



< Risk identification and safety >

Solvents Handling



IAMC Toolkit

Innovative approaches for the Sound Management of Chemicals
and Chemical Waste



Introduction

Solvents are widely used in industry. This presentation provides an explanation on the harm that solvents can have on human beings and on the environment.

The principle of substitution is explained to the reader, as well as the technical and organizational measures to implement to reduce the exposure to these substances.

Hazard Management

1. Risk identification and safety

11. Chemical classification and labelling

12. Risk assessment

13. Safety rules

14. Personal protective equipment

15. Skin protection

16. Emergency escape routes

17. Handling of solvents, acids and bases

18. Safety in gas tank handling

2. Transport and storage

21. Internal transport of chemicals

22. Internal pedestrian routes

23. Storage

3. Fire and explosion protection

31. Fire protection

32. Fire protection in welding and cutting operations

33. Explosion protection

34. Container cleaning

4. Emergency response

41. Emergency response plan

Contents

1. General Concepts
2. Hazards
3. Prevention Measures
 - Substitution
 - Technical measures
 - Organizational measures
4. Sources

General concept

Solvents

- A **solvent** is, generally speaking, a liquid which can **dissolve**, **dilute** or **extract** other **substances** (solid, liquid or gaseous) without altering them and **without modifying its own composition**.
- Examples of solvents: **water, hexane, ethanol, etc.**
- In **industry**, solvents are used as:
 - **Degreasing** agents (metal, textile cleaning)
 - **Additives** and **diluents** (paints, varnishes, inks, glues, pesticides)
 - **Strippers** (paint, varnish and glue strippers)
 - **Purifying** agents (perfumes, drugs)



Source: Suva

Types of Organic Solvents

Oxygenated solvents

- **Alcohols** (e.g. ethanol)
- **Esters** (e.g. ethyl acetate)
- **Ketones** (e.g. acetone)
- **Glycols** (e.g. ethylene glycol)
- **Ethers** (e.g. diethyl ether)

Hydrocarbon solvents

- **Non and low aromatic petroleum solvents** (e.g. hexane)
- **Polyaromatic hydrocarbons**

Halogenated solvents

- **Chlorinated hydrocarbons** (e.g. dichloromethane)
- **Hydrofluoroalkanes**
- **Hydrofluoroethers**

Strictly limited and restricted use

- Most frequently, solvents are commercialized as mixtures.

Hazards

Main Hazards

- The main hazards associated with the use, storage and transport of solvents are:
 - Fire
 - Explosion
 - Health hazards
 - Environmental hazards

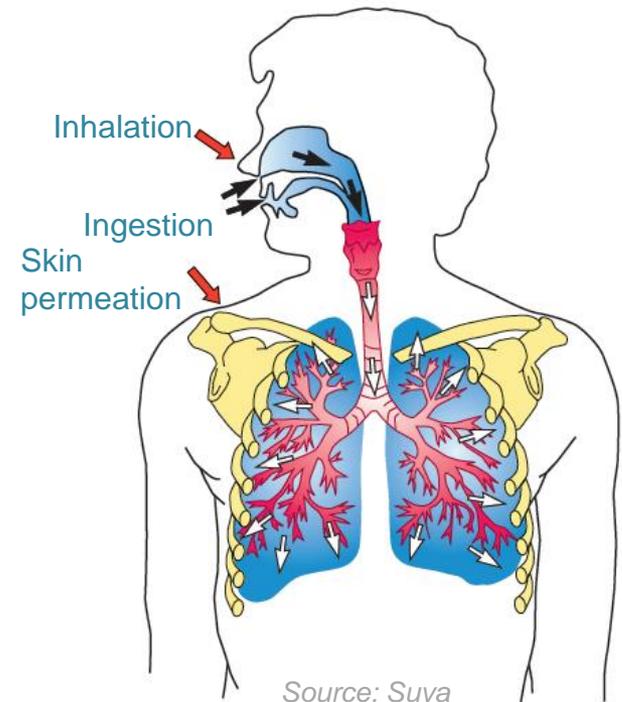
At least 45 workers die in Manila factory fire

By Joseph Santolan
14 May 2015

At least 45 workers are confirmed dead and another 25 or more remain missing after a fire broke out at noon on Wednesday inside the Kentex factory on the northern outskirts of Metro Manila in the Philippines. [...]

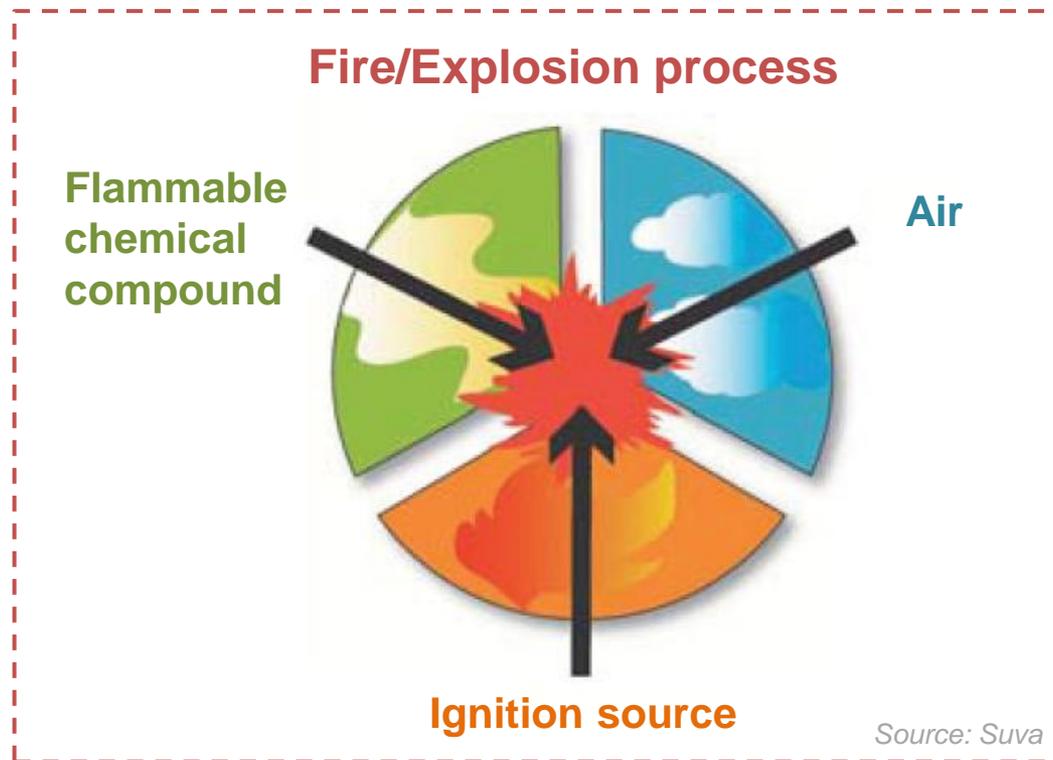
The fire was reportedly started by welding work on the front entrance, near open containers of chemical solvent used in the processing of rubber and plastic. The canisters exploded and the building caught fire.

Source: www.wsws.org (May 2015)



Fire and Explosion Hazards

- An **explosion** or **fire** will occur when a **combustible substance** (gas, vapours, mist, dust), a **combustion agent** (air) and an **effective ignition source** are **simultaneously present**.

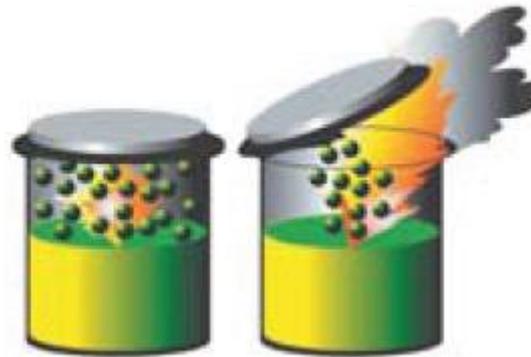


Fire and Explosion Hazards

- Generally speaking, combustion will lead to:
 - A **fire** if it occurs in an **open space**
 - An **explosion** if it occurs in a **closed space**



