Handling. Suitable precautions should be taken to avoid skin contact with dimethylformamide as it can penetrate skin and produce systemic toxicity.

Malignant neoplasms. There have been reports of testicular cancer in men occupationally exposed to dimethylformamide.[1] Such an association could not, however, be substantiated by epidemiological data[2] on 3859 male employees exposed to dimethylformamide between 1950 and 1970 and followed up to 1984. It has been suggested that although dimethylformamide may not itself be carcinogenic, it may increase absorption through the skin of heavy metal carcinogens, possibly including chromates.[3]

1. Levin SM, *et al.* Testicular cancer in leather tanners exposed to dimethylformamide. *Lancet* 1987; **ii:** 1153.
2. Chen JL, Kennedy GL. Dimethylformamide and testicular cancer. *Lancet* 1988; **i:** 55.
3. Ducatman AM. Dimethylformamide, metal dyes, and testicular cancer. *Lancet* 1989; **i:** 911.

Pharmacokinetics
Dimethylformamide is absorbed after inhalation and through intact skin. It is excreted mainly in the urine as metabolites.

Uses
Dimethylformamide is used as an industrial solvent.

Dioxan

Diethylene Dioxide; Diethylene Ether; Dioksan; Dioxane; Dioxano. 1,4-Dioxane.

Диоксан

$C_4H_8O_2$ = 88.11.
CAS — 123-91-1.

NOTE. Do not confuse dioxan and dioxin (p.2295).

Description. Dioxan is a colourless flammable liquid with an ethereal odour. Wt per mL about 1.03 g. B.p. about 101°. Store in airtight containers.

Stability. It is dangerous to distil or evaporate dioxan unless precautions have been taken to remove explosive peroxides.

Adverse Effects, Treatment, and Precautions
Dioxan vapour is irritant to mucous membranes. High concentrations may cause nausea and vomiting, and CNS depression with headache, dizziness, drowsiness, and in severe cases unconsciousness. On repeated exposure, severe hepatic and renal damage, including necrotic changes, can occur and may be fatal. Direct contact with liquid dioxan can result in dermatitis. Dioxan has been shown to be carcinogenic in *animals.*

Treatment consists of removal from exposure and general supportive and symptomatic measures.

Handling. Suitable precautions should be taken to avoid skin contact with dioxan as it can penetrate skin and produce systemic toxicity.

Pharmacokinetics
Dioxan is absorbed after inhalation and through the skin. It is metabolised by oxidation to β-hydroxyethoxy-acetic acid.

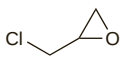
Uses
Dioxan is used as an industrial solvent.

Epichlorohydrin

Epiclorhidrina. 1-Chloro-2,3-epoxypropane.

Эпихлоргидрин

C_3H_5ClO = 92.52.
CAS — 106-89-8.



Description. Epichlorohydrin is a colourless, flammable liquid. Wt per mL about 1.18 g. B.p. 115° to 118°. Store in airtight containers.

Stability. The vapour of epichlorohydrin forms explosive mixtures with air. Harmful gases including phosgene are liberated on heating of epichlorohydrin.

Adverse Effects and Precautions
Epichlorohydrin is irritant. It has been shown to be carcinogenic in *animals*.

◊ References to the toxicity of epichlorohydrin.

1. WHO. Epichlorohydrin. *Environmental Health Criteria 33*. Geneva: WHO, 1984. Available at: http://www.inchem.org/documents/ehc/ehc/ehc33.htm (accessed 30/06/04)
2. WHO. Epichlorohydrin health and safety guide. *IPCS Health and Safety Guide 8.* Geneva: WHO, 1987. Available at: http://www.inchem.org/documents/hsg/hsg/hsg008.htm (accessed 30/06/04)
3. Health and Safety Executive. Ammonia, 1-chloro-2,3-epoxypropane (epichlorohydrin), carcinogenicity of cadmium and its compounds. *Toxicity Review 24.* London: HMSO, 1991.
4. Kolman A, *et al.* Genotoxic effects of ethylene oxide, propylene oxide and epichlorohydrin in humans: update review (1990–2001). *Mutat Res* 2002; **512:** 173–94.

Handling. Suitable precautions should be taken to avoid skin contact with epichlorohydrin as it can penetrate skin and produce systemic toxicity.

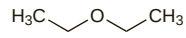
Uses
Epichlorohydrin is used as an industrial solvent.

Solvent Ether

Aether; Aether Aethylicus; Aether Solvens; Diethyl Ether; Eetteri; Éter; Eter; Éter disolvente; Eteris; Éther; Ether; Éther rectifié; Ethyl Ether; Ethyl Oxide.

Диэтиловый Эфир; Этиловый Эфир

$(C_2H_5)_2O$ = 74.12.
CAS — 60-29-7.



NOTE. Solvent ether is not intended for anaesthesia; only ether of a suitable quality (see p.1783) should be so used.

Pharmacopoeias. In *Eur.* (see p.vii), *Jpn*, and *US.*

Ph. Eur. 6.2 (Ether). A colourless, clear, volatile, highly flammable liquid. It may contain a suitable non-volatile antoxidant at a suitable concentration. Relative density 0.714 to 0.716. Distillation range 34° to 35°. Soluble in water; miscible with alcohol, with dichloromethane, and with fatty oils. Store at 8° to 15° in airtight containers. Protect from light.

