severe breathing difficulties. Ulceration of nose and throat.

Ingestion: severely corrosive, severe burns, pain, nausea, vomiting.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly in water — **seek medical aid immediately.**

Eyes: irrigate thoroughly in water — **seek medical aid immediately.**

Inhalation: move to fresh air; if breathing difficult give O_2 ; artificial respiration if breathing stops; **seek medical aid.**

Ingestion: if conscious give large amounts of water to drink. Do not induce vomiting. **Seek medical aid immediately.** Do not give carbonate salts, etc. in attempt to neutralise the acid: the gas generated may cause severe damage to the stomach.

Hydrofluoric acid HF

Synonyms

Phthoric acid. Ingredient of Neolith 6255; hydrogen fluoride.

Normal state

Supplied as 70% aqueous solution of hydrogen fluoride gas.

Uses

In dilute solution to remove stubborn brown stains from silk, cotton; 'laundry sour'; used in sample preparations in some absorption analyses; for preparation of siliceous geological specimens.

Flammability

Non-flammable.

Fire extinguishers

Water.

Incompatible with

Glycerol + nitric acid; ammonium hydroxide; potassium permanganate; NaOH.

Spills

Cover with sodium carbonate or mixture 1:1 soda ash and slaked lime; mix, add water to form slurry; discharge to sewer with copious water.

Storage

Storage hazard. Difficult to contain as attacks most materials except lead, wax, polyethylene and platinum. May generate hydrogen gas. Reacts with water or steam to form toxic and corrosive gas.

Handling

When working with this chemical always have antidote for skin exposure ready: calcium gluconate jelly.

Neoprene gloves; full face shield; plastic coveralls; use in fume cupboard only.

USA: TLV/CL: 3 ppm (Ceiling Limit) 50 ppm and above may be lethal.

UK: OES: 3 ppm (LTEL); 6 ppm (STEL)

Effects of exposure

Skin: dangerous as initial effect is anaesthetic — victim may not know he has been burned. Causes severe, painful, slow healing burns, which may result in gangrene. Rescuers must wear protective clothing — including gloves, before touching the casualties.

Eyes: severe irritant; burns. Exposure must be kept effectively to zero.

Inhalation: poison; inhalation of fumes causes coughing, spitting blood; congestion of lungs; convulsions; a single inhalation of HF fumes may be fatal by delayed action.

Ingestion: mild poisoning; nausea, vomiting, diarrhoea, pain. Blood may be vomited. Severe poisoning; shock, blurred vision, muscle spasms, shallow breathing, convulsions. Kidney failure may occur later.

FIRST AID

Skin: rescuers **must** wear protective clothing before handling casualty. Remove contaminated clothing; drench burns with water 15-30 mins; ice-cold compresses of a concentrated solution of magnesium sulphate (Epsom salts) or cover with paste of 200 gm magnesium oxide in 240 ml glycerol or calcium gluconate jelly. **Seek medical aid immediately.**

Eyes: rinse out eyes for at least 15 minutes (**speed in starting treatment is crucial**) then saline solution for 30 mins. **Seek medical aid immediately.**

Inhalation: move to fresh air. **Seek medical aid immediately.**

Ingestion: if conscious give milk or calcium gluconate by mouth. **Seek medical aid immediately.** Keep warm and at rest.

Hydrogen peroxide H_2O_2

Synonyms

Hydrogen dioxide; hydroperoxide; peroxide; auricome; perhydrol.

Normal state

Colourless, unstable liquid; supplied as 3%, 35%, 50%, 70%, and 90% solution in water. '30 volume' solution releases 30 times its own volume of oxygen.

Uses

Bleach for textiles, straw, paper by releasing oxygen; breaks down compacted clay on fragile excavated material.

Properties

Unstable; catalytically decomposes with impurities. BP 66.7°C. Very powerful oxidiser.

Flammability

Severe explosion hazard when highly concentrated.

Incompatible with

Highly concentrated solutions (65%) may ignite combustible materials; will explosively decompose in presence of acids, platinum, silver, copper, chromium, iron, zinc, lead and manganese (especially at alkaline pH). Concentrated solutions may form explosive compounds with organic materials that can detonate on impact.

Spills

Small spills: neutralise with dilute sulphuric acid; release to drain with plenty of water; or neutralise with dry sodium bisulphate; test pH, release to sewer with plenty of water.

Storage

Lower concentrations (30%) may decompose inside container in presence of heat and/or sunlight. **Pressure of oxygen gas in container may cause explosion.** Keep separate from combustible materials, organic or easily oxidisable material. Store in cool, well-ventilated and fire-resistant place without ignition sources, no direct sunlight. Fit container with a vent, and date label.

Handling

Wear rubber or nitrile rubber gloves and eye protection; do not inhale fumes.

USA: TLV/TWA: 1 ppm

UK: OES: 1 ppm (LTEL); 2 ppm (STEL).

Effects of exposure

Suspect carcinogen; human mutagenic data. Moderately toxic by skin contact, inhalation and ingestion.

Skin: may cause burns; eczema; dermatitis. Lower concentrations will cause bleaching and a burning sensation. Effects may be delayed.

Eyes: conjunctivitis; corneal inflammation; blindness; high concentrations will cause severe injury and blistering which may be delayed in appearing.

Inhalation: irritation of respiratory tract with wheezing and coughing.

Ingestion: injury to mouth and stomach, with possibly bleeding from oesophagus. Large volumes of O_2 may form in stomach as H_2O_2 decomposes, causing oesophagus to distend; severe damage may occur.

FIRST AID

Skin: remove contaminated clothing; flush with water. **Seek medical aid.**

Eyes: irrigate with water; **seek medical aid immediately.**

Inhalation: move to fresh air. Give O_2 if breathing is difficult, artificial respiration if it stops. Keep warm and at rest and **seek medical aid.**

Ingestion: give large volumes of water to drink (only if patient is conscious). **Seek medical aid immediately.**

Imidazole $C_3H_4N_2$

Synonyms

Glyoxalin; iminazole.

Normal state

Crystals.

Uses

Biological buffer.

Properties

Melting point 90°C. Boiling point 257°C.

Very soluble in alcohol; soluble in water, ether, chloroform, pyridine; slightly soluble in benzene.

Incompatible with

Toxic fumes evolved if heated to decomposition.

Effects of exposure

Moderately toxic by ingestion. **Human mutagenic data.**

Incralac

Commercial solution of acrylic resin in solvent mixture (c. 20% toluene, 5% ethanol).

Highly flammable. Flash point below 23°C.

USA: TLV: 100 ppm

Avoid prolonged skin contact.

For effects of exposure, etc, see toluene, ethanol.

Inhibisol®

Degreasing agent used in taxidermy — contains 1,1,1-trichloroethane (see relevant entry).

Iron salts

Iron salts may be encountered as dusts while handling or cleaning iron objects, or else as powdered pigments (e.g. Iron III oxide, Fe_2O_3 , is also known as burnt sienna, raw umber, burnt umber, iron oxide red, jeweller's rouge, mars red/brown, ochre).

Soluble iron salts are highly toxic if they enter the blood stream (e.g. through a cut or wound); inhalation of the dusts irritates the respiratory tract; and ferric chloride and ferric sulphate in particular irritate the skin and are corrosive. Ferrous salts tend to be more toxic than ferric.

Ferric chloride FeCl_3 (black/brown solid) and ferrous chloride FeCl_2 (green/yellow deliquescent crystals) are moderately toxic if swallowed; irritant and corrosive to eyes, skin and mucous membranes.

Ferric sulphate $\text{Fe}_2\text{O}_3 \cdot \text{S}_3$ is moderately toxic if swallowed

Ferrous sulphate FeSO_4 (pale green crystals) or copperas is moderately toxic if swallowed

Iron pyrites (FeS_2) is toxic if inhaled.

There is evidence for mutagenic effects from ferrous chloride and ferrous sulphate; Iron III oxide and iron II sulphate are experimental tumorigens; iron III oxide is also a suspect human carcinogen.

Handling

Eye protection; gloves; efficient dust respirator. Ensure good personal hygiene e.g. washing hands and face before eating; do not eat in work area.

USA: TLV/TWA 1 mg/m^3 as iron salts

UK: OES 1 mg/m^3 (LTEL) 2 mg/m^3 (STEL) as iron salts.

Isobutyl alcohol $(\text{CH}_3)_2\text{CHCH}_2\text{OH}$

Synonyms

2-methyl-1-propanol; isobutanol; I.B.A.

Normal state

Colourless liquid

Uses

Solvent

Properties

S.G. 0.81; B.P. 108°C. Soluble in water, alcohol and ether.

Flammability

Flammable; FP 28°F(82°F). Explosive limits in air: 1.2-10.9 (at 212°F). **Dangerous fire hazard when exposed to heat or flame.**

Fire extinguishers

Dry chemical, CO_2 or alcohol foam.

Incompatible with

Ignition sources; strong oxidisers (may cause fire or explosion); may react with metallic aluminium at high temperature. In fire, carbon monoxide and other toxic gases may be released.

Spills

Absorb small spills on paper towels; leave to evaporate on iron/glass dish in fume hood; burn paper. Larger spills — absorb on earth or vermiculite, put in bucket and leave in secure open place to evaporate in open air. Do not dispose into sewer.

Storage

Flammable liquids store; keep cool, well ventilated and away from all ignition source.

Handling

Avoid contact with liquid or vapour. Rubber or nitrile rubber gloves, goggles, fume cupboard, or else chemical cartridge respirator with full facepiece or organic vapour cartridge. Do not wear contact lenses.

USA: TLV/TWA: 50ppm Odour threshold: 40ppm

UK: OES: 50 ppm (LTEL); 75 ppm (STEL).

Effects of exposure

Experimental carcinogen.

Skin: severe irritation by exposure will cause defatting, leading to drying and cracking of skin, and dermatitis.

Eyes: severe irritation.

Inhalation: over-exposure may cause dizziness, drowsiness, irritation of upper

respiratory tract and headache. Narcotic at high concentrations.

Ingestion: harmful; moderately toxic.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with water, **seek medical aid** if irritation persists.

Eyes: irrigate thoroughly with water; **seek medical aid** if irritation persists.

Inhalation: move to fresh air and rest. If breathing difficult give O_2 , if stopped, give artificial respiration. **Seek medical aid.** Keep warm and at rest.

Ingestion: **seek medical aid immediately.** Give plenty of water to drink if conscious: Keep warm and at rest.

Isopropanol (CH₃)₂CHOH

Synonyms

Isopropyl alcohol; dimethyl carbinol; 2-propanol; IPA; propan-2-ol.

Normal state

Colourless liquid with slight odour resembling mixture of ethanol and acetone.

Uses

Solvent; soften and swell leather; to 'lead in' water to soften hard and brittle parchment.

Properties

B.P. 82.4°C; S.G. 0.79. Miscible with water, alcohol, ether and chloroform.

Flammability

Highly flammable; flash point 12°C. Explosive range in air 2-13%. May flash back along vapour trail from ignition source.

Fire extinguishers

Alcohol foam; water spray; carbon dioxide.

Incompatible with

Strong oxidisers.

Spills

Small spills — absorb on paper; leave to evaporate in fume hood in glass or iron dish; burn paper. Large spills — absorb in earth or vermiculite and take to a secure open area for atmospheric evaporation.

Storage

Cool, dark, well-ventilated place; flammable liquid store with no sources of heat or ignition.

Handling

Safety glasses/goggles; rubber gloves.

USA: TLV/TWA: 400 ppm (at this level, irritation of eyes, nose and throat) STEL: 500 ppm. Odour threshold: 45-200 ppm

UK: OES: 400 ppm (LTEL); 500 ppm (STEL).

Effects of exposure

Can be absorbed through skin. Experimental teratogenic and reproductive effects.

Skin: irritation; defatting, leading to cracking and dermatitis. Mildly toxic via skin.

Eyes: conjunctivitis; corneal ulceration.

Inhalation: irritation of respiratory tract; headaches; nausea, drowsiness, lack of co-ordination. **Poison;** high concentrations may cause deep narcosis and death.

Ingestion: vertigo; headache; vomiting; anaemia. **Poison.**

FIRST AID

Skin: remove contaminated clothing; wash off with soap and water; if irritation persists, **seek medical aid.**

Eyes: irrigate with water; if irritation persists, **seek medical aid.**

Inhalation: move to fresh air and rest. Give O₂ if breathing difficult, artificial respiration if breathing stops. **Seek medical aid.**

Ingestion: **seek medical aid immediately;** if patient conscious, give plenty of water to drink.

Isopropyl benzene $C_6H_5CH(CH_3)_2$

Synonyms

Cumene; Cumol

Normal state

Colourless liquid

Uses

Suggested benzene replacement

Properties

S.G. 0.864; B.P. 152.7°C. Soluble in alcohol, carbon tetrachloride, ether, benzene; insoluble in water.

Flammability

Highly flammable. Ignition temp. 424°C., explosive range 0.88 - 6.5%. Highly combustible.

Incompatible with

Oxidisers; nitric acid.

Fire extinguishers

Water spray. Dry chemical foam or carbon dioxide. Spray containers with water to cool.

Spills

Absorb on paper — leave to evaporate in glass or iron dish in fume hood. Burn paper.

Storage

Flammable liquids store. Avoid all ignition sources.

Handling

Rubber or neoprene gloves, goggles, chemical cartridge respirator.

USA: TLV/TWA: 50ppm (skin).

UK: OES: 50 ppm (LTEL); 75 ppm (STEL).

Effects of exposure

Can be absorbed through skin; moderately toxic via skin contact or ingestion.

Skin: dermatitis.

Eyes: conjunctivitis.

Inhalation: narcotic irritation to respiratory tract.

Ingestion: irritation of throat; nausea; vomiting.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly in soap and water.

Eyes: irrigate thoroughly in water.

Inhalation: move to fresh air; keep warm and at rest. Give oxygen if breathing difficult. **Seek medical aid.**

Ingestion: if conscious give plenty of water to drink; seek medical aid. Keep warm and at rest.

Jenolite rust removers

Based on phosphoric acid — (see relevant section) with Zn or Mn ions.

Klucel

Synonyms

Hydroxy propyl cellulose

Normal state

Cream-white odourless coloured granular solid, max 2.5% moisture content.

Uses

Thickening agent; adhesive for paper.

Properties

Softens at 130°C. Soluble in water below 38°C; insoluble in water above 45°C; soluble in many polar organic solvents.

Hygroscopic. pH in water 5-8.5.

Flammability

Will burn with difficulty. Ignition temperature 400°C. Excess dust in air is an explosion hazard.

Fire extinguishers

Water, foam, dry chemical.

No hazardous or dangerous reactions known.

Spills

Powder: sweep up and dispose as non-hazardous waste. Solution: mop up and release to sewer with plenty of water. An aqueous solution may make the floor slippery.

Storage

Away from sources of ignition; keep dry.

Handling

Wear rubber or vinyl gloves. Nuisance dust only.

USA: TLV/TWA: 10mg/m³

Effects of exposure

Nuisance dust; slightly toxic by ingestion. Biodegradable.

FIRST AID

Skin: wash with soap and water.

Eyes: irrigate with water.

Inhalation: remove to fresh air.

Ingestion: if conscious give water to drink. **Seek medical aid.** Does not appear to be absorbed via gastro-intestinal tract.

Lactic acid $\text{CH}_3\text{CHOHCOOH}$

Synonyms

α hydroxypropionic acid; 2-hydroxypropanoic acid.

Normal state

Colourless to yellow syrupy liquid or crystals.

Properties

BP 122°C; MP 16.8°C. SG 1.20-1.22

Miscible with water, alcohol, glycerin; soluble in ether; insoluble in chloroform, petroleum ether, carbon disulphide.

Incompatible with

Nitric acid; hydrofluoric acid.

Spills

Cover with soda ash or sodium bicarbonate; mix, add water; neutralize and drain into sewer with sufficient water.

Handling

Eye protection; gloves; mask.

Effects of exposure

Skin: pain, irritation; blisters; burns may occur. Eczema.

Eyes: corneal burns.

Inhalation: tightness in chest; breathing difficulties; cough, sore throat, congestion of lungs may occur.

Ingestion: burns around and inside mouth, sore throat, stomach pain, nausea, vomiting.

FIRST AID

Skin: remove all contaminated clothing; wash well with soap and plenty of water. **Seek medical aid** if irritation persists after washing.

Eyes: irrigate thoroughly with water; **seek medical aid.**

Inhalation: move to fresh air. Keep warm and at rest. Give O_2 if breathing difficult, artificial respiration if stops. If lungs congested, support in upright sitting position. **Seek medical aid.**

Ingestion: if conscious, give 1 pint water to drink, followed by 1 pint milk. Keep warm and at rest; **seek medical aid immediately.**

Laponite* XLG; RD; XLS; RDS

Synthetic water-dispersible clays — used for gelling and thickening in restoration of paintings.

No known toxic effects, but excessive skin contact may cause irritation and dryness; possible dermatitis. Wear dust mask.

Laropal K 80

Synonyms

Ketone Resin 'N'

Components

Cyclohexanone polycondensate resin. Non-hydrolyzable ketone resin.

Normal state

Pellets of a pale colour; with very slight odour.

Uses

Surface coatings; lacquer/paint additive.

Properties

Melting Point: 75-85°C. Soluble in ethanol, propanol, isopropanol, butanol, methyl acetate, ethyl acetate, methoxy ethanol, ethoxyethanol, acetone, butanone, cyclohexanone, toluene, xylene, mineral spirit, turpentine, dichloromethane, styrene. Mass density 1.1gm/cm³. May decompose slightly above 80°C.

Flammability

No data.

Fire extinguishers

Foam/dry chemical/carbon dioxide.

Incompatible with

None reported

Spills

Solid: scoop/brush up and dispose with non-toxic waste. Solutions: absorb with sand or paper, leave to evaporate in safe place, dispose as above.

Storage

Shell life 2 years at 40°C or less. Earth against electrostatic charges.

Handling

Supplier reports no health hazards, but treat as though moderately toxic; avoid prolonged skin contact. Wear gloves, goggles; use dust mask.

Effects of exposure

No data.

FIRST AID

Eyes: irrigate thoroughly with water

Lauryl penta-chlorophenol

Synonyms

Mystox; LPL; LSL.

Normal state

Colourless liquid.

Uses

Fungicide/biocide for cellulose, plastics, paints and botanical specimens. As pure chemical, not approved under UK's 1986 Pesticide Regulations. See p.13.

Properties

Benzene, acetone, oil, waxes, plasticisers.

Effects of exposure:

Very toxic by ingestion and skin absorption.

Lead Pb

Normal state

Blue-grey soft heavy metal; may be encountered as the chief constituent of many artistic, architectural and mechanical artefacts; found in solder and in many alloys. Lead dust, fumes and pastes may be released during cleaning and repair work on these objects.

Properties

B.P. 1740°C; S.G. 11.34 Yields highly toxic fumes when heated.

Flammability

Flammable if exposed to heat or flame in the form of dust; moderate explosion risk.

Fire extinguishers

Foam; copious amounts of water.

Incompatible with

Ammonium nitrate; strong oxidising agents; hydrogen peroxide and trioxane; concentrated sulphuric acid.

Handling

In the UK the Lead Regulations apply and practices must conform to those laid down in the Health and Safety Commission's Approved Code of Practice on the Control of Lead at Work. Wherever lead is likely to be encountered in the work place, an assessment must be made of the likelihood of workers being contaminated by lead in any form, including dust, vapour and paste. Protective measures must be taken (i.e. protective clothing, gloves, efficient fume extraction, dust masks) in accordance with the Code of Practice; and if necessary blood and urine tests should be carried out. Washing and changing facilities should be available; all eating, drinking and smoking should be confined to a separate area; face and hands must be washed before eating, drinking or smoking.

USA: TLV/TWA: 0.15/mg/m³ 0.45 mg/m³ (STEL) for inorganic lead

UK: OES 0.15 mg/m³ (LTEL) for inorganic lead

Effects of exposure

Routes of entry — inhalation as dust or fumes; ingestion as dust, or by accidental contamination of food or drink; poor laboratory hygiene. Organic compounds can be easily absorbed through the skin. A cumulative poison; carcinogenic effects on lungs and kidneys; may cause damage to major organs; poisonous to central nervous system; causes fatigue, headaches, aching joints, insomnia, anaemia; abdominal pains.

Lead carbonate PbCO_3

Synonyms

Cerussite; dibasic lead carbonate; white lead

Normal state

Heavy white powder; lead corrosion product.

Properties

S.G. 6.61 insoluble in water; soluble in acetic acid; nitric acid. If heated will decompose at 400°C to PbO , yielding toxic fumes.

Handling

In UK Lead Regulations apply; see Lead.

USA: TLV/TWA 0.15 mg/m^3 0.45 mg/m^3 (STEL) for inorganic lead

UK: OES 0.15 mg/m^3 (LTEL) for inorganic lead

Effects of exposure

Cumulative; see Lead. Main route of entry inhalation and ingestion; considered somewhat more toxic than lead.

Moderately toxic by ingestion.

Lead dioxide PbO_2

Synonyms

Lead brown; Pb (IV) oxide; lead peroxide.

Normal state

Dark brown crystals or powder.

Properties

M.P. 290°C (decomposes). Insoluble in water; soluble in hydrochloric acid; hot caustic solutions. Powerful oxidiser.

Incompatible with

Vigorous reaction with reducing materials; violent reaction with powdered aluminium; sulphur dioxide; some metal sulphide with heat.

Handling

Gloves, respirator, goggles, fume cupboard. See Lead for UK regulations/requirements.

USA: TLV/TWA 0.15 mg/m³ 0.45 mg/m³ (STEL) for inorganic lead

UK: OES 0.15 mg/m³ (LTEL) for inorganic lead

Effects of exposure

Cumulative poison (see Lead); severe irritant to eyes, skin and mucous membranes.

Lead monoxide PbO

Synonyms

Litharge; massicot; plumbous oxide; yellow (lead) ochre.

Normal state

Red or yellow crystalline material; fine powder if supplied as pigment.

Properties

M.P. 888°C; S.G. 9.53 Insoluble in water; soluble in acetic acid, dilute nitric acid.

Incompatible with

Has several explosive reactions, mostly with materials not found in conservation labs, but including: silicon with aluminium and heat; chlorine with ethylene at 100°C; perchloric acid with glycerol. Violent reaction if heated with powdered aluminium; with chlorinated rubber above 200°C; with dichloromethylsilane; may ignite spontaneously with linseed oil.

Handling

Do not inhale dust; wash after handling; U.K. Lead Regulations apply — see Lead.

USA: TLV/TWA 0.15 mg/m³ 0.45 mg/m³ (STEL)

UK: OES 0.15 mg/m³ (LTEL) for inorganic lead.

Effects of exposure

Cumulative poison (see Lead); moderately toxic by ingestion; skin irritant.

Lead oxide Pb_3O_4

Synonyms

Lead orthoplumbate; lead tetraoxide; mineral orange/red; minium; Paris red, red lead; saturn red; trilead tetroxide.

Normal state

Bright scarlet powder.

Uses

Pigment; glass manufacture.

Properties

M.P. 890°C (decomposes). S.G. 8.32 - 9.2. Oxidising agent.

Incompatible with

May be combustible on reaction with reducing agents; explosive hazard with peroxyformic acid; can ignite on contact with dichloromethyl silane; hazardous reactions with aluminium; silica with aluminium; glycerol with heat.

Handling

Do not inhale dust; wash carefully after handling. U.K's Lead Regulations apply — see Lead.

USA: TLV/TWA 0.15 mg/m³

UK: OES 0.15 mg/m³ (LTEL); for inorganic lead

Effects of exposure

Cumulative poison; moderately toxic by ingestion. See Lead.

Lead sulphate PbSO_4

Synonyms

Pigment white 3; fast white; (Freeman's) white lead; milk white.

Normal state

White crystals or powder.

Properties

S.G. 6.2; insoluble in water, alcohol; soluble in sodium hydroxide; ammonium acetate or citrate; slightly soluble in dilute hydrochloric or nitric acid.

Incompatible with

Potassium (explosive reaction); yields toxic fumes if heated to decomposition (1000°C).

Handling

Do not inhale dust; wear gloves, goggles; use efficient extractor system. In U.K. Lead Regulations apply — see Lead for handling requirements.

USA: TLV/TWA: 0.15 mg/m^3 0.45 mg/m^3 (STEL) for inorganic lead

UK: OES: 0.15 mg/m^3 (LTEL) for inorganic lead

Effects of exposure

Moderately toxic if swallowed; suspect human mutagen; irritating and corrosive to skin, eyes and mucous membranes. Cumulative poison — see Lead.

Lindane $C_6H_6Cl_6$

Synonyms

Gamma benzene hexachloride; 1,2,3,4,5,6-hexachlorocyclohexane; Gamma-hexane*; Gammexane*; constituent of Xylamon*.

Uses

Insecticide; fungicide. As pure chemical not approved as a pesticide under U.K.'s 1986 Pesticide Regulations, though some commercial products are approved. See p.13.

Properties

B.P. 288°C. Melts at 113°C. Soluble in acetone, benzene, ether. Decomposes on heating to phosgene and hydrogen chloride.

Fire extinguishers

Water spray; carbon dioxide; dry chemical or foam.

Spills

Absorb with paper; leave to evaporate in glass or iron dish in fume hood; burn paper.

Storage

No sources fire or ignition (see Properties)

Handling

Goggles, rubber gloves, mask.

USA: TLV/TWA: 0.5 mg/m³

UK: OES: 0.5 mg/m³ (LTEL); 1.5 mg/m³ (STEL).

Effects of exposure

Extremely toxic. N.B. Symptoms may be delayed up to 48 hours after exposure.

Can be absorbed through skin. Very irritating to central nervous system; causes fatty degeneration of liver and kidney; conjunctivitis; headache; fever; diarrhoea; mental confusion. Carcinogenicity suspected: implicated in aplastic anemia.

Skin: maybe mild irritation at point of contact. Can be fatal by skin absorption, with symptoms similar to those of inhalation.

Eyes: irritation and redness.

Ingestion: similar to inhalation.

Inhalation: there may be nausea, vomiting, headache. Hyper excitability, tremors, staggering walk and muscle spasms may be followed by convulsions. Breathing may stop.

NB. More toxic than D.D.T.

FIRST AID

Skin: remove contaminated clothing immediately; wash thoroughly with soap and water. Casualty must be transferred to hospital without delay.

Eyes: irrigate with water.

Inhalation: move patient to open air; give O₂ if breathing difficult.

Ingestion: if conscious give plenty of water to drink; seek medical aid. Do not give milk or fats to drink.

PRECLUDE FROM EXPOSURE workers with kidney or liver disease.

Lithium hydroxide $\text{LiOH}\cdot\text{H}_2\text{O}$

Synonyms

Lithium hydroxide monohydrate.

Normal state

Colourless crystals.

Uses

Conservation of iron.

Properties

M.P. 680°C. Absorbs CO_2 from air; soluble in water.

Incompatible with

Strong acids; strong oxidising agents.

Spills

Cover with an excess of dry soda ash or sodium bicarbonate, mix well. Slowly and carefully add to butyl alcohol in a large container; allow to stand for 24 hours in fume hood - release to sewer with large amount of water.

Handling

Skin protection; goggles; work in fume cupboard.

Effects of exposure

Lithium salts have been implicated in aplastic anemia.

Very caustic and toxic; corrosive (similar to sodium hydroxide). Large doses may cause dizziness; kidney damage; nausea; anorexia; apathy; coma; death.

Skin: extremely corrosive; absorbed through skin. Causes burning sensation on contact.

Eyes: severe irritation — severe damage.

Ingestion: corrosion of tissue in mouth and throat

Inhalation: may be fatal. Extremely destructive of mucous membranes.

FIRST AID

Skin: remove contaminated clothing. Wash skin thoroughly with water. **Seek medical aid.**

Eyes: irrigate with water for at least 15 minutes, separating eyelids with fingers if necessary. **Seek medical aid immediately.**

Inhalation: move to fresh air. Give oxygen if breathing difficult, artificial respiration if it stops. **Seek medical aid immediately.**

Ingestion: if conscious give plenty of water to drink and **seek medical aid immediately.**

Loctite

Commercial cyanoacrylate adhesives.

Registered name for wide range of cyanoacrylate and methacrylate adhesives, which includes adhesives that have been specifically developed for use on glass, stone, metals, rubbers and plastics, wood, ceramics, etc. (For methacrylates see sheet on methylmethacrylate). The cyanoacrylates are non-toxic (usually contain no solvents) are non-sensitising and present no significant fire hazard.

Fire extinguishers

Carbon dioxide or water

Solubility

Insoluble in water. Cured resins are resistant to most solvents but should soften or dissolve in: methylene chloride, dimethyl formamide; nitromethane.

Incompatible with

Alkalis or bases cause rapid polymerisation with the evolution of heat. Do not use cloths or gloves contaminated with these even to mop up spillages, as a hazardous reaction may occur.

Spills

No special requirements from safety point of view; shelf life of 1 year @ 25°C or will keep indefinitely if frozen.

Handling

Eye protection; do not wear contact lenses. Wear polyethylene or polypropylene gloves. **Caution: may bond skin; separate by soaking in water, do not force apart.**

USA: TLV: no data; negligible hazards.

Effects of exposure

Skin: no irritant effect, but may bond skin (see above).

Eyes: no ill effects reported, but bonding may result. Cover with pad soaked in warm water. Separation may take hours or days but there should not be any ill effects. (Other sources report that curing cyanoacrylates can be a severe eye irritant.

Inhalation: vapours may be irritant, but as chemical react with moisture are rapidly eliminated. Usually no problems if RH above 50%.

Ingestion: should not cause any ill effects — except for bonding. Check air passages have not been blocked.

Magnesium acetate $(\text{CH}_3\text{COO})_2\text{Mg}\cdot 4\text{H}_2\text{O}$

Uses

Paper de-acidification

Properties

Colourless or white deliquescent crystals.

M.P. 72-75°C. Soluble in water; alcohol.

Fire extinguishers

Water, CO_2 , dry chemical or alcohol foam.

