

# Safety Regulations

Faculty of Mathematics and Natural Sciences



Leiden University

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# Preface

The Faculty of M&NS aims at exercising care for working conditions and environment in a systematic manner. This implies a system of care within the Faculty. Safety regulations are part of this system. These are basically a reflection of a number of agreements established within the faculty (by the Faculty Council) concerning safe and healthy working conditions.

Safe and healthy working conditions are everyone's responsibility. Nevertheless, it will be the Board of Governors that will have the ultimate responsibility for the care for working conditions and the environment on the campus. The Board has delegated its responsibility for this care to the Faculty Boards. Therefore, within the Faculty of M&NS the Faculty Board is responsible for policies concerning working conditions and the environment, and their implementation. For the Faculty Boards to be able to bear this responsibility certain mandates have been issued, along with the proper authority. The scientific directors, for example, by mandate have been given complete responsibility for the working conditions and environmental protection within their institute. It is up to the scientific directors to establish responsibilities and competence within their institutes enabling them to carry this responsibility. These Safety Regulations are a guideline for this and lay down a number of rules that apply within the Faculty. Of course, the Faculty must observe the regulations laid down in the Dutch Occupational Health and Safety Act ("Arbowet"), government-granted licences, and regulations established by the Board of Governors of Leiden University. The Safety Regulations will serve as a guideline for complying with these regulations too.

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# Safety Regulations of Faculty M&NS

## General

- art.1. These regulations apply to everyone present on the grounds, in the buildings or at the plants of the Faculty of Mathematics and Natural Sciences (hereafter referred to as "Faculty of M&NS").
- art.2. Everyone is under the obligation to exercise the greatest possible care for his/her own safety and health and the health and safety of others.
- art.3. Everyone is under an obligation to report near accidents or situations that he or she considers unsafe to the Centre for Safety and Environment (AMD) of the Faculty of M&NS.

**Note:**

*In order to take preventive measures, it is important that dangerous situations, damage or accidents (or near accidents) be reported timely. In addition to establishing rules for reporting defects in the buildings and plants, this article also aims at receiving reports of health-endangering properties of apparatus or chemicals. Suggestions for improving apparatus, set-ups or experimental methods are also important. Reporting can be done by using the "red label". See APPENDIX 10 for more information on the AMD M&NS*

- art.4. Everyone is expected to understand the meaning of all signs of prohibition, warning, order and rescue present within the Faculty of M&NS and to obey the corresponding rules.

**Note:**

*Safety signs are shown and explained in APPENDIX 9.*

- art.5. The presence after normal working hours of persons in the buildings is permitted only if required for the proper continuation of regular activities.  
When present after hours, one is required to enter his or her name, room number and telephone number in the register at the reception.

**Note:** *Regular working hours are defined as the hours between 08:00 am and 6:00 pm on weekdays. After-hours registration is required if someone intends to carry out non-office activities on his or her own.*

- art.6. Carrying out activities and experiments after hours is only allowed after receiving authorization from the SD (after consulting AMD). This does not apply to office duties or work of a similar nature.

- art.7. Smoking ban

In accordance with the Tobacco Act, a ban on smoking applies in all rooms of the Faculty of M&NS. The sole exception applies to lounges and studies where smoking is allowed, provided that there are no objections by colleagues or visitors, and no smoking ban applies because of safety precautions.

**Note:**

*As of January 1, 2004 every employee is entitled to a smoke-free working environment.*

- art.8. Ban on eating and drinking

It is prohibited to consume or store food and drinks in laboratories and workplaces. Carrying out activities to under the influence of alcohol and/or drugs is also prohibited.

**Note:**

*Article 4.5 paragraph 2 of the Dutch Occupational Health and Safety Act ("Arbobesluit art. 4.5 lid 2") prohibits the consumption and storage of food in rooms containing substances meeting the criteria of the Environmentally Hazardous Substances Act ("Wet milieugevaarlijke stoffen") for one or more of the classes of "extremely toxic", "toxic", "carcinogenic", "mutagenic" and "toxic for reproduction".*

*For the Faculty of M&NS this implies that the "ban on eating and drinking" applies to all workplaces, engineering rooms, experiment rooms, laboratory rooms and supply rooms.*

*This ban also applies to rooms where collections are stored, like archives, libraries, plant and animal collections (for both safety reasons and the preservation of the collections).*

*Eating and drinking are permitted in the lounges/studies.*

- art.9. Waste Disposal  
Everyone must be acquainted with and strictly uphold the Waste Disposal Regulations of the Faculty of M&NS.

**Note:**

*The Waste Disposal Regulations of the Faculty of M&NS are included in APPENDIX 6.*

- art.10. Environmental licences and licences for use  
Everyone must be acquainted with and strictly uphold the instructions of the environmental licences and licences for use.

**Note:**

*The environmental licences can be consulted on the website of the Centre for Safety and Environment (AMD).*

- art.11. Use of personal means of transport inside buildings is only permitted for the disabled, and in times of disaster.

- art.12. Everyone must abide by the regulations established by the University.

**Note:**

*A summary of the university regulations is included in APPENDIX 2.*

## Fire and accidents

- art.13. In case of fire or accidents during working hours, the building's emergency number must be dialled at once, and information must be given about location, number of wounded and, if possible, the nature and extent of the fire or accident.  
The emergency number is printed on every telephone.  
If a fire is discovered after hours, either the manual fire alarms must be sounded at once, or the Fire Department must be alerted (telephone number 4444; direct connection to the Regional Emergency Centre).  
In case of fire the use of elevators is not allowed.  
For accidents occurring after hours, the emergency telephone number 4444 must be called.  
In case of fire or accident after hours, you should wait for the emergency services at the reception.  
Every accident must be reported to the Centre for Safety and Environment (AMD).