USP 31 (Ether). A colourless, mobile, volatile, flammable liquid, having a characteristic sweet, pungent odour. It is slowly oxidised by the action of air and light, with the formation of peroxides. B.p. about 35°. Sp. gr. 0.713 to 0.716. Soluble 1 in 12 of water; miscible with alcohol, with chloroform, with dichloromethane, with petroleum spirit, with benzene, and with fixed and volatile oils; soluble in hydrochloric acid. Store in partly filled airtight containers at a temperature not exceeding 30° and remote from fire. Protect from light.

Stability. Though ether is one of the lightest of liquids, its vapour is very heavy, being 2⁄ times heavier than air.

Ether is very volatile and flammable and mixtures of its vapour with oxygen, nitrous oxide, or air at certain concentrations are explosive. It should not be used in the presence of an open flame or any electrical apparatus liable to produce a spark; precautions should be taken against the production of static electrical discharge. Explosive peroxides are generated by the atmospheric oxidation of solvent ether and it is dangerous to distil a sample which contains peroxides.

Adverse Effects
As for Anaesthetic Ether, p.1783. Ingestion of 30 to 60 mL may be fatal.

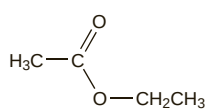
Uses
Solvent ether is widely used as a pharmaceutical and industrial solvent, and is used as an extraction solvent in food processing.

Ethyl Acetate

Acetato de etilo; Acetic Ether; Aethylis Acetas; Aethylium Aceticum; Ethyl Ethanoate; Ethyl-acetát; Éthyle, acétate d'; Ethylis acetas; Etil-acetát; Etilacetatas; Etylacetat; Etylu octan; Etyyliasetaatti.

Этилацетат

$C_4H_8O_2$ = 88.11.
CAS — 141-78-6.



Pharmacopoeias. In *Eur.* (see p.vii). Also in *USNF.*

Ph. Eur. 6.2 (Ethyl Acetate). A colourless, clear, volatile liquid. Relative density 0.898 to 0.902. B.p. 76° to 78°. Soluble in water; miscible with alcohol, with acetone, and with dichloromethane. Store at a temperature not exceeding 30°. Protect from light.

USNF 26 (Ethyl Acetate). A transparent, colourless, flammable liquid having a fragrant, refreshing, slightly acetous odour. Sp. gr. 0.894 to 0.898. Soluble in water; miscible with alcohol, with ether, and with fixed and volatile oils. Store in airtight containers at a temperature not exceeding 40°.

Adverse Effects
Ethyl acetate is irritant to mucous membranes. High concentrations may cause CNS depression. Ethyl acetate may be implicated in volatile substance abuse (p.2019).

◊ For discussion of neurotoxicity after occupational exposure to solvents and the absence of such an effect with ethyl acetate, see under Toluene, p.2026.

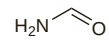
Uses
Ethyl acetate is used as a flavour and solvent in pharmaceutical preparations. It is also used in industry as a solvent and as an extraction solvent in food processing.

Formamide

Carbamaldehyde; Formamid; Formamida; Methanamide.

Формамид

CH_3NO = 45.04.
CAS — 75-12-7.



Description. Formamide is a colourless, oily liquid. B.p. 210°. Wt per mL, about 1.13 g.

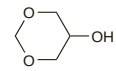
Profile
Formamide is used as an industrial solvent. It is reported to be irritant.

Glycerol Formal

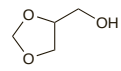
Glycérol formal; Glycerol-formalum. A mixture of the two isomers 4-hydroxymethyl-1,3-dioxolane and 5-hydroxy-1,3-dioxane present in a constant ratio of 40:60 respectively.

Глицерол Формаль

$C_4H_8O_3$ = 104.1.
CAS — 4740-78-7 (5-hydroxy-1,3-dioxane); 5464-28-8 (4-hydroxymethyl-1,3-dioxolane).



(5-hydroxy-1,3-dioxane)



(4-hydroxymethyl-1,3-dioxolane)

Profile
Glycerol formal is used as a pharmaceutical solvent.

Glycofurol

Glicofurol; Glycofural; Glycofurol 75; Tetrahydrofurfuryl Alcohol Polyethylene Glycol Ether. α-(Tetrahydrofuranyl)-ω-hydroxypoly(oxyethylene).

Гликофурфурол

$C_5H_9O.(C_2H_4O)_n.OH$.
CAS — 9004-76-6; 31692-85-0.

Description. Glycofurol is a clear, colourless, almost odourless liquid. Wt per mL about 1.08 g. B.p. 80° to 100°. Incompatible with oxidising agents. Store under nitrogen in airtight containers. Protect from light.

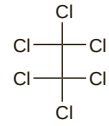
Profile
Glycofurol is used as a pharmaceutical solvent for injections.

Hexachloroethane

Hexacloroetano.

Гексахлорэтан

C_2Cl_6 = 236.7.
CAS — 67-72-1.



Profile
Hexachloroethane is a chlorinated hydrocarbon used in industry as a solvent. Eye irritation and photophobia have resulted from industrial exposure to the vapour. It was formerly used in veterinary medicine as an anthelmintic, but has been superseded by less toxic drugs.