Incompatible with

Strong oxidising agents.

Spills

Sweep up carefully; place in safe container for disposal.

Storage

Protect from moisture.

Handling

Do not breathe dust; wear goggles, respirator, or work in fume hood. Chemical resistant gloves.

No data, occupational exposure limits.

Effects of exposure

Harmful by inhalation, ingestion or skin absorption.

FIRST AID

Skin: remove contaminated clothing; wash skin thoroughly with water.

Eyes: irrigate thoroughly with water. **Seek medical aid.**

Inhalation: move to fresh air; give O_2 if breathing difficult, artificial respiration if breathing stops. **Seek medical aid.**

Ingestion: keep warm and at rest; if conscious give plenty of water to drink and **seek medical aid immediately.**

Magnesium carbonate

Uses

Used to 'stabilise' H_2O_2 in paper conservation.

Properties

Very light, odourless white powder. Soluble in acids; insoluble in water, alcohol.

Incompatible with

Formaldehyde.

USA: TLV/TWA: 10 mg/m³

Handling:

Nuisance dust: wear suitable dust mask when handling powder.

Magnesium silicate (hydrous) $Mg_2Si_3O_8 \cdot 5H_2O$

Synonyms

Sepiolite.*

Normal state

Extremely fine, white-grey powder.

Uses

Cleaning pack for stone — mixed with water.

Caution

Contains fibrous particles 5-10 μ long, 0.1-0.5 μ in diameter at 10-12% by weight.
May be harmful if inhaled — wear face mask.

Human skin irritant.

(It is suggested that attapulgite clays are safer and just as effective.)

Malathion $C_{10}H_{19}O_6PS_2$

Synonyms

O-dimethyl phosphorodithioate; American — Cyanamid 4,049.

Normal state

Yellow-dark brown liquid with characteristic odour.

Uses

Insecticide. Not approved under U.K.'s 1986 Pesticide Regulations for use as pesticide in pure chemical form: but some commercial products may be approved. See p.13.

Properties

B.P. 156°C; M.P. 2.9°C; S.G. 25.

Sparingly soluble in water; soluble in alcohols, ether, ketone, esters, hydrocarbons and fatty oils.

Incompatible with

Strong oxidisers.

Spills

Cover with sodium bisulphite and sprinkle with water. Release to sewer with copious water.

Storage

Outdoor secure storage, or flammable liquid store. Breaks down in contact with iron and loses insecticidal activity.

Handling

Protect from damage. Rubber or neoprene gloves, protective clothing, chemical respirator. Do not eat, drink or smoke in working areas.

USA: TLV/TWA: 10 mg/m³ (skin)

UK: OES: 10 mg/m³ (LTEL).

Effects of exposure

Can be absorbed through skin; **poisonous to central nervous system.**

Skin: May cause allergic reaction.

Eyes: Irritant.

Inhalation: Moderately toxic; cumulative. Headache; anorexia; dizziness; blurred vision, salivation, pain and tremours in muscles.

Ingestion: Moderately toxic; cumulative, nausea; diarrhoea.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly in soap and water.

Eyes: flush with water.

Inhalation: seek medical aid.

Ingestion: seek medical aid immediately. If conscious, give plenty of water to drink; Keep warm and at rest. **Patient should be transferred to hospital as soon as possible.**

Mannitol $C_6H_{14}O_6$

Synonyms

Manna sugar; mannite; 1,2,3,4,5,6 hexanehexol.

Normal state

White crystalline powder, odourless.

Uses

Consolidant for waterlogged wood.

Properties

M.P. 165/7°C; B.P. 290-295°C

Soluble in water; slightly soluble in lower alcohols and amines; almost insoluble in organic solvents.

Flammability

Combustible.

Incompatible with

Emits acid smoke and fumes if heated to decomposition.

Effects of exposure

Mildly toxic by ingestion.

MDI

Synonyms

Di-isocyanato-diphenylmethane; 4,4 diphenyl methane.

Normal state

Dark brown oily liquid with earthy, musty odour.

Uses

In 2-component polyurethane foam.

Properties

S.G. 1.23. Vapour density 8.5. Polymerises at 260°C. May attack and embrittle rubber and plastics.

Incompatible with

Acids — produces deadly hydrocyanic acid gas. Contact with alkalis, acids, caustic soda, ammonia, primary and secondary amines or alcohols - may cause violent reaction. Reacts slowly with water to produce carbon dioxide; pressure build-up inside contaminated container may cause it to rupture.

Spills

Wear self-contained breathing apparatus, coveralls, gloves. Absorb spill with absorbent non-combustible material (eg. sand, earth) and scoop up into a container. Treat with decontaminant (available from supplier) spray with water. Allow to react for at least 20 minutes. Scoop up and transfer to suitable container; add more decontaminant, remove to a safe place and cover loosely. After about a day it can be set aside for disposal. By neutralisation: suitable chemicals can be obtained from supplier. Neutralising agents must always be available in working area. One recommended decontaminating solution consists of 80% water, 8% concentrated ammonia solution, 2% liquid detergent (See relevant sheet for hazards related to ammonia). All equipment used should be decontaminated immediately after use.

Storage

Keep dry: Keep cool but do not allow to freeze. Keep containers tightly closed.

Handling

Self-contained breathing apparatus or work in fume hood, chemical-resistant suit and rubber or PVC gloves, PVC safety boots; absorb spill N.B. All persons using this material must be conversant with the hazards, and trained in the recommended normal and emergency handling procedures. MDI has a lower vapour pressure than TDI, so "with adequate ventilation a vapour concentration approaching the control limit is not reached: detection of cyanides by smell is not reliable as it will vary from individuals: the odour threshold is usually above the control limit."

USA: TLV/TWA 0.005 ppm; STEL: 0.02 ppm

UK: CL: 0.02 mg/m³ (LTEL); 0.07 mg/m³ (STEL)

Effects of exposure:**Extremely poisonous.**

Skin: irritation and redness. Mild tanning action; may cause allergy in some people.

Eyes: irritation and redness.

Inhalation: mild poisoning — irritation of nose and throat; cough; shortness of breath.

Severe poisoning — acute shortage of breath with wheezing, lung congestion, symptoms may be delayed for several hours. May cause allergy.

Ingestion: nausea, vomiting, abdominal pain.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with soap and water. Medical check-up advisable.

Eyes: irrigate thoroughly with water; **seek medical aid.**

Inhalation: move to fresh air; keep warm and at rest. Casualty must be seen by a doctor as symptoms similar to asthma may develop. Keep in upright seated position, give oxygen if breathing difficult. **Seek medical aid immediately.**

Ingestion: keep warm and at rest. If conscious, give plenty of water to drink, and **seek medical aid immediately.**

Mercuric chloride HgCl_2

AVOID ALL USE.

Synonyms

Corrosive sublimate (of mercury).

Normal state

White crystals or powder

Uses

Fungicide for herbaria. May have been used on older collections, especially natural history, ethnographic. Not approved under U.K.'s 1986 Pesticide Regulations. See p.13.

Properties

M.P. 277°C., B.P. 303°C. Soluble in water, ethanol.

Flammability

Non-combustible, but explosive hazard with some materials (See Incompatibles)

Incompatible with

Explosive with phosphorous, antimony, arsenic, silver salts, by heat or impact. Also by impact with alkali metals, alkali sulphides, acetylene and ammonia; by friction or impact; oxalic and metal oxalates. Metal sulphites.

Spills

If possible, dissolve in water (if not convert to soluble nitrate); then adjust the pH and precipitate as mercuric sulphide. Dry this and return to supplier.

Storage

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

Disposal: *see* mercury.

Handling

Workers must be familiarised in proper procedures for working with mercury compounds; e.g. check air intermittently. No eating, drinking, or smoking near work area; wash hands before eating, drinking or smoking. If exposure frequent, physical examinations and urinary mercury examination necessary —interval depending on exposure rate. Always use gloves, chemical cartridge respirator, protective clothing.

USA: TLV/TWA: 0.1 mg/m³

UK: OES: 0.05 mg/m³ (LTEL); 0.15 mg/m³ (STEL).

Effects of exposure

Poisonous

Skin: may occasionally be a skin sensitiser; irritant; **poison via skin contact.**

Eyes: severe irritant.

Inhalation: severe corrosion of mucous membranes. Spitting of blood.

Ingestion: nausea; vomiting; abdominal pain, diarrhoea; kidney damage, exhaustion.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with soap and water; medical follow-up necessary.

Eyes: irrigate with water — seek medical aid.

Inhalation: medical aid immediately.

Ingestion: medical aid immediately.

PRECLUDE FROM exposure anyone with diseases of liver, lungs, kidneys and central nervous system.

Mercury Hg

Synonyms

Quicksilver.

Normal state

Silvery, extremely heavy liquid.

Uses

Main laboratory use will probably be in the thermometers; salts (especially soluble salts) are just as toxic.

Properties

B.P. 356°C but vapourises very easily — vapours colourless, odourless, tasteless.

Explosive with nitric acid and ethanol, nitrates, chlorates.

Incompatible with

Ammonia with moisture; ethylene oxide; methylsilane; oxidants; nitrates; chlorates; nitric acid with ethanol.

Spills

Can be made safe with zinc powder (forms amalgam); or with sulphur powder (commonly called 'Flowers of Sulphur'), or calcium polysulphide with excess sulphur - sprinkle the powders on top of the spillage. Droplets should be pushed together without causing any skin contact; collect with aspirator bulb or vacuum device. Very small droplets can be picked up with sellotape.

Handling

Will give off mercury vapour at relatively low temperatures. Can be absorbed through skin so wear rubber or neoprene gloves; cartridge respirator. Do not re-use gloves or respirator.

USA: TLV/TWA: mercury (all forms except alkyl) — Skin, as mercury vapour, 0.05 mg/m³.

UK: OES: 0.05 mg/m³ (LTEL); 0.15 mg/m³ (STEL).

Effects of exposure

These are cumulative. Can be inhaled as vapour, and readily absorbed through skin (may cause local corrosion).

Symptoms of exposure

— **Experimental carcinogen.** Emotional disturbance; unsteadiness; inflammation of mouth and gums; memory loss, headache; kidney damage.

FIRST AID

Contamination: remove contaminated clothing; wash thoroughly several times.

If swallowed—administer water if patient is conscious; keep warm and at rest; seek medical aid.

Any items contaminated with mercury should be disposed of (including clothes, watches, watch strap, jewellery). **N.B. Dispose of through specialist contractor only - most UK tips or dumps are not allowed to accept mercury in any form.**

Methanol CH_3OH

Synonyms

Methyl alcohol; wood spirit; carbinol; pyroxylic spirit; wood naphtha; methyl hydroxide; wood alcohol.

Normal state

Colourless, volatile liquid with slight odour.

Uses

Solvent; dehydration of waterlogged materials; solvent for spot test or indicator solutions.

Properties

B.P. 64.6°C ., S.G. 0.7924. Miscible with water, alcohol, ether, ketones and most organic solvents.

Flammability

Highly flammable. Flash point 10°C . Flammable limits in air 5-44%; ignition temperature 464°C .

Fire extinguishers

Carbon dioxide; dry chemical; foam.

Incompatible with

Strong oxidisers; sodium, magnesium, bromine, sodium hypochlorite, sodium hydroxide with chloroform; chromium trioxide, nitric acid, hydrogen peroxide. Toxic gases and vapours e.g. carbon monoxide, formaldehyde may be released in fire.

Spills

Absorb onto paper; leave to evaporate in glass or iron dish in fume hood; burn paper.

Storage

Isolated; no sources heat or ignition.

Handling

Rubber or nitrile rubber gloves, goggles; fume cupboard. Do not wear contact lenses.

USA: TLV/TWA: 200 ppm TLV/STEL: 250 ppm. Odour threshold: 2000-5900 ppm.

UK: OES: 200 ppm (LTEL); 250 ppm (STEL).

Effects of exposure

Extremely poisonous.

Apparent intoxication; transfer to hospital, as rapid deterioration can occur up to 24 hrs after exposure. Cumulative effect, so frequent low doses can lead to optic nerve damage. Once absorbed, is only eliminated very slowly from the body.

Skin: eczematoid dermatitis. Can be absorbed through skin: a large splash on the skin will give a large dose, with toxic effects as for ingestion/inhalation.

Eyes: may cause blindness; irritation.

Inhalation: can cause blindness in high concentrations; headache, blurred vision; muscular unco-ordination; bronchitis.

Ingestion: poison; may cause blindness; headache, weakness, drowsiness, light headedness, nausea, vomiting, drunkenness, blurred vision; blindness and death.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with soap and water. If very large splashes, or skin irritation, patient should be sent to doctor.

Eyes: irrigate with water; seek medical aid.

Inhalation: move to fresh air; give O₂ if breathing difficult. If high exposure; seek medical aid as soon as possible.

Ingestion: seek medical aid immediately. Keep warm and at rest—transfer to hospital without delay, even if patient appears unaffected.

2-Methoxy ethanol $\text{CH}_3\text{OCH}_2\text{CH}_2\text{OH}$

Synonyms

Methyl cellosolve, ethylene glycol monomethyl ether

Normal state

Colourless liquid with mild, pleasant odour.

Uses

Solvent.

Properties

S.G. 0.97; M.P. -85.1°C .; B.P. 124.4°C Miscible with water, alcohol, ether, glycerin, acetone and dimethylformamide.

Flammability

Flammable; flash point 46°C . Explosive range 2.5-19.8%; ignition temperature 288°C . Moderate explosive hazard.

Fire extinguishers

Alcohol foam; waterspray; dry chemical or carbon dioxide.

Incompatible with

Strong oxidising agents — may cause fires and explosions. Contact with strong caustics may cause decomposition. Toxic gases may be released in fire.

Spills

Small spills — absorb onto paper. Leave to evaporate in fume hood in glass or iron dish, burn paper. Larger spills — absorb in earth or vermiculite, put into bucket, leave to evaporate in secure open area outdoors. **Do not discharge to drains.**

Storage

Flammable liquids store; no ignition sources. Keep cool and well-ventilated. Keep container closed and protected from direct sunlight.

Handling

Avoid contact with liquid and vapour. Use neoprene or natural rubber gloves, goggles, fume cupboard, and self-contained breathing apparatus if working above the TLV. Do not wear contact lenses.

USA: TLV/TWA: 5ppm. Odour threshold: 60 ppm.

UK: MEL: 5 ppm (LTEL).

Effects of exposure

Repeated exposure may cause reproductive disorders.

Affects central nervous system. Suspect carcinogen.

Skin: irritation; can be absorbed through skin — highly toxic by this route.

Eyes: irritation.

Inhalation: irritation of respiratory tract; headaches, drowsiness, weakness, shaking; staggering; decreased mental ability. May result in blood changes, including anaemia; convulsions.

Ingestion: highly toxic — can be fatal.

FIRST AID

Skin: seek medical aid. Remove contaminated clothing; wash thoroughly with water. If irritation persists.

Eyes: irrigate thoroughly with water; if irritation persists, seek medical aid.

Inhalation: move to fresh air; keep warm and at rest. If breathing difficult give oxygen; if breathing stops give artificial respiration; seek medical aid.

Ingestion: seek medical aid immediately. If victim is conscious, give plenty of water to drink.

PRECLUDE FROM EXPOSURE: personnel with diseases of blood, kidney, liver or central nervous system.

Methoxy magnesium methyl carbonate

Synonyms

MMMC: methyl methoxy magnesium carbonate; component of 'pHizz' - see relevant sheet.

Uses

Paper de-acidification.

No hazards reported for MMMC, but treat as though moderately toxic.

Methylated spirits

Composed of:

Commercial: 90% ethanol, 9.5% methanol, 0.5% pyridine + petroleum, + methyl violet dye

Industrial: 95% ethanol, 5% methanol

See relevant sections.

Flammability

Highly flammable. Flash point 12°C. Explosive limits 3-15%.

Fire extinguishers

Carbon dioxide; dry chemical.

Methyl bromide CH_3Br

Synonyms

Bromomethane; Profume.

Normal state

Colourless gas, with chloroform-like odour.

Uses

Fumigant (insecticide). Approved in pure chemical form under U.K.'s 1986 Pesticide Regulations. See p.13.

Properties

B.P. 4°C. Soluble in alcohol, ether, carbon bisulphide, carbon tetrachloride, benzene.

Flammability

Moderate fire and explosion hazard in presence of oxygen; lower explosive limit in air 13.5%; upper explosive limit 14.5%.

Fire extinguishers

Water; foam; carbon dioxide; dry chemical.

incompatible with

Dimethylsulphoxide — violent reaction. Alkali metals (especially aluminium and magnesium); impact; ethylene oxide.

Spills/Leaks

Absorb on paper towel; leave to evaporate in fume hood on glass or iron dish; burn paper.

If spilled onto clothing, remove clothing immediately.

Storage

Well-ventilated place, below 40°C; no sunlight, heat, physical impact.

Handling

Should be handled by trained fumigation personnel only.

Leather gloves; self-contained breathing apparatus; protective clothing. Will penetrate rubber.

USA: TLV/TWA: 5ppm

UK: OES: 5 ppm (LTEL); 15 ppm (STEL).

Effects of exposure

Absorbed through skin. **Highly toxic; neurotoxic and narcotic; symptoms may not appear for 2-48 hours.**

Skin: highly toxic by skin absorption; bad burns; itching, scaly dermatitis; severe blisters, may take hours or days to appear.

Eyes: conjunctivitis; temporary blindness; blurred vision. Liquid may cause severe

injury.

Inhalation/Ingestion: **highly toxic**; damage to central nervous system; kidney and liver. Loss of memory; confusion, agitation; tremors; dizziness; headache; defective control of muscles; numbness of extremities; coughing; fever; bronchitis; vomiting and nausea; death.

Symptoms of headache, nausea, dizziness indicate first aid treatment should start immediately

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with water; if irritation persists, **seek medical aid.**

Eyes: irrigate thoroughly with water; **seek medical aid immediately.**

Inhalation: move to fresh air; keep warm and at rest. In severe poisoning (TLV 200 ppm or more) move to fresh air; give oxygen, continuing for 30 mins each hour for 6 hours, even if no evidence of lung damage. If breathing difficult, give artificial respiration also; **seek medical aid immediately.**

Ingestion: **seek medical aid immediately.** If conscious, give plenty of water to drink.

Methylene dichloride CH_2Cl_2

Synonyms

Dichloromethane; methylene (di)chloride; methylbichloride; carrene; main constituent of Nitromors*; Freon 30.

Normal state

Colourless, volatile liquid; slightly soluble in water; easily soluble in alcohol and ether. Nitromors* (water of alcohol type) is a gel.

Uses

Paint and varnish stripper; degreasing agent; breaks down synthetic resins eg. Araldite*; removing excess polyethylene glycol from surface of treated wood; dry cleaning.

Properties

B.P. 40.1°C. S.G. 1.326.

Flammability

Not flammable; no flash point (unless alcohol-based Nitromors*). Flammable limits in air 12-19%, inflammable air/vapour mixture above 100°C.

Incompatible with

Contact with red-hot surfaces produces deadly phosgene gas and hydrochloric acid. Incompatible with strong oxidisers, caustics, chemically active metals; with methanol, above 102° at 1 bar; aluminium; nitric acid.

Spills

Scrape or mop up; small amounts — dispose by evaporation in fume cupboard. Large amounts — contractor.

Storage

Build-up of acidic fumes inside container may rupture it.

Handling

Avoid skin contact; use fume cupboard. Wear natural, neoprene, nitrile or butadiene rubber gloves; goggles.

USA: TLV/TWA: 50 ppm; TLV/STEL: 250 ppm Odour threshold: 300 ppm and above: not detectable by sense of smell at 100 ppm (TLV). Suspect carcinogen.

ACIGH proposed changing TLV/TWA to 50 ppm; TLV/STEL to 175 ppm

UK: MEL 100 ppm (LTEL); RL: 250 ppm (STEL).

Effects of exposure

Suspect human carcinogen: human mutagenic data; animal carcinogen.

Skin: burns on contact; degreases skin.

Eyes: eye damage.

Inhalation: narcotic; causes headache; dizziness; digestive disturbances.

Ingestion: moderately toxic; nausea, vomiting, abdominal pain, diarrhoea; development of shock followed by unconsciousness. Convulsions may occur. Kidney and liver failure may occur later.

FIRST AID

Skin: remove contaminated clothing; wash skin thoroughly with water. If irritation persists after washing; seek medical aid.

Eyes: flush with water; **seek medical assistance immediately.**

Inhalation: move to fresh air.

Ingestion: **seek medical assistance immediately;** if conscious give plenty of water to drink; keep warm and at rest.

Methylethylketone $\text{CH}_3\text{COC}_2\text{H}_5$

Synonyms

Ethylmethylketone; 2-butanone; MEK

Normal state

Colourless liquid with odour like acetone.

Uses

Solvent for uncured Rutapox[®] resin; solvent for some adhesives and resin.

Properties

B.P. 79.6°C; S.G. 0.806. Soluble in water; miscible with ethanol and ether.

Flammability

Flammable — **severe fire and explosion hazard**. Flash point -1°C. Flammable limits 2-12%. Ignition temperature 515°C (960°F).

Fire extinguishers

Alcohol-resistant foam; powder; carbon dioxide.

Incompatible with

Chloroform at alkaline pH; isopropanol; very strong oxidisers; forms explosive peroxides with hydrogen peroxide/nitric acid.

Spills

Absorb onto paper; leave to evaporate in fume cupboard on glass or iron dish; burn paper.

Storage

Keep closed; store in cool place away from ignition sources, explosives, oxidising material.

Handling

Neoprene or nitrile rubber gloves, goggles, fume cupboard. Do not wear contact lenses.

USA: TLV/TWA: 200 ppm; TLV/STEL: 300 ppm.

UK: OES: 200 ppm (LTEL); 300 ppm (STEL).

Effects of exposure

Skin: dermatitis; strong irritant.

Eyes: irritation; strong irritant.

Inhalation: headache; nausea; dizziness; inhalation of concentrated vapour may cause paralysis; strong irritant.

Ingestion: stomach and throat irritation; drowsiness.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with soap and water. If irritation persists after washing, seek medical aid.

Eyes: irrigate with water. **Seek medical aid.**

Ingestion: **medical attention immediately.** Keep warm and at rest. If conscious, give plenty of water to drink. **Transfer to hospital as soon as possible.**

Methylethyl ketone peroxide $C_8H_{16}O_4$

Synonyms

'Hardener'.

Uses

Catalyst in synthetic resins — eg. polyesters.

Properties

Strong oxidiser; may cause fire with organic materials. Explosive with heat.

Incompatible with

Explosive with heat or shock. Degraded in sunlight. Strong oxidiser.

Spills

Absorb with vermiculite; transfer to plastic bucket. Add slowly to 20% solution of sodium hydroxide (c. 10 x the weight of the peroxide). Leave in a non-combustible container for 24 hours; neutralise with 6M hydrochloric acid, then wash down drain with large amounts of water.

Storage

No sparks/ignition sources; well-ventilated; cool and dark.

Handling

Goggles/safety glasses or face shield; rubber gloves, coverall. Use in fume cupboard.

USA: Ceiling 0.2 ppm.

UK: OES: 0.2 ppm (LTEL); 0.2 ppm (STEL).

Effects of exposure:

Extremely toxic, Corrosive and Irritant; causes burns to skin, eyes, lungs.

Skin: may be severe irritation and redness at the site of contact. May cause burns.

Eyes: severe damage; corneal burns, though may not occur for up to one week after exposure.

Inhalation: mild poisoning — cough, shortness of breath, sore throat. **Severe poisoning** — acute shortness of breath; lung congestion; unconsciousness.

Ingestion: sore throat, nausea, vomiting, abdominal pain, unconsciousness.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with soap and water.

Seek medical attention if any irritation.

Eyes: **seek medical aid immediately.** Irrigate thoroughly with water.

Inhalation: **seek medical aid immediately.** Move to fresh air; support in sitting position; give oxygen if breathing difficult.

Ingestion: **seek immediate medical aid.** Keep warm at rest; if conscious give plenty of water to drink.

Methyl methacrylate $\text{CH}_2=\text{C}(\text{CH}_3)\text{COOCH}_3$

Synonyms

Acrylic resin monomer; Elvacite® 2044. Technovit 4004; Acrulite. 2-propenoic acid, 2-methyl-, methyl ester.

Normal state

Colourless, volatile liquid with characteristic odour.

Uses

Monomer for polymethacrylate resins.

Properties

B.P. 101°C., M.P. -48°C.; S.G. 0.949. Refractive index 1.4140. Volatile; slightly soluble in water and most organic solvents. Polymerised by light, heat and catalysts. Thermoplastic soluble in chlorinated hydrocarbons; toluene, esters, ketones.

Flammability

Highly flammable. Flash point 10°C. Explosive limits in air 2.1-12.5%. Vapour heavier than air — distant ignition possible. Auto-ignition temperature 421°C.

Fire extinguishers

Dry chemical; foam; carbon dioxide.

Incompatible with

Nitrates; oxidisers; peroxides; polymerisers; strong alkalis; moisture.

Spills

Absorb on paper; leave to evaporate in fume hood in glass or iron dish; burn paper.

Storage

Standard flammable liquid store.

Handling

Rubber gloves; face shield; fume cupboard.

USA: TLV/TWA: 100 ppm.

UK: OES: 100 ppm (LTEL); 125 ppm (STEL).

Effects of exposure

Lachrymator. Irritates respiratory tract; headache; loss of appetite; drowsiness. Severe eye and skin irritation. May be allergenic.

Poison by ingestion: experimental carcinogen, tumorigen, teratogen.

FIRST AID

Skin: remove contaminated clothing; wash skin thoroughly with soap and water.

Eyes: irrigate with water; **seek medical aid.**

Inhalation: move to fresh air; keep warm and at rest. Give oxygen or artificial respiration if necessary. **Seek medical aid.**

Ingestion: if patient is conscious, wash mouth out with water and give glass of warm water to drink. Keep warm and at rest. **Seek medical aid immediately.**

n-Methyl pyrrolidone C_5H_9ON

Synonyms

NMP

Normal state

Clear, pale yellow liquid, mild amine odour.

Uses

Paper conservation - old starch paste removal.

Properties

Hygroscopic, BP 202°C.

Flammability

Flammable; flash point 212°F (100°C). **Combustible** in presence of heat or flame.

Fire extinguishers

Dry chemical, carbon dioxide or foam.

Incompatible with

Oxidising materials in presence of heat or flame.

Spills

Wear protective clothing and equipment. Absorb onto paper; leave to evaporate in fume hood or glass or iron dish. Burn paper. Larger spills can be absorbed in earth or vermiculite and moved to secure area outdoors to evaporate.

Storage

In flammable liquids store; keep away from oxidising materials.

Handling

Avoid contact with liquid and vapour. Use only in fume cupboard; wear gloves (polyethylene) and goggles. Do not wear contact lenses

UK: OES: 100 ppm (LTEL)

Effects of exposure

Absorbed through skin.

Skin: initially absorbs water from skin and has itchy, irritating effect. Later skin begins to peel off. Exposure of 5 mins or more can cause serious inflammation.

Eyes: severe irritation.

Inhalation: severe irritation of respiratory and gastro-intestinal tract if vapour above 100°C. High concentration may cause unconsciousness and will cause kidney and liver damage.

Ingestion: irritation of stomach; internal damage; nausea and vomiting may cause liver and kidney damage.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with soap and copious amounts of water.

Eyes: irrigate thoroughly with water; seek medical attention.

Inhalation: move to fresh air; keep warm and at rest; give O₂ if breathing difficult, artificial respiration if stops; **seek medical aid.**

Ingestion: if conscious, give plenty of water to drink and **seek medical aid immediately.**

Methylsalicylate $C_8H_8O_3$

Synonyms

Betula oil; gautheria oil; wintergreen oil, salicylic and methyl ester.

Normal state

Colourless to pale yellow, transparent liquid.

Uses

Taxidermy; solvent; insecticide; pesticide.

Properties

MP -8.3°C BP 222.2°C; SG. 1.186. Almost insoluble in water; very soluble in alcohol, ether, chloroform and glacial acetic acid.

Flammability

Combustible. Flash point 101°C. Ignition temperature 454°C.

Fire extinguishers

Water spray, dry chemical, foam or carbon dioxide.

Spills

Absorb on paper; leave to evaporate in fume hood. Burn paper.

Handling

Gloves, goggles, coveralls, respirator.

Effects of exposure

Severe skin and eye irritant.

Inhalation: see ingestion; pulmonary oedema.

Ingestion: nausea, vomiting, drowsiness, convulsions, sweating, irritability and confusion. Very large dose may be fatal.

FIRST AID

Ingestion: keep warm and a rest; if conscious give water to drink and seek medical aid immediately.

Mineral spirits

Synonyms

Petroleum benzene; petroleum ether; naphtha. UK definition: flash point below 0°C.

Normal state

Colourless volatile liquid. Mixture of the lower hydrocarbons of the alkane series consisting mainly of pentane and hexane.

Uses

Solvent; especially in rubber adhesives.

Properties

Commonest fraction boils at 130-145°C.

B.P. varies - 30°C upwards; S.G. 0.6.

Flammability

Flammable. Flash point varies depending on fraction; but below 0°C. e.g. -48.3°C.

Flammable limit 1-6% in air. Explosive in heat or flame.

Fire extinguishers

Dry chemical; foam; carbon dioxide.

Incompatible with

Contact with strong oxidisers may cause fires and explosions.

Spills

Absorb on paper; leave in fume hood to evaporate on glass or iron dish; burn paper.

Storage

Standard flammable liquids store — well-ventilated; no sources of ignition.

Handling

Rubber gloves; face shield; good ventilation, or else use in fume hood. Do not wear contact lenses.

USA: TLV: 300 ppm. Hexane USA: TLV: 100ppm; UK: OES: 100 ppm. Pentane:

USA: TLV: 600 ppm

Effects of exposure

Skin: dermatitis due to defatting.

Eyes: conjunctivitis; blurred vision.

