SAFETY@WORK

A WALK THROUGH THE MAIN ISSUES OF SAFETY RELEVANT TO YOUR WORK

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This brochure aims to walk you through the main issues of safety relevant to your work inside our laboratories. We kindly ask you to read the text with the utmost attention and absorb its information in order to be able to act in accordance with its guidelines in every-day practice.

Every chain is only as strong as its weakest link. This also applies to the matter of safety measures. Please make sure you are not the weakest link.You should realize that your fellow workers are counting on you, just as you yourself are counting on their sense of responsibility.

Did you know

that young, newly hired employees run three times as high a risk of having an occupational accident? Similarly, people who do their job by sheer habit, and fail to think through what they are doing, also run an increased risk of being involved in a work-related accident.

1. A FEW SIMPLE GROUND RULES

- Find out and be sure to know exactly who is responsible for which specific safety issue, so you will know whom to turn to in case of an emergency.
- Pay attention to all signals, signs and indications, and act in accordance with them in practice.
- Keep yourself abreast of things and check out the availability and operating instructions of fire extinguishers, eye rinsing tools, emergency showers and escape routes.
- Think before you begin your working activities.
- Wear the protective equipment that has been put at your disposal for your safety.
- Do not eat or drink in the laboratory and certainly never at the bench.
  Use the coffee room and cafetaria.
- Do not smoke inside the buildings. If you do need to smoke, step outside.
- Try to work in an orderly and neat fashion: tidy up and dispose of everything that may be removed.
- Never try to run all things at the same time. Focus on one thing.
- Ask for clarification if something is not clear to you.
- Report all unsafe situations to the person in charge: defective safety measures, leaking recipients, ...

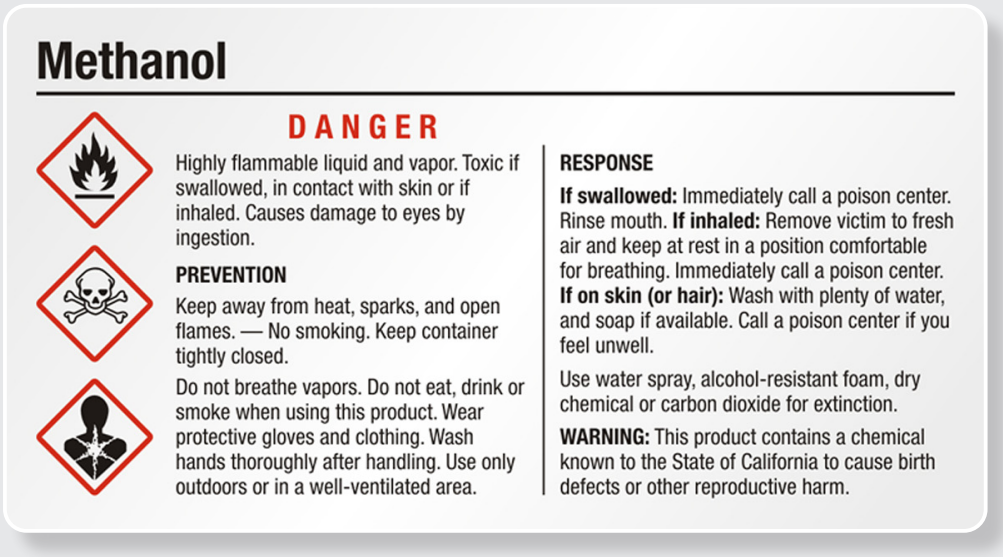
The only risks to take are **acceptable** risks. **Ask** around if something is not clear to you or if something strikes you as dangerous. Ask your coach, supervisor or the person in charge to point out the specific dangers of your task.

2. CHEMICAL SUBSTANCES

As scientists, we handle a great variety of chemical products in our laboratories. Every person working with hazardous substances is considered to be aware of their specific properties and is supposed to be able to manipulate them in a responsible manner. Remember: this does not only concern your own personal safety, but also that of your fellow workers and of the environment.

How can we find out the specific properties of a substance?

1. Carefully read the label. Apart from the substance's name, it also mentions the hazard symbols, the hazard and prevention statements (H- and P-statements)



Methanol

DANGER

Highly flammable liquid and vapor. Toxic if swallowed, in contact with skin or if inhaled. Causes damage to eyes by ingestion.

PREVENTION

Keep away from heat, sparks, and open flames. — No smoking. Keep container tightly closed.

Do not breathe vapors. Do not eat, drink or smoke when using this product. Wear protective gloves and clothing. Wash hands thoroughly after handling. Use only outdoors or in a well-ventilated area.

RESPONSE

If swallowed: Immediately call a poison center. Rinse mouth. **If inhaled:** Remove victim to fresh air and keep at rest in a position comfortable for breathing. Immediately call a poison center. **If on skin (or hair):** Wash with plenty of water, and soap if available. Call a poison center if you feel unwell.

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide for extinction.

WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.

Hazard symbols and H- and P-statements offer a good first indication of the dangers the substance may contain.

2. Whenever a substance is marked with a hazard symbol, be sure to look up additional information in an MSDS ('Material Safety Data Sheet'). A sheet lists the following information:

   a. Composition of / Information about the composing elements
   b. Risks
   c. Safety measures in case of exposure
   d. Safe manipulation and storage instructions
   e. Instructions for removal
   f. etc.

   MSDS can be found at different locations online. Here is a helpful link: **http://gestis.itrust.de/nxt/gateway.dll/gestis_en/000000.xml?f=templates&fn=default.htm&vid=gestiseng:sdben**

3. Never use a product of which you do not know the composition or functioning. Always make sure that the recipient carries a valid label. If necessary, request a label from the person in charge in your center.

