

# A short introduction to Laboratory Safety

LORET Suzanne, PhD  
Biosafety Officer  
UNamur – SIPPT  
[Suzanne.loret@unamur.be](mailto:Suzanne.loret@unamur.be)  
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# Content:

1. Risk in laboratories, an introduction
2. Risk assessment Principles
3. Risk Management Principles
4. Management of laboratory Accidents

# 1. Introduction

## Examples of laboratory accidents

Date	Accident location	Accident - Consequence
March 5, 2018	Frontage Laboratories Inc. in Chester County, PA - USA	26-year-old worker at Frontage Laboratories died as a result of exposure to potassium cyanide
Dec 7, 2018	Indian Institute of Science in Bengaluru, India	Gas Cylinder Explosion Kills Researcher at Indian Laboratory Two professors have been arrested for negligence in connection with the blast.
Oct 12, 2015	Leeden National Oxygen, Jurong - Singapore	Leeden National Oxygen chemist was killed in an explosion caused by a faulty valve on a gas cylinder (containing a mix of methane, nitrogen and oxygen)
Oct 9, 2013	Dow Chemical electronic materials facility in North Andover, Mass. USA	Dow Chemical Worker Dies After Plant Fire. Safety: Trimethylindium identified as cause of electronic materials facility blaze (Trimethylindium, used to make semiconductors, ignites spontaneously in air).
May 4, 2012	San Francisco Veterans Affairs medical center CA - USA	25-year-old VA hospital lab worker died from exposure to bacterial strain causing septicemia and meningitis.
Aug 20, 2010 June 29, 2011	Multistate cluster of infections - USA	A Salmonella Typhimurium outbreak linked to lab exposure sickened 109 people in 38 states and caused one death
Oct. 8, 2008	Windsor, Nova Scotia , CA	Lab worker died from lung failure after exposure to trimethylsilyldiazomethane (TMSD) - the fume hoods in the lab were apparently down for maintenance during this time
Jan 16, 2009	UCLA's Molecular Sciences Building - USA	A UCLA research assistant who was seriously burned in a laboratory fire has died of her injuries. The accident occurred while the assistant was working with T-Butyl lithium, a highly flammable compound. She was wearing nitrile gloves, safety glasses and synthetic sweater. She was not wearing a lab coat. The fire ignited the gloves and the sweater.
Sept 13, 2009	university of Chicago - USA	A researcher at the University of Chicago Medical Center died from exposure to <i>Yersenia Pestis</i> , a plague-related bacterium

***Basic principle of Laboratory safety:***

**A PROPER TRAINING IS  
MANDATORY BEFORE STARTING  
ANY WORK IN A LABORATORY**



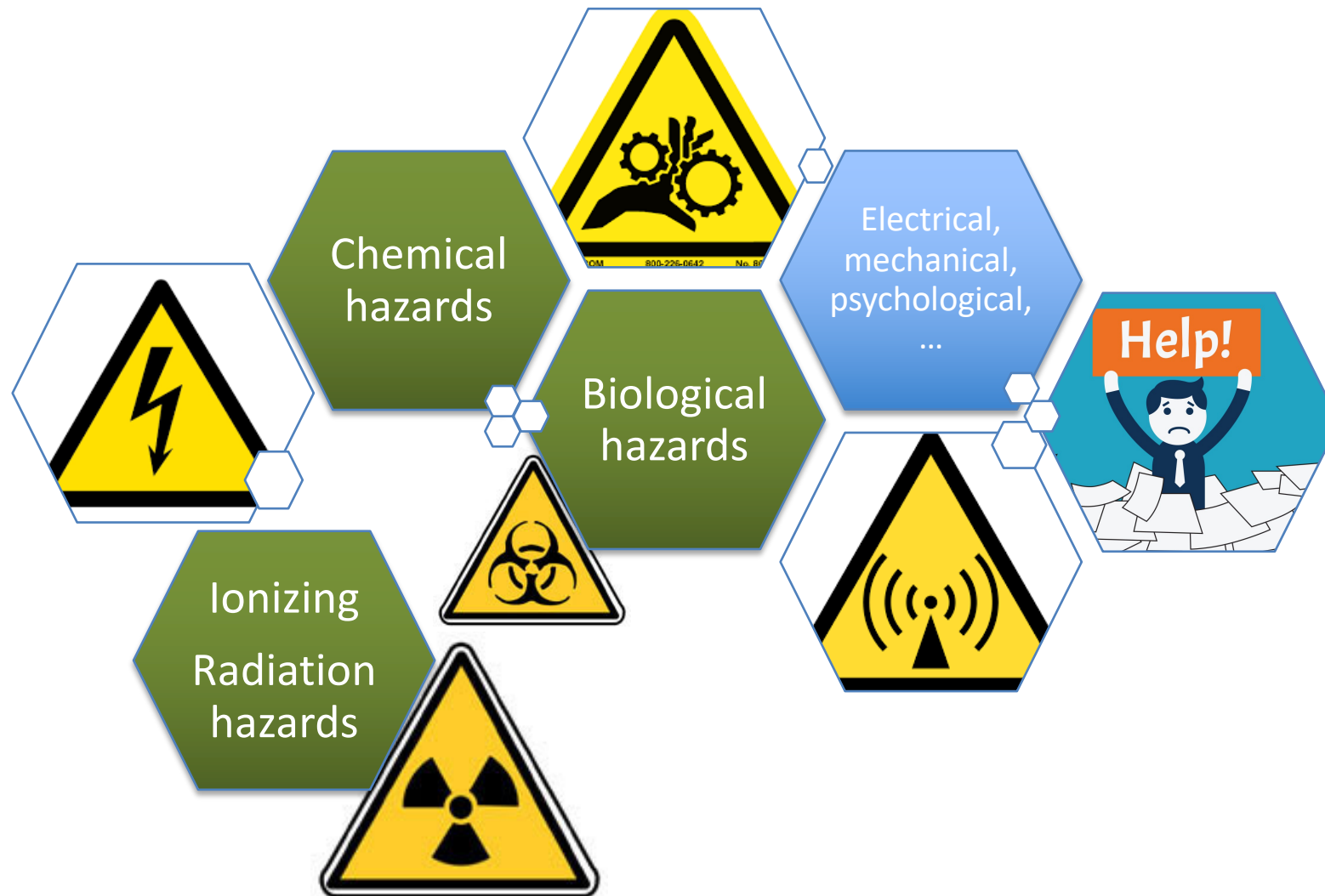
## Mandatory trainings in laboratory safety