**Note:**

*Reporting a fire or accident in any other way than specified here can lead to serious delays in the rescue efforts. If possible, reporting accidents to the Centre for Safety and Environment (AMD) should be done by those directly involved (victim or rescuer). The account of the accident aims, besides the creation of necessary measures, at supporting any claims for damages (for the initial report, use the red label, available at the reception or on the AMD website).*

- art.14. When the acoustic evacuation signal sounds, apparatuses must be switched off, if necessary, windows and doors must be closed, and you should evacuate the building as quickly as possible by the stairs and indicated escape routes. The instructions of the institution's emergency response team, the fire department and instructions broadcasted over the public address system must be strictly followed.
- art.15. The acquisition, placement and moving of general safety devices (like fire extinguishers and warning signs) is only permitted after receiving permission by the Centre for Safety and Environment (AMD).
- art.16. All fire extinguishing devices, manual fire alarms, off switches, shutoff valves, hallways, stairs, exits, passageways and escape routes must be kept free of obstacles.  
Walkways in laboratories, experiment rooms and workplaces must always allow passage, for them to serve as escape routes.

## Activities

- art.17. When work is either commissioned or carried out, proper measures must be taken to ensure within reason that there will be no fire, explosion and/or personal exposure to hazardous chemical, physical or biological agents.  
Before starting new activities (new to him or her), everyone is obliged to obtain the necessary information about:
- risks associated with these activities regarding health and safety for him or her, and others,
  - risks associated with these activities regarding the environment,
  - alternatives available for reducing the risks associated with these activities,
  - necessary safety measures, and
  - safety equipment required for these activities.

**Note:**

*Information must be obtained from a personal supervisor, colleagues, room supervisor, practical coordinators or assistants, superiors, or by personally consulting literature.  
To obtain information and advice about the work routine measures required, or safety equipment, you can consult the Centre for Safety and Environment (AMD).*

- art.18. Wearing work clothes and/or personal protective equipment (PPE) is obligatory in all classified areas and in areas thus designated by authorised personal.

**Note:**

*Work clothes will be supplied by the employer.  
Students are obliged to obtain laboratory clothing (at their own expense) and are responsible for cleaning, repairing and replacing the same when necessary.  
Personal protective equipment is available at the supply rooms.  
Special rules apply to PPEs that require personal adjustment and PPEs that must be used in specific workplaces and for specific activities.  
For advice concerning personal protective equipment the Centre for Safety and Environment (AMD) can be consulted.*

- art.19. Those responsible for supervising laboratory practicals or workgroups, specialists supervising classified areas, and authorised personnel can set further rules that apply only to their field of activity.  
These rules must be approved by the Faculty Board.

**Note:**

*The above further rules are or will be recorded in regulations the content of which must be presented to personnel working in the areas to which these regulations apply, as well as to anyone expressing the wish to be kept informed. Regulations always apply to classified workplaces, and these can be obtained from the Faculty of M&NS's Centre for Safety and Environment (AMD).  
A list of classified workplace types is included in APPENDIX 3.*

## Chemicals, apparatus and plants

- art.20. Transport of chemicals, compressed gases and cryogenic fluids is allowed only with the proper means of transport.  
Connecting cylinders containing compressed gases to plants and valves is permitted to trained personnel only.  
If a building has a service elevator, the only allowed transport of the aforementioned substances is by this service elevator.

**Note:**

*There are further rules that apply to the transport of cryogenic fluids in elevators. For more information, please consult the Faculty's Centre for Safety and Environment (AMD).*

- art.21. Acquisition, storage, use and transport of apparatuses, chemicals, radioactive substances, pathogenic materials and genetically modified materials must comply with the guidelines set by the Faculty Board.

**Note:**

*For each laboratory room the following guideline applies: a maximum of 1 litre combustible fluid per m<sup>2</sup> floor surface area, on average. In normal laboratory rooms the maximum volume of highly flammable solvents allowed per test is 2 litres.*

*For workplaces and experiment rooms, as a guideline, only the amount of chemicals necessary for daily work may be present.*

*After hours flammable solvents and degreasants may only be present in laboratories if placed in flame-retardant cupboards.*

*Proper extinguishing agents must be present in every room containing highly inflammable substances.*

*Restrictions apply to the use of several types of chemicals according to the Dutch Occupational Health and Safety Act, chapter 4: Hazardous substances and biological agents ("Arbowet."). By this chapter, the general use of benzene, pentachloroethane, 1,1,2,2-tetrachloroethane and tetrachlorocarbon as solvents, cleaning agents or diluting agents is prohibited. The same prohibition applies to products containing one or more volume-percent of these substances. Their use is permitted only in a closed system or in a manner that offers at least an equivalent level of protection. For the Faculty of M&NS this means that use of the above-mentioned chemicals is prohibited, unless authorisation has been obtained from the Centre for Safety and Environment (AMD).*

*Furthermore, the preparation or use of the following substances is prohibited:*

- 2-naphthylamine and its salts,*
- 4-aminodiphenyl and its salts,*
- benzidine and its salts,*
- 4-nitrodiphenyl.*

*It is prohibited to keep supplies of these chemicals.*

*The prohibition does not apply if the substances are present in a mixture or solution at a concentration lower than 0.1 percent by weight.*

*Highly toxic, explosive or highly reactive chemicals may only be used with the greatest possible precautions in specially designated and equipped spaces (fume cupboard, point suction, explosion-proof). For further information, please consult the Faculty's Centre for Safety and Environment (AMD).*

- art.22. Repairs or modifications to plants or apparatus are allowed only if carried out by, or per the instructions of, authorised personnel.

**Note:**

*Any repairs, modifications or construction of permanent plants are carried out by trained personnel. This also includes placement and mounting of apparatus, scaffolding, blackboards and paintings. In cases of breakdown of technical plants the proper department must be informed (see APPENDIX 10).*

*After hours please call the emergency number of the Technical Service (see APPENDIX 10).*

- Art.23. Use of ionising radiation is allowed only:
- after internal permission has been granted,
  - in designated workplaces (radionuclide laboratories),
  - by fully qualified personnel (level 5B radiation technician) and those authorised by the radiation technician in charge,
  - entering the designated workplaces is allowed only after approval by the local technician.

