

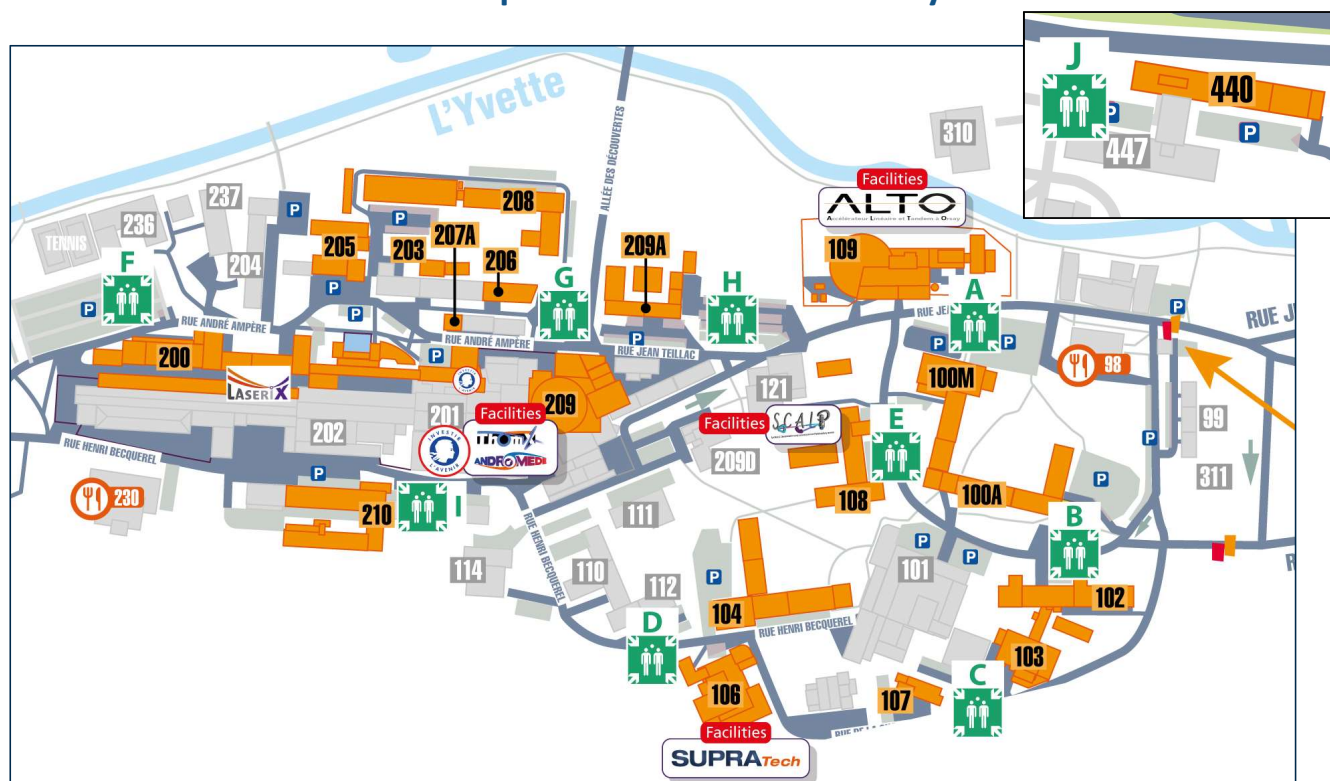
# NOTE OF INFORMATION – IJCLAB SAFETY MEMENTO



This note is a summary of informations relative to the safety of people working at « Laboratoire de Physique des 2 infinis Irène Joliot-Curie (IJCLab) at Orsay ».

It presents the particular risks linked to the intervention to be made, the applicable rules in particular of radiation safety as well as the instructions to be followed in case of incident.

After reading it, it is recommended to keep it with you or near by during your stay in the premises of the Laboratory.



Gathering areas /  
meeting points in case of  
evacuation:

- 100M\*-109 : **A**
- 100A-102 : **B**
- 103\*-107 : **C**
- 104-106 : **D**
- 108 : **E**
- 200-205 : **F**
- 206-208 : **G**
- 209A-209C : **H**
- 210-201A : **I**
- 440 : **J**

*\*: for 100M/103, proceed to B afterwards*

## Radiological risks

### « ALARA » : As Low As Reasonably Achievable

- (1) Any exposure to radiations must be **JUSTIFIED** by an indisputable objective leading to a recognized & validated advantage.
- (2) For a given source of radiations, the values of individual & collective doses must be planned, **OPTIMIZED** and maintained at the lowest possible level considering the available technical conditions.
- (3) No exposure can exceed the **LIMITS** fixed by the regulations for the exposed workers and public.

