

SAFE USE OF CHEMICALS IN THE LABORATORY & HAZARDOUS WASTE MANAGEMENT

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OUTLINE

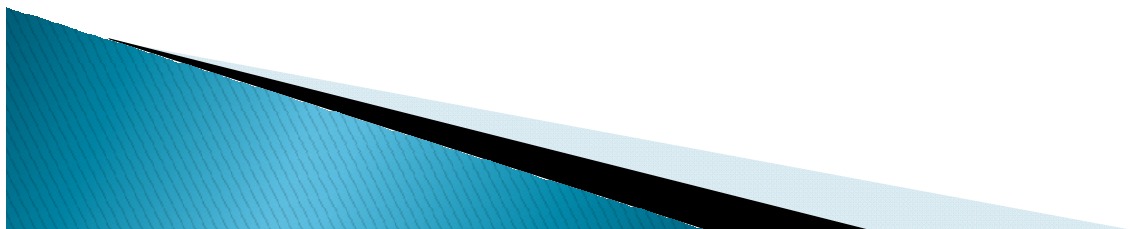
- ▶ *Safety with chemicals – Principles*
- ▶ *Hazards*
- ▶ *Categories of hazardous chemicals*
- ▶ *Labeling*
- ▶ *Hygiene rules*
- ▶ *Safety rules - Obligations*
- ▶ *Personal Protective Equipment (PPE)*
- ▶ *Disposal*
- ▶ *References - Bibliography*

GENERAL SAFETY RULES WITH CHEMICALS IN THE LABORATORIES

NOT ALL POSSIBLE RISKS CAN BE PREDICTED!

Every person (using chemicals) in the lab must

- 1. be aware of the potential hazards*
- 2. be prepared for the possibility of an accident*



LIST OF HAZARDS IN THE LABORATORIES

▶ Physical:

explosion, fire, electric shock, frostbite,
broken glass injuries etc

▶ Chemical:

Acute

allergy, skin burn, eye-throat irritation etc

Chronic

long term effects of mutagens, carcinogens,
heavy metals, etc

▶ Radioactivity hazards

HAZARDS DEPENDENCE

On:

- 1. Knowledge and compliance with Good Laboratory Practices (GLP)**
- 2. Physical, chemical and biological properties of chemicals**
- 3. Quantity**
- 4. Way of handling/storing/transporting**
- 5. Way of using**
- 6. Duration of contact/exposure**
- 7. Number of persons in direct or indirect contact with chemical**
- 8. Disposal**

CHEMICALS AND HEALTH HAZARDS

DEFINITIONS

Hazardous: *any substance or mixture for which there is adequate statistical proof, based on at least one scientific study, that*

a) it poses a physical risk

b) it may or will cause either acute (immediate) or chronic (long term) health effects

CHEMICALS AND HEALTH HAZARDS: TOXIC

DEFINITIONS

TOXICITY: the degree to which a substance can damage an organism, either as a whole or affect its substructure, such as a cell (cytotoxicity) or an organ.

Acute: the adverse effects of a substance that result either from a single exposure or from multiple exposures in a short space of time (usually less than 24 hours) (e.g. HCN, H₂S)

Chronic: the effect of a substance on a living organism which is exposed to it continuously or repeatedly (e.g. carcinogens, heavy metals etc.)

WARNING! ANY UNKNOWN OR NOT TESTED MATERIAL SHOULD BE CONSIDERED TOXIC UNTIL PROVEN SAFE!!

CHEMICALS AND HEALTH HAZARDS: TOXIC

TLV -TWA (Treshold Limit Value): maximum permissible concentration of a material (ppm in air), for some defined period of time (often 8 hours). Also called MEL (Maximum Exposure Limit)

STEL (Short Term Exposure Limit): maximum permissible concentration of a material (ppm in air), for a defined short period of time (typically 5 min)

ED50 (Effective Dose 50): amount of material required to produce a specified effect in 50% of an animal population

LC50 (Lethal Concentration 50): concentration of a chemical which kills 50% of a sample population, when exposure to a chemical is through the animal breathing it in

LD50 (Lethal Dose 50): dose of a chemical which kills 50% of a sample population, when exposure is by swallowing, through skin contact, or by injection

TD50 (Tumor Dose 50): chronic dose-rate (mg/kg body wt/day) which would induce tumors in half the test animals at the end of a standard lifespan for the species

SPECIAL TYPES OF HAZARDOUS CHEMICALS

1. ALLERGENS/SKIN EYE IRRITATING

Great variety of allergens! Usually cause dermatitis.

Most common:

- Diazomethane
- Cr, Ni
- Dichromate and isocyanate salts
- HCHO
- some phenols

Gloves, mask and goggles must be worn !!!!

Use always in a hood !!!

SPECIAL TYPES OF HAZARDOUS CHEMICALS

2. EMBRYOTOXINS

Harmful agents that retard the growth, or adversely affect the development of an unborn child.

(Hg compounds, heavy metals, formamide, benzene, carbon tetrachloride, chloroform, formaldehyde, xylene, toluene, nitrous oxide, propylene glycol and radiation)

PRECAUTIONS - HANDLING:

1. Store separately-label properly. Storage and handling areas adequately ventilated
2. Handling in fuming hood only
3. Appropriate safety apparel, special gloves
4. Women of childbearing potential should take adequate precautions or be excluded from use
5. In case of inhalation/ingestion call doctor immediately

SPECIAL TYPES OF HAZARDOUS CHEMICALS

3. CORROSIVE – CAUSTIC – TEAR INDUCING IRRITANTS

Destroy or cause severe damages to the living tissue (skin, eyes, respiratory system, internal organs)

1. Strong acids: especially HF, H₂SO₄, HNO₃, H₂CrO₄ (severe burns, deadly if inhaled or indigested)

2. Strong bases: especially NaOH, KOH, NH₃ (severe burns, deadly if inhaled or indigested)

3. Desiccants: π. H₂SO₄, CaO, NaOH, P₂O₅

4. Oxidizing agents: e.g. Permanganate – halogen - nitrate compounds, sulfuric acid, chlorine etc. Danger of explosion in contact with alcohols, glycerin etc.

UPON CONTACT, NEUTRALISE AND WASH CONTAMINATED AREA IMMEDIATELY AND THOROUGHLY WITH WATER!

SPECIAL TYPES OF HAZARDOUS CHEMICALS

4. EXPLOSIVES

- ▶ Acetylene and acetylides
- ▶ AlCl_3 (combines with water with explosive violence and liberation of much heat and HCl, neurotoxin)
- ▶ $\text{NH}_3 + \text{I}_2 \rightarrow$ explosive NI_3 as well as with $\text{ClO}^- \rightarrow \text{Cl}_2$
- ▶ CS_2 : highly toxic, highly flammable (flash point = - 30 ° C)
- ▶ Chlorine + hydrocarbons + light
- ▶ Diazomethane (CH_2N_2) : highly toxic and explosive
- ▶ Dimethyl sulfoxide (DMSO)
- ▶ Dry ice
- ▶ Ethers and ether peroxides
- ▶ Ethylene oxide ($\text{C}_2\text{H}_4\text{O}$) :
- ▶ Chloroform and carbon tetrachloride
- ▶ H_2O_2 : explosive vapors and reactions
- ▶ Inorganic and organic peroxides

SPECIAL TYPES OF HAZARDOUS CHEMICALS

5. CHEMICALS REACTING VIOLENTLY WITH WATER

- ▶ *Alkali metals (eg Na, K, Cs), amides and hydrides*
- ▶ *Grignard reagents*
- ▶ *Nonmetal halides (BF_3 , PCl_3 , PCl_5 etc.)*
- ▶ *Inorganic acid halides (SOCl_2 , POCl_3 etc.)*
- ▶ *Metal halides (AlCl_3 , SnCl_4 etc.)*
- ▶ *Calcium carbide*
- ▶ *Phosphorus pentoxide*
- ▶ *Organic acid halides (e.g. acetyl chloride)*
- ▶ *Simple organic acid anhydrides (e.g. acetic anhydride)*

SPECIAL TYPES OF HAZARDOUS CHEMICALS

6. CARCINOGENS

All chemicals known or believed to cause cancer. Few in number, but a lot of substances are suspected to be carcinogenic.

> 85% of mutagens are carcinogenic

7. LUNG – NEURO – HEMO – KIDNEY TOXINS

8. PYROPHORIC

Substances that ignite spontaneously in air at or below 54.55 °C (e.g. alkali metals, P, silane, SiCl₄ etc). Flame may not be visible.