**Note:**

*The use of ionising radiation emitting apparatus and the acquisition, use and waste disposal of radioactive materials (open radioactivity) is bound to the site permit granted to the University (Nuclear Energy Act, ("Kernenergiewet")) and any supplementary regulations and rules set by or on behalf of the Faculty Board.*

- *Internal permission can be requested through the radiation technician in charge and is ultimately granted by the senior radiation specialist of Leiden University.*
- *Applications for the radiation hygiene course will be handled by the radiation specialist in charge.*
- *Acquisition of radioactive substances is by a Level 3 radiation specialist and by the accounts department (i.e. not by the supply department or directly). Any material received must be registered with the radiation specialist in charge responsible for the records.*
- *The radioactive material stocks are stored in a flame-retardant box. In the radionuclide laboratories only current supplies are allowed and these must be stored in the designated cupboards.*

- Art.24. The preparation of genetically modified organisms (GMO's) and working with the same, including storage and transport, is allowed only:
- after submitting a project application at and receipt of a permit from VROM (Dutch Ministry for Housing, Regional Development and the Environment)
  - in designated workplaces (areas of contained use, incubators, greenhouses and animal housing),
  - by fully qualified or experienced personnel authorised for these activities by the Biological Safety Officer (BSO),
  - by personnel in training under direct supervision of the above-mentioned personnel and after applying to the BSO.

**Note:**

*For more detailed information on the following items, please refer to the GMO manual:*

- *the procedure for submitting and changing projects (via BSO),*
- *workplaces with different classification levels,*
- *requirements imposed on the lay out of areas of contained use,*
- *directions for work to be carried out there,*
- *procedure for application, training and allowing access by or to employees, and*
- *required checks, registrations and supervision.*

- Art.25 Depending on the classification of the organisms used or the substances produced, certain regulations apply to performing experiments with biological agents.  
If the agents belong to class 3 or 4 (pathogenic for humans), the experiments can only take place:
- after reporting this to the Dutch Labour Inspectorate (Arbeidsinspectie) through the BSO of the Centre for Safety and Environment (AMD).

**Note:**

*More information and advice can be obtained from the BSO of the Centre for Safety and Environment (AMD).*

- Art.26. Laboratory animals
- Before performing experiments on animals, approval must be obtained from the University Animal Experimentation Committee ("Universitaire Dier Experimenten Commissie", UDEC).
  - For housing of and experimenting with genetically modified laboratory animals (restriction level D1, transgenics) or laboratory animals with an associated modified organism (restriction level DM-II, Gene therapy) a positive decision from the Ministry for Housing, Regional Development and the Environment (VROM) is required.
  - For carrying out biotechnological treatment of animals, as described in the "Biotechnology and Animals Decree" ("Besluit biotechnologie bij dieren"), article 66, paragraph a, items a and b, a permit is required from the Ministry of Agriculture, Nature Management and Fisheries ("Ministerie van Landbouw, Natuurbeheer en Visserij").
  - Experiments on animals are permitted only to properly authorised personnel (ex article 9 or ex article 12 officials).
  - Laboratory animals must be registered.
- Experiments with genetically modified animals are also subject to the items listed in article 24.

**Note:**

See APPENDIX 3: *classified workplaces*.

- NB** The activities listed in articles 23, 24, 25 and 26 must take place during normal working hours (art. 5) whenever possible.  
During weekends and in the evenings, these activities are allowed only under expert supervision.  
For carrying out these activities out during the night, written permission from the scientific director is required

- Art.27. The use of class 3b and class 4 lasers is allowed only in properly classified workplaces. Without the required safeguards listed in the "Non-Ionizing Radiation Regulations, Leiden University" ("Regeling Niet-Ioniserende Straling Universiteit Leiden"), class 3b and class 4 lasers may not be operated.

**Note:**

See APPENDIX 3, *classified workplaces*, and appendix 4a, 'Working with NIR'.

- Art.28. Access doors of rooms in which magnets with very strong magnetic fields (leakage field higher than 0.5 mT=5 Gauss) are operated, must be provided with warning signs. Access doors to adjoining rooms in which the leakage field could exceed 0.5 mT (5 Gauss) must also be provided with warning signs.

**Note:**

See APPENDIX 3 *classified workplaces*, and appendix 4a, 'Working with NIR'.

- art.29. All apparatuses must be switched off after office hours or labelled.  
Apparatuses required for maintaining specific conditions (cooling, heating, vacuum, etc.) are not subject to this rule.

**Note:**

*Apparatuses operating after hours: for the continuous operation of equipment permission is required from the room supervisor or from a Centre for Safety and Environment (AMD) employee (see rear of green label). After inspection of the apparatus (by the aforementioned employees), approval is indicated by a label on the equipment stating the apparatus may operate after hours. Approval is granted for a maximum of one year.*

# **Legal aspects of the safety regulations.**

## **The Dutch Occupational Health and Safety Act**

The Dutch Occupational Health and Safety Act 98 ("Arbowet 98") defines the obligations of employers and employees to ensure proper working conditions. The Labour Inspectorate ("Arbeidsinspectie") is responsible for monitoring compliance. The safety regulations of the Faculty of M&NS are based on the Occupational Health and Safety Act 98 and the associated Occupational Health and Safety Decree.

## **Responsibilities**

The Board of Governors has charged the Faculty Board with the responsibility for safety within its faculty. The dean of the Faculty of M&NS has mandated this responsibility to the scientific directors of the institutes (see Preface).

Failure to comply with the various stipulations of the safety regulations can be regarded as neglect of duty in the sense of the CAO (collective labour agreement) of the Dutch universities (art.11.1, paragraph 3). These regulations also apply to students, trainees and guest employees. In cases of non compliance with the various conditions of the safety regulations they too can be denied access to the laboratory practicals and/or the buildings of the Faculty of M&NS for a short or long term.

## **Legal liability**

Staff members of the Leiden University, registered students and visiting staff members are covered by the insurance for third-party liability taken by Leiden University (see memo 312980 of the BoG of Aug. 1973). This insurance is paid out only if Leiden University is held liable or partly liable. Intentional damage is excluded, in those cases personal liability applies.

