SAFETY REGULATIONS

LION

Publication January 2001

Leiden Institute of Physics

CONTENTS

1. Organization

University

The responsibility for the care of safety and environment rests by the chairman of the College Board (CvB). This task is for the most part mandated to the boards of the faculties and therein to the various institutes. The Service for Safety and Environment (DVM) is concerned with support for this task, as are the safety officials of the faculties. In practice, these safety officials are the first contacts (after the direct chef / the docent) concerning questions or comments about the care of safety.

The Service for Safety and Environment advises both the CvB as well as the faculties about the care of safety. As foundation for their advice, the

DVM does measurements on the work floor, such as on climate, or on work hygiene. Other tasks of the DVM are collecting chemical and radioactive waste and maintaining contacts with government agencies (Labor Inspection, the City). Furthermore, they coordinate training, for example for the local help services and for safely working with radioactivity.

LION

The responsibility for the care of safety and environment within the Leiden Institute for Physical Research (LION) rests by the Scientific Director. As support for this task, there are safety officers working for the faculty. The safety officer for LION is H.J. Rijskamp.

In order to be able give the care of safety an adequate form, the safety officer, with some regularity, does safety inspections, together with the technicians. On the basis of that which is noted during these inspections, the safety officer gives advice and/or suggests steps to improve the work situation.

The activities of the LION take place in the Huygens Laboratory, in the Kamerlingh Onnes Laboratory, and in the Oort building. In these buildings are also located the Sterrewacht (the star watch, i.e. astronomy) and a portion of the administrative activities of the faculty. For the occupants of these three buildings there is one common Internal Safety Assistance Group (BHV-ploeg) and one safety commission.

2. Internal Safety Assistance

Internal Safety Assistance Group-The BHV Group

The BHV Group consists of a First Aid Team and a Fire Alarm Team.

They are well informed about typically dangerous situations and have practiced to be able to provide the best possible help in emergencies. With accidents with material damage, they lend first assistance and also assist the fire department and police with the necessary information. In order to maintain their preparedness, they follow training practice eight times a year, under the leadership of an instructor from the Leiden Fire Department. The practice is done in their "own" building, in order to a.o. increase the awareness of the various situations in the building.

The First Aid Team follows required repetitive courses for continuance of their diplomas. The Service for Safety and Environment (DVM) organizes courses to become Fire Guard and for wearing a compressed air mask. The DVM is also responsible for purchase and renewal of the equipment of the BHV group. The safety officer is coordinator of the BHV group.

What to do in the case of a fire alarm

Suppress your curiosity and don't hinder the members of the BHV group in carrying out their duties. By an alarm, follow immediately all instructions. Warn guests and foreigner colleagues.
By a fire alarm, the use of lifts (elevators) is forbidden. The personal lifts of the Huygens Laboratory and the Oort Building park automatically on the ground floor during fire alarm. The goods lift of the Huygens Laboratory is equipped with a special electronic circuit which allows use by the fire department only. Close doors and windows when there is a fire. Shut the gasline valves and switch off the electricity. Remove gas cylinders and other dangerous material, if present. Stay at your post in order to assist or to inform the BHV groups, the fire department and/or the First Aid team.
Inform yourself first of all of all the possible escape routes, and don't block them.
Don't try to put out a fire by yourself. Warn roommates or neighbors. Press the hand fire warning (a direct notice to the fire department). If you see a fire, warn the reception desk immediately. Don't use a lift (elevator). If necessary, you will be warned via the intercom to leave the building. CO_2-snow extinguishers, powder extinguishers and Halon-extinguishers may be used to suppress a fire which is just beginning. Be careful that your hands don't freeze onto the extinguisher. The fire hoses are only to be used by members of the BHD-team, after the electricity has been turned off. Untrained persons are not permitted to use the fire hoses. The use of breathing masks is restricted to those who have been assigned their use and have been trained for it.

First Aid

In case of a serious accident during working hours, the victims, if necessary, can be transported to the hospital-in-service by the ambulance of the First Aid service (tel. 4444). In case of an accident, always try to call in First Aid assistance by warning the reception.

All industrial accidents will be reported to the College Board. In case of serious damage or injury, an investigation will be carried out by the safety officer, the Labor Inspection, Police and/or Fire Department. Report forms are available from the safety officer (tel. 5760), who also arranges for the administration thereof. Coworkers, who have suffered damage to personal property or suffered financial loss not covered by insurance, are entitled to compensation.

First Aid Cases (with bandages, etc.) are available:

in the Huygens Laboratory in rooms: M021, M025, reception, 101, 143, 303, 404, 522, 607, 721b, 805, 829, 902, 1007, and 1128. They can also be found in the canteen on the ground floor. In the Oort-building, the First Aid Cases can be found in rooms: 151, 251, 351, and in the office across from 460. In the Kamerlingh Onnes Laboratory there are First Aid Cases in the East Hall and in the West Hall.

The location of a First Aid Case is clearly visible and is indicated by a sign in the hallway. When material has been used out of a First Aid Case, the First Aid person who is responsible for the Case will immediately replenish it. The remainder of the Cases will be replenished every half year or at the request of the safety officer.