SPECIAL TYPES OF HAZARDOUS CHEMICALS

9. LIGHT SENSITIVE

Decompose under influence of light giving dangerous products or explosion

(e.g. CHCl_3 , ketones, tetrahydrofuran, anhydrides)

10. CRYOPHORIC

Liquefied gases (N_2)

Special mixtures – Cooling baths

(e.g. dry ice + isopropyl ether --> -60°C)

COMPRESSED GASES

DANGEROUS

C_2H_2

NH_3 (anhydrous, 1500-2000 ppm in 1 hour: very dangerous)

CO

Cl_2

H_2 (non toxic but flammable)

HX & HS (X=halogen, highly toxic and corrosive, throat, lungs, respiratory system)

NO_x (respiratory system)

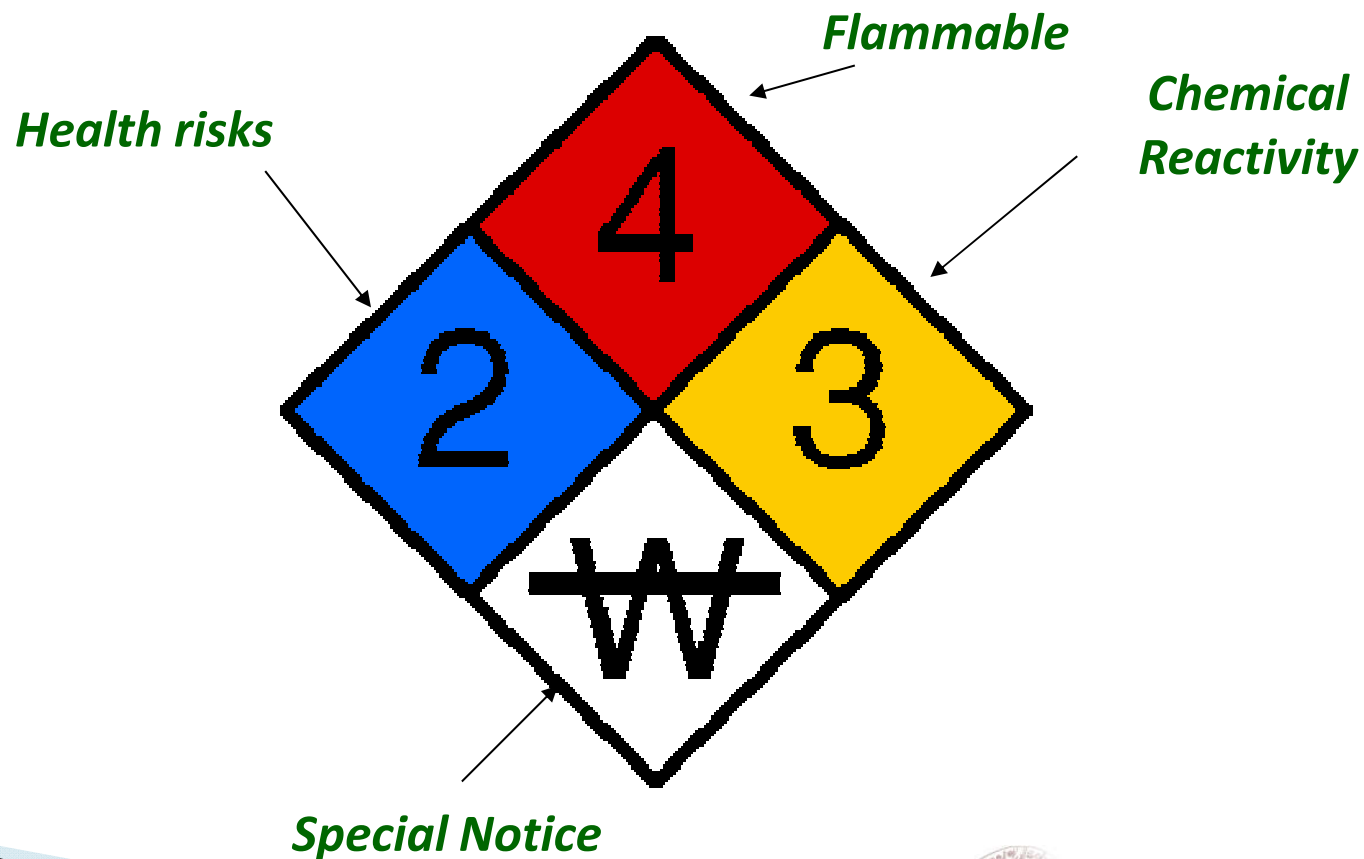
O_2 (upon contact with flammables)

HAZARDS: Mechanical, chemical

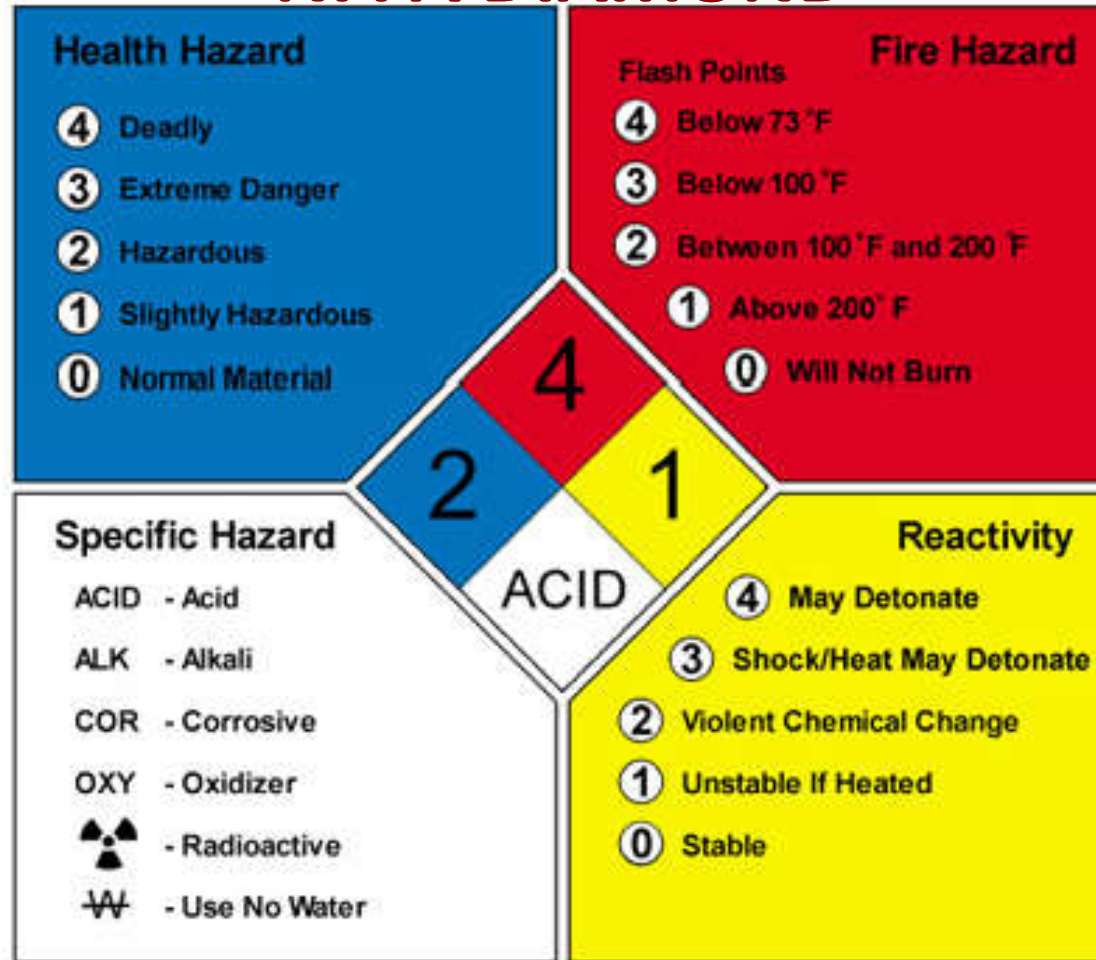
HANDLING: Stability of bottles, extra care with regulators, valves, tubing

LABELING OF CHEMICALS & IDENTIFICATION OF HAZARDS: NFPA DIAMOND

(National Fire Protection Association, www.nfpa.org)



LABELING OF CHEMICALS & IDENTIFICATION OF HAZARDS: NFPA DIAMOND













LABELING OF CHEMICALS & IDENTIFICATION OF HAZARDS: NFPA DIAMOND



LABELING OF CHEMICALS & IDENTIFICATION OF HAZARDS GHS



LABELING OF CHEMICALS & IDENTIFICATION OF HAZARDS GHS

	Exploding bomb (for explosion or reactivity hazards)		Flame (for fire hazards)		Flame over circle (for oxidizing hazards)
	Gas cylinder (for gases under pressure)		Corrosion (for corrosive damage to metals, as well as skin, eyes)		Skull and Crossbones (can cause death or toxicity with short exposure to small amounts)
	Health hazard (may cause or suspected of causing serious health effects)		Exclamation mark (may cause less serious health effects or damage the ozone layer*)		Environment* (may cause damage to the aquatic environment)
	Biohazardous Infectious Materials (for organisms or toxins that can cause diseases in people or animals)				

EUROPEAN UNION REGULATIONS

CLP (1272/2008/EK)

(Classification, Labeling and Packaging of chemical substances and mixtures to the Globally Harmonised System)

<http://ec.europa.eu/enterprise/sectors/chemicals/documents/classification/>

REACH (1-7-2007)

(Registration, Evaluation, Authorisation & Restriction of Chemicals)

Primary aim:

Protection of workers, consumers and the environment

MATERIAL SAFETY DATA SHEET (MSDS)

SECTION 1: Identification of the substance/mixture and of the company/undertaking

SECTION 2: Hazards identification

SECTION 3: Composition/information on ingredients

SECTION 4: First aid measures

SECTION 5: Firefighting measures

SECTION 6: Accidental release measures

SECTION 7: Handling and storage

SECTION 8: Exposure controls/personal protection

SECTION 9: Physical and chemical properties

SECTION 10: Stability and reactivity

SECTION 11: Toxicological information

SECTION 12: Ecological information

SECTION 13: Disposal considerations

SECTION 14: Transport information

SECTION 15: Regulatory information

SECTION 16: Other information

MATERIAL SAFETY DATA SHEET (MSDS)

A Responsible Care® Company

MATERIAL SAFETY DATA SHEET

This Material Safety Data Sheet complies with the Canadian Controlled Product Regulations and the United States Occupational Safety and Health Administration (OSHA) hazard communication standard.