## Radiations and body

Ionizing radiations can have several origins:

- From materials containing unstable atoms which, in order to return to a stable state, emit particles or radiations (alpha, beta, gamma, X, neutrons) : these are radioactive **SOURCES** (can be in solid, liquid or gaseous state).
- From **electric generators** which produce beams of radiation or particles (X-rays generators, accelerators, cavities, etc.).

Depending the way they affect/reach the body, there are **external exposure** (irradiation, contamination) when the person is standing in the way of the radiation or if the person touches radioactive products and **internal exposure** (inhalation, ingestion, wound) when the radiations are incorporated by the organism.



## Units

**BECQUEREL (Bq)**: the name for the unit of **activity** of a radiation source. It represents the number of disintegrations per second at a given time. It is frequently expressed in kBq (kilo = 1000), MBq (mega =  $10^6$  = 1 million), GBq (giga =  $10^9$  = 1 billion).

**GRAY (Gy)**: the name for the unit of the **absorbed dose**. It represents the quantity of energy in Joules (J) imparted by ionising radiation to a mass unit of matter such as tissue in kilogrammes (kg).

**SIEVERT (Sv)**: the name for the unit of **equivalent dose received by a biological tissue**. It is the absorbed dose by an given organ weighted according to the biological damaging potential of the radiation depending on its nature. It is also the unit of **EFFECTIVE DOSE**: dose equivalent for the **ENTIRE BODY** weighted for the susceptibility to harm different tissues or organs.

## Categories of workers

<b>A</b>	Staff susceptible to be exposed to an effective dose higher than 6 mSv per year or a dose equivalent higher than 150 mSv in the extremities or 15 mSv in the eye lens	20 mSv / year (max limit)
<b>B</b>	Staff susceptible to be exposed to an effective dose higher than 1 mSv per year. Trainees or students over 15 to 18 years old	6 mSv / year (max limit)
<b>PUBLIC</b>	Non exposed staff: not susceptible to be exposed to an effective dose higher than 1 mSv per year	1 mSv / year (max limit)
Particular cases	Pregnant, breast feeding women: consult the medical service before any exposure	
	Exposure limit for an emergency intervention during crisis situation	100 mSv

## Protection from ionizing radiations

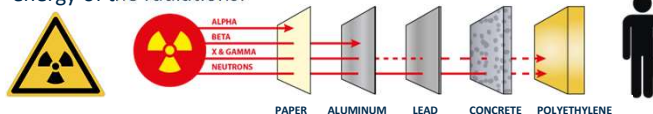
Protection against **internal exposure** is insured by collective means aiming to prevent **spread of radioactive substances** in the laboratory and being in contact with the body (ventilated and confined equipments such as hoods and glove boxes). Those are completed with individual means (lab coat and shoes staying at the premises, gloves, etc.)

Protection against **external exposure** is insured by the 3 following principles:

**REDUCE THE EXPOSURE TIME**: the absorbed dose by the body is directly proportionnal to the exposure time.

**INCREASE THE DISTANCE BETWEEN YOU AND THE SOURCE**: the absorbed dose by the body decreases when the distance between you and the source increases. In cases of photons and neutrons, passing from 1 cm to 1 meter, the dose is divided by 10 000.

**INTERPOSE SCREENS**: it acts like a shield by reducing the absorbed dose according to its material (nature), its thickness, the type, intensity and energy of the radiations.



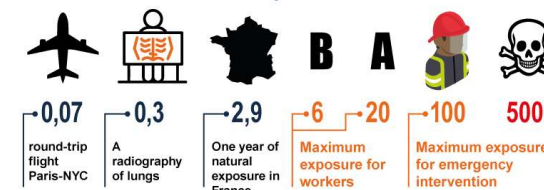
## Delimited areas

	Threshold values (since 2018)
Zone non délimitée (publique)	E < 80 µSv in 1 month
Zone Surveillée bleue	E < 1,25 mSv in 1 month
Zone Contrôlée Verte	E < 4 mSv in 1 month
Zone Contrôlée Jaune	E < 2 mSv in 1 hour
Zone Contrôlée Orange	E ≤ 100 mSv in 1 hour or < 100 mSv mean value over 1 second
Zone Contrôlée Rouge	
Zone d'Extrémités	He > 4 mSv in 1 month
Zone Radon	E > 6 mSv per year (radon activity concentration rate in the air)

E = effective dose

He = equivalent dose at extremities (hands, forearms, feet, ankles)

## Some examples in mSv



## Dosimetry



**Passive dosimetry** or delayed reading: carrying a passive dosimeter is mandatory for classified workers in all delimited areas (zone « surveillée » blue and all the zones « contrôlées »).