3. Safety measures

In addition to the university rules for industrial safety, there are a number of technical provisions installed, such as emergency exits, emergency lighting, and fire alarm boxes. The primary rules and provisions are treated below.

Fire detection boxes

Automatic fire detectors have been installed in experimental areas of the laboratories and hand fire alarm boxes next to the fire hoses. De automatic fire alarms give a report of gas or smoke development to the fire alarm center in the reception. A lamp on the fire detector will start blinking, and in the hallway adjacent to fire detector giving the warning signal, a warning light will also be lit. Members of the BHV-team will be warned by the intercom-system. If the BHV-team doesn't quickly deactivate it, the system will automatically send the alarm on to the fire department. Outside of working hours, the alarm goes straight through to the Fire Department. This means that exceptional care is needed, because the fire detectors are adjusted very critically, and will react immediately to smoke or vapor development.

At this alarm, the Fire Department will receive an immediately warning signal. The Fire Department will use the alarm telephone to warn the Safety and Environment Service of the university, which at this juncture has only the task of warning the alarm telephone of the administrative unit involved. Signals from hand fire alarms ***always*** go directly to the regional fire alarm center, and at the same time, the BHV-team is called into operation.

As soon as the fire alarm system is activated, the emergency exits of the building are unlocked (this also happens in the case of power failure).

If, during working hours, there is a situation where work is necessary which might lead to a fire detector being activated, for example with welding or soldering, the Technical Service must be warned in advance, so that they can (allow) the local fire detector to be switched off.

It is strongly prohibited to, in any way whatever, disable the fire detectors and the PA system.

Fire Extinguishing Equipment

Rooms, which are intended for use by a group, are provided with a CO_2-snow fire extinguisher. They are also to be found in large experimental areas near the hallways and by stairwells. In several non-standard areas, powder or Halon extinguishers are also to be found.

Inform yourself about the locations where the available fire extinguishing equipment can be found. In use, turn the valves completely open.

In chemical rooms there should be, in addition to a CO_2-snow extinguisher, a sandbox with shovel available, filled with enough dry sand to extinguish the (liquid) materials present.

Near the chemical rooms are closets with fire blankets. Whenever by an accident the clothing of a victim catches fire, one should place the victim ***on the ground*** and roll him in a fire blanket, or the victim must throw the blanket around himself and then lie down. If one remains standing, a "chimney effect" can occur, which can increase the fire. Thereafter, the victim should be cooled with water for a considerable time, preferably under a safety shower; don't pull off clothing.

Area signs

The CvB, on 16 June 1986, passed a regulation area signs, the purpose of which was to make clear recognition within the university possible. The signs encompass especially places where radioactive material is present or where lasers are being used.

Emergency Exits

At various places, emergency exits have been installed. The emergency exits can be recognized by the green retro-reflecting stickers, with the writing "NOODUITGANG" (EMERGENCY EXIT). The emergency exits have been equipped with electrical locks or "clinging magnets", which are unlocked by a fire alarm. For other "emergency situations", there is an unlocking switch next to each emergency exit. Whenever a door is open, this is always registered at the reception!

In the Huygens Laboratory, the southern stairwell has been built smoke free. During strong smoke development on a floor, the doors entering this last mentioned stairwell are automatically locked and the exits to the balcony unlocked. Via this balcony one can then reach the stairwell. To exit the building in case of fire, the stairs should be used and not the lifts (elevators)!

Emergency exits, hallways, and halls must never be blocked.

Emergency Lighting

By power failure, a diesel-motor-driven 3-phase generator of 69 kVA, located on the twelfth floor, is automatically started, whereby the (light)distribution boxes on each floor are supplied. Power watchers have been installed in these boxes, so that voltage level control on each floor is present. The emergency power generator serves the control current and the alarm installation, as well as an emergency lighting installation. This emergency lighting has been installed in all the hallways, stairwells, and areas for general use, the boards "UIT" ("OUT"), and the direction indicator lamps in the hallways.

In the Oort-building and in the Kamerlingh Onnes Laboratory, the emergency lamps have their own power supplies.

In the experimental areas, the power distribution boxes are equipped with a special switchbox to which a separate emergency lamp can be connected, if necessary. One can request this from the Technical Service.

These emergency lamps are a safety feature and therefore may not be used for anything else.

Defect Warning Indicators

The defect warning system and the central control switches mounted on the central control panel in the reception are for: lifts (elevators), air conditioning system, refrigeration machines, emergency generator, transformers, fire detection system, PA system, intercom system for the BHV, and the helium gas recovery system.

Safety Showers

Safety showers have been placed in the hallways near the experimental rooms. In a situation where your clothing has caught fire or you have been hit by dangerous chemical liquid, you can use the safety shower. Pulling the handle turns it on.

Checking the Fire Detector System

The fire detector system of the laboratories is checked on the first Monday of each month by a "trained person" (=officially appointed).

4. Working with…

a. Lasers

During the installation of a laser system, the directives of the Labor Inspection and the internal university regulations (Regeling Laser Veiligheid/Rules for Laser Safety). Be aware of the required warning signs. Laser light (class 3b and 4) can damage the retina, even if only reflected by an object. When working with a laser, always wear goggles with lenses which are adapted for the type of laser.