Fire



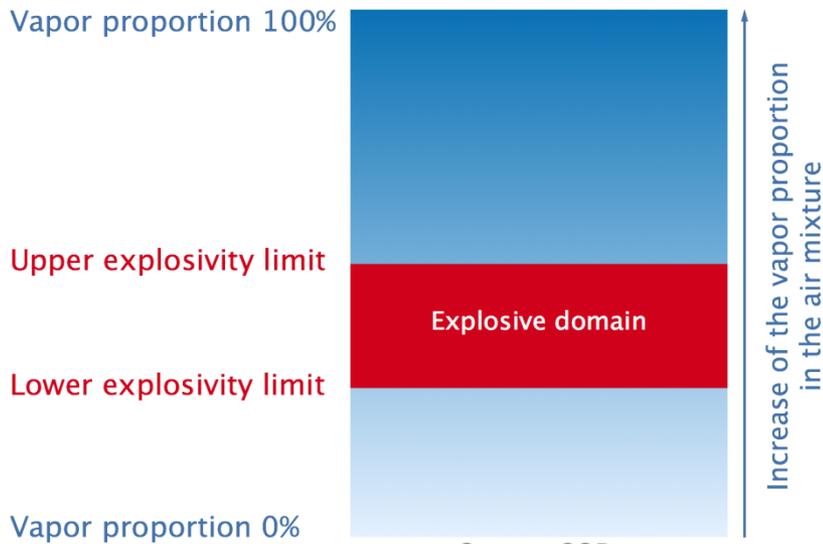
Explosion

Source: Suva

Explosible Range and Flash Point

Explosible range

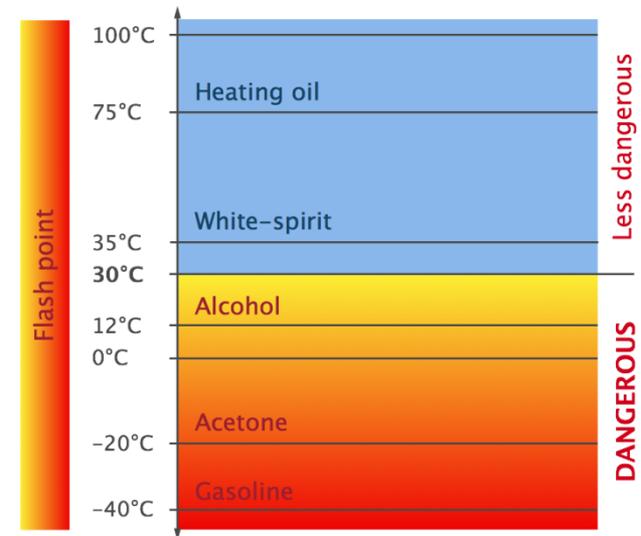
The mixture of flammable gases or vapours and air can only lead to a spontaneous combustion or an explosion if the mixture's concentration is between the upper and lower explosivity limits.



Source: CSD

Flash point

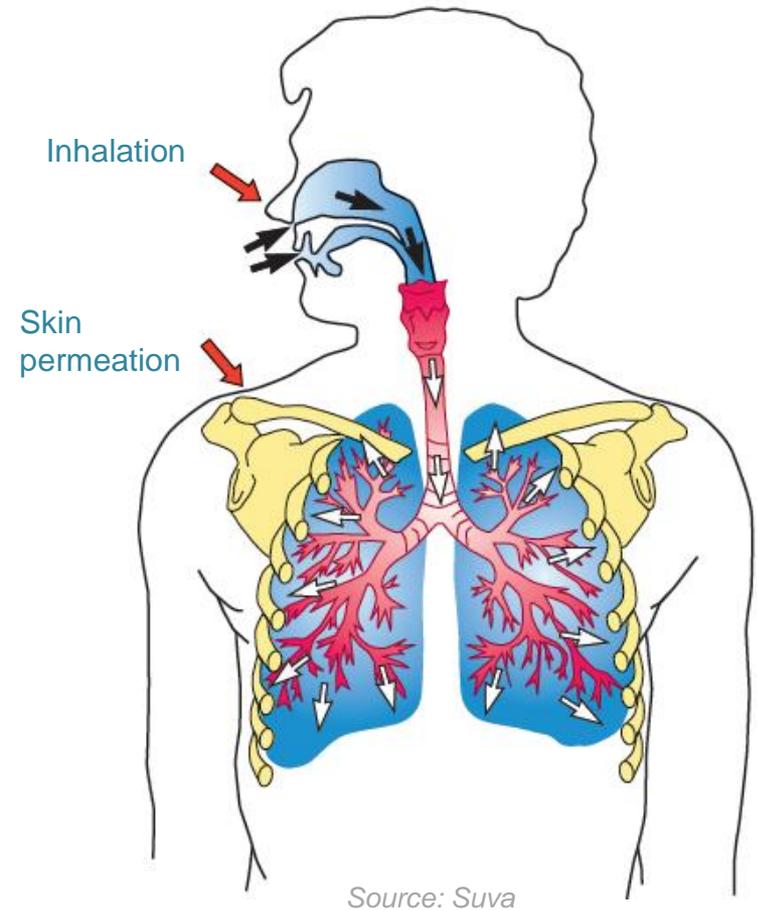
The flash point is the lowest temperature at which a liquid releases enough vapours to form a potentially explosive atmosphere at the surface. With the presence of an ignition source, the mixture ignites. After the ignition, the flame dies.



Source: based on FOEN

Health Hazards

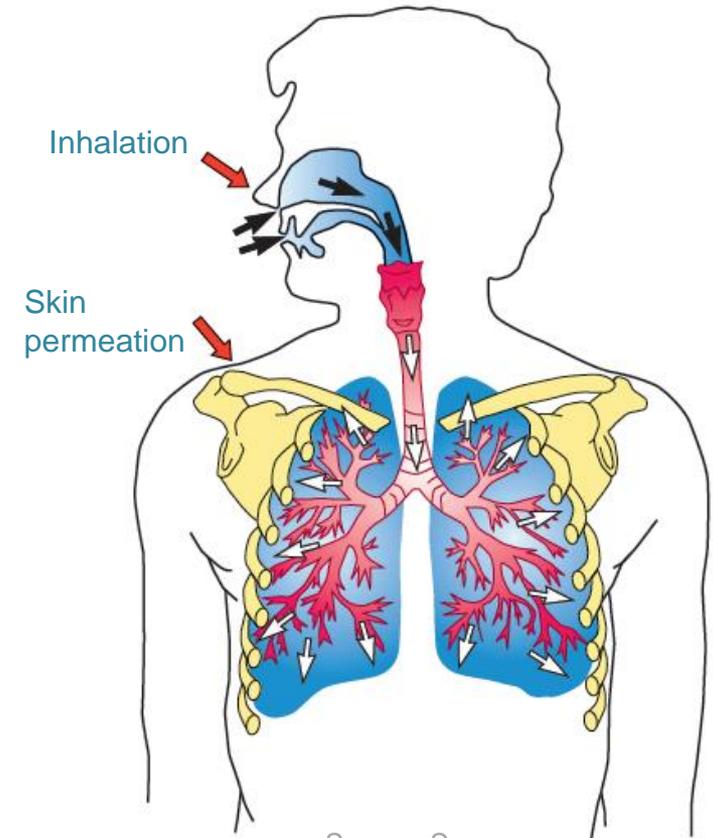
- The majority of solvents can cause irritations, burns or intoxication if not adequately used.
- Routes of entry of the substances:
 - Inhalation of the vapours
 - Skin permeation
 - Ingestion



Health Hazards

■ Consequences:

Acute intoxication	Chronic intoxication
<ul style="list-style-type: none">- Fatigue- Dizziness- Headache- Coma, etc.	<ul style="list-style-type: none">- Skin dryness- Conjunctivitis- Inflammations, etc.



Source: Suva

Health Hazards – Example

- **Never wash hands with solvents!**
 - Solvents dissolve the skin's natural protective film and **can cause irritations and inflammations** (dermatitis, eczema) characterized by redness, skin swelling, itching, dryness, crusting, flaking, blistering, cracking, oozing or bleeding.
 - Solvents may be toxic or facilitate the absorption of another toxic chemical.
- **Protective measures:**
 - Wear protective gloves resistant to the specific chemical (for concentrated organic solvents, use natural rubber, neoprene or nitrile gloves).
 - Wash hands thoroughly with an appropriate soap after handling solvents.
- **Attention:** Remove gloves when opening doors, using the phone, etc.

Environmental Hazards – Examples

- Solvents with chlorinated hydrocarbons can **bio-accumulate** in various organisms.
- Solvents containing VOCs can **reduce air quality and increase urban smog**.
- Solvents might also lead to the **eutrophication** of waters.

This presentation focuses on occupational health and safety.

To prevent environmental hazards, please refer to APELL:

<http://www.unep.org/apell/>

Hazards

- In the next slides, a list of **solvents used in industry** and their **specific hazards** are presented. The following legend applies:

1 Worst	to	10 Best
Major issues have been identified. Appropriate control procedures need to be in place.	Issues have been identified. The need for control procedures should be considered.	No major issues identified in this area.