In cases of intentional or reckless damage to the property or buildings of the university by a staff member, he or she will be held liable for the damage caused for the amount not covered by the university insurance.

## Appendix 2:

# University regulations

This summary is not complete. The regulations can be consulted at the Faculty's Centre for Safety and Environment (AMD). For a complete summary of the current regulations, the website of the Internal Safety, Health and Welfare Service of Leiden University: <http://www.arbodienst.leidenuniv.nl/> should be consulted

- Crisis management coordination regulations
- Emergency response team regulations
- Chemical waste disposal regulations
- Area classification regulations
- Radiology technicians training regulations
- Laser safety regulations
- Non-ionizing radiation manual (draft)
- GMO (genetically modified organisms) manual
- Regulations accidents and (environmental) incidents
- Ionising radiation and X-ray equipment regulations
- Ionizing radiation manual (draft)

## Appendix 3

# Classified workplaces

The use of certain apparatuses and/or experiments is restricted to a number of specialized or classified workplaces. Classified means that access to these areas is restricted and subject to specific rules. This applies to activities with lasers/NIR, magnets, ionizing radiation, modified organisms, pathogenic micro-organisms, and laboratory animals. Example of warning classified area see appendix 9 (Safety signs, warning signs)

### **Lasers**

Use of these light sources is restricted to classified workplaces, so designated by warning signs. Whenever a class 3b or 4 laser is active, this is indicated by a lit warning sign. Access to these workplaces is allowed only after obtaining permission from the employee responsible for operating the laser set-up. At the access door(s) to these workplaces a sign indicates under whose responsibility the laser set-up operates. See for further information the Laser Safety Regulations ("Regeling laserveiligheid", to be replaced by the Non-ionizing Radiation Regulations, Leiden University).

### **Magnets**

In some workplaces magnets with very strong magnetic fields are operated. No persons wearing a pacemaker, implants with iron-containing materials (cardiac valves) and implanted electronic devices (electronic hearing aids, insulin pumps, electronically controlled prostheses and muscle stimulators) is allowed near these strong magnetic fields. For those who wear any of the above-mentioned prostheses not only the static field is dangerous, but moving through such a field may pose an even greater danger. Information stored on bank cards may be erased by such magnetic fields. Please pay attention to the warning signs.

### **Genetically Modified Organisms (GMO)**

May only be created and/or used in specially designated workplaces (areas of contained use). Modifying the lay out or classification (up or downgrading) or discontinuation of the classification of these rooms is allowed only after consultation with the BSO. See the GMO manual.

### **Pathogenic micro-organismes (classes 2, 3 and 4)**

These micro-organisms may only be used after consultation of the Faculty's Centre for Safety and Environment (AMD) and only in specially designated workplaces.

### **Ionizing radiation**

Activities involving radio nuclides may only be conducted in B, C and D laboratories. Ionizing radiation emitting equipment may be operated only in specially designated and approved rooms. The names of the personnel in charge are always stated on the access doors to rooms in which radioactive radiation is used. Changing or dismantling of a radionuclide laboratory is allowed only after obtaining permission from the radiation technician of the Faculty's Centre for Safety and Environment (AMD).

### **Laboratory animals**

The housing and treatment of laboratory animals are governed by specific regulations. Access to rooms for housing and treating laboratory animals is restricted to authorised personnel (art. 9 or art. 12 as listed in the Laboratory Animals Act). For the housing and treatment of laboratory animals within the Faculty of M&NS: see Laboratory Animal Facilities Protocol, M&NS, February 2002

### **Cold-storage rooms**

When working in cold-storage rooms, protective clothing against the cold is mandatory.

## Appendix 4a

# Working with Non-Ionizing Radiation (NIR)

## Microwave Radiation

Microwaves pass through the entire body. The best known effect of microwaves in the body is the development of heat by the absorption of microwaves by body water. The amount of heat depends on the frequency (wavelength). Microwave radiation is especially harmful in the frequency range of 1000-3000 MHz (microwave oven: 2450 MHz) when the energy per unit area (field strength and per unit time) is large enough. Occasionally 10 W/m<sup>2</sup> (1 mW/cm<sup>2</sup>) with an exposure of 8 hours per day (5 days a week) is used as a standard: in case of a continuous exposure below this standard during a working day, no harm is to be expected. The heat effect can be especially harmful to organs with little blood circulation (poor cooling).

The group technician or the Centre for Safety and Environment (AMD) can supply the proper equipment for verifying the presence of harmful radiation.

## Lasers (art. 27 SR)

When installing a laser system, the directives of the Labour Inspectorate ("Arbeidsinspectie") and the internal university regulations (Laser Safety Regulations ("Regeling Laserveiligheid")) must be followed. Please pay attention to the mandatory warning signs. Laser light (class 3b and 4) can damage the retina, even when reflected. When working with a laser, always wear goggles with lenses adapted for the specific laser type.

Use gloves when working with toxic laser fluids. Clean up spilled fluids immediately. For laser fluid waste disposal use the containers with the black or red band (see the LION waste disposal regulations).

Whenever the warning sign above the laboratory access door is lit (indicating 'LASER'), the laser is active, and wearing the prescribed safety equipment when entering the room is mandatory.

To each laser system one person is appointed as responsible. He or she is responsible for a safety report and instruction manual for the laser system. The laser safety report must be updated every two years, or sooner, in case of extensive alterations of the laser system.

Be aware that nearly all dyes used in dye lasers are toxic and/or (suspected) carcinogenic. (Use gloves.) Weigh them in a special place (fume hood) and do not spill them (even in solution).

## Magnetic Fields

In some workplaces magnets with very strong magnetic fields are operated. No persons wearing a pacemaker, implants with iron-containing materials (cardiac valves) and implanted electronic devices (electronic hearing aids, insulin pumps, electronically controlled prostheses and muscle stimulators) are allowed near these strong magnetic fields. For those who wear any of the above-mentioned prostheses, not only the static field is dangerous, but moving through such a field may pose an even greater danger. Information stored on bank cards may be erased by such magnetic fields. Please pay attention to the warning signs.

