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Occupational and Environmental Health

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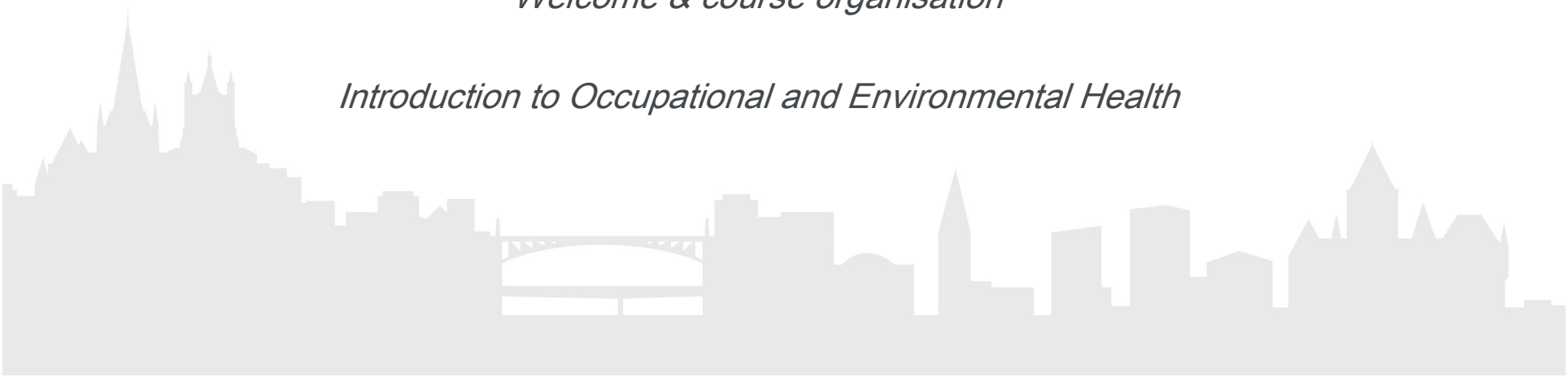
Welcome & course organisation

Introduction to Occupational and Environmental Health



Unisanté

- About 900 employees
- All public health and community health activities in Vaud
- Affiliated to the University of Lausanne

DSTE

- Applied research, education
- Specialized medical consultations
- Services to companies
- Hygienists, toxicologists, chemists, environmental engineers, biologist, ergonomists, physicians, psychologists…

Course outline

Overview of Health Risks by categories

- Chemical substances
- Physical agents
- Physico-chemical agents
- Biological

Specific topic

- Climate change and health
- Health interventions
- Indoor air quality

Course program SIE EPFL 2025						Exercices	Theory
08.09	15.09	22.09	29.09	6.10	13.10	20.10	27.10
Intro	Chemicals - properties	Public holiday	Chemical - intake, toxicology	Chemicals - assessment and control	Physico-chemical - particles and fibres	Public holiday	Physico-chemical - particles and fibres
				presentation	presentation		presentation
03.11	10.11	17.11	24.11	01.12	08.12	15.12	
Biological risks	Physical agents - noise and vibration	Physical agents - thermal	Physical agents - non ionising radiation	Physical agents - extreme environnments	Climate change and health	Health risk inteventions	
presentation	presentation	presentation	presentation	presentation	presentation		

What will I learn ?

- To understand the **health impacts** of some environmental determinants
- To be able to identify **hazardous situations** associated with environmental pollutants
- To be familiar with how occupational and environmental risks **are quantified** and managed

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Introduction
Occupational and Environmental Health (OEH)

Context of OEH

Issues at stake

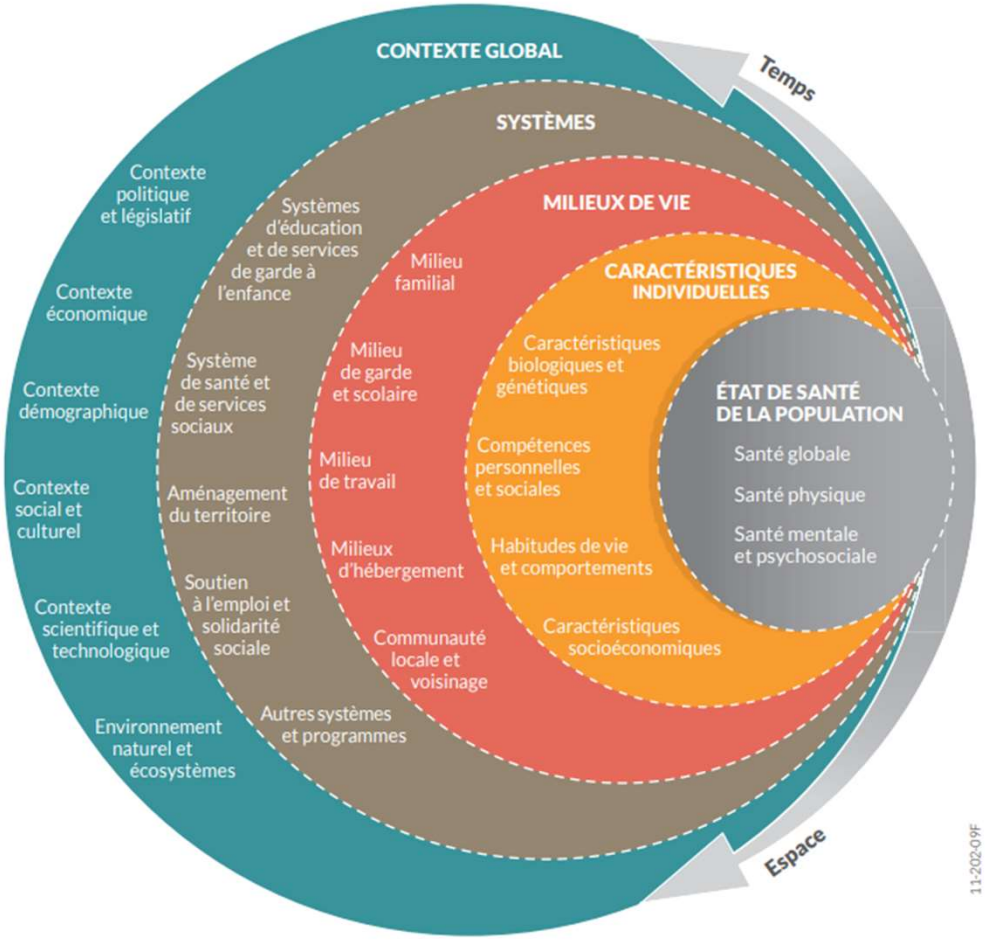
Legal and organizational framework

Risk assessment

Context

Concept of health determinants

- scope of health determinants across global, systemic, living environment, and individual levels
- Environment(s) is a key determinant of health
- **Public health engineering,** applies engineering principles to reduce health risks (through primary prevention)