- The level is evaluated for four areas (1 = worst, 10 = best)
 - **Waste:** recycling, incineration, VOC and biotreatment issues
 - **Impact:** effects on the environment
 - **Health:** acute and chronic effects on human health and exposure potential
 - **Safety:** explosivity, flammability and operational hazards

SOLVENT		Waste	Impact	Health	Safety
Polar aprotics	N-Methyl pyrrolidone	4	7	7	10
	Dimethyl acetamide	4	8	5	9
	Dimethyl propylene urea	4	7	5	9
	Dimethyl formamide	4	8	4	7
	Acetonitrile	2	4	2	8
Acids	Propionic acid	5	8	5	9
	Acetic acid (glacial)	3	6	4	8
Alkanes	Cyclohexane	5	5	6	2
	Heptane	6	2	5	1
	Hexane	5	3	3	1
	Petroleum spirit /ether	4	2	5	1
Chlorinated	Dichloromethane	3	3	1	10
Ethers	1,2-Dimethoxyethane	3	5	4	2
	T-Butylmethyl ether	4	4	3	3
	Bis(2-methoxyethyl) ether	6	5	2	3
	Tetrahydrofuran	2	7	4	2
	Diisopropyl ether	5	2	6	1
Basics	Pyridine	2	3	1	6

SOLVENT		Waste	Impact	Health	Safety
Alcohols	Ethylene glycol	4	9	7	10
	1-Butanol	5	7	5	8
	Diethylene glycol mono butyl ether	5	8	5	10
	Ethanol/IMS	3	7	4	6
	2-Propanol	3	10	7	7
	Methanol	3	8	4	8
	2-Methoxy ethanol	4	9	2	7
Esters	Butyl acetate	7	7	7	6
	Propyl acetate	7	6	7	6
	Isopropyl acetate	5	7	7	6
	Ethyl acetate	4	9	7	4
	Methyl acetate	2	6	5	5
Aromatics	Xylene	8	4	5	5
	Toluene	7	3	5	4
Ketones	Methylisobutyl ketone	7	4	6	7
	Acetone	2	7	6	5
	Methylethyl ketone	3	6	5	5

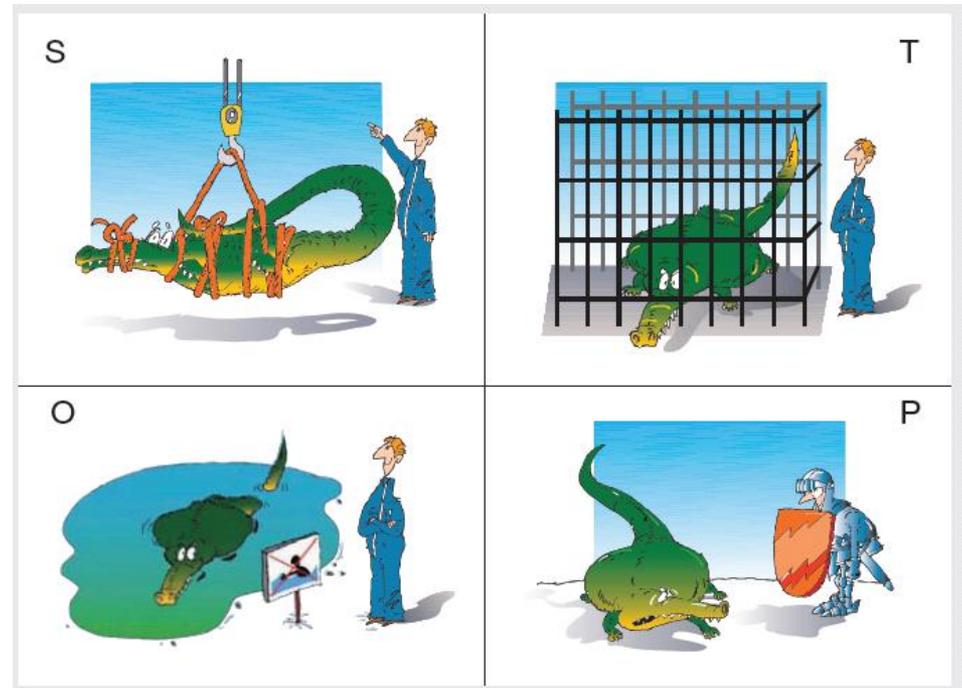
Source: based on Curzons A.D. et al.

UNIDO | IAMC Toolkit | Images may not be copied, transmitted or manipulated

Prevention Measures

Prevention Measures

- Prevention measures follow the **STOP** logic:
 - **S**. Substitution of the hazardous substances and processes
 - **T**. Technical measures
 - **O**. Organizational measures
 - **P**. Personal protection measures



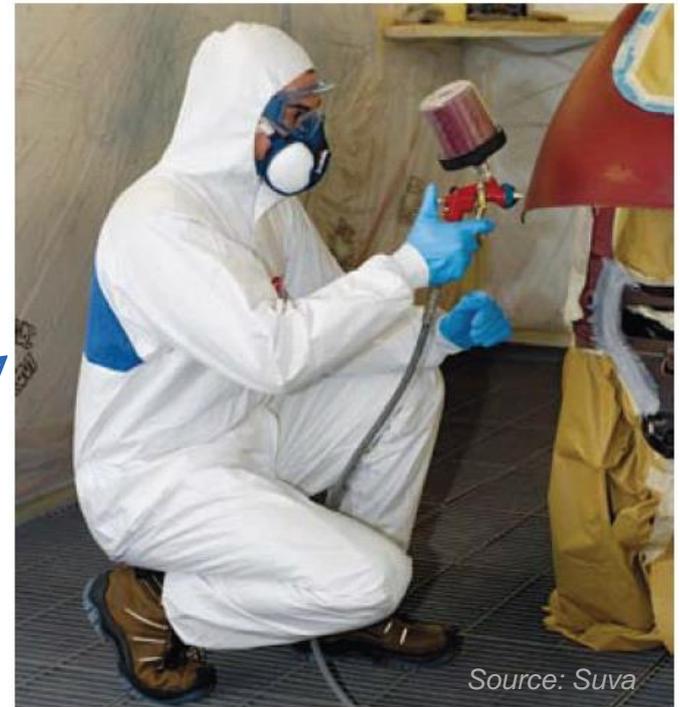
Source: Suva

Technical Prevention Measures

Substitution

- **Substitution aims at reducing the risks for the workers.**
 - **Attention:** It is **not acceptable** to replace a carcinogenic solvent by a less harmful but highly flammable substance.
- A thorough risk analysis has to be conducted prior to introducing any new substances or processes.

Substitution example: Replace solvent-based paints by water-based paints.



Substitution

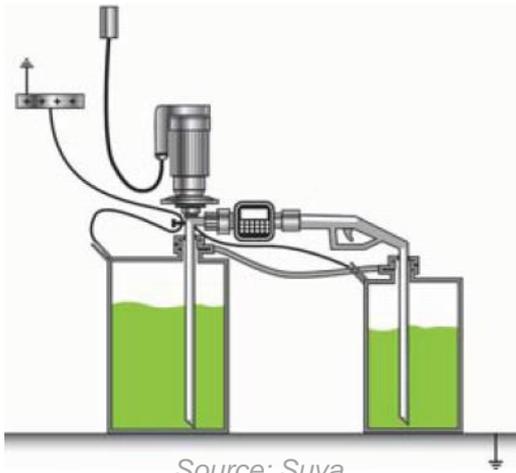
Undesirable	Usable	Preferred
<ul style="list-style-type: none">- Pentane- Hexane- Di-isopropyl ether- Diethyl ether- Dichloromethane- Dichloroethane- Chloroform- Dimethyl formamide- N-methylpyrrolidinone- Pyridine- Dimethyl acetamide- Dioxane- Dimethoxyethane- Benzene- Carbon tetrachloride	<ul style="list-style-type: none">- Cyclohexane- Methylcyclohexane- Toluene- Heptane- Methyl t-butyl ether- Isooctane- Acetonitrile- 2-methyl-tetrahydrofuran- Tetrahydrofuran- Xylenes- Dimethyl sulfoxide- Acetic acid- Ethylene glycol	<ul style="list-style-type: none">- Water- Acetone- Ethanol- 2-propanol- 1-propanol- Ethyl acetate- Isopropyl acetate- Methanol- Methyl ethyl ketone- 1-butanol- t-butanol

Source: based on www.chemistryinnovation.co.uk

Technical Measures

- **Limit hazardous vapour emissions** by organizing work procedures in a way to reduce the evaporation or dispersion of solvents (isolation, vapour recovery systems, etc.).