4. Never pour a product from one recipient into a non-conformed recipient. Drinking bottles, and similar containers, are strictly taboo. The same holds for recipients that do not carry a label, or that have a damaged or wrong label. Always keep the products in well-closed recipient and stored at the right location.

5. Never pour a product into a recipient that still contains residue of another product or that carries the wrong label.

6. Always carefully seal the recipient after use.

7. Do not trust your nose. A label is much more reliable and much less dangerous. Never smell the product.

8. Always pipette with a mechanical pipette or pipette balloon, and never with your mouth.

9. Never mix products when this is not prescribed.

10. Wear the personal protective equipment whenever this is required.

11. If in doubt, when you think additional information is needed, always consult your immediate supervisor or the prevention service (for coordinates, see the flip pages at the end of this brochure). They will look it up for you.

12. Thoroughly wash your hands upon concluding any experiment and before leaving the laboratory.

13. Of all chemical products no more than the quantities necessary for the daily work of running projects are allowed in the laboratory.

14. Move chemical products internally around in a safe way. Limit external transport to a minimum. External transport of larger quantities of dangerous chemical products should be performed in consultation with the environmental service of your university (for coordinates see the flip pages at the end of this brochure).

15. When a hazardous substance becomes a waste product, it usually keeps its hazardous properties. Make sure that the waste product is collected and conveyed in correctly labelled recipients and that the persons charged with transporting it are fully aware of the dangers they are dealing with.

ETHANOL


Türen schliessen!
Keep the doors closed!
Fermer les portes!
Chiudere le porte!
Cerrar puertas!
Deuren sluiten!
TÜV
DIN TRbF
DIN EN ISO 9001
TÜV
CE
Modell/Model/
Modèle/Modello/
Modelo/Model:
2-193000
Fertigungsnr./Production no./
Numéro de série/Numero di matricola/
N°. de fabricación/Productienr.:
2193204121162
Schlüsselnr./Key no./
Numéro de clé/Chiave numero/
Llave N°./Sleutelnr.:
BMB A003
Nächster Prüfungs- u. Wartungs-
termin laut § 39 UVV und
§ 53 ArbStättV:
Next term for examination and
maintenance according to national
ground safety regulations:
Prochain contrôle et entretien se
référer aux réglementations et normes
nationales:
Data dell'ultima revisione richiesta
dal cliente eseguita secondo le più
recenti norme di sicurezza:
Próxima fecha de revisión y
mantenimiento de acuerdo con las
normas nacionales de seguridad:
Volgende controle en onderhouds-
beurt volgens nationale veiligheids-
voorschriften:
GEPRÜFT
Prüfer:
Supervisor:
Contrôleur:
Collaudatore:
Técnico:
Controleur:
J. DOPERTHAL 05/03 Nr. 506998

HAZARD SYMBOLS

Explosive

Highly flammable

Oxidizing

Gasses onder pressure

Corrosive

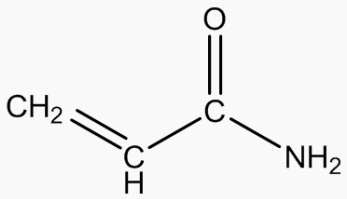
Toxic

Irritating
sensibilisation
Harmful

Longer term
health hazards

Dangerous
for environment

CARCINOGENIC SUBSTANCES



Acrylamide

Among the hazardous substances, the CMRs or carcinogenic, mutagenic and reprotoxic substances require special attention.

- Carcinogenic agents or carcinogens are substances that can cause cancer, or increase the frequency of cancer as a result of intake through mouth, respiratory ways and skin. They carry the marking for long term health risks and/or the hazard statements H350 (able to cause cancer) or H351 (suspected of the ability to cause cancer). Examples are benzene, asbestos, formaldehyde, acrylamide.

- Mutagenic agents or mutagens are substances that can cause, or increase the frequency of, a permanent and transmittable modification on the level of genetic material as a result of inhalation or intake via mouth or skin. They carry the marking for long term health risks and/or the hazard statements H340 (able to cause genetic damage) or H341 (suspected of the ability to cause genetic damage). Examples are ethidiumbromide, acrylamide.

- Reprotoxic (or teratogenic) agents are substances that, as a result of inhalation or intake via mouth or skin, can cause, or increase the frequency of, non-hereditary anomalies in the offspring and/or have a harmful effect on the male or female reproductive functions. They carry as marking the symbol for long term health risks and/or the hazard statements H360 (able to cause damage to fertility or the unborn child) or H361 (possible danger of damage to the unborn child). Examples here are lead compounds.

While working with these substances the general safety measures for working with chemical products apply. In addition, some general measures are also applied:

- Substitution, if possible, of the carcinogenic or mutagenic product by a non- or less hazardous product.

- These products are to be used as much as possible in a closed system, insofar this is technically feasible.

- If the application of a closed system cannot be technically performed, exposure of the employee is to be limited to a level as low as technically possible.

- Possible use of specific personal protective means such as nitrile gloves.

GASES

Apart from the fact that gases may possess hazardous properties – flammable, toxic, corrosive or oxidizing – , it is good to realize they are contained under high pressure in a gas cylinder. The heads and couplings are the weak spots.

- Always fasten and secure the gas cylinder at two thirds of their height to the wall or in a specific safety cup board.
- Always use an exposure lever, but never use this exposure lever as stopcock.
- Always store full and empty cylinders in an external storage facility. Always bear in mind the rules of distance between the different gases.

Expansion

Gas stored under pressure will increase in volume tremendously upon escape. Depending on the amount of gas, the size of the room and the ventilation regime this may lead to a real risk of suffocation resulting from a decline in oxygen level in the room. That is why in certain cases oxygen level detection alarm will be necessary.