## **Working with: Ionizing Radiation**

### **Radioactive substances (art 21&23 SR)**

A written permission from the Scientific Director is needed before one is allowed to work with radioactive materials in the laboratory.

The actual supervision is by a radiation specialist.

Generally, the time necessary to obtain a legal permit for working with radioactive materials can take the not inconsiderable period of six to twelve months!

Anyone working with radioactive materials should acquaint him or herself with the legal and university regulations, and strictly adhere to these regulations.

Generally extensive technical building modifications are needed for obtaining a permit.

Radioactive material orders require the consent of the radiation specialist.

### **Working with X-ray emitting equipment**

Working with x-ray emitting equipment should also be carried out under the supervision of the radiation specialist.

For any x-ray equipment a license must have been applied for at the Ministry of VROM (Radiation Protection Decree of the Dutch Nuclear Energy Law ("Besluit stralenbescherming Kernenergie wet")), or – depending of the tube voltage- the x-ray equipment must be reported to the Ministry. A license must always be applied for if any x-ray equipment is used for educational purposes. The equipment may be used only after obtaining the license.

## Appendix 5

# Working with cryogenic fluids

## Personal protection

- When working with cryogenic liquids, one should wear the prescribed personal protection equipment, such as:
- a face shield or safety goggles with side protectors against splashes;
- cold-insulating gloves, with a loose fit for quick removal, in case splashes of cryogenic fluids were to enter the glove;
  - loose laboratory jackets that can be removed quickly.

## Safety procedures

Pouring liquefied gases out of glass Dewar flasks is advised against. Dewar flask rims are welded. Contact of the weld with extremely cold fluids can induce tensions, causing an implosion of the flask; therefore, always use a siphon or specially constructed transportation containers.

Only the proper Dewar flask lid may be used to close the bottle, because this lid contains special openings allowing continuous venting of the gas produced. Note that these lids, when they come into contact with cryogenic fluids, can become brittle and break easily.

In flasks containing liquid oxygen, no glass flasks with active carbon or other easily flammable organic substances may be cooled; these substances should be cooled with liquid nitrogen.

Because of explosion risks neither liquid oxygen nor liquid air may be used when cooling flammable gases or fluids to very low temperatures. In these cases too, one should use liquid nitrogen as a coolant. When using liquid nitrogen in open air, one should be aware that, within a short period of time it will also contain liquid oxygen.

Provide glass Dewar flasks with a protective jacket (metal gauze, sheet metal, cloth, tape). When filling, cool with limited amounts of coolant.

## Liquid helium

Whenever one works with very low temperatures, the safety aspect should play an important roll. There are several hazards to consider.

1. The fluids mentioned are extremely cold; as mentioned, helium is the coldest of all fluids. Contact with cold fluids (even cold helium gas!) causes severe frost burns.
2. The extremely low temperatures of liquid helium will cause air to condense and freeze. A typical example of this is the occurrence of fluid droplets on helium evaporation pipelines; these are droplets of liquid air, so be careful.
3. When working with liquid helium, keep external surfaces clean. In paragraph 2, the occurrence of droplets on the outside of pipelines is mentioned. In case of this kind of condensation, the liquid nitrogen will evaporate out of the liquefied air first, because it has a lower boiling point than oxygen. As a result an oxygen-rich fluid drips from the pipeline; when this happens, spontaneous ignition of grease and oil is not impossible. A clean work area is important.
4. NEITHER helium, NOR nitrogen supports life. At high concentrations of helium gas or nitrogen gas an imminent oxygen shortage occurs.  
Although helium is not toxic, it may cause breathing difficulties in poorly ventilated rooms. High concentrations of helium gas can be noticed by the effect on the vocal cords.

Symptoms by oxygen deficiency are:

- |           |   |
|-----------|---|
| 19%-15%   | Obviously delayed reactions.  |
| 15%-12%   | Deep breathing, fast pulse, comprehensive coordination disorder.        |
| 12%-10%   | Feeling dizzy, erroneous judgement, and pale-blue coloured lips.        |
| 10%-8%    | Vertigo, queasiness, unconsciousness.                                   |
| 8%-6%     | Brain damage after 4-8 minutes. Death occurs after more than 8 minutes. |
| 4% and << | Coma within 40 seconds, then death.                                     |

5. When using helium one should bear in mind the huge volume expansion from liquid to gas. Small amounts of fluid are converted into huge amounts of gas by evaporation: 1 litre of fluid produces 750 litres of gas! Most cryogenic fluids require significant amounts of heat to evaporate. However, this is not the case for liquid helium; when helium is introduced in a warm or only partially cooled apparatus, spontaneous evaporation occurs. Rapid and violent evaporation occurs during careless filling of cryostats, and when breaking vacuum. Therefore, one should always take care that gas venting is adequate.

### **Comments regarding safety**

1. Burns caused by cold liquids should be treated like normal burn wounds. This implies immediate and extensive flushing with running water.
2. If anyone becomes dizzy or faints when working with helium, take him or her to a well ventilated room at once.
3. The vapour appearing when liquid helium comes into contact with air, is condensed pollution; mainly air and water vapour, not the helium gas itself, which is invisible.
4. Never become overconfident with cryogenic liquids! Errors can be fatal!

### **Special helium hazard**

Breathing in helium gas in order to demonstrate the change in sound velocity in helium is prohibited. Due to the displacement of oxygen, breathing in helium gas can have far reaching consequences. More information is available at the Centre for Safety and Environment (AMD).

## Appendix 6

# Waste disposal regulations Faculty M&NS

Laboratory waste is divided into four categories:

1. Industrial waste
2. Hazardous (chemical) waste
3. Biological and microbiological waste
4. Radioactive waste

All types of waste are subject to strict regulations with regard to safety and external disposal. Failure to comply with these regulations can be dangerous and may lead to research delays.

## 1. Industrial waste

All waste from lounges, workplaces and laboratories is disposed of as industrial waste, unless it is hazardous (household) waste. This includes all waste not specified in the special waste type groups stated below (no. 2 to no. 4).