Use gloves when working with poisonous laser liquids. Clean up spilled fluids immediately. Use the laser waste containers for laser liquids with the black or red band (see waste disposal rules of LION).

Whenever the warning board above the door is lit (with the words 'LASER'), the laser is in operation, and before entering the room you are required to wear the prescribed safety equipment.

Someone is appointed as responsible for each laser system. This person is expected to provide a safety report and a users instructions. The laser safety report must be updated every two years, or sooner if there has been an extensive alteration of the laser system.

Be aware that dye liquids used in dye lasers are almost all poisonous and/or (suspected to be) carcinogens. Weigh them in a special place (fume hood) and don't spill them (even in solution).

b. Microwaves

Microwaves pass through the whole body. The best known effect of microwaves in the body is the development of heat via the absorption of microwaves by body water. The amount of heating is dependent on the frequency (wavelength). Microwave radiation is especially damaging in the frequency range 1000-3000 MHz (microwave oven: 2450 MHz), whenever the energy per unit area (field strength and per unit time) is strong enough. An often-used norm is 10 W/m2 (1 mW/cm2) by an exposure of 8 hours per day (5 days a week): whenever there is a continuous exposure during a working day below this norm, no damage is to be expected. The heat effect can be especially damaging in organs with little blood circulation (poor cooling).

Check if there is damaging radiation present. The group technician or the safety officer can obtain the necessary equipment.

c. Magnetic Fields

Magnets with very large magnetic fields are in use in several work areas. People with a pacemaker, with iron-containing implants (heart valves), and implanted electronic systems (electronic hearing aid, insulin pump, electronically driven artificial body parts, and muscle stimulators) must not come into the direct neighborhood of these strong magnetic fields. Not only can the static field be dangerous for people wearing the above named artificial body parts, but even more dangerous for them is moving through such a field.

The information stored in giro- and bank passes can also be erased by these high magnetic fields.

Pay attention to the warning stickers.

d. Glass

Be careful with glass. A new hose or the cost of a new shield is preferable to an accident.

Try not to reach a higher production by being less attentive to safety.

Take care that glass systems are and remain tension-free.

Learn to cut off and melt the edges to a round shape on glass tubes or staffs, to insert a glass tube or thermometer into a cork or rubber bung, as well as to remove them, to push rubber tubing over the end of a glass tube, and turn a glass stop-cock.

When working with glass with a gas flame, one is obliged to wear safety goggles, which provide adequate protection against infrared, ultraviolet, and yellow sodium light.

Glass balls to be filled with a gas should be packed into a container in advance, to prevent flying glass, should the ball break.

Plastic jackets are a good protection around glass cryostats.

e. Radioactive materials

In order to be allowed to work with radioactive materials in the laboratory, it's necessary to have written permission from the Scientific Director.

The radiation safety officer carries out the actual supervision.

Normally, the time necessary to obtain legal permission to work with radioactive materials can take the not inconsiderable time of one half year to one whole year!

One should therefore place a request for such permission with the Scientific Director as soon as possible.

Everyone who works with radioactive materials should make him-/herself amply aware of the legal and university regulations, and should strictly follow them.

Generally extensive technical modifications of the building are necessary for obtaining a license.

Ordering radioactive material requires the consent of the radiation safety officer.

Also working with equipment which emits x-rays should be carried out under the supervision of the radiation safety officer.

A license must be applied for for x-ray equipment or—-depending on the tube voltage—the Ministry of VROM (Decision Radiation Protection Nuclear Energy Law) must be informed. For x-ray equipment used for educational purposes, a license must always be applied for. The equipment may be taken into operation only after the license has been obtained.

f. Toxic materials

Register

All the materials present in the laboratory must be noted in register, which is kept up to date.

Information about chemicals

Information about a large number of chemicals can be obtained from the safety officer. Besides this information, more can be found about a great number of chemicals via the computer network. Next to a general description of the material, the physical and chemical characteristics, stability and reactivity, labeling, storage and treatment, emergency measures, toxicological facts, ecological facts, and possible additional information can be found.
The following programs are available:

Chemdat	Materials catalog of the firm Merck +/- 10,000 materials. The catalogue contains all relevant safety information
Chemiekaarten	Safety information about 1233 materials.

Safety Measures

- In areas where chemicals, in whatever form, are used, one is obliged to wear safety goggles or a face shield.
- One is obliged to wear gloves in all chemical work where, through spattering, the skin can be injured.
- When pouring or tapping of chemicals, where safety goggles don't offer enough protection, on is obliged to wear a face shield.
- When working with bases, acids, or materials with a caustic or etching behavior, one is required to wear a face shield, a rubber apron, gloves, and safety boots.
- To dilute concentrated sulfuric acid, one should slowly add small amounts to water (and not the reverse!!!).
- The internal transportation of chemicals should take place with wagons especially constructed for this purpose, which are provided with a catch basin (leakage and/or

breaking of glassware). The wagons are available at the stores shop. Chemicals which react with each other should be transported separately (separate catch basins).
- It is allowed to transport separate bottles in plastic buckets, meant for this use.
- Work preferably in a fume hood. Fume hoods have been installed in the Huygens Laboratory in the following rooms: 135, 522, 607, 628, 725, 828, 1009c, 1025, 1106, and 1128.
- Clean spilt chemicals immediately, and water as well, so they cannot damage tables and floor coverings.
- Place insulation material on tables under containers which are being or will be heated, so that the table surfaces won't be damaged.