3. PATHOGENS AND GMOs

Dealing with living organisms is an essential property of working in life sciences or biotechnological research. A number of these living organisms may potentially be harmful: they can cause disease in humans, animals or in plants; they may pose a hazard for the bioenvironment; or they can form a combination of both.

Always work safely with GMOs and pathogens:

- Get to know the main properties of the organism before starting to work with it.
- Know in which risk class the organisms belongs and act according to the given authorization for this activity.
- Respect the 'Safe Microbiological Techniques' (see box).
- Try to avoid the production of aerosols that can cause a spread of the organisms, and, if this is not possible, perform the action in a class II microbiological safety cabinet.
- Always perform actions in a microbiological safety cabinet in such a way that the cabinet can provide its protection (see box).
- Never dispose of material that can contain living GMOs or pathogens via the sewerage system or waste matter flow. Make sure it becomes inactive by way of a validated method, or ends up in the waste recipient for hazardous medical waste.

Safe microbiological techniques

- Keep windows and doors shut during working activities.
- Wear a lab coat, and keep it buttoned up.
- Do not eat or drink in the lab, and certainly never at the bench.
- Do not wear any jewellery or watch. Keep your hands clean and your fingernails short.
- Proceed to immediate disinfection in case of spilling material that contains living organisms.
- Minimize the generation and spread of aerosols.
- Always do your pipetting with a pipette balloon or a mechanical pipette, never with your mouth.
- Move living material in such a way that it cannot spread and transport infectious material solely in closed recipients.
- Disinfect used materials before washing and reusing them.
- Inactivate material that contains living organisms before disposing of it. Or throw it in the recipients for hazardous medical waste.
- Wash your hands upon concluding an experiment and before leaving the laboratory.

Did you know that you generate aerosols whenever you:

- Pour liquids from great height
- Drop drops of liquid
- Blow out a pipette
- Open up a wet stopcock
- Centrifuge with open tubes
- Dip hot inoculation needles in a liquid

You can find more background information about safe working with GMOs and pathogens in the VIB booklet '**Biosafety in the laboratory**'.

Safe use of a class II microbiological safety cabinet

- Carefully prepare an experiment and gather all necessary material before you start.
- Leave the safety cabinet running for 15 minutes before you start working in it. Check the displays on the cabinet to verify it functions as it should.
- Disinfect the working surface and the air intake grids with an appropriate disinfectant.
- Put only the materials needed for the experiment in the cabinet.
- Do not put any paper in the cabinet.
- Only use open racks that do not block the air flow.
- Never put any materials on the air intake grids.
- Operate from a 'clean' to a 'dirty' side. Place a small container or bag at the 'dirty' side for contaminated materials like pipette points.
- Move your arms calmly, so as not to disturb the air flows.
- Minimize the activities that could disturb the protective air screen, such as the opening of near-by doors, or personnel passing closely along the cabinet.
- Work well into the cabinet, and not halfway outside of it.
- Do not use a Bunsen burner or a similar electrical heat source, since it causes a strong turbulence. Use disposable inoculation needles as an alternative.
- When the work is finished: disinfect all materials externally before removing them from the safety cabinet.
- Waste must be removed in a sealed container or sealed plastic bag that has been disinfected externally before removing it from the safety cabinet.
- Disinfect the working surface and the air intake grids with an appropriate disinfectant.
- Leave the safety cabinet running for another 10 minutes before switching it off.

RISK ASSESSMENT

of pathogens and GMOs

Depending upon their disease-generating capability, organisms are arranged in four ascending classes, with the highest-ranking class posing the highest risk:

risk group 1:
organisms unable to cause disease, e.g. Saccharomyces cerevisiae, Lactococcus lactis.

risk group 2:
Moderate risk for individual, limited risk for the community, e.g. Pseudomonas aeruginosa, influenza virus.

risk group 3:
high risk for individual, serious risk for the community, e.g. HIV, Mycobacterium tuberculosis.

risk group 4:
high risk for individual and community, e.g. Ebola virus.

Organisms in risk groups 2, 3 en 4 are called pathogens.

Pathogens can also be classified according to the type of host they are able to infect:
- human pathogens
- animal pathogens
- zoönoses; able to infect humans as well as animals
- plant pathogens

Genetically Modified Organisms (GMOs) are organisms whose genetic material has been altered in a way that is not possible through mating or natural recombination. They are arranged in four risk classes, similar to the way we can classify organisms according to their disease-generating capacity:
- **risk class 1:** GMOs with no or negligible risk for human health or bioenvironment
- **risk class 2:** GMOs with low risk
- **risk class 3:** GMOs with moderate risk
- **risk class 4:** GMOs with high risk

Every risk class is paired with a level of containment: a combination of physical containment measures and a number of working practices. The higher the risk class, the more strict the measures.

For a correct evaluation of the risks involved in working with GMOs, you must first perform a risk assessment. The process consists of the following consecutive steps:
- mapping the dangers of the receptor, vector and donor sequences: this offers a first idea of the risk class of the resulting GMO.
- taking into account the nature and scale of the activity and the environment that may be exposed: focus on the steps in which a risk exists of the GMO's spread.
- selecting the containment measures, working practices and personal protection means, necessary for a safe working environment.
- assigning the final risk level.

The assessment of risks involved in working with pathogens runs a similar path. Only the first step is easier since you can look up the risk class of the pathogen in legal lists (via www.biosafety.be).
The risk group by itself, however, will not suffice. You must also be aware of the pathogen's main properties, such as its natural dispersal route.


N27

4. WORKING WITH CRYOGENIC LIQUIDS

Liquid nitrogen is used for various applications. Its main application is for the storage of biological materials. It is also used as coolant for a number of applications.