1. Product and Supplier Identification

Product: Methanol (CH₃OH)

Non-Emergency Tel. #: (604) 661-2600

Synonyms: Methyl alcohol, methyl hydrate, wood spirit, methyl hydroxide

Emergency Tel. #: 1-800-424-9300
(CHEMTREC) (Canada and US)

Product Use: Solvent, fuel, feedstock

Company Identification: Methanex Corporation,
1800 Waterfront Centre,
200 Burrard Street,
Vancouver, B.C.
V6C 3M1

Note: CHEMTREC number to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

Importer: Methanex Methanol Company
Suite 1150 – 15301 Dallas Parkway
Addison, Texas 75001
Telephone: (972) 702-0909



MATERIAL SAFETY DATA SHEET (MSDS)

2. Composition

Component	% (w/w)	Exposure Limits*	LD ₅₀	LC ₅₀
Methanol (CAS 67-56-1)	99-100	ACGIH TLV-TWA: 200 ppm, skin STEL: 250 ppm, skin notation OSHA PEL: 200 ppm TLV Basis, critical effects: neuropathy, vision, central nervous system	5628 mg/kg (oral/rat) 20 ml/kg (dermal/ rabbit)	64000 ppm (inhalation/rat)

* Exposure limits may vary from time to time and from one jurisdiction to another. Check with local regulatory agency for the exposure limits in your area.

MATERIAL SAFETY DATA SHEET (MSDS)

3. Hazards Identification

Routes of Entry:

Skin Contact: Moderate Eye Contact: Moderate Ingestion: Major Inhalation: Major

Effects of Short-Term (Acute) Exposure:

Inhalation: Inhalation of high airborne concentrations can also irritate mucous membranes, cause headaches, sleepiness, nausea, confusion, loss of consciousness, digestive and visual disturbances and even death. NOTE: Odour threshold of methanol is several times higher than the TLV-TWA. Depending upon severity of poisoning and the promptness of treatment, survivors may recover completely or may have permanent blindness, vision disturbances and/or nervous system effects. Concentrations in air exceeding 1000 ppm may cause irritation of the mucous membranes.

Skin Contact: Methanol is moderately irritating to the skin. Methanol can be absorbed through the skin and harmful effects have been reported by this route of entry. Effects are similar to those described in "Inhalation"

Eye Contact: Methanol is a mild to moderate eye irritant. High vapour concentration or liquid contact with eyes causes irritation, tearing and burning.

Ingestion: Swallowing even small amounts of methanol could potentially cause blindness or death. Effects of sub lethal doses may be nausea, headache, abdominal pain, vomiting and visual disturbances ranging from blurred vision to light sensitivity.

Effects of Long-Term (Chronic) Exposure: Repeated exposure by inhalation or absorption may cause systemic poisoning, brain disorders, impaired vision and blindness. Inhalation may worsen conditions such as emphysema or bronchitis. Repeated skin contact may cause dermal irritation, dryness and cracking.

Medical Conditions Aggravated By Exposure: Emphysema or bronchitis.

MATERIAL SAFETY DATA SHEET (MSDS)

4. First Aid Measures

Note: Emergency assistance may also be available from the local poison control centre.

Eye Contact: Remove contact lenses if worn. In case of contact, immediately flush eyes with plenty of clean running water for at least 15 minutes, lifting the upper and lower eyelids occasionally. Obtain medical attention.

Skin Contact: In case of contact, remove contaminated clothing. In a shower, wash affected areas with soap and water for at least 15 minutes. Seek medical attention if irritation occurs or persists. Wash clothing before reuse.

Inhalation: Remove to fresh air, restore or assist breathing if necessary. Obtain medical attention.

Ingestion: Swallowing methanol is potentially life threatening. Onset of symptoms may be delayed for 18 to 24 hours after digestion. If conscious and medical aid is not immediately available, do not induce vomiting. In actual or suspected cases of ingestion, transport to medical facility immediately.

NOTE TO PHYSICIAN: Acute exposure to methanol, either through ingestion or breathing high airborne concentrations can result in symptoms appearing between 40 minutes and 72 hours after exposure. Symptoms and signs are usually limited to CNS, eyes and gastrointestinal tract. Because of the initial CNS's effects of headache, vertigo, lethargy and confusion, there may be an impression of ethanol intoxication. Blurred vision, decreased acuity and photophobia are common complaints. Treatment with ipecac or lavage is indicated in any patient presenting within two hours of ingestion. A profound metabolic acidosis occurs in severe poisoning and serum bicarbonate levels are a more accurate measure of severity than serum methanol levels. Treatment protocols are available from most major hospitals and early collaboration with appropriate hospitals is recommended.

MATERIAL SAFETY DATA SHEET (MSDS)

5. Fire Fighting Measures

Flash point:	11°C (TCC)
Autoignition temperature:	385 °C (NFPA 1978), 470 °C (Kirk-Othmer 1981; Ullmann 1975)
Lower Explosive Limit:	6% (NFPA, 1978)
Upper Explosion Limit:	36% (NFPA, 1978), 36.5% (Ullmann, 1975)
Sensitivity to Impact:	Low
Sensitivity to Static Discharge:	Low
Hazardous Combustion Products:	Toxic gases and vapours; oxides of carbon and formaldehyde.
Extinguishing Media:	Small fires: Dry chemical, CO ₂ , water spray Large fires: Water spray, AFFF(R) (Aqueous Film Forming Foam (alcohol resistant)) type with either a 3% or 6% foam proportioning system.

Fire Fighting Instructions: Methanol burns with a clean clear flame that is almost invisible in daylight. Stay upwind! Isolate and restrict area access. Concentrations of greater than 25% methanol in water can be ignited. Use fine water spray or fog to control fire spread and cool adjacent structures or containers. Contain fire control water for later disposal. Fire fighters must wear full face, positive pressure, self-contained breathing apparatus or airline and appropriate protective clothing. Protective fire fighting structural clothing is not effective protection from methanol. Do not walk through spilled product.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) HAZARD INDEX:

HEALTH: 1

FLAMMABILITY: 3

REACTIVITY: 0

MATERIAL SAFETY DATA SHEET (MSDS)

6. Accidental Release Measures

Overview: Flammable liquid which can burn without a visible flame. Release can cause an immediate risk of fire and explosion. Eliminate all ignition sources, stop leak and use absorbent materials. If necessary, contain spill by diking. Fluorocarbon alcohol resistant foams may be applied to spill to diminish vapour and fire hazard. Maximize methanol recovery for recycling or re-use. Restrict access to area until completion of cleanup. Ensure cleanup is conducted by trained personnel only. Wear adequate personal protection and remove all sources of ignition. Notify all governmental agencies as required by law.

Personal Protection: Full face, positive pressure self-contained breathing apparatus or airline, and protective clothing must be worn. Protective fire fighting structural clothing is not effective protection from methanol.

Environmental Precautions: Biodegrades easily in water Methanol in fresh or salt water may have serious effects on aquatic life. A study on methanol's toxic effects on sewage sludge bacteria reported little effect on digestion at 0.1% while 0.5% methanol retarded digestion. Methanol will be broken down to carbon dioxide and water.

Remedial Measures: Flammable liquid. Release can cause an immediate fire/explosion hazard. Eliminate all sources of ignition, stop leak and use absorbent materials. Collect liquid with explosion proof pumps. Do not walk through spill product as it may be on fire and not visible.

Large Spills: If necessary, contain spill by diking. Fluorocarbon alcohol resistant foams may be applied to spill to diminish vapour and fire hazard. Maximize methanol recovery for recycling or reuse. Collect liquid with explosion proof pumps.

Small Spills: Soak up spill with non-combustible absorbent material. Recover methanol and dilute with water to reduce fire hazard. Prevent spilled methanol from entering sewers, confined spaces, drains, or waterways. Restrict access to unprotected personnel. Full. Put material in suitable, covered, labeled containers. Flush area with water.

MATERIAL SAFETY DATA SHEET (MSDS)

7. Handling and Storage

Handling Procedures: No smoking or open flame in storage, use or handling areas. Use explosion proof electrical equipment. Ensure proper electrical grounding procedures are in place.

Storage: Store in totally enclosed equipment, designed to avoid ignition and human contact. Tanks must be grounded, vented, and should have vapour emission controls. Tanks must be diked. Avoid storage with incompatible materials. Anhydrous methanol is non-corrosive to most metals at ambient temperatures except for lead, nickel, monel, cast iron and high silicon iron. Coatings of copper (or copper alloys), zinc (including galvanized steel), or aluminum are unsuitable for storage. These materials may be attacked slowly by the methanol. Storage tanks of welded construction are normally satisfactory. They should be designed and built in conformance with good engineering practice for the material being stored. While plastics can be used for short term storage, they are generally not recommended for long-term storage due to deterioration effects and the subsequent risk of contamination.