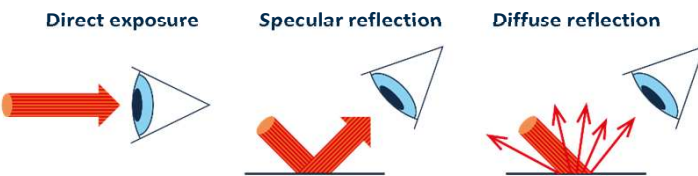
**Active dosimetry** or **operational** with immediate reading: carrying an active dosimeter, delivered by the SPR is mandatory in zones « contrôlées » for classified workers and in every delimited area for any other worker.

## Laser hazards

- Laser are **photons** emission sources in ultraviolet, visible light, infrared zone. Emission is characterized by its wavelength and if continuous or pulsed. According to this, we are interested in nominal power, energy pulse, mean power, duration of pulse, frequency of repetition, etc.

- Because they concentrate a great amount of energy in a very compact beam, we speak about **coherent light** (directivity, low divergence, both temporal and spatial coherence), those **equipements can be very dangerous**.

- The exposures targets are mainly the **eye** (various iris lesions, on cornea, pupil, retina or optical nerve, from temporary lesion to loss of vision according to the exposure type and laser class) and the **skin** (epidermis burns, dermis, subcutaneous tissues).



### Essential precautions

- AVOID EXPOSURE if worst eye is below 4/10 corrected.
- **SUBMIT YOURSELF TO MEDICAL EXAMINATION prior to exposure.**
- AVOID EXPOSURE when carrying contact lenses.
- CONSULT immediatly in case of accident.

### According to laser class

Danger	Class (international classification)						
	1	1M	2	2M	3R	3B	4
EYE : direct vision	OK	*	**	*	!	!!	!!
EYE : specular reflection	OK	*	**	**	!	!!	!!
EYE : diffuse reflection	OK	OK	OK	OK	OK	!	!!
SKIN : burn	OK	OK	OK	OK	OK	!	!!
FIRE HAZARD	OK	OK	OK	OK	OK	OK	!!

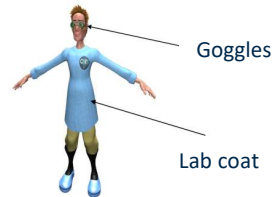
\* : Dangerous if use of optical instruments to look at the beam  
 \*\* : Protection is OK if palpebral reflex (eyelids close in less than 0.25 s)  
 ! : Might be dangerous  
 !! : IS DANGEROUS

## Protections

- **Intrinsic to the device:** enclosures, tubing at the nearest of the source, circuit cutter, shutter, filtering glasses.

- **Collective:** laboratory design and experimental setup, restricted access to habilitated staff only, sas, partitioning, non reflective coating surfaces (matte painting), barriers, curtains, screens, signalling, controls and interlock, emergency stop buttons, emission indicators, laboratory proper lightning, beam below eye level, installation plan or display, written instructions, etc.

- **Individual:** safety glasses or goggles, gloves, lab coats.



- **No jewelry/ reflexion source** (rings, watches, bracelets, necklaces, etc.)
- **Goggles adapted to the laser type**
- **Covering clothes**
- **Non flammable gloves**



There is **no such thing as universal safety goggles**: their type has to be chosen according to the type of operation (setting or protection), wavelength and source characteristics (continuous, pulsed). It is a matter of expertise, of experienced and properly trained users. They protect only for **accidental** and **very short time** exposures. **They must be carefully checked prior to every use**. The smallest degradation (little scratch on the surface) renders them unfit to use or even dangerous.