Liquid nitrogen is a gas that has been condensed to a liquid. It has an extremely low temperature of about -196°C. When this liquid is exposed to outside air, it shifts boiling into its gas form. The transition from liquid to gas triggers a forceful increase in pressure and/or an increase in volume. In its transition to gas, liquid nitrogen's volume increases ***700*** times. This increase in pressure can lead to explosions.

The transition to the gas stage also implies that the nitrogen concentrations in the air increase, and that the oxygen concentration, normally amounting to 21%, strongly decreases, heightening the danger of suffocation for people that enter the space at that moment. In many cases it will therefore be recommended to install oxygen level detection in the room.

Oxygen percentage	Effects
Between 19% and 14%	Rapid fatigue and headaches, diminished judgmental abilities
Between 14% and 10%	Feeling unwell and accelerated pulse
Between 6% and 8%	Coma, respiration stops
0% oxygen	Death after inhaling three times

Because of its extremely low temperature, liquid nitrogen can cause serious frostbite, comparable to third-degree burns.

Whenever liquid nitrogen comes into contact with objects that are relatively warmer, it will start to boil, as is the case when manually filling a Dewar-container. This can result in the liquid starting to spurt, leading to uncovered bodyparts being exposed to the liquid and thus causing frostbites and burns. Amongst others on the eyes, especially, permanent lesions can be caused.

Prevention measures:

- When dealing with liquid nitrogen, always wear a facial protective shield and temperature-proof gloves.
- Always wear a lab coat that is completely buttoned up.
- Wear shoes that cover the skin.
- Transport liquid nitrogen only in closed barrels.
- Cryotubes cooled with liquid nitrogen are only to be warmed up in a safety cabinet.
- Upon contact with skin or eyes, rinse lengthily with water and consult a first aid worker.
- Treat any sustained injuries as burns.

5. PROTECTION OF MOTHERHOOD

When you are pregnant or breast-feeding, you are not allowed to simply continue working with any kind of material. Certain things are even explicitly prohibited. VIB has worked out a procedure that can be consulted on its intranet. These rules boil down to this:

- Inform the human resources center and, if you are a researcher, also the head of your group as soon as you know you are pregnant. The sooner the better, because especially in the first weeks of the pregnancy the chances that things may go wrong are the highest.
- A consult with the occupational medicine doctor will be organized. Prepare for this meeting, so you can accurately point out the substances you get or do not get into contact with during your work.

Contra-indicated activities:

- Activities with ionizing radiation
- Activities with pathogens that can cause harm to the unborn foetus, for example rubella
- Activities with chemical substances which are harmful to the unborn foetus, for example chloroform and all substances with carcinogenic, mutagenic and teratogenic properties. This goes too for all substances with the following H-statements:

H300: Fatal if swallowed
H304: May be fatal if swallowed and enters airways
H310: Fatal in contact with skin
H330: Fatal if inhaled
H340: May cause genetic defects
H341: Suspected of causing genetic defects
H350: May cause cancer
H351: Suspected of causing cancer
H360: May damage fertility or the unborn child
H361: Suspected of damaging fertility or the unborn child
H361d: Suspected of damaging the unborn child
H362: May cause harm to breast-fed children
H370: Causes damage to organs
H371: May cause damage to organs

- Lifting heavy burdens in the last three months of the pregnancy and the first 10 weeks after giving birth.
- Extreme ambient temperatures (below 6 oC or above 30 oC).
- Together with the occupational health physician it will be determined which activities you can still perform and which ones you are no longer allowed to perform during your pregnancy and during the period of breast feeding.

If you are a university employee, similar rules also apply, or sometimes even more stringent ones. These rules can be consulted via the prevention services of the university.

The combination of pregnancy and laboratory work does not always have to be problematic. It does, however, require a clear adjustment: all activities that pose a real risk to your pregnancy must be avoided. It this is not possible and you also cannot switch to administrative tasks, removal from the workplace is the only remaining option.

6. RADIOACTIVE SUBSTANCES

Radioactive substances are regularly used in research as a relatively easy applicable marker for biological material.

In VIB laboratories the following radioactive substances are used: 3H, 14C, 35S, 32P, 33P, and 125I.
These are all β-radiating sources, except for 125I that emits γ-radiation.

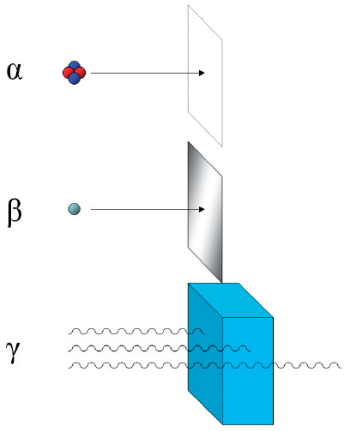
β-radiation
Beta rays are electrons rapidly emitted by the nucleus of which the mass value practically equals zero.

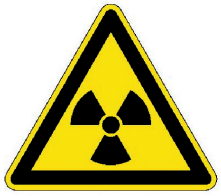
γ-radiation
Gamma rays originate in the nucleus by its switching from one energy status to another.