A distinction will be made between industrial waste and reusable waste.

### The following waste group are collected separately:

- Batteries
- Bottles and other glass
- Sharps/injection needles
- Metals
- Redundant computers/accessories and/or parts
- Paper and cardboard
- Fluorescent light tubes Toner cassettes/ink cartridges
- Hazardous Household Waste (HHW) ("Klein chemisch afval")
- Plastics

For more information/questions regarding hazardous waste, please consult the Faculty of M&NS's Centre for Safety and Environment (AMD).

For questions regarding industrial waste, you can consult staff members the Supply Centre.

The following are included under Household Hazardous Waste ("Klein chemisch afval"):

- leftover paint, glue
- diskettes, videotapes
- markers, Tippex
- spray cans (empty or full)

## 2. Hazardous (chemical) waste

Hazardous waste includes all waste chemicals as defined in the Chemical Waste Disposal Regulations, Leiden University. This waste is divided into **liquid and solid** hazardous waste.

### Liquid hazardous waste

Liquid hazardous waste is stored in ten-litre drums divided in types recognizable by the coloured band. Drums should be filled in such a way that at least 5 cm below the opening is kept free (otherwise transport of the drums will be seriously hampered).

Drums may not contain any solid parts (e.g. needles, pipette tips, stirring magnets, etc.). When filling the drum, use a filter or sieve/funnel.

- *Category 1A: Aqueous solutions (>pH5)*

Colour code = black.

Contents: Any more or less toxic and polluting organic and inorganic substances dissolved in water.

Examples: aqueous solutions of heavy metals, dichromate-sulphuric acid (neutralize with a base), film developer, lead containing dyes, inorganic sulphides, neutralized acids, bases.

- *Category 1B: Aqueous solutions (<pH5)*

Colour code = black.

Contents: Any more or less toxic and polluting organic and inorganic substances dissolved in water.

Examples: aqueous solutions of dichromate-sulphuric acid, lead containing dyes, inorganic sulphides, and acids. This drum must be labelled with a special sticker showing the "corrosive and caustic" pictogram.

- *Category 2: Flammable fluids*

Colour code = red.

Contents: Flammable fluids, including any substances dissolved, if not included in any other category.

Contents: Organic solvents and dissolved substances, excluding those containing more than 50% water (see cat. 1A).

Examples: toluene, ethyl acetate, pentane, hexane, ether, pyridine.

- *Category 3: Halogen-containing, organic chemical fluids.*

Colour code = blue.

Contents: F, Cl, Br or I substituted organic chemical substances, both liquid and solid, if dissolved in organic solvents.

Examples: dichloromethane, chloroform, trichloroethylene, ethylene bromide, methylene chloride, DDT or hexachlorocyclohexane in alcohol, paradichlorobenzene in ether.

- *Category 4: Oil residues.*

Colour code = green.

Contents: spent lubricants and greases, originating from workplace and laboratory apparatuses (e.g. oil pumps, oil baths, etc.).

### **Solid hazardous waste**

Solid chemical waste can only be accepted in a properly sealed, clearly labelled packaging.

The label must state:

- name and department of the producer
- name of the substance
- quantity of the substance
- (gross) formula of the substance

Large quantities of waste resulting from clean-up operations or transfers should be disposed of in consultation with the hazardous waste specialist.

### **Metallic mercury**

Metallic mercury and mercury containing equipment are collected separately. The packaging must be sealed properly at delivery.

## **3. Biological and microbiological waste**

Biological waste includes all leftovers from microbiological work, plants, cadavers, and human remains. Biological and microbiological waste must be stored in the designated containers or rooms.

Biological waste produced in experiments involving radioactive material is subject to the regulations for radioactive waste (see no. 4).

Cadavers of laboratory animals must be decapitated before disposal. The bucket can be temporarily stored in a freezer or cold-storage room. The responsible staff member will see to this.

### **Uninfected laboratory animals**

Laboratory animals are collected in a plastic bag and deposit in a special sealable bucket for biological waste disposal containing a label with: "BIOLOGISCH AFVAL, KADAVERS", and also the date, workgroup, room number and telephone number.

### **Laboratory animals infected with micro-organisms**

Hand over in well-sealed autoclaveable garbage bags in metal containers, labelled with autoclave tape.

### **Human remains**

These human tissues and sera: collect in a special sealable bucket for biological waste disposal labelled: "BIOLOGISCH AFVAL, HUMAAN", and also showing the date, workgroup, room number and telephone number.

### **Microbiological waste**

Microbiological waste can be disposed of in two ways:

1. as industrial waste after autoclaving: the waste must be handed over in well-sealed autoclaveable garbage bags in metal containers, labelled with autoclave tape.
2. as biological material: the material is disposed of immediately and should be collected in special sealable plastic drums.

### **Plant waste**

Plant waste is disposed of as industrial waste.

If the material was experimentally brought into contact with micro-organisms and may have become modified, the waste must be treated as microbiological waste (see above).

### **Sharps/injection needles**

Sharps derived from biological activities must be placed in the designated yellow pots for sharps (with biohazard sign.) The pots are labelled with autoclave tape and disposed of as industrial waste after autoclaving.

Other sharp waste must be collected separately in a so-designated and labelled container.

This container will be disposed of as industrial waste.

Sharp waste that must be explicitly disposed of as hazardous waste (chemical) (see hazardous chemical waste) is treated as an exception.

## **4. Radioactive waste**

Radioactive waste includes all waste produced in B, C or D laboratories.

Disposing of possibly radioactive material through the drain or as household/industrial waste is strictly prohibited.

The categories are: liquid waste, solid waste and counting vials:

### **Liquid radioactive waste**

This waste must be collected in specially designated drums. The liquid waste may contain no solid objects (pipette tips, Pasteur pipettes, paper, gel, etc.). Funnels must be fitted with a filter.

### **Solid radioactive waste**

This category of **wast** must be collected in the designated drums.