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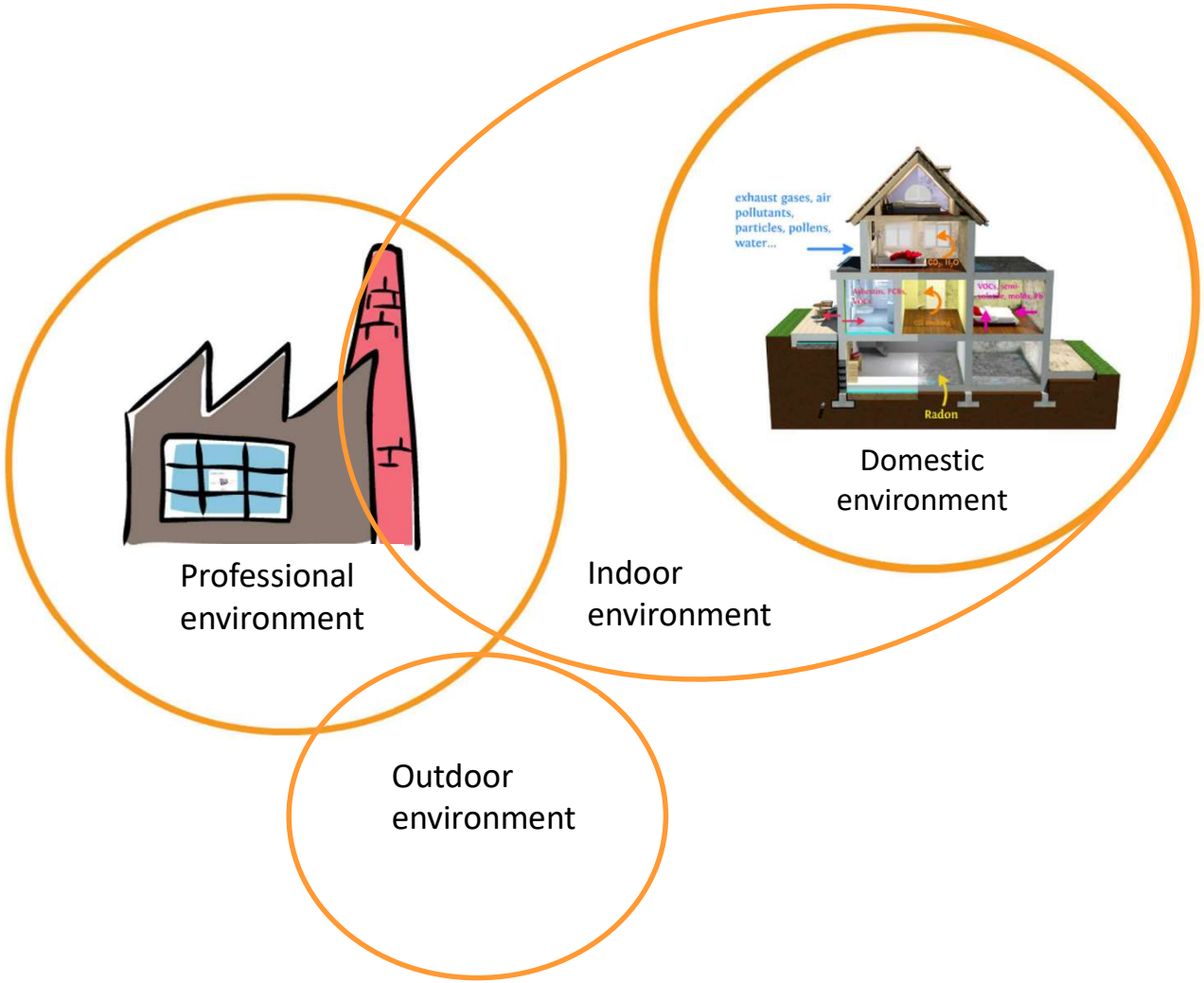
Source: INSPQ

Context

Our living environment

Where do we spend our time ?



Question

Can you give example of exposure situations in each domains ?

Context - Definitions

Occupational health

Occupational Health is the promotion and maintenance of the highest degree of **physical, mental and social well-being** of workers in all occupations by preventing departures from health, controlling risks and the adaptation of work to people, and people to their jobs.

WHO/ILO 1950

Environmental health

Those aspects of the human health and disease that are determined by **factors in the environment**. It also refers to the theory and practice of assessing and controlling factors in the environment that can potentially affect health.

WHO 1989

Context - Genesis of OEH

460-380 av JC

Hippocrate

Lead poisoning of miners and metalworkers.

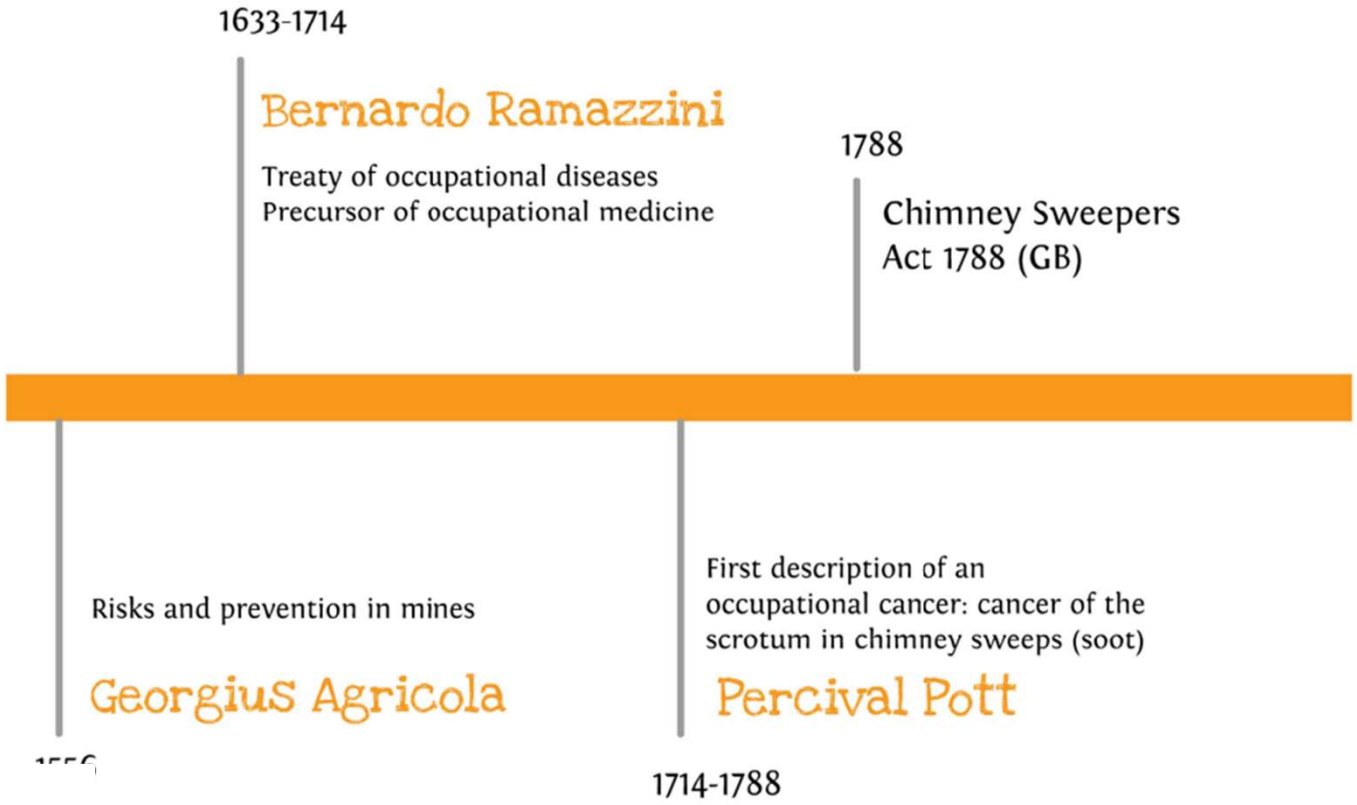
Air quality in the environment.

23-79 ap JC

Pline l'ancien

De historica naturalis
(sheepskin bladder to protect against lead fumes)

Context - Genesis of OEH



Context - Genesis of OEH

1822

Philibert Patissier

Treaty of the diseases of the craftsmen and those which result from the various professions, according to Ramazzini
First modern vision of occupational hygiene.

1869-1970

Alice Hamilton

Investigated the effects of working conditions and chemical substances on the health of miners (Hg, Pb, organic solvents, Ra).
Established the first precise causalities between exposure and effect.
Created a research team at the University of Harward under the name of Industrial Hygiene.

1962

Rachel Carson

The silent spring
a pioneer in the concept of environmental health.