Inhalation: irritability; irritation of nose and throat; headache; vertigo; drowsiness; cough.

Ingestion: harmful

FIRST AID

Skin: remove contaminated clothing; wash off with soap and water; if irritation persists, **seek medical aid.**

Eyes: irrigate with water; if irritation persists, **seek medical aid.**

Inhalation: move to fresh air; keep warm and at rest. If breathing difficult give oxygen; **seek medical aid.**

Ingestion: get medical attention immediately. Do not induce vomiting. Keep warm and at rest. Give plenty of water to drink.

PRECLUDE FROM EXPOSURE persons with diseases of the central nervous system, liver and kidneys.

Morpholine $\text{OCH}_2\text{CH}_2\text{NHCH}_2\text{CH}_2$

Synonyms

1,4-tetrahydro oxazine.

Normal state

Colourless liquid with weak ammonia-like odour.

Uses

Strong solvent; 5% solution in isopropyl alcohol for treatment of decomposing pyritised fossils; corrosion inhibitor; solvent for wax, resin. Vapour phase inhibitor for copper and copper alloys.

Properties

B.P. 128.9°C.; S.G. 1.002. Hygroscopic; miscible with water and most organic solvents.

Flammability

Flammable. Flash point 38°C. Moderate fire hazard when exposed to heat, flames or oxidising agents. Flash back may occur. Explosive limits 1.8-11%. Auto-ignition temperature 310°C.

Fire extinguishers

Water spray; carbon dioxide; dry powder.

Spills

Spread with a 9:1 mixture of sand and soda ash; mix transfer to paper carton stuffed with ruffled paper, burn in open furnace with utmost care.

Storage

Standard flammable liquid store; keep away from heat, flames and strong acids or oxidising agents.

Incompatible with

Cellulose nitrate; nitromethane; strong acids; strong oxidisers - may cause fires. Toxic gases and vapours (eg oxides of nitrogen and carbon monoxide) may be released in a fire.

Handling

Butyl or neoprene rubber gloves; goggles; fume hood; cartridge respirator.

USA: TLV/TWA: 20 ppm; STEL: 30 ppm (skin)

UK: OES: 20 ppm (LTEL); 30 ppm (STEL).

Effects of exposure

Highly toxic.

Skin: absorbed through skin; may cause severe irritation and ulceration.

Eyes: serious damage; corrosive; irritant.

Inhalation: severe irritation; burning sensation in nose and throat; coughing, and lung congestion. High exposures will damage lungs, liver and kidneys. Symptoms may be delayed for a day or two.

Ingestion: harmful; may result in anoxia, cyanosis and convulsions. May cause kidney and liver damage.

FIRST AID

Skin: remove contaminated clothing; wash off immediately with soap and water — repeat several times. If irritation persists after washing, **seek medical aid.**

Eyes: irrigate with water; seek medical assistance.

Inhalation: move to fresh air; **seek medical assistance immediately.** Keep in seated upright position to ease breathing. If breathing is difficult, give oxygen; artificial respiration if breathing stops. Keep warm and at rest.

Ingestion: If conscious give large quantities of water to drink; **seek medical attention immediately.** Keep warm and at rest.

Mowilith DMC2

Synonyms

Polymer of vinyl acetate dibutyl maleate.

Normal state

55% copolymer dispersion in water.

Uses

General purpose adhesive. Good for vinyl substrates. Soft flexible film properties.

Properties

Soluble in water; dilutes for ease of clean up. Soluble in isopropanol, acetone, toluene. s.g. 1-16; pH 4-5; Tg 11°C.

Spills

Water dilution to drain or absorbent or sand.

Storage

15-25°C. Replace after 6 months. Keep sealed from air.

Handling

Wear vinyl gloves; goggles: normal room ventilation for comfortable working conditions.

Effects of exposure

Skin: none unless very sensitive; hence use of PVC gloves

Eyes: mild irritation, wash away quickly.

FIRST AID

Skin: wash with soap and water. Remove residues with normal Elastoplast adhesive remover from pharmacy.

Eyes: wash with clean water using eye bath dispenser system.

Mowilith D 50

Synonyms

Homopolymer of vinyl acetate.

Normal state

50% Dispension in water.

Uses

Adhesive and binder. Film is fairly hard at ambient temperature.

Properties

Soluble in water; dilutes for ease of clean up. Soluble in isopropanol, acetone, toluene. pH 3-4 Tg c.30°C.

Flammability

Combustible.

Fire extinguishers

All suitable.

Spills

Water dilution to drain or absorbent or sand.

Storage

15-25°C Replace after 6 months with fresh material . Keep sealed from air.

Handling

Wear vinyl gloves; goggles. Normal ventilation for comfortable working conditions.

Effects of exposure

Skin: none reported.

Eyes: mild irritation; wash away quickly.

FIRST AID

Skin: wash with soap and water.

Eyes: wash with clean water using eye bath dispenser system.

Naphthalene $C_{10}H_8$

Synonyms

Moth flakes; white tar; tar camphor; naphthalin; moth balls.

Normal state

Aromatic white crystalline volatile flakes — moth ball odour.

Uses

Insecticide, preservative. Not an approved pesticide under U.K.'s 1986 Pesticide Regulations see p.13.

Properties

s.g. 1.145; b.p. 217.7°C. Insoluble in water; soluble in most organic solvents. Soluble in benzene, absolute alcohol, fixed volatile oil; ether. Combustible; sublimes; absorbs UV light.

Flammability

Flash point 79°C Open cup. Explosive limits in air 0.9-5.9%. Auto ignition temperature 567°C. Combustible; moderate hazard with flame; flammable vapours on heating — forming explosive mixture with air. Dust can be explosive in air.

Fire extinguishers

CO_2 ; dry chemical; foam. Water on molten naphthalene may cause extensive foaming.

Incompatible with

Violent reaction with CrO_3 (chromic anhydride); and with strong oxidisers — may cause explosion.

Spills

Small spills — brush onto paper sheet; place in iron pan in fume hood; burn paper. Disposal furnace.

Storage

Protect against physical damage. Cool; no sources of heat/ignition or oxidising materials.

Handling

Fume cupboard or breathing apparatus. Rubber or nitrile rubber gloves; goggles.

Low vapour pressure and volatility prevent levels in air reaching USA: TLV.

USA: TLV/TWA: 10 ppm, 50mg/m³; TLV/STEL: 15 ppm, 75 mg/m³.

UK: OES: 10 ppm (LTEL); 15 ppm (STEL).

Effects of exposure

Onset of symptoms may be delayed by 2-4 hours or more. Some people may be hypersensitive. Experimental tumorigen.

Skin: absorbed through skin; may cause blood, kidney and liver damage. Dermatitis, irritation, rash and hypersensitivity dermatitis.

Eyes: irritation at 15 ppm; irritation; optical keritis, corneal damage, cataracts, conjunctivitis.

Inhalation: irritation; headache; nausea; loss of appetite; vomiting. May cause destruction of red blood cells, with anaemia, fever, yellow jaundice, kidney and liver damage.

Ingestion: toxic at 100mg/kg. Symptoms as for inhalation, with confusion, malaise, sweating etc.

FIRST AID

Skin: if molten naphthalene gets onto skin; **seek medical aid immediately.** For other forms of naphthalene, wash thoroughly with soap and water, **seek medical aid if irritation persists.**

Eyes: irrigate thoroughly with water; if irritation persists; **seek medical aid.**

Inhalation: move to fresh air and rest. If symptoms are severe, **seek medical aid** as soon as possible. If breathing is difficult, give oxygen; artificial respiration if breathing stops.

Ingestion: if conscious, give plenty of water to drink; **seek medical aid immediately.** Keep warm and at rest.

Annual health check recommended if exposure light and frequent; should include eyes, blood count; urine analysis. Preclude from exposure — persons with diseases of blood, liver and kidneys.

Nitric acid HNO_3

Normal state

Colourless liquid with characteristic choking odour; fumes in moist air. A solution of nitrogen dioxide (NO_2) gas in water (usually 70%/weight).

Properties

Powerful nitrating and oxidising agent; attacks almost all metals except gold. B.P. 86°C . May discolour on exposure to light.

Flammability

Non-flammable but some reactions may be explosive; moderately flammable by chemical reaction with reducing agents.

Fire extinguishers

Water, carbon dioxide, dry chemical powder, alcohol or polymer foam.

Incompatible with

Reacts explosively with metallic powders, carbides, dichloromethane; diethyl ether; acetone with acetic or sulphuric acid; hydrogen sulphide and turpentine. Yields explosive product with alcohols. Ignition or explosion with concentrated ammonia water. In concentrated form explosive with most organic compounds, including wood and paper etc. Contact with strong bases may cause violent sputtering. Explosive with anion exchange resins; lead-containing rubber (e.g. gloves); hydrazine.

Spills

Spread over with sodium bicarbonate or a 1:1 mixture of soda ash and slaked lime; mix with vast amounts of water and release to drain.

Storage

Protect container against physical damage. Keep away from metallic powders, organic acids, alcohols, and all combustible, organic or other readily oxidisable material (see Incompatibilities).

Handling

Goggles, vinyl or heavy duty rubber gloves; face shield; protective clothing; fume hood. Emergency eyewash must be available. Do not use cartridge respirator with activated charcoal filter — use non-oxidisable sorbents only.

USA: TLV/TWA: 2 ppm; TLV/STEL: 4 ppm

UK: OES: 2 ppm (LTEL); 4 ppm (STEL).

Effects of exposure

Very poisonous and corrosive.

Skin: local infections; severe and penetrating burns with necrosis; skin ulcers. Weak solutions can cause defatting, dermatitis and yellow stain on skin.

Eyes: conjunctivitis; corneal ulcer; severe burns; visual impairment.

Inhalation: **highly toxic**; severe chest pain; coughing; sneezing; dental erosion. High concentrations may cause pneumonia and pulmonary oedema which may be fatal; there may be a delay of 4-30 hours before symptoms appear.

Ingestion: yellow discolouration of teeth, mouth, throat; dental erosion; stomach ache; vomiting blood; circulatory collapse.

FIRST AID

Skin: remove contaminated clothing; rinse with 5% solution sodium bicarbonate; to burns apply cloth with saturated solution potassium thiosulphate. **Seek medical aid.**

Eyes: immediately irrigate with water — **seek medical aid.**

Inhalation: fresh air and **medical aid immediately.**

Ingestion: **seek medical aid immediately;** till then if conscious give large volumes of water to drink, and keep warm and at rest.

Osmium tetroxide OsO_4

Synonyms

Osmic acid (anhydride), perosmic oxide.

Normal state

Yellow crystals.

Uses

Preparation of natural history specimens.

Properties

S.G. 4.90; B.P. 180°C; M.P. 40°C. Soluble in benzene, alcohol, ether. Slightly soluble in water. Unpleasant odour.

Handling

Avoid skin contact completely. Use only in fume cupboard; manipulate under water.

USA: TLV/TWA: 2 mgm/m³; **TLV/STEL:** 0.0006 ppm.

UK: OES: 0.0002 ppm (LTEL); 0.0006 ppm (STEL) as Osmium.

Effects of exposure

Onset of symptoms may be delayed by up to 3 days. Severe irritant.

Skin: irritation and redness at point of contact; skin ulcers, dermatitis.

Eyes: irritation; redness; patient may see a 'halo' effect due to swelling of cornea.

Inhalation: headache; sore throat; tightness of chest. Severe poisoning causes lung congestion with shortness of breath. Kidney damage may occur.

Ingestion: **poison;** nausea; vomiting. Kidney damage.

FIRST AID

Skin: **seek medical aid immediately.** Remove contaminated clothing; wash thoroughly with soap and plenty of water; if irritation persists after washing.

Eyes: **seek medical aid.** Irrigate thoroughly with water.

Inhalation: **seek medical aid.** Move to fresh air; keep warm and at rest. Give O_2 if breathing difficult. If lungs congested, support in upright sitting position.

Ingestion: **seek medical aid immediately.** If conscious, give 1 pint water to drink, then 1 pint milk, then more water. Keep warm and at rest.

Oxalic acid $\text{HOOC.COOH.2H}_2\text{O}$

Synonyms

Ethanedioic acid; dicarboxylic acid.

Normal state

White crystalline substance. M.P. 190°C.

Uses

Rust removal; removal of iron stains; tanning of mammal skin.

Properties

Water soluble; sublimable crystals; also soluble in alcohol, ether, glycerol.

Flammability

Non-flammable.

Fire extinguishers

Water spray, dry chemical or carbon dioxide.

Incompatible with

Silver and silver compounds; mercury; sodium hypochlorite (bleach); bases; acid chlorides; alkali metals; strong oxidisers.

Spills

Cover with soda ash or sodium bicarbonate; mix and add excess water; neutralise with dilute acid or alkali and discharge to drain with plenty of water.

Storage

In 'Poisons' cupboard if possible.

Keep dry; avoid incompatible chemicals; use corrosion-proof containers.

Handling

Rubber gloves; goggles; fume cupboard; for dust (when handling solid) high efficiency particulate filter respirator with full facepiece. Do not wear contact lenses.

USA: TLV/TWA: 1 mg/m³; TLV/STEL: 2 mg/m³.

UK: OES: 1 mg/m³ (LTEL); 2 mg/m³ (STEL).

Effects of exposure

Extremely poisonous.

Skin: chemical burns; gangrenous ulcerations. May slowly enter body through skin.
Corrosive.

Eyes: corneal damage; severe eye irritation; splashes will cause burns.

Inhalation: irritation of respiratory tract; ulceration of mucous membrane; headache; nausea; vomiting.

Ingestion: burning and corrosion of mouth and stomach; abdominal pain; diarrhoea;

bloody stools; shock; fits. **As little as 5g may be fatal.**

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with water; **seek medical aid** if necessary.

Eyes: irrigate with water; **seek medical aid immediately.**

Inhalation: keep warm and at rest. **Seek medical aid as soon as possible.**

Ingestion: if conscious give large quantities of water to drink immediately. **Seek medical aid immediately.** Keep warm and at rest.

Preclude from exposure personnel with liver or kidney complaints.

Panacide

Synonyms

5,5' Dichloro- 2,2'-dihydroxy diphenyl methane.

Uses

Biocide

See U.K.'s Pesticide Regulations note on p.13.

From BDH Chemicals.

Paraloid B48N

Components

Acrylic resin with up to 3% residual toluene.

Normal state

Clear granules of acrylic resin.

Uses

Consolidant.

Properties

Almost insoluble in water. S.G. 1.15.

Flammability

Combustible; burns vigorously with intense heat. Ignition temperature 393°C.

Fire extinguishers

Water; spray; carbon dioxide.

Spills

Sweep up for disposal on landfill site.

Storage

Avoid contact with ignition source. Store between -18°C and 49°C.

Handling

Wear gloves; goggles; dust mask when handling granules; use fume cupboard when working with solvents.

UK: OES: 50 ppm (LTEL) for toluene content. STEL: 75 ppm.

Effects of exposure

Skin: vapour from heated resin may cause irritation.

Eyes: vapour from heated resin may cause irritation.

Inhalation: vapour from heated resin can irritate nose, throat and lungs and cause headache, drowsiness and nausea.

FIRST AID

Skin: wash with soap and water

Eyes: irrigate with water

Inhalation: move to fresh air

Paraloid B67

Components

Acrylic resin

Normal state

Clear granules

Properties

Virtually insoluble in water. S.G. 1.06

Flammability

Combustible with intense heat. Resin burns vigorously. Ignition temperature 393°C.

Fire extinguishers

Water fog; dry chemical; carbon dioxide.

Spills

Scoop or shovel up for disposal at landfill site.

Storage

Avoid contact with ignition sources; store between -18°C and 49°C.

Handling

Absorbed through skin/inhalation.

Wear neoprene; nitrile; butyl or natural rubber or vinyl gloves; goggles. Ensure good ventilation.

USA: TLV/TWA: 50ppm for toluene content (up to 1.5% residual in resin).

Effects of exposure

Vapour from heated product can irritate skin and eyes.

Inhalation: vapour from heated product can irritate the nose, throat and lungs; and cause headache, drowsiness and nausea.

FIRST AID

Skin: wash with soap and water

Eyes: flush with water

Inhalation: move to fresh air

Paraloid B.67MT

Normal state

Clear, colourless solution of acrylic resin (45%) in aliphatic petroleum hydrocarbons.

Properties

Insoluble in water. Viscosity 1000-1400cps. S.G. 0.89

Flammability

Flammable. Solvent vapours can travel to ignition source and flash back. Ignition temperature 506°C. Explosive limits in air: 0.9% to 6.0%.

Fire extinguishers

Water fog foam; dry chemical; carbon dioxide. Cool containers with water spray. Solid stream of water will spread the fire.

Incompatible with

Combustion products are toxic.

Handling

Wear neoprene; nitrile; butyl or natural rubber or vinyl gloves; goggles; face mask; dust mask; chemical cartridge respirator; work in fume cupboard.

Effects of exposure

Over-exposure by any route can cause liver and kidney damage.

Skin: may cause irritation.

Eyes: may cause conjunctivitis.

Inhalation: solvent vapours, mists or residual monomers can cause headache, nausea, drowsiness, cough, bronchitis, blurred vision, lack of co-ordination, irritation of respiratory tract, and depression of central nervous system.

FIRST AID

Skin: wash with soap and water.

Eyes: irrigate with water.

Inhalation: remove to fresh air; if breathing difficult give oxygen; if stopped, give artificial respiration. **Seek medical aid immediately.**

Ingestion: **Seek medical aid immediately.** Keep warm and at rest; give plenty of water to drink if conscious.

All information supplied by manufacturer.

Paraloid B72

Synonyms

Ethyl methacrylate co-polymer; acrylic resin.

Normal state

Clear granules, or as clear solution.

Uses

Consolidation; varnish.

Properties

S.G. 1.15. Ignition temperature 393°C.

Soluble in: butanol, diacetone alcohol, methylene chloride, ethylene dichloride, trichloroethylene, ethyl acetate, amyl acetate, cellosolve, toluene, xylene, acetone, methyl ethyl ketone, dimethyl formamide.

Flammability

Combustible; lower explosive limit 0.03oz/cu.ft.

Fire extinguishers

Carbon dioxide; dry chemical; water fog.

USA: TLV: As nuisance dust 10mg".

Effects of exposure

Skin: may cause localised irritation with frequent exposure.

Eyes: dust may cause painful eye irritation.

Inhalation: irritation of nose, throat, upper respiratory tract.

Ingestion: negligible if dust only ingested.

FIRST AID

Skin: wash with soap and water.

Eyes: wash with water. Seek medical aid if irritation persists.

Inhalation: remove subject to fresh air.

Pentachlorophenol C_6Cl_5OH

NB: Too toxic for general use: obtain specialist advice.

Synonyms

PCP; Chem-Tol*; Santophen 20*; Dovicide EC-7*; Dovicide G*; Santobrite*; Phenchlorol*; Monsanto Penta*.

Normal state

Light brown solid with phenolic odour; pungent when hot.

Uses

Contact fungicide for solvent-based systems; bactericide; fungicide; slimicide used mainly for cellulose. As pure chemical, not an approved pesticide under U.K's 1986 Pesticide Regulations; commercial versions may have received approval. See p. 13.

Properties

B.P. 310°C.; M.P. 190°C. Volatile with steam; soluble in alcohol, acetone, ether, benzene; cellosolve.

Flammability

Emits highly toxic chloride fumes at high temperature.

Fire extinguishers

Water spray; carbon dioxide; dry chemical powder; alcohol foam.

Incompatible with

Strong oxidisers; strong bases; acid chlorides and acid anhydrides.

Spills

Absorb onto paper; evaporate on glass or iron dish in fume hood; burn paper.

Storage

Keep dry and cool; keep containers tightly closed.

Handling

Avoid skin contact; do not breathe dust/vapours. Wear rubber, neoprene or nitrile rubber gloves; goggles; respirator. Always work in fume cupboard.

USA: TLV/TWA: 0.5 mg/m³.

UK: OES: 0.5 mg/m³ (LTEL); 1.5 mg/m³ (STEL).

Effects of exposure

Teratogen; animal carcinogen. Particularly dangerous if exposure occurs during hot weather. Poisonous to nervous system. Highly toxic; may be fatal.

Skin: readily penetrates skin; irritant at 0.3 ppm; skin burns; pigmentation; other effects as for inhalation.

Eyes: visual damage; conjunctivitis; corneal numbness.

Inhalation: irritation; impaired autonomic function; sweating; cough and shortness of breath; breathing may stop; nausea; convulsions; collapse; kidney and liver damage.

Ingestion: nausea, vomiting and abdominal pain.

FIRST AID

Transfer casualty to hospital as soon as possible. Until then, he must be kept absolutely still, lying flat.

Skin: remove all contaminated clothing; wash very thoroughly with copious amounts of water. **Seek medical aid.**

Eyes: irrigate with water; **seek medical advice.**

Inhalation: move to fresh air; keep at rest. Give oxygen and artificial respiration if necessary. If lungs congested, support in sitting position. **Get immediate medical aid.**

Ingestion: **get immediate medical aid.** If conscious, give plenty of water to drink and keep warm and at rest.

Perchloric acid HClO_4

Normal state

Volatile liquid; colourless.

Uses

Powerful oxidising agent.

Properties

B.P. 203°C. Volatile; very hygroscopic; soluble in water and alcohol. Combines vigorously with water, evolving heat. When hot reacts violently with organic material.

Flammability

Severe explosion hazard.

Non-flammable but explosive hazard when 60-72% solution mixed with organic material; strong dehydrating agents convert it to anhydrous perchloric acid, which decomposes at ordinary temperatures and explodes on contact with most organic material. This substance has a long history of exploding violently and unpredictably with a vast variety of materials. Before using it the novice is strongly advised to obtain specialist advice on his materials and methods. e.g. Muse, L.A. *Journal of Chemical Education*, 1972 Vol 49 A463.

Fire extinguishers

Water. Approach fire with extreme caution.

Incompatible with

See Flammability section; from acetic acid to zinc diphosphide and about 100 chemicals in between!

Spills

Cover with weak reducing agents; e.g. hypo, bisulphites, ferrous salts. Transfer to container, neutralise with soda ash; release to drain with plenty of water.

Storage

No unprotected metal or wood should come into contact with this acid or its vapours, because of serious explosion risk. N.B. This includes the fume cupboard, shelves, ducting and extractor fan. See: Cooke, 'J. Perchloric acid: the dangers of contamination in the laboratory'. *Health and Safety at Work* Dec. 1979 Vol. 54. Limit lab storage to one 500 ml bottle wherever possible. Protect against freezing, damage; containers should be surrounded by sufficient inert packing material to absorb the acid. Keep small bottle on a glass tray. Keep away from all flammable and combustible material.

Handling

Goggles; natural, neoprene or butyl rubber gloves; protective clothing. Make sure all handling procedures are known before using this acid — it is an extremely dangerous chemical. Use only in special fume cupboard — i.e. duct washed system.

No data USA: TLV: or UK: OELs

Effects of exposure

Very corrosive. Irritation of eyes and respiratory tract; severe burns on contact; chronic skin rash. **Poisonous.**

Skin: irritation and pain; redness or whiteness of skin in area of exposure, possible blistering; severe burns.

Eyes: irritation, redness, pain; corneal burns.

FIRST AID

Transfer to hospital as soon as possible; meanwhile keep warm and at rest.

Skin: remove all contaminated clothing; wash with soap and water; **seek medical aid.**

Eyes: irrigate with water; **seek medical aid.**

Inhalation: fresh air; **seek medical assistance.** If necessary, give O₂ and artificial respiration.

Ingestion: **Seek medical aid immediately.** If conscious, give one pint water to drink, followed by one pint of milk, if available.

Perchloroethylene CCl_2CCl_2

Synonyms

Tetrachloroethylene; ethylene tetrachloride; tetrachloroethane; Perclene*; PCE.

Normal state

Colourless, heavy liquid with ether-like odour.

Uses

Solvent; dry-cleaning solvent for textiles.

Properties

B.P. 121°C.; S.G. 1.63. Miscible with alcohol, ether; insoluble in water.

Flammability

Non-flammable but will decompose at high temperatures to chlorine, carbon monoxide and toxic phosgene.

Incompatible with

Aluminium, nitrogen dioxide; sodium hydroxide; strong oxidisers. Violent reaction with nitric acid.

Spills

Absorb onto paper; leave in fume cupboard to evaporate on glass or iron dish; burn paper.

Storage

Keep container closed; cool; away from direct sunlight. High vapour density means fumes will collect at low level so don't store in cellar or hollow places.

Handling

Moderately toxic.

Goggles; rubber gloves; work in fume cupboard.

USA: TLV/TWA: 50 ppm; TLV/STEL: 200 ppm Odour threshold: 5-10 ppm

UK: OES: 50 ppm (LTEL); 150 ppm (STEL).

Effects of exposure

Experimental carcinogen and teratogen. Absorbed through skin, giving same effects as inhalation. Metallic taste. Affects kidney, lungs, liver, heart and eyes.

Human mutagenic data.

Skin: skin burns and blisters; inflammation.

Eyes: conjunctivitis; severe irritation.

Inhalation: congestion of frontal sinus; unconsciousness; dizziness; headache; nausea and vomiting; irritability.

Ingestion: nausea, vomiting, abdominal pain, diarrhoea; gradual development of shock, then unconsciousness. Convulsions may occur.

FIRST AID

Skin: remove contaminated clothing; wash off with plenty of soap and water.

Eyes: irrigate with water; seek medical assistance if necessary.

Inhalation: move to fresh air, give O₂ if breathing difficult; seek medical aid.

Ingestion: if conscious give large volumes of water to drink; seek medical aid immediately. Keep warm and at rest.

PRECLUDE FROM EXPOSURE all persons with diseases of heart, lungs, liver or kidneys.

Perspex*

= methyl methacrylate resin

Highly flammable: depolymerises on heating to highly flammable methyl methacrylate.

NB. Toxic fumes released when cutting with hot wire.

(See methyl methacrylate.)

Phenol C_6H_5OH

Synonyms

Carbolic acid; (mono) hydroxybenzene; benzophenol; phenic acid; phenylic acid; phenyl hydrate.

Normal state

White, crystalline substance with a distinctive aromatic acid odour. Pink if impure or affected by light.

Uses

Disinfectant; taxidermy/natural history. Vapour phase inhibitor for copper and copper alloys.

Properties

M.P. 41°C.; B.P. 182°C. Hygroscopic; soluble in water, alcohols, ether, chloroform, glycerol, carbon disulphide.

Flammability

Combustible; **on heating forms explosive mixture with air. Do not expose any body surface in fire — vapours absorbed through skin.** Flash point 78°C.

Fire extinguishers

Water; carbon dioxide; dry chemical or foam.

Incompatible with

Formaldehyde; sodium nitrite; calcium hypochlorite; strong oxidisers.

Spills

Absorb with rags, paper, etc; place in polythene bag and dispose. **Avoid skin contact.**

Storage

Detached storage preferred; cold, dry, well-ventilated area; keep containers tightly closed and well away from any sources of heat or open flame.

Handling

Highly toxic and potent skin irritant, so wear goggles, neoprene or vinyl gloves, face shield, etc. Use in fume cupboard.

USA: TLV/TWA: 5 ppm.

UK: OES: 5 ppm (LTEL); 10 ppm (STEL).

Effects of exposure

Suspect carcinogen; teratogen. Extremely poisonous and corrosive. **Transfer casualty to hospital immediately.**

Skin: readily absorbed through skin; toxic by dermal route; skin contact may cause instant dermatitis, blistering and severe burns, but effects may be delayed.

Severe spills on skin may cause death. Speed in commencing first aid is vital.

Eyes: conjunctivitis; corneal necrosis; effects may be delayed.

Inhalation: breathing difficulties; cough; cyanosis; pulmonary oedema; high body temperature; vertigo; visual disturbances, tremors; fits.

Ingestion: toxic; vomiting, sweating; burns in mouth, stomach, oesophagus. High temperature. Other symptoms — similar to inhalation effects.

FIRST AID

Skin: wearing protective gloves remove all contaminated clothing **IMMEDIATELY**. Flush chemical off skin with water. **Seek medical aid immediately.**

Eyes: irrigate with water; **seek medical aid immediately.**

Inhalation: fresh air; oxygen if necessary; **seek medical aid.**

Ingestion: toxic. **Seek medical aid IMMEDIATELY.** If conscious give plenty of water to drink, and one pint of milk if available.

PRECLUDE FROM EXPOSURE workers with diseases of liver, central nervous system, lungs or kidneys.

Phenol/formaldehyde resin

Uncured; separate components are dangerous — see relevant entries.

Cured resin slightly flammable, e.g. Bakelite, Amberlite

o-Phenyl phenol $C_6H_5 \cdot C_6H_4 \cdot OH$

Synonyms

Dowicide* 1; o-hydroxydiphenyl; o-xenol. (Sodium salt is Dowicide* A.); diphenylol.

Normal state

White to pale brown flakes.

Uses

Fungicide; disinfectant. As pure chemical not approved under U.K.'s 1986 Pesticide Regulations: some commercial versions may be approved. See p.13.

Properties

M.P. 56-58°C. Insoluble in water; soluble in most organic solvents.

Flammability

Flash point 128.3°C.

Fire extinguishers

Alcohol-resistant foam.

Spills

Brush up onto paper sheet; dispose via licensed disposal contractor.

Handling

Rubber gloves; face shield; use in fume cupboard.

USA: TLV: STEL: no data.

Effects of exposure

Toxic by ingestion; affects central nervous system; may cause damage to liver, kidney, pancreas and spleen.

FIRST AID

Skin: remove contaminated clothing; wash off with plenty of soap and water.

Eyes: irrigate with water; **seek medical assistance if necessary.**

Inhalation: move to fresh air, give O_2 if breathing difficult; seek medical aid.

Ingestion: if conscious give large volumes of water to drink; **seek medical aid immediately.** Keep warm and at rest.

pHizz*

Synonyms

Methyl Magnesium Carbonate; Wei T'o Spray.

Normal state

Solution in spray cannister. Components include methanol; 1,1,2-trichloro 1,2,2-trifluoro ethane.