### **Counting vials**

Counting vials must explicitly be well sealed before collection in the designated waste drum.

Furthermore, a distinction must be made between the isotopes:

•H  
•C  
•P, •P, •S  
•I

Tape, stickers and cardboard with symbols or text concerning radioactivity should be disposed of only in drums designated for •C (solid waste).

The authorized service or specialist will provide empty waste drums with the proper cards. When a drum is full, the local radiation specialist submits the completed card, deposits it in the pigeonhole for radioactive waste, or hands over the waste at the storage area at the designated times.

The aforementioned specialist is responsible for further disposal and record handling regarding this waste.

## Appendix 7

# Registration of hazardous substances regulations

As of June 2005 the new guideline PGS-15 ("publicatie Gevaarlijke Stoffen", publication Hazardous Substances) applies. This guideline states how to register, label and store hazardous substances. The new environmental permits (permits necessary for performing activities like research) refer to and comply with this new guideline.

The faculty regulations (established in 2005, stating a lower limit) are overruled by this new guideline. According to PGS-15 all hazardous substances (substances with a pictogram with orange background) have to be registered, and no lower limit applies to either weight or volume.

Besides the "Arbeidsinspectie" (AI, Labour Inspectorate), the Milieudienst Midden Nederland (Regional Environment Department of the Central Netherlands) (on behalf of the Leiden Council), and FIOD (Dutch tax inspectorate of the Inland Revenue) and customs now also take part in the registration of hazardous substances.

In case of calamities, emergency services also need this information (e.g. which hazardous substances are present in the building, their locations and amounts).

As of 2006 each researcher is requested to register the following data of all hazardous substances (the substance characteristics can be found on the labels or on the internet, MSDS):

- Room number
- CAS number
- Name of the substance (in English)
- Quantity (maximum weight and volume, indicated on the label)
- Risks (indicated on the label, pictogram)
- Risk- & Safety sentences (numbers, indicated on the label)

This information needs to be registered digitally in a computer database using the standard format supplied by the faculty.

The registration of hazardous substances must to be updated at least once a year, more often if necessary (e.g. at delivery).

The data on carcinogenic, mutagenic or reproduction toxic substances must to be updated at least once a month.

## Appendix 8

# Hazardous substances labelling regulations

## Labelling of chemicals

As a result of a visit by the "Arbeidsinspectie" (Labour Inspectorate) in 2000, the Faculty Board established the "Hazardous substances labelling regulations" ("Regeling etikettering gevaarlijke stoffen"). These regulations came into being by close cooperation of the Centre for Safety and Environment (AMD) ("arbo- & milieudienst") and the Faculty's various safety committees.

As of 2006 the environmental permit refers to PGS-15, a hazardous substances guideline stating how hazardous substances should be registered, labelled and stored. The permit enforces compliance with this guideline. The Scientific Director of the institute decides which departments of this institute should label the solutions.

### Labelling regulations:

1. All solutions and non-hazardous substances in non-original packaging should have a label containing the following data:
  - Name of the substance or structure formula and, if possible, the CAS number and concentration of the substance
  - Name of owner/ user
  - Date of purchase/ production

This manner of labelling also applies to hazardous substances in non-original packaging present in a room for no longer than one week.  
Abbreviations and acronyms are not allowed unless common enough to avoid any misunderstandings (e.g. EDTA).
2. Concentrated solutions of hazardous substances and organic substances or mixtures must be provided with pre-printed labels. These labels should contain the following data:
  - Name of the substance (including the concentration of the substance, whenever possible)
  - CAS number
  - Risk pictogram
  - R & S numbers
  - Date of purchase or date of production

*Exception:* If these substances are present in a room for a maximum of one week only, labelling as under item 1 will suffice.
3. For preparations with unknown risks the following should be clearly written down on the label:
  - Name of the responsible employee
  - Date and time
  - Name or structure formula of the substance
  - And, on the location of the R sentence, the sentence: "Preparaat, onbekend risico".

*Exception:* If these substances are present in a room for a maximum of one week only, labelling as under item 1 will suffice.
4. Solutions of acids and bases at concentrations of 1 M and higher must be provided with pre-printed labels as mentioned in item 2.  
If these substances are present in a room for a maximum of one week only, labelling as under item 1 will suffice.
5. Aqueous substances: diluted solutions of hazardous substances (toxic, irritable or flammable) that can be considered to be hazardous no more (the hazardous properties have been literally solved), can be labelled as under item 1. Either the main component or a logical name should be used in establishing the name of the substance (e.g. TRIS-buffer).
6. R & S sentences should be shown with the character(s) and the proper number(s). There is often no room on the label for the full sentences. Each laboratory must be provided with a clearly visible poster explaining the R & S sentences.

## Appendix 9

# Safety Signs

The legal regulations provide guidelines for the colours used as well as the shapes and symbols. Colours used for safety instructions are **red** ("stop"; "prohibited"), **yellow** ("caution"; "possible danger"), **green** ("no danger"; "help"), **red** ("extinguishing agents") and **blue** ("directions"; "orders").

**Prohibitory signs:** are round, have a red rim and diagonal bar, and a black symbol on a white background.

**Warning signs** are triangular, have a black rim and a black symbol on a yellow background.

**Order signs** are round with a white symbol on a blue background.

**Safety signs** are square with a white symbol on a green background.

**Rescue equipment signs** are square with a white symbol on a red background.

### Prohibitory signs

(red rim and diagonal bar, and a black symbol on a white background)

1. smoking prohibited
2. smoking and open fire prohibited
3. unfit for drinking
4. no admittance
5. no admittance with a pacemaker



1.



2.



3.



4.



5.