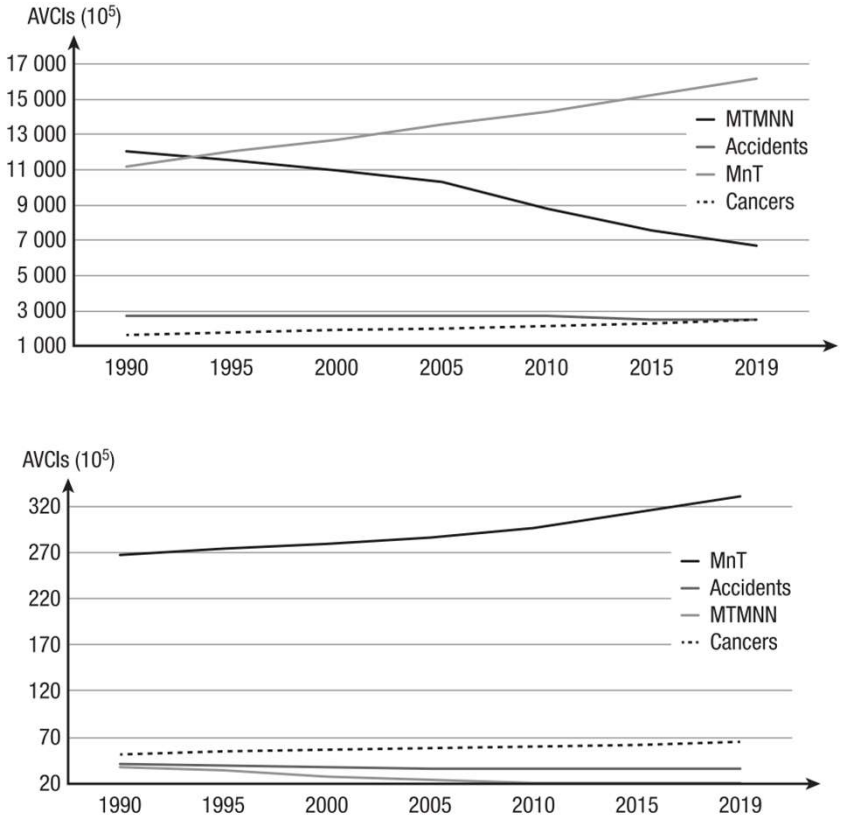
Context – Evolution of public Health

- Public Health 1.0 (Late 19th - Mid 20th Century): Focused on environmental hygiene and combating infectious diseases (antibiotics, vaccines).
- Public Health 2.0 (Late 20th Century): Established dedicated organizations, essential functions, specific competencies, and performance standards.
- Public Health 3.0 (Current Expansion): Broadens action beyond health organizations to other sectors. Orchestrating intersectoral responses and partnerships to influence environmental, social, and economic determinants.

Context – Evolution of public health

- Public Health: Emergence of concepts like "Medicine 4.0" and "Precision Public Health," integrating digital advancements (connected objects, big data) and genomics

Evolution of the burden of disease (in DALYs): a. Worldwide, b. OCDE countries

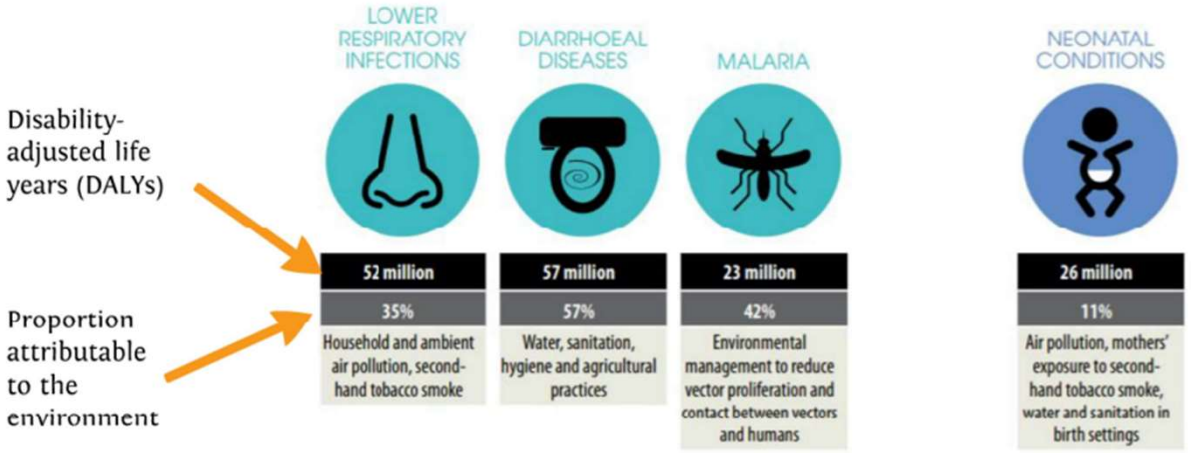


Source: environnement et santé publique (2023)

Issues at stake

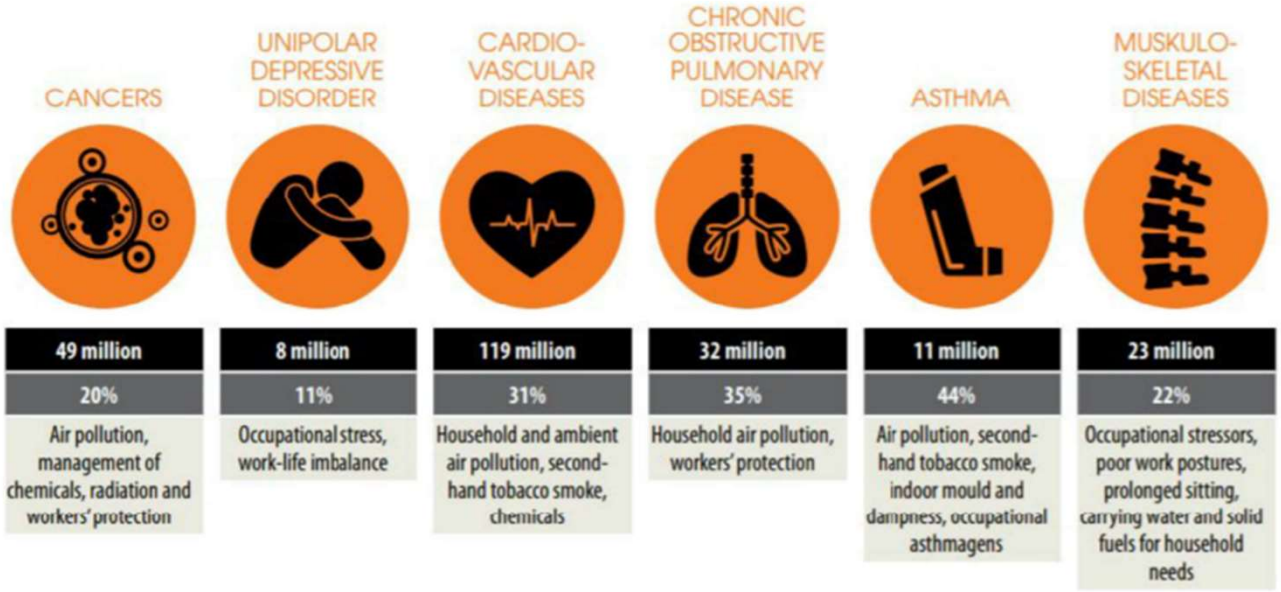
Environment - Burden and health impacts

- 24% of all death are related to the environment



Issues at stake

Environment - Burden and health impacts



Issues at stake

Occupational health – Risk factors

Traditionals

Chemicals
Gases, vapors
Mists, aerosols
Physical agents
Noise, vibrations
Temperature, humidity
Radiation
Accidents, safety
Ergonomics of workstations

Emerging

Work organization
Psychosocial factors
Repetitive movements
Biological agents
Physical effort
Night work and flexibility
etc.