Uses

Treatment of Paper.

Properties

B.P. 42°C

Flammability

'Nonflammable'; but see relevant sheets for solvent components, some of which are flammable.

Incompatible with

Decomposes in presence of fire to release acidic irritating fumes.

Spills

Allow to evaporate; ventilate well. Flush with water if necessary. Wear breathing apparatus if enclosed space.

Handling

Wear natural, neoprene, nitrile, butyl rubber or vinyl gloves. Work in fume cupboard or well ventilated area.

TLV: 910 ppm. (Supplier's information: but methanol USA:TLV and UK: OES 200 ppm; 1,1,2-trichloro 1,2,2-trifluoro ethane has USA:TLV 1000 ppm and affects the central nervous system.)

Effects of exposure

Skin: degreasing action.

Eyes: irritating.

Inhalation: high concentrations may produce drowsiness; unconsciousness.

Ingestion: as above

FIRST AID

Skin: use lanolin cream.

Eyes: flush well with water.

Inhalation: move to fresh air. If serious obtain **medical attention**.

Ingestion: Do not administer adrenalin or similar drugs.

Phloroglucinol $C_6H_3(OH)_3 \cdot 2H_2O$

Synonyms

1,3,5-benzenetriol; phloroglucine; 1,3,5-trihydroxybenzene; 3,5-dihydroxyphenol.

Normal state

White crystalline material; yellow crystals.

Uses

Paper conservation.

Properties

M.P. 218°C. Light and air sensitive: may discolour. If heated to decomposition releases acid smoke and irritating fumes.

Fire extinguishers

Water; carbon dioxide; dry chemical powder; alcohol foam.

Incompatible with

Acid chlorides, acid anhydrides, bases and oxidising agents.

Spills

Sweep up onto paper: burn with great care in fume hood.

Storage

Keep container tightly closed in cool dark place.

Handling

Respirator; chemical resistant gloves; safety goggles/face shield; protective clothing. Use only in a fume cupboard.

USA: No data USA: TLVs or UK: OESs.

Effects of exposure

Severe irritant; readily absorbed through skin. Moderately toxic through skin.

Skin: irritation and redness, splashes may cause blisters.

Eyes: irritation and redness; splashes may cause blisters.

Inhalation: low concentrations may cause dry and sore throat; high concentrations drowsiness, mental confusion or unconsciousness. Lungs may become congested.

Ingestion: irritation of mouth and throat; nausea; vomiting. Possible unconsciousness. Fumes from stomach may be inhaled giving same effect as inhalation.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with soap and water. If irritation persists; **seek medical aid.**

Eyes: irrigate with water; if irritation persists; **seek medical aid.**

Inhalation: move to fresh air — keep warm and at rest. Give O₂ if breathing difficult; support in sitting position if lungs congested; **seek medical aid.**

Ingestion: if conscious give plenty of water to drink; **seek medical aid as soon as possible.**

Phosphine PH_3

Synonyms

Hydrogen phosphide

Normal state

Gas

Uses

Fumigation. **NB not approved under UK's 1986 Pesticide Regulations:** see note p.13.

Properties

M.P. -133°C . B.P. -85°C .

Slightly soluble in cold water; insoluble in hot water; soluble in ethane; ether and cuprole chloride.

Colourless flammable gas; garlic-like odour in poisonous concentration.

Flammability

Extremely dangerous fire risk. Ignition temperature $40-60^\circ\text{C}$.

Fire extinguishers

Turn cylinder off; keep cool with water spray; if possible move cylinder well away from any fire.

Incompatible with

Impure gas ignites spontaneously in air; on contact with chlorine, bromine, (or aqueous solutions thereof); fuming nitric acid; silver nitrate; oxygen.

Spills/Disposal

Return to supplier or vent slowly — via spark-proof fume cupboard or ventilation system — to open air, well away from people and livestock.

Storage

Secure outside storage away from all sources of spark or ignition.

Handling

Wear natural/neoprene or rubber gloves; goggles; self-contained breathing apparatus/ work in fume cupboard. **Strictly avoid moist air.** Good and safe ventilation system essential.

USA: TLV/TWA: 0.3 ppm STEL: 1 ppm

UK: OES 0.3 ppm LTEL: 1 ppm STEL

Effects of exposure

Highly poisonous gas. Casualty should be transferred to hospital for observation.

Skin: Irritation and redness.

Eyes: Irritation and redness

Inhalation: **Mild poisoning:** headache, weakness, muscle pain, nausea, vomiting and diarrhoea. **Severe poisoning:** tingling in arms and legs, staggering, shock. Severe shortness of breath due to lung congestion — may be delayed up to 72 hours. Liver damage; convulsions.

FIRST AID

Skin: wash thoroughly with soap and water. Seek medical attention if irritation persists.

Eyes: irrigate thoroughly with water; seek medical aid.

Inhalation: using protective clothing and airline; move casualty to fresh air. Keep warm and at rest. Maintain in seated position if lungs congested; give O₂ if breathing difficult.

o-Phosphoric acid H_3PO_4

Synonyms

Phosphoric acid.

Normal state

Hygroscopic transparent solid; usually supplied as 50% aqueous solution.

Uses

Anti-rusting agent.

Properties

B.P. 261°C.; M.P. 42.35°C.; S.G. 1.83. Miscible with water and alcohol.

Flammability

Non-combustible.

Fire extinguishers

Water spray.

Incompatible with

Heat/fire — toxic vapours formed; generates hydrogen gas with many metals — gas forms flammable mixture with air; chlorides with stainless steel; nitromethane; strong caustics; most metals.

Spills

Cover with sodium carbonate or a 1:1 mixture of soda ash and slaked lime; mix, dilute with water and release to sewer with copious water. Care should be exercised as heat will be generated during neutralisation and dilution.

Disposal

Add slowly to large amount of solution of slaked lime and soda ash (with care, as heat will be generated). Mix well; discharge into sink lined with protective matting and filled with marble chips.

Storage

Protect containers from damage; keep cool and dry.

Handling

Rubber gloves; goggles; work in fume cupboard, well-ventilated area or wear breathing apparatus. Do not wear contact lenses.

USA: TLV/TWA: 1.0 mg/m³; TLV/STEL: 3 mg/m³.

Effects of exposure

Corrosive.

Skin: burns

Eyes: conjunctivitis; burns.

Inhalation: irritation of respiratory tract.

Ingestion: nausea; stomach pain; vomiting; diarrhoea; shock.

FIRST AID

Skin: remove contaminated clothing; wash with water, if irritation persists after washing; **seek medical aid.**

Eyes: irrigate with water; **seek medical aid immediately.**

Inhalation: move to fresh air; keep warm and at rest. Give O_2 if breathing difficult; **get medical aid.**

Ingestion: If conscious give one pint of water to drink, followed by one pint of milk if available. **Seek medical aid immediately.** Keep warm and at rest.

Pigments

Although the amounts of pigments used in conservation and restoration are usually relatively small, some have health hazards that must be taken into consideration. This list is not complete: if a particular pigment is not listed, do not assume it has no health hazards.

- Barium white* (barium sulphate). Negligible hazards; see relevant sheet.
- Burnt sienna* (iron oxides). See 'Iron salts'.
- Burnt umber* (iron oxides; manganese oxide). **High toxicity by inhalation and ingestion.**
- Cadmium yellow* (cadmium sulphide). Suspect carcinogen: high toxicity by inhalation and ingestion. UK: MEL: 0.05 mg/m³.
- Carbon black* (carbon). **Human carcinogen.** Moderately toxic by inhalation and ingestion.
- Chrome yellow* (lead chromate). See 'Lead'; 'Sodium bichromate'. **Human carcinogen**; teratogen, suspected mutagen. Moderately toxic to skin; **highly toxic by inhalation and ingestion.**
- Cobalt blue* (cobalt oxide; aluminium, oxide). Allergen. Slightly toxic by skin contact or ingestion; moderately toxic by inhalation (cobalt).
- Prussian blue* (ferric ferrocyanide). Only slightly toxic by itself but extremely toxic hydrogen cyanide gas generated if heated to decomposition, or in contact with hot acid, or with strong ultraviolet radiation.
- Raw sienna* (clay with iron; aluminium oxides). Negligible hazards.
- Raw umber* (clay with iron and manganese silicates; Van Dyke Brown)
- Red lead* (lead tetroxide; minium). **Poisonous:** see 'Lead', and 'lead oxide'
- White lead* (lead carbonate); see 'Lead' and 'Lead carbonate'.
- Zinc white* (zinc oxide; Chinese White). Slightly toxic; avoid breathing dust.

See also: Iron salts.

NB Cadmium, Chromium and Lead compounds need extremely careful use. Cadmium and chromates have Maximum Exposure Limits and lead compounds must be assessed under the Lead at Work Regulations (UK) before use.

Pliantex*

Flexible polyacrylic resin based on ethyl acrylate.

Normal state

Supplied as viscous liquid; 30% solution in ethyl acetate (see relevant entry).

Uses

Consolidation/sticking fragile leather.

Properties

Gives flexible film on drying; does not cross-link Soluble in esters, ketones (eg acetone); aromatic and chlorinated hydrocarbons (eg trichloroethane).

Flammability

Highly flammable. (Ethyl acetate FP -5°C).

for ethyl acetate

USA: TLV/TWA: 400 ppm.

UK: OES: 400 ppm (LTEL)

Pliantine standard; & special G

Synonyms

British Museum Leather Dressing.

Normal state

Thick, brownish liquid consisting of lanolin, cedarwood oil; beeswax; 1,1,1-trichloroethane. Special*G omits the beeswax.

Uses

A dressing for hard, brittle leather.

For hazards see 1,1,1-trichloroethane.

Plus Gas formula A

Normal state

Pale yellow, volatile liquid; contains hydrocarbons and chlorinated hydrocarbons. (i.e. oils in penetrating solvents).

Uses

Solvent-based rust softener.

Properties

Immiscible with water. S.G. 0.88.

Flammability

Highly flammable. Flash point 30°C.

Fire extinguishers

Dry powder; carbon dioxide; foam.

Spills

Flush away with water or absorb on earth.

Storage

Keep away from sources of ignition. Product will attack some plastics and rubbers.

Effects of exposure

No data health hazards.

'Do not inhale aerosol spray'.

FIRST AID

If ingested, do not induce vomiting — seek medical aid immediately.

Polybutylmethacrylate

Flammability

Flammable.

Fire extinguishers

Water; carbon dioxide; dry chemical powder; alcohol foam.

Incompatible with

Strong oxidising agents, strong bases.

Spills

Sweep up powder and bag for disposal. If in liquid form, absorb onto paper, allow solvent to evaporate in fume cupboard, burn paper.

Storage

No data.

Handling

Goggles; respirator; rubber gloves. Do not breathe dust; do not get in eyes, or on skin, clothing.

Effects of exposure

May be harmful by inhalation, ingestion or skin absorption; may cause skin and eye irritation.

Polyester resins and alkyd resins

Synonyms

Various trade-names.

Normal state

Transparent — opaque yellow — brown. Readily dissolved but becomes insoluble as a film due to cross-linking. Oils incorporated into film.

Supplied powdered, granulated or as liquid (flammable) solutions in monomer, e.g. styrene. (See relevant section).

Curing effected by catalysts eg organic peroxides, such as Butanox* — see relevant entry or methyl ethyl ketone peroxide (see relevant section) — and initiated by accelerators or heat.

Premature polymerisation may be caused by metal halides, ferrous salts, sulphuric acid, peroxides — so avoid contamination with these.

Flammability

Flammable. Flash points vary. High fire risk with organic peroxides.

Fire extinguishers

Foam; sand; carbon dioxide; dry chemical.

Incompatible with

Organic peroxides.

Spills

Absorb with dry earth or vermiculite if liquid; if dry powder, sweep up.

Storage

Avoid ignition sources; avoid exposure to fluorescent lighting, sunlight or heat.

Handling

Do not allow to come into contact with skin; wear barrier cream and gloves when handling uncured resin.

USA: TLV: dust particulate 10 mg/m³. (Resin granules or cured resin) For hazards of solvent/monomer see **Styrene** (Uncured resin and hardener).

Effects of exposure

Skin: dermatitis; irritant; corrosive.

Eyes: irritant and corrosive.

Inhalation: irritant; nausea; dizziness; headache.

Ingestion: toxic.

See also: *Butanox; methyl ethyl ketone peroxide.

Cured films relatively unaffected by hydrocarbons, oils, weak acids.

FIRST AID

Skin: remove contaminated clothing; wash well with resin skin cleanser or soap and water; apply cream.

Eyes: irrigate with water; **seek medical aid.**

Inhalation: fresh air.

Ingestion: do not induce vomiting; if conscious administer milk of magnesia (magnesium hydroxide). **Seek immediate medical advice.** Keep warm and at rest.

Polyethylene glycol $H(OCH_2CH_2)_nOH$

Synonyms

PEG; Carbowax*.

Normal state

White flakes or pellets

Uses

Conservation of waterlogged wood; vegetable material; shale.

Properties

Water soluble wax in different grades, from MW c.400 up to MW c.15,000. Lower MW grades are softer and absorb water more easily. Corrodes iron, zinc, aluminium, lead. Surfaces of treated objects can be cleaned with methylene chloride and methanol or hot toluene; or hot water.

Flammability

Flammable; decomposes at 430°F (222°C); moderate fire hazard if exposed to heat or flame.

Fire extinguishers

Carbon dioxide or dry chemical for small fires; foam or water spray for large fires.

Effects of exposure

One reference to the possibility of PEG 'carrying' chemicals through the skin; in this case lead salts, resulting in mild lead poisoning.

Slight — mild toxicity by ingestion (varies with molecular weight)

Skin irritation at higher MWs (above 1000).

Polyurethane foam

Synonyms

Foam supplied as 2 liquid components - resin-polyol composite, and isocyanate hardeners (eg toluene di-isocyanate; MDI; see relevant entries. One supplier lists '35% crude MDI' as a component.)

Uses

Casting; moulding; support for excavated material.

Properties

Greatly increases in bulk when 2 components mixed. Residual monomer and toxic fumes may be released if cured foam is cut with a hot wire — so use a cold knife to cut it.

Fire extinguishers

Carbon dioxide.

Flammability

Toxic combustible fumes evolved in contact with heat or flame. Auto-ignition temperature 250°C.

Incompatible with

Some isocyanates react with sodium hydroxide, ammonia, primary and secondary amines — often violently. Uncured resin releases carbon dioxide in an exothermic reaction: excess heat may be generated in contact with substances which have active hydrogen groups as a result of polymerisation. **DO NOT USE HOT CUTTING/ WELDING METHODS OR HOT FLAMES OR SOURCES OF IGNITION ON OR NEAR POLYURETHANE FOAMS.**

Handling

Gloves; goggles; cartridge respirator or for larger quantities, self-contained breathing apparatus. Attacks plastic and rubber — use PTFE or Teflon*. **N.B. Consult 'Toluene di-isocyanate' and MDI entries before use.**

Storage

Avoid water contamination in uncured state: avoid all sources heat and flame for components or polymerised foam.

USA: TLV: isocyanates 0.02 ppm. Take care as odour threshold is well above this.

Effects of exposure

Breathing difficulties — the effects may be delayed. May lead to allergenic reaction in some people with asthma-like symptoms.

Experimental carcinogen and tumorigen.

FIRST AID

Skin: Wash with soap and water for 5 minutes.

Eyes: Flush with water for 15 minutes.

Ingestion: If conscious, give plenty of water to drink to reduce corrosivity.
Seek medical aid.

Polyvinyl acetate $C_4H_6O_2$

Synonyms

Selamul N6525; Vinamul N6525; Rhodopas M; Mowilith. Elvacet, Dispersions-Emultex, Calatac; Texicote V, Texilac, Vinalac.

Normal state

Available in solution with alcohol or toluene; as emulsion in water; or as powder. Several grades of different toughness.

Uses

Adhesive; consolidant; textile conservation; release agent for polyester casts.

Properties

Soluble in ethanol, alcohols, ketones, esters. Internally plasticised with e.g. dibutyl phthalate, chloroform, etc.

Flammability

See solvents in relevant sections. High concentrations of dust in air may ignite. Keep away from oxidising material.

Effects of exposure

Residual monomers may cause irritation to skin, eyes and mucous membrane.

Polyvinyl alcohol CHOH.CH_2

Synonyms

Kochlight* 72,000 mol.wt. Rhodoviol* 40/20. Gelvatol* 40/20; Rhodoviol Ineroil* 25/140; Alcotex*; Elvanol*; Moviol*; Polyviol*.

Normal state

Colourless amorphous powder - slightly hygroscopic. Fibre forms: e.g. Cremona, Kuralon, Mewlon, Vinal, Vinytan

Uses

Consolidant.

Properties

pH 5. SG 1.23-1.30. Softens at 100°C; decomposes over 200°C; soluble in water. Shrinks and darkens at 217°C. May become insoluble due to crosslinking.

Flammability

Non-flammable; though slight explosion hazard if fine dust exposed to flame; when exposed to heat may react with oxidising material.

Fire extinguishers

Water; alcohol-resistant foam; carbon dioxide.

Handling

Gloves; respirator; protective clothing. Use in fume hood.

Effects of exposure

Suspect animal carcinogen; may be human carcinogen.

May be harmful by ingestion, inhalation or skin absorption. May cause irritation.

FIRST AID

Skin: wash with plenty of water.

Eyes: flush with water for at least 15 minutes; **seek medical aid.**

Inhalation: move to fresh air; give O_2 if breathing difficult, artificial respiration if breathing stops. **Seek medical aid.**

Polyvinyl butyral $C_8H_{14}O_2$

Synonyms

Butvar* 98; Butacite*, Pioloform* B.

Normal state

White flakes which reform to give clear, colourless, inert films.

Uses

Consolidant: adhesive; etc.

Properties

Soluble in phenols; 40/60 acetone/toluene; 30/70 alcohol/carbon tetrachloride; lower alcohols, acetone, aromatic hydrocarbons; toluene; esters.

Plasticised by castor oil, phthalates, phosphates, some epoxy resins.

Swollen by aromatic hydrocarbons and ketones (dissolves). Relatively unaffected by: petrol, mineral oils, water (some 3-5% absorbed), turpentine, vegetable oil, cold alkalines, diluted acids. Moderately impermeable to water. Softens 80-140°C decomposes at 200°C.

Very slightly affected by sunlight.

Incompatible with

Strong oxidising agents.

Fire extinguishers

Water, carbon dioxide, dry chemical powder, alcohol foam.

Handling

Do not breathe dust. Wear goggles, dust respirator.

Storage

Cool dry place.

Effects of exposure

May cause irritation.

Polyvinylpyrrolidone

Synonyms

PVP; Albigen A; Kollidon.

Uses

Adhesive; emulsifying/thickening agents; affinity for certain dyestuffs — used in alkaline solutions with sodium hydrosulphite for stripping sulphur colours, vat dyes, prints and for partial stripping of direct dyes from cellulosic textiles.

Properties

Similar to polyvinyl alcohol as soluble in water; pH neutral; soluble in acid solutions; many organic liquids (including chlorinated hydrocarbons). Swollen by aromatic hydrocarbons, unaffected by aliphatic hydrocarbons.

Handling

Gloves; goggles; respirator.

Effects of exposure

May be harmful by inhalation, ingestion or skin contact. May cause irritation.

Potassium chlorate $KClO_3$

Synonyms

'Potcrate'

Normal state

Transparent, colourless crystals or white powder.

Uses

Oxidising agent.

Properties

Oxidising agent. S.G. 2.337; M.P. 368°C. Decomposes above 400°C. Soluble in water, alkalis, alcohol.

Flammability

Powerful oxidising agent; **very reactive**.

Incompatible with

Forms explosive mixture with combustible, organic or easily oxidisable materials — easily ignited by friction or heat. Incompatible with: acids, ammonium salts, sulphur, flammable vapours, carbon disulphide, organic sulphur/sulphide, red phosphorous, hydrazine, hydroxylamine, ammonium rhodanate (esp. with copper and alcohol); zinc chloride; sugar with ferricyanides; sodium hyposulphite; combustible powders; amines.

Spills

Immediately remove and dispose of spillages; cover with weak reducing agents, e.g. hypo, bisulphites or ferrous salts. Transfer to large container, add water and neutralise with soda ash. Release to sewer with abundant water.

Storage

Protect against physical damage. Keep away from incompatible substances. Do not store on wooden floors. **Consult HSE note on safe storage of chlorates.**

Handling

Rubber gloves, face shield.

Effects of exposure

Skin: corrosive; irritation; redness.

Eyes: irritation, redness.

Inhalation: shortness of breath; absorbed through lungs, other symptoms similar to ingestion.

Ingestion: poisonous to blood cells; vomiting, diarrhoea, abdominal pain. Headache, drowsiness, shock, unconsciousness; possible convulsions. Casualty may turn blue around mouth, face and head.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with plenty of water; if irritation persists after washing, **seek medical aid**.

Eyes: irrigate thoroughly with water; **seek medical aid** if still irritated.

Inhalation: move to fresh air; give O₂ if breathing difficult; **seek medical aid**.

Ingestion: may cause liver and kidney damage. Keep warm and at rest; give water to drink and **seek medical aid immediately**. Transfer to hospital as soon as possible.

Potassium cyanide KCN

AVOID USE: EXTREMELY POISONOUS.

Normal state

Deliquescent solid with faint almond smell.

Uses

Removal of stubborn stains from silver.

Properties

Deliquescent; soluble in sulphuric acid, alcohol, glycerol. Absorbs carbon dioxide and water from air and slowly decomposes.

Flammability

Not combustible.

Incompatible with

Acids — evolves highly flammable hydrogen cyanide gas; explosive hazard with ammoniacal silver, with sodium or potassium nitrite; violent reaction with chlorates, nitrites, NCI_3 , NaClO_3 ; oxidants. May evolve flammable hydrogen cyanide gas in contact with acid. This is highly toxic.

Spills

Solid: sweep up and transfer to fume hood. Prepare a 1% sodium hydroxide solution, allowing 50ml per 1g. of cyanide. Add cyanide to this, then slowly stir in household bleach (allow 70ml/g of cyanide). Continue as for solution spills. Solution: cover spill with 1:1:1 mixture by weight of soda ash or calcium carbonate; clay cat litter (bentonite); sand. Scoop mixture into container and transfer to fume hood. Slowly add to a bucket containing household bleach. (c. 70ml/g of cyanide). Test for presence of cyanide using Prussian blue test (to 1ml of solution add 2 drops fresh 5% aqueous ferrous sulphate solution, Boil for 60 seconds. Cool to room temperature, add 2 drops 1% ferric chloride solution. Add 6M hydrochloric acid till pH is acid. Deep blue precipitate forms if cyanide still present). Add bleach till test is negative; release to drain with copious amounts of water.

Storage

Keep in cool, dry place; keep separate from acids and oxidising materials (see Incompatibilities).

Handling

No eating or drinking in work area; personnel must not work alone. Wear gloves, goggles, face shield and protective clothing; work in fume cupboard or with self-contained breathing apparatus. **ANTIDOTE MUST BE AVAILABLE.**

USA: TLV/TWA: 5 mg/m³ (skin).

UK: OEL: 5 mg/m³ (LTEL).

Effects of exposure

Extremely toxic; obtain medical aid as soon as possible and transfer victim to hospital. Onset of symptoms may be delayed 1-12 hours.

Skin: irritation, redness and pain may occur at point of contact. Absorbed through skin to give same symptoms as for ingestion and inhalation.

Eyes: irritation, redness and pain may occur at point of contact. Corneal burns.

Inhalation: mild poisoning; shortness of breath, chest pains; agitation. Severe poisoning; dizziness; rapid unconsciousness and convulsions.

Ingestion: burning sensation in throat with nausea and vomiting. Severe poisoning symptoms same as for inhalation.

FIRST AID

Skin: seek **IMMEDIATE** medical aid. Remove all contaminated clothing; wash affected area very thoroughly with soap and copious amounts of water. Keep under observation in case further symptoms develop as this chemical can be absorbed through the skin.

Eyes: irrigate thoroughly with flowing water; **seek medical aid.**

Inhalation: first aid as for ingestion.

Ingestion: if O₂ available give 100% by mask, with casualty seated and kept still. If not breathing, **do not** give mouth-to-mouth or mouth-to-nose resuscitation, because of risk to operator. Use resuscitation bag and mask instead. If casualty breathing, break 2 amyl nitrite capsules open and hold them under his nose so he inhales the vapours. Kelo-cyanor can also be given as an antidote, but must be used **only** by trained personnel and **only** if it is absolutely certain that cyanide poisoning has occurred as Kelo-cyanor is extremely dangerous to anyone not suffering from cyanide poisoning.

Potassium hydroxide KOH

Synonyms

Caustic potash. Potassium hydrate.

Normal state

Odourless white deliquescent solid.

Uses

Bleach; paper conservation, absorbent for carbon dioxide and hydrogen sulphide.

Properties

B.P. 1320-1344°C.; M.P. 360°C. Soluble in water, alcohol and glycerine; extremely hygroscopic.

Flammability

Non-flammable.

Fire extinguishers

Water spray; use large volumes to dilute chemical.

Incompatible with

Considerable heat is generated when this solid is mixed with water — may cause local boiling and sputtering. Produces flammable hydrogen gas with metals; violent reaction with acid; alcohols; chlorine dioxide; tetrahydrofuran.

Spills

Solid: sweep up; fill large container with water and slowly add spilled chemical to it. (N.B. This generates considerable heat — local boiling may even occur). Then neutralise with 6M hydrochloric acid, and discharge to sewer with copious amounts of water. Solutions: neutralise and release as above.

Storage

Keep container well stoppered; keep dry and protected from physical damage.

Handling

Avoid contact with dust or mist; wear natural, neoprene or nitrile rubber gloves; goggles; use fume cupboard. Do not wear contact lenses.

USA: TLV: 2mg/m³ (Ceiling limit). (Dust or mist)

UK: OES: 2 mg/m³ (LTEL); 2 mg/m³ (STEL). (Dust or mist)

Effects of exposure

Toxic and corrosive.

Skin: burns.

Eyes: strongly caustic; very harmful to eyes — corrosive to tissue; very irritating as dust or mist; concentrated solution will cause burns.

Inhalation: very harmful; dust or mist irritates upper respiratory tract, may cause

lesions of nasal septum. Can cause extensive damage to upper respiratory tract - may prove fatal. Ingestion: very harmful — KOH destroys tissues on contact.

FIRST AID

Skin: remove all contaminated clothing; wash thoroughly with water; if irritation persists after washing, **seek medical attention.**

Eyes: irrigate thoroughly with water; at least 15 mins. as tends to penetrate skin and continue burning even after it appears to have been washed off; **seek medical aid as soon as possible.**

Inhalation: move to fresh air; keep at rest. Give O_2 if breathing difficult, artificial respiration if breathing stops; **seek medical attention.**

Ingestion: **get medical aid immediately.** If conscious give 1 pint water to drink, then 1 pint of milk; keep warm and at rest and transfer to hospital.

Potassium permanganate KMnO_4

Synonyms

Potassii permanganas; p-hypermanganate.

Normal state

Dark violet crystals, odourless but with sweet taste.

Uses

Powerful oxidising agent; bleach.

Properties

M.P. 240°C . Soluble in water, acetone and methanol; decomposes in alcohol or organic solvents, releasing oxygen. Powerful oxidiser.

Flammability

Not flammable but **explosive hazard in contact with; organic or easily oxidised material; ethylene glycol, glycerol, ethanol, sulphuric acid, concentrated acids, ether, hydrogen peroxide, alcohol, paper, iron, ammonium nitrate.** Containers may explode in fire.

Fire extinguishers

Water.

Incompatible with

See 'Flammability', also — acetic acid; acetone; alcohols with nitric acid; ammonia with sulphuric acid; glycerol; hydrochloric acid; hydrofluoric acid; hydrogen peroxide; oxygenated organic compounds e.g. ethylene glycol, propane 1,2,-diol; mannitol; triethanolamine; acetaldehyde. Polypropylene; sulphuric acid, wood in presence of moisture/friction.

Spills

Mix with a vast volume of a concentrated solution of a reducing agent e.g. bisulphite or ferrous salts, with $3\text{M H}_2\text{SO}_4$, or hypo. Neutralise with soda ash or dilute hydrochloric acid; release to sewer with large amount of water.

Storage

Keep containers closed; keep separate from chemicals mentioned in Flammability section.

Handling

Rubber gloves; face shield.

USA: TLV: CL 5 mg/m^3

Effects of exposure

Skin: irritation; brown stains.

Eyes: irritation.

Inhalation: highly toxic.

Ingestion: highly toxic. Brown stains on face, mouth, hands, teeth. Burning sensation in mouth and stomach; nausea; vomiting; bronchitis; shock. Harmful if swallowed.

FIRST AID

Skin: remove contaminated clothing; wash skin well with soap and water; **seek medical aid** if irritation persists.

Eyes: irrigate with water; **seek medical aid** if irritation persists after washing.

Inhalation: move to fresh air; keep warm and at rest if breathing difficult, give O₂ artificial respiration if breathing stops. **Seek medical aid.**

Ingestion: **Seek medical attention at once.** Keep warm and at rest. Give plenty of water to drink, if patient is conscious.

Primal AC-73X

Normal State

Milky white aqueous acrylic emulsion, with mild ammoniacal odour. 46 parts acrylic: 54 parts water.

Uses

Consolidant; adhesive; film-forming.

Properties

M.P. 0°C; B.P. 100°C; S.G. 1-1.2.

pH 9.5-10 Viscosity 400 cps max.

Flammability

Non-combustible, but may spatter if temperature exceeds boiling point. Polymer film will give off oxides of carbon and nitrogen if burned.

Fire extinguishers

Non combustible.

Spills

Absorb and contain with sand or a vermiculite; transfer to container for disposal on land fill site — do not release to sewer. Emulsions can be coagulated by step-wise addition of lime and ferric chloride or ferric sulphate to a clear water end point.