Below you can find the main properties of the used radioactive substances:

	^{3}H	^{14}C	^{35}S	^{32}P	^{33}P	^{125}I
$T_{1/2}$	12,3 years	5730 years	87,4 days	14,3 days	25,4 days	60,0 days
β-energy E_{mean} (MeV)	0,006 (weak)	0,049 (weak)	0,053	0,69 (strong)	0,085	Auger electrons 0,035
Monitor	Swabs counted by liquid scintillation	Thin-end window β-counter	Thin-end window β-counter	β-counter	β-count.	γ-probe
Critical organ	Whole body	Whole body fat	Whole body testis	Bone	Bone	thyroid
Maximum range in air	6 mm	24 cm	26 cm	6,1 m	89 cm	> 10 m
Shielding required (safety screen)	None	Plexiglass screen 1cm	Plexiglass screen 1 cm	Plexiglass screen 1 cm	Plexiglass Screen 1 cm	Lead 0,152 mm (or special Pb plexi screen)
Special considerations	Avoidance of direct contact with the radioactive source is the main precaution	Very, very slow decay	-	Potential high-level source of external radiation. Body dosimeter required	Body dosimeter required	Lodine sublimes, work in fume hood. Spills are removed with Count-Off. Many iodine compounds penetrate rubber gloves: wear two pairs. Body dosimeter required.

Protection against ionizing radiation





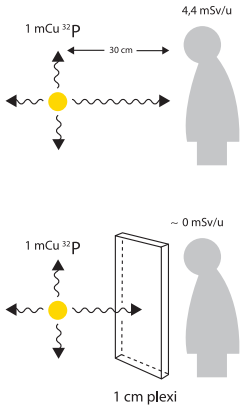
Adequate methods to reduce radiation danger to a minimum are available:

1) Length of exposure: the shorter the duration of exposure, the smaller the radiation dose.
2) Distance from the source: the more distant from the radioactive source, the smaller the dose. Two times further removed from the source = 4 times less radiation.
3) Shielding and inclosure: encasing of radioactive substances blocks the spread. Shielding also ensures that the radiation cannot reach us.

Alpha rays are already blocked by a sheet of paper, beta rays only by a thin plate of steel or plexiglass (1 cm).

Gamma rays are less ionizing than alpha or beta rays, but possess a far greater penetrating capacity. Protection from these rays requires a thicker layer.

4) ALARA-principle: "As Low As Reasonable Achievable".
   Use, for example, ^{33}P in stead of ^{32}P, or use another technique like photoluminescence.



An open point source of 1 milliCurie (37 megaBecquerel) ^{32}P creates at a distance of 30 cm on the skin an effective dose of 4,4 milliSievert per hour (0.073 mSv per minute).

When you place a plexi screen in between no β-rays will reach the skin anymore. Behind the plexi you do receive a very small amount of REM-radiation that results from the collision of the electrons with matter, but the energy of it is so low that only when working with large amounts of radio-active substances (> 5 milliCurie) and extra protection (1 mm lead) is advised.

The following specific rules apply for working with radioactive substances:

1) You are only allowed to work with radioactive substances after having completed appropriate training

2) Working with radioactivity, as well as the presence of radio-isotopes, is strictly limited to the premises and rooms that have been provided for this purpose and have been granted a permit. The doors to these facilities must be locked at all times and can be recognized by their radiation marking.

3) Always wear the (coloured or marked) lab coat that has been provided to you and keep it sealed. It can never leave the radioactive rooms.

4) Always carry your personal dosimeter with you, except when the work in the room only involves ^{3}H, ^{14}C or ^{35}S.

5) Do not take any unnecessary objects with you into the room. Eating, drinking, smoking and using cosmetics are prohibited, as well as preserving foodstuff.

6) Do not wear a watch or any jewelry on your hands.

7) Always wear gloves.

8) Any pipetting with the mouth is strictly prohibited.

9) Work behind a safety screen (plexiglass), or a lead screen in case of ^{125}I. Use Count-Off in case of spilling ^{125}I.

10) Accidental radioactive contaminations are to be removed as quickly and as thoroughly as possible. Following the removal and cleaning, a control will be performed in order to verify if everything has indeed been removed. Any possible incident is to be reported to the person responsible of the room.

11) Use absorbing paper behind the safety screen.

12) All radioactive waste is collected in waste containers intended for this purpose.

13) Hands must be washed upon concluding the experiment and before leaving the room. Use liquid soap instead of soap bars to avoid any contamination.

14) Inspect the workplace, your hands, lab coat and shoe soles before leaving the room. Only when the room solely involves work with 3H, this control can be omitted. In case of regular use of 3H, contamination control requires the weekly taking of swap samples at a number of relevant places.

15) Please keep a log.

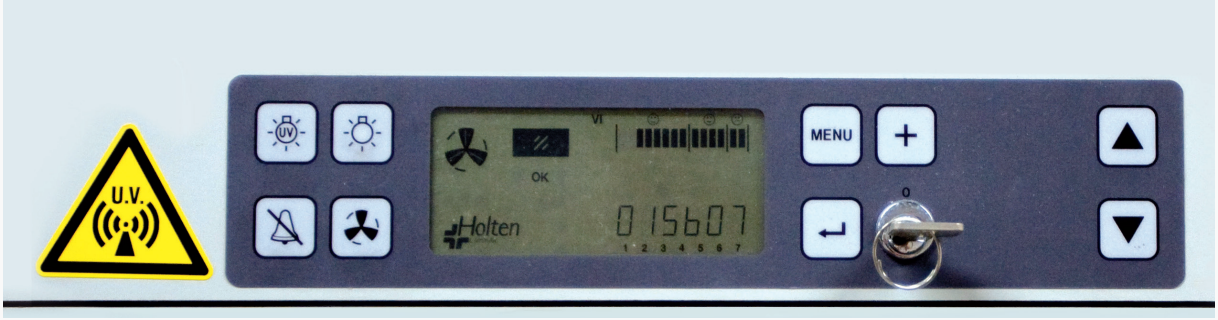
Dosimeters and health supervision

Every month, dosimeters are exchanged via a person responsible in the center. They are read and the results passed on to the university's Physical Control service. This applies to personnel on the VIB payroll as well as to those on the university payroll. It is an arrangement set in the frame agreement between VIB and the university. If a dose measurably exceeds the natural dose, the person involved is contacted by Physical Control in order to verify what could have been the origin of the dose and find out how this can be avoided in the future. In case of radiations exceeding the limit dose of 20 mSv[1] per 12 consecutive months, the prevention advisor/occupational medicine doctor will take appropriate measures, such as an extra medical examination and a temporary removal from the radiation risk.