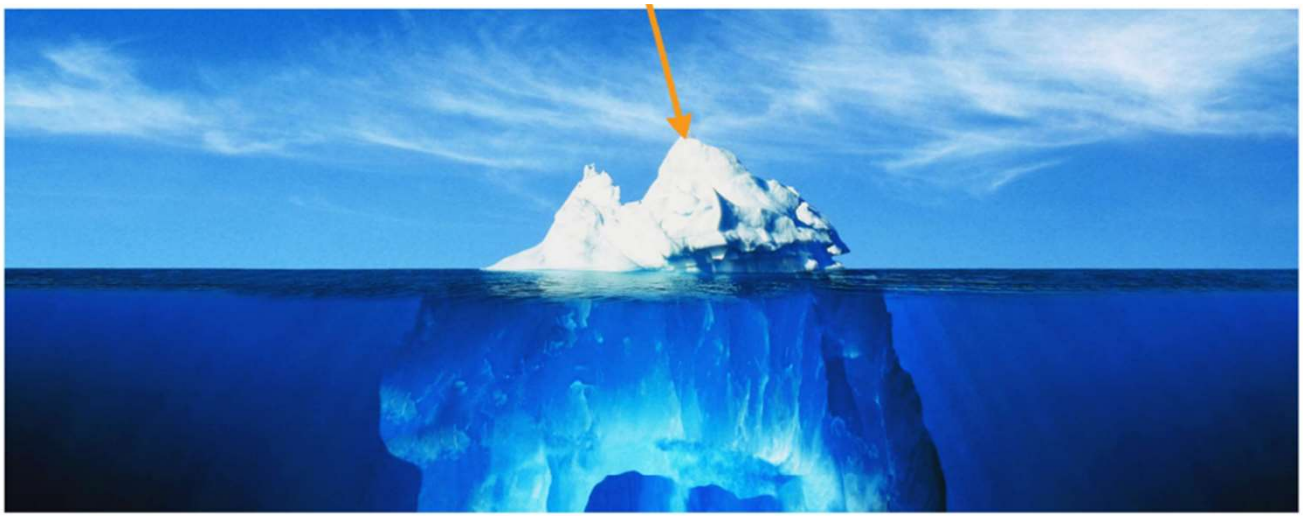
Issues at stake

Occupational health – Impact

- Active population 5.07 Mio
- Accidents leading to work interruption
- Predominance of skin and respiratory diseases

Occupational diseases and accident recognized/year in Switzerland (2022)

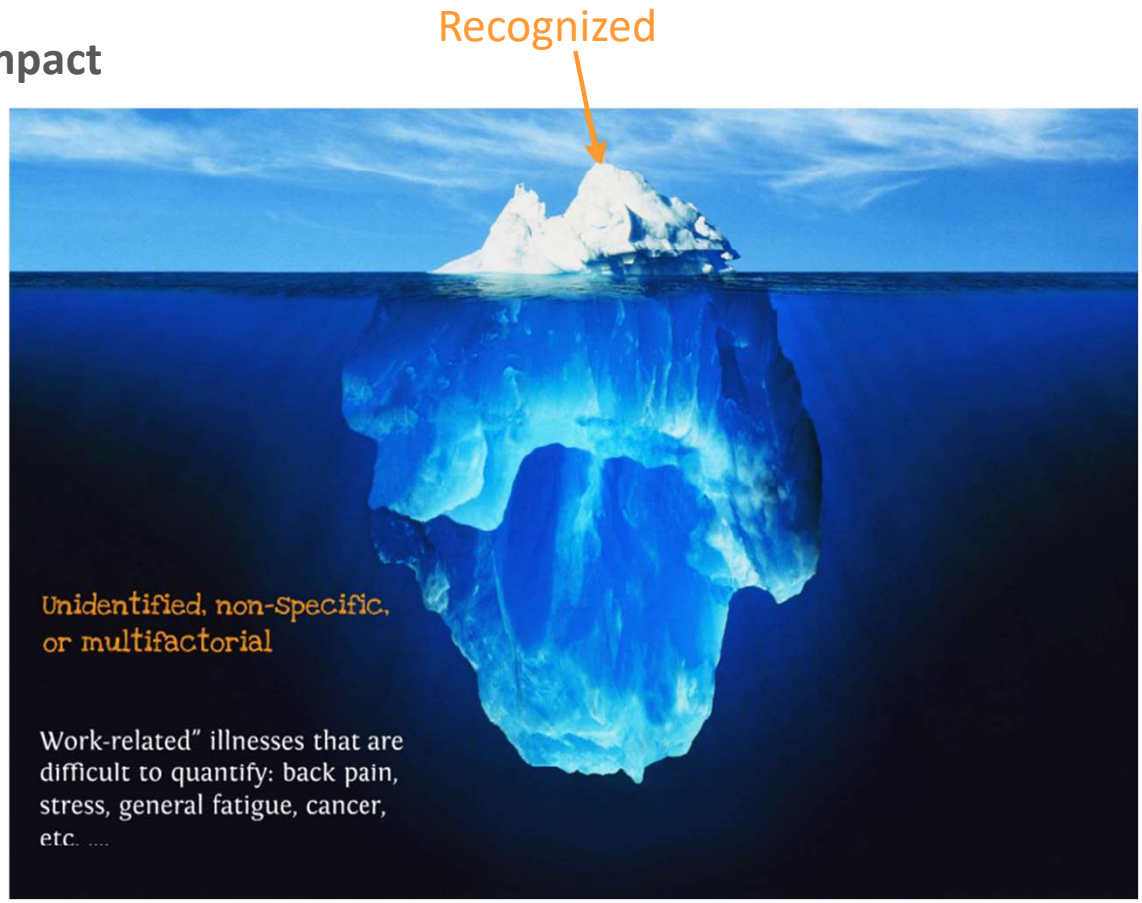
293’132 accidents
14’251 diseases
2’287 diseases (excluding infections)
534 deaths



Issues at stake

Occupational health – Impact

Under-recognition phenomenon



Question 1.a

Can you imagine situations leading to under-reporting of occupational injuries ?

Issues at stake - solution

Question 1.a

General comment

- While, the possible link between diseases and occupational exposure may not be identified (occupational history not taken, few occupational physicians, link not known or poorly documented), the causal link for occupational accidents should however be straightforward.
- Occupational accidents are easily identifiable and should therefore be reported in full.

Marginally, one can imagine circumstances in which accidents are not reported

- When the absence of accidents can lead to substantial benefits (e.g. employer's bonus) it is possible that "light" accidents are not always reported.
- “out of work” accidents, that are not identified as occupational. Unclear boundaries between private and professional life (e.g. travel between work and home)

Issues at stake

Occupational health – impact (perceived)

- > 30% of European workers declare that work affects their health
- Prevalence of EU workers exposed >25% of the time

Traditional risks still present, little change over time

	2005	2010	2015
Proportion of workers in EU28 exposed one-quarter of the time or more (%)			
Vibrations from hand tools, machinery	24	23	20
Noise so loud that you would have to raise your voice to talk to people	30	29	28
High temperatures which make you perspire even when not working	25	22	23
Low temperatures whether indoors or outdoors	22	23	21
Breathing in smoke, fumes (such as welding or exhaust fumes), powder or dust (such as wood dust or mineral dust)	19	17	15
Breathing in vapours, such as solvents and thinners	11	10	11
Handling or being in skin contact with chemical products or substances	14	15	17
Tobacco smoke from other people	20	11	9
Handling or being in direct contact with materials which could be infectious, such as waste, bodily fluids, laboratory materials, etc.	9	11	13
Tiring or painful positions	46	46	43
Lifting or moving people	8	9	10
Carrying or moving heavy loads	35	34	32
Repetitive hand or arm movements	62	63	61