**Warning signs**

(black rim and symbol on a yellow background)

1. danger
2. danger, high voltage
3. magnetic fields
4. explosive substances
5. flammable substances
6. oxidizing substances
7. laser beam
8. biohazard
9. radioactive substances
10. corrosive substances
11. toxic substances



Warning signs classified area  
(black rim and symbol on a yellow background)

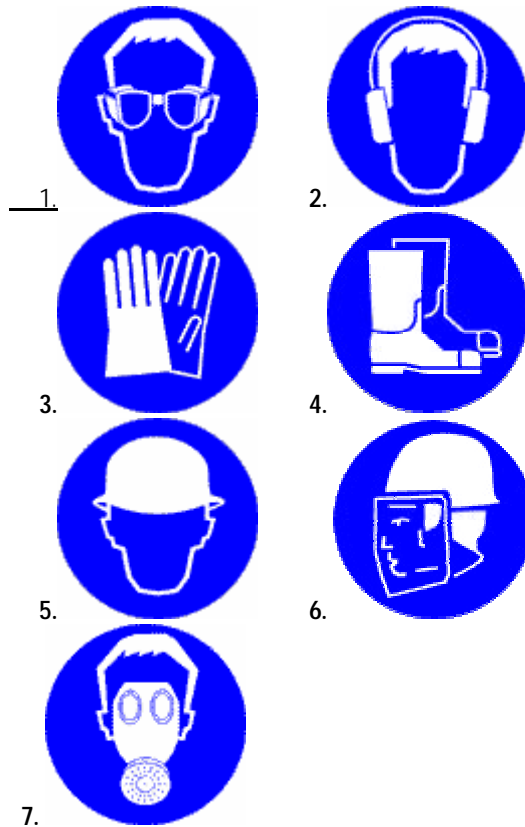


Example: classified area (GMO),  
microbiological laboratory level II

**Order signs**

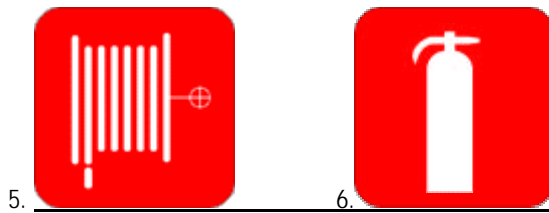
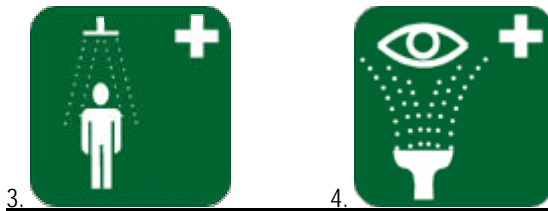
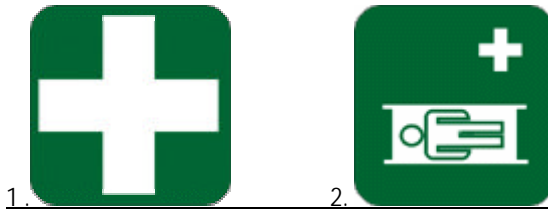
(white symbol on blue background)

1. eye protection mandatory
2. hearing protection mandatory
3. gloves mandatory
4. safety shoes mandatory
5. safety helmet mandatory
6. face protection mandatory
7. respiration protection mandatory



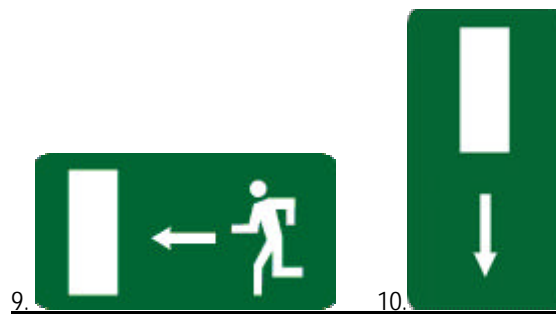
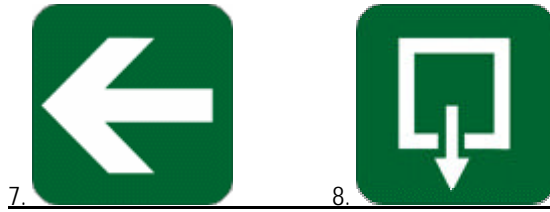
**Safety signs (rescue equipment signs)**  
(white symbol on green or red background)

1. first aid post
2. stretcher
3. emergency shower
4. eye shower
5. fire-hose
6. fire extinguisher



**Safety signs (direction and exit)**  
(white symbol on green background)

- 7. escape route direction
- 8. (emergency) exit
- 9. emergency exit direction
- 10. emergency exit location



## Appendix 10: General information

### Reporting fire & accidents

Only a small fire can be extinguished without help.

<b>Building (reception)</b>	<b>Telephone number reception</b>	<b>Alarm during office hours (08:00-18:00)</b>
Gorlaeus Laboratory	4611/4400	4222
Huygens complex	5700/5800/5900	5678
Het Snellius	6969	6999
Van Steenis	3500/3502	3501
Van der Klaauw	5000/5001	5005
Clusius	4700	4700
Botanical Gardens	5144/5145	5005

**After hours alarm: 4444 (18:00-08:00 hour)**

**Filing general complaints:** At the reception you will be referred to the department or organisation that will handle your complaint.

### After hours reporting of technical emergencies (emergency number)

*Gorlaeus/Huygens/Oortgebouw/ Kamerlingh Onnes/ Het Snellius: 4600*

### Centre for Safety and Environment faculty of Sciences (AMD)

For any questions or advice you have about safety, health or environment at your work place, please refer to:

Email: [AMD@Science.leidenuniv.nl](mailto:AMD@Science.leidenuniv.nl)

Info AMD: <http://www.amd.leidenuniv.nl>

### Employees AMD:

*Marc Flutters* (☎ 4333 or cell phone: 904333): acting head AMD:

Safety officer, Radiation Safety Coordinator, BSO.

*Cees Verschoor* (☎ 4312 or cellphone 90 4312)

Safety officer, Emergency Response Team (BHV) coordinator

*Frans Brederode* (☎ 4662 or cell phone: 904662)

Local Radiation Safety Officer, B laboratories, BSO

*Peter Roemelé* (☎ 5760 or cell phone: 904566)

Safety officer

*Paul Verlaan* (☎ 4753 or cell phone: 904753)

Radiation Safety Coordinator IBL, BSO.