Corrosion rates for several construction materials:

<0.508 mm/year	Cast iron, monel, lead, nickel
<0.051 mm/year	High silicon iron
Some attack	Polyethylene
Satisfactory	Neoprene, phenolic resins, polyesters, natural rubber, butyl rubber
Resistant	Polyvinyl chloride, unplasticized

MATERIAL SAFETY DATA SHEET (MSDS)

8. Exposure Controls, Personal Protection

Engineering Controls: In confined areas, local and general ventilation should be provided to maintain airborne concentrations below permissible exposure limits. Ventilation systems must be designed according to approved engineering standards.

Respiratory Protection: NIOSH approved supplied air respirator when airborne concentrations exceed exposure limits.

Skin protection: Butyl and nitrile rubbers are recommended for gloves. Check with manufacturer. Wear chemical resistant pants and jackets, preferably of butyl or nitrile rubber. Check with manufacturer.

Eye and Face Protection: Face shield and chemical splash goggles when transferring is taking place.

Footwear: Chemical resistant, and as specified by the workplace.

Other: Eyewash and showers should be located near work areas. NOTE: PPE must not be considered a long-term solution to exposure control. PPE usage must be accompanied by employer programs to properly select, maintain, clean, fit and use. Consult a competent industrial hygiene resource to determine hazard potential and/or the PPE manufacturers to ensure adequate protection.

MATERIAL SAFETY DATA SHEET (MSDS)

9. Physical and Chemical Properties

Appearance: Liquid, clear, colourless

Odour: Mild characteristic alcohol odour

Odour Threshold: detection: 4.2 - 5960 ppm
(geometric mean) 160 ppm
recognition: 53 - 8940 ppm
(geometric mean) 690 ppm

pH: Not applicable

Vapour Pressure: 12.8 kPa @ 20°C

Solubility: Completely soluble

Vapour Density: 1.105 @ 15°C

Freezing Point: -97.8 °C

Boiling Point: 64.7 °C @ 101.3 kPa

Critical Temperature: 239.4 °C

Relative Density: 0.791

Evaporation Rate: 4.1 (n-butyl acetate =1)

Partition Coefficient: Log P (oct) = -0.82

Solubility in other Liquids: Soluble in all proportions in other alcohols, esters, ketones, ethers and most other organic solvents

10. Stability and Reactivity

Chemical Stability: Yes

Incompatibility: Yes. Avoid contact with strong oxidizers, strong mineral or organic acids, and strong bases. Contact with these materials may cause a violent or explosive reaction. May be corrosive to lead, aluminum, magnesium, and platinum.

Conditions of Reactivity: Presence of incompatible materials and ignition sources.

Hazardous Decomposition Products: Formaldehyde, carbon dioxide, and carbon monoxide.

Hazardous Polymerization: Will not occur.

MATERIAL SAFETY DATA SHEET (MSDS)

11. Toxicological Information

LD₅₀:	5628 mg/kg (oral/rat), 20 ml/kg (dermal/rabbit)
LC₅₀:	64000 ppm (rat)
Acute Exposure:	See Section 3
Chronic Exposure:	See Section 3.
Exposure Limits:	See Section 2.
Irritancy:	See Section 3.
Sensitization:	No
Carcinogenicity:	Not listed by IARC, NTP, ACGIH, or OSHA as a carcinogen.
Teratogenicity:	No
Reproductive toxicity:	Reported to cause birth defects in rats exposed to 20,000 ppm
Mutagenicity:	Insufficient data
Synergistic products:	None Known

12. Ecological Information

Environmental toxicity: Methanol in fresh or salt water may have serious effects on aquatic life. A study on methanol's toxic effects on sewage sludge bacteria reported little effect on digestion at 0.1% while 0.5% methanol retarded digestion. Methanol will be broken down into carbon dioxide and water.

Biodegradability: Biodegrades easily in water.

MATERIAL SAFETY DATA SHEET (MSDS)

13. Disposal Considerations

Review federal, provincial or state, and local government requirements prior to disposal. Store material for disposal as indicated in Section #7, **Handling and Storage**. Disposal by controlled incineration or by secure land fill may be acceptable.

14. Transport Information

Transport of Dangerous Goods (TDG and CLR):	Methanol, Class 3(6.1), UN1230, P.G. II Limited Quantity: ≤ 1 litres
United States Department of Transport (49CFR): (Domestic Only)	Methanol, Class 3, UN 1230, P.G. II, (RQ 5000 lbs/2270 kg) Limited Quantity: ≤ 1 litres
International Air Transport Association (IATA):	Methanol, Class 3(6.1), UN1230, P.G. II Packaging Instruction: 305, 1 litre maximum per package,
International Maritime Organization (IMO):	Methanol, Class 3(6.1), UN1230, P.G. II, Flash Point = 12 °C EmS No. F-E, S-D Stowage Category "B", Clear of living quarters

MATERIAL SAFETY DATA SHEET (MSDS)

15. Regulatory Information

CANADIAN FEDERAL REGULATIONS:

CEPA, DOMESTIC SUBSTANCES LIST: Listed

WHMIS CLASSIFICATION: B2, D1A

UNITED STATES REGULATIONS:

29CFR 1910.1200 (OSHA): Hazardous

40CFR 116-117 (EPA): Hazardous

40CFR 355, Appendices A and B: Subject to Emergency Planning and Notification

40CFR 372 (SARA Title III): Listed

40CFR 302 (CERCLA): Listed

16. Other Information

Preparation Date: October 13, 2005

























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Disclaimer: The information above is believed to be accurate and represents the best information currently available to us. Users should make their own investigations to determine the suitability of the information for their particular purposes. This document is intended as a guide to the appropriate precautionary handling of the material by a properly trained person using this product.

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CHEMICAL COMPATIBILITY OF MATERIALS

DANGEROUS GOODS & COMBUSTIBLE LIQUIDS STORAGE COMPATIBILITY CHART													
Class or Subsidiary Risk													
FLAMMABLE GASES		OK TO STORE TOGETHER	OK TO STORE TOGETHER	SEGREGATE At least 3m	SEGREGATE At least 3m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 3m	ISOLATE	SEGREGATE At least 3m	SEGREGATE At least 5m
NON TOXIC NON FLAMMABLE GASES		OK TO STORE TOGETHER	OK TO STORE TOGETHER	OK TO STORE TOGETHER	OK TO STORE TOGETHER	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 3m	ISOLATE	SEGREGATE At least 3m	SEGREGATE At least 5m
TOXIC GAS		SEGREGATE At least 3m	OK TO STORE TOGETHER	MAY NOT BE COMPATIBLE CHECK MSDS AND NOTES	SEGREGATE At least 3m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 3m	ISOLATE	SEGREGATE At least 3m	SEGREGATE At least 5m
OXIDIZING GAS		SEGREGATE At least 3m	OK TO STORE TOGETHER	SEGREGATE At least 3m	OK TO STORE TOGETHER	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 3m	ISOLATE	SEGREGATE At least 3m	SEGREGATE At least 5m
FLAMMABLE LIQUIDS + COMBUSTIBLE LIQUIDS		SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	OK TO STORE TOGETHER	SEGREGATE At least 3m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	ISOLATE	SEGREGATE At least 5m	SEGREGATE At least 3m
FLAMMABLE SOLID		SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 3m	OK TO STORE TOGETHER	SEGREGATE At least 3m	SEGREGATE At least 5m	SEGREGATE At least 3m	ISOLATE	SEGREGATE At least 3m	MAY NOT BE COMPATIBLE CHECK MSDS AND NOTES
SPONTANEOUSLY COMBUSTIBLE		SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 3m	OK TO STORE TOGETHER	SEGREGATE At least 5m	SEGREGATE At least 5m	ISOLATE	SEGREGATE At least 3m	SEGREGATE At least 3m
DANGEROUS WHEN WET		SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	OK TO STORE TOGETHER	SEGREGATE At least 5m	ISOLATE	SEGREGATE At least 3m	SEGREGATE At least 5m
OXIDIZING AGENT		SEGREGATE At least 3m	SEGREGATE At least 3m	SEGREGATE At least 3m	SEGREGATE At least 3m	SEGREGATE At least 5m	KEEP APART	SEGREGATE At least 5m	SEGREGATE At least 5m	MAY NOT BE COMPATIBLE CHECK MSDS AND NOTES	ISOLATE	SEGREGATE At least 3m	SEGREGATE At least 3m
ORGANIC PEROXIDE		ISOLATE	ISOLATE	ISOLATE	ISOLATE	ISOLATE	ISOLATE	ISOLATE	ISOLATE	ISOLATE	OK TO STORE TOGETHER	ISOLATE	SEGREGATE At least 3m
TOXIC SUBSTANCES		SEGREGATE At least 3m	SEGREGATE At least 3m	SEGREGATE At least 3m	SEGREGATE At least 3m	SEGREGATE At least 5m	SEGREGATE At least 3m	SEGREGATE At least 3m	SEGREGATE At least 3m	SEGREGATE At least 3m	ISOLATE	OK TO STORE TOGETHER	SEGREGATE At least 5m
CORROSIVE		SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 3m	MAY NOT BE COMPATIBLE CHECK MSDS AND NOTES	SEGREGATE At least 3m	SEGREGATE At least 5m	SEGREGATE At least 3m	SEGREGATE At least 3m	SEGREGATE At least 5m	MAY NOT BE COMPATIBLE CHECK MSDS AND NOTES