European Working Conditions Survey (EWCS 2015)

Issues at stake

Occupational health – Attributable fraction

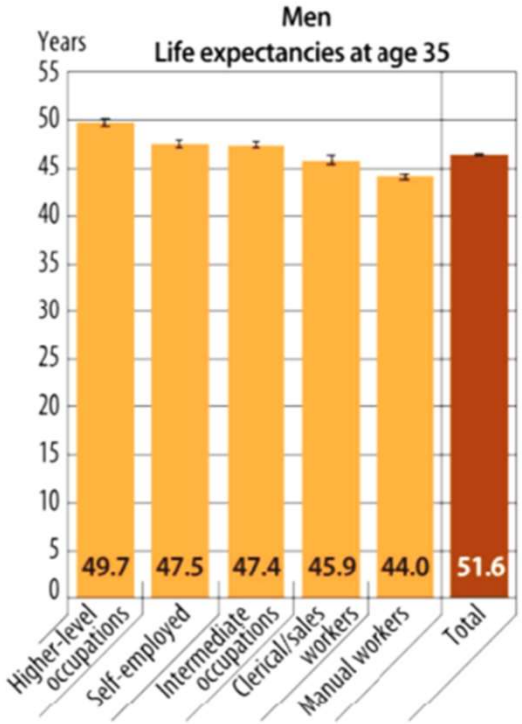
- Lack of indicators, indirect relationships, non-specific diseases, lack of knowledge

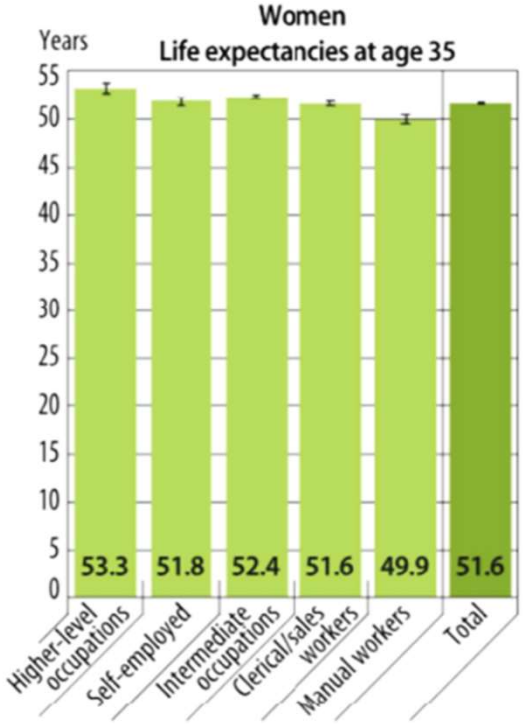
Disease	portion attributable to work
musculoskeletal disorders (MSD)	33 %
cardiovascular diseases	5-20 %
of which night work	7 %
psychological diseases	10 %
cancers (mortality)	4-10 %

Issues at stake

Occupational health – Impact

Life expectancy at the age of 35 (France) per sex and occupational class

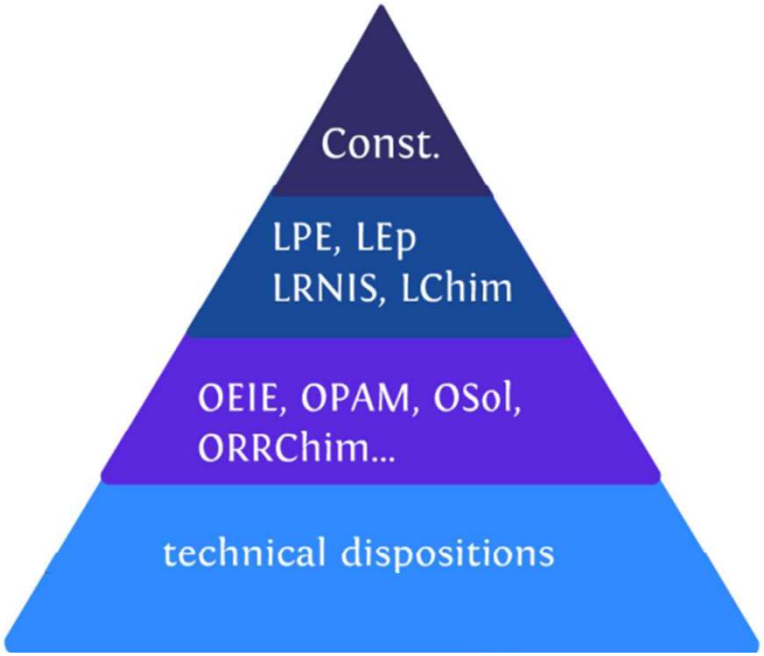




Source: Bonnet et al. 2023

Legal framework (in Switzerland)

Environnement - health related legislation



Legislation (LPE): protection of humans, animals and plants. Conservation of resources and biodiversity

Executive authorities (Federal offices)

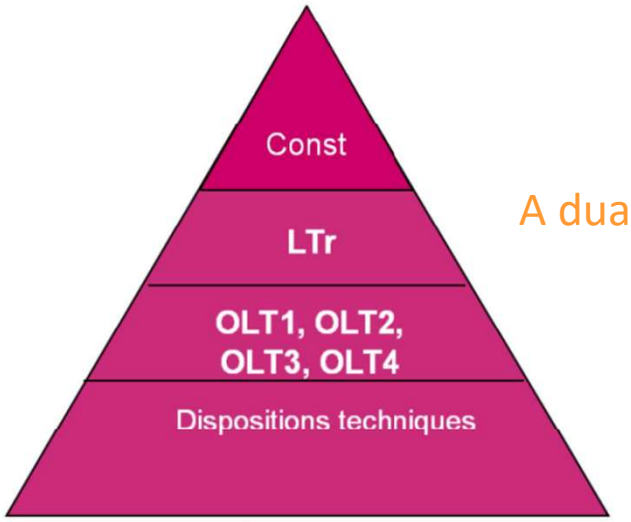
FOEN (environment) soil, water, air, natural hazards, environmental and health protection

FOPH (health): health and accident insurance, chemicals, medicines, health promotion, radiation protection, etc.

Legal framework

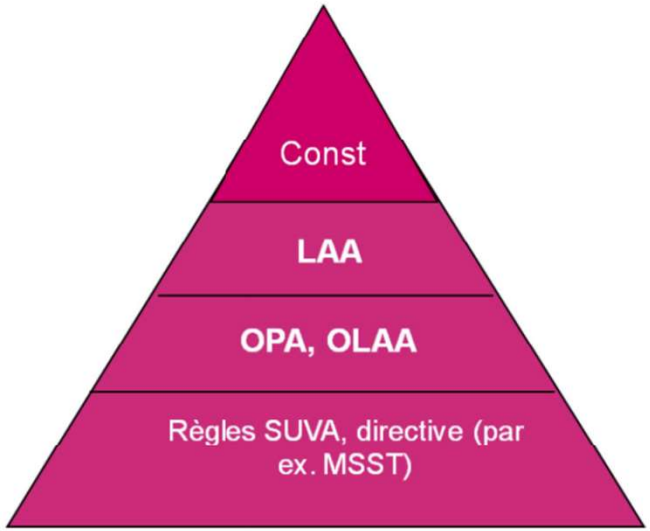
Occupational health – work-related legislation

Labor Law (LTr): Health protection, working hours and rest periods, approval of plans