Barrel pump equipped with a vapour recovery system

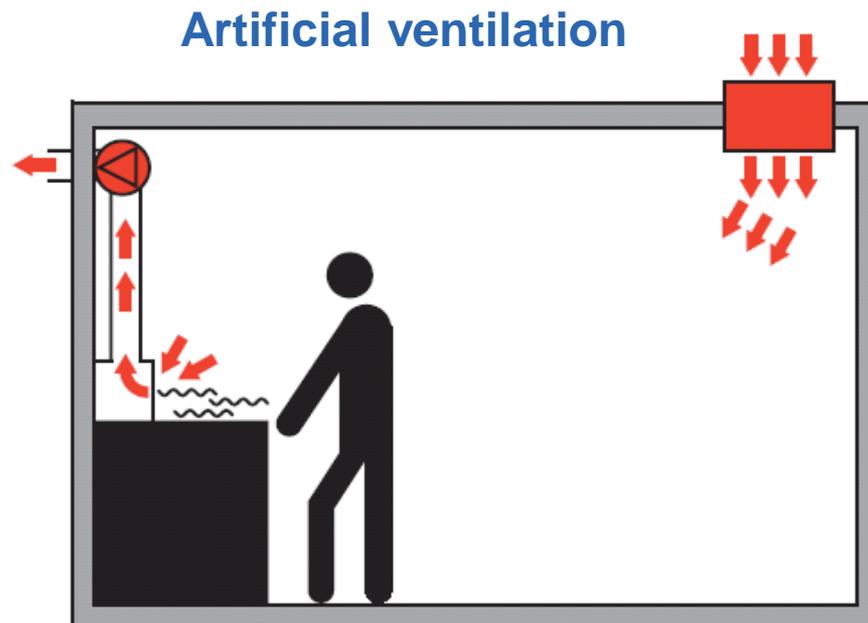


Containers designed to limit evaporation



Technical Measures

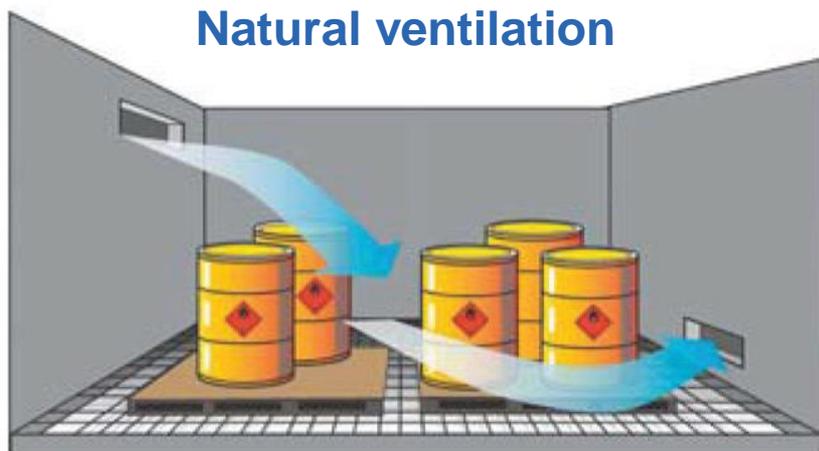
- Ventilate the workplaces and storage premises:
 - Natural ventilation (windows, doors, openings)
 - Artificial ventilation (general ventilation, ventilation at source)



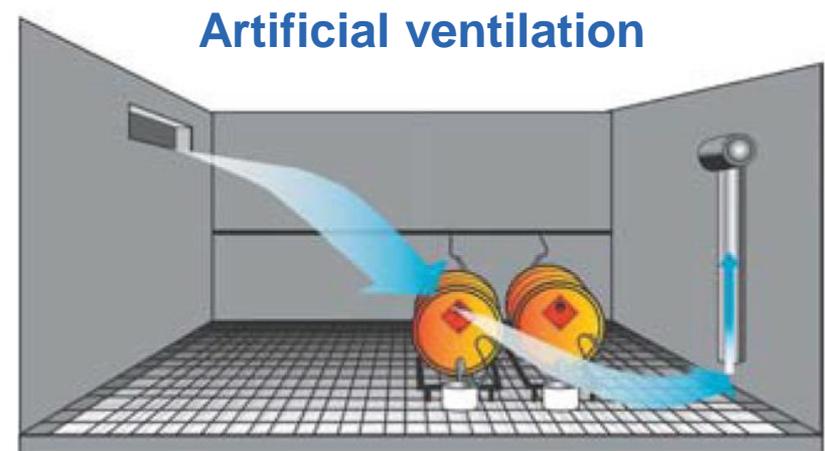
Source: Suva

Technical Measures

- Ventilation of storage premises:
 - Natural ventilation (windows, doors, openings)
 - Artificial ventilation (general ventilation)



Source: Suva

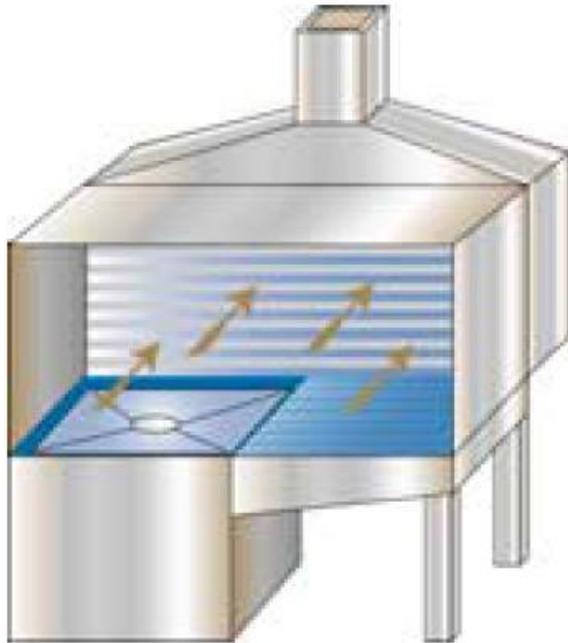


Source: Suva

Technical Measures

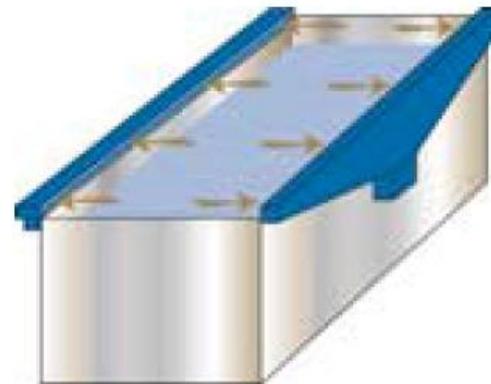
- Ventilation at source – Examples:

Ventilated open cabin



Source: INRS

Laterally ventilated oil extraction tanks



Source: INRS

Technical Measures – Industrial Application

Ink preparation workstation



- In a pad printing workshop
- Solvents used to dissolve the ink and clean the workstation
- Manual preparation of the inks
- Cleaning with a dampened rag

What **ventilation** measures should be taken?

Technical Measures – Industrial Application



Source: INRS

Ventilation at source directly where the mixtures are prepared



Source: INRS

Open waste bin with suction system for the vapours of used solvents

Technical Measures

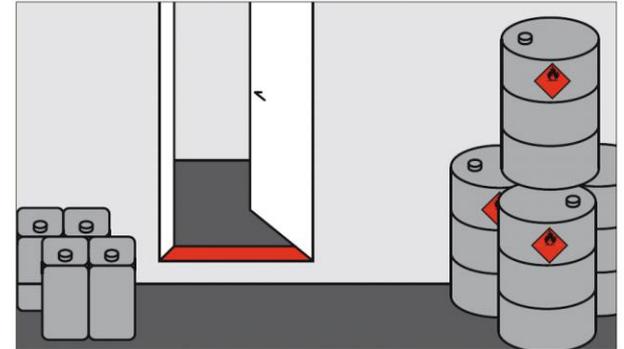
- Storage **cabinets**:
 - Small quantities (< 100 l) of solvents can be stored in working areas in adequately labelled, non-flammable **cabinets** equipped with a collecting vessel.
 - In working areas, only the **quantities** required for the daily operations should be stored.



Source . Suva

Technical Measures

- **Storage of solvents:**
 - **Containment measures** should be taken to prevent liquids from spreading including:
 - Safety sills
 - Retention basins
 - **Incompatible substances** must not be stored together.
 - Containers should be stored in an **upright position**.
 - **Not more than two containers** should be stacked.



Source: Suva

Attention: Retention basins should be built with suitable material (e.g. a concrete basin is not advisable for solvent retention).