CHEMICAL COMPATIBILITY OF MATERIALS



Alphabetical Listing of Materials	Concentration+Weight %	ABS	Acetal	Acrylic	CAB	CPVC	ECTFE (Halar®)	Fluoros
Acetaldehyde Aq.	40	D	A	D	*	D	*	A
Acetic Acid Aq.	10	*	B	B	C	A	A	A
Acetone		D	B	D	*	D	A	A
Alcohols, Aliphatic		*	A	D	*	*	A	A
Aluminum Chloride Aq.	10	*	*	*	A	A	*	A
Aluminum Sulphate Aq.	10	*	*	*	A	A	A	A
Ammonia Gas		*	*	*	*	A	A	A
Ammonium Carbonate Aq.	10	*	*	*	*	A	A	A
Ammonium Chloride Aq.	10	*	*	*	A	A	A	A
Amyl Acetate		D	*	D	*	*	*	A
Aniline		*	A	D	*	D	A	A

CHEMICAL COMPATIBILITY OF MATERIALS

The screenshot shows the Cole-Parmer website's Chemical Compatibility Database. The browser window title is "Chemical Compatibility Database from Cole-Parmer - Mozilla Firefox". The address bar shows the URL "www.coleparmer.com/Chemical-Resistance". The page features a navigation bar with a search box and a "Search" button. Below the navigation bar, there are links for "Shop All Products", "Shop by", "Service & Support", "Technical Resources", and "My Account". A "Shopping Cart" widget in the top right corner shows "Item Total = \$0.00" and "Items = 0".

The main content area is titled "Chemical Compatibility Database" and includes a list of "Resource Types":

- Articles and White Papers (421)
- Case Studies (105)
- Conversions and Technical Data (93)
- [+] Show more (4)

Below the resource types are "Product Resources" and "Industries":

- Actuators (1)
- Air Cleaners (1)
- Air Compressors (2)
- [+] Show more (97)
- Chemical Process (61)

The central section provides instructions for using the database:

1. Select a Material **or** Chemical.
2. **Optional** - select another category (Material, Chemical, or Rating) to narrow your results for a specific combination or compatibility rating.
3. Click "See results"

Note: You can not choose Rating with BOTH Material **and** Chemical selected.

Below the instructions are two dropdown menus for selection:

- Material**: All, ABS plastic, Acetal (Delrin®), Aluminum, Brass
- Chemical**: All, Acetaldehyde, Acetamide, Acetate Solvent, Acetic Acid

A "Rating" dropdown menu is set to "All".

On the right side, there is a "Share" button and a promotional banner for "Masterflex I/P Digit Process Drive" with a "Buy Now!" button. The banner text reads: "Powder-Coated Housing, Reversible motor, anti-drip functionality".

The Windows taskbar at the bottom shows the Start button, system tray with the time "14:59" and date "20/1/2014", and open applications including "Facebook - Mozilla Fir...", "Microsoft PowerPoint...", and "Chemical Compatiblt...".

CHEMICAL COMPATIBILITY OF MATERIALS

The screenshot shows the Cole-Parmer website interface. At the top, there's a navigation bar with 'Search' and 'View Cart' buttons. Below it, a secondary navigation bar includes 'Shop All Products', 'Shop by', 'Service & Support', 'Technical Resources', 'My Account', and 'Check order status'. The main content area is titled 'Chemical Compatibility Results' and features a search bar with 'Aluminum' entered. A table lists the results for Acetaldehyde with a 'B-Good' compatibility rating. To the right, there's a detailed 'Explanation of Footnotes' and a 'Ratings -- Chemical Effect' section. A 'WARNING' box at the bottom states that the information is supplied to Cole-Parmer by other reputable sources. The browser's taskbar at the bottom shows the Windows Start button, several open applications, and the system clock indicating 15:01 on 20/11/2014.

Chemical Compatibility Results

Chemicals with a Compatibility Rating of **All** for your selected Material are listed below:

Material Selected: Aluminum

Chemical	Compatibility
Acetaldehyde	B-Good

Explanation of Footnotes

1. Satisfactory to 72°F (22°C)
2. Satisfactory to 120°F (48°C)

Ratings -- Chemical Effect

A = Excellent.
B = Good -- Minor Effect, slight corrosion or discoloration.
C = Fair -- Moderate Effect, not recommended for continuous use. Softening, loss of strength, swelling may occur.
D = Severe Effect, not recommended for ANY use.
N/A = Information not available.

WARNING
The information in this chart has been supplied to Cole-Parmer by other reputable

SAFETY RULES – OBLIGATIONS

Planning and precautions prior to an experiment

1. Hazard category of consumables
2. Personal protective equipment required
3. Space available
4. Need for special equipment (e.g. fuming hoods)
5. Need for special storage
6. Getting permissions/licenses
7. Cleaning
8. Handling/disposal of waste
9. Emergency procedures in case of a leak or accident

SAFETY RULES – OBLIGATIONS

USE

- ▶ Avoid eating/drinking/smoking in the lab
- ▶ Keep equipment and workstations neat and clean
- ▶ Know the location/type/use of appropriate safety equipment
- ▶ Avoid getting exposed to fumes, gases, aerosols
- ▶ Avoid mouth pipeting
- ▶ Wear comfortable clothes
- ▶ Wash hands frequently with soap+water and !NOT with organic solvents! (potential risk of absorption/irritation/toxicity)
- ▶ Warn everybody in case of an emergency
- ▶ Always act in accordance with personal and general laboratory safety rules/practices and COMMON SENSE.

SAFETY RULES – OBLIGATIONS

STORAGE

- ▶ Avoid purchasing/storing large quantities of chemicals
- ▶ Make sure all chemicals are kept in suitable, tightly closed, labeled and properly stored containers.
- ▶ Keep records of chemical stock. Update regularly.
- ▶ Label shelves/drawers/closets
- ▶ After use: put it back!
- ▶ **CHECK/ASK/BORROW BEFORE YOU BUY!**

DISPOSAL

- ▶ Avoid disposing hazardous waste down the drain, sewer or trashcan and follow safe disposal procedures

SAFETY RULES – OBLIGATIONS



➤ *Always hold bottle with both hands! One hand under it, should it fall.*



➤ *Long distance:
Use of special plastic
transportation
carrier/bucket*

FLAMMABLE CHEMICALS: SAFETY RULES

USE

- ▶ **Maintain good ventilation**
- ▶ **Ignition sources removed from storage/handling areas (sparks from electrical equipment, hot surfaces, open flames, smoking materials)**
- ▶ **If possible, flammable substances exchanged with less flammable ones, or eliminated from the process altogether.**
- ▶ **If an open flame is needed (e.g. Bunsen burner):**
 - a) warn everyone b) remove flammables
 - c) long hair tied back d) flame never left unattended
 - e) full control f) be extremely careful

FLAMMABLE CHEMICALS: SAFETY RULES

STORAGE

- ▶ Keep in suitable containers
- ▶ Spills kept contained and prevented from spreading
- ▶ Stored/used well away from other processes and general storage areas.
If possible, separated by physical barrier/wall/partition.
- ▶ STORAGE IN THE LAB: Only minor quantities (max 3-4 liters, ignition point > 60 °C)
- ▶ FIRE FIGHTING EQUIPMENT: Be aware of location/use

SMOKING IS STRICTLY PROHIBITED!



TOXIC CHEMICALS: SAFETY RULES

All personnel involved in the use, handling or storage of toxic chemicals must be aware of

- 1) types of toxicity*
- 2) ways of exposure*
- 3) categories of toxic/corrosive/oxidizing substances*

NOTE! Some products/derivatives of a reaction may be more toxic than the reactants themselves e.g.



Replace a toxic substance with a safer one, if possible

TOXIC CHEMICALS: SAFETY RULES

EXPOSURE PATHWAYS

1. INHALLATION 2. INGESTION 3. SKIN/EYE CONTACT

Large surface area of lungs-throat-skin → toxicants easily/rapidly absorbed → carried into circulatory system

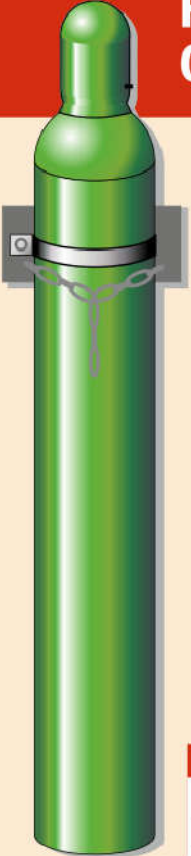
Degree of injury depends on:

- 1) inhalation rate
- 2) toxicity of material
- 3) solubility in tissue fluids
- 4) concentration/duration of exposure.