Handling

Wear rubber or vinyl gloves; goggles. Ensure adequate ventilation. Do not inhale spray.

USA: TLV/TWA: 25 ppm for ammonia content only (c.0.3% by weight of emulsion).

USA: TLV/TWA: 0.55 for formaldehyde (0.05% by weight of emulsion); 5 ppm 10mg/m³ for sprays.

Effects of exposure

Skin: Prolonged contact may cause irritation.

Eyes: May cause irritation.

Inhalation: Exposure to vapours or spray mists may irritate nose, throat respiratory tract; may cause headache and nausea.

FIRST AID

Skin: Wash with soap and water. Seek medical aid if irritation persists.

Eyes: Irrigate with water.

Inhalation: move to fresh air.

Ingestion: if conscious, give 2 glasses of water to drink. Seek medical aid.

Primal AC-261K

Normal state

Milky white liquid with slight odour of ammonia; emulsion.

Uses

Consolidant; film formation.

Properties

M.P. 0°C.; B.P. 100°C. Soluble in water.

pH 8.5-9.1; Viscosity 400 cps max SG 1.0-1.2.

Flammability

Non-combustible.

Spills

Floor may be slippery. Absorb and contain with sand or vermiculite for disposal on landfill site. Do not release to sewer.

Storage

1-60°C. Do not allow to freeze — product may coagulate.

Handling

Wear rubber or vinyl gloves; goggles ensure good ventilation or work in fume cupboard.

USA: TLV: 25 ppm for ammonia content (0.4% max. of emulsion)

Effects of exposure

Skin: prolonged exposure may cause irritation.

Eyes: slightly irritating.

Inhalation: spray or mist may cause headache, nausea and irritation of nose, throat and lungs.

Ingestion: slightly irritating.

FIRST AID

Skin: wash with soap and water.

Eyes: irrigate with water.

Inhalation: move to fresh air.

Information supplied by manufacturer.

Primal WS24 Resin

Synonyms

Acrylic co-polymer in water (36%).

Normal state

Milky white liquid with slight odour of ammonia.

Uses

Consolidant: film formation.

Properties

M.P. 0°C; B.P. 100°C.; SG 1.0-1.2.

pH 6.8-7.2; Viscosity 600cps max.

Flammability

Non-combustible but polymer film may burn

Incompatible with

Material may spatter above 100°C.

Spills

May make floor slippery, so take care. Absorb and contain with inert material (sand, vermiculite) and sweep up. Do not release to sewer; disposal at landfill site. To coagulate — see Primal AC 73.

Storage

Between 1-60°C. Do not allow to freeze — product will coagulate.

Handling

Wear rubber or vinyl gloves; goggles, chemical cartridge respirator or work in fume cupboard.

Effects of exposure

Skin: long exposure may be irritant.

Eyes: slightly irritating.

Inhalation: vapour or spray mist may cause headache, nausea, irritation of nose, throat and lungs.

FIRST AID

Skin: wash thoroughly with water; seek medical aid if irritation persists.

Eyes: irrigate with water; seek medical aid if irritation persists.

Inhalation: move to fresh air.

Propylene phenoxytol $C_6H_5O(CH_2)_2OH$

Synonyms

2-Phenoxy-ethanol; phenyl cellosolve; ethylene glycol mono-phenyl ether.

Normal state

Colourless liquid or partial solid with faintly aromatic odour.

Uses

Preservative for zoological specimens; possible alternative to formalin.

Properties

M.P. 17-180°C.; B.P. 242°C. Soluble in water. Miscible with alcohol, ether, propylene glycol, arachis oil. Insoluble in mineral oil. MW 152.2.

Flammability

Flashpoint: 121°C.

Fire extinguisher

Carbon dioxide; dry chemical.

Incompatible with

No data available.

Effects of exposure

Moderately toxic orally or through skin.

Inhalation: narcotic.

Pyrethrum

Synonyms

Pyrethrin 1 or 2; Cinerin 1 or 2; Jasmolin 1 or 2.

Normal state

Fine powder.

Uses

Fungicide/insecticide. See p.13 for U.K.'s 1986 Pesticide Regulations.

Properties

Oxidises on exposure to air — may lose 20% of activity in a year.

Flammability

No data.

Incompatible with

Strong oxidisers.

Handling

Goggles; mask or respirator; gloves.

USA: TLV/TWA: 5 mg/m³.

UK: OES: 5 mg/m³ (LTEL); 10 mg/m³ (STEL).

Effects of exposure

Skin: may cause irritation; allergies; sensitiser; contact dermatitis; asthma; sneezing.

Eyes: conjunctivitis; irritant.

Inhalation: poisonous; allergies; asthma; nausea.

Chronic exposure may cause liver change.

FIRST AID

Skin: wash thoroughly with soap and water.

Eyes: irrigate with water.

Ingestion: If conscious give plenty of water to drink; seek medical aid.

PRECLUDE FROM EXPOSURE workers with lung diseases or allergies.

Pyridine C_5H_5N

Synonyms

Azine; asabenzene.

Normal state

Colourless or slightly yellow liquid with nauseating odour.

Uses

Solvent for shellac, oil, tar. Vapour phase inhibitor for copper and copper alloys.

Properties

B.P. 115°C.; S.G. 0.978. Volatile with steam; soluble in water, alcohol, ether. Strong reducing agent. Hygroscopic.

Flammability

Highly flammable. Flash point 17°C. Flammable limits in air 1.8-12.4%. Auto-ignition temperature 482°C. Vapours form explosive mixture with air, and may travel considerable distance to source of ignition and flash back. Decomposes on heating to release hydrogen cyanide, oxides of nitrogen, and carbon monoxide.

Fire extinguishers

Dry chemical; alcohol-resistant foam; carbon dioxide.

Incompatible with

Strong oxidisers; strong acids (violent spattering).

Spills

Absorb with mixture of 9:1 sand and soda ash; put into paper carton stuffed with paper; burn with care in open furnace.

Storage

In fireproof storage; keep away from strong oxidisers. Keep container tightly closed. Handle and store under nitrogen.

Handling

Goggles; butyl rubber gloves; work in fume cupboard. Ensure no sources sparks or ignition.

USA: TLV/TWA: 5 ppm. 0.012-0.23 ppm; objectionable at 10 ppm.

UK: OES: 5 ppm (LTEL); 10 ppm (STEL).

Effects of exposure

Irritant.

Skin: may be readily absorbed through skin to give similar symptoms to inhalation; itching; eczema.

Eyes: conjunctivitis.

Inhalation: anorexia; nausea; asthmatic breathing, anxiety, unconsciousness. **Large doses affect central nervous system; causes serious damage to bone marrow, kidneys and liver. Heart poison**

FIRST AID

Skin: remove all contaminated clothing; wash chemical off with copious amounts of water.

Eyes: irrigate with water; **seek medical aid** if irritation persists after washing.

Inhalation: fresh air; keep warm and at rest. Give O₂ if breathing difficult, artificial respiration if breathing stops. **Seek medical aid.**

Ingestion: if patient conscious, give water to drink and **seek medical aid.**

Resorcinol $C_6H_4(OH)_2$

Synonyms

Resorcin; m-dihydroxybenzene; 1,3-benzenediol.

Normal state

White needle-like crystals that turn pink on exposure to air or iron.

Uses

Manufacture of resorcinol/formaldehyde resins.

Properties

M.P. 109-110°C.; B.P. 176°C.

Soluble in water, ethanol, ether, glycerol, benzene. May discolour on exposure to light.

Flammability

Combustible. Flash point 127°C. Auto-ignition temperature 607°C.

Fire extinguishers

Water; carbon dioxide; dry chemical.

Incompatible with

Acid chlorides, acid anhydrides, oxidising agents and iron or iron salts.

Handling

Goggles; natural, neoprene or nitrile rubber gloves; cartridge respirator; fume cupboard.

USA: TLV/TWA: 10 ppm; TLV/STEL: 20 ppm.

UK: OES: 10 ppm (LTEL); 20 ppm (STEL).

Effects of exposure

Toxic; irritant to skin and eyes. Readily absorbed through skin. Exposure to resorcinol may cause headaches, nausea, fits, palpitations.

Resorcinol resins; **cancer suspect agents**. Components may contain residual resorcinol and formaldehyde.

Robac 22 $C_3H_6N_2S$

Synonyms

Ethylenethiourea; 2-Mercapto-2-imidazolidine-2-thione.

Normal state

White powder.

Uses

Rubber grade of ethylene thiourea (ETU).

Properties

M.P. 185°C. Moderately soluble in water and organic solvents.

Flammability

Combustible — products include oxides of sulphur and nitrogen. Flash point; above 66°C (150°F).

Fire extinguishers

Water; foam; alcohol-resistant foam; dry powder; sand; earth; carbon dioxide.

Spills

Sweep up with sawdust and incinerate; remove last trace with water and detergent.

Handling

Safety glasses, face mask, overalls, PVC gloves.

Effects of exposure

Experimental teratogen and carcinogen.

Minimum exposure at all times.

FIRST AID

Skin: remove contaminated clothing; then wash with soap and water.

Eyes: irrigate thoroughly with water.

Pregnant women should avoid contact during manufacturing process.

Rosin core solder

Pyrolysis products: wood rosin decomposition products include acetone, methyl alcohol, aliphatic aldehydes, carbon monoxide, methane, ethane, abietic acid and diterpene acid.

Vapour irritates eyes, nose and throat. Fumes may be toxic on repeated inhalation. May induce asthma — especially colophony-based cored solders.

Handling

All work with solders should be carried out using local exhaust ventilation. *See also* Lead.

USA: TLV/TWA: (as formaldehyde): 0.1mg/m³; TLV/STEL: 0.3mg/m³.

UK: OES: " " " " (LTEL) " "

Rubber latex

Normal state

Creamy, whitish liquid smelling of ammonia

Uses

Adhesive; moulding; cleaning.

Flammability

Non-flammable in liquid form.

Fire extinguishers

Water; carbon dioxide; dry chemical.

Spills/Disposal

May be coagulated rapidly by mixing with sodium chloride.

Effects of exposure

Contains ammonia as anti-coagulant — see relevant entry. May irritate skin, eyes and mucous membranes; allergenic.

FIRST AID

Ingestion: coagulates in stomach — seek medical aid immediately.

Rutapox R1210, R1200

Normal state

Colourless, 2-component epoxy resin. Aliphatic epoxy resin — mixture of butanediol diglycidylether, and methane diamine.

Uses

Consolidation of fragile wood.

Properties

Clean tools with methylethylketone; removes uncured resin only. Cured resin may be softened and removed with 'a normal paint remover', then washed with water

Storage

Will keep 2 years + if in closed container, and kept cool and dry.

Part B is corrosive.

No data health hazards: first aid.

Sebralit*

Synonyms

Catalyst contains benzoyl peroxide.

Normal state

Greenish/Yellow 2-part polyester resin supplied as liquid or paste, coloured or uncoloured.

Uses

Polyester resin mastic for stone.

Properties

Weight density 1.068 (transparent liquid).

Most of the hazards are associated with the styrene solvent: see relevant sheet.

Handling

Absorbed through skin/inhalation

Wear: natural/neoprene/nitrile/butyl rubber or vinyl gloves; goggles; operate in fume cupboard.

Effects of exposure

Skin: irritant.

Inhalation: irritant.

FIRST AID

Skin: remove contaminated clothing; wash skin with soap and water.

Inhalation: move to fresh air; **seek medical aid.**

Ingestion: keep warm and at rest and **seek medical aid immediately.**

Shellsol A

Normal state

Colourless liquid. High boiling, high aromatic hydrocarbon solvent.

Properties

s.g. 0.875.

Flammability

Flammable. Explosive limits in air 1.0 - 7.5%. Flash point 50°C. Auto-ignition temperature 450°C.

Fire extinguishers

Carbon dioxide; dry chemical powder; foam; water fog; sand or earth.

Spills

Extinguish all flames. Absorb with sand or earth; scoop into container with non-sparking tools and leave to evaporate in safe place.

Storage

All containers to be earthed. Keep cool; avoid all sources of sparks/heat.

Handling

Keep area well ventilated; work in fume cupboard; wear eye protection.

TLV: 50 ppm:

Effects of exposure

Skin: defatting; irritation; skin disorders.

Eyes: irritation.

Inhalation: may cause irritation; dizziness, lack of co-ordination, unconsciousness.

FIRST AID

Skin: remove all contaminated clothing; wash skin with water; seek medical aid if irritation persists.

Eyes: irrigate for 15 minutes — seek medical aid.

Inhalation: move to fresh air. Seek medical aid immediately if any ill effects.

Ingestion: wash mouth out with water; give pint water to drink if conscious. Keep still and at rest and send to hospital.

Shellsol E

Normal state

Colourless liquid. High boiling, high aromatic hydrocarbon solvent.

Properties

S.G. 0.858.

Flammability

Flammable. Flash point 110°F (46°C). Auto-ignition temperature 115°C. Explosive limits in air 1.0-7.0%

Fire extinguishers

Foam; carbon dioxide; dry chemical

Spills

Extinguish all flames. Absorb with sand or earth; scoop into container with non-sparking tools and leave to evaporate in safe place.

Storage

All containers to be earthed. Keep cool; avoid all sources of sparks/heat.

Handling

Keep area well ventilated; work in fume cupboard; wear eye protection.

TLV: 50 ppm:

Effects of exposure

Skin: defatting; irritation; skin disorders.

Eyes: irritation.

Inhalation: may cause irritation; dizziness, lack of co-ordination, unconsciousness.

FIRST AID

Skin: remove all contaminated clothing; wash skin with water; seek medical aid if irritation persists.

Eyes: irrigate for 15 minutes — seek medical aid.

Inhalation: move to fresh air. Seek medical aid immediately if any ill effects.

Ingestion: wash mouth out with water; give pint water to drink if conscious. Keep still and at rest and send to hospital.

Shellsol T

Normal state

Clear, water-white liquid. A high boiling aliphatic hydrocarbon solvent, composed almost entirely of iso paraffins.

Uses

Solvent.

Properties

S.G. 0,755. Boiling point 186-214°C. Immiscible with water; soluble in aromatic and aliphatic hydrocarbons.

Flammability

Combustible. Flashpoint 52°C. Auto-ignition temperature 404°C. Explosive limits in air; 1,1% - 6,5%.

Fire extinguishers

Carbon dioxide; foam; dry chemical powder; sand; earth.

Incompatible with

None reported.

Spills

Absorb with sand, earth or sawdust. Move to safe area (use non-sparking tools) for evaporation/burning.

Storage

Keep below 30°C in flammable liquid store.

Handling

Wear plastic or rubber gloves; eye protection; work in fume cupboard.

Effects of exposure

Skin: slightly irritating.

Eyes: mildly irritating.

FIRST AID

Skin: flush with plenty of water; a little soap can be used.

Eyes: irrigate with water; seek medical aid if irritation persists.

Silane (stone consolidant) $\text{CH}_3\text{-Si}(\text{OCH}_3)_3$

Synonyms

Methyl trimethoxysilane.

Normal state

2-part resin with catalyst; supplied with 0.5% methanol content.

Uses

Coating for iron; with catalyst as stone consolidant.

Properties

B.P. 102°C. May decompose on exposure to moist air or water.

Flammability

Flash point 11°C. Flammable. In case of emergency telephone Barry (0446) 732350. May ignite spontaneously in air.

Fire extinguishers

Carbon dioxide; foam or fine water spray.

Incompatible with

Oxidisers; strong acids.

Spills

Cover with dry lime, sand or soda ash. Place in covered containers using non-sparking tools, and transport outdoors. Leave to evaporate in secure area.

Storage

Keep away from sources of ignition.

Handling

Gloves; safety glasses; mask.

TLV: no data.

Effects of exposure

Highly toxic by inhalation, ingestion or skin contact.

Inhalation: anaesthesia; headache.

FIRST AID

Skin: remove contaminated clothing; flush immediately with plenty of water.

Eyes: irrigate with plenty of water.

Inhalation: move patient to fresh air; seek medical aid immediately.

Ingestion: extremely toxic; seek medical assistance immediately. Give plenty of water to drink if conscious; keep patient warm and at rest.

Silica gel H_2SiO_3

Synonyms

Silicic acid (precipitated).

Normal state

Crystalline or pellets, clear but may be white (non-indicating) or pink to blue if self-indicating.

Uses

To absorb moisture; to stabilise environment in storage of objects sensitive to moisture or to changes in relative humidity; in preservation of botanical specimens.

Incompatible with

Hydrogen fluoride.

USA: TLV/TWA: 10 mg/m³

Effects of exposure

Sell-indicating type contains 0.5% cobalt chloride which may cause asthma if inhaled (see 'Pigments').

Inhalation of the silica dust may have pulmonary effects; irritating to eyes, mucous membranes and upper respiratory tracts.

Silver nitrate AgNO_3

Normal state

Colourless, odourless sheet-like crystals.

Uses

Detection of chlorides in solution: test solution 10% AgNO_3 in water, with nitric acid (see relevant entry) as 10% of total volume. Chlorides form white precipitate — sensitive to c. 5ppm.

Properties

M.P. 208.5°C. Soluble in water; slightly soluble in alcohol, acetone, glycerine, ether.

Flammability

Strong oxidising agent — crystals may flame up when in contact with inflammable and oxidising material.

Fire extinguishers

No data.

Incompatible with

Violent reaction with ammonium hydroxide and ethanol; ammonia; ammonia with sodium carbonate or sodium hydroxide; ethanol; alkalis; aluminium; carbon; carbonates; chlorides; copper; phosphates; plastics; tannic acid; thiocyanates.

Storage

Avoid light.

Handling

Natural or nitrile rubber gloves; face mask.

USA: TWA/TLV: Silver (soluble compounds) as Ag 0.01 mg/m^3

UK: OES: 0.01 mg/m^3 (LTEL); 0.3 mg/m^3 (STEL).

Effects of exposure

Dust severe irritant to eyes, skin, respiratory tract. Causes burns. If ingested - poisonous. Experimental tumorigen; human mutagenic data.

FIRST AID

Skin: remove contaminated clothing; flush skin with water immediately.

Eyes: irrigate with water immediately.

Ingestion: if conscious give plenty of water to drink and seek medical aid immediately.

Sodium bicarbonate NaHCO_3

Synonyms

Sodium hydrogen carbonate.

Normal state

White powder or lumps

Uses

Air-abrasive machine; cleaning; neutralising.

Properties

Soluble in water, insoluble in alcohol.

Effects of exposure

Slightly toxic through oral route.

Sodium bichromate $\text{Na}_2\text{Cr}_2\text{O}_7 \cdot 2\text{H}_2\text{O}$

Synonyms

Sodium dichromate.

Normal state

Red-orange monoclinic crystals.

Uses

Corrosion inhibitor for metals in water; oxidising agent.

Properties

Soluble in water; insoluble in alcohol.

Flammability

Decomposes on heating to release oxygen which promotes combustion. **Explosive hazard.**

Fire extinguishers

Flood with water.

Incompatible with

Carbide; amines (eg hydrazine, hydroxylamine, aniline).

Spills

Cover with reducing agent (eg hypo; with bisulphite or ferrous salts add 3M H_2SO_4); transfer sludge to beaker, neutralise with soda ash and release to sewer with copious water.

Storage

Avoid incompatibles; keep dry; keep away from oxidising or inflammable materials.

Handling

Avoid all skin contact. Neoprene or natural rubber gloves; face shield; protective clothing; use in fume cupboard.

USA: TLV/TWA: 0.5 mg/m³

UK: OES: 0.5 mg/m³ (LTEL) as chromates poisonous by ingestion, inhalation and skin contact.

Effects of exposure

Strongly corrosive; transfer to hospital as soon as possible. Carcinogen.

Skin: severe pain, redness and burns at contact site; sensitising dermatitis; causes chronic ulcers on exposed skin, especially knuckles and base of nails — ulcers have punched-in appearance and are extremely difficult to heal.

Eyes: severe pain, redness; corneal burns.

Inhalation: sinusitis; perforation of nasal septum; laryngitis, congestion of lungs;

carcinoma of lungs.

Ingestion: anorexia; nausea; vomiting, occasionally of blood. Severe poisoning can damage kidneys and liver.

FIRST AID

Skin: remove all contaminated clothing; wash thoroughly with soap and water; **seek medical aid.**

Eyes: wash thoroughly with water; **seek medical aid.**

Inhalation: move to fresh air; keep warm and at rest. Give O₂ if breathing difficult. If lungs congested, support in upright seated position to aid breathing.

Get medical aid immediately.

Ingestion: **seek medical attention immediately.** Keep victim warm and at rest give 1 pint water to drink followed by 1 pint milk, if conscious.

Sodium borohydride NaBH_4

Hazardous chemical: avoid use.

Normal state

White to grey crystalline powder or pellets.

Uses

Paper bleaching agent with water/methanol/ethanol.

Properties:

M.P. 36°C.

Flammability

Combustible; moderate fire hazard when exposed to heat or flame or by reaction with oxidiser.

Fire extinguishers

Carbon dioxide, dry chemical powder, alcohol or polymer foam.

Incompatible with

Heat, flame; oxidising agents, alkalis and hot water; alcohols; polyglycols; oxidisers, metal salts. Flammable and explosive; gas may be produced on contact with metals, acid or heat. Reacts with water or steam to give hydrogen gas and sodium hydroxide. Explosive hazard reported of spontaneous ignition of the gases released by a saturated solution of NaBH_4 in dimethyl formamide @ 17°C.

Spills

Powder: sweep up or scoop spillage into dry plastic bags for reclamation or solution: mop up and dilute greatly with water before releasing to sewer.

Storage

Large quantities in outdoor flammable liquids store; smaller quantities can be kept in fire-resistant storage in labs.

Handling

Avoid all contact; wear neoprene, nitrile or natural rubber gloves; goggles or face mask; approved particulate respirator. Use only in fume cupboard. Do not wear contact lenses.

USA: TLV/OES: Not established.

Effects of exposure

Corrosive, highly poisonous.

Skin: pain and redness at point of contact; burns. Absorbed through skin and may cause similar symptoms to inhalation.

Eyes: severe pain and redness.

Inhalation: mild poisoning; tightness of chest, weakness, confusion. Severe

poisoning causes muscle spasms, tremors, mental confusion, unconsciousness, convulsions. **Kidney and liver damage. May be fatal.**

Ingestion: nausea, vomiting, abdominal pain, other symptoms as for inhalation.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with soap and copious amounts of water. If pain or irritation persists, **seek medical aid.** Chemical burn should be treated by holding in cold running water.

Eyes: irrigate thoroughly with water; **seek medical aid immediately.**

Inhalation: move to fresh air; keep warm and at rest. Give O₂ if breathing difficult, artificial respiration if it stops. If lungs congested, support in upright sitting position. **Get medical attention immediately.**

Ingestion: if conscious give plenty of water to drink; **seek medical aid immediately.**

(anhydrous) Sodium carbonate Na_2CO_3

Synonyms

Soda ash.

Normal state

White crystal/powder.

Uses

Chemical spillages; photography.

Properties

M.P. 851°C. Decomposes, liberating carbon dioxide at 400°C. Slowly absorbs moisture from air. Soluble in water; insoluble in alcohol.

Flammability

Not flammable.

Fire extinguishers

Water

Incompatible with

Ammonia with silver nitrate; sulphuric acid.

Spills

Liquid — transfer to beaker (then neutralise (with care) with 6M HCl; release to sewer with copious water).

Solid — sweep into beaker; dissolve in plenty of water; neutralise as above.

Storage

Keep containers closed.

Handling

Gloves, goggles; mask if in powder form.

Effects of exposure

Skin: irritation; ulcers.

Eyes: irritation.

Inhalation: irritation; perforation of nasal septum in frequent high exposures.

Ingestion: nausea; vomiting; diarrhoea. Moderately toxic.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with water; seek medical aid if irritation persists.

Eyes: irrigate with water; seek medical aid.

Inhalation: move to fresh air; seek medical aid.

Ingestion: if conscious, give 1 pint of water to drink; followed by 1 pint milk; seek medical aid.

Sodium carboxymethyl cellulose R_n-OCH_2COONa

Synonyms

Cellulose, carboxymethyl ether sodium salt; S.C.M.C; CMC 7HC.

Normal state

Granular powder, white, odourless.

Uses

Adhesive; thickener for water-based solutions; prevents redeposition of soils in washed textiles.

Properties

Soluble in water. Non-hazardous product.

Flammability

Auto ignition 370°C. Dust is flammable when finely divided and suspended in air.

Fire extinguishers

Water; foam; dry chemical; carbon dioxide water spray or fog.

Incompatible with

Ignited by oxidising agents.

Spills

Mechanical clean-up for use or disposal. Incineration or burial.

TLV: not determined.

Effects of exposure

'Non-hazardous product'

Inhalation: slight irritation.

Materials not expected to cause physiological problems at low/normal concentrations, but dust may have drying effect on skin and mucous membranes.

Mildly toxic if ingested.

FIRST AID

Eyes: water irrigation.

Inhalation: remove to fresh air.

Mostly Supplier's information.

Sodium chlorite NaClO_2

Normal state

White crystalline powder.

Uses

Paper bleach with formaldehyde — gaseous chlorine dioxide method.

Properties

Slightly deliquescent; readily soluble in water. Decomposes 180-200°C. Powerful oxidising agent.

Flammability

Powerful oxidising agent; decomposes 180-200°C with evolution of heat. Forms highly explosive mixtures with combustible organic and readily oxidisable materials. Decomposes at higher temperatures to produce oxygen — containers may explode in fire.

Fire extinguishers

Water: use from a safe distance and in large quantities.

Incompatible with

Limited possibility of explosion on percussion with combustible, organic, and readily oxidisable materials. Forms extremely poisonous chlorine dioxide (ClO_2) with strong acids, especially sulphuric and nitric. Hazardous ignition with sulphur, sodium dithionite, oxalic acid, organic acids, carbon disulphide, organic sulphides.

Spills

Cover with weak reducing agent eg. hypo, bisulphites or ferrous salts (latter need small amounts 3M H_2SO_4 added); transfer to large container, mix with excess water and discharge to sewer.

Storage

Protect container from damage, sunlight and heat. Keep cool and dark. Do not store with acids, sulphur and its compounds, fats, fatty oils, flammable chemicals.

Handling

Ensure good ventilation — use fume cupboard, rubber gloves, breathing apparatus; body shield, goggles.

TLV/OES: no data.

Effects of exposure

Skin: severe irritation; solution is corrosive.

Eyes: severe irritation; solution is corrosive.

Inhalation: mild poisoning; sore throat, shortness of breath; lung congestion; breathing difficulties due to swelling of throat lining.

Ingestion: mildly toxic; less harmful as destroyed by stomach acids.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with water; if irritation still present after washing, **seek medical aid.**

Eyes: irrigate with water for 15 mins and **seek medical aid.**

Inhalation: move to fresh air; give O₂ if necessary. Treat lung congestion by keeping patient in upright sitting position; get medical aid; keep warm and at rest.

Ingestion: **seek medical aid immediately.** If conscious give plenty of water to drink; followed by milk if available.

Sodium chromate Na_2CrO_4

Uses

Corrosion inhibitor for metals in water.

Properties

Powerful oxidiser

USA: TLV/TWA 0.05 mg/m³ (as CrO).

UK: OES: 0.5 mg/m³ (LTEL) as chromate.

Effects of exposure

Poison by skin contact; inhalation; ingestion. Suspect carcinogen.

For further details, see sodium bichromate.

Sodium fluoride NaF

Normal state

Solid: clear crystals or white powder.

Uses

Insecticide, fungicide, rodenticide; wood preservative; electroplating.

Properties

M.P. 993°C.; B.P. 1704°C. Soluble in water; slightly soluble in alcohol. Aqueous solution have an alkali reaction and etch glass.

Incompatible with

Heating; if heated above decomposition point, or in contact with acid or acid fumes, highly toxic hydrogen fluoride fumes emitted.

Spills

Solid: scoop up, dissolve in large amounts of water; add soda ash, mix add 6M HCl to neutralise, then release to sewer with copious amounts of water.

Liquids: cover with soda ash, mix, scoop into bucket. Neutralise and release to sewer with copious amounts of water, as above.

Storage

Store away from heat; away from acids.

Handling

Avoid contact; gloves, goggles or face shield. Use only in a fume cupboard. Do not wear contact lenses.

USA: TLV/TWA: 2.5 mg/m³

Effects of exposure

High corrosive; rapidly absorbed into the body, where it acts on all cells as a direct poison. Transfer casualty to hospital as soon as possible.

Skin: severe irritation; may cause necrotic skin burns.

Eyes: severe irritation; corneal burns.

Inhalation: highly toxic; salty and soapy taste, with nausea, vomiting, diarrhoea, abdominal pain, depression of central nervous system; shock.

Ingestion: highly toxic; ingestion of less than 1 gm can be fatal; causes salivation; nausea; vomiting; epigastric pain; diarrhoea; kidney failure possible.

FIRST AID

Skin: remove contaminated clothing; wash skin thoroughly with water; if irritation still present after washing, **get medical attention**. Do not touch affected area with bare hands.

Eyes: irrigate thoroughly with water; if irritation still present, **seek medical aid immediately**.

Inhalation: move person to fresh air and rest. Give O_2 if breathing is difficult, artificial respiration if breathing stops. Keep warm and at rest— **seek medical attention**.

Ingestion: **get medical aid immediately**. Till help arrives, keep person at rest: if conscious give 1 pint water then 1 pint milk to drink, then further water.

Sodium hexametaphosphate $\text{Na}(\text{PO}_3)_6$

Synonyms

Calgon*

Normal state

White crystalline material.

Uses

Softening calcareous deposits; removal of soap scum from textiles.

Properties

Soluble in water.

Effects of exposure

Moderately toxic if enters bloodstream; mildly toxic if ingested.

Sodium hydrosulphite $\text{Na}_2\text{S}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$

Synonyms

Sodium dithionite; sodium hydrogen sulphite; sodium bisulphite.

Normal state

White-yellow crystals or powder.

Uses

Removal of corrosion products from marine silver.