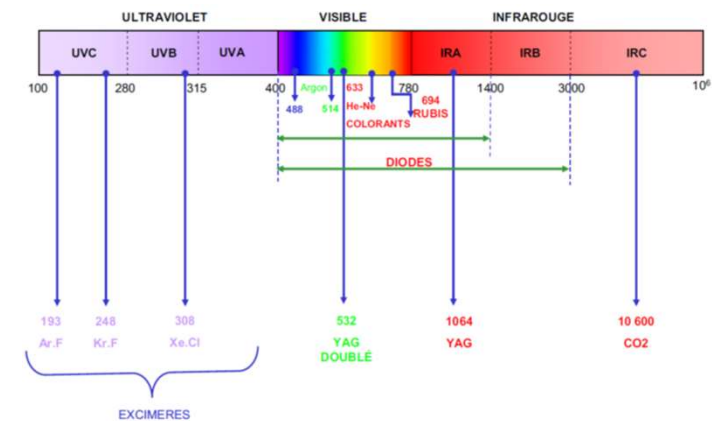
## Associated risks

**Laser use associated risks** could be:

- **Mechanical:** shocks, vibrations while equipment is in function, important amount of material in the laboratory.
- **Electrical:** high voltage power, during maintenances and settings (electrical habilitation).
- **Heat:** energy of the beam causes heating.
- **Cryogenic:** low temperature fluid use.
- **Noise nuisances:** for instance when the cooling system is in function (hearing protection to be used).
- **Physicochemical:** gas, dye product and type of target.
- **Ionizing radiations:** X-rays produced by high voltage.
- **Ergonomic:** the beam must not be at eye level, some workposts can become painful (setups < 1.50 m).
- **Flood:** in case of important leak of the cooling system.
- **Fire:** inflammation, explosion if the beam impacts a dangerous area.

### Laser spectrum

Indicated value is the wavelength in nanometers (nm)





## Other non ionizing radiations (NIR)

**Electric, magnetic and electromagnetic fields (EMF)** are non ionizing radiations: they carry not enough energy in order to eject an electron from an atom or molecule (in opposition to ionizing radiations). Other than optical radiations (lasers), the NIR are characterized by their frequency (frontier between « low » and « high » is at 100 kHz). Static magnetic fields (null frequency) are permanent magnets, electromagnets powered in direct current or more generally DC sources.

EMF can have effect on the worker's health.

**Short term effects** can be:

- **direct**: heating of biological tissues on entire body or localised organ, superficial or deep burn, nervous system stimulation, electrical shocks, etc.
- **indirect**: fire or explosion due to a spark or electric arc, malfunction of electronic devices including active medical devices such as pacemakers, projection of ferromagnetic object, etc.
- **Sensory effects** such as dizziness, nausea, vision troubles, fatigue with no consequence for health can be felt at very low frequencies. Those effects can have consequences on the safety of workers in some conditions. Therefore they should be considered.

**Prevention means** are:

- Identify the source: magnets around accelerator facilities, workshops, welding, induction oven, radiofrequency facilities, WIFI, etc.
- Identify characteristics: frequency, power, duration of emission.
- Prefer devices with protection design included from the conception phase.
- Install electromagnetic shielding (metal sheet or grid connected to the earth of the equipment, faraday cage and/or earth device).
- When operating under high intensity fields, remove all ferromagnetic object from the body (tools, jewelry).
- Ensure proper maintenance of the equipments (door seals, protection device), detect any potential leak.
- Signalling the risk and materialize emission perimeter in order to prevent from any part of the body to enter the area by accident.
- Handle high frequency exposed parts with non metallic tools (wood stick, plastic).
- Increase the distance between the source and the operator.
- Measure the exposure levels with proper equipment (not trivial).
- Exposure is forbidden to any person wearing an implant :
  - \* Active implants (pacemaker, brain valve, hearing aid, etc.): possible implant disruption.
  - \* Passive implants (metallic object such as plate, pin, stent, etc.): possible moving of the implant by attraction or heating by induction.



## Chemical risks

Chemicals products can come in following states: solid (powder, aérosols), liquid (solvents, acids, bases) ou gazeous (acid fumes or other, hydrogen) and present various exposure risks: skin absorption, eye projections or inhalation through the lungs.

**Labels applied on original chemical products MUST indicate the nature of hazard implied:**



Apply a new label on each container when subdividing content of original container.

**Never poure any chemicals in the drain**

One must know/identify the product, and how to interpret the hazard statements (H) and the precautionary statements (P). Read the associated **Safety Data Sheet (SDS)** which indicates main characteristics, associated risks, basic instructions to be followed regarding handling, storage, packaging, transportation, etc. It is mandatory to follow the storage conditions and prevent all possible **incompatibility** between products (carefull - danger), and know how to identify what collective and individual protection means are necessary for handling the product safely: glovebox, ventilated hood, lab coat, covering clothes, specific gloves, protection visor, safety glasses, masks, etc. Contact the SPR regarding the **waste disposal from residues to higher quantities** and empty but **polluted** containers.