If the help materials mentioned above are not directly available, one may ***not*** begin with the work for which they are required. All the personal protection equipment mentioned are available in the stores shop.

For the removal of oil vapor and dangerous gases, one should arrange with the technical service for the installation of the required equipment. On removing dangerous gases, one should try to neutralize them (see also 'dirty gas pipeline').

Eating, drinking, and smoking in laboratories

The law states that one may not smoke, and no food nor drinks may be consumed nor stored in workrooms of certain categories. Those are, in general, areas where chemicals such as mercury, acetone, various alcohols, etc.... are being utilized.
The labor inspection checks that the university community lives up to these regulations. Only warning that forbidden behavior is present is not enough for the labor inspection. They require that management check on the following of the regulations and takes measures by transgressions.

g. Gases

Inflammable and/or poisonous gases

Before one begins to work with inflammable, poisonous and/or corrosive gases, a number of possibilities should be investigated, in order to reach a responsible use of these gases.
1. Investigate if there are less dangerous gases which can be used instead.
2. External placement of the gas cylinders.
3. Placing gas cylinders in a ventilated area or recess, should the cylinders be placed inside.

Before deciding to place gas cylinders in experimental rooms, the just mentioned possibilities should be thoroughly considered (discuss with the safety officer).

In those cases where it is inescapable to place a gas cylinder in an experimental room, this is only permitted after consultation with the Scientific Director. Only written requests for permission will be considered. Possible permission will only be given for the duration of the experiment (maximum a half year).

Rules and advice for the use of inflammable, poisonous, and/or corrosive gases are to be found in the publication 'Veiligheid en Milieu in Laboratoria' ('Safety and Environment in Laboratories'), a publication of the Service for Safety and Environment.

Experiments with inflammable and/or poisonous gases

Prolonged experiments with these gases may only take place after checking with the safety officer and having received written permission from the Scientific Director. Requests must therefore be submitted well in advance, in writing, to the Scientific Director.

For working with poisonous gases, fitting safety measures should be taken (point gas extraction, gas detectors, escape masks, etc.).

The use of oxygen and acetylene gas is reserved for the colleagues of the technical service and the fine mechanical workshop.

The use of butane and propane gas cylinders is forbidden.

Dirty gas pipeline

For the safe removal of inflammable, poisonous, and aggressive gases, a dirty gas system has been installed in the Kamerlingh Onnes Laboratory and on the floors 5, 6, 7, 8, 9, 10, and 11 of the Huygens Laboratory. On this removal pipeline are a number of connection points; therefore, care should be taken in removal of dangerous gases. Poisonous and corrosive gases must be neutralized before they are removed.

Gas cylinders

General suggestions

- The shutoff valve of an empty cylinder should be closed and the word 'leeg' ('empty') written on the cylinder (with chalk).
- A cylinder must not be transported without its safety cap.
- Transport cylinders with a cylinder wagon.
- A gas cylinder should not be completely emptied, in order to prevent leakage of air or dirt into the cylinder.
- Gas cylinders must be protected from mechanical damage.
- Gas cylinders must be protected against falling, by fixing them with a chain, a canvas belt, a shackle, a wall clamp, a table clamp, etc..
- Gas cylinders must not block exits, and must never be placed near lifts (elevators), passages, nor in places where heavy and/or falling objects could hit them.
- Opening the shutoff valve should done slowly.
- The opening of the shutoff valve should point in a direction where no people are present.
- Before a gas cylinder is put into use, all the other valves of the system should be checked for leakage. This should never be done with an open flame. In most cases, the use of soapy water is a good way to discover a leak. Hoses should be replaced regularly.

- Neither adjustable wrenches nor pliers should be used for opening the shutoff valve of a gas cylinder.
- If the gas cylinder shutoff valve doesn't have a hand wheel, there should be a special wrench present. Such special wrenches are available in the stores shop.
- Repairs to gas cylinders may only be carried out by officially appointed persons.
- Gas cylinders must not be used for anything other than that for which they were meant.
- The type of gas must be embossed on the gas cylinder.
- Gas cylinders have to undergo periodic inspection (every ten years for inert gases, every two years for poisonous or corrosive gases, and every five years for all other types). The inspection date must be embossed on the gas cylinder.
- Lecture bottles also fall under this regulation.
- In case of fire, gas cylinders must be removed from areas endangered by the fire.
- Rental must be paid on gas cylinders, not owned by the laboratory, which will be placed on the account of the work group or service group. For this reason, gas cylinders should not be kept any longer than is strictly necessary.
- Storage of gas cylinders is done in rooms especially prepared for this use (outside the building, with sun and rain protection/Arbo-informatieblad AI-18, Laboratoria (Work information sheet AI-18, Laboratories)(available at the Arbo- en Milieudiest faculteit W&N (Work- and Environment Service, faculty of Mathematics and Physics).

