LABORATORY SAFETY TRAINING

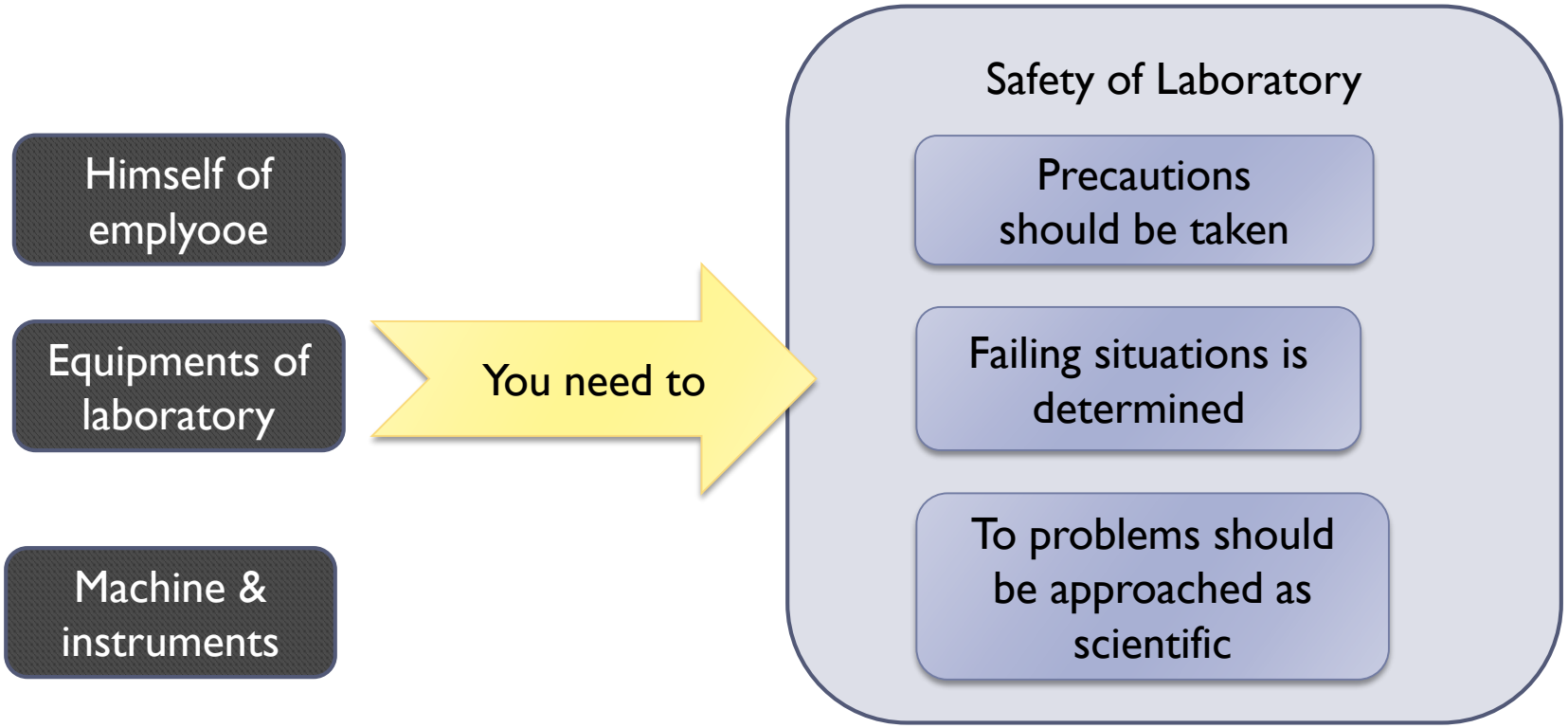
Marmara University , Department of Environmental Engineering

Responsibilities of Laboratory

- Esra ERDİM – Lab manager
- Evren TUGTAS – Lab manager
- Serap Yıldırım Akyel – Lab coordinator

Safety of Laboratory

- Experiments or studies made in the laboratory;



Why is it important safe working?

- Safe working:
  - You,
  - Other laboratory employees,
  - Cleaning staff
  - Visitors and
  - Protects your works.

Safety of Laboratory

- In the laboratory, a very low part of accidents occurring is technical errors ,
- A large part of accidents that caused by human errors.
- As shows that the pictures ;
  - make jokes with laboratory equipments

What are the causes of accidents in the laboratory ?