## Biological hazard



Follow laboratory specific instructions (gloves and lab coat). Contact Medical whenever unusual symptoms occur. Respect ethical rules in case of animal experimentation (a certificate to do so is mandatory). Careful handling anesthetic products: storage in appropriate and safe location. Keeping track of the stock by the pharmacy manager. Handle wastes according to specific instructions: **never poure in the drain**.

## Electrical hazard



Working with electrical installation requires official **HABILITATION** in relation with the type of work performed (repair, connections, test, etc.) and the voltage level (Low Voltage if > 50 V, High Voltage if > 1,000 V). This certificate is delivered individually by the director of the laboratory or a company responsible after having completed a training course leading to a qualification and its compulsory recycling, at the request of their group leader or responsible.

## Cryogenic liquids / gas under pressure



While decompression, materials in contact with gases may cause severe freezing: carrying of safety gloves is recommended.



In closed areas, presence of inert gas may reduce oxygen proportions. In case of breathing pain, shut the gas bottle down and leave the premises. For repetitive or extended operations, using a device to measure oxygen rate is recommended.



While using gas bottles, check that they remain permanently attached to a fixed point of the building (on the upper 2/3 of their height).

## General risks



**Asbestos**: contact SPR to get informed of the possible presence of asbestos on premises to obtain safety information prior to any work in the area (ground floor, walls, ceilings and any work causing dust).



**Cranes**: do not stay underneath while in use. Do not attempt to use unless properly habilitated.

## General risks (continuation)



### Mechanical risk

Hazardous machines can be used in the laboratories mechanical workshops or on experiment mounting sites.

**Object projection risks:** wear safety glasses.

To prevent of something **been caught by the machine:** no neckless, no bracelet, attach your hair, etc.

Risk of **being smashed:** wear safety shoes whenever you work in the area. To operate the machines, one must be authorized by the proper supervisor.



### Fall on the ground!

No haste nor rush. Make sure to keep clear all the circulations and the premises. It is the most common cause of workplace accidents! Wear safety shoes.

### Watch your back!

Prevent musculoskeletal disorders related to lesions of areas around the joints due to false movements when moving loads, poorly adapted workstations (ergonomics), repetitive tasks.



Use mechanical handling (handling cart, pallet truck, etc.) and if this is not possible, limit loads, use individual protection (helmets, gloves, safety shoes), use the principles of safety and less effort, adopt the right gestures and postures.

**Psychosocial risks** to mental, physical and social health, caused by employment conditions and organizational and relational factors that may interact with mental functioning (stress, harassment, etc.).



**Internal** contacts: supervisor, team responsible, unit manager, human resources.

**External** contacts: prevention doctor, nurse, social service assistant, human resources, staff representatives.



## To access the premises

N° badge 10xxx

In order to enter the laboratory premises at all times, you must detain **an access card** delivered by the SPR. This card is **INDIVIDUAL** and **BY NAME**. It must **not be borrowed, lent nor used to give access to another person**.

The card **must be returned** to the SPR before leaving the premises.

### Identify a trained rescuer



Some colleagues are trained rescuers (french acronym is SST): they master first aid and have access to a first aid kit. They have a sticker like that on their office door. IJCLab rescuers (SST) list is displayed on walls of common areas or in circulations and is frequently reported by the SPR.

### Using a defibrillator



#### Apply basic survival chain:

- Person is not conscient, **call immediately for help: 15, 18 or 112** and a trained rescuer (SST).
- Person does not breathe, **practice cardiac massages** 100 or 120 compressions per minute.
- Use the **electric standalone defibrillator** and let it defibrill when it decides (do not touch the victim when the diagnosis is in progress).
- Continue the treatments (massage & defibrillation) and follow the defibrillator's instructions until help arrives.

**Location of electric standalone defibrillators:**  
Ground floor in buildings 102, 106, 109, 200, 440  
First floor in building 210

## In case of fire - Don't panic

### OPERATE THE NEAREST FIRE ALARM AND FOLLOW THE INSTRUCTIONS « IN CASE OF EMERGENCY »



If you are properly trained and feel fit to it: use appropriate extinguisher towards the base of the flames (water + additive, CO2, powder, etc.).



Ignited clothes: prevent the victim from running and wrap him/her with a blanket.



Proceed through smoke bending towards the floor with a handkerchief on mouth and nose (the air is cooler at ground level).



Never use elevators.



Leave the premises upon alarm tone signal to the meeting point of your building: **refer to mini-map of this document**.



Close doors and windows while leaving.