Management Administration

The management of gas cylinders (also lecture bottles) is done by the stores shop. Under this management fall:

a. the ordering of all gases;
b. administration of de gas cylinders;
c. supervision of the lending of cylinders;
d. the care of limiting the costs of rental cylinders;
e. contacts with the safety officer, with respect to the permission for lending dangerous gases (other than inert gases, acetylene, or mixtures of these gases);
f. guarding the validity of inspection (offering for re-inspection, not lending cylinders beyond the valid inspection date);
g. charging the costs to the accounts of research groups and services.
h. management of the gas cylinder storage.

The stores shop maintains an administration of all gas cylinders (both for rental and well as own cylinders) in which the above mentioned points are listed.

The safety officer will periodically check the administration of the gas cylinders.

If an employee has taken a gas cylinder from the stores shop and gives this cylinder to another (research) group, he/she must immediately inform the stores shop. Only then is it possible to realize an effective safety and cost control.

Helium

It is forbidden to breathe in helium gas in order to demonstrate the change in sound velocity in helium. Through displacing of oxygen, breathing in helium gas can have far reaching consequences. More information is available from the safety officer.

Pressure regulators

If no gas is being extracted from a gas cylinder with pressure regulator or needle valve, the shutoff valve must be closed.

Check the pressure ring between the shutoff valve and the pressure regulator. A gas leak is expensive and can also be dangerous. For repair of pressure regulators, or for questions about pressure regulators, one can turn to the ISD, room 404 HL (Instrument Service Group).

h. Cryogenic liquids

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, which fit loosely enough to be quickly removed, should one catch a splash of cryogenic liquid in the glove;
- loosely fitting laboratory jackets, which can be quickly removed.

Safety procedures

Pouring liquefied gases out of glass dewar bottles is inadvisable. The lip of the dewar bottle has been welded. Brining the weld into contact with the extremely cold liquid can create tension, whereby an implosion of the bottle can occur; for this reason, a transfer siphon should be used, or a specially constructed transportation ball.

Only the lid, which is meant for a dewar bottle, may be used to close the bottle, because this lid contains special openings, which allow continuous escape of the gas produced. Pay attention to the fact that these lids, when they come into contact with cryogenic liquid, can become brittle and can break easily.

In dewar bottles containing liquid oxygen, no glasses with activated charcoal or other easily inflammable organic materials should be cooled; cooling these materials should be done with liquid nitrogen.

For cooling inflammable gases or liquids to very low temperatures, neither liquid oxygen nor liquid air should be used, in connection with the danger

of explosion. Also in this case, one should use liquid nitrogen as coolant. When using liquid nitrogen in open air, one should be aware that, within a short time, liquid oxygen will also be present.

Provide glass Dewar bottles with a protective jacket (metal gauze, sheet metal, cloth, tape). Cool, during filling, with a limited amount of cooling liquid.

Liquid helium

Whenever one works with very low temperatures, the safety aspect should play an important roll. There are various dangers which should be taken into account.

1. *The liquids mentioned are extremely cold;* as was mentioned, helium is the coldest of all liquids. Contact with the cold liquid (also cold helium gas!) results in serious freezing effects.

2. The extremely low temperature of liquid helium will cause air to condense and freeze. A typical example of this is the forming of *liquid droplets on helium evaporation pipelines;* these are droplets of liquid air, so be careful!

3. When working with liquid helium, keep external surfaces clean. Under point 2, the forming of droplets on the outside of pipelines was mentioned. During this condensation, the liquid nitrogen will evaporate first out of the liquified air, because it has a lower boiling point than oxygen. The result is that an oxygen-rich liquid drips from the pipeline; where this happens, a spontaneous ignition of grease and oil in not impossible. *A clean work area is important.*

4. *NEITHER helium NOR nitrogen support life.* By high concentrations of helium gas or nitrogen gas there is a direct shortage of oxygen.
   Although helium in not poisonous, in poorly ventilated rooms it can cause breathing difficulties. High concentrations of helium gas are apparent through the effect on the vocal cords.
   The symptoms by oxygen deficiency are:

19%-15%	A clearly decreased reaction.
15%-12%	Deep breathing, fast pulse, comprehensive problems with coordination.
12%-10%	A dizzy feeling, wrong estimates, and light blue colored lips.
10%-8%	Giddiness, inclination to vomiting, unconsciousness.
8%-6%	Brain damage after 4-8 minutes. Death after longer than 8 minutes.
4% and <<	Coma after 40 seconds, then death.

5. With helium, cognizance should be taken of the *enormous volume expansion from liquid to gas.* Small amounts of liquid become huge amounts of gas by evaporation:
   1 liter of liquid gives 750 liters of gas! Most cryogenic liquids require a good deal of heat to evaporate. For liquid helium, this is not the case; when helium is introduced into warm or only partially cooled apparatus, a spontaneous evaporation occurs. Rapid and violent evaporation takes place during careless filling of cryostats, and by breaking the vacuum. Therefore care should always be taken that adequate gas escape is possible.

Comments with respect to safety:

1. Burns caused by cold liquids should be treated just as normal burn wounds. Thus, immediate and extensive washing with running water.