- Ignorance
- Over-confidence
- Carelessness and neglect
- Degradation of concentration
- Negative physical conditions
- Mood

Dangers to be Encountered in the Laboratory

- Flammable and Burning Liquids
- Chemicals
- Carcinogenic matters
- Electrical accidents

If you have not enough knowledge about you will use chemicals, devices, etc for your experiments, you should take information from responsible person or teacher

What should we do for laboratory safety?

- All substances should be considered potentially hazardous,
- Unnecessary material and apparatus should be removed from the work area.

- When the studies are finished, the work area and used materials should be cleaned, all equipment and installation should be closed, the used materials should be placed its place.

If you are working with samples containing pathogens, you should disinfect your working area. You should ask teacher for appropriate disinfectant.

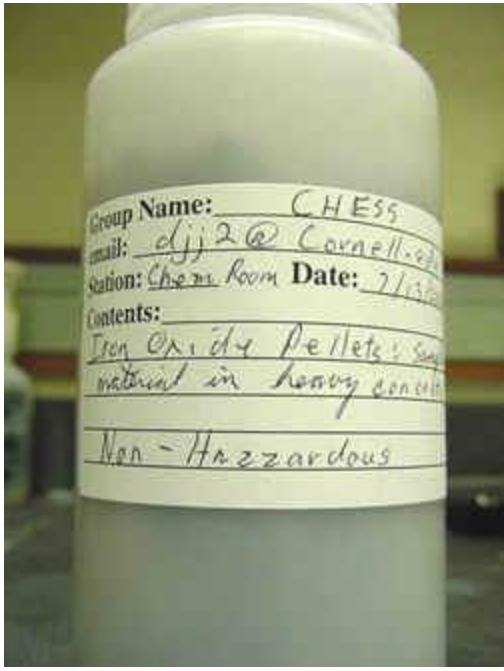
Picture: http://uwsscience.wordpress.com/2011/08/26/new-chemistry-journal/

What should we do for laboratory safety?

- Always the possible dangers against should be vigilant and prepared,
- Personal protective clothing and equipments should be used in all laboratory studies.
- Body covering clothing should be worn against to scattering and splashes,
- If there is a risk of injury, gloves and safety goggles should be worn,
- If you do not have the time , do not enter the laboratory, the quickly made laboratory work will cause carelessness and result in an accident.

What should we do for laboratory safety?

- All containers, bottles, and samples must be stored properly;
  - Chemical name
  - Date,
  - Prepared by /used by
  - Hazard information labeled to show,
- Only specially designed lab bottles should be used in the laboratory. Water bottles, food bottles etc., should not be used to keep/store chemicals or any other thing in the lab.



Personal Protective Equipments

- Lab glasses
- Gloves
- Lab coat
- Suitable clothes

Long hair must pulled back

Pictures:
https://www.utexas.edu/safety/ehs/training/oh201/index.php?slide=21
http://www.med.uottawa.ca/ehss-spe/eng/accidents.html

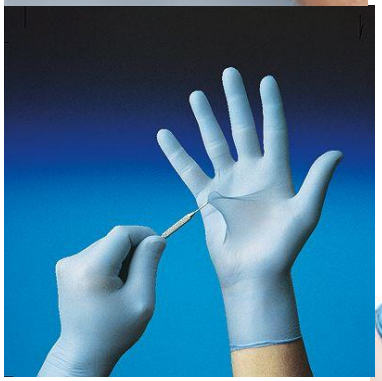
Personal Protective Equipments
Suitable Gloves

Latex gloves

•not resistant to chemicals
•resistant to biological experiment

Nitrile gloves

• resistant to tear
•resistant to chemicals



Oven gloves

Personal Protective Equipments
Suitable Shoes

✓ CLOSED SHOES				
✗ OPEN SHOES				

On all sides closed shoes must be worn, to prevent damage your feet (chemical spilled, etc).