A dual system

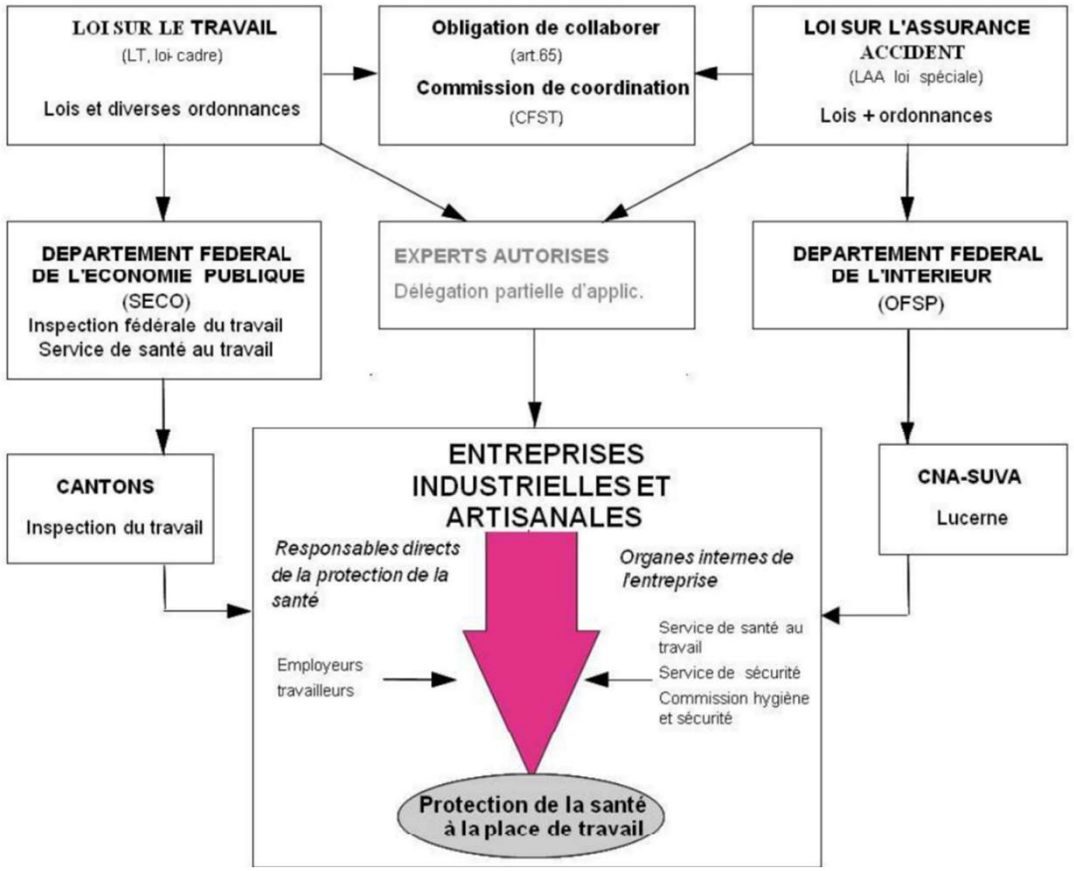
Accident insurance Law (LAA: recognition, prevention and occ. Disesase



Legal framework

Occupational health – organization of the legal system

Common ground: "the employer is obliged to take, in order to prevent occ. accidents and diseases, all measures which experience has shown to be necessary, which the state of the arts allows to be applied, and which are suitable of the given conditions" (Art. 82 LAA).



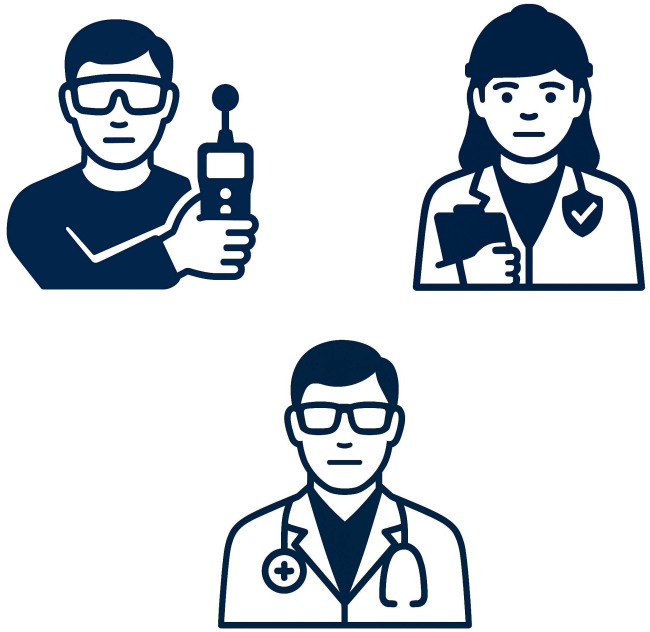
Legal framework

Occupational health – Directive CFST 6508

- Applicable to all enterprises
- Except companies with fewer than 5 workers and subject to a premium rate of up to 5‰
  355'000 entreprises

- Defines the company's obligations in terms of safety organization and the use of specialists.
  Safety engineers/officiers, hygienists, occupational physicians

- Obligations according to the size of the company and the presence of specific hazards
  Solvents or chemicals in large quantities
  Special or industrial waste
  Work with harmful substances according to the exposure limit values at the workplace...



Mandatory call to recognized specialists

Mandatory risk assessment

Legal framework

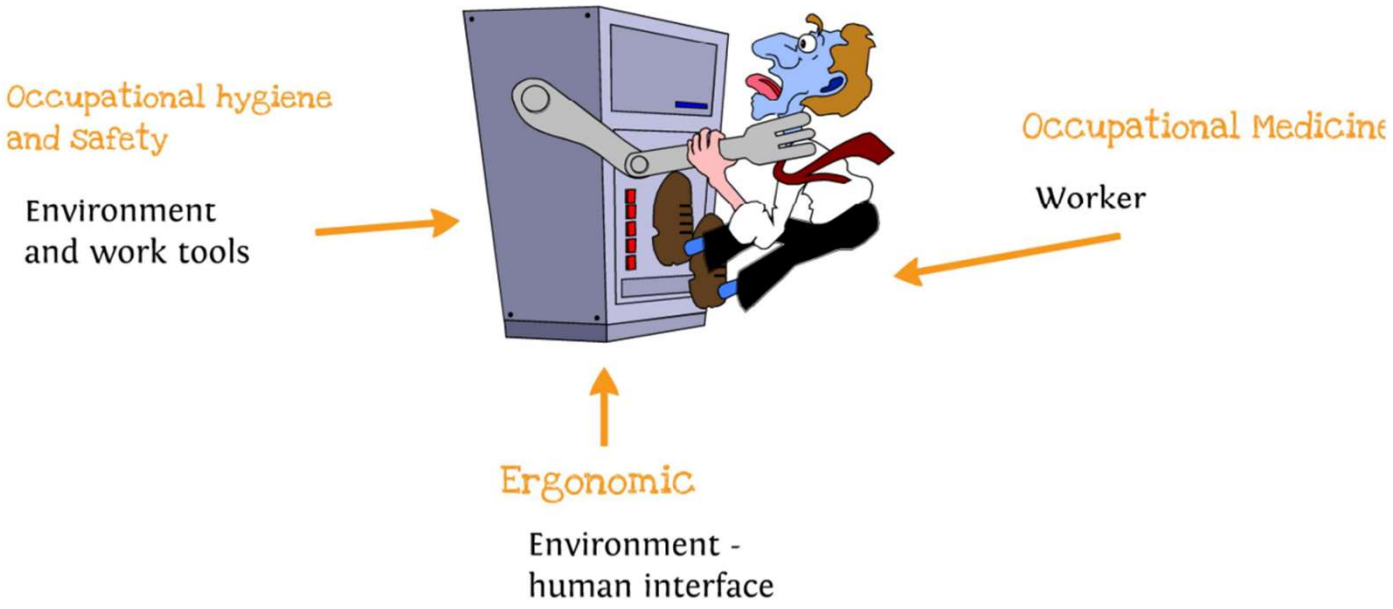
Occupational health – recognition of specialists