Applying for or terminating the use of a dosimeter is arranged by the person responsible in the center. Attention: a personal dosimeter only makes sense when working with ^{32}P, ^{33}P and ^{125}I.

All employees who are exposed to ionizing radiation, are annually summoned for a special occupational medicine check-up at the occupational medicine service.

ATTENTION: Pregnant women must avoid exposure to ionizing radiation at all costs and are therefore prohibited from working with radioactive substances. In addition, women who are pregnant or breast-feeding must avoid exposure to the risk of contamination with open radioactive sources. Consequently, they are also prohibited from entering any room where an open radioactive source may be present.



Everything around us is to a smaller or greater extent radioactive. Radioactivity is a perfectly natural phenomenon. The natural radiations originate from the universe (cosmic radiation) and from natural radioactive components in the earth. Apart from that, we are exposed to various kinds of man-made radiation sources such as building materials, television sets, fire detectors, medical appliances, etc. Flanders' population is annually exposed to a mean 2.6 mSv[1] from these ionizing rays.

Radioactive substances degrade: they spontaneously transform into another substance while emitting radioactivity. The speed at which they do so is indicated by their half-life ($T_{1/2}$). The shorter the half-life, the faster they degrade.

Radioactive substances emit ionizing radiation that has the ability to ionize matter. The radiation knocks loose electrons from the present atoms, thereby causing their structure to modify. In living tissue, the damage is done to the hereditary material, resulting in both somatic and genetic damage.

Somatic damage can cause disease syndromes that vary from superficial skin damage (redskin, burns) to coagulation of proteins, modifications in the blood and bone marrow composition, eye lens blurring, hair loss, failure of the metabolism and destruction of internal organs. Deterministic effects (cell death) only occur at upper levels of around 0.5 Sv (=500 mSv). These levels are only attained in nuclear explosions (Hiroshima) or nuclear accidents (Tchernobyl). The authorized level for professionally exposed personnel is an annual 20 mSv. At such small levels merely stochastic effects may occur, such as an increase of the risk of developing cancer.

Damage by radiation can occur following external radiation (e.g. devices or another radiation source) or internal radiation (occurring as a result of intake through respiratory ways, mouth or skin).

A distinction is made between particles radiation and electromagnetic radiation.
The particles radiations are the following:
- Proton radiation;
- Neutron radiation;
- α-radiation;
- β-radiation.

The electromagnetic radiations are immaterial radiations that possess neither mass nor charge. They are:
- γ-radiation;
- X-radiation (or Röntgen radiation).

[1] The term mSv is short for millisievert and is an expression of the effective (or equivalent) dose of ionization that a person has received. The effective dose is the product of the absorbed dose (in Gray) and the radiation weight factor. The radiation weight factor indicates the biological activity of various sorts of ionizing radiations. The β-radiation and γ-radiation weight factor is 1. A radiation source's activity (in Becquerel = 1 desintegration per second) is not simply converted into the effective dose (in Sv of mSv) a person suffers. This hinges upon the situation and also depends on the kind of radio-isotope (and its energy), the distance, and the barriers that may be present.


▲ATTENTION : LIMITE DE REMPLISSAGE
Ne jamais forcer pour l'introduction des déchets
Déchets d'Activités de Soins à Risques Infectieux
Déchets à éliminer conformément à la législation en vigueur
Septifas 60L
OPGELET : MAXIMALE VULLIJN ▲
Vulcapaciteit nooit forceren
Risicohoudend medisch afval
Afval te verwijderen in overeenstemming met de heersende reglementering
Aanwijzingen bij montage:
Indications de montage:
A. Fermeture provisoire: pour le couvercle sans appuyer
B. Fermeture définitive: appuyer consécutivement sur chaque côté du couvercle. Tous les ergots doivent être enfoncés dans leur fente
Pour plus de renseignement sur ce produit: www.mih.be
MATIERE INFECTIEUSE
RISICOHOUDEND MEDISCH AFVAL
EN CAS DE DOMMAGE OU DE FUITE AVISER IMMEDIATEMENT LES AUTORITES DE LA SANTE PUBLIQUE
IN GEVAL VAN BESCHADIGING OF LEKKAGE ONMIDDELLIJK VOLKSGEZONDHEID VERMITTIGEN
6
UN 3291
Producteur / Producent
Nom /Naam
Service / Dienst
Date / Datum
Collecteur / Transporteur
Conforme NFX 30-505
UN 3291
AFVAL
DANGEREUX
RISICOHOUDEND

7. WASTE

Where people are at work, waste is produced. In laboratories, this waste is often dangerous. Laboratories produce different waste flows, each requiring their own specific removal and processing.

It is important to be well-informed about the various waste flows and the rules that apply to them. Inform yourself and act accordingly in practice. Each waste flow has its own type of recipient, and each waste flow needs to be clearly labelled. The coordinates of the person in charge to contact regarding waste in your center can be found on the pages at the end of this brochure.

The following dangerous waste flows are frequently present in our laboratories:

- Chemically contaminated, solid waste
- Liquids that (may) contain GMOs and/or pathogens
- Hazardous medical waste
- Radioactive waste
- Various flows of chemical liquids, such as:
  - > Halogenated carbons
  - > Non-halogenated carbons
  - > EtBr
  - > ...

Evidently, there are also waste flows that are not hazardous, such as residual waste, paper and cardboard, foam rubber, cartridges ...