Laboratory Accidents

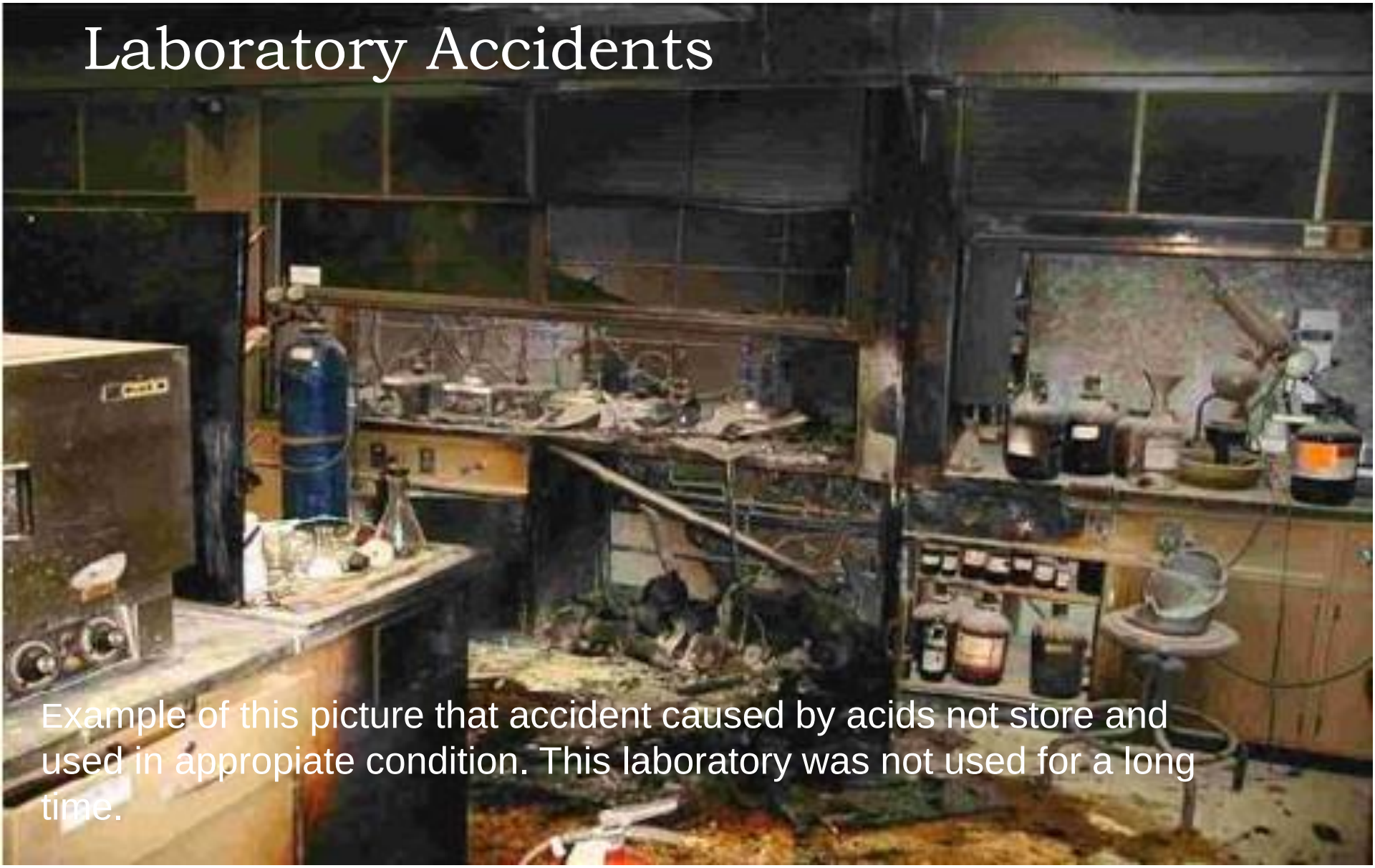
- The person in the picture, survived the accident unscathed. Because the person wore appropiate clothing.

Chemical burn in the eye

As a result of the accident, caused blindness. Because the lab glasses was not used

Pictures: http://www.med.uottawa.ca/ehssspe/eng/accidents.html

Laboratory Accidents



Example of this picture that accident caused by acids not store and used in appropiate condition. This laboratory was not used for a long time.

Laboratory Accidents

Texas Tech, 2010 – The student lost his fingers and serious damage has occurred on eyes

Laboratory Security Tools

- Entry, exit and escape signs of laboratory
- Fire alarms
- Fire extinguishers
- Emergency discharge plans and meeting places
- Eye showers
- Length showers
- The nearest first aid kit

Personal Protective Equipments Gloves-1

- Appropriate gloves should be selected for the work.
- Selection should be based on manufacturers specifications.
- Gloves should be selected based on the work conditions – Different gloves should be used for hazardous chemicals, patogens, heat, cold.
- When wearing gloves, a person should not touch to eyes, hairs, glasses, telephones.
- You should always wash your hand when leaving the laboratorty, even if you use gloves.

Personal Protective Equipments Gloves-2

- Gloves should be removed when using computer /phone . Gloves also be removed when touching door handles, common telephones, instruments control panes to prevent contaminating those areas for the ones using them without gloves.
- Gloves should be selected according to the work type.
- Vinyl or nitrile gloves (green, blue or purple in color) should be preferred if you are handling chemicals.
- You SHOULD NOT leave from the laboratory with laboratory coats or gloves.