Technical Measures

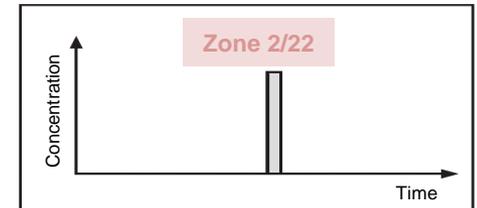
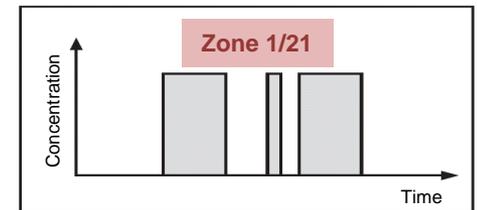
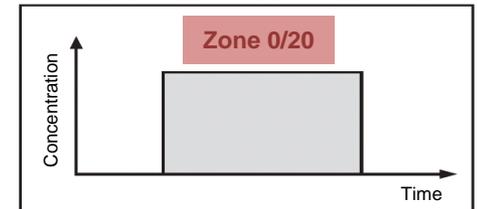
- Classification in explosion-hazard zones (based on the ATEX standard)

Nobody should work in Zones 0 and 20



Area where a potentially explosive atmosphere occurs:

Zone 0 (gases/vapours) Zone 20 (dusts)	<ul style="list-style-type: none"> - Constantly present - Present for long periods - Frequently present for short periods
Zone 1 (gases/vapours) Zone 21 (dusts)	<ul style="list-style-type: none"> - Periodically present - Occasionally present under normal operating conditions
Zone 2 (gases/vapours) Zone 22 (dusts)	<ul style="list-style-type: none"> - Rarely present and for short periods only
Zone N.D	<ul style="list-style-type: none"> - Very improbable

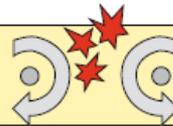


Source: Suva

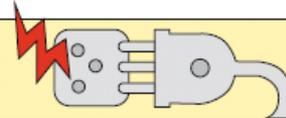
Technical Measures

- Elimination of ignition sources

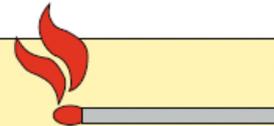
An **ignition source** is **effective** if it provides enough **energy** to the potentially explosive atmosphere for the **combustion** to **go on by itself**.



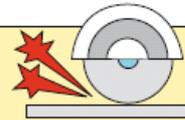
Static discharge



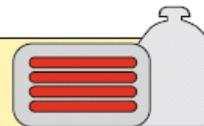
Sparks of electrical origin



Fire, flames, embers



Sparks of mechanical origin

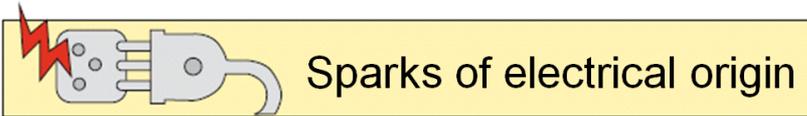


Warm surfaces

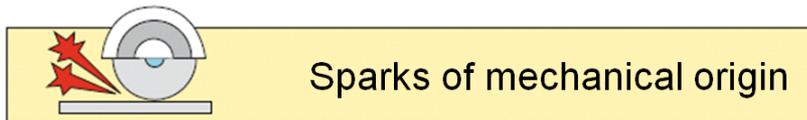
Source: Suva

Technical Measures

- Elimination of ignition sources



In premises exposed to explosion risks, every **electrical device should be protected from the explosion risk.**



Source: Suva

In **Zones 0 and 20**, devices that can produce sparks should not be used.
In **Zones 1 and 2**, sparks are tolerated only if special prevention measures are taken (combination of adequate materials, etc.)

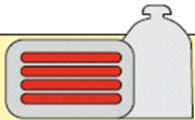
Technical Measures

■ Elimination of ignition sources



Fire, flames, embers

- **Smoking banned**
- **Open-flame devices** should not be used in **Zones 0 and 20**. They are tolerated in **Zones 1, 2, 21, 22** only if preventive measures have been taken.
- Preventing **smouldering fires**:
 - Eliminate dust deposits.
 - Maintain surfaces humid.
 - Use spark detection and extinguishing systems.



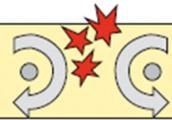
Warm surfaces

Source: Suva

- In **Zone 0**, the surface temperature should be **20% lower** than the **combustible's ignition temperature**.
- In **Zones 1 and 2**, the surface temperature should **never** be higher than **the combustible's ignition temperature**.
- In **Zones 20, 21, 22**, the surface temperature should not exceed two thirds of the **combustible's ignition temperature.***

Technical Measures

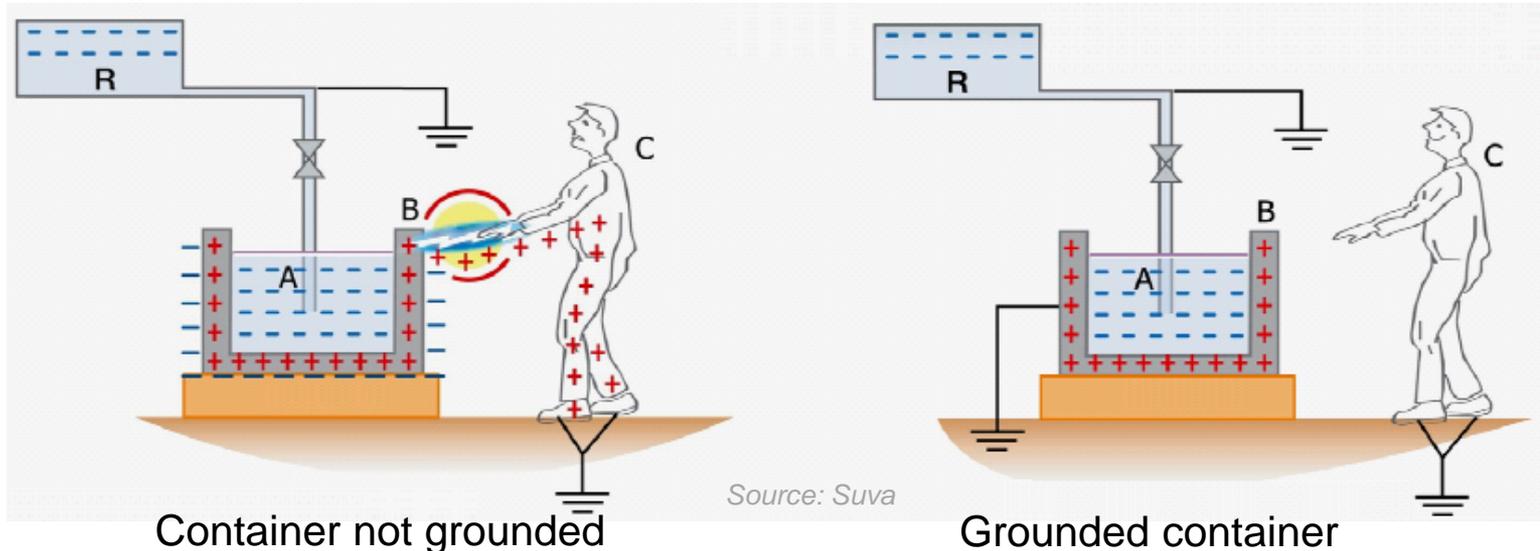
■ Elimination of ignition sources



Static discharge

Source: Suva

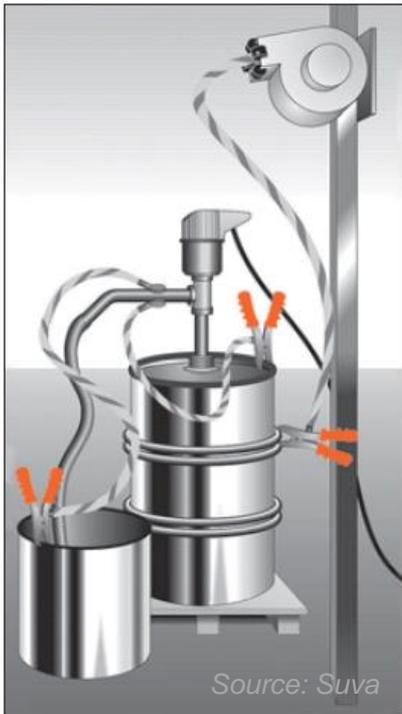
- Only use grounded hoses, pipes, containers, etc.
- In **Zones 1 and 21**, ground the staff by using shoes and floors enabling the dissipation of electrostatic charges.
- Use grounded metal containers when decanting flammable substances.