Needles and scalpels require special small containers. In these containers, you can deposit the needles of the syringes without having to touch the needle.
For this purpose, a special clip is present in the lid of the container.

ATTENTION: NEVER RECAP A NEEDLE.
It is at this point that most of the pricking accidents happen.

When dealing with waste, apply the following rules:

- Reduce waste production.
- Separate waste as much as possible.
- Collect the waste in the right, correctly labelled waste recipient.
- Never fill the waste recipient up to the edge.
- Warn the person in charge when the recipient is full, or move it to a temporary storage place in accordance with center al rules.

8. PERSONAL PROTECTIVE EQUIPMENT

**Personal Protective Equipment (PPE) is available for your own safety. Use it!
If you need PPE and it is not available, ask for it with your supervisor or the person in charge of the stock.**

The lab coat

Wearing a lab coat is requirement number 1 when you work in a laboratory. Button up your lab coat and never roll up the sleeves, or protection will not be complete.

NOT WEARING A CLOSED LAB COAT IN A LABORATORY IS A CAPITAL SIN!

Disposable gloves

You can wear disposable gloves for two reasons: to protect yourself or to protect your experiment. Do not wear gloves when this is not necessary, and certainly do not touch keyboards, doorknobs and other things with (dirty) gloves. People after you may touch these things with their bare hands. And if you do have to go from one room to the other with a rack with potentially hazardous material, only wear one glove, and use the non-gloved hand to open the doors.

You have to wear gloves to protect yourself when you are working with substances that can pose a danger through contact with the skin. This holds, for example, for human infectious agents, radioactive substances and certain chemical substances. Change gloves on a regular basis. And also wear the correct disposable gloves in these instances. Do not wear 'medical gloves', but real PPE gloves of category III, which can be recognized by the CE mark with a four digit code on the packaging.

Safety glasses

You do not have to wear safety glasses at all times, but you are obliged to wear them when working with substances or agents that can become a hazard for or via the eyes. This is more often the case than you think. Consider, for example, methylene blue or fenol.

Oral and facial masks and the use of the fume hood

An oral mask or fine dust mask is recommended whenever there is a risk of inhaling dangerous particles or hazardous agents that spread easily in the air, and whenever you cannot perform the activities with these particles or agents in a fume hood or microbiological class II safety cabinet.

You are obliged to wear a facial mask when you are working with substances or agents that can damage the skin or may pose a hazard by way of the mucous membranes, or which pose an actual risk of splashes. This is true, for example, for handling liquid nitrogen.

When there is a risk of inhaling hazardous volatiles, the activities must be performed in a fume hood. Make sure the fume hood is functioning and close its window as far as possible. In this case, you are not obliged to wear safety glasses.

Depending on the center , additional PPE's can be available. These are often specific to the type of work. Follow internal instructions. If you have questions, ask your mentor or contact the safety advisor.

9. INCIDENTS, ACCIDENTS, EMERGENCY SITUATIONS

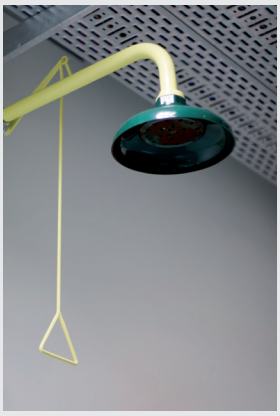
An incident or accident may occur at any given time. The best way to prevent it is by planning your work thoroughly, and working in a calm, orderly and neat manner. If something does go wrong, do not panic. Stay calm, try to remedy the incident step by step and, if necessary, call upon your colleagues for help. It is important that everybody is aware of the evacuation plan and procedures.

Incident with a hazardous substance: contamination or intake

- Splashes or spills on the skin: rinse thoroughly with water or, if the substance does not solve in water, with an appropriate harmless solvent.
- Splashes in the eye: rinse abundantly by means of an eye wash bottle or an eye shower.
- In case of intake via aerosol, ingestion or wound contact, immediately seek medical assistance.
- Personally consult or have a colleague consult the MSDS and apply the prescribed measures.
- If necessary, consult the prevention advisor the occupational medicine doctor, and/or the local first aid worker. (coordinates on flip pages at the end of this brochure).
- Report the incident to the secretary office of your center. If necessary, they will call in the occupational accidents insurance through the personnel service.

In case of an accident with injury

- In case of serious injuries, call for medical assistance as soon as possible and according to the directives and emergency numbers that apply within the institution. While waiting for the doctor's arrival, FIRST AID must be applied. To do so, notify a first aid worker within your center.
- While waiting for emergency services, the following rules need to be applied, even when you are not qualified to administer first aid:
  > Do not move the victim, unless there is danger (fire, explosion, collapse, poisoning, ...);
  > Prevent a second accident from happening;
  > Clear the access ways for the emergency services;
  > Reassure the injured person. Do not leave a person in trouble, but do not put yourself in danger.
- In case of pricking, cutting or biting accidents:
  > Have someone notify the technical assistant;
  > Let the wound bleed (to wash away pollution or contaminations);
  > Carefully clean the wound;
  > Disinfect the wound;
  > Apply bandages, if necessary;
  > Report the accident to the secretary office of the center. If necessary, they will call in the occupational accidents insurance via the personnel service.
  > Depending upon the accident and upon the question if there has been exposure to hazardous substances or biological agents, the situation needs to be assessed with the prevention advisor and/or occupational medicine doctor (coordinates on the pages at the end of this brochure) in order to decide whether additional steps need to be taken or not.