General Safety

- Keep clean your work area
- Unused materials should are put their places.
- Clean your bench when leaving the laboratory

As shown in the figure, you must avoid irregularities that may cause an accident

General Safety

- Be attempted alone in the laboratory, a second person to be who knows the location of the employee is required
- Against pouring of chemicals and pieces of broken glass always closed shoes should be worn.
- Long hair should be pulled back while working in the laboratory.
- Chemical wastes must be properly tagged and put in bottles, absolutely should not be emptied sink.
- In any case of accident in the laboratory, emergency act plan, which is on the enterence wall of the laboratory should be followed.

How to work with a chemical

- Find out about chemical.
- Documentation of MSDS (Material Safety Data Sheet) should be investigated for information about the chemical.
- Do not breathe unknown chemicals.
- Chemicals should not be kept contact with nose and face in directly.
- Always should wear appropriate laboratory clothes.
- The pipette should not put into the standard solutions,solutions should be prepared in a separate container.

Storage of the Chemicals

- Corrosive chemicals should be stored in steel cupboard.
- Volatile chemicals should be stored at +4°C.

Material Safety Data Sheet (MSDS)

SIGMA-ALDRICH sigma-aldrich.com

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006
Version 4.0 Revision Date 26.12.2010
Print Date 05.09.2011

GENERIC EU MSDS - NO COUNTRY SPECIFIC DATA - NO OEL DATA

1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1 Product identifiers

Product name : Tridodecylamine

Product Number : 91660
Brand : Aldrich
CAS-No. : 102-87-4

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Chemie GmbH
Riedstrasse 2
D-89555 STEINHEIM

Telephone : +49 89-6513-1444
Fax : +49 7329-97-2319
E-mail address : eurtechserv@sial.com

1.4 Emergency telephone number

Emergency Phone # : +49 7329-97-2323

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 [EU-GHS/CLP]
Skin irritation (Category 2)
Eye irritation (Category 2)
Specific target organ toxicity - single exposure (Category 3)

Classification according to EU Directives 67/548/EEC or 1999/45/EC
Irritating to eyes, respiratory system and skin.

2.2 Label elements

Labelling according Regulation (EC) No 1272/2008 [CLP]

Pictogram

Signal word Warning

Hazard statement(s)
H315 Causes skin irritation.
H319 Causes serious eye irritation.
H335 May cause respiratory irritation.

Precautionary statement(s)
P261 Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Supplemental Hazard Statements none

Aldrich - 91660 Page 1 of 6

N_2O-MSDS

This example was purchased from Sigma-Aldrich chemical company, has provided the MSDS form.

As you can see that the first part of MSDS form (for nitrous oxide), has given information about chemical properties .

To protect yourself, you should find the MSDS form of used chemical and take the appropriate measures

Working out of office hours and on weekends

- Should inform lab management.
- Should be reported to working out of office hours (on weekends)
- Make sure all the doors are locked when exiting.
- Make at least two people in the laboratory.

Hygiene Laboratory

- **Never** eat, drink or smoke in a laboratory
- Avoid touching your mouth, face, and eyes.
- DO NOT TOUCH door handles, cell phones, computers, while wearing gloves in your hand,
- ABSOLUTELY WASH HANDS before leaving the laboratory.

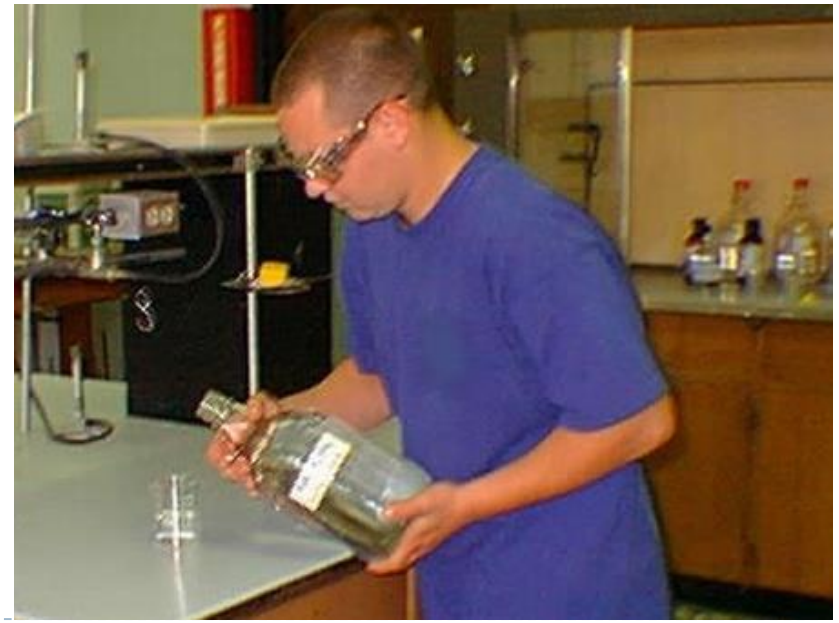
Picture: http://www.kutztown.edu/admin/facilites/EHS/posters.htm