- Wear gloves, use of hood, use of mask if necessary
- If possible, toxic substances exchanged with less toxic ones, or eliminated from the process altogether

COMPRESSED GASES: SAFETY RULES

Handling & Storing Cylinders Safely



- 1 SECURE cylinders properly at all times.
- 2 STORE cylinders in cool, well-ventilated, fire-resistant areas in compliance with local, state and federal regulations.
- 3 PLACE cylinders where they will not be damaged by forklifts, knocked over or hit by falling objects.
- 4 CLOSE valves and TIGHTEN caps when not in use.
- 5 INSPECT cylinders for leaks and CHECK support brackets regularly for strength and integrity.
- 6 MOVE cylinders using hand trucks designed for the purpose.
- 7 REPORT leaks or any damage to your supervisor immediately.

EMERGENCY EQUIPMENT LOCATED AT:



SmartSign.com • 800-952-1457 • S-2074



a



b

Secure gases $\frac{3}{4}$ of the way up on the tank	Improperly stored gases
	

LIQUID NITROGEN & CRYOGENICS: SAFETY RULES

WARNING !! EXTREMELY COLD! (-196 °C). CAN CAUSE SEVERE BURNS (FROSTBITE) AND/OR ASPHYXIATION!

(1 volume of liquid → 700 volumes of gas at ambient temperature!)

HANDLING: Cryo gloves, goggles, uniform

TRANSFER – USE - STORAGE:

- ▶ Use proper transfer equipment (only containers designed for low-temperature liquids)
- ▶ Avoid overfilling, spilling, splashing
- ▶ Hold transfer hose steadily
- ▶ Keep flow low
- ▶ Store and use only in a well ventilated place
- ▶ Avoid spilling on the floor or in the sewer



AUTHORISED AND TRAINED PERSONNEL ONLY!

LIQUID NITROGEN COLD BURNS (FROSTBITE) – FIRST AID

- ▶ Flush affected areas with lukewarm water (max 40-45 ° C)
- ▶ Seek medical attention at once!
- ▶ If blister or deep tissue damage has occurred, do not rub!
Wrap the damaged limbs in a sterile dry gauze. Be careful to not break open the blisters.
- ▶ In case of anoxia: move to a warm, well ventilated place, loosen clothing, apply chest compressions and rescue breaths, supply oxygen



LABORATORY GLASSWARE: SAFETY RULES

- ▶ *Great care always required! Especially when used in contact with hazardous material*
- ▶ *Proper size, good fit*
- ▶ *Connections minimized*
- ▶ *Lubricate tubing with glycerin or water before inserting into rubber stoppers or rubber tubing*
- ▶ *For vacuum, overpressure or heating → special glass*
- ▶ *DISPOSAL: If possible, decontaminate/clean. Cracked, chipped, badly scratched, non-repairable, with stubborn stains glassware → BIN IT! Sharps, pieces of broken glass dispose separately. BIN CENTER PROPERLY LABELED AND TAPPED.*

PERSONAL PROTECTIVE EQUIPMENT

Great variety of PPE available. Proper use reduces risks






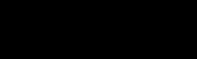





1. Goggles, masks, face shields
(Caution! Contact lenses should be avoided)
2. Gloves: Check before use (scratches/chemical degradation).
Choose appropriate type
3. Uniforms
4. Other: fire extinguishers, emergency body/eyes showers
5. First Aid Kits

Main aim: Prevent an Accident!

PERSONAL PROTECTIVE EQUIPMENT

FACE MASKS



Colour code	Filter type	Contaminants present
	AX	Gases and vapours of organic compounds with boiling point < 65°C
	A	Gases and vapours of organic compounds with boiling point >65°C
	B	Inorganic gases and vapours, e.g. chlorine, hydrogen sulphide, hydrogen cyanide
	E	Sulphur dioxide, hydrogen chloride
	K	Ammonia and organic ammonia derivatives
	CO	Carbon monoxide
	Hg	Mercury vapour
	NO	Nitrous gases including nitrogen monoxide
	Reactor	Radioactive iodine including radioactive methyl iodide
	P	Particles
		Example: A2B2-P3

http://www.draeger.com/sites/assets/PublishingImages/Segments/Industry/APR_Online_Training/Docs/FilterSelectionCard_EN.PDF

PERSONAL PROTECTIVE EQUIPMENT

GLOVES

Chemical Resistance of Gloves (most common solvents)

Quick guide

Nitrile:

Acetone - fair
Ethanol - excellent
Isobutyl - alcohol excellent
Isopropyl - alcohol excellent
Methanol - fair

Latex:

Acetone - good
Ethanol - excellent
Isobutyl - alcohol poor
Isopropyl - alcohol excellent
Methanol - fair

PVC:

Acetone - poor
Ethanol - excellent
Isopropyl alcohol - good
Methanol - good

Viton & Butyl:

Acetone good

PERSONAL PROTECTIVE EQUIPMENT

GLOVES

Chemical	Incidental Contact	Extended Contact
Acetic Acid	nitrile	neoprene, butyl rubber
Acetic Anhydride	nitrile (8 mil), double glove	butyl rubber, neoprene
Acetone	natural rubber (latex) (8 mil)	butyl rubber
Acetonitrile	nitrile	butyl rubber, polyvinyl acetate (PVA)
Acrylamide	nitrile	butyl rubber
<i>bis</i> -Acrylamide	nitrile	
Ammonium Hydroxide	nitrile	neoprene, butyl rubber
Arsenic Salts	nitrile	
Benzotriazole, 1,2,3-	nitrile	
Bismuth Salts	nitrile	
Cadmium Salts	nitrile	
Carbon Disulfide	nitrile (8 mil), double glove	viton, polyvinyl acetate (PVA)
Carbon Tetrachloride	nitrile (8 mil), double glove	viton
Catechol	nitrile	
Chloroform	nitrile (8 mil), double glove	viton, polyvinyl acetate (PVA)
Chromium Salts	nitrile	
Cobalt Chloride	nitrile	

4 mil = 0.12 mm thickness

PERSONAL PROTECTIVE EQUIPMENT

GLOVES

Chemical	Incidental Contact	Extended Contact
Cobalt Salts	nitrile	
Copper (Cupric) Sulfate	nitrile	
3,3'-Diaminobenzidine (DAB)	nitrile	nitrile, double glove
Diazomethane in Ether	nitrile (8 mil), double glove	Norfoil
Dichloromethane	nitrile (8 mil), double glove	polyvinyl acetate (PVA) or viton
Diethyl Pyrocarbonate	nitrile	nitrile, double glove
Dimethyl Sulfoxide (DMSO)	¹ natural rubber (latex) (15-18 mil)	butyl rubber
1,4-Dioxane	nitrile (8 mil), double glove	butyl rubber
Dithiothreitol	nitrile	
Ethanol	nitrile	
Ethidium Bromide (EtBr)	nitrile	nitrile, double glove
Ethyl Ether	nitrile (8 mil), double glove	polyvinyl acetate (PVA)
Formaldehyde	nitrile	
Formamide	nitrile	butyl rubber
Formic Acid	nitrile (8 mil), double glove	butyl rubber, neoprene (30 mils)
Gallic Acid	nitrile	
Heptane	nitrile (8 mil), double glove	nitrile (35 mil or thicker), viton, PVA
Hexamethylenediamine	nitrile (8mil)	neoprene
Hexane	nitrile (8 mil), double glove	nitrile (35 mil or thicker), viton, PVA
Hydrochloric Acid	nitrile	neoprene, butyl rubber
Hydrofluoric Acid (HF)	nitrile (8 mil), double glove	