2. If someone becomes dizzy or faints while working with helium, bring them immediately to a well-ventilated room.

3. The vapor that appears when liquid helium comes into contact with air is condensed pollution; this is mainly air and water vapor, not the helium gas itself, which is invisible.

4. Never become nonchalant with cryogenic liquids! Errors can be fatal!

5. Mechanical work

- During work where rotating machine parts and/or cutting machines are present, one is not only required to wear safety glasses, but as well, in the case of long hair, one is obliged to wear a hairnet or headgear, such that no loose hair comes from under the hairnet or headgear. Hairnets are available in the stores shop.
- During work where heavy objects or materials takes place, the wearing of safety shoes is required.
- In the workshop, wearing loose clothing (neckties!) and wide sleeves in forbidden.
- The use of protective jackets made of artificial materials is forbidden.
- The occupants must clean workshops daily. Metals cuttings on the ground can cause slipping or cuts. For this reason, cuttings should be removed daily.
- Working on materials which contain asbestos, is forbidden.

Welding and silver soldering

Special facilities have been installed in the mechanical workshops for welding and silver soldering, such as fume hoods. This sort of work should be carried out there, as much as possible.

Be careful of the vapors and the gases produced during (electric) welding and silver soldering (ozone, nitrous vapors).

Heavy transportation

During heavy transportation in buildings, one is obliged to follow the existing safety regulations. In addition, one should realize that the coverings can be easily damaged by too large a weight on the floor (crushing the sub-floor). Therefore, transportation of bulky equipment or of very heavy objects should take place under the supervision of the household service and the technical service. For this type of transportation, one is obliged to wear safety clothing (o.a. safety shoes).

6. Prohibition of smoking

There is a general prohibition of smoking in all public areas of the university (Decision limitation selling and use of tobacco-products, 7-10-1998).

One may only smoke in ones own sitting-/workroom, as long as others (colleagues, visitors) are not inconvenienced.

This rule in no way rescinds the rules which have been stated, for example on the grounds of safety.

There is a smoking prohibition in all rooms of the laboratory with smoke detectors.

Literature on the area of safety is available for reading by the safety officer,

telephone 5760.

Appendix 1

WASTE DISPOSAL regulations department LION

LION recognizes the following sorts of waste:

1. Operational waste

Under operational waste one understands all of the rubbish from offices and canteens, excepting small dangerous garbage. Operational waste will be collected by the cleaning service, and deposited in the "grey" container.

2. Chemical waste

Chemical waste consists of all the chemical waste that is listed in the Ruling Waste Chemicals UL. This ruling (enacted by the College Board, 16 April, 1986), consists of the collection, the storage, and the transportation of both liquid and solid chemical waste. Radioactive waste and biological waste are not treated in this ruling.
Chemical waste is divided into liquid and solid waste.

Liquid chemical waste
Liquid chemical waste is collected in 10-liter waste containers provided by the Safety and Environment Service. Both empty as well as full containers will be kept in the storage area for chemical waste. For the temporary storage of chemical waste, three chemical closets have been placed in the hallway by the stores shop.

Important general suggestions
- Under no circumstances dump chemical wastes through the sink.
- Chemical waste contains materials that can damage the health. Treat them with care.
- The containers should be well sealed before transportation to the storage area. Seal the container with the lid meant for the purpose, which is provided with air exit valves.
- It is forbidden to fill the containers completely; leave about 5 cm free space above the liquid level.
- Reactive chemicals should ALWAYS be made safe c.q. neutralized before being dumped into the waste container (o.a. reduction and oxidation materials, acids, and bases). If in doubt, consult the literature or the safety officer.
- Mercury, mercurius compounds, and extremely toxic materials should only be dumped after consultation with the safety officer.
- Don't drop glass, paper, textiles, or solids in the containers.
- Clean the exterior of the container should it become contaminated by spillage.
- Poking holes in the lids is not permitted.
- Waste containers may only be transported in the goods lift.
- A wagon with a catch basin is available in the stores shop.

Liquid chemical waste is divided into the following categories:

❖ ***Inorganic materials in solution***
Color code: black band.

- Neutralized and diluted acids and bases (o.a. hydrochloric acid, sulfuric acid, nitric acid, phosphoric acid, diverse hydroxides). PH-value between 5 and 9.
- Diverse salts in solution (cat- and anions).
- (Heavy) metals in solution (cat- and anions).
- Non-recoverable photographic developer.

❖ ***Organic liquids, halogen free***
color code: red band.

- Diverse (mixtures of) solvents (o.a. (petroleum) ether, ethyl acetate, acetone, pyridine, toluene, ethanol), including de therein dissolved materials.
- Diverse organic liquids (o.a. aromatics, aliphates, aldehydes, esters, ketons, amines).
- Liquid remnants of organic (re)argentia (o.a. from reactions, distillations, work, and processes).
- Organic liquid/water mixtures.

❖ ***Organic liquids containing halogens***
color code: blue band.

- Diverse (mixtures of) halogen bearing solvents (o.a. dichlor methane, chloroform, trichlorethane), including de therein dissolved materials.
- F-, Cl-, Br-, or I-bearing liquid organic materials (o.a. benzyl chloride, ethylene bromide, ethylene iodide, fluoro-nitril).