Protection of health

- Please inform to responsible person the following cases :
  - If you are allergic to one of the laboratory substances
  - If there is a significant health problem
  - (epilepsy, diabetes, etc.)

The use of concentrated acids

- Do **not** add water to concentrated acid. Add acid to water slowly.
- If acid is poured into the work area, pour the sodium bicarbonate to the region.



Gas Cylinders

- Gas cylinders are located under the normal pressure. They can be very dangerous because of pressure and contain gas.
- Gas cylinders may be only designated areas.
- Gas cylinders should be secured against tipping over, falling. For example, it can be connected to the wall with a chain
- Gas cylinder connections should be done properly by qualified personnel, and the connection should be checked for leakage.

The using of fume cupboard

- Make sure its fan system running, before fume cupboard using.
- Do not your face put into the fume cupboard.
- The chemicals should be kept as little as possible in fume cupboard.
- The spilled chemicals to the surface is cleaned immediately.
- Generate toxic gases and acids solvents should be studied with the fume cupboard.
- Chemical substances are taken place at least 15 cm back from the front of the fume cupboard.

Ultra-pure water & deionized water

- In the preparation of standards and other sensitive solutions ultra-pure water is used.
- For general use and washing of glass materials, deionized water is used.
  - Ultra-pure water after the use of the device should be left in standby. The amount taken should be written to table.

Devices

- Any device setting must not be changed without asking to the person concerned in the laboratory.

(For example :Oven)

<u>Use of balance suitable for the purpose :</u>

- Precision measurements > 0.001g→ sensitive balance
- Rough measurements > 0.1 g → rough balance
- You should pay particular attention to the balance weight range, and use the appropriate scales

Safety Equipment

- Know where it is!
- Know how to use it!
- Maintain clear access to equipment

- Picture: http://www.safetycommunity.com/photo/blocked-fire-extinguisher?context=latest

AID TRAINING

Types of Fire

1. **Class of A:**

Wood, paper, textile, and other fabrics
Elements of extinguishing : Water
Methods of extinguishing: Cooling

2. **Classs of B:**

Flammable liquids and liquefiable solids
Elements of extinguishing : Dry dust, chemical foam, mechanical foam, CO_2 liqui
that into the light water vapor
Methods o extinguishing : Strangulation

3. **Class of C:**

Gase and liquefied gases
Elements of extinguishing : Dry dust, chemical vapor forming liquids, CO_2
Methods of extinguishing: Strangulation

4. **Class of D:**

Metals (Magnesium, titanium, Sodium, Potassium vb.)
Elements of extinguishing: Dry dust, specially formulated chemical dust
Methods of extinguishing : Strangulation

5. **Fires that are caused by electrical reasons**

Types of Fire xtinguisher

- Portable water-based fire extinguishers
- Portable foam extinguishers
- Carbon dioxide extinguishers
- Portable dry chemical powder fire extinguishers

Portable Water-based Fire Extinguishers

- Only A of class fires is used.
- **Certainly B, C, D of electrical origin** in fires should **not be used.**

Portable Foam Extinguishers

- Only A and B of class is used.
- Should not be used fire caused by electricity.

Dry Chemical Dust Extinguishers

KURU TOZLARIN YANGIN SINIFLARINA ETKİSİ

SÖNDÜRME MADDESİ	A	B	C	D	Elektrik Yangınları <1000 V ,	Elektrik Yangınları >1000 V
ABC	+	+	+	-	1m	--
BC	-	+	+	-	1m	5m
D	-	-	-	+	-	-

- **ADVANTAGES OF DRY DUST**
- It used as a wide variety. (ABC)
- The large liquid fires can be used too.
- It can be used with Foam
- It is effective in (-50 / +60 °C).
- It has no effect of poisoning, Bicarbonate-based powders make acids neutral.
- **DISADVANTAGES OF DRY DUST**
- . Must be cooled with water
- Flammable dust can be ventilated by cloud of dust in environment.
- Used limited in power electrical installations.