Properties

Decomposes at 55°C; oxidises in air to acidic sodium sulphite or acidic sodium sulphate. Strong reducing agent. Soluble in water; slightly soluble in alcohol.

Flammability

Flammable but non-explosive; fire risk as generates heat in contact with moisture and air — may ignite adjacent flammable substances. In fire generates toxic sulphurous acid gas.

Fire extinguishers

Dry chemical. Dry sand.

Incompatible with

Exothermic reaction with water; sodium chlorite.

Spills

Solid: sweep into container, dilute with water, add soda ash, mix, neutralise with 5M hydrochloric acid. Release to sewer with much water. Solutions: cover with soda ash, mix, transfer to beaker containing water, neutralise and dispose of as above.

Disposal

Pour slowly into large container of water, then slowly add soda ash and stir. Leave 24 hours then decant or siphon off liquid, neutralise with 6M hydrochloric acid, and release to sewer with much water.

Storage

Keep containers securely closed and in dark. Keep away from acids and oxidising material.

Handling

Gloves; goggles; use in fume cupboard.

TLV/OES: no data.

Effects of exposure

Allergen.

Skin: severe irritation; redness and burns at the site of contact.

Eyes: severe irritation; redness; corneal burns.

Inhalation: mild poisoning; irritation of throat and nose with shortness of breath, coughing and choking; wheezing. Acute poisoning; lung congestion, causing severe shortness of breath.

Ingestion: toxic.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with soap and water; if irritation persists after washing, seek medical aid.

Eyes: irrigate thoroughly with water — seek medical aid.

Inhalation: move to fresh air; keep warm and at rest. Give O₂ if breathing difficult; artificial respiration if stops. To ease lung congestion support victim in upright sitting position. Seek medical aid.

Ingestion: if conscious, give one pint of water to drink, followed by 1 pint milk. Keep warm and at rest and seek medical aid.

Sodium hydroxide NaOH

Synonyms

Caustic soda; lye.

Normal state

White deliquescent sticks, pellets, or granules.

Uses

Electrolyte; inhibition of corrosion in iron stored underwater; stripping treatments for metals.

Properties

M.P. 318°C. Will absorb water and carbon dioxide from air; generates hydrogen gas in contact with some metals. Soluble in water, alcohol, glycerol.

Flammability

Non-combustible but if solid form in contact with moisture, it may generate sufficient heat to ignite combustible material.

Fire extinguishers

Flood with water — take great care not to spatter this material.

Incompatible with

Organic peroxides; acids; metals; easily ignitable materials i.e. soft iron, Cu, Sn, Al, Zn or alloys. May cause explosion with nitromethane; nitro compounds; trichloroethylene and organic halogen compounds; flammable liquids, water and acids. Vigorous reaction with chloroform/methanol. Hydrogen gas evolved in contact with Al, Zn and Sn.

Spills

If solid, sweep up, dilute in suitable container with large volume water, neutralise with 6M hydrochloric acid. Release to drain with water. If in solution, neutralise with hydrochloric acid, collect with mop or water vacuum, drain into sewer with copious water.

Storage

Keep away from organic peroxides, metals, acids, explosive, easily ignitable materials. Keep dry.

Handling

Glove; goggles; work in fume cupboard or with extractor. Do not wear contact lenses.

USA: TLV/TWA: 2 mg/m³. (Ceiling Limit)

UK: OES: 2 mg/m³ (LTEL); 2 mg/m³ (STEL).

Effects of exposure

Very corrosive to animal and vegetable tissue; it gelatinises animal tissue.

Skin: deep skin burns. 25%-50% solution causes irritation within 3 minutes —

reactions to weaker solutions may be delayed several hours.

Eyes: conjunctivitis; corneal burns; may cause blindness. Severe damage even from dilute solutions e.g. 2.5M.

Inhalation: irritates respiratory tract; destructive burns and scarring.

Ingestion: burning pain; diarrhoea; swelling of larynx and suffocation; severe burns may be fatal.

FIRST AID

Skin: remove contaminated clothing; wash skin with plenty of water; **seek medical aid**

Eyes: irrigate with water; **get medical aid immediately.**

Inhalation: move to fresh air, give O₂ if necessary; **seek medical aid as soon as possible.**

Ingestion: **seek medical aid immediately.** If conscious, give plenty of water to drink — **do not induce vomiting.**

Sodium hypochlorite NaOCl

Synonyms

'Bleach'.

Normal state

Solid commercially as 5.25% in water; or crystals.

Uses

Bleach for textiles and paper.

Properties

M.P. 18°C. Crystals very unstable; soluble in cold water, decomposes in hot water.

Flammability

Dangerous fire and explosion hazard; may cause ignition in contact with organic materials.

Fire extinguishers

No data.

Incompatible with

Amines; aziridine; heating; acids (evolves chlorine gas); methanol in presence of acids. May cause ignition in contact with organic materials, or on heating.

Spills

Cover with weak reducing agent, e.g. solution of hypo, bisulphites, or ferrous salts, together with 3M sulphuric acid. Transfer to large container of water, neutralise with soda ash, dilute, then discharge into sewer with much water.

Storage

Keep in cool, dark place; decomposes on storage. Keep all containers securely closed and protect from moisture. If stored as concentrated solution, caps should have venting mechanism to allow oxygen to escape (and eliminate danger of explosion).

Handling

Nitrile, neoprene or natural rubber gloves; goggles; face mask.

USA: TLV/TWA: 0.5 ppm TLV/STEL: 1 ppm for chlorine.

UK: OES: 1ppm (LTEL); 3 ppm (STEL) for chlorine — under review.

Effects of exposure

Human mutagenic data.

Skin: irritation; blistering; eczema; may cause burns.

Eyes: irritation; corrosive; causes burns.

Inhalation: blistering in throat; cough; breathing difficulties; nausea.

Ingestion: blistering in throat; may perforate stomach; toxic.

FIRST AID

Skin: remove contaminated clothing; wash skin thoroughly with water; if irritation persists; **seek medical advice.**

Eyes: irrigate with water and **seek medical advice.**

Inhalation: move to fresh air; keep warm at rest. **Seek medical aid.** If breathing difficult, give O₂. If lungs congested, support victim in upright sitting position.

Ingestion: if not swallowed, rinse mouth several times with water and spit it out. If swallowed, and patient is conscious, give large amounts of water to drink and get **medical aid immediately.**

Sodium metabisulphite NaOS(O)OS(O)ONa

Synonym

Sodium disulphite; sodium pyrosulphite.

Normal State

White crystalline powder with a sulphur dioxide odour.

Uses

Antichlor; antioxidant.

Incompatible with

Sodium nitrite.

USA: TLV/TWA: $5\text{mg}/\text{m}^3$

UK: OES: $5\text{mg}/\text{m}^3$ (LTEL).

Effects of exposure

Skin: irritation.

Eyes: irritation.

Inhalation: irritation.

Sodium nitrate NaNO_3

Synonyms

Soda niter; cubic niter.

Normal state

Colourless, odourless, transparent crystals or white powder.

Uses

Fossil preparation.

Properties

Oxidising agent. SG 2.26; M.P. 308°C. Soluble in water; glycerine. Slightly soluble in alcohol.

Flammability

Heat or friction may cause ignition; **explodes** when heated to 540°C; if in contact with oxidisable material, violent combustion or explosion may occur with any ignition source. Increases flammability of any combustible material.

Fire extinguishers

Copious amounts of water. N.B. if water sprayed onto molten chemical, severe spluttering occurs.

Incompatible with

Easily oxidisable materials; aluminium; aluminium oxide; organic fibres (e.g. wood, jute etc.) at raised temperatures.

Spills

Solid: sweep into beaker; dilute with plenty of water. Add soda ash; mix; neutralise with 6M — HCl. Release to sewer with abundant water. Solution: use soda ash and HCl as above.

Storage

Prevent physical damage; keep cool and dry and away from flammable/oxidisable substances. Wooden floor not acceptable.

Handling

Rubber gloves, safety glasses, protective clothing. Wooden floor not acceptable.

Effects of exposure

Experimental tumorigen, teratogen. Human mutagenic data.

Skin: absorbed through skin; may cause symptoms similar to ingestion.

Eyes: irritation; redness.

Inhalation: similar to ingestion.

Ingestion: poison; dizziness, headaches; vomiting, flushes, shock.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with soap and plenty of water.

Eyes: irrigate thoroughly with water. **Seek medical aid** if irritation persists.

Inhalation: **seek medical aid** if any effect on breathing.

Ingestion: if conscious, give plenty of water to drink. Keep calm and at rest; **seek medical aid.**

Preclude from exposure: workers with diseases of kidneys and lungs.

Sodium nitrite NaNO_2

Synonyms

Erinitrit.

Normal state

Crystals, pellets, rods or powder - white or yellow-white.

Uses

Corrosion inhibitor for metals in water.

Properties

Oxidises on exposure to air; soluble in water; slightly soluble in alcohol, ether.

Flammability

Explosive hazard. Explodes if heated up to 538°C.

Fire extinguishers

Spray with water; if large quantity of chemical, water may cause scattering of molten material.

Incompatible with

Hydrazine and hydrates; ammonium halides; ammonium salts; thiocyanates; potassium cyanate; ferricyanides; combustible materials, metal cyanides; phenol; sodium disulphite; sodium thiosulphate; urea; wood.

Spills

Cover with soda ash or sodium bicarbonate, place in large beaker, add equal volume calcium hypochlorite with caution, stir in water. Leave 1 hour, dilute, neutralise, release to drain with abundant water.

Storage

Outdoors or detached if possible; indoors — incombustible area.

Handling

Rubber gloves; goggles; overalls; fume cupboard.

TLV/OES: no data.

Effects of exposure

Irritant. **Poisonous to blood cells; experimental carcinogen.** Transfer casualty to hospital as soon as possible.

Skin: irritation and redness may occur at point of contact: absorbed through the skin and may cause similar symptoms to ingestion.

Eyes: irritation; redness.

Inhalation: similar symptoms to ingestion.

Ingestion: mild poisoning: dizziness, headaches, vomiting. Severe poisoning:

shortness of breath, shock, blue discolouration of skin, mouth and lips; dark coloured urine. Unconsciousness and convulsions may occur.

FIRST AID

Skin: remove all contaminated clothing; wash skin thoroughly with soap and water.

Eyes: flush thoroughly with water; seek medical aid.

Inhalation: move to fresh air; keep warm and at rest. **Get medical aid as soon as possible.**

Ingestion: **seek medical aid immediately.** Keep warm and at rest. Give large volumes of water to drink if conscious.

Sodium orthophenyl phenate

Synonyms

Topane

Uses

Fungicide for leather: pure chemical form not approved under U.K.'s 1986 Pesticide Regulations, though commercial products may be permissible: see p.13.

Properties

Water soluble.

Effects of exposure

Moderately toxic if ingested; irritates skin.

Some evidence experimental carcinogen.

Sodium pentachlorophenate C_6Cl_5ONa

Synonyms

Dowicide 7; Santobrite.

Normal state

White/pale brown solid; flakes or powder.

Uses

Fungicide. Pure chemical form not approved under U.K.'s 1986 Pesticide Regulations, though commercial products may be permissible. See p. 13.

Incompatible with

Heat: gives off toxic chloride fumes when heated.

Storage

Keep away from heat.

Handling

Gloves; goggles; respirator/fume cupboard. Avoid contact with solid or liquid. Do not wear contact lenses. **Avoid use if possible.**

Effects of exposure

Irritant; **poisonous** to nervous system in high concentration and is particularly dangerous if exposure occurs during hot weather. People exposed to this chemical must be **kept absolutely still and transferred to hospital.**

Skin: can be absorbed through skin; severe irritation.

Eyes: severe irritation.

Inhalation: toxic by inhalation; severe irritation of respiratory tract.

Ingestion: nausea; abdominal pain; vomiting.

FIRST AID

Skin: remove contaminated clothing; wash skin thoroughly with water; if irritation persists after washing **seek medical aid.**

Eyes: irrigate thoroughly with water; **seek medical attention** if irritation persists after washing.

Inhalation: move to fresh air and rest. If breathing is difficult, give oxygen; **seek medical aid.**

Ingestion: **Get medical attention immediately;** keep warm and at rest.

Sodium perborate NaOBO_2

Synonyms

Sodium peroxyborate

Uses

Bleaching agent.

Properties

Oxidising agent.

Flammability

Fire risk in contact with organic materials.

Incompatible with

Light friction may cause detonation of the true peroxoborate, but the common 'tetrahydrate' is relatively stable: it may be subject to catalytic decomposition by heavy metals and their salts.

Spills

Carefully cover with sodium metabisulphite; or sodium thiosulphate or a ferrous salt. Mix well; spray with water. If a sulphate or a ferrous salt, add 2M sulphuric acid. Scoop slurry into large container, neutralise with soda ash. Release to drain with copious amounts of water.

Handling

Rubber gloves; goggles; overalls; work in fume cupboard.

Effects of exposure

Skin: mild irritation and redness. May be absorbed through skin, giving same symptoms as for ingestion.

Eyes: mild irritation and redness.

Inhalation: mild shortness of breath; cough.

Ingestion: nausea; vomiting and diarrhoea (may be bloody). Lethargy, muscle twitching; unconsciousness; convulsions. May cause liver and kidney damage.

FIRST AID

Skin: remove contaminated clothing; wash skin immediately with soap and copious amounts of water.

Eyes: irrigate thoroughly with water; seek medical aid if irritation persists.

Inhalation: move to fresh air; give oxygen if necessary. Seek medical aid.

Ingestion: keep warm and at rest; if conscious, give plenty of water to drink. Seek medical aid.

Sodium sulphite Na_2SO_3

Normal state

White crystals or powder.

Uses

Dechlorination of marine iron; photographic developers.

Properties

Decomposes before reaching melting point; soluble in water, glycerine, slightly soluble in alcohol. Fairly stable; hydrate easily oxidises.

Flammability

Non-flammable.

Spills

Cover with soda ash or sodium bicarbonate; transfer to large beaker and with great care add equal amount of calcium hypochlorite. Add water while stirring; leave one hour then dilute with water, neutralise with concentrated hydrochloric acid, or concentrated sodium hydroxide, and discharge to drain with plenty of water.

Storage

Keep container sealed; keep cool and protect from moisture.

Handling

Gloves; goggles; mask if chemical dust in air.

TLV/OES: no data.

Effects of exposure

Moderately toxic by oral route; irritant by inhalation or skin contact.

Sodium tetraborate decahydrate $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$

Synonyms

Disodium tetraborate; sodium borate (2,4,7); sodium pyroborate; borax.

Normal state

White powder.

Uses

Taxidermy - drying skins of small birds and animals.

Spills

Sweep/mop up: dilute with excess water and release to drain.

USA: TLV/TWA: $5\text{mg}/\text{m}^3$.

UK: OES: $5\text{mg}/\text{m}^3$ (LTEL).

Effects of exposure

Moderately toxic following absorption through damaged skin, inhalation, ingestion. Affects nervous system, kidney and brain.

Skin: mild irritation and redness at point of contact. Absorbed through skin and may give same symptoms as ingestion. **N.B.** If large quantities pass into blood stream (e.g. via cut) may cause heart failure.

Eyes: mild irritation and redness.

Inhalation: cough; mild shortness of breath.

Ingestion: nausea, vomiting, diarrhoea (which may be bloody). Lethargy; muscle twitches — may develop into unconsciousness and convulsions. Liver and kidney damage may occur.

FIRST AID

Skin: remove contaminated clothing. Wash thoroughly with soap and copious amounts of water; seek medical aid.

Eyes: irrigate with water.

Inhalation: move to fresh air; keep warm and at rest. Give O_2 if breathing difficult and obtain medical attention.

Ingestion: if conscious, give 1 pint water to drink then 1 pint milk if available. Keep warm and at rest and seek medical aid **immediately**.

Sodium thiosulphate $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$

Synonyms

'Hypo'; sodium hyposulphite.

Normal state

White, transparent crystals or powder.

Uses

Dechlorinating agent; bleaching of bone; straw; ivory; fixative; silver extraction.

Properties

S.G. 1.69. M.P. 48°C. B.P.—decomposes. Soluble in water; turpentine oil. Insoluble in alcohol.

Incompatible with

Metal nitrates.

Spills

Cover with soda ash or sodium bicarbonate. Put into large beaker — add equal amounts calcium hypochlorite with great caution; add additional water while stirring. After 1 hour, neutralise with 6M HCl then release with copious amounts of water to sewer.

Storage

Protect containers from damage.

Handling

Rubber or nitrile gloves; safety glasses.

Effects of exposure

May cause blood effects if enters body through skin or bloodstream.

Ingestion: slightly toxic; may cause diarrhoea.

FIRST AID

Skin: remove contaminated clothing; wash skin thoroughly with soap and water.

Eyes: flush with water.

Soluble nylon

Synonyms

Calalon* (ICI product code 06479).

Normal state

Supplied as white powder or emulsion of nylon in water. Water-permeable film on drying.

Uses

Consolidation of fragile surfaces.

Properties

Soluble in thymol, alcohols and phenols; best solvents ethanol and methyl alcohol.

Flammability

Flammable when dry or in a flammable solvent.

Solvol Autosol*

Normal state

White, creamy liquid.

Uses

Restoring gloss to glazed surface; removing dirt from (e.g.) alabaster.

Properties

Fine abrasive agent consisting of kieselguhr (diatomaceous earth), a methylated soap, ammonia (2%) and white spirit (Stoddard Solvent).

Flammability

Stoddard Solvent/White Spirit is flammable (see White Spirit).

UK: OES: 1.5 mg/m³ (LTEL) for dry dust.

Stoddard Solvent

See also White Spirit (UK).

Synonyms

Naptha Safety Solvent; Varnoline; White Spirits (USA).

Normal state

Clear, colourless liquid with characteristic odour. Usually supplied as a mixture of approx. 85% nonane (C_9H_{20}) and trimethyl benzene ($(CH_3)_3C_6H_3$).

Uses

Solvent; dry cleaning; solvent/medium for paints and varnishes.

Properties

B.P. 220-300°C; S.G 1.0. Insoluble in water; miscible with some organic solvents e.g. acetone, benzene, carbon tetrachloride, chloroform and some oils.

Flammability

Moderate to serious fire hazard: flash point 100-110°F; vapour explosive if exposed to heat or flame — explosive limits in air 1% (l_{el}) — 6% (u_{el}).

Fire extinguishers

Foam; CO₂; dry chemical.

Spills

Absorb with paper towels or vermiculite; leave in secure, well-ventilated place (e.g. fume cupboard) to evaporate.

Storage

Cool, secure storage with no sources of sparks or heat; keep away from strong oxidisers.

Handling

Nitrile or viton gloves; eye protection; work in fume cupboard if possible.

USA: TLV/TWA: 200 ppm nonane; TLV/TWA: 25 ppm trimethyl benzene

UK: OES: 25 ppm (LTEL); 35 ppm (STEL) for trimethyl benzene; under review.

Effects of exposure

Skin: may cause defatting; irritation and redness

Eyes: irritation and redness

Inhalation: mildly toxic

FIRST AID

Skin: remove contaminated clothing; wash skin thoroughly with water.

Eyes: irrigate with water; **seek medical aid** if irritation persists after washing.

Inhalation: move to fresh air; if breathing difficult support in upright sitting position and **seek medical aid**.

Ingestion: if conscious, give plenty of water to drink; keep patient still and **seek medical aid immediately**.

Sorbitol $\text{CH}_2(\text{OH})\cdot(\text{CH}\cdot\text{OH})_4$

Synonyms

Sorbex, Sorbidex; Glucitol, Sorbo, Sorbite.

Normal state

White crystalline powder, odourless

Uses

Leather lubricant(?)

Properties

Slightly soluble in methanol, ethanol, acetic acid, phenol, acetimide

Effects of exposure

Low toxicity rating.

Styrene monomer $C_6H_5CHCH_2$

Synonyms

Phenyl ethylene; vinyl benzene; styrol; cinnamene.

Normal state

Colourless to yellowish, oily liquid.

Uses

Solvent; manufacture of polystyrene plastics; solvent in polyester resins.

Properties

B.P. 145.2°C. (293°F.) Soluble in alcohol, ether, acetone, methanol.

Flammability

Highly flammable. Flash point 31°C. (88°F.) Auto-ignition temperature 490°C. (914°F.) Explosive limits in air 1-8%; **vapours may travel considerable distance to ignition source and flash back.**

Fire extinguishers

Fight fire at a distance; use dry chemical, foam or carbon dioxide extinguisher.

Incompatible with

Oxidisers; catalysts for vinyl polymers; peroxides; aluminium chloride; strong acids; chlorine; iron (III) chloride.

Spills

Absorb onto paper; leave to evaporate on glass or iron dish in fume hood; burn paper.

Storage

In glass. Keep cool; avoid any source of ignition and incompatible chemicals.

Handling

Goggles; nitrile, neoprene or natural gloves; work only in fume cupboard with exhaust ventilation.

USA: TLV/TWA: 50 ppm. TLV/STEL: 100 ppm. OSHA(PEL) TWA: 100 ppm CL: 200 ppm.

UK: MEL: 100 ppm (LTEL); 250 ppm (STEL).

Effects of exposure

Systemic irritant and central nervous system effects in man; possible neurotoxin.

Causes tumours in rats — no evidence to support carcinogenicity in man.

Skin: defatting dermatitis; readily absorbed through skin.

Eyes: conjunctivitis; lachrymatron, itching, severe eye damage.

Inhalation: drowsiness; nausea; headache; fatigue; dizziness.

Ingestion: poison.

FIRST AID

Skin: remove contaminated clothing; wash off with soap and water.

Eyes: **seek medical aid immediately**; irrigate with water.

Inhalation: **seek medical aid immediately**; move patient to fresh air.

Ingestion: **seek medical aid immediately**; do not induce vomiting.

Sulphuric acid H_2SO_4

Uses

Removal of copper corrosion products — especially cuprite. Approved under U.K.'S 1986 Pesticide Regulations for use as pesticide. See p. 13.

Normal state

Concentrated sulphuric acid is 93-98% aqueous solution. Colourless, odourless oily liquid.

Properties

M.P. 10.4°C.; B.P. 315-338°C.; S.G. 1.84. Decomposes at 340°C. Miscible with water and alcohol. Highly reactive; dissolves most metals.

Flammability

Non-flammable but reacts with metals to produce flammable hydrogen gas. On contact may ignite finely divided materials; much heat evolved in contact with water. See incompatibles list.

Fire extinguishers

Water, but use with great care, as it will cause heat and spattering.

Incompatible with

Finely divided materials; acetaldehyde; copper; hydrogen peroxide; nitro-methane; permanganates; carbonates; organic materials; carbides; picrates; powdered metals; chlorates; nitrates; fulminates. Contact with metals may form toxic sulphur dioxide fumes and flammable hydrogen gas. Mixes violently with water.

Spills

Sprinkle with soda ash or sodium carbonate mixed 1:1 with slaked lime; mix well; add water; release to sewer with plenty of water.

Storage

Keep dry in corrosion-proof container; avoid physical damage to container; keep away from incompatible material (see Incompatibilities)

Handling

In fume cupboard or well-ventilated area; nitrile or natural rubber gloves; goggles. Do not wear contact lenses.

USA: TLV/TWA: 1 mg/m³

UK: OES: 1 mg/m³ (LTEL).

Effects of exposure

Causes rapid discolouration of plant and animal tissue.

Skin: severely corrosive; burns, necrosis; dermatitis; ulceration.

Eyes: conjunctivitis; necrosis; severely corrosive as mist or splashes, and may cause blindness.

Inhalation: irritation of nose and throat; swelling of larynx; bronchitis; breathing difficulties; loss of consciousness. Repeated exposure to vapours/mists can cause erosion of teeth, chronic inflammation of nose, throat and bronchial tubes.

Ingestion: dental erosion; burning in mouth, throat, abdomen; nausea; vomiting of blood and eroded tissue.

FIRST AID

Skin: remove contaminated clothing; wash off with plenty of soap and water; **seek medical aid immediately.**

Eyes: irrigate with water; **seek medical aid immediately.**

Inhalation: move to fresh air; medical aid as soon as possible.

Ingestion: if conscious, give copious water to drink and **seek medical aid immediately.** Do not induce vomiting.

Sulphuryl difluoride SO_2F_2

Synonyms

Vikane; sulphur oxyfluoride.

Uses

Insecticidal fumigant. Not approved under UK's 1986 Pesticide Regulations: see note p.13

Normal state

Colourless, odourless gas.

Properties

B.P. -55°C . Stable in presence of water; hydrolyses in aqueous caustic soda solution; slightly soluble in cold water and most organic solvents.

Flammability

Non combustible

Spills

Gas leakages: flow into mixed solution of caustic soda and slaked lime, place cylinder in fume cupboard.

Handling

Rubber gloves; safety gloves; self-contained breathing apparatus.

USA: TLV/TWA: 5 ppm. STEL: 10 ppm.

UK: OES: 5 ppm (LTEL): 10 ppm (STEL)

Effects of exposure

General: highly corrosive; rapidly absorbed into the body where acts on all the cells as a direct poison. Transfer casualty to hospital as soon as possible.

Skin: severe pain and redness at point of contact; burns may be visible immediately, or skin may remain unbroken while burn develops beneath it as underlying tissue is destroyed.

Eyes: severe pain and redness; corneal burns.

Inhalation: poisoning: coughing; choking. Severe poisoning — shortness of breath, lung congestion; muscle spasm; convulsions.

Ingestion: poisoning — nausea; vomiting, diarrhoea, abdominal pain. Blood may be vomited. Severe poisoning: shock, blurred vision, muscle spasms, shallow breathing, convulsions. Kidney failure may occur later.

FIRST AID

Skin: **seek medical aid immediately.** Remove contaminated clothing wearing protective gloves. Wash thoroughly under running water 15-30 minutes. Put calcium gluconate gel (if available) over affected area.

Eyes: **seek medical aid immediately.** Wash with running water 10 minutes, then irrigate with normal saline, if available, for at least 30 minutes. Do not use calcium gluconate gel.

Inhalation: **obtain medical help immediately.** Move to fresh air; give O₂ if breathing difficult. If lungs congested support in upright seated position; keep warm and at rest.

Ingestion: **seek medical aid immediately.** Give milk or calcium gluconate to drink if conscious.

Synocryl* 9045C

Synonyms

Acrylic co-polymer in trichloroethylene

Normal state

Viscous liquid in trichloroethylene

Properties

See: trichloroethylene

Incompatible with

Only problems due to solvent — see relevant sheet.

Synperonic* NDB

Synonyms

Nonyl phenol ethylene oxide condensate: Lissapol.

Uses

Non-ionic detergent/wetting agent for use with water. Can react with strong oxidising agents. Avoid prolonged skin contact — may cause dermatitis or irritation.

No other recorded health hazards.

Tannic acid $C_6H_2(OH)_3CO.O.C_6H_2(OH)_2COOH$

Synonyms

Gallotannin; gallotannic acid; digallic acid.

Normal state

White to brown fine crystals.

Uses

Archaeological leather; ironwork; taxidermy.

Properties

M.P. 200°C. Soluble in water; alcohol.

Flammability

Low fire hazard but combustible if exposed to heat or flame. Flash point 200°C. Auto-ignition temperature 980°F (527°C). Yields acrid smoke and fumes when burnt.

Fire extinguishers

Water.

Incompatible with

Strong oxidising agents and strong bases; salts of heavy metals, alkaloids, gelatin, albumen, starch.

Spills

Powder: sweep up; dissolve in a large amount of water. Neutralise; release to sewer with large amounts of water. Solution: as above

Storage

Keep dry.

Handling

Nitrile rubber gloves; goggles; face mask; respirator. Avoid skin contact and inhalation of dust or aerosols. Wear disposable coveralls and discard after use.

TLV/OES: no data.

Effects of exposure

Experimental animal carcinogen. Moderately toxic if swallowed, highly toxic if enters bloodstream (eg through wound).

FIRST AID

Skin: remove contaminated clothing; wash skin thoroughly with plenty of water.

Eyes: irrigate with water for at least 15 minutes; **seek medical aid.**

Inhalation: move to fresh air. Give oxygen if breathing difficult, artificial respiration if breathing stops; **seek medical aid.**

Ingestion: keep warm and at rest. If conscious, give plenty of water to drink and **seek medical aid immediately.**

Tarnprufe*

Normal state

Impregnated cotton cloth: zinc based.

Uses

Tarnish prevention during storage of silverware

Effects of exposure

Nil

Supplier's information.

Teflon* $-C_2-F_4-$

Synonyms

PTFE (polytetrafluoroethylene); Algofluon*; Fluon*; Halon*; Teflar*; Tetran*.

Normal state

Gas; commercial products resemble a plastic. Stable: $-100^{\circ}C$ to $350^{\circ}C$.

Properties

No known solvent. Unaffected by weathering — but creeps.

Uses

Solvent/acid/alkali resistant labels: bags.

Flammability

At high temperatures (above $750^{\circ}F$) highly toxic perfluoroisobutylene gas formed.

Insufficient research yet for TLV.

Effects of exposure

Main danger in conservators' use of labels etc is in event of fire, when decomposition products may cause 'polymer fume fever' — ie chills, fever, tightness of chest.

Reports of Teflon* fragment igniting inside cigarette and causing serious injury. Smoking to be prohibited where PTFE dust likely.

Tego* 51B

Synonyms

(Alcalyl)-(aminoethyl)-glycin.

Normal state

Clear liquid; pale yellow to brown.

Uses

Fungicide for wood, leather in water storage. See p. 13 re. U.K.'s 1986 Pesticide Regulations.

Handling

Wear gloves if handling concentrates.

Effects of exposure

No toxic effects reported but treat as though mildly toxic. May cause defatting of skin with prolonged contact, even if dilute.

FIRST AID

Ingestion: if conscious, give plenty of water to drink: **seek medical aid.**

Tegovakon

Synonyms

Ethyl silicate in white spirit.

Normal state

Clear, odourless to slightly yellow liquid.

Uses

Stone consolidant.

For data on white spirit, see relevant entry.

See also Tetraethylorthosilicate.