❖ ***Waste oils and greases***
color code: green band.

- Diverse waste oils and greases from machine shops and laboratory equipment (o.a. from oil pumps and heating baths; lubrication- and mineral oils).

Procedures solid waste
Producers of solid chemical waste must deliver this waste, well packed and correctly labeled (name and group of the producer, name of material, chemical formula and weight), to the safety officer, who will be responsible for the handling. There is the same obligation for labeling chemical waste as for the chemicals themselves.

Solid chemical waste

- Unused or partly unused pots with chemicals.
- Chemical packaging, when these still contain leftovers.
- Non-pourable viscous fluids, pastes, greases and fats, paraffin.
- Sediments, crystalline materials, crystallized materials.
- Filtered materials, filtrates.
- Cloths, tissues, contaminated with grease or oil.
- Material contaminated by chemicals, such as column fillings, drying materials, gloves, filters, filter paper, absorption material, molecular sieves. N.B. Label the nature of the contamination.
- Paint, leftover paint and empty paint cans. Pour cans into a collection container for leftover paint, until they are empty, and then flatten them. Paint remover.

- Asbestos and materials containing asbestos.
- Teflon.
- Ink ribbons and toners, if they are not recyclable.

In addition to the stream of waste just mentioned, there are more and more materials being sent to recycling plants for re-use. There is a obligatory separation required for the following stream of garbage:

a. paper
b. ink ribbons, toners
c. fluorescent lamp tubes
d. old materials, separated according to type
e. batteries, separated according to type
f. old equipment

a. Paper
   Paper is collected by the cleaning service once a week. In the case of large quantities, the household service can arrange for between-times pickup. Paper should be separated according to type, for removal (for example, carton, colored and white paper, separately).
b. Fluorescent lamp tubes
   There is a special container available for fluorescent lamp tubes. Only fluorescent tubes with a length of at least 1,20 meters are to be placed in this container. Handling of fluorescent lamp tubes in done principally by the technical service. For smaller fluorescent tubes and discharge tubes, there is a container present at the Gorlaeus Laboratory. The technical service provides transport to this container.
c. Old materials
   In the cellar of the laboratory there are waste containers present for old materials. The ISD supervises a correct use of these waste containers. For large amounts of waste materials, one should contact the ISD. The head of the ISD is responsible for the removal of old material.
d. Batteries
   In the stores shop there are waste buckets available, where one can deposit batteries, separated according to sort.
e. Old equipment
   Old equipment should be deposited with the ISD. The ISD investigates whether or not the equipment can be offered for sale, or if it should go to a waste reduction factory. As a last possibility, where necessary, still useable parts will be demounted and stored. The disposal of old equipment takes place in line with the Ruling Disposal, Re-use of excess listed equipment. The responsibility for this rests with the head of the ISD.

Appendix 2

Safety signs

The regulations in the law give directions for both the colors used, as well as the shape and symbols. For safety sign colors, the following are valid: ***red*** ("stop"; "forbidden"), ***yellow*** ("be Careful"; "possible danger"), ***green*** ("no danger"; "help"), and ***blue*** ("instructions"; "order").

Prohibition signs are round, have a red outside edge, a red diagonal stripe, and a black symbol on a white background.
Warning signs have a triangular shape, a black outside edge, and a black symbol on a yellow background.
Command signs are round, with a white symbol on a blue background.
Rescue signs are rectangular, with a white symbol on a green background.

Prohibition signs

(red outside edge and diagonal stripe, with a black symbol on a white background)

1. Forbidden to smoke
2. Smoking and open fire are forbidden
3. Non-potable water
4. No entrance for persons with a pacemaker
5. Forbidden to enter

1

2

3

4

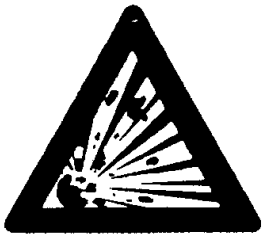
5

Warning signs

(black outside edge and a black symbol on a yellow background)

1. inflammable material
2. explosive material
3. poisonous material
4. corrosive material
5. radioactive material
6. dangerous electrical voltage
7. danger
8. laser beam
9. magnetic field