PERSONAL PROTECTIVE EQUIPMENT

GLOVES

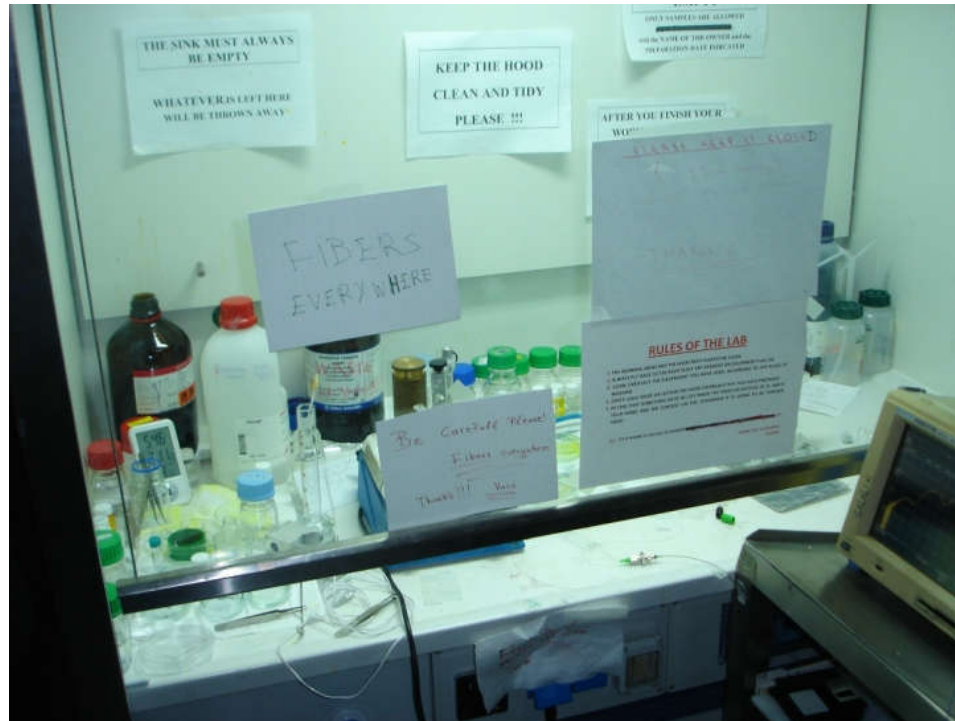
Chemical	Incidental Contact	Extended Contact
Isopropanol	nitrile	
Laser Dyes	nitrile	
Lead Acetate	nitrile, double glove	
Lead Salts	nitrile	
Mercuric Chloride	nitrile, double glove	
Mercury	nitrile	
Mercury Salts	nitrile	
Methanol	nitrile	
Methylene Chloride	nitrile (8 mil), double glove	polyvinyl acetate, viton
Methyl Sulfonic Acid, Ethyl Ester (EMS) (Ethyl Methanesulfonate)	nitrile	nitrile, double glove
Monoethanolamine	nitrile	
Nickel Chloride	nitrile	
Nickel Salts	nitrile	
N-Methylethanolamine	nitrile (8 mil), double glove	viton, neoprene, butyl rubber
Organophosphorous compounds	nitrile (8 mil), double glove	
Osmium Salts	nitrile	
Osmium Tetroxide	nitrile, double glove	
Paraformaldehyde	nitrile	
Phenol	nitrile (8 mil), double glove	neoprene, butyl rubber
Phenol-Chloroform mixtures	nitrile (8 mil), double glove	viton

PERSONAL PROTECTIVE EQUIPMENT

GLOVES

Chemical	Incidental Contact	Extended Contact
Phenylmethylsulfonyl Fluoride (PMSF)	nitrile	nitrile, double glove
Polychlorinated Biphenyls (PCB's)	nitrile (8 mil) glove over a neoprene glove	neoprene (20 mil)
Polyoxyethylenesorbitan Monolaurate (Tween 20)	nitrile	
Psoralen	nitrile	nitrile, double glove
Pump Oil	butyl rubber	
Silane based silanization or derivatization compounds	nitrile (8 mil), double glove	
Silver Nitrate	nitrile	
Silver Salts	nitrile	
Sodium Dodecyl Sulfate (SDS)	nitrile	
Sodium Azide	nitrile	
Sulfuric Acid	nitrile (8 mil)	neoprene, butyl rubber (≥20 mil)
Tetrahydrofuran (THF)	nitrile (8 mil), double glove	Norfoil
3,3',5,5'-Tetramethyl-Benzidine (TMB)	nitrile	nitrile, double glove
N,N,N',N'-Tetramethylethylenediamine (TEMED)	nitrile	nitrile, double glove
Toluene	nitrile (8 mil), double glove	viton, polyvinyl acetate (PVA)
Trichloromethyl Chloroformate (diphosgene)	nitrile (8 mil) over butyl rubber glove box gloves	Material must be used in a glove box.
Triton-X 100	nitrile (8 mil), double glove	
Uranium Salts	nitrile	
Xylene	nitrile	polyvinyl acetate (PVA), viton

FUMING HOODS



KEEP CLEAN – NEAT – EMPTY – IN ORDER
WHEN NOT IN USE, SASH PROPERLY CLOSED
SAFETY – COMFORT – GOOD PERFORMANCE
PROTECTION OF VENTILATION SYSTEM
MINIMUM POWER CONSUMPTION

EMERGENCY EQUIPMENT

EMERGENCY SHOWERS AND EYEWASH STATIONS



HANDLING AND DISPOSAL OF WASTE

GENERAL RULES

1. Scheduled experiment ↔ proper disposal of waste scheduled beforehand.
2. Dangerous substances being substituted by safer ones.
Possible?
3. Toxic/hazardous waste:
neutralization/transformation into safer prior to disposal.
4. All personnel:
 - ▶ safe disposal practices
 - ▶ obey established laboratory rules/international legislation.

HANDLING AND DISPOSAL OF WASTE

Neutralization of toxic chemicals

Examples

1. Phenol : Oxidation with FeSO_4 and H_2O_2
2. Aldehydes : Oxidation with KMnO_4
3. Mercaptanes: Oxidation with NaOCl
4. Acids & Bases : neutralisation
5. Toxic anions and cations: sedimentation

DRAIN/SEWAGE DISPOSAL

GENERAL GUIDELINES

MSDS FIRST!

ONLY

**highly diluted water soluble, biodegradable,
non toxic, non violently reacting with water!**

SMALL QUANTITIES SMALL CONCENTRATIONS
DILUTED > 3% PH 4-10

Quantities limited \leq a few hundred gr or ml /day (up to 100 gr or 100 ml /discharge). Disposal followed by flushing with \geq 100-fold excess of water at the sink. (i.e for 100 ml of chemical, water run for \geq two minutes at maximum flow.)



DRAIN/SEWAGE DISPOSAL

FORBIDDEN!

1. **NO! Toxic, carcinogens, mutagens, irritant, halogenated hydrocarbons**
2. **NO! Strong acids/bases (HCl, HF, NaOH etc)**
3. **NO! Acetone (destruction of plumbing)**
4. **NO! Ashes, solid/viscous substances/residues capable of causing obstruction to the flow of sewers.**
5. **NO! Explosives (azides, peroxides etc)**
6. **NO! Highly volatile solvents, nitro-compounds (explosion hazard!)**
7. **NO! Water reactive materials**
8. **NO! Malodorous/tear inducing substances**
9. **NO! Heavy metals** (Only minor quantities in special cases (\leq mg))
10. **NO! Oils**
11. **NO! Water soluble polymers that could form gels**
12. **NO! Bio-hazard materials**

DRAIN/SEWAGE DISPOSAL

ALLOWED

A. ORGANICS

- 1. ALCOHOLS:** Saturated up to 5 C, amyl, glycerin, Carbohydrates, alcoxy alcanoles up to 7 C, unsaturated up to 8 C
- 2. AMIDES:** up to C
- 3. CARBOXYLIC ACIDS:** Unsaturated aliphatic carboxylic acids, hydroxy- and amino- derivatives up to 6 C, salts with K, Na and NH_4 up to 20 oC
- 4. ESTERES:** Up to 5 C, isopropyl acetate
- 5. SULPHONIC ACIDS:** Salts with Na and K

B. INORGANIC (Salts)

Cations: Al, Ca, Cu, Fe, Li, Mg, Na, Ti, NH_4

Anions: boric, carbon, nitric, potassium, sulphuric

DRAIN/SEWAGE DISPOSAL (Appendix)

ALLOWED (≤ 10 g or 100 ml + water flow)

Safe - Amides

RCONH₂ and RCONHR with 4 or fewer carbon atoms and RCONR₂ with 10 or fewer carbon atoms:

- ▶ formamide
- ▶ N-methyl formamide
- ▶ N,N-diethyl formamide
- ▶ N,N-dimethyl formamide
- ▶ N-ethyl formamide
- ▶ acetamide
- ▶ N-methyl acetamide
- ▶ N,N-dimethyl acetamide
- ▶ N-ethyl acetamide
- ▶ propionamide
- ▶ N-methyl propionamide
- ▶ N, N-dimethyl propionamide
- ▶ butyramide
- ▶ Isobutyramide

DRAIN/SEWAGE DISPOSAL (Appendix)

ALLOWED (≤ 10 g or 100 ml + water flow)

Safe - Amines

Aliphatic amines with 6 or fewer carbon atoms:

- ▶ methylamine
- ▶ ethylamine
- ▶ trimethylamine
- ▶ N-ethyl methylamine
- ▶ N-methyl propylamine
- ▶ dimethyl propylamine
- ▶ isopropylamine
- ▶ 1-ethyl propylamine

- ▶ butylamine
- ▶ methyl butylamine
- ▶ N-ethyl butylamine
- ▶ isobutylamine
- ▶ amylamine
- ▶ hexylamine

Aliphatic diamines with 6 or fewer carbon atoms:

- ▶ 1,2- or 1,3- propanediamine (1,2- or 1,3- diaminopropane)

*Amines with a disagreeable odor, such as dimethylamine and 1,4-butanediamine should be neutralized, and the resulting salt solutions flushed down the drain, diluted with at least 100 volumes of water. Disposal limit is 100ml of material

DRAIN/SEWAGE DISPOSAL (Appendix)

ALLOWED (≤ 10 g or 100 ml + water flow)

Safe – Carboxylic acids

Alkanoic acids with 5 or fewer carbon atom: *

- ▶ formic acid
- ▶ acetic acid
- ▶ propionic acid
- ▶ butyric acid*
- ▶ isobutyric acid
- ▶ valeric acid*
- ▶ isovaleric acid

Alkanedioic acids with 5 or fewer carbon atoms:

- ▶ oxalic acid (1,2-ethanedioic acid)
- ▶ malonic acid (1,3-propanedioic acid)

- ▶ succinic acid (1,4-butanedioic acid)
- ▶ glutaric acid (1,5-pentanedioic acid)

Hydroxyalkanoic acids with 5 or fewer carbon atoms:

- ▶ lactic acid (2-hydroxypropanoic acid)
- ▶ 3-hydroxybutyric acid
- ▶ 2-hydroxy isobutyric acid

Aminoalkanoic acids with 6 or fewer carbon atoms and the ammonium, sodium and potassium salts of these acids.