Properties

Density 0.9.

Flammability

Highly flammable. Flash Point 13°C. May form explosive mixture with air.

Fire extinguishers

Foam, carbon dioxide, dry chemical powder.

Spills

Absorb with 'absorbent material' and leave to evaporate in safe place. Do not release to drains.

Storage

Keep cool; away from all ignition sources. Stable in sealed containers for up to 6 months. Do not use plastic containers.

Handling

Fume cupboard or well-ventilated area; wear rubber gloves; eye protection.

Effects of exposure

Non reported; believed non-toxic, but avoid contact by skin, eyes, inhalation, ingestion

FIRST AID

Skin: wash thoroughly with water.

Eyes: irrigate with water.

Tetrabromoethane $C_2H_2Br_4$

Extremely toxic — avoid use.

Synonyms

1,1,2,2 Tetra bromoethane; TBE; acetylene tetrabromide; sym-tetrabromoethane.

Normal state

Liquid with pungent odour; clear, but darkens on exposure to light.

Uses

Solvent.

Properties

S.G. 2.969; B.P. 239-241°C (decomposes) Freezing point 0.0°C. Miscible with most organic liquids, including ethanol, chloroform, ether, aniline, glacial acetic acid.

Flammability

Non-flammable.

Spills

Cover with sand or vermiculite to absorb. Leave in safe secure area to evaporate.

Handling

Rubber gloves, goggles, fume cupboard.

USA: TLV/TWA: 1 ppm

UK: OES: 0.5 ppm (LTEL)

Effects of exposure

Toxic: transfer casualty to hospital as soon as possible. Mutagen. Can be absorbed through skin — severely poisonous by this route.

Skin: defatting; irritation and redness at point of contact; if absorbed through the skin may give same symptoms as ingestion.

Eyes: irritation; redness.

Inhalation: low level exposure causes mild poisoning; shortness of breath; tightness in chest. High exposure causes lung congestion; drowsiness, slurred speech, weakness, muscle twitches, blurred vision, dilated pupils, shock. Unconsciousness, convulsions and kidney and liver damage may occur.

Ingestion: liver and kidney damage; nausea; vomiting other symptoms as for inhalation.

FIRST AID

Skin: remove all contaminated clothing, wash affected areas thoroughly with soap and water. If a large splash, **seek medical aid.**

Eyes: irrigate thoroughly with water. If irritation persists after washing, **seek medical aid.**

Inhalation: move to fresh air; keep warm and at rest; if breathing is difficult, give O₂. For lung congestion, support victim in upright seated position; **obtain medical aid as soon as possible.**

Ingestion: if conscious, give plenty of water to drink and **seek medical aid immediately.** Keep warm and at rest.

Tetraethylorthosilicate $\text{Si}(\text{OCH}_2\text{CH}_3)_4$

Synonyms

Ethyl silicate; TEOS; Extrema Grade.

Normal state

Clear, colourless liquid.

Uses

Conservation of waterlogged wood and basketry by silification.

Properties

B.P. 165-160°C. Soluble in water; slightly soluble in benzene; miscible with acetone. When cured: soluble in hydrofluoric acid. May decompose on exposure to moist air or water.

Flammability

Moderate fire risk. Flash point 52°C.

Fire extinguishers

Foam; dry powder; carbon dioxide.

Incompatible with

Strong oxidising agents; strong acids.

Spills

Absorb onto paper; leave to evaporate on glass or iron dish in fume cupboard; burn paper.

Storage

Outdoor or detached; fire-resistant well-ventilated storehouse with no ignition sources. Keep containers tightly closed — moisture sensitive.

Handling

Rubber gloves; face mask; face shield. Work in fume cupboard. Do not breathe vapour.

USA: TLV/TWA: 10 ppm

UK: OES: 10 ppm (LTEL); 30 ppm (STEL).

Effects of exposure

Victim should be transferred to hospital for observation.

Skin: irritant.

Eyes: strong irritant; conjunctivitis.

Inhalation: irritation; narcotic at high concentrations; dizziness, tremors and shortness of breath; possibly leading to lung congestion.

Ingestion: may damage liver and kidneys. Nausea, vomiting; severe poisoning causes drowsiness, confusion and agitation.

FIRST AID

Skin: remove contaminated clothing; wash off with soap and water.

Eyes: irrigate with water.

Inhalation: fresh air; if breathing difficult, give oxygen. If lungs congested, support patient in upright sitting position. **Seek medical aid.** Keep warm and at rest.

Ingestion: if conscious give large quantities of water to drink; **seek medical aid;** keep warm and at rest.

Tetrahydrofuran $\text{OCH}_2\text{CH}_2\text{CH}_2\text{CH}_2$

Synonyms

Cyclotetramethylene oxide; THF; di-ethylene oxide; tetramethylene oxide.

Normal State

Colourless mobile liquid, ether-like odour.

Uses

Solvent.

Properties

B.P. 65.4°C.; Flash point -15°C (5°F) (open cup). Freezing point -108.5°C. Density 0.888 at 20°C. Auto ignition temp. 610°F. Miscible with water, alcohols, ketones, esters, ether and hydrocarbons. Toxic fumes on heating; reacts with oxidising materials. Vapour forms explosive mixture in air.

Flammability

Dangerous fire risk: highly flammable. Explosive limits in air 2.3 -11.8%. Flash point -17°C. (i.e. minus 0°C). Dangerous via heat, flames; oxidisers. Forms thermally explosive peroxides with exposure to air and light.

Fire extinguishers

Foam; dry chemical; carbon dioxide.

Incompatible with

Strong oxidisers. Violent reaction with air on standing due to formation of explosive peroxides; containers may explode when stopper removed. Add 0.5 - 1% p-cresol as antioxidant; N.B. This may be depleted in presence of caustic alkalis. **Hazardous reactions** with lithium aluminium hydroxide; potassium hydroxide; sodium hydroxide; Na, Al, H_2 .

Spills

Water to cool container or to disperse leak. Disperse small spills in water to dilute to non-flammable mixtures. Absorb with paper; evaporate completely all spill surface, burn paper after complete evaporation in ventilated box.

Storage

Keep container full (NB see Incompatibilities). Protect from physical damage; keep cool, dark, well-ventilated. Detached storage preferred. Inside — flammable storage, room/cabinet separate from oxidising material. No longer than a few days after opening unless contains an inhibitor — or store under N_2 . Add 0.05-1% of p-cresol as anti-oxidant; inspect for peroxides. Commercial material is supplied with a phenolic antioxidant; this is effective under normal closed storage conditions, to prevent formation and accumulation of peroxide. For methods for testing for peroxides and for their removal see: Anon, *Organic Syntheses* 1966 (46)p. 105.

Handling

Nitrile rubber gloves, self-contained breathing apparatus. Goggles, or approved chemical cartridge respirator for low concentrations. Avoid contact. Do not wear contact lenses.

USA: TLV/TWA: 200 ppm (590mg/m³); TLV/STEL: 250ppm (750mg/m³) Odour threshold: 30 ppm.

UK: OES: 200 ppm (LTEL) 250 ppm (STEL).

Effects of exposure

Extremely irritating; human mutagenic data.

Skin: irritation and redness; delatting may occur with frequent exposure.

Eyes: irritation; redness even at low exposures.

Inhalation: low exposure — cough, irritation of throat, shortness of breath. Continued exposure — mental confusion, unconsciousness, occasionally convulsions. Lung congestion.

Ingestion: moderately toxic; nausea; vomiting; abdominal pain; severe poisoning may cause mental confusion and unconsciousness.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with soap and plenty of water; seek medical aid if irritation persists after washing.

Eyes: irrigate thoroughly with water; if irritation persists after washing; seek medical aid.

Inhalation: move to fresh air; keep warm and at rest. Give O₂ if breathing difficult; artificial respiration if stops. Treat lung congestion by supporting victim in upright seated position; obtain medical aid as soon as possible.

Ingestion: if conscious give plenty of water to drink, and keep warm and at rest; seek medical aid immediately.

Tetra-iso-propyl titanate $Ti(=CH(CH_3)_2)_4$

Synonyms

Silane Stone Consolidant Catalyst; Tyzor TPT; iso-propyl titanate; titanium tetraisoperoxide.

Normal state

Clear liquid.

Uses

Catalyst for Silane Stone Consolidant*.

Properties

Reacts rapidly with any kind of moisture — including air and skin — to form polymeric titanium compounds and isopropyl alcohol.

Flammability

Moderate fire hazard if exposed to heat or flame.

Fire extinguishers

No data.

Incompatible with

Oxidising materials.

Spills

No data.

Storage

No data.

Handling

Protective gloves and goggles; work in fume cupboard or well-ventilated area. In emergency telephone Middlesbrough (0642) 63571.

USA: TLV/TWA: 400 ppm.

Effects of exposure

Low toxicity but narcotic effect and irritates eyes, nose and throat.

FIRST AID

Skin: flush thoroughly with much water; seek medical aid.

Eyes: irrigate with copious amounts of water; seek medical aid.

Inhalation: no data; seek medical aid.

Ingestion: no data; seek medical aid.

Tetrasodium pyrophosphate $\text{Na}_4\text{P}_2\text{O}_7$

Normal state

White crystalline powder.

Uses

Component of cleansing solution for textiles; water softener.

Spills

Slowly and carefully cover with solid sodium bicarbonate or soda-ash/calcium hydroxide mixture (1:1). Mix to a slurry; release to sewer with copious amounts of water.

Handling

Wear gloves, goggles, chemical cartridge respirator.

USA: TLV/TWA: 5 mg/m³.

UK: OES: 5 mg/m³ (LTEL).

Effects of exposure

Slightly alkaline; dust irritates eyes and respiratory passages — corrosive.

Skin: irritation or pain at site of contact with redness or whiteness of skin where exposed to chemical. May cause burns and/or blistering.

Eyes: pain, redness, watering; severe corneal burns may occur.

Inhalation: tightness in chest and shortness of breath, cough; sore throat. Lung congestion may occur; followed by unconsciousness.

Ingestion: **poisonous by ingestion**; soreness and redness in mouth; sore throat, difficulty in swallowing.

FIRST AID

Skin: remove all contaminated clothing; wash thoroughly with soap and water; **seek medical aid** if irritation still persists.

Eyes: irrigate thoroughly with water; **seek medical aid**.

Inhalation: move to fresh air; keep warm and at rest. Give oxygen if breathing difficult. If lungs are congested, support victim in upright breathing position. **Seek medical aid**.

Ingestion: keep warm and at rest. If conscious, give copious amounts of water to drink and **seek medical aid**.

Thioglycolic acid HSCH_2COOH

Synonyms

Mercaptoacetic acid; thiovanic acid; 2-mercaptoethanoic acid.

Normal state

Colourless liquid with strong unpleasant odour.

Uses

Rust removal; paper conservation; fossil preparation.

Properties

B.P. 108°C (approx). Soluble in water, alcohol, most organic solvents. Readily evolves hydrogen sulphide gas on decomposition.

Flammability

Non-flammable; but when heated to decomposition emits toxic hydrogen sulphide gas.

Spills

Mix with weak solution of calcium hypochlorite; transfer to large beaker —after 12 hours neutralise with 6M HCl or 6M ammonium hydroxide. Discharge to sewer with plenty of water.

Handling

Protective clothing; goggles; nitrile or heavy-duty natural rubber gloves; use fume cupboard or self-contained breathing apparatus.

USA: TLV/TWA: 1 ppm.

UK: OES: 1 ppm (LTEL).

Effects of exposure

Skin: corrosive; irritant; depilatory; eczema; hives; irritation.

Eyes: corrosive; irritant; severe, lasting irritation.

Ingestion: **poisonous by ingestion;** pain in mouth and throat; nausea; vomiting.

FIRST AID

Skin: remove contaminated clothing; wash off immediately with soap and plenty of water.

Eyes: irrigate with water; **seek medical aid.**

Ingestion: if conscious give 1 pint water to drink followed by 1 pint milk if available. Keep warm and at rest — **seek medical aid immediately.**

Thiourea $\text{CH}_4\text{N}_2\text{S}$

Synonyms

Thiocarbamide; isothiourea.

Normal state

White glossy crystals.

Uses

Removal of silver chloride. Corrosion inhibitor for metals during (eg) chemical stripping treatments to prevent damage to metal; mould inhibitor.

Properties

M.P. 180-182°C. Soluble in water and alcohol.

Flammability

Non-flammable. **Toxic fumes on heating.**

Incompatible with

Heat; hydrogen peroxide with nitric acid; strong oxidising agents, strong acids.

Spills

Cover with weak solution of calcium hypochlorite (up to 15%); transfer to large beaker; after 12 hours neutralise with 6M HCl or 6M ammonium hydroxide. Release to drain with water.

Storage

Keep dry.

Handling

Avoid exposure.

Rubber gloves; work in fume cupboard.

TLV/OES: no data.

Effects of exposure

Poisonous; allergenic; experimental animal carcinogen (liver and thyroid);
suspect mutagenic; causes goitre.

Skin: irritant; may cause skin allergy. May cause skin photosensitisation

Eyes: mild irritation; blurred vision.

Inhalation: irritation

Ingestion: slight acute effect-nausea, vomiting. Long term exposure may affect bone marrow, causing anaemia, low white cell count, etc.

FIRST AID

Skin: wash thoroughly with soap and water. Avoid further contact if allergenic reaction.

Eyes: irrigate thoroughly with water. If irritation persists after washing, **seek medical aid.**

Inhalation: move to fresh air. Give O_2 if breathing difficult, artificial respiration if it stops. **Seek medical aid.** Keep warm and at rest.

Ingestion: **seek medical aid immediately;** keep warm and at rest.

Thymol $(\text{CH}_3)_2\text{CHC}_6\text{H}_3(\text{CH}_3)\text{OH}$

Synonyms

3-hydroxy-p-cymene; thyme camphor; thymic acid.

Normal state

White crystalline phenol derivative; smells of thyme.

Uses

Fungicide for leather, furs, paper, parchment etc. As a pure chemical not approved under U.K.'s 1986 Pesticide Regulations. See p.13.

Properties

M.P. 51.5°C.; B.P. 233.5°C. Soluble in alcohol, carbon disulphide, chloroform, ether. Slightly soluble in water.

Flammability

Flammable; when heated to decomposition yields acrid fumes.

Fire extinguishers

Water; carbon dioxide; dry chemical powder.

Incompatible with

Strong oxidising agents; strong bases.

Storage

Avoid heat.

Spills

Brush onto paper sheet; burn with great care in iron pan in fume hood or in open furnace. If uncontaminated, can be re-used.

Handling

Do not wear contact lenses. Wear gloves, goggles; use cupboard for handling large quantities.

Effects of exposure

Irritant; allergen.

Skin: irritation; may produce allergic reaction. (If so, obtain medical advice.)

Eyes: irritation.

Inhalation: moderately toxic and may cause irritation to mucous membranes. Repeated long term exposure may cause allergic reaction.

Ingestion: moderately toxic.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with water; if irritation persists, **seek medical aid.**

Eyes: irrigate thoroughly with water. If irritation still present after washing, **seek medical aid.**

Inhalation: move to fresh air; keep warm and at rest. Give O₂ if breathing difficult; artificial respiration if it stops. **Seek medical aid immediately.**

Ingestion: if conscious, give large quantities of water to drink and **seek medical aid.** Keep warm and at rest.

Titanium dioxide TiO_2

Synonyms

Titanium white; titania; titanium oxide.

Normal state

Finely divided white powder.

Uses

White pigment.

Properties

Insoluble in water; soluble in hot, concentrated sulphuric acid.

Incompatible with

Violent reaction with some metals, e.g. aluminium; calcium; magnesium; potassium; sodium; zinc.

Flammability

Non-combustible.

USA: TLV/TWA: 10 mg/m³

UK: OES: 10 mg/m³ (LTEL).

Effects of exposure

Experimental carcinogen; skin irritant.

Inert or nuisance particulate only; may contain extenders such as barium sulphate — for barium hazards see barium hydroxide.

Titanous chloride Cl_3Ti

Synonyms

Titanium chloride; titanium trichloride.

Normal state

Colourless to light yellow liquid.

Uses

Paper conservation — rarely used, drastic solvent for impurities.

Properties

M.P. -30°C .; B.P. 136.4°C . S.G. 1.772. Fumes in moist air.

Flammability

When heated to decomposition it emits toxic fumes of chlorine and hydrogen chloride.

Fire extinguishers

DO NOT USE WATER. Use carbon dioxide, dry chemical powder, alcohol or polymer foam.

Incompatible with

Strong oxidising agents; liberates heat and hydrogen chloride on contact with water; reacts violently with potassium; hydrogen fluoride.

Spills

Absorb on sand or vermiculite and place in sealed container for disposal.

Storage

Keep container tightly closed. Keep dry and cool — air and moisture sensitive. Handle and store under nitrogen.

Handling

Use only in a fume cupboard. Wear chemically resistant goggles, heavy rubber gloves, protective clothing, face shield.

TLV/OES No data.

Effects of exposure

Highly irritant to skin, eyes and mucous membranes. Highly corrosive because it liberates heat and hydrochloric acid on contact with moisture.

Skin/Eyes: corrosive (HCl effect); severe irritant; corrosive.

Inhalation: may be fatal as a result of a spasm; inflammation and swelling of respiratory passages and lungs. Symptoms may include wheezing, sore throat, shortness of breath, headache, nausea and vomiting.

FIRST AID

Skin: remove contaminated clothing; wipe skin with *dry* cloth then flush with copious amounts of water; **seek medical aid** if any irritation.

Eyes: irrigate for at least 15 minutes with water — hold eyelids apart if necessary. **Seek medical aid.**

Inhalation: move to fresh air. Give O₂ if breathing difficult, artificial respiration if breathing stops. **Seek medical aid immediately.**

Ingestion: No data. **Seek medical aid immediately.**

Toluene $C_6H_5CH_3$

Synonyms

Toluol; methyl benzene; phenyl methane.

Normal state

Colourless liquid with characteristic odour.

Uses

Solvent — replaces benzene as less toxic; dry cleaning; wax and lacquer solvent; fine art restoration; mountant for microscope work.

Properties

B.P. 110°C.; S.G. 0.866. Miscible with alcohol, chloroform, ether, acetone; insoluble in water. Commercial grades may contain benzene as an impurity.

Flammability

Highly flammable. Flash point 4.4°C. Flammable limits 1-7% in air. Auto-ignition temperature 480°C. **Explosive** if vapour exposed to flame.

Fire extinguishers

Water spray; carbon dioxide; dry chemical; foam.

Incompatible with

Contact with concentrated nitric acid; sulphuric acid; with nitric acid; $AgClO_3$; strong oxidisers — may cause fires and explosions.

Spills

Absorb onto paper; leave in fume hood to evaporate in glass or iron pan; burn paper.

Storage

Standard flammable liquids store.

Handling

Nitrile or neoprene rubber gloves; goggles; face shield; work in fume cupboard or else use approved chemical cartridge respirator. Do not wear contact lenses.

USA: TLV/TWA: 100 ppm. **TLV/STEL:** 150 ppm. **Odour threshold:** 10-15 ppm (rapid olfactory fatigue i.e. sense of smell less sensitive).

UK: OES: 100 ppm (LTEL); 150 ppm (STEL).

Effects of exposure

Suspect mutagen.

Toxic action on blood-forming tissues; may cause bleeding of urinary tract.

Skin: absorbed through skin; dermatitis.

Eyes: conjunctivitis; corneal burns.

Inhalation: bronchitis; pneumonitis; anorexia; fatigue; headache; nausea; irritability.

'pins and needles' sensation. Very high concentration may cause loss of consciousness and death. Kidney and liver damage, especially if high alcohol consumption. Ingestion: toxic; nervousness; muscle fatigue; insomnia.

FIRST AID

Skin: remove contaminated clothing; wash off with plenty of soap and water.

Eyes: irrigate with water; if irritation persists after washing, seek medical advice.

Inhalation: move to fresh air; give O₂ if breathing difficult artificial respiration if breathing stops. **Seek medical aid.**

Ingestion: **seek medical attention immediately; do not induce vomiting.** Keep patient still.

Toluene di-isocyanate $\text{CH}_3\text{C}_6\text{H}_3(\text{NCO})_2$

Synonyms

TDI; 2,4-tolylene di-isocyanate; meta-tolylene di-isocyanate.

Normal state

Clear liquid, colourless to pale yellow with pungent characteristic odour.

Uses

Component of polyurethane foam.

Properties

M.P. 19.5°C. B.P. 250°C; S.G. 1.22. Miscible with ether, acetone, carbon tetrachloride, benzene, chlorobenzene, kerosene. Reacts with water to give carbon dioxide.

Flammability

Combustible; explosive if vapour exposed to flame. Flash point 127°C. Fire Point 145°C; freezing point below 14°C. Vapour pressure 3×10^{-2} Flammable limits 0.9-9.5%. containers may rupture in fire. Highly toxic fumes given off in fire.

Fire extinguishers

Carbon dioxide; dry chemical; foam.

Incompatible with

Alkalis — cause uncontrollable polymerisation; primary or secondary amines; alcohols; acids. React slowly with water, releasing carbon dioxide.

Spills

One manufacturer recommends that the following decontaminant solutions should always be available in the working area for neutralising spilled isocyanates.

90% water, 8% concentrated ammonia solution, 2% liquid detergent.

The following decontaminant should only be used in a protected area as it is flammable:

50% alcohol (ethanol, isopropanol or butanol), 45% water, 5% concentrated ammonia solution.

Storage

Protect containers from physical damage; store in cool, dry, well-ventilated place with no ignition sources. Avoid strong alkalis. Do not store in polyethylene containers as water may be absorbed through the plastic.

Handling

NB. At normal temperatures the concentration of TDI in air will exceed the control limit.

Goggles; rubber gloves; mask; fume cupboard. Self-contained breathing apparatus. Do not wear contact lenses.

USA: TLV/TWA: 0.005 ppm. (0.02 mg/m³) STEL: 0.02 ppm. (0.02 mg/m³) Odour threshold: above TLV. Ceiling: 0.02 ppm/20 mins.

UK: MEL: 0.02 mg/m³ (LTEL); 0.07 mg/m³ (STEL).

Effects of exposure

Poison by ingestion, inhalation.

Mutagenic; may cause hypersensitivity to subsequent exposure. Victims unaware they are inhaling it. At high exposure gradually it decreases lung capacity, and there may be no obvious symptoms, until this process leads to breathlessness, tiredness and premature ageing.

Skin: irritation; blistering; mild tanning effect. May cause allergy in some cases.

Eyes: conjunctivitis; corneal opacities; burning prickling sensation.

Inhalation: severe allergen — reduce effective exposure by respiratory route to zero. Irritation of upper respiratory tract; cough; breathing difficulties, vomiting. **N.B.** Onset of symptoms may be delayed several hours. Asthmatic attacks; bronchial spasm; pulmonary oedema in low concentrations.

Ingestion: nausea; vomiting; jaundice; anaemia. Toxic

FIRST AID

Skin: remove contaminated clothing; wash off with plenty of water; if irritation persists, **seek medical aid**.

Eyes: irrigate with water for at least 15 minutes; **seek medical aid**.

Inhalation/Ingestion: **seek medical aid immediately**. Keep warm and at rest. Give O₂ if breathing difficult.

PRECLUDE FROM EXPOSURE all persons with diseases of blood and liver.
If frequently used, annual health checks necessary, including full blood count.

Supplier's information and other sources.

1,1,1-Trichloroethane CH_3CCl_3

Synonyms

Methyl chloroform; Genklene*; Chlorothene*..

Normal state

Clear colourless liquid.

Uses

Solvent; dry cleaning; component of most leather dressings. Substitute for carbon tetrachloride.

Properties

b.p. 74.1°C. s.g. 1.349. Soluble in alcohol, ether, benzene; insoluble in water. Some references state miscible with acetone; one warns about a violent reaction with acetone. **Highly volatile.**

Flammability

Non-flammable at normal temperature and pressure; flammable at higher temperatures and pressures.

Incompatible with

Readily corrodes aluminium. Incompatible with strong caustics, strong oxidisers, chemically active metals (aluminium, magnesium, sodium, potassium). **On exposure to hot surfaces or ultraviolet light, decomposes to highly toxic phosgene gas and dichloroacetylene.** Some authorities reports violent reaction with acetone.

Spills

Absorb with paper; leave to evaporate in fume hood on glass or iron dish; burn paper.

Storage

Avoid contact with naked flames hot surfaces and incompatible chemicals — see above. Do not store in aluminium.

Handling

PVC or nitrile rubber gloves; goggles; fume cupboard. Do not wear contact lenses.

USA: TLV/TWA: 350 ppm; TLV/STEL: 450 ppm **Odour threshold: 20-400 ppm.**
N.B. Concentration of the chemical can be as high as 50,000 ppm immediately above the liquid's surface.

UK: MEL: 350 ppm (LTEL); 450 ppm (STEL)

Effects of exposure

Mutagen. Causes liver cancer in mice. Chronic exposure causes kidney and liver damage.

Skin: defats — causes redness, scaliness and cracking.

Eyes: conjunctivitis; severe irritant.

1, 1, 1-Trichloroethane (continued)

Inhalation: lower concentration — headache, dizziness, unconsciousness. High concentration — anaesthesia above 500 ppm — may cause tissue damage but not death (unless over 14,000 ppm); cardiac sensitisation/arrest. Depression of central nervous system.

Ingestion: moderately toxic.

FIRST AID

Skin: remove contaminated clothing; wash off with plenty of soap and water.

Eyes: irrigate with water.

Inhalation: move to fresh air; **seek medical aid if necessary.**

Ingestion: give plenty of water to drink; keep warm and at rest; **seek medical attention immediately.**

Trichloroethylene $\text{CHCl}_2\text{CCl}_2$

Synonyms

Ethylene trichloride; trichloroethene; 1,1,2-Trichloroethylene; Tri; Triklone; Trichlor; Trilene; 'Trike'.

Normal state

Colourless, heavy liquid with odour like chloroform.

Uses

Photographic conservation (distinguishing between nitrocellulose and safety films); solvent for oils, fats, waxes.

Properties

B.P. 86.7°C. S.G. 1.465. Slightly soluble in water; miscible with most organic solvents. Slowly decomposes in presence of light and moisture.

Flammability

Flammable; explosive in form of vapour when exposed to heat or flame. Flash point 32°C. Auto-ignition temperature 420°C. Flammable limits in air 8-90%. At high temperatures may decompose to toxic and corrosive substances. Phosgene gas forms in fire.

Incompatible with

Alkalis; aluminium; epoxides; potassium or sodium hydroxide; oxidants (e.g. perchloric acid, nitrogen dioxide; nitric acid). **Highly toxic gas trichloroethylene can be formed in presence of strong alkalis — e.g. caustic soda. Gas is explosive and will burn in air.**

Spills

Absorb on paper; leave to evaporate in fume hood on glass dish; burn paper.

Storage

Flammable liquid store; keep cool and dry; avoid light.

Handling

Goggles; polyvinyl or nitrile gloves; work in fume cupboard. Self contained breathing apparatus at high concentrations.

USA: TLV/TWA: 50 ppm; TLV/STEL: 200 ppm (Banned in some US states)

U.K: MEL: 100 ppm (LTEL); 150 ppm (STEL).

Effects of exposure

Experimental carcinogen (liver). Depresses central nervous system, more severe in conjunction with alcohol.

Skin: inflammation; long exposure may cause paralysis of thumb and forefinger.

Eyes: conjunctivitis.

Inhalation: irritation of nose and throat; fatigue; bronchitis; narcotic and anaesthetic;

cardiac failure; nausea; liver damage; headache; dizziness; disturbances of vision. May be addictive. May cause tiredness during week, followed by insomnia at weekends. Bone marrow damage.

Ingestion: burning sensation; moderately toxic; nausea and vomiting; abdominal pain; headache; inco-ordination; respiratory collapse.

FIRST AID

Skin: wash well with soap and water.

Eyes: irrigate with water.

Inhalation: move to fresh air; **seek medical aid.**

Ingestion: give plenty of water to drink if patient is conscious; **seek medical aid immediately;** keep warm and at rest.

PRECLUDE FROM EXPOSURE personnel with diseases of lungs, liver, kidneys and central nervous system. If used frequently, annual health check recommended.

Trichloromonofluoro methane Cl_3CF

Synonyms

Fluorocarbon 11

Normal state

Colourless liquid with ether-like odour.

Uses

Drycleaning solvent. Fire extinguishers.

Properties

M.P. -111°C .; B.P. 23.7°C . S.G. 1.484. Insoluble in water; soluble in alcohol, ether, other organic solvent.

Flammability

Non-combustible.

Incompatible with

Heat (decomposes to yield toxic materials e.g. phosgene gas); aluminium; barium; lithium.

Spills

Keep area well-ventilated till evaporated.

Handling

Goggles; fume cupboard; wear gloves — some protection is afforded by nitrile or natural rubber gloves.

USA: TLV/CL: 1000 ppm

UK: OES: 1000 ppm (LTEL); 1250 ppm (STEL).

Effects of exposure

Skin: pain and redness; if area becomes white and painless, frostbite has occurred.

Eyes: irritation; redness.

Inhalation: paralysis may occur at high concentration; poison; liver changes.

Ingestion: nausea; vomiting; cold burns of mouth and throat.

FIRST AID

Skin: remove contaminated clothing; wash skin in water; if frostbite, warm affected area slowly in warm water — remove constriction near area e.g. rings, watches, clothing as swelling may occur; **seek medical aid.**

Eyes: irrigate thoroughly in water; **seek medical aid.**

Inhalation: move to fresh air; **seek medical aid.**

Ingestion: if conscious: give plenty of water to drink immediately; **seek medical aid immediately.** Keep warm and at rest.

2,4,6 -Trichlorophenol $C_6H_3Cl_3O$

Synonyms

Dowicide 2; Phenachlor; TCP; 1,3,5 trichlorophenol.

Normal state

Colourless to yellow crystals with strong phenolic odour.

Uses

Fungicide for Cellulosics. Not approved in pure chemical form under U.K.'s 1986 Pesticide Regulations, see p. 13.