In case of a spill with a human pathogen in an L2 laboratory, for instance a tube that splashes on the floor

- First protect yourself and your colleagues, by immediately leaving the laboratory. This is because there will be a cloud of aerosols above the spill.
- Check yourself and put possibly contaminated clothing in a waste bin.
- Put a clear indication on the door – Entry forbidden, risk of infection – to prevent others to go in.
  And notify the (bio)safety responsible.
- Collect all the materials you need to clean up the spill:
  > A yellow waste bin for hazardous medical waste
  > A large pair of tweezers
  > Absorbing paper towels
  > A disposable labcoat that closed tightly on the wrists
  > Disposable safety gloves (PPE category III)
  > An FFP3 mouth mask
  > Disposable shoe-covers
  > A squeeze bottle with the correct disinfectant in a relatively high concentration
  > Safety goggles

- Wait until at least 30 minutes after the incident before going back in to clean the spill.
- Put on the protective clothing and equipment and go back in with the spill kit. Put on two pairs of gloves.
- Approach the spill from one side and cover the complete spill with paper towels so that they can absorb the spill. Put the tube that has splashed on the floor carefully on top of the paper towels or put it, when this can be done without risk of leaking, while using the pair of tweezers, into the waste bin. Do not touch anything with your hands.
- Carefully apply disinfectant to the paper towels. Work from the outside to the inside. Let the disinfectant do its work for 10 minutes.
- Use the pair of tweezers to sweep together the paper towels (not all in one go) and put them in the waste bin.
- Repeat the whole procedure: covering with towels, applying disinfectant, waiting, and removing the towels into the waste bin.
- Thoroughly disinfect the surface a few times with paper towels soaked with disinfectant. Check that you have not forgotten any small droplets or splashes. End with a thoroughly disinfected dry surface.
- Take of the outer pair of gloves, put them in the waste bin and put the lid on. Don't fully close it yet.
- Remove the material to the airlock (if there is one). Remove the shoe-covers, take of the labcoat and the gloves and put it in the waste bin. Thoroughly close the waste bin. Wash your hands.

In case of fire

- Immediately report the fire to the reception and/or to the FIT-representative (First Intervention Team). Give a clear report about the WHAT, WHERE, and SEVERITY of the fire.
- The FIT arrives at the scene and, if possible, tries to put out the fire themselves.
- If this proves to be impossible, the emergency services are called.
- Upon hearing the evacuation signal, follow the directives of the evacuation leaders and calmly leave the building.
- Close windows and doors.
- Take the shortest and safest route.
- NEVER use the elevator.
- Whatever you may have left behind, do not ever return inside.
- Gather at the assembly point, indicated by:

- If your escape route is blocked, try to signal your presence to the outside world (telephone, waving at the window).
- Report yourself with your supervisor.
- The persons in charge of FIT check if there are still people in the building.

10. MACHINES, DEVICES AND TOOLS

Laboratories are filled with all sorts of devices. The number of accidents resulting from our use and application of these devices is relatively small, but when they happen, they may be very serious. Think about your fingers, fractured inside a still whirling centrifuge.... Take care to use machines, devices and tools only for what they were originally intended and created, and only with the appropriate instruments. It is recommended to keep the main operating instruction close to or upon the machine on the so-called safety instruction cards.

Please observe the following general instructions while performing work or activities at or in the vicinity of machines and devices:

- It is prohibited to run devices without shielding or without the necessary safeties being activated. All bridging of safety switches is strictly prohibited.
- All defective devices or devices in maintenance must bear a warning sign: "do not switch on". Only qualified personnel are allowed to perform repairs and maintenance.
- Passages around devices must have a minimal width of 80 cm and be kept free at all times.
- The same rules apply to electronic devices. In addition, special attention must be paid to sufficient shielding of live-wired elements.

Warning signs, prohibition and order signs and emergency direction signs

Not only on the recipients of chemicals you can find hazard symbols. Everywhere where there is a need for warning or order this will be indicated with a pictogram. To help you understand the meaning of these pictograms below an overview is given of the most important ones.

WARNING SIGNS

Ionizing radiation

Biological agents

Flammable

Harmful or irritating substances

Corrosive substances

Poisonous substances

Dangerous voltage

Laser beam

Warning: danger!

Cold surface

Warm surface

Non-ionizing radiation

Important magnetic field

Oxidizing substances

Beware: slippery

Danger of suffocation

FIRE PROTECTION SIGNS

Fire extinguisher

Fire hose

Fire alarm button

Fire blanket

PROHIBITION SIGNS

Non-authorized personnel forbidden to enter

Forbidden to smoke

No drinking water

Forbidden to use mobile phone

ORDER SIGNS

Obligation to wear safety goggles

Obligation to wear face protection

Obligation to chain gas bottles

Obligation to wash your hands

Obligation to wear mild breathing protection

Obligation to wear gloves

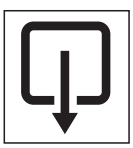
Obligation to wear shoe covers

Obligation to wear a safety suit

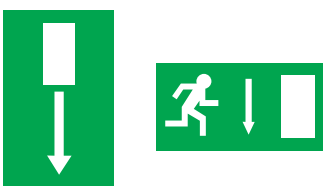
EMERGENCY DIRECTION SIGNS

Exit

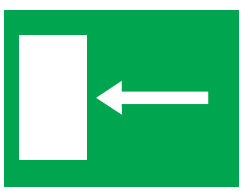
Direction of exit



Exit not according requirements (i.e. door opens to the inside)



Direction of emergency exit



First aid materials

Emergency shower

Eye shower

Evacuation assembly point

Emergency exit

CONTACT DETAILS SECURITY SERVICES

SAFETY@WORK

VIB

GHENT UNIVERSITY

KU LEUVEN

Universiteit Antwerpen

VUB VRIJE UNIVERSITEIT BRUSSEL

UHASSELT