Technical Measures

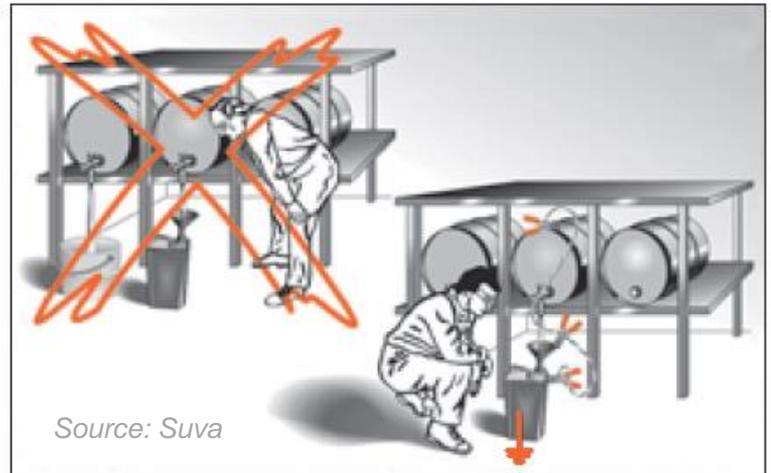


Static discharge



Grounded containers

- **Any conductor element** from any installation should be **bonded and grounded**.
- Containers and pipes should **not have insulating inner linings**.



- When **decanting flammable liquids**, the **container**, the **tank** and the other **conductor elements** should be **bonded and grounded**. The tanks' support should also be grounded.
- The **flow of the flammable substances** should be reduced to a **minimum**.

Technical Measures

■ Elimination of ignition sources



Lightning

- **Buildings and installations comprising explosion-hazard zones** should be **protected** against lightning strikes (e.g. Faraday cage).



Chemical reactions

- Improve the heat dissipation (e.g. smaller storage units, store in intermediate premises).
- Regulate the **pressure and temperature**.
- Store at **lower temperatures**.
- **Inerting**

Source: Suva

Technical Measures

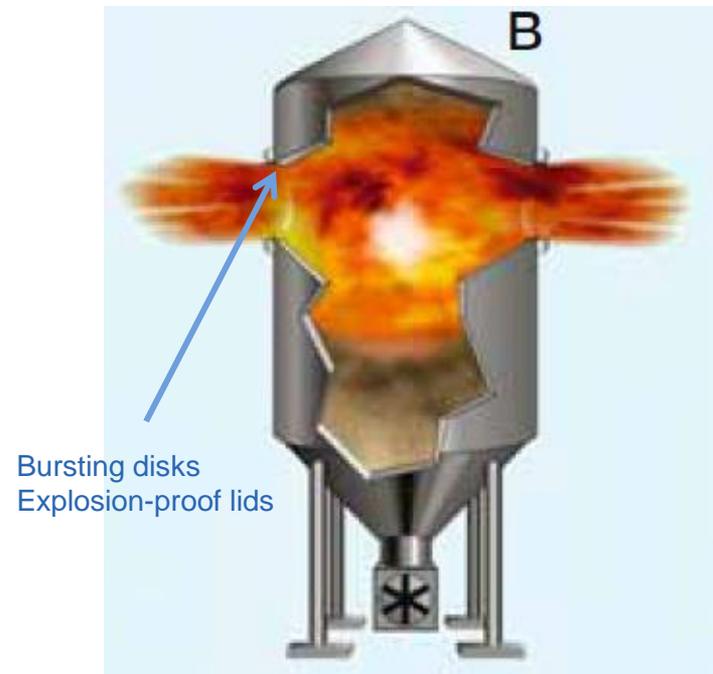
- Limiting the consequences of a fire or explosion

Explosion-resistant installations



Source: Suva

Explosion relief devices



Source: Suva

Technical Measures

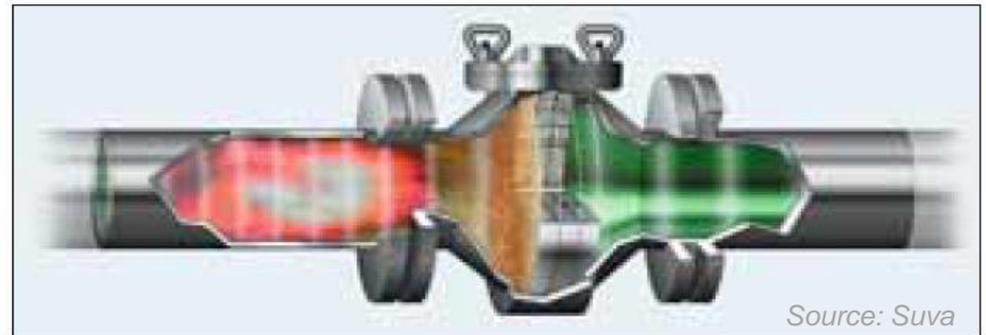
- Limiting the consequences of a fire or explosion

Explosion suppression



Source: Suva

Explosion decoupling



Flame extinction:

The flame is cooled down until it fades out.

Technical Measures

- Extinguishers and first aid:
 - Areas where solvents are handled have to be equipped with:
 - Extinguishers and cooling systems
 - First aid facilities (showers, eye-wash stations)
 - These facilities have to be regularly checked.



Extinguisher

Source: CSD



Source: Shutterstock

Technical Measures - Recap

- Substitution with less hazardous substances
- Limitation of hazardous vapour emissions
- Ventilation of the workplaces
- Ventilation of the storage premises
- Storage cabinets in workplaces
- Retention basins and safety sills
- Classification in explosion-hazard zones
- Elimination of ignition sources
- Limitation of the consequences of a fire/explosion
- Extinguishers and first-aid facilities

Solvent handling Prevention Measures

Solvents Handling – Good Practices

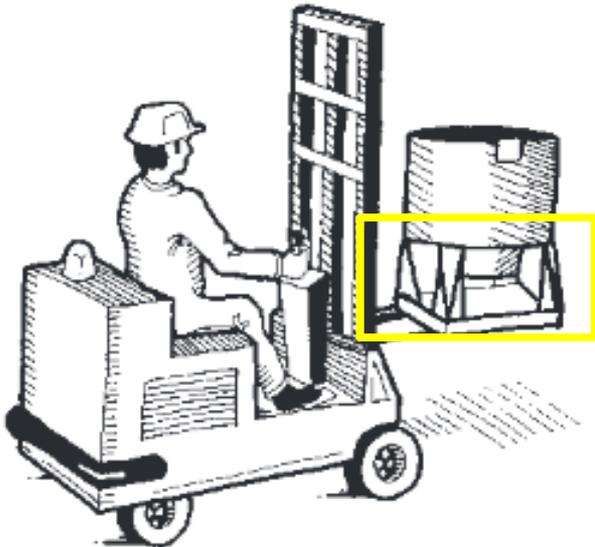
- Limit the release of vapours (**close the lid**, etc.).
- **Avoid inhaling** solvent vapours.
- Frequently **clean your hands**.
- **Never clean your hands** with a solvent.
- **Do not eat, drink or smoke** in premises where solvents are used.
- Adopt a “**clean as you go**” philosophy: Clean after each small task.
- **Never decant a solvent in a container used for other chemical substances.**

Solvents Handling – Good Practices

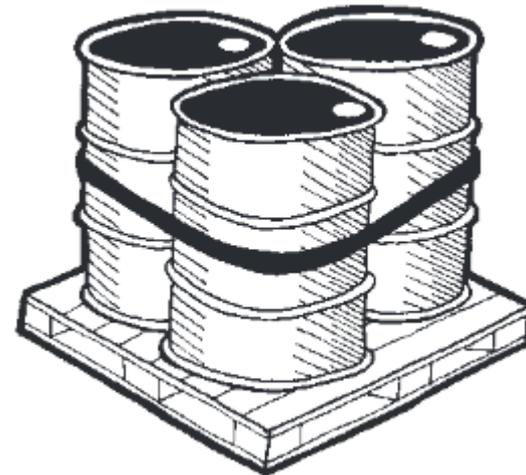
- Use inlet valves that close automatically to avoid overflow.
- Never release solvents into the sewer system.
- Do not exert pressure on the containers and do not roll them when full.
- If a spill occurs, use an inert absorbent to contain the leakage.
- Solvent-drenched wipes and rags are a fire hazard and should be treated as hazardous waste. They should be disposed of in a closed bin located in a ventilated place.

Solvents Handling – Good Practices

- When carrying drums on fork lifts and trolleys, use a **drum catch**.
- When more than two drums are carried, **tape or strap them together** to improve stability.



Source: Environmental Technology Best Practice Program



Source: Environmental Technology Best Practice Program

Solvents Handling – Exercise

You are working for a chemical company and **work with solvents daily**. What **precautions** should you take while handling solvents to guarantee **safe operation**?

Solvents Handling – Exercise

Recommendations for solvent handling:

Vapours:

- Close the lid to prevent the release of vapours.
- Avoid inhaling solvent vapours (use PPE).

Hygiene:

- Frequently clean your hands.
- Never clean your hands with a solvent.
- Adopt a “clean as you go” philosophy: Clean after each small task.
- Do not eat, drink or smoke in premises where solvents are used.