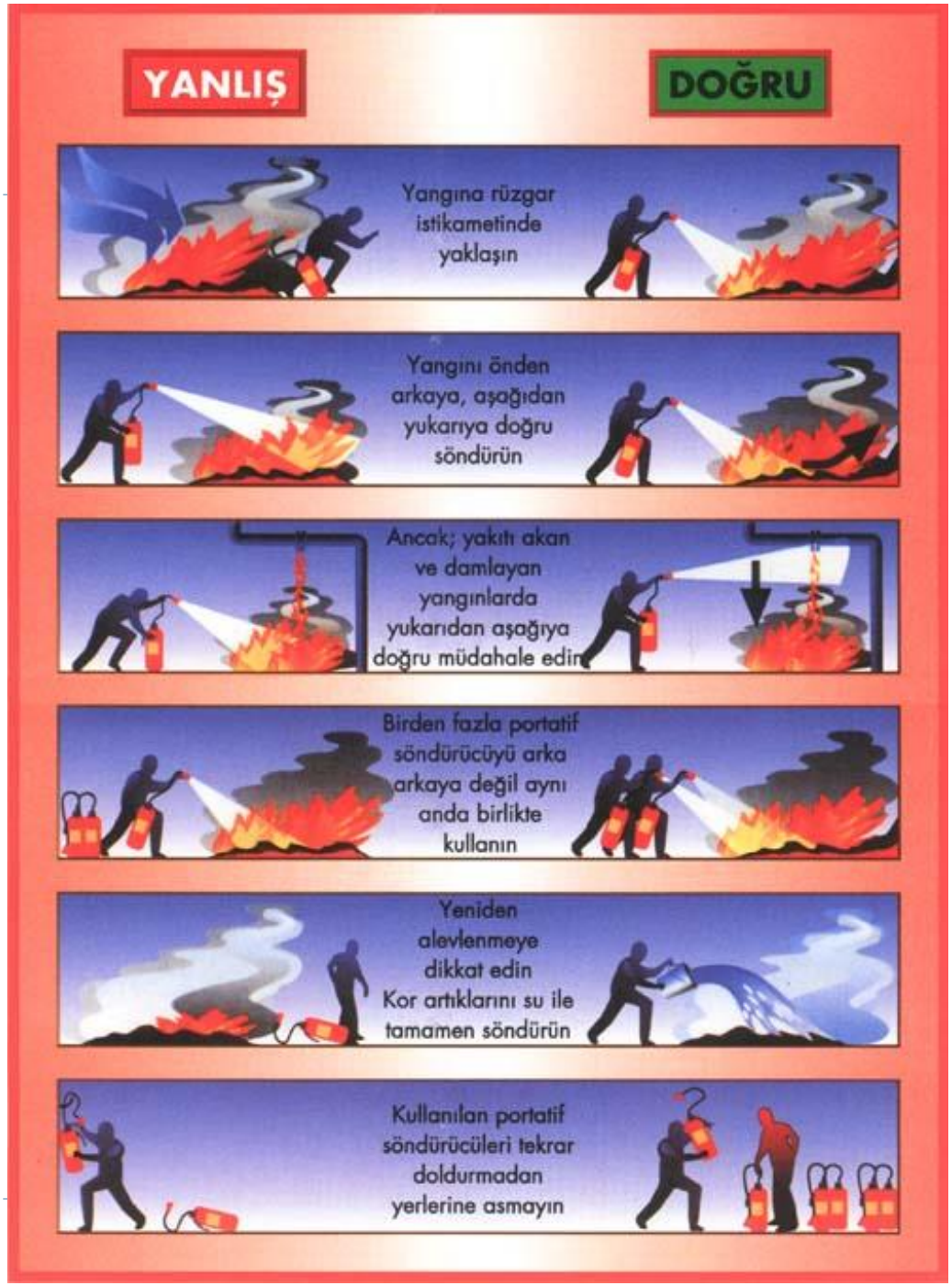
Carbon Dioxide Extinguishers

KARBONDİOKSİTİN YANGIN SINIFLARINA ETKİSİ

SÖNDÜRME ETKİSİ	A	B	C	D	Elektrik Yangınları <1000V , > 1000 V
KARBONDİOKSİT	-	+	+	-	1m 5m

- **ADVANTAGES OF CARBON DIOXIDE**
- High concentrations of CO2 is created the effect of sudden extinction in closed volume . It's insulator against electrical current. However, should be left the distance for mobile devices.
- Cheaper than other extinguishing gases and can be filled easily.
- Clean extinguisher. There's very little irritation and corrosion effects.
- **DISADVANTAGES OF CARBON DIOXIDE**
- CO_2 shows the stifling effect in the high-density
- Because of the critical temperature, the tube pressure increases in hot environments
- The emergence of the **gas -78 ° C** will cause cold burns with contact
- The dry ice particles carry static electricity.