- A multi-disciplinary domain
- Recognized specialist covers only a part of it

recognized specialists in occupational health and safety

Legal framework

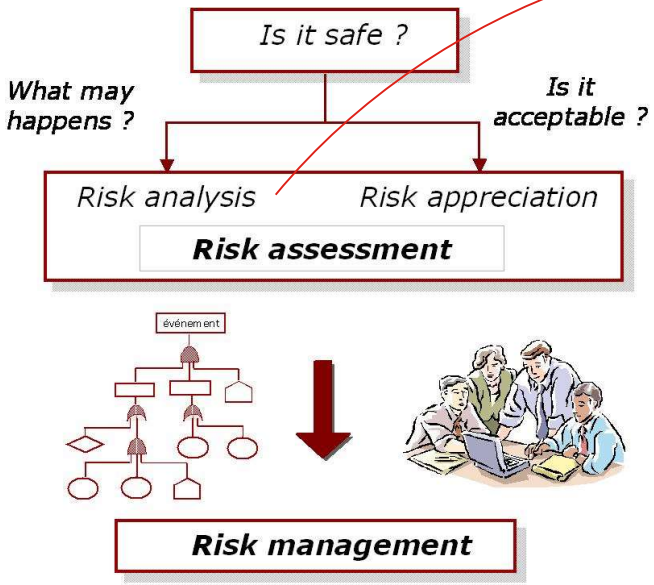
Occupational health – domains of the different specialists



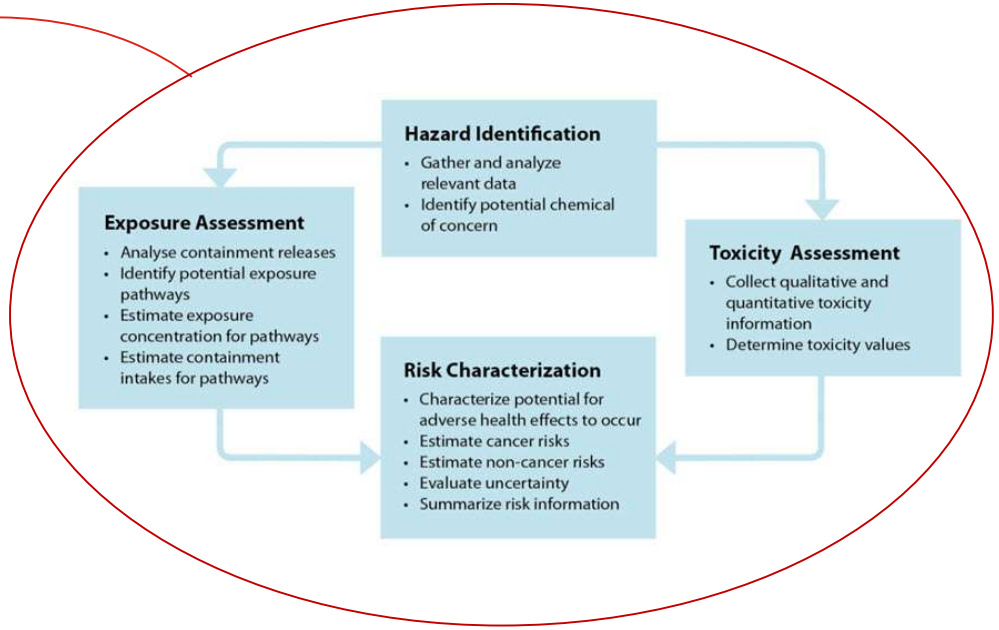
Risk assessment

General framework and principles

Risk management



Risk analysis (chemical risk)



Risk assessment

Example - emergency care facility

Assessment process

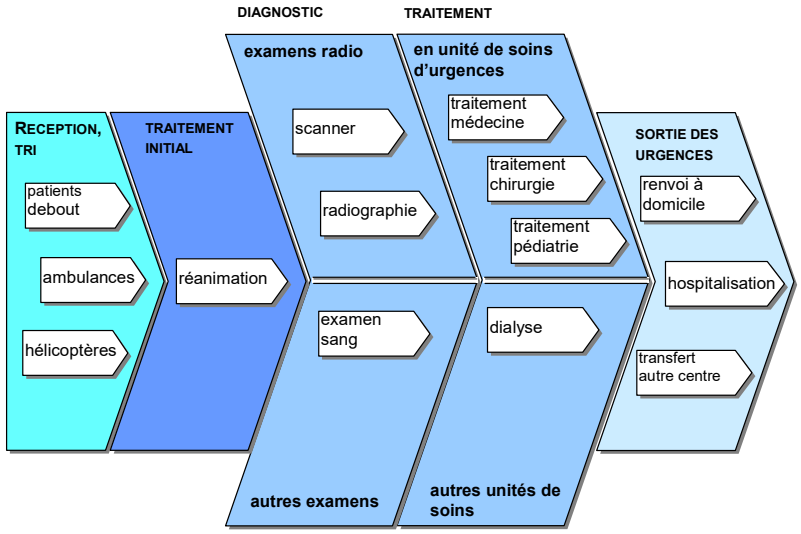
- Delimit the assessment perimeter
- Identify hazards
- Quantify the risk
- Assess the risk

Risk assessment

Example - emergency care facility

Limits

- Activities relating to the treatment of patients



- Included
  - All service personnel
  - All materials and equipment necessary for the care and treatment
- Excluded
  - external staff
  - processes other than the management and treatment of patients

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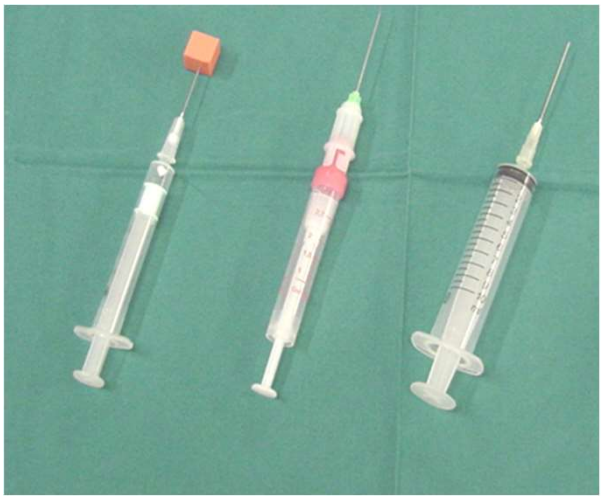
Risk assessment

Example - emergency care facility

Hazard identification

- Mechanical
  moving beds, movement of people, syringes, cuts
- Chemical
  drugs, anesthetic gases, allergens ...
- Physical
  noise, radiation, pressure vessels ...
- Biological
  Pathogens (blood, urine, aerosols ...)
- Mental / emotional
  Difficult situations, assault, travails in emergencies, responsibilities, management by upstream



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Risk assessment

- Moving beds

N°.	Activity	Nr.	Hazardous event or hazardous phynomenon	Damage	quant.		Zone	Comments
					G	P	1-3	
2.4	send to a nursing unit or examination	2.4.2	being cheated on foot	crushing (toe, foot)	IV	B	2	already occurred, beds of 200-300 kg

- Contaminated objects

3.2	patient care	3.2.1	cut with a potentially contaminated object (broken glass, scalpel)	hand cut, viral infection (hepatitis B)	III	B	1	
				hand cut, viral infection AIDS)	I	C	I	low risk of HIV transmission

- Every risk is a study by itself !