Amino acids and the ammonium, sodium and potassium salts of these acids.

*Organic acids with a disagreeable odor, such as butyric acids and valeric acids should be neutralized and the resulting salt solutions flushed down the drain, diluted with at least 100 volumes of water. Disposal limit is 100 ml. of material.

DRAIN/SEWAGE DISPOSAL (Appendix)

ALLOWED (≤ 10 g or 100 ml + water flow)

Safe - Esters

Esters with 4 or fewer carbon atoms:

- ▶
- ▶ methyl formate
- ▶ ethyl formate
- ▶ isopropyl formate
- ▶ propyl formate
- ▶ methyl acetate
- ▶ ethyl acetate
- ▶ methyl propionate
- ▶ Isopropyl acetate

DRAIN/SEWAGE DISPOSAL (Appendix)

ALLOWED (≤ 10 g or 100 ml + water flow)

Safe - Ketones

Ketones with 4 or fewer carbon atoms:

- ▶ acetone
- ▶ methyl ethyl ketone (butanone)
- ▶ methyl isopropyl ketone (3-methyl butanone)

Sulfonic Acids and the Ammonium, Sodium, and Potassium Salts of these Acids:

- ▶ methane sulfonic acid, sodium or potassium salt
- ▶ ethane sulfonic acid, sodium or potassium salt
- ▶ 1-propane sulfonic acid, sodium or potassium salt
- ▶ 1-butane sulfonic acid, sodium or potassium salt
- ▶ 1-pentane sulfonic acid, sodium or potassium salt
- ▶ 1-hexane sulfonic acid, sodium or potassium salt
- ▶ 1-heptane sulfonic acid, sodium or potassium salt
- ▶ 1-octane sulfonic acid, sodium or potassium salt
- ▶ 1-decane sulfonic acid, sodium or potassium salt
- ▶ 1-dodecane sulfonic acid, sodium or potassium salt
- ▶ 1-tetradecane sulfonic acid, sodium or potassium salt
- ▶ 1-hexadecane sulfonic acid, sodium or potassium salt

HANDLING AND DISPOSAL OF WASTE AT FORTH

Temporary storage



HANDLING AND DISPOSAL OF WASTE AT FORTH

Temporary storage



HANDLING AND DISPOSAL OF WASTE AT FORTH

Liquid and solid waste disposal containers



Sharps disposal



HANDLING AND DISPOSAL OF WASTE AT FORTH

*Two year renewal contract between FORTH
and a specialized Greek company*



Member of :

- arca
- ISWA
- HACI
- HSWMA
- Clean up Greece
- PASEPPE
- SEEDA



HANDLING AND DISPOSAL OF WASTE AT FORTH

*Two year renewal contract between FORTH
and a specialized Greek company*



Indicative list of clients:

- HELLENIC MILITARY FORCES
- MINISTRY OF AGRICULTURE
- MINISTRY OF FOREIGN AFFAIRS
- COUNTY AUTHORITIES
- UNIVERSITY OF PATRAS, CRETE, CHANIA, THESSALONIKI
- INSTITUTIONS, FOUNDATIONS
- HOSPITALS
- BANKS
- AGET HERACLES
- TITAN
- ELBAL
- MOTOR OIL
- EKO
- PETROLA
- PPC (D.E.H.)
- ELEFSINA SHIPYARDS
- HELLENIC NAVY
- L'OREAL
- RILKEN
- CROWN HELLAS
- BASF AGRO
- GLAXO
- ALUMINIUM DE GRECE
(International call for tenders of Pechiney)
- SOUDA NATO Base **(International call for tenders of NATO)**
- GENERAL STATE LABORATORY
- NCSR DEMOKRITOS
- VIVECHROM
- COCA COLA
- ELVO (Hellenic Vehicle Industry)
- AIR LIQUIDE
- A. HATZOPOULOS
- ASTRA ZENECA
- S.C. JOHNSON
- HENKEL
- SIEMENS
- HALYPS CEMENT
- THESSALONIKI PORT AUTHORITY
- UNILEVER
- GEOFARM
- INTRACOM
- HALCOR
- AGNO
- EYDAP



HANDLING AND DISPOSAL OF WASTE AT FORTH

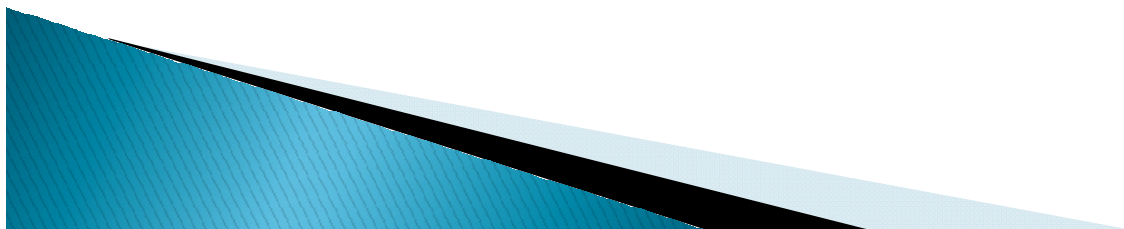
*From ENVIROCHEM, Athens, Greece,
to AVG mbH, Hamburg, Germany*



member of **INDAVER** Group

Waste treatment/destruction via

Controlled, high-temperature incineration (>1000 ° C)



HANDLING AND DISPOSAL OF WASTE AT FORTH

LICENCE - CERTIFICATION - AUTHORISATION

- ▶ **AVG mbH, Borsigstrasse 2,22113 Hamburg**
- ▶ **Contact Person: Mr. Kuhbach**
- ▶ **Tel:+4940733510**
- ▶ **fax: +49407325164**
- ▶ **Registration No: BO1VS0013**
- ▶ **Number of Permission: IB2234/AVG-GENB-2 / 120443**
- ▶ **Disposable code: D10 (incineration)**
- ▶ **German Authorities: FREIE UND HANSESTADT HAMBURG**
- ▶ **Mr. s Bössow (tel: +3049404284042947 - fax:+304940428452129)**

- ▶ **The establishment of AVG has been authorized by the German state and the Greek Ministry of Environment, PERPA**
Responsible : Mrs Zervou, tel. 2108653294
- ▶ **Perm. Number ENVIROCHEM : 52428/4405/23-9-2013 – expir. Date 23/9/2018**
- ▶ **Registr. Number : 0002 - expir. Date 23/9/2018**
- ▶ **All necessary documents have been submitted to FORTH**



HANDLING AND DISPOSAL OF WASTE AT FORTH

IMPORTANT!!

UNIDENTIFIED – NOT PROPERLY LABELLED (in detail)



WILL NOT BE TAKEN!



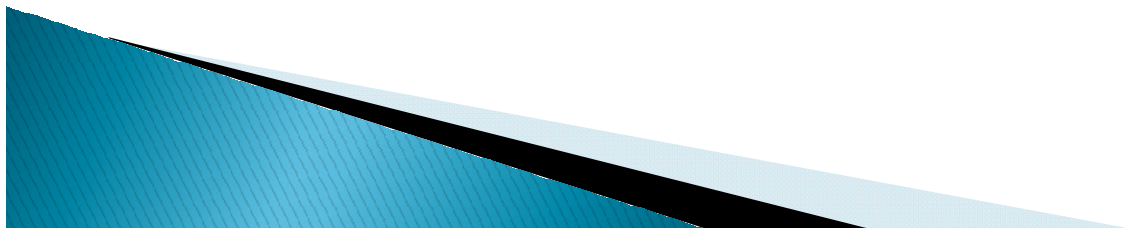
HANDLING AND DISPOSAL OF WASTE AT FORTH

RADIOACTIVE WASTE!

No private company can or will dispose such waste.

ONLY

**the National Center of Scientific Research “Demokritos”
(Institute of Nuclear Technology and Radiation Protection),
Athens, possesses expertise and facilities for radioactive
waste treatment, and thus, can be contacted.**



HANDLING AND DISPOSAL OF WASTE AT FORTH

- ▶ *Permanent disposal of Chemical waste is not cheap!*
(3 E + VAT per kilo/lt, content + container, up to 1.5 tons of waste per year at FORTH)
- ▶ *For safety/environment/economy:
need for keeping production of chemical waste
(solid & liquid) to a minimum.*
(On average two tones of waste are produced at FORTH per year (only by IESL and IMBB). Cost is distributed accordingly.
- ☑ *Buy only as much as you need!*
- ☑ *Donate/exchange surplus quantities with other groups/departments/IESL/University*

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- 5. *Prudent Practices for Disposal of Chemicals from Laboratories, National Academy Press***
- 6. *Dangerous Properties of Industrial Materials”, N. I. Sax***
- 7. *IUPAC Goldbook, <http://goldbook.iupac.org/PDF/goldbook.pdf>***

THANK YOU VERY MUCH!!

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