When a large-scale fire in laboratory, get away from there, do not endanger yourself. Inform the relevant people and fire department.

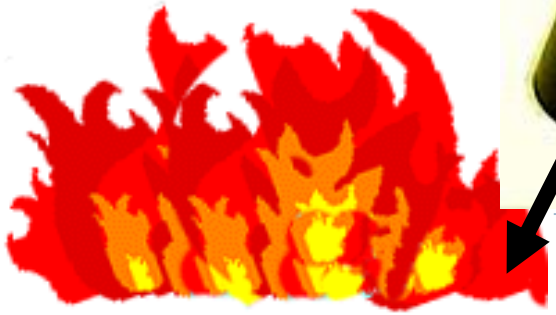


Fire Extinguishers

(3)
Squeeze
the handle

(2)
Pull the pin

(1)
Aim nozzle at
base of the fire



CAUTION :

Typical Fire Fighting Equipment has

10 second spray power

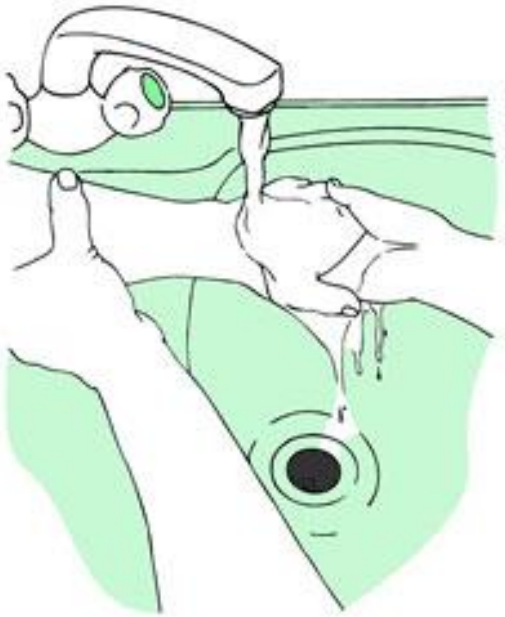
First Aid

When an accident occurs, the laboratory directors should be informed.

First Aid

Laceration: Burn

What to do : Skin is washed with cold water until the end of burning sensation. gency shower should be used.



First Aid

Laceration :

What to do :

Poisoning

- Should be investigated to which substance is caused intoxication
- MSDS information should be accessed.
- The attendant should be informed.

First Aid

Laceration : Chemical splashes to the skin

What to do : Wash with plenty of water. Bicarbonate solution can be used for splashing acid, boric acid or vinegar can be used to base jump.

First Aid

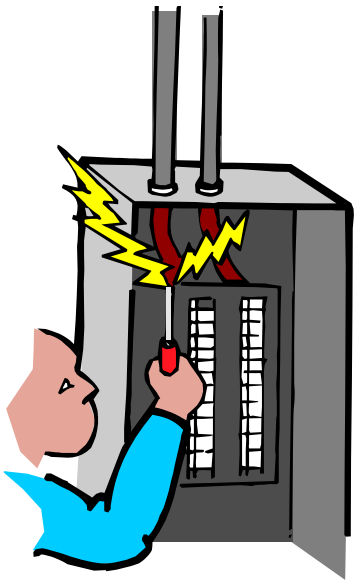
Laceration : Chemical splash to the eye

What to do : The eye is washed plenty of water using eye shower.