1

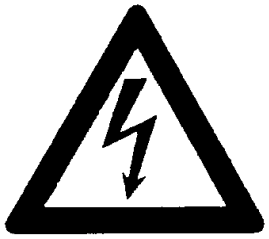


2

3

4

5



6

7

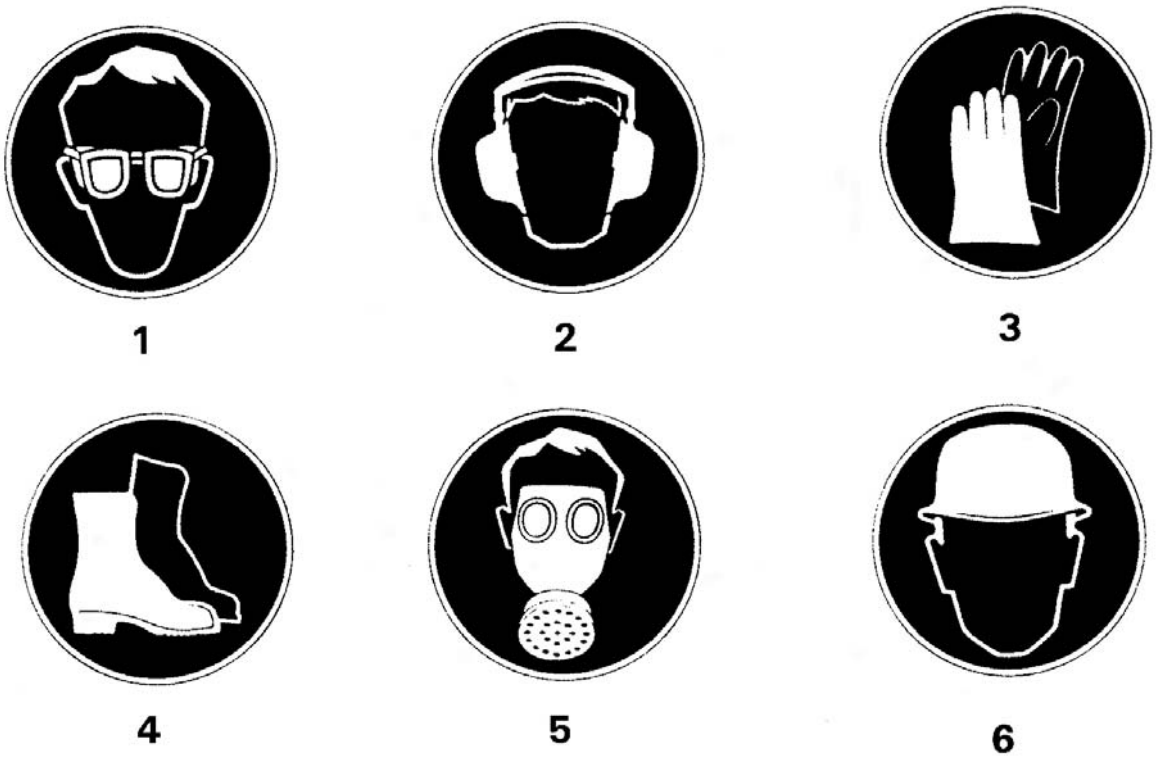
8

9

Command signs

(white symbol on a blue background)

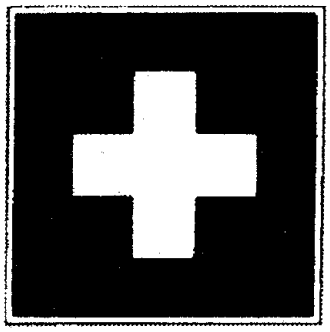
1. eye protection mandatory
2. ear protection mandatory
3. gloves mandatory
4. safety shoes mandatory
5. breathing protection mandatory
6. safety helmet mandatory



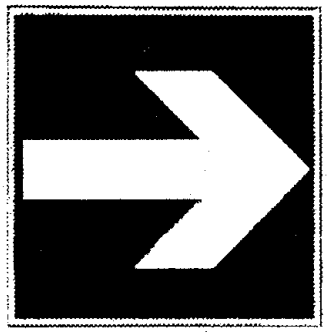
Rescue signs

(white symbol on a green background)

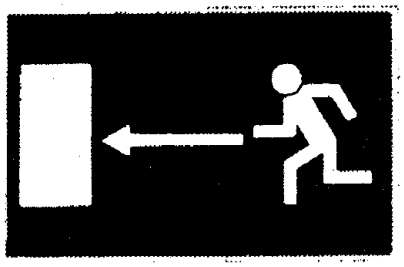
1. first aid post
2. direction to an escape route
3. escape route to an exit
4. escape route – exit
5. shower



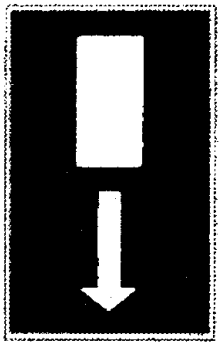
1



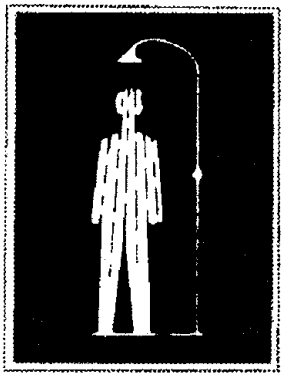
2



3



4



5

	What to do in case of .....
Brand  **Fire**	**Stay calm, do not panic** 1. Always press the fire alarm (direct connection with the Leiden Fire Brigade) 2. Close windows and doors 3. **Never** try to extinguish a fire on your own 4. Be available for providing information 5. Wait for the Fire Brigade at the reception, outside office hours Please take note of the safety regulations in the building, make sure that you know where to find fire alarms, extinguishers, and emergency exits.
Ongeval  **Accident**	**During office hours:** 08.30 - 17.00 hrs. Warn the receptionist ext.: 5800/5900 **Outside office hours:** Call GGD ext.: 4444 (regional office)
Storing  **Disorder**	**In case of breakdown or danger, call:** **During office hours:** Warn the reception ext.: 5800/5900 **Outside office hours:** Call the technician on duty, ext.: 06 12157408