Follow evacuation path towards meeting point.



Assist disabled persons when needed.



Follow the instructions given by the people in charge of the evacuation.



**DO NOT LEAVE THE MEETING POINT OR RETURN IN THE PREMISES BEFORE BEING INVITED TO DO SO BY THE PEOPLE IN CHARGE OF THE EVACUATION.**

## Some advice


### ALWAYS

- Prefer collective protection means: screens, ventilated hoods, gloveboxes, barrier gestures, fire detection, extinguishers, railing, etc.
- Use individual protection means if necessary: helmet, safety glasses or goggles, auditive protection, lab coat, gloves, safety shoes, etc.
- Wear appropriate working clothes (again lab coat, gloves, glasses, etc.).
- Wear safety shoes while moving heavy loads.
- Follow carefully all applicable instructions in the premises (for instance instruction to be followed in case of fire alarm).
- Respect all signalling and their meaning at the entrance of laboratories or facilities.
- Respect particular instructions in specific working places.
- Use specific equipment only AFTER being properly trained to do so.
- Work in hazardous areas only within opening hours.
- Read labels carefully before using chemicals.
- Use adequate ventilation systems (ventilated hoods, aspiring arm or duct, etc.).
- Carry your personal dosimeter(s) at all time while working in delimited areas.
- Let your colleagues know about your attendance in hazardous areas.
- Refer to medical service in case of unusual symptoms.
- Know how to contact the SPR and emergency help (firemen, medical) in case of problem.
- Be able to identify the person in charge of evacuation of your area, the nearest rescuer, the person in charge of prevention, the radiation safety officer, the laser safety responsible, etc.

### NEVER


- Use someone else's access card.
- Park a car on reserved parking space for firemen or disabled person.
- Work isolated on your own in hazardous areas.
- Use a specific equipment or realize an operation in a facility which needs proper habilitation/clearance if you were not allowed to do so.
- Introduce radiation source without authorization or hazardous wastes, chemicals, biological products, etc. from other facilities.
- Carry or move a radioactive source without authorization.
- Leave an ongoing experiment unattended.
- Leave a delimited area with your working clothes (potentially contaminated).
- Smoke or vape inside premises.

## Instructions during sanitary crisis




**COVID-19**


**RESPECT THOSE INSTRUCTIONS:**




**TO PROTECT YOURSELF AND OTHERS FROM CORONAVIRUS**




Wash your hands very often



When coughing or sneezing, cover your mouth and nose with your arm



Dispose of any tissues you have used



**IF YOU ARE SICK**  
Wear a face mask

For further information

**0 800 130 000**

(toll free)

- **Barrier gestures and physical distance.**
- **Wash your hands very often with water and soap (toilets).**
- **Wearing a mask is mandatory inside the premises as well as outside depending on instructions, properly adjusted covering from top of the nose to below the chin.**
- **Use hydroalcoholic gel disposable at all accesses.**
- **Consider following risks:**
  - \*Chemical: frequent cleaning might increase chemical exposure to cleaning products, etc.
  - \*Biological: systematic massive and frequent disinfections might lead to development of resisting biological agents.
  - \*Psychosocial risks: isolation measures, reduction of collective work, etc.
  - \*Mechanical risks: restarting a machine after a long period of shutdown, etc.
- **Risky work situations:** requirements of social distance can lead employees to find themselves in an isolated worker situation, etc.
- **Follow specific instructions in those cases:**
  - \*Person in contact of a proven case (positive) or of a specific risky person.
  - \*Person having specific symptoms (see below).
  - \*Person tested positive including without any symptoms.
  - \*For the organization of professional events.
- **In case of symptoms** (fever, coughing, runny nose, loss of taste and smell, respiratory discomfort): call your responsible, human resources, **do not come to the premises** and contact by telephone the care center of your area.

**General phone number SPR**  
**01 69 15 71 33**  
**You are the first in line when it comes to your safety!**

**CONSIGNES D'URGENCE SPR**

**La journée**

**INCENDIE : 18** Pompiers ou **112** Appel d'urgence  
**ACCIDENT : 15** SAMU ou **112** Appel d'urgence  
**Gardien Campus : 19** ou **01 69 15 79 99**  
 Pour signaler l'appel aux secours et les orienter

**Week-end, fermetures IJCLab**

**Gardien (bât. ex IPN) : 14** ou **01 69 15 71 11**  
**CONTACT SPR : [spr@ijclab.in2p3.fr](mailto:spr@ijclab.in2p3.fr)**