Training type	Department		
	<ul style="list-style-type: none"> <li>• Biology</li> <li>• Veterinary Medicine</li> <li>• Human Medicine</li> <li>• Biomedical Sciences</li> <li>• Pharmacy</li> <li>• Chemistry-CBS</li> <li>• Chemistry-CBO</li> </ul>	Chemistry (non-CBS, non-CBO)	Physics
Introduction to laboratory safety	✓	✓	✓
Biosafety	✓		
Chemistry Risk Management	✓	✓	(✓)*
Radioprotection	✓	(✓)*	✓






← Today

*\*: only if recommended by the risk assessment (laboratory head decision)*







## 2. Major Risks in the lab











# Regardless of the risk type ***a common signalling code***

Table 4: HAZARD WARNING SIGNS		
Shape / Colour CODE	Meaning	Examples
	Caution; Hazard ahead	 Ionizing radiation hazard symbol
	Caution; Chemical Risks 9 GHS symbols <b>on product / material labels</b>	 Environmental toxicity  Acute toxicity

# Regardless of the risk type ***a common signalling code***

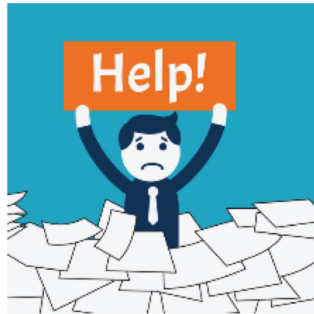
Table 5: SAFETY SIGNS		
Shape / Colour	Meaning	Examples
	<b>FORBIDDEN</b> You must not; Do not; Stop.	 No admittance (restricted access)
	<b>MANDATORY</b> You must do; Obligation to follow the rule.	 You must wear protective gloves
	<b>SAFE CONDITION</b> Emergency exit. Emergency; Evacuation route (arrow); First aid material.	

## 2. Major Risks in the lab

<b>BIOLOGICAL RISK:</b> 	<p>Results from the intentional use of hazardous biological organisms, comprising pathogenic organisms (such as bacteria, viruses, parasites, prions and biotoxins) and genetically modified organisms (GMO).</p>
<b>CHEMICAL RISK:</b>           <i>Two types of pictogram:</i>    	<p>Results from the intentional use of Chemical hazardous material and substances.</p> <p><b>Health hazards</b> include skin irritants, carcinogens or respiratory sensitizers that have an adverse effect on a worker's health in case of accidental exposure.</p> <p><b>Physicochemical hazards</b> are presented by flammable, corrosive, oxidizing or explosive substances</p> <ul style="list-style-type: none"> <li>• Product / materials labels (<b>inherent risk</b>)</li> <li>• Doors of laboratories or product storage-rooms and -cabinets (<b>situation risk</b>)</li> </ul> <p> <i>is used sometimes to warn about all chemical risk!</i></p>
<b>RADIOLOGICAL RISK:</b>  	<p>results from the intentional use of sources of ionizing radiations (IR). In laboratories, the major sources of radioactivity are X-Ray diffractometers and radiolabelled compounds used to track various physiological and synthesis pathways.</p> <p>Most frequent adverse effects of IR include tumours development in irradiated / contaminated organs and tissues.</p>
<b>NIR RISK:</b>  	<p>results from the intentional use of sources of non-ionizing radiations (NIR). NIR is relatively low-energy radiation (sources include power lines, microwaves, infrared radiation, visible light and lasers). In laboratories, NIR can cause localised heating, or photochemical reactions leading to possible permanent harm (risk of damage to the skin and eyes, mostly).</p>

## 2. Major Risks in the lab

### PSYCHOSOCIAL RISK:



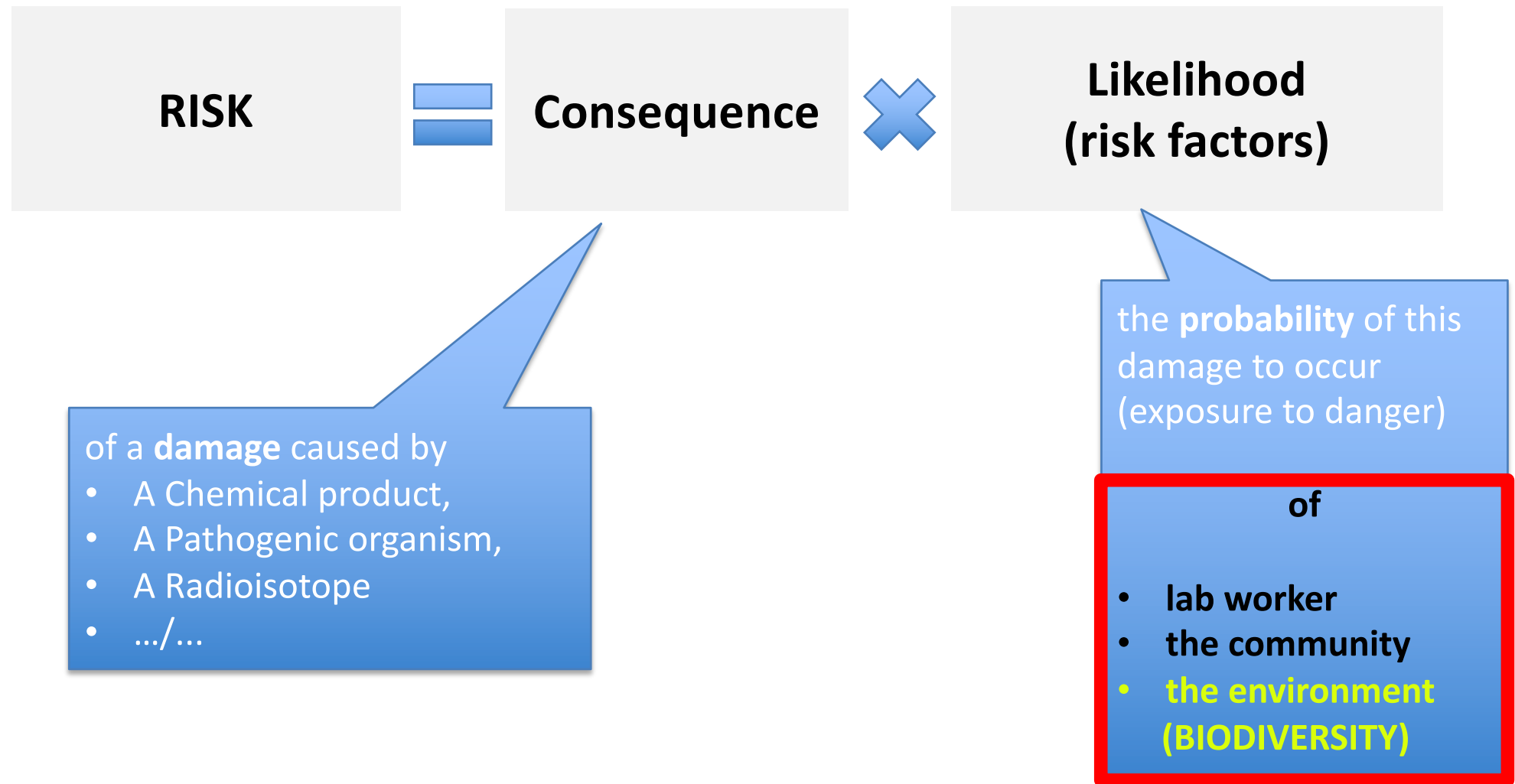
result from increased pressure, due to excessive work demands and other "stressors", to a level greater than the individual's ability to cope with this situation.