Containers:

- Never decant a solvent in a container used for other chemical substances.
- Use automatically closing inlet valves to avoid overflow.

Transport:

- Do not exert pressure on the containers and do not roll them when full.
- When carrying drums on fork lifts and trolleys, use a drum catch.
- When more than two drums are carried, tape or strap them together to improve stability.

Disposal:

- Never release solvents into the sewer system.

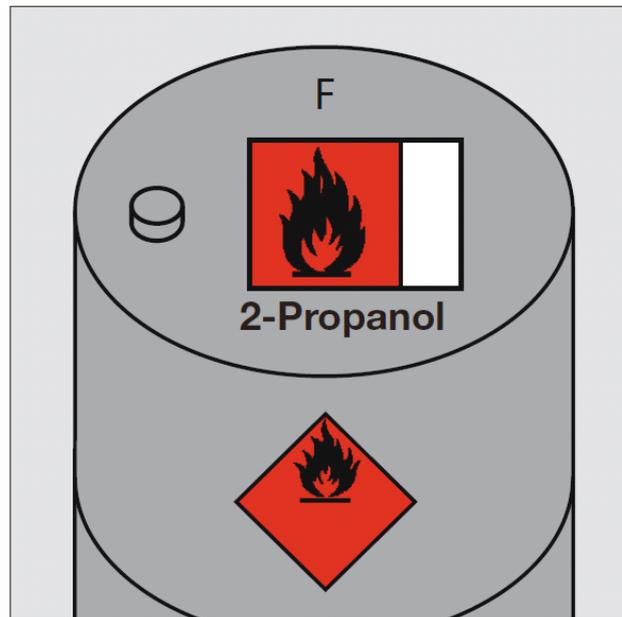
Spill:

- If a spill occurs, use an inert absorbent to contain the leakage.

Organizational Prevention Measures

Organizational Measures

- Labelling containers, tanks, pipes, etc.
 - The equipment (containers, tanks and pipes) should be **appropriately labelled** (always visible and permanently labelled).



Source: Suva

Organizational Measures

- Labelling containers, tanks, pipes, etc.

2-METHYL FLAMMALINE	1
	SIGNAL WORD 2
	Hazard statements 3
Precautionary statements Additional information as required by the competent authority as appropriate	4
Supplier identification	5

Organizational Measures

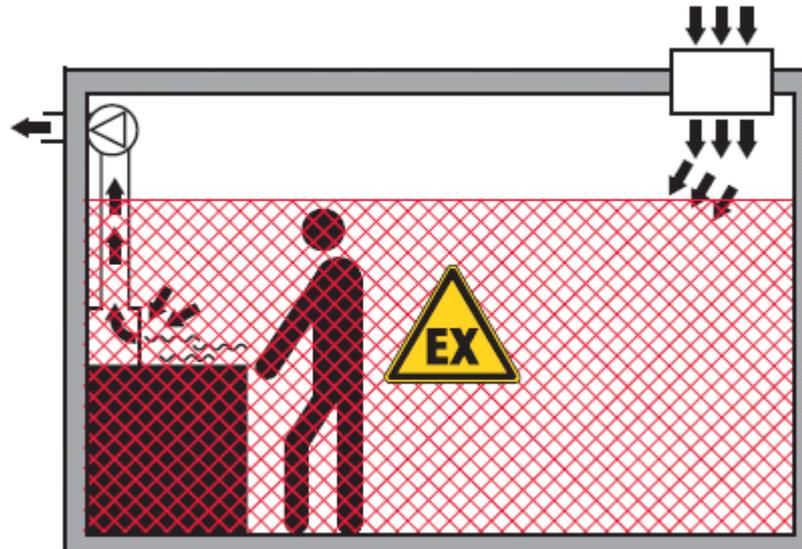
- Labelling containers, tanks, pipes, etc.

  	Methanol (solvent) (N° CE: 603-001-00-X)		1	
	Highly flammable liquid and vapour			H225
	Toxic if swallowed Toxic in contact with skin Toxic if inhaled Causes damage to organs (especially to eyes)		3	H301 H311 H331 H370
	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Store in a well-ventilated place. Keep container tightly closed. Wear protective gloves/clothing, eye/face protection. If on skin: Wash with water and soap. If swallowed: Rinse mouth. Do NOT induce vomiting. Immediately call a poison centre or a doctor. Store locked up.		4	P210 P403/233 P280 P302/352 P301/310 P405
	2	Chemistry Example Sarl St. Example 10, 1111 Town Telephone 032 600 60 60	200 litres	5

Source: based on Sicherheitsinstitut

Organizational Measures

- Signalling of zones where highly flammable solvents are used:
 - Zones where highly flammable solvents are handled should be marked appropriately to prevent the introduction of ignition sources.



Source: Suva

Organizational Measures

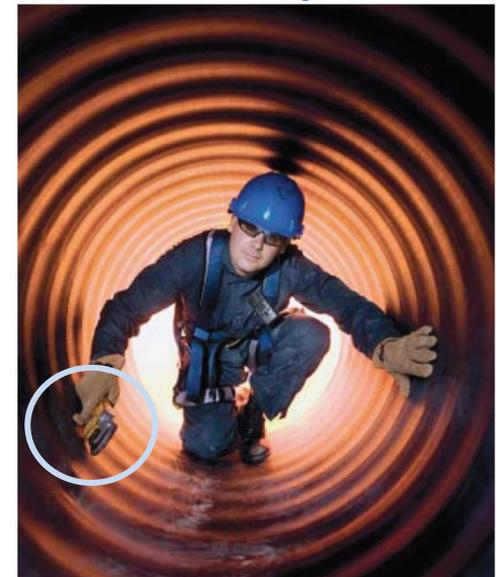
- Verifying the efficiency of prevention measures:
 - To evaluate the risks or the efficiency of the prevention measures in a given workplace, **vapour concentration measurements** can be conducted.

Colorimetric tests



Source: Suva

Use of a gas detector in confined spaces



Source: Suva

Organizational Measures

- **Staff training should:**
 - Provide the **knowledge** employees need to work in **safe conditions**
 - Take place when they **join the company** and at **regular intervals**
 - Include the **following topics:**
 - Legal foundations and requirements
 - Labelling schemes used for chemical substances and mixtures
 - Main rules of conduct
 - Requirements for the personal protective equipment including monitoring, maintenance, etc.
 - Good practices when working in explosion-hazard zones
 - First aid and fire protection guidelines
 - Guidelines for the sorting and disposal of waste, etc.

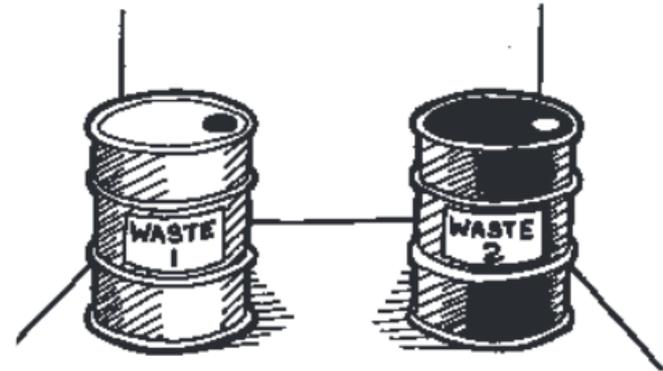
Organizational Measures

■ Managing spills:

- Train staff on how a spill should be dealt with.
- Install spillage kits at relevant locations (absorbent material).
- Set up a reporting system for significant spills (e.g. more than one litre of solvent or more than 2.5 litres of solvent-based coating).
- Set up an emergency procedure for large spills (20 litres or more):
 - Notify the emergency team.
 - Use spillage kits.
 - Place solvent-soaked materials in a sealed drum.
 - Report the spillage to the production manager.

Organizational Measures

- **Disposal of spent solvents:**
 - Keep a careful record of all wastes.
 - **Segregate waste** using clear labelling (e.g. separate chlorinated from non-chlorinated waste).
 - Ensure that the containers are **well sealed and in good condition**.
 - **Remove** used solvents from the site **regularly**.



Source: Environmental Technology Best Practice Program

Organizational Measures

■ Disposal of spent solvents:

- Spent solvents present the **same risks as new products** and should be **handled and stored** following exactly the **same guidelines**.
- **Recyclable solvents** (if the solvent contains **less than 30% of impurities**) can be:
 - Treated on site
 - Delegated to a service provider
- **Non-recyclable solvents** should be incinerated in specialized centres. If no centres are available, a risk assessment should be conducted to consider other options for substitution.