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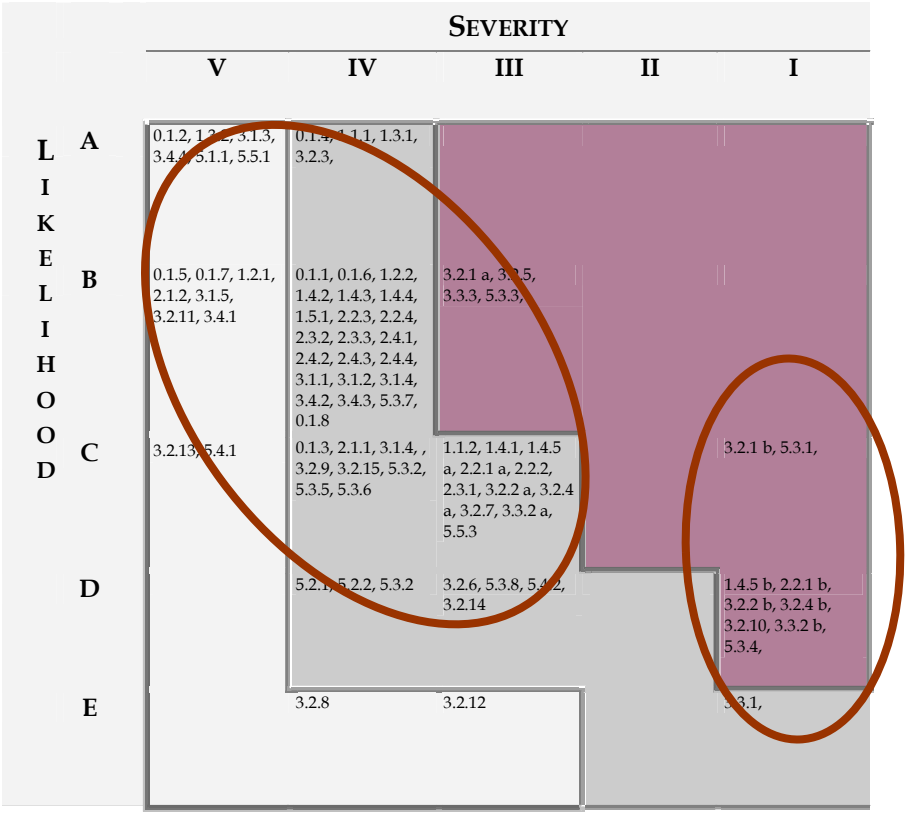
Risk assessment

Example - emergency care facility

- Chronic discomfort, work environment (stress, fatigue, ...)
- Small and frequent accidents (mechanical, assault)
- Serious but rare accidents (contamination)



Question 1.b

How do you rank chronic exposures ?

Risk assessment- solution

Question 1.b

Risk is generally defined as the product of the **Hazard** (potential damage of an adverse event) and the **Probability of occurrence** of this adverse event.

- Hazard ranking is the same for acute events (accidents) and chronic exposure (disease), as it is the defined by the final adverse outcome (mortality, morbidity)
- The probability of occurrence of the adverse event is trickier, since the adverse event is not the exposure to the hazard, but the occurrence of the outcome.

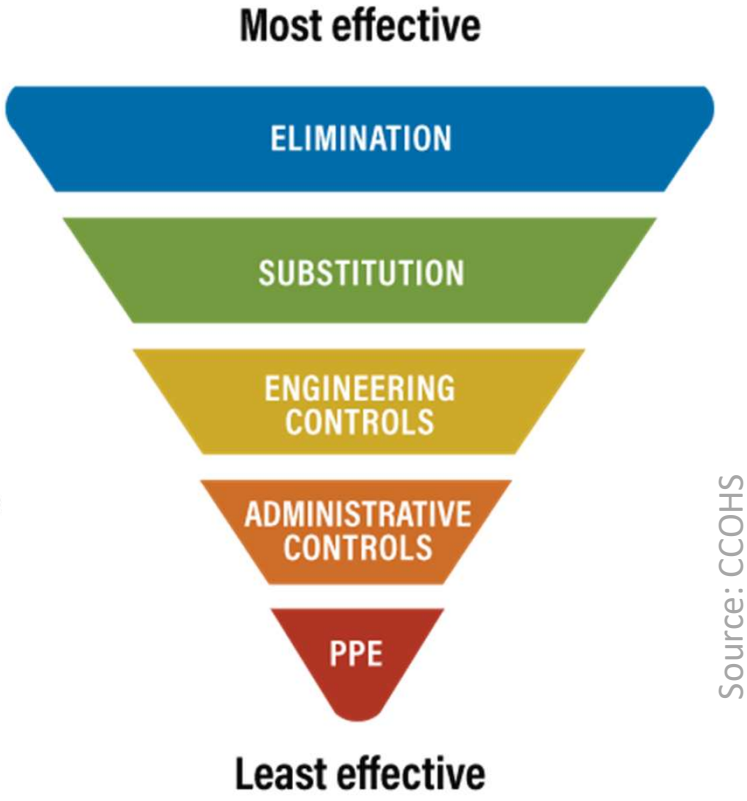
  In the case of a carcinogenic substance, the outcome is the cancer, not the fact of being exposed to a carcinogenic substance
- The notion of **dose** should be used as a surrogate of probability of occurrence, since the increase of exposure dose is associated with an increase of the probability of an adverse response

  the dose "metric" is generally ranked against regulatory or recommended threshold

Risk assessment

Hierarchy of control measures

- Source Control: Elimination, Substitution (replacing dangerous substances), Engineering controls (e.g., local exhaust ventilation, enclosure/containment)
- Pathway Control: General ventilation, engineering modifications, isolation
- Administrative/organizational measures (reduce exposure time, training, information),
- Personal Protective Equipment (PPE) (e.g., respirators, hearing protection)



Source: CCOHS

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Risk assessment

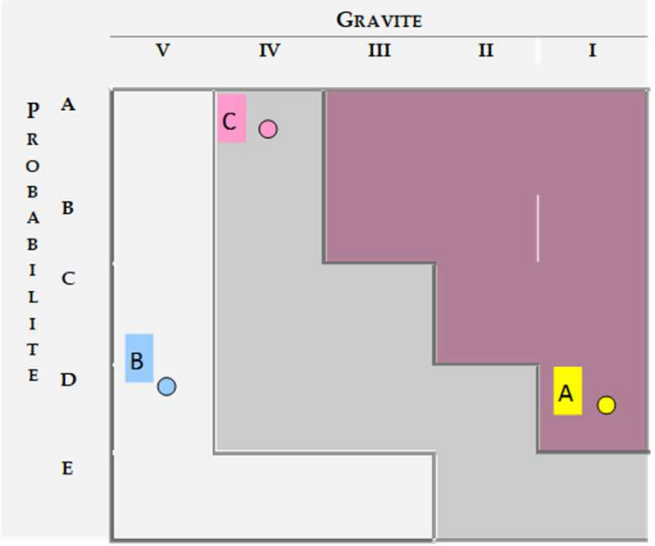
Example – Industrial bakery

- A transportation company and fuel delivery (truck) commissioned an analysis of occupational risks by a safety engineer.

- The risk matrix obtained highlights three main hazards.

Question 1.c

what preventive measures would you recommend and why ?



A getting caught/dragged into the dough mixer

B being exposed to heat (working near ovens)

C slipping on the tiles, risk of falling or hitting a sharp edge (furniture, machines)

Risk assessment - solution

Question 1.c

The proposed measures should have the following characteristics:

Risk A: Priority measure (of a strategic or technical nature) which can significantly reduce the severity or frequency of events (purchase of a new machine meeting stricter safety standards, installation of a protective cover, a contact bar with safety switch, etc.).

- **Risk B**: No measures required. Investments should be primarily reserved for higher risk hazards (A and C). Organizational or individual measures of lower cost can be considered (protective apron against infrared, rotation of activities to reduce the time spent working in hot environments).
- **Risk C**: Economically and technically reasonable measures. Given the acceptance matrix, measures to reduce the severity of damage should be preferred (e.g., protection or removal of sharp edges). Measures to reduce the probability of occurrence will reduce the risk, but probably not get out of the ALARP zone (e.g. anti-slip soles, reorganization of flows to limit travel,...)