When stress reactions persist over a prolonged period of time, this may result in more permanent, less reversible health outcomes: such as chronic fatigue, burnout, musculoskeletal problems or cardiovascular disease.

***Psychosocial risk consequences can interfere with a person's ability to manage properly other laboratory risks.***

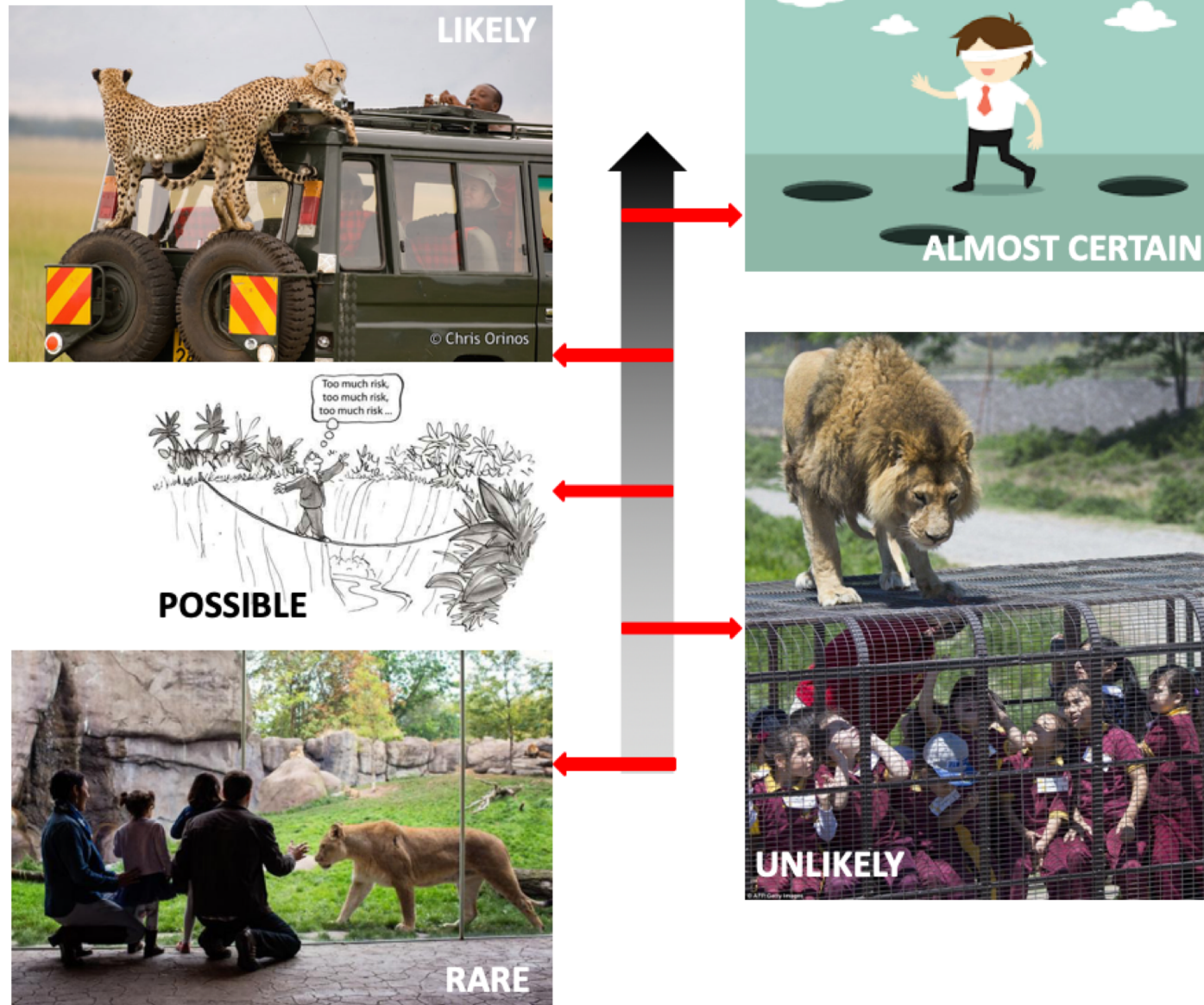
If you need help, you can contact : [risques-psychosociaux@unamur.be](mailto:risques-psychosociaux@unamur.be)

# Laboratory hazard (risk) : what does it mean?





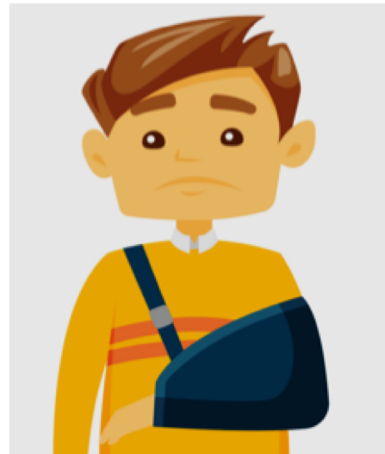
## Likelihood scale:





## Consequence scale:

**MAJOR:**  
disabling wounds,  
hospitalization



**MODERATE:**  
controlled allergy,  
curable infection



**INSIGNIFICANT:**  
temporary slight  
discomforts

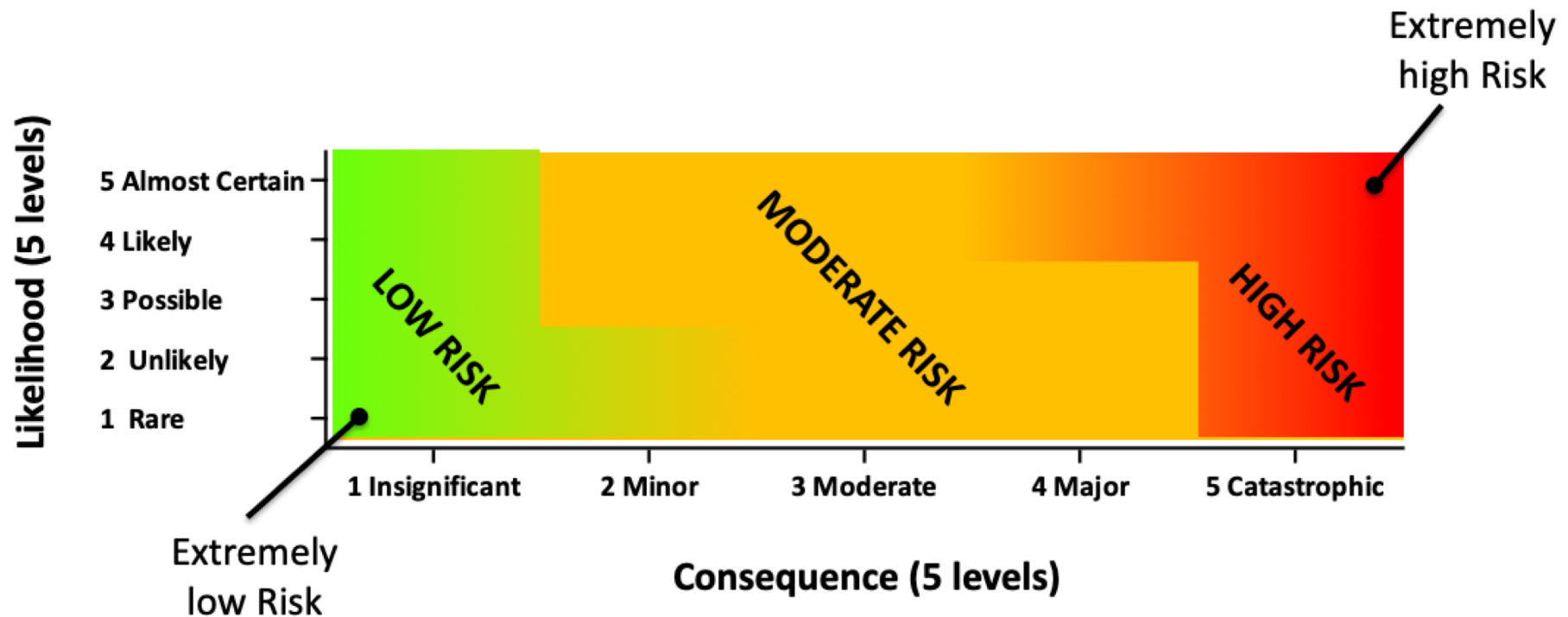


**CATASTROPHIC:**  
Fatal outcome  
*(Deadly burns - 2008, UCLA, USA)*







**MINOR:**  
slight injuries, varied  
small disturbances

**Risk:** a situation involving exposure to hazard (danger). The risk scale results from the combination between the likelihood of the hazard and its consequence (damages scale).



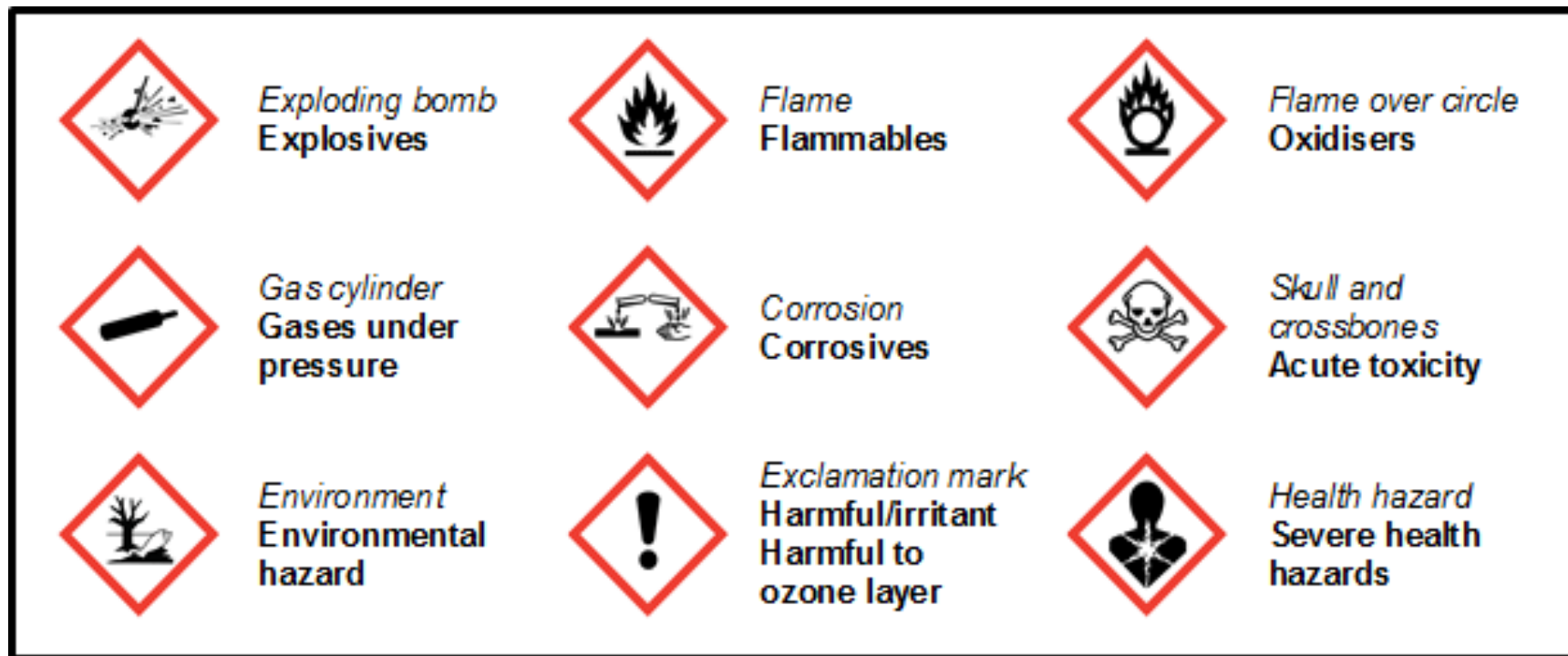
## 2. Risk Assessment (RA)

RA STEPS	Examples in laboratories				
<div>Hazard type ?</div>	 IR	 Biological	 Chemicals	 NIR	
<div>Intrinsic properties of Hazard source (consequences)</div>	<div>Insignificant or minor consequence</div> <ul style="list-style-type: none"><li>• non-toxic chemical (NaCl, KCl, ..)</li><li>• slightly noxious substance</li><li>• Low energy IR</li><li>• organism with little or no pathogenicity</li></ul>		<div>Moderate to catastrophic consequence</div> <ul style="list-style-type: none"><li>• Highly toxic substance</li><li>• Highly carcinogenic substance</li><li>• High energy IR (old nuclear power plant)</li><li>• Deadly contagious pathogen (Ebola v.)</li></ul>		
<div>Risk factors of the Activity (likelihood)</div>	<div>Low likelihood (rare, unlikely)</div> <ul style="list-style-type: none"><li>• No contact with the body, no exposure</li><li>• Short quantities, no frequent use</li></ul>		<div>High likelihood (possible, likely, almost certain)</div> <ul style="list-style-type: none"><li>• No safety barrier (high exposure)</li><li>• Substantial quantities, daily use</li></ul>		
<div>RISK LEVEL (consequence and Likelihood combined)</div>	LOW RISK		MODERATE RISK		HIGH RISK

# Pictograms for Chemical Risk

## Tools for risk management

### a) Hazard pictograms



**Read label and safety data sheet before using a chemical product!**



**Danger.** May be corrosive to metals. Causes severe skin burns and eye damage. Wear protective gloves/ protective clothing/ eye protection/ face protection. IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. IF exposed or concerned: immediately call a POISON CENTER or doctor/ physician. WARNING! This product contains a chemical known to the State of California to cause cancer. I Adjusted to titer t = 1.000 at +20°C. Variation: approx. 0.02%/°C.

**Danger.** Peut être corrosif pour les métaux. Provoque des brûlures de la peau et des lésions oculaires graves. Porter des gants de protection/ des vêtements de protection/ un équipement de protection des yeux/ du visage. EN CAS D'INGESTION: rincer la bouche. NE PAS faire vomir. EN CAS DE CONTACT AVEC LES YEUX: rincer avec précaution à l'eau pendant plusieurs minutes. Enlever les lentilles de contact si la victime en porte et si elles peuvent être facilement enlevées. Continuer à rincer. EN CAS d'exposition prouvée ou suspectée: Appeler immédiatement un CENTRE ANTIPOISON ou un médecin. I Ajusté au titre t = 1,000 à +20°C. Ecart: env. 0,02 %/°C.

**Pericolo.** Può essere corrosivo per i metalli. Provoca gravi ustioni cutanee e gravi lesioni oculari. Indossare guanti/ indumenti protettivi/ Proteggere gli occhi/ il viso. IN CASO DI INGESTIONE: sciacquare la bocca. NON provocare il vomito. IN CASO DI CONTATTO CON GLI OCCHI: sciacquare accuratamente per parecchi minuti. Togliere le eventuali lenti a contatto se è agevole farlo. Continuare a sciacquare. IN CASO di esposizione o di possibile esposizione: Contattare immediatamente un CENTRO ANTIVELENI o un medico. I Regolato su titolo t = 1,000 a +20°C. Deviazione: ca. 0,02%/°C.

**Peligro.** Puede ser corrosivo para los metales. Provoca quemaduras graves en la piel y lesiones oculares graves. Llevar guantes/ prendas/ gafas/ máscara de protección. EN CASO DE INGESTION: Enjuagarse la boca. NO provocar el vómito. EN CASO DE CONTACTO CON LOS OJOS: Aclarar cuidadosamente con agua durante varios minutos. Quitar las lentes de contacto, si lleva y resulta fácil. Seguir aclarando. EN CASO DE exposición manifiesta o presunta: Llamar inmediatamente a un CENTRO DE TOXICOLOGÍA o a un médico. I Ajustado al título t = 1,000 a +20 °C. Desviación: aprox. 0,02%/°C.

**Perigo.** Pode ser corrosivo para os metais. Provoca queimaduras na pele e lesões oculares graves. Usar luvas de proteção/ vestuário de proteção/ proteção ocular/ proteção facial. EM CASO DE INGESTÃO: enxaguar a boca. NÃO provocar o vômito. SE ENTRAR EM CONTACTO COM OS OLHOS: enxaguar cuidadosamente com água durante vários minutos. Se usar lentes de contacto, retire-as, se tal lhe for possível. Continuar a enxaguar. EM CASO DE exposição ou suspeita de exposição: Contacte imediatamente um CENTRO DE INFORMAÇÃO ANTIVENENOS ou um médico. I Aferido ao título t = 1,000 a +20°C. Desvio: aprox. 0,02%/°C





## On labels / safety data sheets of chemical products, hazard statements

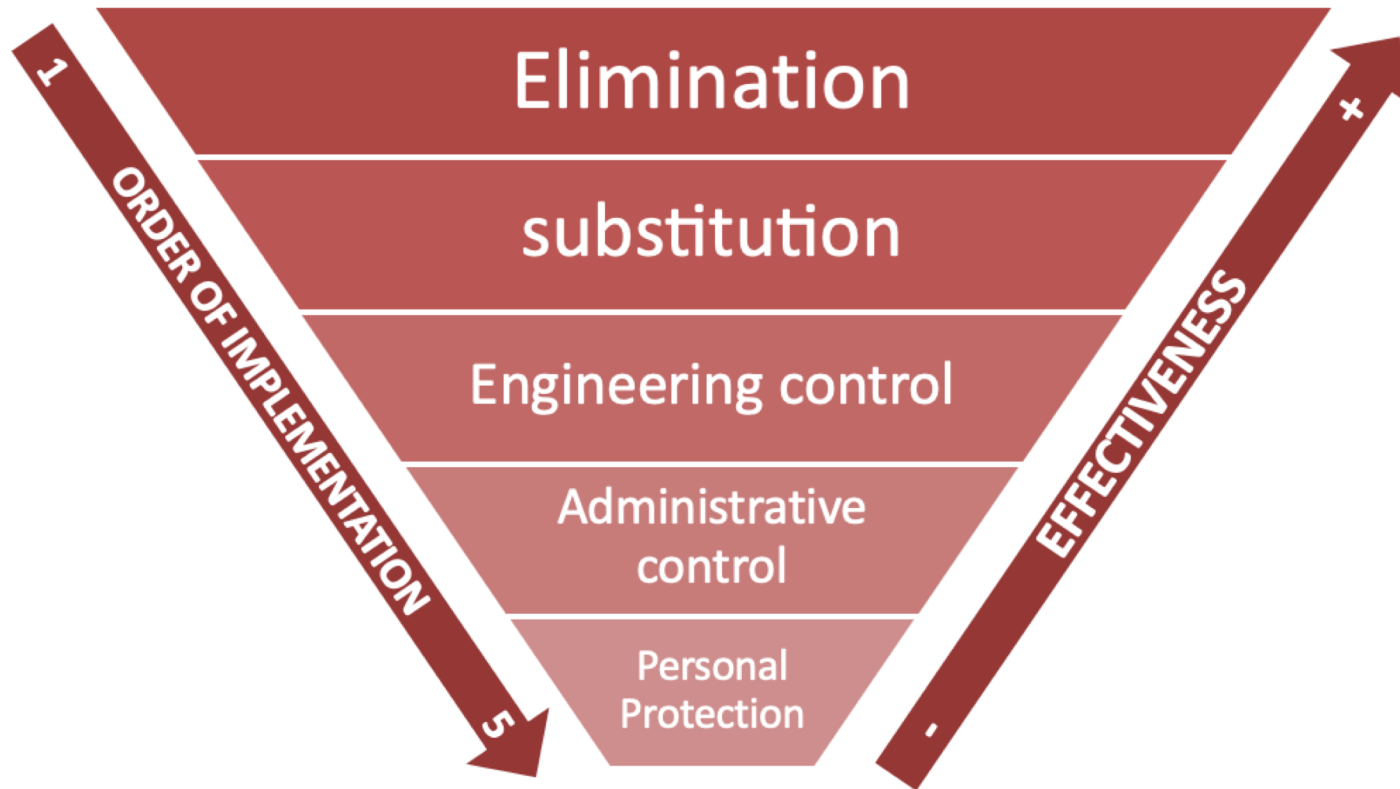
### Examples of Hazard Statements

<b>Code</b>	<b>Physical Hazard Statements</b>
H 200	Unstable explosive.
H 205	May explode in a fire.
H 290	May be corrosive to metals.
<b>Code</b>	<b>Health Hazard Statements</b>
H 300	Fatal if swallowed.
H 319	Causes serious eye irritation.
H 370	Causes damage to organs.
<b>Code</b>	<b>Environmental Hazard Statements</b>
H 400	Very toxic to aquatic life.
H 410	Very toxic to aquatic life with long lasting effects.
H 420	Harms public health and the environment by destroying ozone in the upper atmosphere.

Hazard statements are used on labels and SDSs to alert and inform product users.

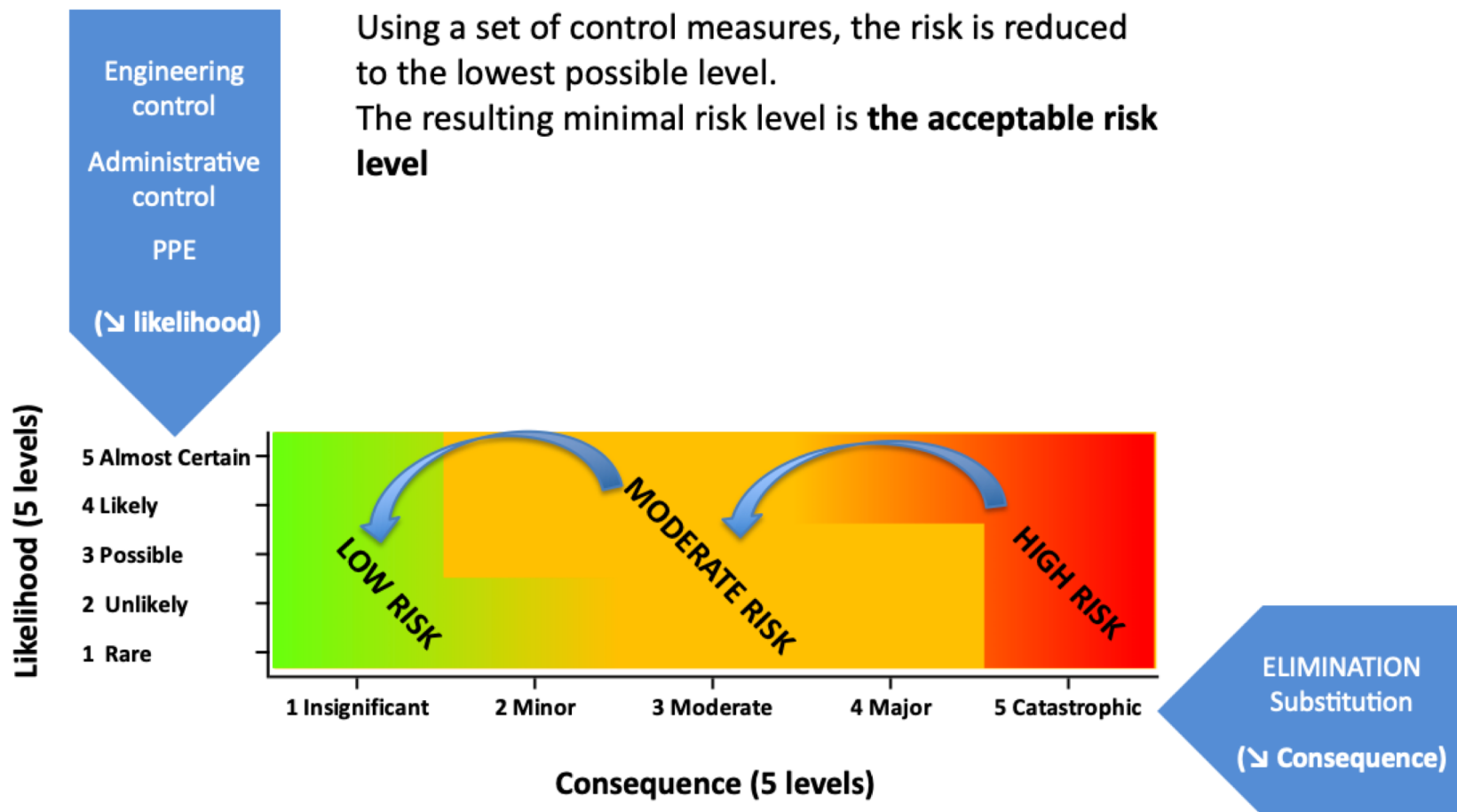
### 3. Risk Management (RM)

#### Risk Management strategies (hierarchy of control measures)



# Risk Management strategies

## Control measures implementation





# Regardless of the risk type

## **Basic safety rules:**

### **Good laboratory Practices (1-4)**

1. A PROPER TRAINING IS MANDATORY BEFORE STARTING ANY WORK IN A LABORATORY
2. Always wear a Lab coat
3. Always wear eye goggles when handling noxious products
4. tie your hair
5. In the laboratory, it is strictly forbidden to :
  - eat or drink (and/or store foodstuff in lab fridges), smoke, apply ones cosmetics or contact lenses,
  - wear jewelry
  - use ones cell phone
  - practice mouth pipetting
  - sniff chemicals or bacteria cultures on agar-plates



# *Regardless of the risk type*

## ***Basic safety rules:***

### ***Good laboratory Practices (5-10)***

5. Obtain the laboratory **director's consent for any work done in the evening or during the weekend.**
6. Follow the institution rule to notify your presence on extra hours at the security department.
7. **Never be alone in high risk level laboratory** (examples: L3-URBM, LARN, UCO, PMR)
8. **Declare any accident / incident / suspect situation** to the lab director and SIPPT
9. Ask SIPPT for an **appointment with the Occupational Medicine** in case of:
  - ***Pregnancy***
  - ***Accident in a high risk level laboratory***
10. **Cleanliness at the end of experimentation:**
  - wash hands
  - clean work surfaces
  - strictly respect the rules for hazardous waste disposal

## On labels / safety data sheets of chemical products, safety statements



**WARNING**

### **Hazard Statements:**

H226 Flammable liquid and vapour.

H302 Harmful if swallowed.

H315 Causes skin irritation.

H411 Toxic to aquatic life with long lasting effects.

### **Precautionary Statements:**

P210 Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

P264 Wash skin thoroughly after handling.

P280 Wear protective clothing, gloves, eye and face protection.

P301+312 IF SWALLOWED: Call a POISON CENTER/doctor if you feel unwell.

P273 Avoid release to the environment.

P302+352 IF ON SKIN: Wash with plenty of water.

P321 Specific treatment (see medical advice on this label).

P332+P313 If skin irritation occurs: Get medical advice/attention.

P362 Take off contaminated clothing.

P501 Dispose of contents/container in accordance with national regulations.

**Precautionary statements could include recommendations regarding**

- **Personal protection**



- **Containment of volatile material in a chemical hood**

Follow the institution rule to notify your presence on extra hours at the security department.

*Example for chemical waste*



***Follow the chemical waste disposal Guidelines.***  
***Example:***

**In case of doubt**, your contacts are:

- The **safety coordinator of your lab/department** (see list on last slide)
- The **laboratory waste manager** (Thierry Mayenne SIPPT, 5349)



## 4. Management of laboratory accidents

*Regardless of the risk type,  
please memorize your  
**emergency telephone numbers***

**112** *if no answer, call 5000*

Mention your location (i.e. building and room number)

Inform SIPPT: 081/72 5342 – 5340 – 5341

***YOU MUST LEARN THE FOLLOWING BASIC DEFINITIONS AND PRINCIPLES  
BEFORE STARTING YOUR WORK IN THE LAB :***

***An ABNORMAL SITUATION:*** is any situation that attracts your attention as it could lead to an incident or accident (such as, the laboratory door left open the night or the observation of non-authorized persons near the facility)

***An INCIDENT:*** is a sudden exposure to a risk without immediate perceptible effect, but with the potential to lead to postponed effect on the worker health, public health or biodiversity. Examples: an electric breakdown as you handle a harmful volatile compounds in the fume hood, the splashing of a culture of pathogenic organisms on the laboratory ground or the accidental short exposure to ionizing radiation. Each of these event could lead to health problem (tumors, infections, ...)

***A MINOR ACCIDENT:*** is a sudden exposure to a hazard, with an immediate effect that can be managed with a first aid kit, preferably with the help of a UNamur rescuer (see below how to find him or her)

***An ACCIDENT:*** is a sudden exposure to a hazard, with an immediate effect necessitating the intervention of the emergency services or an immediate visit to a medical center or at the work medicine service.



*In case of MINOR ACCIDENT*, call UNamur rescuers present in your research unit for first aid. A square sticker “secouriste” is showed on her / his office door.



**IN CASE OF INCIDENT**

**or**

**OBSERVATION OF ABNORMAL SITUATION**

**fill out the notification form available on the SIPPT website:**

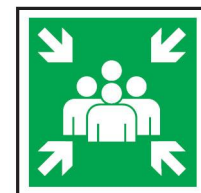
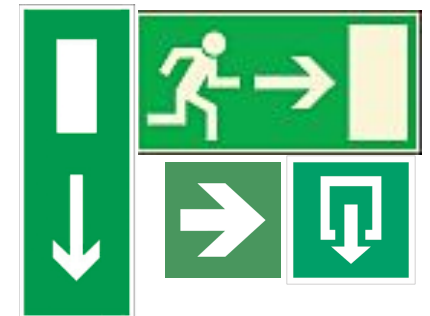
<https://www.unamur.be/services/sippt>

[sippt@unamur.be](mailto:sippt@unamur.be)



## CONDUCT IN CASE OF FIRE ALARM - *NEVER IGNORE A FIRE ALARM!*

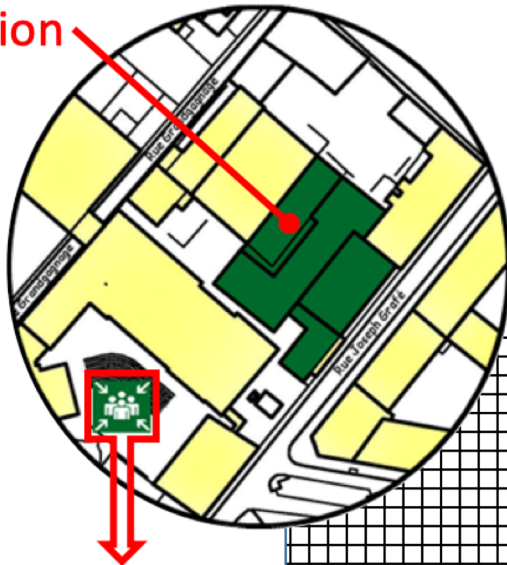
1. Your first reaction should be alert the people around you and go.  
***LEAVE YOUR WORK UNFINISHED WITHOUT SECOND THOUGHT ABOUT YOUR SCIENTIFIC PROGRAM OR THE COST OF THE EXPERIMENTAL PROCEDURE***
2. Act immediately but try to stay calm.
3. **Do not waste time getting dressed or searching for valuables.**
4. **Do not attempt to extinguish a fire unless you are trained to do so.**
5. If heat and smoke come in, slam the door tightly, stuff clothing, towels, or newspapers in the door's cracks to keep smoke out, and use your alternate way out.
6. If the hallway is clear of smoke, walk in a calm manner to the nearest fire exit and evacuate the building (**follow instructions of green pictograms**).
7. **Use the stairs – NEVER use elevators.**
8. Close doors as you leave to confine fire as much as possible.
9. If the alarm is not already sounding, pull the fire alarm on your way out of the building. If there is no alarm to activate, yell “fire” as you leave.
10. **Move quickly to emergency assembly point.**



## Learn how to read an emergency plan in case of accident

### EVACUATION PLAN – Building name - Floor

Laboratory  
Position



Emergency  
assembly  
point

#### LABORATORY PLAN:

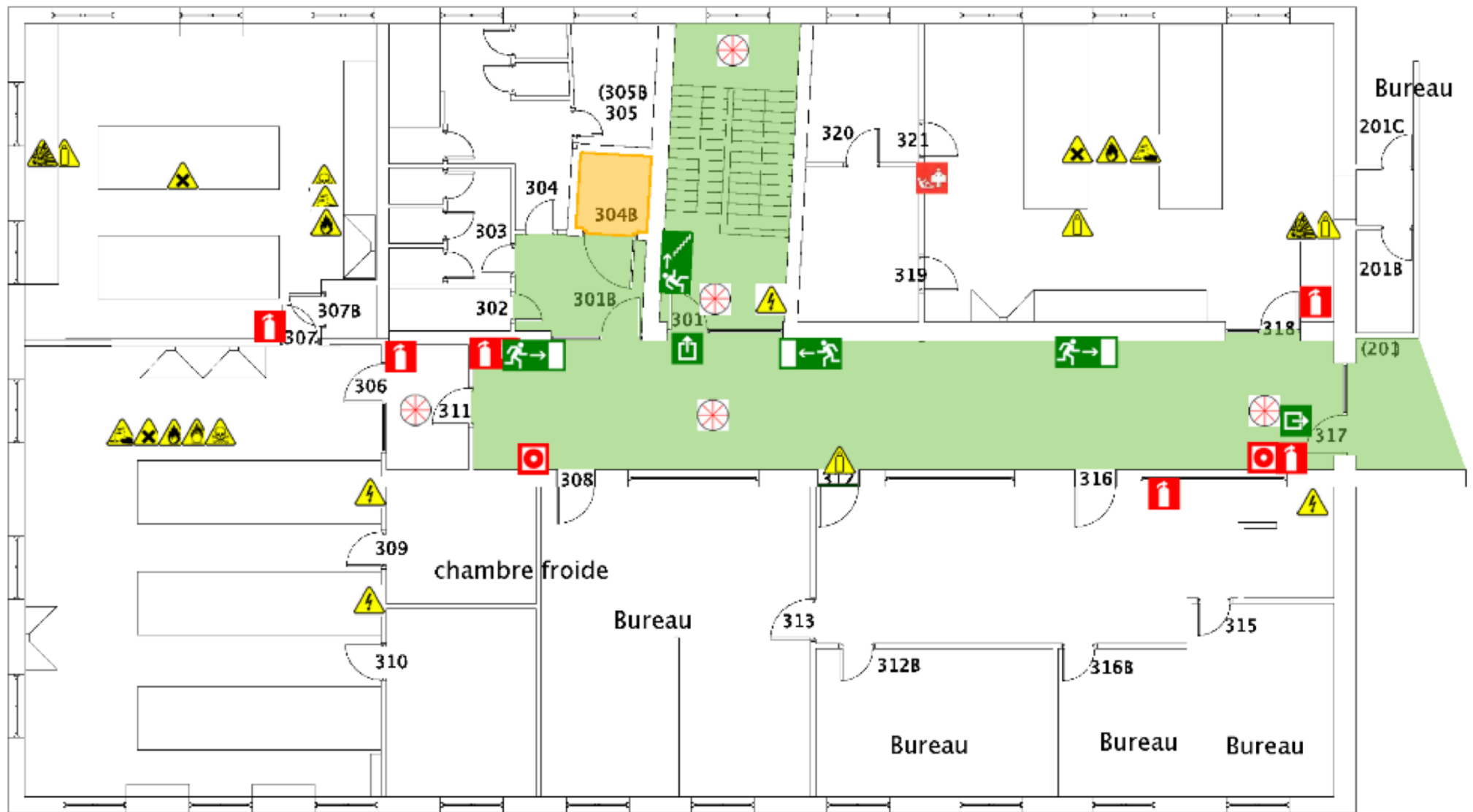
- Hazard pictograms
- Emergency exits and routes
- Fire safety signs

Rules to be complied with  
in case of ALARM ringing

Rules to be complied with  
in case of FIRE

Rules to be complied with  
in case of ACCIDENT

## Example of laboratory plan



# Contact Persons:

## **Radioprotection and Dangerous waste**

Thierry Mayenne (SIPPT) – [thierry.mayenne@unamur.be](mailto:thierry.mayenne@unamur.be) - 5349

## **Chemical Risk**

Steve Lanners (Chemistry Dpt, UCO) – [steve.lanners@unamur.be](mailto:steve.lanners@unamur.be) - 4539

## **Biological Risk**

Suzanne LORET (SIPPT) – [suzanne.loret@unamur.be](mailto:suzanne.loret@unamur.be) - 4467

Research Unit / Department	NAME	Forname	email	tél ( 081 72)
Physiology (MED)	BOTTON	Olivia	olivia.botton@unamur.be	4238
LabCeTi (MED)	DE GLAS	Valérie	valerie.deglas@unamur.be	4229
Anatomy (MED)	MAIRESSE	Samuel	samuel.mairesse@unamur.be	4302
Chem. Physiology / Biomedicine Dpt (MED)	TEVEL	Virginie	virginie.tevel@unamur.be	4233
Animal Facility (MED) / Biology - URBE (SCI)	LEONARD	Amelie	amelie.leonard@unamur.be	4336
Biology - URBC (SCI)	FATTACCIOLI	Antoine	antoine.fattaccioli@unamur.be	4323
Biology - URBM (SCI)	WAROQUIER	Mathieu	mathieu.waroquier@unamur.be	4420
Chemistry - CMI (SCI)	CHARLES	Valérie	valerie.charles@unamur.be	4574
Chemistry - Teaching Unit (SCI)	PIERARD	Sarah-Davina	sarah-davina.pierard@unamur.be	4525
Chemistry - UCO (SCI)	BARBERA	Giuseppe	giuseppe.barbera@unamur.be	4545
Physics - LARN (SCI)	TABARRANT	Tijani	tijani.tabarrant@unamur.be	5493
Physics - PMR (SCI)	BROWET	Olivier	olivier.browet@unamur.be	4584
Veterinary Medicine / URVI (SCI)	WIGGERS	Laetitia	laetitia.wiggers@unamur.be	4419