Solvent recycling facility



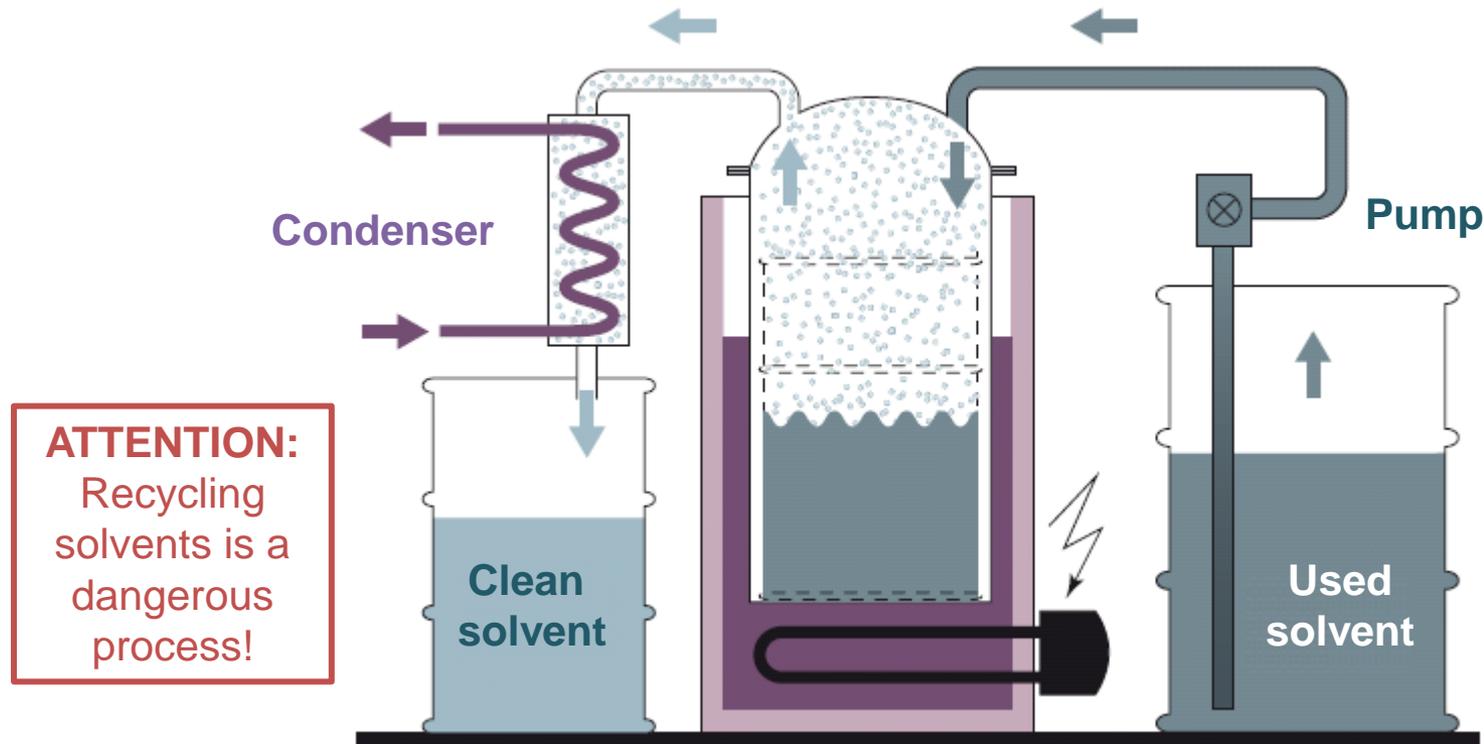
Source: INRS



[C12 Substitution of chemicals](#)

Organizational Measures

- Disposal of spent solvents: Recycling on site



ATTENTION:
Recycling solvents is a dangerous process!

Source: INRS

Organizational Measures – Exercise

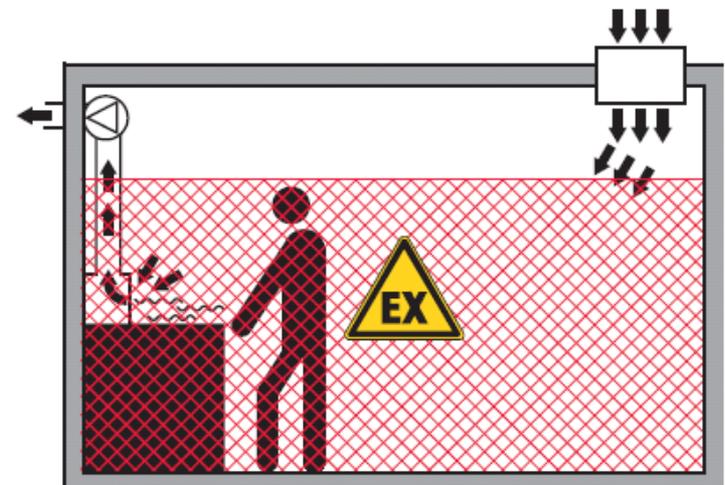
You are organizing a training session on the **safe use of solvents** for your employees.
What **topics** should you cover?

Organizational Measures – Exercise

- Topics to cover during a training session:
 - Legal foundations and requirements
 - Labelling schemes used for chemical substances and mixtures
 - Main rules of conduct
 - Requirements for the personal protective equipment including monitoring, maintenance, etc.
 - Good practices when working in explosion-hazard zones
 - First aid and fire protection guidelines
 - Guidelines for the sorting and disposal of waste, etc.

Organizational Measures – Recap

- Labelling of containers, tanks, pipes
- Safety signs to indicate zones where highly flammable solvents are used
- Verifying the efficiency of prevention measures
- Staff training
- Managing spills
- Disposal of used solvents



Source: Suva

Risk Reduction Measures

Personal Protective Equipment (PPE)

- To be used if the hazard could not be totally eliminated by substitution or technical measures.
- The safety data sheets (SDSs) of the substances used should indicate any relevant information to ensure their safe handling.
- Management should ensure that:
 - Staff is well trained
 - Protective equipment is regularly checked
 - Staff complies with the guidelines concerning the PPE



Zones where **PPE** is required should be **clearly indicated**.

Types of PPE



Source: Suva

**Eye and face protection is essential
when handling solvents.**

Personal Protective Equipment (PPE) – Example

Protective eyewear



Skin protective equipment

Respiratory protective equipment

Source: Suva

Key messages

- Solvents present risks for the environmental, health and safety
- Most frequently, solvents are commercialized as mixtures.
- Their properties need to be known in order to be able to apply adequate risk reduction measures.

Sources

Sources

- CSD Engineers, Switzerland/ISSPPRO, Germany, 2015
- Suva: Santé et sécurité au travail lors de l'emploi de solvants, Switzerland, 2012
- Suva: Liste de contrôle: Emploi de solvants, Switzerland, 2012
- Suva: Liste de contrôle: Electricité statique, Switzerland, 2010
- Curzons A.D., Constable D.C., Cunningham V.L.: Solvent selection guide: a guide to the integration of environmental, health and safety criteria into the selection of solvents, Springer, 1999
- INRS: Recycleurs de solvants, France, 2009
- Waswo: extra.suva.ch, Switzerland, June 2015

Sources

- INRS: Postes d'utilisation manuelle de solvants, France, 2009
- United Nations: Globally Harmonized System of Classification and Labelling of Chemicals (GHS), 2003, last revision 2013
- FOEN: Entreposage des matières dangereuses, Guide pratique, Switzerland, 2011
- Environmental Technology Best Practice Programme: Good housekeeping measures on solvents, United Kingdom, 1996
- Sicherheitsinstitut: Lagerung gefährlicher Stoffe, Leitfaden für die Praxis, Switzerland, 2011
- www.chemistryinnovation.co.uk, February 2010

Images

- CSD Engineers, Switzerland, 2015
- Suva: Santé et sécurité au travail lors de l'emploi de solvants, Switzerland, 2012
- Suva: Explosions – Risques et mesures de prévention, Switzerland, 2009
- Suva: Liste de contrôle – Emploi de solvants, Switzerland, 2012
- Suva: Liste de contrôle – Risques d'explosion, Switzerland, 2013
- Suva: Liste de contrôle – Electricité statique, Switzerland, 2010
- Environmental Technology Best Practice Programme: Good housekeeping measures for solvents, United Kingdom, 1996

Images

- INRS: Postes d'utilisation manuelle de solvants, France, 2009
- INRS: Recycleurs de solvants, France, 2009
- United Nations: Globally Harmonized System of Classification and Labelling of Chemicals (GHS), 2003, last revision 2013
- Shutterstock, USA, 2015

Disclaimer

This presentation was prepared with the requested diligence and with the generally accepted principles of the relevant field.

If a third party uses the contents of the presentation in order to take decisions, the authors disclaim any liability for any kind of direct or indirect (consequential) damage.