First Aid

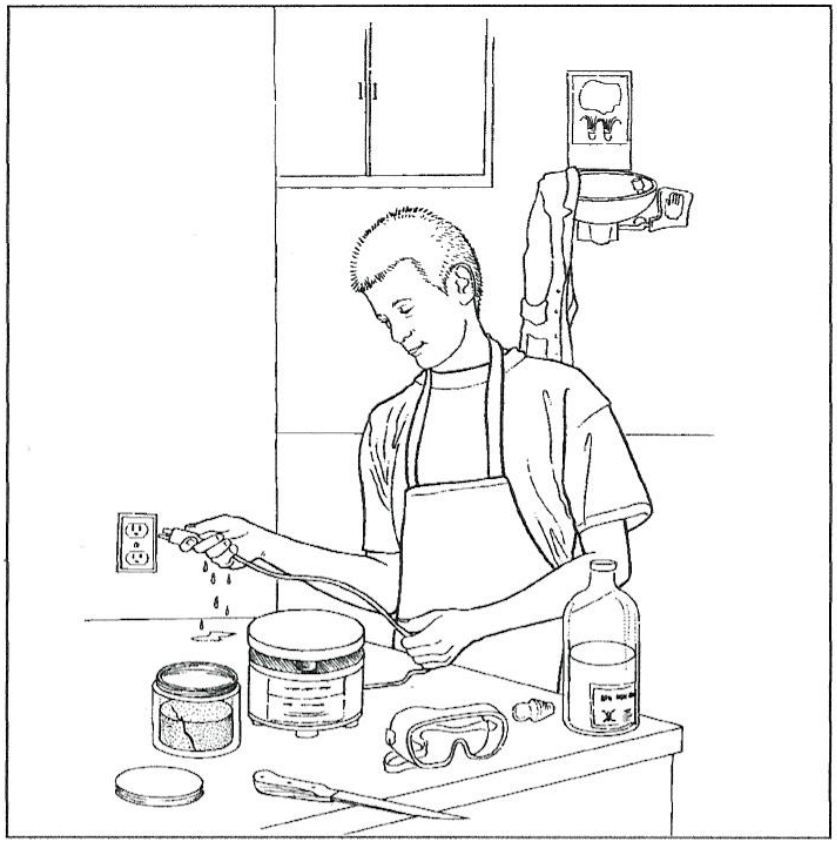
Laceration : Shock

What to do : Use all fuses to disconnect electrical. Use the insulator object to touch .Please inform to the attendant



What is wrong this picture?

This picture is an example that how should not work in the laboratory.
For example, the person in the picture trying to insert it into the plug with a wet hand, uses a broken beaker, not wear clothes appropriate laboratory work, chemical flask and a knife edge of the table in unsafe way.
If you see in a similar way working people or breaking the rules in the laboratory, you should warn or notify responsible of the laboratory those people.



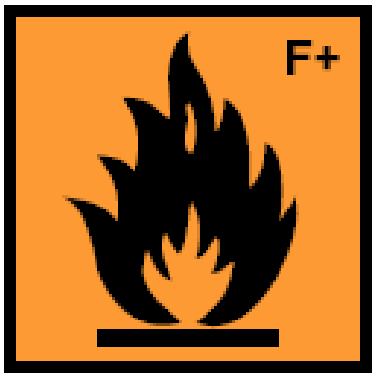
Chemicals Hazard Signs

Each chemical has the hazard warning sign

F: Highly flammable

Property*:* To be indicated which flash point below 21 ° C and the "highly flammable liquids and flammable solids,"

Precaution : Should be kept away from naked flame, sparks and sources of heat.



F+ : Extremely flammable

Property : Fluids which flash points below the 0 °C and boling points (maximum) 35 °C. To be flammable gases and gas mixtures with air in normal pressure and room temperature .

Precaution: Should be kept away from naked flame, sparks and sources of heat.

T : Toxic

Property: If it is swallowed, inhaled and in contact with the skin condition, it can damage health, even fatal.

Precaution : Avoid contact with human body, seek medical help.

T+ : Very Toxic

Property : If it is swallowed, inhaled and in contact with the skin condition, it can damage health, even fatal.

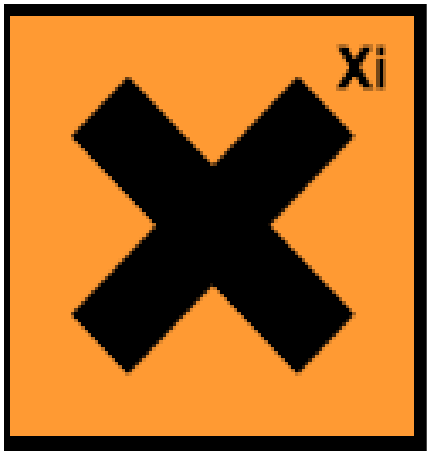
Precaution: Avoid contact with human body, otherwise, seek medical help.

.

Xn: Harmful Chemicals

Property: If it is swallowed, inhaled and in contact with the skin condition, it can damage health.

Precaution: Avoid contact with human body.



Xi: Irritant

Property: Although it isn't abrasive which contact skin immediate, prolonged or repeated may cause inflammation.

N : Dangerous for the environment

Property:Dangerous for the wild life in the environment

Precaution:Considering the risk of such substances must be not contact with soil or the environment.

C: Abrasive (corrosive)

Property: Damage to living tissues.

Precaution: Should be taken special measures for protect to eyes, skin and clothing. Vapor should not breathed, otherwise seek medical help.