Properties

M.P. 69°C; B.P. 244°C; S.G. 1.675. Soluble in most organic solvents.

Flammability

Nonflammable: when heated to decomposition emits toxic chlorine gas.

Handling

Use only in fume cupboard.

Effects of exposure

Experimental animal carcinogen.

Skin: may cause irritation, chemical burns.

Eyes: irritation.

Inhalation: irritation.

Ingestion: moderately toxic.

FIRST AID

Skin: remove contaminated clothing; wash skin thoroughly with water.

Obtain medical attention unless exposure has been slight.

Eyes: irrigate thoroughly with water; **seek medical aid.**

Inhalation: move to fresh air; keep warm and at rest. **Seek medical aid** unless exposure slight.

Ingestion: if conscious give water to drink; **seek medical aid immediately;** do not induce vomiting.

Trichlorotrifluoroethane $\text{CCl}_2\text{F}-\text{CClF}_2$

Synonyms

Trichloro tri fluoroethane 112 - trichloro-1,2,2 trifluoroethane Freon 113 Freon TF

Normal state

Colourless, almost odourless, non-combustible liquid — easily volatile.

Uses

Dry cleaning fluid. Solvent.

Properties

Non-combustible. b.p. 47-57°C s.g. 1.576 Freezing point -31°F -35°C.

Flammability

Non-combustible.

Incompatible with

Chemically active metals e.g. calcium, powdered aluminium, zinc, magnesium and beryllium. Contact with magnesium alloys containing more than 2% magnesium may cause decomposition. Toxic gases released in fire.

Spills

Absorb on paper; leave to evaporate in fume cupboard in glass dish. Burn paper

Storage

Avoid chemically active metals.

Handling

Avoid contact; goggles; gloves; fume cupboard. Do not wear contact lenses.

USA: TLV/TWA: 1000 ppm; TLV/STEL: 1250 ppm

UK: OES: 1000 ppm (LTEL); 1250 ppm (STEL)

Effects of exposure

Skin: defatting; frequent exposure may cause dermatitis.

Eyes: may cause irritation.

Inhalation: irritation of throat; drowsiness. High concentration may cause heart to beat irregularly or to stop. Nausea; drowsiness; occasionally physical hyperactivity.

Ingestion: harmful.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with water; seek medical aid, if skin is sore or numb.

Eyes: irrigate thoroughly with water. If irritation persists seek medical aid.

Inhalation: move to fresh air; keep warm and at rest. Give O_2 if breathing difficult; seek medical aid.

Ingestion: if conscious give plenty of water to drink; keep warm and at rest and get medical help immediately.

Triethanolamine $N(\text{CH}_2\text{CH}_2\text{OH})_3$

Synonyms

2'2" Nitrioltriethanol; trihydroxytriethylamine.

Normal state

Clear viscous liquid; colourless, or brown if exposed to air.

Uses

Corrosion inhibitor for iron.

Properties

M.P. 21.2°C; B.P. 360°C. Alkaline; very hygroscopic. Miscible with water, alcohol.

Flammability

Combustible when exposed to heat or flame. Flash point 180°C.

Incompatible with

Reacts vigorously with oxidising materials.

Spills

Cover with sodium bisulphate; sprinkle with water; discharge to drain with plenty of water.

Storage

Separated from oxidants.

Handling

Gloves; goggles; use only in fume cupboard.

Effects of exposure

Corrosive: causes burns. Experimental carcinogen.

Skin: severe irritation and redness at point of contact; severe burns possible. Easily absorbed through skin.

Eyes: severe irritation, redness, pain. Blurred vision and corneal burns may occur.

Inhalation: mild poisoning may cause cough, shortness of breath, irritation of throat; nausea and vomiting. Severe poisoning may cause lung congestion and severe shortness of breath; shock, confusion, unconsciousness and convulsions.

Ingestion: nausea, vomiting, abdominal pain. Mental confusion, unconsciousness and convulsions may occur with severe poisoning.

FIRST AID

Skin: remove all contaminated clothing; wash thoroughly with water; if irritation persists after washing, **seek medical aid.**

Eyes: irrigate with water; if irritation persists after washing; **seek medical aid.**

Inhalation: move to fresh air; keep warm and at rest. Give O₂ if breathing difficult, artificial respiration if stops. If lungs congested, support in upright sitting position; **seek medical aid.**

Ingestion: if conscious, give 1 pint water to drink followed by 1 pint milk. Keep warm and at rest, and **seek medical aid immediately.**

Turpentine (oil) $C_{10}H_{16}$

(For Turpentine Substitute see 'White Spirit').

Synonyms

Spirit of Turpentine.

Normal state

Colourless liquid with distinctive penetrating odour.

Uses

Solvent; fine art restoration.

Properties

B.P. varies 154-170°C. S.G. 0.86-0.875. Miscible with benzene, chloroform, ether, oils. Immiscible with water.

Flammability

Flammable. Flash point 32-46°C. Auto-ignition temperature 488°F. Flammable limits in air 0.8-6%.

Very dangerous fire hazard if exposed to heat or flame.

Fire extinguishers

Dry chemical; foam; carbon dioxide. Water spray only to cool containers.

Incompatible with

Oxidising materials; chlorine; $Ca(OCl)_2$; CrO_3 .

Spills

Absorb on paper; leave on glass or iron dish in fume cupboard to evaporate; burn paper.

Storage

Avoid ignition sources, oxidising materials.

Handling

Goggles; rubber gloves.

USA: TLV/TWA: 100 ppm

UK: OES: 100 ppm (LTEL); 150 ppm (STEL)

Effects of exposure

Can cause serious irritation of kidneys.

Irritant; depresses action of nervous system; **Experimental carcinogen.**

Skin: eczemea. Absorbed through skin and may give similar symptoms to injection.

Eyes: conjunctivitis; corneal burns.

Inhalation: headache; dizziness; chest pain; coughing; breathing difficulties.

Ingestion: if conscious nausea; vomiting; colic; shallow rapid breathing;

unconsciousness and convulsions may occur.

FIRST AID

Skin: wash off with plenty of soap and water.

Eyes: irrigate with water.

Inhalation: move to fresh air; keep warm and at rest. Give O₂ if breathing difficult, artificial respiration if stops. **Seek medical aid.**

Ingestion: give plenty of water to drink and milk if available. Keep warm and at rest — **seek medical aid immediately.**

ultraviolet radiation

Synonyms

UV.

Definition

Electromagnetic radiation not detectable by the human eye, or by the skin, unless over-exposure has taken place. Wavelengths 400-315nm (near UV, UVA or Black light) are present in sunlight, daylight and most lamps. Wavelengths 315-200nm (UVB or UVC) are only encountered indoors from unshielded lamps.

Uses/sources

UVA; UV inspection lamps, 'Blacklamps', photographic flood-lights, high-pressure mercury bulbs (eg microscope lamps, light-fading lamps, UV-curing lamps). UVB, UVC; above with their filters removed or ill-fitting, xenon-arc or carbon-arc lamps with filters removed, sterilising lamps (used principally in hospitals), lamps sold for viewing chromatograms etc but used as inspection lamps.

Handling

Eye protection: close-fitting plastic glasses.

Hands and skin: cover; polythene gloves give little protection. If in doubt, use Perspex,* glass or UV-filtered screen in front of lamp.

Effects of exposure

UVA: conjunctivitis, otherwise negligible, though long exposure to sunlight may be linked with skin cancer.

UVB, UVC; erythema (sunburn) and possibly skin cancer.

Conjunctivitis (delayed by several hours) indicates over-exposure and prevents chronic exposure.

Recommended levels of UV exposure exist, but specialised equipment is needed to measure the emission at each wavelength from lamps.

UniBond Universal PVA Adhesive and Sealer

Synonyms

As above.

Normal state

Liquid: polyvinyl acetate emulsion with additives.

Uses

Stone consolidant; as directed on pack and data sheet.

Properties

B.P. 100°C.

Flammability

Non flammable.

Incompatible with

None.

Spills

Do not wash into drains. Allow to set or soak up with absorbent material and dispose of as solid.

Storage

Between +5°C and 30°C.

Handling

Normal hygienic working practices.

Effects of exposure

Skin: none.

Eyes: slight irritant.

Inhalation: n/a.

Ingestion: slight.

FIRST AID

Skin: wash off with soap and water.

Eyes: wash out with plenty of clean water and seek medical advice if required.

Inhalation: n/a.

Ingestion: seek medical advice if required.

Vinamold

Synonyms

Hot melt compound; polyvinyl chloride.

Uses

Re-usable material for making flexible moulds.

Properties

m.p. 150-170°C.

Flammability

Flammable. Keep away from naked flames. In fire pvc can yield toxic fumes of chlorine and phosgene.

Fire extinguishers

Sand or earth — avoid water.

Effects of exposure

Avoid breathing fumes while melting; molten vinamold may cause severe burns.

Vinamul 3252

Synonyms

Vinyl acetate-ethylene copolymer and water.

Normal state

White, liquid.

Properties

M.P. 0°C.; B.P. 100°C. Density: 1.1 gm/l; pH 4.5.

Flammability

Nonflammable.

Fire extinguishers

Water; foam; dry chemical; carbon dioxide.

Spills

Mop up or absorb with (eg) towels or sand, and set aside for incineration or approved landfill. Rinse contaminated area with water.

Handling

Wear gloves; goggles, work in well-ventilated area; do not inhale spray.

Effects of exposure

Skin: avoid prolonged contact — may cause skin defatting.

Eyes: can cause soreness and redness.

Ingestion: not poisonous, but should not be swallowed.

FIRST AID

Skin: wash off before emulsion dries. Dried emulsion should be removed with a skin cleanser.

Eyes: irrigate with water: seek medical aid if any irritation.

Ingestion: if conscious, give water to drink and seek medical aid.

Vinamul 3254

Synonyms

Vinylacetate-ethylene copolymer

Normal state

White liquid.

Properties

M.P. 0°C.; B.P. 100°C. Density: c.1.1.

Flammability

Flammable.

Fire extinguishers

Sand or earth.

Incompatible with

None.

Spills

Soak up with absorbed material; set aside for incineration or landfill disposal.
Wash contaminated area.

Handling

Wear gloves if frequent exposure likely.
Work in well-ventilated area. Avoid inhalation of spray.

Effects of exposure

Skin: prolonged contact may cause defatting.

Eyes: may cause soreness and redness.

Ingestion: not poisonous, but should not be swallowed.

FIRST AID

Skin: wash off before emulsion dries. Dried emulsion should be removed with skin cleanser.

Eyes: irrigate with water: seek medical aid if any irritation.

Inhalation: move to fresh air.

Ingestion: if conscious, give water to drink: seek medical aid.

Vinamul 9910

Synonyms

Polyvinyl acetate 46% in water with dibutylphthalate 5%. See relevant sheet.

Normal state

White liquid.

Properties

M.P. 0°C.; B.P. 100°C. pH 4.5.

Flammability

Non-flammable.

For further information see other Vinamul sheets; and dibutyl phthalate.

Fire extinguishers

Water; foam; drychemical; carbon dioxide.

Vinamul 6815

Synonyms

Polyvinyl acetate emulsion. Main component: vinylacetate-acrylate copolymer.

Normal state

White liquid emulsion containing 15% 2-ethyl hexyl acrylate.

Uses

Consolidant for damp material; dilute 1:3 with water. May be used as adhesive for earthenware.

Properties

S.G. 1.1, pH4; B.P. 100°C. Soluble in water before drying, after drying, soluble in xylene, hydrogenated naphtha, butanol, ethyl ether.

Flammability

Nonflammable.

Fire extinguishers

Water; foam.

Incompatible with

None.

Spills

Mop/soak up with absorbent material; leave to evaporate in fume cupboard then dispose as normal waste.

Handling

Work in well-ventilated area. Wear goggles; and gloves if frequent skin contact likely.

Effects of exposure

Skin: prolonged contact may cause defatting.

Eyes: may cause redness and soreness.

Ingestion: non-poisonous but should not be swallowed.

FIRST AID

Skin: remove contaminated clothing. Wash off emulsion before it dries. If it has dried — remove with skin cleanser.

Eyes: irrigate with water; seek medical aid if irritation persists.

Ingestion: give water to drink, if conscious. Keep warm and at rest, and seek medical aid.

VM & P naphtha

Synonyms

Varnish-makers and painters' naphtha.

Uses

Solvent.

Mixture of aliphatic hydrocarbons, naphthalenes and aromatic hydrocarbons.

TLV: for VM & P naphtha is 300 ppm STEL: 400

White Spirit (or Stoddard solvent) is usually substituted for this.

Vulpex $C_{24}H_{43}O_3K$

Synonyms

Potassium cyclohexyloleate.

Uses

Soap; for leather, featherwork etc. where use of water impractical.

Properties

pH 10.5-11.5. Soluble in white spirit (turpentine substitute), trichloroethane or water.
B.P. 100°C. Flash point c. 64°C. No hazardous reactions known.

Storage

Store below 25°C.

Effects of exposure

Degreases skin with long exposure; otherwise no known health hazard.

Wacker OH stone strengthener/consolidant

Synonyms

Silicic ester in solvents.

Normal state

Colourless/yellowish liquid; a 75% solution in a hydrocarbon solvent.

Uses

Masonry consolidant/strengthener.

Properties

b.p. 56°C. Soluble in hydrocarbon solvents.

s.g. 0.94 Refractive index 1.38.

Flammability

Flammable. Flash point (open cup) 42°C. Ignition temperature 230°C. Explosive limits in air 1.8% to 30%.

Fire extinguishers

Foam/Dry chemical/carbon dioxide (Note: foam must be alcohol resisting).

Spills

Absorb with sand, earth or absorbing agent (i.e. kieselguhr) (avoid the use of combustible materials i.e. sawdust, where possible) and dispose by incineration according to the Control of Pollution Act.

Storage

In a cool dry place, out of direct sunlight, away from sources of ignition. (Preferably in accordance with the Petroleum (Consolidation) Act (Amended 1984). Shelf life 1 year.

Handling

Wear neoprene/nitrile/butyl rubber or vinyl gloves; work in fume cupboard if possible; goggles/self-contained breathing apparatus. Take precautionary measures against static discharges.

TLV: 200 ppm/590mg/m³ STEL: 300 ppm/885 mg/m³.

Effects of exposure

It has been noted that repeated inhalation at a rate of 400 ppm over 30 days will cause absorptive poison effects.

Skin: dryness and irritation.

Eyes: irritation.

Inhalation: irritation to mucous membranes at higher concentrations may cause narcotic effects.

Ingestion: abdominal pains/cramps.

FIRST AID

Skin: remove contaminated clothing; wash skin with soap and water.

Eyes: rinse with copious quantities of water; if irritation persists seek medical aid.

Inhalation: remove patient to fresh air; administer oxygen if necessary. **Seek medical advice.**

Ingestion: allow patient to vomit, take care to avoid aspiration of material into the lungs. It is possible that inhalation of fumes from stomach may cause symptoms due to inhalation **seek medical attention at once.**

Asthmatic workers should be excluded from working with this chemical. Regular health checks recommended for those people working with this product in the long term.

(Finnegan's) Waxoyl

Synonyms

Inhibited wax suspension (probably containing white spirit).

Normal state

Slightly thixotropic liquid, ready for use.

Uses

Corrosion inhibiting coating for ferrous and mixed metal systems.

Properties

B.P. 150°C. Insoluble in water. Soluble in White Spirit.

Flammability

Flammable. Flash Point (closed cup) 44°C. Auto-ignition temperature: 250°C. Explosive limits in air 0.9% to 8%.

Fire extinguishers

Foam/dry chemical/carbon dioxide.

Incompatible with

N/A.

Spills

Should be contained and soaked up in absorbant non-flammable material (dry earth or sand).

Handling

Absorbed through inhalation. Use only in areas of good ventilation.

TLV: 100 ppm

Effects of exposure

Skin: defatting of skin.

Eyes: irritation.

Inhalation: dizziness and loss of consciousness to severe exposure.

Ingestion: irritation of mouth, throat and digestive tract.

FIRST AID

Skin: wash with warm soapy water.

Eyes: wash with copious amounts of water, for at least 10 minutes.

Inhalation: move to fresh air, keep warm and at rest.

Ingestion: do not induce vomiting. Give half pint of milk or water to drink if conscious; seek medical aid.

White spirit approx. C_9H_{20}

Synonyms

Turpentine substitute; mineral spirit; solvent naphtha; petroleum spirits. See also Stoddard Solvent.

Uses

Solvent; dry cleaning; leather treatments.

Properties

Mixture mainly of alkanes of boiling range 150-200°C. Flash point 100-110°F. Miscible with acetone; absolute alcohol; benzene; ether; chloroform; carbon tetrachloride; some oils; immiscible with water. If heated to decomposition emits acrid fumes. S.G. 1.0.

Flammability

Flammable in contact with heat or flame. Explosive if vapour exposed to flame. Upper explosive limit: 6%; lower explosive limit 1%. Auto-ignition temperature 450°F.

Fire extinguishers

Water; carbon dioxide; dry chemical.

Incompatible with

May react with oxidising agents.

Storage

Keep away from sources of ignition.

Handling

Goggles; nitrile, rubber or vinyl gloves; face mask.

USA: TLV/TWA: 300 ppm STEL: 400 ppm

UK: OES: 100 (LTEL); 125 ppm (STEL)

Effects of exposure

Severe eye irritation at 150 ppm; defats skin if in contact. Depresses action of central nervous system.

Skin: may irritate; will defat skin causing dermatitis if exposure frequent.

Eyes: irritation; redness.

Inhalation: dry throat; cough, tightness of chest. Drowsiness, mental confusion or unconsciousness. Shortness of breath due to lung congestion. Mildly toxic by inhalation.

Ingestion: irritation of throat; nausea; vomiting. Inhalation of fumes from stomach may give same symptoms as for inhalation.

FIRST AID

Skin: remove contaminated clothing; wash thoroughly with water.

Eyes: irrigate with water; seek medical aid if irritation persists after washing.

Inhalation: move to fresh air; keep warm and at rest. Give O₂ if breathing difficult, artificial respiration if stops. If lungs congested, support in upright seated position. Seek medical aid as soon as possible.

Ingestion: if conscious give 1 pint water, then 1 pint milk to drink; keep warm and at rest; seek medical aid.

Wood dust

Fire risk if high concentration of dust in air.

USA: TLV/TWA: 1 mg/m³ hard wood. **TLV/TWA:** 5 mg/m³ soft wood.

UK: MEL 5gm/m³ (LTEL) hardwood. **OES:** 5 mg/m³ (LTEL) soft wood (under review)

Wear face mask.

Avoid breathing dust if at all possible; some varieties are more toxic/acidic than others. Fine particles — eg from sandpapering — are more dangerous.

Can cause dermatitis, respiratory disease (including asthma), nose bleeds, congestion of nasal passage.

Some individuals may be allergic to the dust of certain woods.

Long term exposure to wood dust (especially of hardwoods) may lead to an increased risk of leukaemia and of cancers of the lung, stomach, bladder, skin and nasal cavity. Some people may suffer after contact with:

Irritation and allergies: beech, western red cedar, cocobolo, cork oak, cottonwood, ebony, ipe, iroko, mahogany, obeche, peroba (roso and white), rosewood, satinwood, teak and yew.

Respiratory disorders may result from inhalation of dusts of: beech, boxwood, western red cedar, cocobolo, cork oak, ebony, ipe, iroko, mahogany, oak, obeche, peroba, sequoia, stavewood, teak and yew.

Wykamol plus – Cementone multiplus

Normal state

Clear liquid consisting of 0.5% w/w gamma HCH; 0.5% w/w bis-(tri-n-butyl tin) oxide; 2% w/w organoboron ester in unspecified organic solvent.

Uses

Wood preservative for elimination of woodworm and dry rot. See p. 13 re. U.K.'s 1986 Pesticide Regulations.

Flammability

Flammable. Flash Point 105°F (40°C).

Fire extinguishers

Dry powder or foam.

Incompatible with

No data.

Spills

Absorb with sand and dispose of safely.

Storage

Store safely in dry conditions.

Handling

Use protective safety overalls/synthetic rubber/PVC gloves, eye protection and respiratory equipment when spraying.

TLV: STEL: Odour threshold:

8 hour TWA value: Approx. 50 mg/m³

Effects of exposure

Irritant.

Skin: irritant — causes burns, may be severe.

Eyes: irritant

FIRST AID

Skin: treat as a burn and seek medical aid.

Eyes: irrigate with cold water for 15 minutes by the clock. Seek medical aid if irritation persists.

Inhalation: if overcome by vapour remove to fresh air and seek medical aid.

Ingestion: do not induce vomiting. Seek medical aid immediately and show label (where possible).

Wykamol murosol* 20

Replacing Thaltox* 20

Normal state

Cloudy, mobile liquid; dilute 1 part Murasol* to 19 parts water. Shelf life: 3-4 days in opened container; indefinitely if containers unopened. Contains 10% w/w bis(tri-n-butyltin) oxide; 50% w/w alkylbenzyl dimethyl ammonium chloride.

Uses

Concentrated biocide: dilute before use. Removal and prevention of growth of slime, algae, lichen, moss, from masonry. See p. 13 re U.K.'s 1986 Pesticide Regulations.

Properties

Miscible with water.

Flammability

Non-flammable.

Spills

'Absorb with sand and dispose of safely'.

Storage

Protect from frost and direct sunlight.

Handling

PVC or synthetic rubber gloves; goggles; face protection; mask; protective clothing; respiratory equipment while spraying.

TWA: 2.5 mg/m³ (or approx. 50mg/m³ when diluted ready for use).

Effects of exposure

Harmful by skin contact, inhalation of mists, ingestion. **Highly toxic.**

Skin: irritant; causes burns.

Eyes: irritant.

N.B. Compiler's note:

Bis-(tributyl tin) oxide:

USA: TLV/TWA: 0.1 mg/m³

UK: OES 0.1 mg/m³ (LTEL); 0.2 mg/m³ (STEL)

Poisonous by ingestion; moderately toxic by skin contact; severe eye irritant. Probable mutagen.

Alkyl benzyl dimethyl ammonium chloride

Human poison by parenteral route.

Experimental poison by ingestion, subcutaneous and intravenous routes. Human skin and severe eye irritant. Yields highly toxic fumes if heated to decomposition.

FIRST AID

Skin: wash off immediately.

Eyes: irrigate with water; **seek medical aid.**

Ingestion: **seek medical aid immediately.**

Wykamol* woodworm killer/ cementone* woodworm killer

Uses

Organic solvent based ready for use Wood Preservative. See p. 13 re. U.K.'S 1986 Pesticide Regulations.

Properties

Contains 0.5% w/ws gamma HCH.

Flammability

Flash point 105°F (40°C).

Fire extinguishers

Dry Powder or Foam.

Spills

Absorb with sand and dispose of safely.

Storage

Store safely in dry conditions.

Handling

Use protective safety overalls/synthetic rubber/PVC gloves/eye protection and respiratory equipment when spraying.

TLV: STEL: Odour threshold:

8 hour TWA value: Approx 100mg/m³.

Effects of exposure

Irritant. If symptoms persist seek medical aid.

Skin: irritant.

Eyes: irritant.

Compiler's note:

Gamma HCH: Human systemic poison by ingestion.

Poisonous by ingestion, skin contact. Can cause convulsions, dyspnoea, cyanosis. Mutagen.

USA: TLV/TWA: 0.5 mg/m³

UK: OES: 0.5 mg/m³ LTEL

FIRST AID

Skin: treat as burn and seek medical aid.

Eyes: irrigate with cold water for 15 minutes by the clock. Seek medical aid if irritation persists.

Inhalation: if overcome by vapour remove to fresh air and seek medical aid.

Ingestion: do not induce vomiting. Seek medical aid and show label (where possible).

X-rays

X-rays, like most types of radiation, can cause somatic and genetic defects even at very low doses. Doses which are considered to cause a negligible increase in the risk of diseases which might be caused by radiation are determined by the International Commission on Radiological Protection and the National Radiological Protection Board, and are recommended as the maximum dose (either annual or in terms of working life) for workers in particular jobs. The X-ray units used in conservation are all adequately shielded, so no radiation leaks should occur. Regular maintenance and checks on such machines are essential. Nevertheless it is advisable to wear a film badge, which will indicate any radiation dose to which the wearer may have been subjected. Film badges are supplied by the National Radiological Protection Board every month they send a new badge, and the old one is returned to them for processing to determine the radiation dose. The NRPB maintains radiation dosage records for each worker.

For advice, consult manufacturer or Radiological Protection Officer at a hospital or university.

Consult: Health & Safety Executive's Approved Code of Practice 16: *Protection of persons against ionising radiation arising from any work activity; The Ionising Radiations Regulations 1985: approved code of practice 35*. HMSO, London.

Xylamon BV spezial

Synonyms

Thin, clear liquid; available to stain wood a light brown (standard) or colourless.

Uses

Wood preservation. Eradication of House Longhorn Beetle and Woodworm; protects against further attack. See p.13 re. U.K.'s 1986 Pesticide Regulations.

Properties

S.G. 0.81 g/cm (1 litre=0.81Kg). Contains Lindane* — see relevant entry.

Flammability

Flash point 55°C.

Spills

No data.

Handling

Avoid skin contact or inhaling. Clean equipment with white spirit.

TLV: no data.

Effects of exposure

No data.

Xylamon-combi-S

Normal state

Thin, clear, colourless liquid.

Uses

For architectural woodwork. Destroys wood beetles and termites, or prevents further attack by insects or fungi. See p.13 re. U.K.'s 1986 Pesticide Regulations.

Properties

Soluble in white spirit or turpentine — but do not dilute for use.

Flammability

Flammable. Flash point above 55°C.

Storage

Flammable liquids store.

Handling

Gloves; goggles; respirator with special filter for suspended particles.

Effects of exposure

'Misuse will cause health hazards.'

Xylamon-LX-hardening-N

Normal state

Clear liquid.

Uses

Consolidation of deteriorated wood.

Properties

May soften or damage paint, varnishes.

Active constituent Lindane* (0.9%) — see relevant entry. Can be thinned with trichloroethylene (see relevant entry); surface may be brushed with this or ethyl acetate (see relevant entry) to eliminate gloss.

Flammability

Non-flammable.

Storage

Keep in original, tightly sealed container.

Effects of exposure

Injurious to health when inhaled, ingested or on skin contact.

Xylamon woodworm killer

Uses

Wood preservation; interior use to prevent insect attack. See p. 13 re. U.K.'s 1986 Pesticide Regulations.

Properties

Brushes etc. can be cleaned with white spirit/turpentine.

Flammability

Flammable. Flash points: Injector can and spray below 55°C; 0.750 litre & 2.5 litre cans above 55°C

Storage

Standard flammable liquids store.

Effects of exposure

"May cause health hazards if inhaled or ingested."

Xylene $C_6H_4(CH_3)_2$

Synonyms

Xylol; dimethylbenzene.

Normal state

Clear, colourless liquid.

Uses

Solvent; low surface tension, may be used to dehydrate very fragile specimens after alcohol baths.

Properties

B.P. 139°C.; S.G. 0.868. Soluble in alcohol, ether; insoluble in water.

Flammability

Highly flammable. Flash point 25°C. Flammable limits in air 1.1-7%. Gives off vapour at normal temperatures. Vapours may ignite at distant ignition source and flash back. Very dangerous fire hazard in presence of heat/flame.

Fire extinguishers

Foam; dry chemical; carbon dioxide.

Incompatible with

May react with oxidising materials.

Handling

Vinyl, viton or rubber gloves; goggles; fume cupboard.

Spills

Absorb onto paper; leave to evaporate on glass or iron dish in fume hood; burn paper.

Storage

Standard flammable chemicals store.

USA: TLV/TWA: 100 ppm; TLV/STEL: 150 ppm. Odour threshold: 200 ppm.

UK: OES: 100 ppm (LTEL); 150 ppm (STEL).

Effects of exposure

Irritant; moderately toxic by ingestion and inhalation. Experimental reproductive mutagenic and teratogenic effects.

Skin: inflammation; defatting. Can be absorbed through the skin.

Eyes: conjunctivitis; can cause corneal vacuolisation.

Inhalation: irritation of mucuous membranes and respiratory tract; breathing difficulties; fatigue; headache; nausea; dizziness; anaemia. Has been associated with menstrual irregularities. Chronic exposure: damage to kidneys, liver; blood effects.

FIRST AID

Skin: remove contaminated clothing; wash off with plenty of soap and water; if irritation persists after washing; **seek medical aid.**

Eyes: irrigate with water; if irritation persists after washing, **seek medical aid.**

Inhalation: move to fresh air. Give oxygen if breathing difficult. Get medical attention. Keep warm and at rest.

Ingestion: **get medical aid immediately;** keep warm and at rest.

Chemical: Formula

Synonyms

Normal state

Uses

Properties

B.P. °C; M.P. °C; S.G. Soluble in:
Insoluble in:

Flammability

Flammable/Nonflammable. Flash Point:
Flammable Limits in air:
Explosive hazard?

Fire extinguishers

Water/dry chemical/carbon dioxide/alcohol foam.

Incompatible with

Spills

Storage

Handling

USA:TLV/TWA: ppm mg/m³; TLV/STEL ppm mg/m³ CL: ppm mg/m³
UK: OES: ppm mg/m³ (LTEL); ppm mg/m³ (STEL) MEL: ppm mg/m³ (LTEL);
ppm mg/m³ (STEL)

Effects of exposure

Skin:

Eyes:

Inhalation:

Ingestion:

FIRST AID

Skin:

Eyes:

Inhalation:

Ingestion:

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ppm mg/m³ (STEL)

Effects of exposure

Skin:

Eyes:

Inhalation:

Ingestion:

FIRST AID

Skin:

Eyes:

Inhalation:

Ingestion:

MSDS

Chemical: Formula

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ppm mg/m³ (STEL)

Effects of exposure

Skin:

Eyes:

Inhalation:

Ingestion:

FIRST AID

Skin:

Eyes:

Inhalation:

Ingestion: