Cluster for Molecular Chemistry

Information & Safety Manual

Molecular Chemistry Cluster October 2019

Contents

I Organization of the Molecular Chemistry Cluster

1. Management
2. Address
3. Secretaries
4. Supporting Personnel
5. Safety Committee and Stewards, PAM-mers, Laboratory Rooms
6. First Aid (EHBO)
7. Pressurized Air

1. Management

The Molecular Chemistry Cluster is an integral part of the Institute for Molecules and Materials and consists of five research groups, Physical Organic Chemistry, Molecular Nanotechnology, Synthetic Organic Chemistry, Bio-organic Chemistry, and Spectroscopy and Catalysis:

Scientific Staff:

Physical Organic Chemistry

- Prof. dr. W. T. S. Huck, Professor of Physical Organic Chemistry
  (HG03.025, phone: 52138, e-mail: w.huck@science.ru.nl)

Molecular Nanotechnology

- Prof. dr. Roeland M.J. Nolte, Academy of Science Professor
  (HG03.009, phone: 52143, e-mail: r.nolte@science.ru.nl)
- Dr. J.(Hans) A.A.W. Elemans, Associate Professor
  (HG03.017, phone: 53099, e-mail: j.elemans@science.ru.nl)
- Prof. dr. E.(Bert) W. Meijer
  (phone: 52331, e-mail: b.meijer@ru.nl)

Synthetic Organic Chemistry

- Prof. dr. Floris P.J.T. Rutjes, Professor of Organic Chemistry
  (HG03.024, phone: 53202, e-mail: f.rutjes@science.ru.nl)
- Dr. Martin C. Feiters, Associate Professor
  (HG03.021, phone: 52016, e-mail: m.feiters@science.ru.nl)
- Dr. Daniël Blanco Ania, Staff Scientist
  (HG03.010, phone: 52407, e-mail: d.blanco@science.ru.nl)

System Chemistry

- Prof. dr. Daniela A. Wilson, Professor of System Chemistry
  (HG 03.014, phone 52185, email: d.wilson@science.ru.nl)
- Prof. dr. Ir. Jan C.M. van Hest
  (e-mail: j.vanhest@science.ru.nl)
- Dr. Dennis W.P.M. Löwik, Assistant Professor
  (HG03.016, phone: 52382, e-mail: d.lowik@science.ru.nl)

Spectroscopy and Catalysis

- Prof. dr. Jana Roithova, Professor Spectroscopy and Catalysis
  (HG03.015, phone 53006, e-mail: jana.roithova@ru.nl
- Dr. Paul Kouwer, Associate Professor
  (HG03.011, phone: 52464, e-mail: p.kouwer@science.ru.nl)

Tenure Trackers

- Dr. Kim M. Bonger
  (HG 03.018, phone 52464, email: k.m.bonger@science.ru.nl)
- Dr. Thomas J. Boltje
  (HG03.022, phone 52331, email: t.boltje@science.ru.nl)
- Dr. Peter A. Korevaar
  (HG03.012, phone 52137, email: p.korevaar@science.ru.nl)
- Dr. Evan Spruijt,
  (HG03.020, phone 52455, email: e.spruijt@science.ru.nl)

Emeriti Staff Members

- Prof. dr. Binne Zwanenburg, Emeritus professor
  (phone: 53159, e-mail: b.zwanenburg@science.ru.nl)
- Dr. J. (Hans) W. Scheeren, Emeritus associate professor
  (e-mail: h.scheeren@science.ru.nl)

2. Address

The official address of all groups (for use in articles, posters etc) is:

Institute for Molecules and Materials
Radboud University Nijmegen Heyendaalseweg 135
6525 AJ Nijmegen
The Netherlands

3. Secretaries

The Molecular Chemistry Cluster has three secretaries (management assistants):

- Physical Organic Chemistry
  Désirée van der Wey
  (HG03.028, phone: 52676, email: d.vanderwey@science.ru.nl)
- Molecular Nanotechnology
  Désirée van der Wey
  (HG03.028, phone: 52676, email: d.vanderwey@science.ru.nl)
- System Chemistry
  Paula Willems
  (HG03.012, phone: 53421, email: paula.willems@science.ru.nl)
- Spectroscopy and Catalysis
  Paula Willems
  (HG03.012, phone: 53421, email: paula.willems@science.ru.nl)
- Synthetic Organic Chemistry
  Marieke Egbertzen
  (HG03.028, phone: 52091, email: m.egbertzen@science.ru.nl)

The secretaries can answer questions related to work and provide office equipment.
Note: to call a university (five digit) number from outside the university, first dial +31 (0)24-36.

4. Supporting Personnel

- Logistics and purchasing agent:
  Peter A.S. van Dijk
  (HG03.026, phone: 52818, email: p.vandijk@science.ru.nl)
- Mass spectrometry:
  Peter M. van Galen
  (HG03.409, phone: 52362, email: p.vangalen@science.ru.nl)
- NMR spectroscopy:
  Dr. Paul B. White
  (HG03.019, phone: 52959, email: p.white@science.ru.nl)
- Teaching and Research assistant (System Chemistry):
  Helene I.V. Amatdjais-Groenen
  (HG03.409, phone: 52942, email: H.Amatdjais-Groenen@science.ru.nl)
- Research assistant (Synthetic Organic Chemistry):
  F.(Jan) Dommerholt
  (HG03.019, phone: 52375, email: j.dommerholt@science.ru.nl)
- Research assistant (Spectroscopy and Catalysis):
  Theo P.J. Peters
  (HG03.010, phone: 52186, email: t.peters@science.ru.nl)
- Research assistant (Physical Organic Chemistry):
  José Roelofs-Hendriks
  (HG02.210, phone: 52937, email: josehendriks@gmail.com)
- Research assistant (Physical Organic Chemistry)/laser safety:
  Aigars Piruska
  (HG03.200, phone: 52304, email: a.piruska@science.ru.nl)

5. Safety Committee and Stewards, PAM-mers, Laboratory Rooms

The Department has rooms of the following Safety Levels

- SL-0: Offices and rooms where eating and/or drinking is permitted
- SL-1: Chemical laboratory with limited risks
- SL-2: Standard chemical laboratory
- L-2: Laser laboratory
- ML-1: Molecular biology laboratory

Lab	Safety Steward(s)	Lab Steward	Cat.	Group	PAM-mer
03.230	Mitch Winkens	William Robinson	SL-2	Huck	Peter van Dijk Theo Peters
03.227	Anne Swartjes	Pieter Gilissen	SL-2	Nolte	Peter van Dijk Theo Peters
03.224	Anne Swartjes	Anne Swartjes	SL-2	Nolte	Peter van Dijk Theo Peters
03.221	Mitch Winkens (LSO Aigars Piruska)	Aigars Piruska	L-2	Huck	Peter van Dijk Theo Peters
03.218	Mitch Winkens	Alexandr Pogodaev	SL-2	Huck	Peter van Dijk Theo Peters
03.215	Mitch Winkens	Mahesh Vibhute	SL-1	Huck	Peter van Dijk Theo Peters
03.214	Mitch Winkens	Mahesh Vibhute	SL-1	Huck	Peter van Dijk Theo Peters
02.216	(José Roelofs-Hendriks)		ML-1/SL-1	Huck (Celikel)	Ron Engels
02.242	(José Roelofs-Hendriks)		ML-1/SL-1	Huck (Celikel)	Ron Engels
02.225			SL-1	Huck (Celikel)	
02.244			SL-1	Huck (Celikel)	
03.109	Sam Moons	Emiel Rossing	SL-2	Rutjes	Peter van Dijk Theo Peters
03.112	Sam Moons	Hidde Elferink	SL-2	Rutjes	Peter van Dijk Theo Peters
03.113	Sam Moons	Hidde Elferink	SL-2	Rutjes	Peter van Dijk Theo Peters
03.114	Sam Moons	Hidde Elferink	SL-2	Rutjes	Peter van Dijk Theo Peters
03.115	Sam Moons	Victor Bloemendal	SL-2	Rutjes	Peter van Dijk Theo Peters
03.118	Sam Moons	Freek Janssen	Sl-2	Rutjes	Peter van Dijk Theo Peters
03.130 left	Helene Amatdjais-Groenen	Bob Ignacio	SL-2	Rutjes	Peter van Dijk Theo Peters
03.130 right	Helene Amatdjais-Groenen	Helene Amatdjais-Groenen	SL-2	Wilson	Peter van Dijk Theo Peters
03.120	Helene Amatdjais-Groenen	Helene Amatdjais-Groenen	SL-1	Rutjes	Peter van Dijk Theo Peters
03.430	Danny Lenstra	Danny Lenstra/Abbas Al Temimi	SL-2	Rutjes	Peter van Dijk Theo Peters
03.427	Noël de Kler	Noël de Kler	SL-2	Roithova	Peter van Dijk Theo Peters
03.442	Danny Lenstra	Danny Lenstra	SL-2	Rutjes	Peter van Dijk Theo Peters
03.411	Danny Lenstra	Peter van Galen	SL-1	Wilson	Peter van Dijk Theo Peters
03.418	Helene Amatdjais-Groenen	Paul White	SL-1	Rutjes	Peter van Dijk Theo Peters
03.421	Noël de Kler	Guilherme Tripodi	SL-1	Roithova	Peter van Dijk Theo Peters
03.424	Noël de Kler (LSO Aigars Piruska)	Jesus de Pozo Mellado	L-2	Roithova	Peter van Dijk Theo Peters
03.810 Lab 1	Sjoerd Rijpkema	Wen Chen	SL-2	Wilson / Roithova	Peter van Dijk Theo Peters
03.810 Lab 2	Sjoerd Rijpkema	Motilal Mathesh Shanmugam	SL-2	Wilson / Roithova	Peter van Dijk Theo Peters
03.810 Lab3	Sjoerd Rijpkema	David Asrian	SL-2	Wilson / Roithova	Peter van Dijk Theo Peters
03.827	Sjoerd Rijpkema	Sjoerd Rijpkema	SL-1	Wilson / Roithova	Peter van Dijk Theo Peters
03.828	Sjoerd Rijpkema	Paula de Almeida	SL-1	Wilson / Roithova	Peter van Dijk Theo Peters
03.830	Sjoerd Rijpkema	Jelle Toebes	SL-1	Wilson / Roithova	Peter van Dijk Theo Peters

The Environment, Health and Safety (ARBO) Officers (PAM-mers) are Peter A. S. van Dijk, Theo P. J. Peters, Helene Amatdjais-Groenen and Marieke Egbertzen for the cluster for Molecular Chemistry, and Ron Engels (Celikel group, Phone 52398) for the 2nd floor labs of Physical Organic Chemistry. Note that the 2nd floor laboratories do not have a Safety and Lab Steward system as they are shared (molecular) biology labs. José Roelofs-Hendriks is responsible co-worker regarding GMO work. Aigars Piruska is Laser Safety Officer for lab HG03.221 and lab HG03.424.

The Safety Committee consists of the Chairman: prof. W. T. S. Huck, the PAM-mers, and the Safety Stewards. The members of the Safety Committee can be contacted about safety problems which they discuss in their meeting (once a month).

6. First Aid (EHBO)

First Aid diploma holders (EHBO):

- Theo Peters
- Shauni Keller
- Jelle Toebes
- Jeroen Bruekers

First Aid boxes are available in or near every lab. Please check the location of the box near your workplace. New members of the cluster must make sure that they are introduced to the First Aid diploma holders in their laboratory wing (see also check-in form).

7. Pressurized Air

Our department possesses two sets of pressurized air equipment. In case of an emergency, these will enable rescue operations to be conducted in areas filled with smoke. The following people have been trained to operate this equipment:

- Victor Bloemendal

II Useful Information

1. Check in
2. Basics
3. Illness
4. Environment, Health and Safety
5. Ordering Chemicals
6. Computers
7. List of instrumentation
8. Check out
9. Disclaimer

1. Check in

Every student that is going to fulfil a traineeship within the Molecular Chemistry Cluster at the Radboud University Nijmegen has to check in first. This means that the check-in form, the Internship Agreement, and the Confidentiality Agreement, have to be filled in and signed. Choose the right links:

- Internship MLW, Internship SK
- Internship Science
- Confidentiality Agreement (English version)
- Confidentiality Agreement (Dutch version)

2. Basics

The Molecular Chemistry Cluster allows flexible working hours although it is most common to work between 8.30 and 17.30.

The Huygens building is open between 6.30 and 21.30 on Monday to Friday and between 9.30 and 16.00 on Saturday. All people, PhD students, post-docs, visiting students, undergraduate students and staff members need a campus card to obtain entrance to the wings that belong to the cluster. Access to the wings can be requested by the secretaries. Students have access to the wings on Monday to Friday between 8.00 and 19.00. The campus card gives for employees (including PhD students and post-docs) also access to the Huygens building outside opening hours, however a PIN-code needs to be entered.

There is an in/out-board attached to the entrance door of each wing with the names of PhD students, post-docs and permanent staff members working in that wing. It is important that whenever you are in the building, you mark yourself as in and whenever you go outside the department, you mark yourself as out.

3. Illness

In case you are ill, you must call one of the secretaries, Désirée van der Wey (024-3652676), Marieke Egbertzen (024-3652091) or Paula Willems (024- 3653421) and they will inform your mentor and colleagues. It is also important to inform the secretary when you have resumed working.
If you have any complaints that could indicate RSI (Repetitive Strain Injury), please contact Marieke Egbertzen. Adjustments to the workplace could prevent further RSI complaints.

4. Environment, Health and Safety

This manual contains a section on safety, which gives information on safe working procedures, and what to do in case of an accident. Please read this carefully and make sure you know all regulations described. In principle, you have the main responsibility that your behaviour guarantees your own and your colleagues' safety. In order to gain access to the laboratories, a safety test will be conducted. If you make more than 5 mistakes the first time (out of 35), you can have one resit after studying the safety manual again. If your score is again more than 5 mistakes a chemical buddy will be assigned to supervise you on safety in the lab. till he is satisfied. The chemical buddy will be together with the head of the department decide when supervision is no longer necessary.

If a member of staff violates a safety regulation, his/her manager will immediately call the member of staff to account at an interview. The interview will be recorded in writing and signed by the manager. The report will describe the reason, the actions of the member of staff (whether correct or incorrect) and the warning issued regarding the possibility of far-reaching legal measures in the event of a subsequent violation. In this way, violation of regulations is dealt with both directly and indirectly. Depending on the circumstances, the corrective interview will be conducted by the manager and the Dean of the Faculty. Subsequent violations or very serious situations may result in far-reaching legal measures being imposed, including removal from certain tasks, reallocation of duties, compulsory transfer, an irreparable breach of confidence, a request to the UWV Employee Insurance Agency to sanction dismissal, the start of dismissal proceedings in the district court and in extreme situations, summary dismissal (urgent reasons). In the event of a violation, the member of staff must be told immediately that his/her conduct is unacceptable and should not be repeated.

Each lab has its own Safety Steward (see list of room responsibles) to ensure a safe environment in the lab. If anyone is not following the correct safety procedures, it is the responsibility of the Safety Steward to report this to that particular person and the relevant work group leader. Furthermore, in each lab there is a Lab Steward who is responsible for the running of the lab.

People who intend to do chemical work in the laboratories of the Cluster for Molecular Chemistry but do not themselves have a background in chemistry (physics, biology, or any education in which they did not follow practical courses in Chemistry at Bachelor level in an institute of higher education - University or 'HBO') must make sure that they have a 'chemical buddy' in their laboratory wing, i.e. someone who has the requested chemical background with whom they discuss their chemical work.

If you have questions or problems regarding safety, please discuss them with your mentor and the Safety steward. For other problems, such as misbehaviour, unwanted behaviour, sexual harassment, intimidation, teasing/bullying, gossip, and any other behaviour at the department that you find annoying or that disturbs your work, you can discuss this with your group leader. If you don't want this for any reason, you can talk confidentially to a so-called trusted person (Dutch: "vertrouwenspersoon"). See
http://www.ru.nl/english/about-us/our-university/integrity-conduct/confidential/ (English) or
http://www.ru.nl/over-ons/overradboud/integriteitsbeleid/vertrouwenspersonen/ (Dutch).

5. Ordering Chemicals

The program used for ordering chemicals, both internal and external orders, is Labservant (https://labservant.science.ru.nl). PhD-students, post-docs, and permanent staff members can login with their u number. If an undergraduate student needs to order chemicals he/she has to ask his/her mentor.
Internally ordered chemicals will be delivered, twice per day, in the Logistic Transfer Rooms. Externally ordered chemicals will be delivered personally or at the location that is printed on the Labservant label.
When a container is empty and contains a Labservant label it should be removed from Labservant by using "Scan out containers" in Labservant.

Any other necessities (e.g. equipment) can be ordered from Peter van Dijk and Theo Peters.
Daily used consumables can be obtained from Jan Dommerholt and Peter van Dijk.

If you have any chemicals that you don't use anymore, put them back in the transfer room. They will be stored in the Logistic Centre and available for internal orders. Chemicals without bar code will not be taken away.

6. Computers

Computers and laptops should be used responsibly. Each person is responsible for making sure that the computer he/she is using has an up to date virus scanner and Firewall, and that his/her work is regularly backed up. Research results are the most important data. The researcher is responsible for the backing-up of his or her own data, to prevent losing important files in case of a computer crash. All shared folders on the network should be read-only. Software for computers can be obtained via this link, http://wiki.science.ru.nl/cncz/Categorie:Software. It is only possible to access this computer within the network. Software for computers can be obtained via this link. It is only possible to access this computer within the network. Underneath you will find a short list of some of the available software and some useful links.

Chemistry-related software

- ChemBioOffice
- RU huisstijl (templates for presentations etc.)
- MestReNova
- Spectragryph

The offices have furniture (tables, chairs) that can in principle be adjusted for your personal needs. Be aware that use of a laptop computer without a separate keyboard and mouse can give rise to RSI/KANS (repetitive strain injuries). More information can be found on https://www.radboudnet.nl/veiligengezond/veiligheid/arbeidsomstandigheden/

Useful links:

C&CZ security wiki	http://wiki.science.ru.nl/cncz/ICT-Beveiligingscampagne
C&CZ software wiki	http://wiki.science.ru.nl/cncz/Categorie:Software
Booking site for general equipment	https://bookings.science.ru.nl/
Reaxys (search for reaction conditions, structures, literature)	https://www.reaxys.com/#/search/quick
Google Scholar (scientific webcrawler)	http://scholar.google.com/
RU Library	http://www.ru.nl/ubn/
Oracle (time cards, internal lab supplies, expensive requests)	https://bass.ru.nl/
RUQUEST (on-line request of literature)	https://ru.on.worldcat.org/
Web-of-Science (search for literature)	http://www.webofknowledge.com
Cambridge Structural Database (X-ray <1000D)	http://www.ccdc.cam.ac.uk/products/csd/
Brookhaven Crystallographic DB (X-ray >1000 D)	http://www.rcsb.org/pdb/

Finally here is a summary of useful symbols for your presentations/publications: symbols

7. List of instrumentation

Keys of every lab and office equipment can be obtained from Peter van Dijk

Instrumentation that can be used can be found on site
https://www.ru.nl/bio-orgchem/instrumentation/.
They can be booked on the booking site https://bookings.science.ru.nl/
A short manual for the 500 MHz NMR can found here.

Important: For all equipment a short course is obligatory. Do not use any equipment if you do not know how it works. Ask the responsible person.

8. Check out

There are several things that have to be done prior to permanently leaving the Molecular Chemistry Cluster.

Checklist: There is a checklist for people who are leaving the cluster. You obtain it from the secretary upon arrival, but you can also print this pdf-file (Checklist for leaving the cluster). Some important issues on that list are discussed in more detail below.

Chemicals: All products that you want to keep after you leave should be well labelled with your name, the date it was made, an experimental reference number, a structural formula and stored in containers. Anything left in round-bottom flasks or not properly labelled will be thrown away. Make sure that you make a sample file which contains structures, purities, quantities and locations of the products and handed over to your mentor.
Make sure that any chemicals registered in Labservant in your name are returned to the Logistics Centre or transferred to a colleague.

Data: All data on computer should be burnt to CD and one copy given to your mentor, one to your work group leader and one for the archive. Then everything should be erased from the cluster's computers, and all email accounts on windows should be removed. This includes all instrument computers such as the CD spectrometer etc. Inform the administrator(s) that all data have been backed up and can be deleted. Anything required for the writing of reports or theses should be copied and removed, unless the report is being written in the cluster. All paper data should be given to the work group leader upon completion of the report or thesis.

9. Disclaimer

This is meant as a guideline to the workings of the cluster and is in no way fully complete. If anyone has any questions or comments on anything in this manual then you can ask anybody working around you.

III Safety regulations

1. Introduction

As part of the Faculty of Science Policy on Hazardous Substances, approved by the Faculty Board on 8-11-2010, laboratories have been divided into a number of categories (Table 1).

Level	Risk category	Name	Description	Measure
0	None	SL-0	Offices and rooms where eating and/or drinking is permitted	Lab coats prohibited. Chemicals constituting a health risk prohibited.
1	Low	SL-1 (chemical laboratory with limited risk)	The rooms are used for work involving flammable, toxic, irritating or oxidising chemicals, or chemicals that could damage long-term health, in such small quantities that the health risks are limited.	A cotton lab coat, long trousers, sturdy shoes and safety glasses are compulsory while working with flammable, toxic, irritating or oxidising chemicals, or chemicals that could harm health in the long term.
2	Medium	SL-2 (standard chemical laboratory)	The rooms are used to work with flammable, corrosive, toxic, irritating, explosive or oxidising chemicals, or chemicals that may damage health in the long term.	A cotton lab coat, long trousers, sturdy shoes and safety glasses are compulsory, irrespective of the work being carried out.
2+	High	SL-2 + (chemical laboratory with increased risks)	The room is used to work with high-risk substances and/or processes.	In addition to a cotton lab coat, long trousers, sturdy shoes and safety glasses, adequate PPE (such as a face mask, gloves and gas mask) is also compulsory. Other clothing may be compulsory in specific situations.
B1	Low	ML-1 (molecular biology laboratory)	Rooms used for work involving low-risk genetically modified organisms.	No entrance for unauthorized persons. To work in ML-1 labs training is required; contact the responsible officer (for labs 02.216 and 02.242: José Roelofs-Hendriks.
2	Medium	L-2 (laser laboratory Class 3B, 3R and 4)	Rooms used to work with high-risk laser beams More information on laser safety you can read on microscopyu.com.	To work at L-2 level, contact your Laser Safety Officer (for lab 03.221: Aigars Piruska)

The regulations stated below apply to laboratory areas in the 'medium' category (SL-2). These are areas were people work with chemicals that are flammable, corrosive, toxic, irritating, explosive, oxidising or otherwise dangerous to long-term health. The foremost safety rule is that lab coats and safety glasses are compulsory, irrespective of the work being carried out. Departments will alert new staff/interns starting work in laboratories in the 'high' category to the additional rules that apply there.

These safety regulations for working with hazardous substances are a more specific version of the general Faculty of Science safety regulations and recommendations issued by the Faculty of Science Internal and Housing Affairs department[1] We also refer you to this document for information on the Working Conditions Act, electricity, Ionising radiation, lasers, environmental protection, working with machines, hoisting and transport, working at heights, and working with vacuum applications. The faculty regulation for waste management for was drawn up with the Radboud University Department of Occupational Health & Safety and Environmental Service (also available in English)[2].

Included in the policy on working with hazardous substances is the commitment to strictly monitor the compliance with the regulations in question. This means that the supervisors in the Bachelor's practical courses can refuse to admit students to the labs if they are not dressed according to the regulations, or send them away if they do not observe the guidelines relating to personal protection equipment or order, tidiness and hygiene; the same applies to Safety Stewards and work group supervisors in the labs of the research institutes in relation to Master's students, staff and guests. Environment, Health & Safety is a recurring subject in annual interviews between staff and managers. Repeated violation of safety regulations will result in sanctions.

Additional to the chemical labs, the molecular chemistry cluster makes use of some laboratory spaces with a higher safety level regarding the use of GMOs or lasers. Special safety officers are employed to administer the safety in those rooms. This manual does not include safety regulations on GMOs or lasers; contact your safety officer before starting to work in those labs.

[1]These safety regulations can be found on http://www.radboudnet.nl/fnwi/fnwi/arbo/ (in Dutch).
[2]The faculty waste management regulation was devised with the RU Department of Occupational Health & Safety and Environmental Service and can be found on https://www.radboudnet.nl/veiligengezond/duurzaamheid/afvalscheiding/ (in Dutch)

2. General safety

2.1. Important rules

There are several important obligatory rules.

Safety glasses should be worn at all times in SL-2 laboratories, irrespective of the work being carried out. Safety glasses can be obtained from Peter van Dijk. If you have prescription glasses you can ask Peter van Dijk to order a pair of prescription safety glasses at the cluster's expense (not for undergraduate students).
Lab coats should be worn at all times in SL-2 laboratories, irrespective of the work being carried out. If you work in the department for more than two weeks (Bachelor internship or longer) a lab coat is provided by the department.
It is strictly forbidden to work alone in the lab. Always make sure that there is a PhD student, post-doc or staff member within seeing or hearing distance from the lab. Undergraduate students are not allowed to work in the lab outside working hours (in the evenings and weekends) without direct supervision. Students have only access to the wings between 08:00 and 18:00.
It is not allowed to work with genetically modified organisms (GMOs) in the SL-1, SL-2, and L-2 laboratories of the Cluster of Molecular Chemistry. GMO work should be carried out in the Molecular Biology labs assigned for this purpose (e.g. ML-1). Working in such labs can only be done with permission from the responsible co-workers. It is not allowed to take the products of work with GMOs out of these labs (and into other labs) unless one is absolutely sure that the cells are dead. Discuss this carefully with your mentor, and with the responsible people in the GMO-authorized laboratory.

Make sure you know how to handle in case of an emergency (see sections 4.2-4.7).

Before starting an experiment, always make sure you know the safety risks involved and what measures should be taken regarding safety and environment (waste management, see section 3.5).

Work tidy and clean up the workspace(s) when you are finished. Always close your fume cupboard completely when you go away. Report any defects to equipment to the responsible person immediately.

Fill in the appropriate overnight experiment card when you conduct overnight reactions (see section 2.7).

Ask for help from the responsible co-worker or an experienced PhD student, post-doc or staff member when using unfamiliar equipment or techniques, in particular:

- Hazardous gases (see section 3.7)
- Schlenk lines
- Distillation setups
- Cold traps (see section 3.8)
- Vacuum setups (desiccators, freeze-dryers, etc.)

2.2. Organisation of safety[3]

The following staff fulfil an important role in the faculty/departmental safety policy:
Mentor: Every new person starting in a laboratory (student, intern, PhD student, post-doc researcher, support & management staff, academic staff, hereinafter to be referred to as laboratory worker or staff and students) will be assigned a mentor (usually his/her academic supervisor) to be his/her first point of contact in relation to safety questions.
Lab Steward: Every laboratory area has a Lab Steward (list per department), who is responsible for the day-to-day running of the lab. The Lab Steward (or someone appointed by him/her) checks the laboratory area every evening to make sure that: all equipment is switched off, all solvent containers have been returned to the appropriate ventilated cabinets, and all taps have been turned off. If the Lab Steward is not the last person to leave the laboratory at the end of a working day, he/she must delegate this checking duty to another person. The Lab Steward is also responsible for the experiments conducted at night (see relevant section).
Safety Steward: In addition to a Lab Steward, every laboratory area also has a Safety Steward who keeps an eye on the safety in the lab. The Safety Steward is in touch with the departmental environment, health & safety officer, and in combination with him/her and the other Safety Stewards, they form a departmental Safety Committee which meets every month to discuss the current state of affairs. The Safety Steward can always be contacted for questions related to safety.
Environment, Health & Safety Officer: Every department with laboratories in the 'medium' category or higher has an environment, health & safety officer (PAM-mer), who acts as the contact person for the Department of Occupational Health & Safety and Environmental Service (university level) and the environment, health & safety coordinator (faculty level).
Environment, Health & Safety Coordinator: This person is the first point of contact for cross-department and department-level health and safety matters.
Responsibilities: As stated in the faculty safety regulations, managers are responsible for guidelines and monitoring. The director of business operations is responsible for the policy and its enforcement throughout the faculty.
Drills: Every laboratory worker must take part in a fire extinguishing drill and safety instruction session at least once a year (organised together with the Department of Occupational Health & Safety and Environmental Service).

[3] Every member of staff may adopt one or more of these roles

2.3. Personal Protection Equipment (PPE)

Personal protection equipment (lab coat and safety glasses) is compulsory at all times in labs in the 'medium' category or higher. This also applies to staff and visitors present in the lab areas but not actually handling hazardous substances; other experiments taking place in the lab can also constitute a hazard. Pegs for lab coats and cupboards for safety glasses are located at the entrance to the lab. Coats and safety glasses are also available for visitors. They must be put on when entering the laboratory and taken off and hung up when leaving. People may only enter/leave the labs via these entrances; all other exits are reserved for emergencies.

A complete overview of Personal Protection Equipment (PPE) is available in the general Faculty of Science safety regulations and recommendations[4]. The most relevant PPE for working with hazardous substances in lab areas in the 'medium' category are shown below.

- **Safety glasses** for protecting the eyes: these are compulsory in the laboratory. People who wear hard contact lenses should be aware that hazardous substances that get behind their lenses are very difficult to remove. Safety glasses with prescription lenses are preferable.
- **Safety clothing** (a lab coat) to protect clothes and skin is compulsory in the laboratory. A lab coat needs to be made of cotton; coats made from nylon or other synthetic materials are forbidden due to the fire risk (nylon melts). Lab coats should be fastened to provide adequate protection. As lab coats do not cover all clothing, other clothes must also comply with certain regulations: long trousers and closed shoes. Cotton clothing is less flammable. Natural fibres are strongly recommended in view of the above mentioned risks of synthetics.
- **Gloves** to protect the hands: gloves can either be used to protect your experiment or to protect your skin from dangerous compounds. In the latter case, to prevent contamination, make sure that you only use them when risking direct contact with this compound. Take your gloves off otherwise you will contaminate balances, pc's, doorknobs and microscopes etc., and put on new gloves when returning to your compound. Be aware that gloves have different breakthrough times for different kinds of chemicals, varying also per manufacturer (Appendix 1). They should at all times be replaced immediately in case of contamination. In general, gloves are highly permeable for organic solvents, and therefore rather increase than decrease the safety risk when working with such compounds. One of the main drawbacks of latex gloves (alongside permeability to organic solvents) is that they can cause latex allergies. In general, most gloves will lead to skin complaints if used excessively. In general, it is advised to work with gloves only when you have the risk to come in contact with corrosive compounds, or with toxic or suspected carcinogenic/mutagenic/reprotoxic compounds that can penetrate the skin (if a compound belongs to one of those categories can be found in Chemwatch), but of course only when gloves offer sufficient protection.
- Masks to protect the eyes and face. To be used when working with corrosive and cryogenic substances, and when performing tasks that involve brushing. They can be found in the transfer rooms.

[4] For the links, see paragraph 5.2 at the end of this document.

2.4. Order, tidiness and hygiene

As will be explained in more detail in 3.1. Preparing an experiment and 3.2. Health risks, these safety regulations revolve around reducing risk when working with hazardous substances by using the Personal Protection Equipment described in 2.3 . If during preparations for an experiment it becomes evident that one or more of the substances being used is highly toxic, the person conducting the experiment should consider whether replacing the substance with a less toxic alternative would affect the results. Alternatively, consider using smaller amounts of the substance.
Whatever the circumstances, all experiments involving chemicals must be carried out in a fume cupboard, all solutions, reagents and products must be clearly and correctly labelled, and proper PPE should be worn at all times.

Safety regulations to prevent **ingesting** hazardous substances:

- Eating and drinking are prohibited in the lab areas, with the exception of the designated areas (no chewing gum and no sucking/chewing pencils etc). Smoking is prohibited throughout the building.
- Do not put food or drink in a fridge or any other area or container intended for chemicals. Never drink from glassware used in the lab.
- Always wash your hands before eating or drinking and before and after using the toilet, but also during your work whenever necessary.
- Never wipe your hands on your lab coat; change your coat for a clean one regularly.
- Sucking liquid into a pipette is prohibited, unless it is clearly stated that the liquid being drawn up is entirely safe; use a pipette balloon (do not let the liquid touch the balloon), a micropipette or a dispenser.

Safety regulations to prevent **absorption through the skin:**

- Use high-quality gloves whenever necessary (Appendix 1).
- Do not wash your hands with organic solvents (they remove the natural oils from your skin).
- Never work with an open wound; always cover it with a band aid that will not come off easily.
- Ensure good personal hygiene, i.e. clean hands and short nails. - Wash your hands when leaving the lab (always before eating and drinking) and during your work if necessary.

Safety regulations to prevent entry via the eyes (and eye damage):

- Wear safety glasses

Safety regulations to prevent inhalation:

- Always use a fume cupboard when working with chemicals and keep it closed as much as possible. Never work in a fume cupboard which is out of order and/or gives an alarm.
- Close bottles of chemicals immediately after use.
- Never smell substances directly from bottles; waft a little vapour or smell the stopper carefully.
- Avoid dispersing particles.

Safety regulations to prevent accidents:

- **Hai**r: Long hair must be tied back and no headwear may be worn. This is to avoid contamination and fire risk.
- **Transporting chemicals:** Use special trays with handles for transporting bottles of chemicals from one lab to another.
- **Needles:** avoid walking around with noncapped injection needles. Discard needles properly (in a “SharpSafe”, see section 3.5) immediately after use. If this is no option, cap them (carefully!)

The main message of the detailed safety regulations shown above is that **good personal hygiene** and **meticulous, careful, orderly and tidy working practices** will help to prevent accidents. This is not only the responsibility of the person carrying out the work, but also of the people working around him/her. Many accidents are not caused by the victim, but by someone else working in the same area.

A large proportion of accidents in a laboratory are caused by falling, stumbling, or bumping into things. **Order and tidiness** in the lab are vital. Never work on the edge of the bench or fume cupboard. Place heat sources (burners, heating mantles and hot plates) where they are least dangerous. All laboratory workers must conduct experiments in a way that will keep the **fire risk** to a minimum. When working with flammable substances, welding or other activities with a high fire risk, extinguishers should always be within easy reach. Make sure that benches and fume cupboards are clean. Clear up spillage immediately (including water). Label all spray bottles. Wash and tidy up

equipment after use. Make sure that the lab is clean and tidy at the end of every working day. Plan weekly and six-monthly cleaning sessions together with other workers in the laboratory.

Every laboratory worker must ensure that:

- fire and smoke protection doors are not propped open
- corridors, emergency exits and escape routes are kept clear of obstacles
- fire extinguishers and alarm buttons are always visible and accessible, and can be used without delay if necessary
- no rubbish, packaging material or paper is left lying around
- power connections are sound, electric wires are properly fused, and approved adapters are used
- equipment is switched off when not in use
- no household appliances (coffee machines, toasters etc.) are used in the rooms or laboratories
- defects and irregularities are reported immediately
- no superfluous chemicals or cleaning agents are left in the lab areas.

2.5. Orientation in the laboratories

Before embarking on experiments, new laboratory workers must feel confident in the laboratory and be made aware of a few important aspects.

Every laboratory worker must be (and remain) familiar with the location of and where applicable, how to use:

- Exits and emergency escape routes
- The first-aid boxes, and the qualified first-aiders (list available for every department). There is at least one first-aid box per department (and per lab in some departments); ask the office staff or the first-aiders from the department and/or Internal Emergency Team if necessary.
- Fire extinguishers and hose reels.

  Find out where they are (next to fume cupboards and in the lab areas and corridors) and how to use them. Read the instructions on the fire extinguisher.
  - CO_2 extinguisher: can be used in case of most types of fire, but will be empty within ~20 seconds! Never use on persons, as liquid CO_2 is so cold that it causes burns-wounds. Never use on metal fires because carbon dioxide reacts with for example $LiAlH_4$ and elementary magnesium, sodium, potassium and aluminium.
  - Hose reel: general extinguishing equipment; never use in case of:
    - Burning organic solvents, especially oil, as they will float on the water and the fire will spread quickly.
    - Metal fires, as water reacts with for example $LiAlH_4$ and elementary magnesium, sodium, potassium and aluminium.
    - Fires involving GMO's, because the GMO's will be spread.
    - Persons, as the hose is really strong.
    - Electrical equipment (unless power is absolutely off), because water causes short circuits.
  - Sand: preferred to extinguish metal fires. Can also be used for organic solvents.

  Laboratory workers can familiarise themselves with the various extinguishing devices during the periodical drills arranged by the Department of Occupational Health & Safety and Environmental Service (see paragraph 2.2).

- Emergency showers
  Find out where they are and how they work.
  Be careful:
  1. they are connected to the mains and are under high pressure;
  2. the area can soon flood if they are used so try not to leave them on for too long.

  Emergency showers can be better than fire blankets as they not only extinguish the fire, but they also have a cooling effect on the victim.
- Fire blankets
  Find out where they are and how to use them.
  IMPORTANT: a person needs to be laid down on the floor and rolled into the blanket. When the victim is standing upright, the fire will not be extinguished.
- The location of the nearest green telephone
  These telephones continue to work even if the main switchboard is out of order; only to be used to report emergencies if the other telephones are down.
- The emergency and alarm buttons. There are three sorts:
  1. Large round buttons near the emergency exits of all lab areas;
     pressing the button cuts off the electricity in the wall sockets in the laboratory concerned (or several labs in a wing).
  2 Square red boxes with a glass front, which can be activated by breaking the glass (see figure 4 in paragraph 4.5). These are fire alarms; they set off an alarm.
  3 Square green boxes with a glass front, which can be activated by breaking the glass. They release the lock on the emergency exit if this does not happen automatically as part of an evacuation alarm.

2.6. Working alone, working outside regular working hours

Working alone means that a person is working in a situation whereby he/she **cannot** continually be seen or heard by others. Situations like this can occur during regular working hours; laboratory workers should try to anticipate periods in which most of the group is attending a conference, for example. The guidelines for working alone are as follows:

- Working alone in a laboratory in the 'medium' (SL-2) or 'low' (SL-1) category is strictly prohibited. Another member of staff must be in sight or within hearing distance of the workplace/fume cupboard at all times. When working outside regular working hours, the overtime clock must be activated in order to restore the ventilation in the lab. Without proper exhaustion it is not safe to work in the lab.
- Laboratory workers may work alone in one of the offices on library work, computer work or reading and writing.

Figure 1: Overtime clock.

Laboratory, practical or workshop activities are not allowed outside regular working hours unless explicit permission has been given by the manager concerned; working alone is still prohibited, even if permission for working outside regular working hours has been granted. The group leader is authorised to make decisions in these matters and is therefore ultimately responsible.

2.7. End of the working day, night-time experiments

1. Close the fume cupboard at the end of the day and switch off the lights.
   IMPORTANT: fume cupboards must be properly closed as they only work at 30% of their capacity at night!
2. Switch off all equipment at the end of the day.
3. Take special care that all water cooling is turned off if it's not needed for an experiment. In case you do need water cooling, please take care that all your water hoses are properly secured (only use transparent/plastic ones!) and that the water flow is not too high. Be aware that water pressure might increase significantly during the evening and at night.

The Lab Steward (see 2.2) is responsible for experiments that continue into the night; regulations may vary per department. For each overnight experiment a card that shows information about the specific risks of the experiment must be placed at the fumehood window. This card can be red, green or yellow, depending on the risk level of the experiment. The general rules regarding the cards are as follows:
Green card: for reactions that do not require heating/reflux, pressure, vacuum or hydrogen
Red card: for reactions that require heating/reflux, pressure, vacuum, or hydrogen; also an overnight running vacuum pump requires a red card
Yellow card: for continuously operating setups (drying liquids under nitrogen or argon)

Also the filling in of the cards should happen according to strict rules:

- Name, phone number, location
- In case of green or red card: date of the experiment (from [day] to [day])
- Type of experiment
- Volume of the reaction solvent
- Write down all solvents and chemicals that you use in the reaction, including their hazards, on the card in full: that means that you must not use abbreviations like THF, KOH, DCC, Pd/C, etc.

If the researcher concerned has not left one of these cards or the appropriate card at the fume cupboard containing the experiment, if the card is filled in incomplete, or the reaction set-up causes a safety hazard, the Lab Steward is authorized to stop the experiment during his evening rounds. The cards are collected and placed in the rack near the entrance to the laboratory area so that the Internal Emergency Team and fire service, as well as other people that make use of the lab, can quickly assess the risks and locations of experiments in the area in the event of an emergency.

IMPORTANT: laboratory workers carrying out night-time experiments are personally responsible for taking the card back to the fume cupboard with the experiment the next morning. The Safety Steward can withdraw the card (or cards) if the laboratory worker misuses them.

3. Hazardous substances

3.1. Preparing an experiment

Before every experiment, examine the specific risks of the chemicals you are using by looking at the label, consulting Chemwatch[5] and reading the supplier's information. Do not simply take note of the risks if everything goes according to plan, but look at what can happen if something goes wrong. Think about the possible repercussions, or what would happen if the agitator, reaction flask, cooling or heating were to break or fail. Precautions must be taken for these risks.

The safety regulations shown in the previous section (2. General safety) are aimed at limiting all the risks involved in working with hazardous substances. The following paragraph (3.2. Health risks) shows exactly why everything must be done to minimise the risk of a hazardous substance being ingested, absorbed via the skin, penetrating the eyes or being inhaled. If the risk inventory indicates that one or more of the substances being used in an experiment is highly toxic, the laboratory worker should consider whether less-toxic chemicals could be used without affecting the results. Another useful measure is to keep the amount of the substance used to a minimum. Whatever else, all experiments involving chemicals must be carried out in a fume cupboard, all solutions, reagents and products must be correctly labelled, and good personal protection equipment must be worn.

[5]For links, see paragraph 5.2 at the end of this document.

3.2 Health risks

The GHS-CLP (Globally Harmonised System of Classification, Labelling and Packaging of Chemicals) system5 introduced throughout Europe in 2009 distinguishes between the following hazard risks and categories of hazardous substances and mixtures, using the pictograms shown below:

- Physical hazards (flammable, corrosive, explosive, compressed gases, oxidising);
- Health hazards (corrosive, toxic, irritating/sensitising, long-term health risks, oxidising);
- Environmental hazards (hazard to aquatic environment).

Any particular substance may belong to several risk classes and categories.

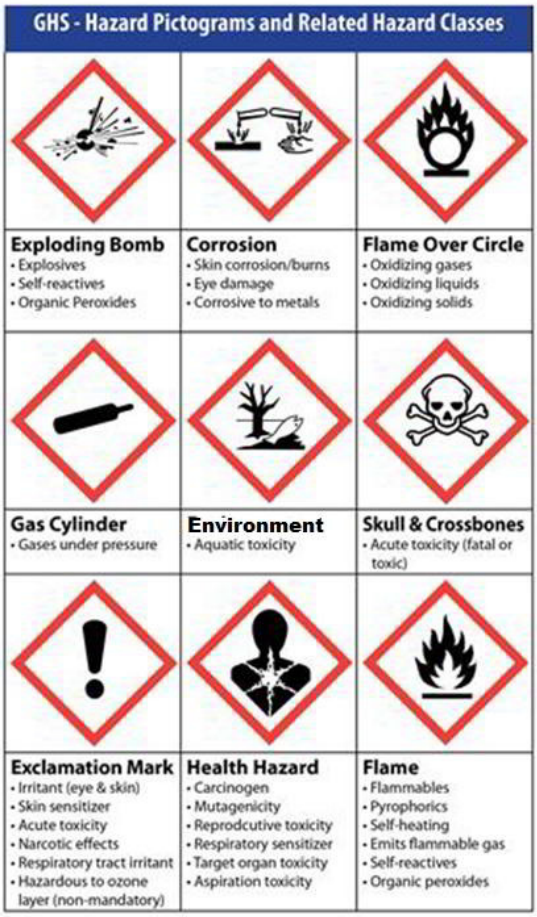

Figure 2: GHS categories for hazardous substances and the relevant pictograms.

A GHS label comprises the following elements:

- one or more pictograms or hazard symbols (see Figure 2), showing the hazard category;
- a signal word ('danger' or 'warning'), depending on the hazard category of the substance;
- one or more hazard statements ('H statements'), which replace the present 'R statements' (risk statements) and describe the risks posed by the substance;
- one or more precautionary statements ('P statements'), which replace the present 'S statements' (safety statements), and explain the safety regulations governing working with the substance concerned. There are five types of safety recommendations: general statements, and statements regarding prevention, response, storage and disposal. Pictograms can also be used to indicate the recommendations.

Home-made mixtures and solutions of chemicals should be labelled according CLP (Classification, Labelling and Packaging) regulation.
The bottle or container for general use should contain:

- Name and ratios of the chemicals inside the bottle or container
- Hazard pictograms
- The relevant signal word

For personal use also:

- Your name
- Date

If for solutions no GHS symbols are applicable, a **blank GHS sticker** should be used as a proof of checking its properties. If GHS classification of newly synthesized compounds is unknown, no stickers should be used. Stickers with GHS symbols as well as blank stickers are available from Peter van Dijk.

Posters showing GHS symbols and the H and P statements are available from the Department of Occupational Health & Safety and Environmental Service. The measures per hazard category shown below correspond with those in section 2.3. Personal protection equipment and 2.4. Order, tidiness and hygiene.

The hazard categories are:

Flammable:

Solids, aerosols, gases and liquids (such as organic solvents with a high vapour pressure, e.g. diethyl ether, ethanol) are flammable.
Measure: Avoid open flames in a lab where these substances are used, and beware of heat sources, sparks, electric discharge etc. that may cause ignition.

Corrosive:

Corrosive (aggressive) substances (such as concentrated acids, concentrated alkali, strong oxidisers) are dangerous if they come into direct contact with the skin, eyes and mucous membranes.
Measure: Avoid contact by using PPE.

Toxic:

Toxicity: It is best to assume that all chemicals are potentially dangerous to health, even though for some of them (e.g. water) the concentration would have to be very high to pose a serious risk. In chemistry, the term toxic substances is used if even small doses of a substance could damage the body. Toxicity is therefore relative and depends on the dose. This in turn depends on:

- concentration,
- duration of exposure;
- means of entering the body: ingestion, via the skin, via the eyes, inhalation.

The effect of the dose also depends on personal factors such as sensitivity and general condition.
Measure: Avoid contact by using PPE; do not eat or drink in the labs and wash your hands when leaving the lab..

Irritating, Sensitising, Harmful:

Irritating substances are mildly toxic and single exposure causes minor irritation to the skin, eyes or airways without lasting damage. In the case of repeated exposure without time to recover, the cumulative effect can cause a chronic inflammation. Examples: high or low pH, dissolving skin oil due to organic solvents, specific reactions to epoxide resins, for example, with protein in the skin or mucous membranes. Sensitising substances are allergens that cause an allergic reaction by activating the immune system. This can lead to inflammation and allergic conditions. Alongside reactions to biological-based substances, an allergic reaction can also be caused by latex, for example. Take care when using gloves (see Appendix 1).
Measure: Avoid contact by using PPE; do not eat or drink in the labs.

Long-term health risk:

This includes all the CRM substances: carcinogenic (causes cancer), reprotoxic (dangerous to unborn foetus) and mutagenic (causes permanent) changes to genetic material).
Measure: Avoid contact by using PPE; do not eat or drink in the labs. If substances in this category are ordered in Labservant, a warning is generated by Chemwatch stating that this is a CRM substance; in extreme cases, certain orders will initially be blocked. The Internal & Housing Affairs department and the head of the department concerned will first look for an alternative to this substance; if this is not available, a permit for working with the substance will have to be applied for via the Department of Occupational Health & Safety and Environmental Service.
IMPORTANT: Pregnant women must avoid all contact with reprotoxic substances. Tell your manager in plenty of time if you are pregnant. Strictly speaking, all laboratory workers (m/f) planning a family should stay away from reprotoxic substances.
Compounds that damage the airways when inhaled (such as asbestos and silica) form another important category and can lead to silicosis

(Potter's rot). Asbestos should only be processed by specialist companies; chromatography columns should be filled in a fume cupboard with good exhaustion (see 3.6).
Measure: See the PPE for breathing protection (dust and gas masks) in the faculty safety regulations[6].

Hazard to aquatic environment:
Toxic to water organisms.
Measure: Avoid releasing these substances into the environment by for example discharging them through the drains (see also Appendix 3).

Explosive:
Substances and mixtures that may undergo a powerful exothermal discharge without contact with oxygen (air), with a rise in pressure resulting from the accumulation of gases.
Measure: Avoid heat, shocks and high concentrations. Use the fume cupboard when working with substances of this kind.

Oxidising:
Helps to ignite flammable substances.
Measure: Avoid contact with flammable substances.
Compressed gases (see section 3.6)

[6]For links, see paragraph 5.2 at the end of this document.

3.3. Threshold limits

Threshold limits have been set for hazardous substances:
The limit of the exposure concentration is linked to a specific duration. The combination of threshold limit and duration should be chosen so that a laboratory worker would not suffer damage to his/her health even after having worked with the defined threshold limit of the substance concerned for forty years. For this reason, the threshold value is defined as a Time Weighted Average over a period of eight hours, the length of an average working day; this is the so-called **8-hour TWA**. The time-weighted average for acutely toxic substances is defined as the **15-min TWA**. Specific cases require an instantaneous exposure threshold limit, the so-called **ceiling value** (reference time practically zero). The laboratory worker is at liberty to determine the reference time for the threshold limit, as long as the basic principle is realised: exposure at the threshold limit during an employee's entire working life must not cause damage to his/her health; this also applies to his/her children (see table 2 for the example of acetone).

Threshold limits can be found in Material Safety Data Sheets. However, the extent of exposure in the lab is hard to estimate. Therefore, always work in your fume cupboard to prevent inhalation.

Table 2. Threshold limits for occupational exposure to acetone.

Legal threshold limit (Netherlands)	
Acetone	
Threshold limit 8-hr TWA	1210 mg/m^3
Threshold limit 15-min TWA	2420 mg/m^3
EU (directive 2000/39/EC)	
Acetone	
Indicative threshold limit 8 hr	500 ppm
	1210 mg/m^3

3.4. Storage of chemicals

Chemicals are separated according to their danger categories. In case of multiple categories for a single compound, the priority is:

1. Flammable
2. Oxidizing
3. Toxic
4. Corrosive
5. Dangerous for the aquatic environment

Dangerous combinations can be found in Figure 3. The fifth category is normally combined with the other categories, so no extra precautions are needed.
Don't store Flammable and Oxidizing compounds together at any time.

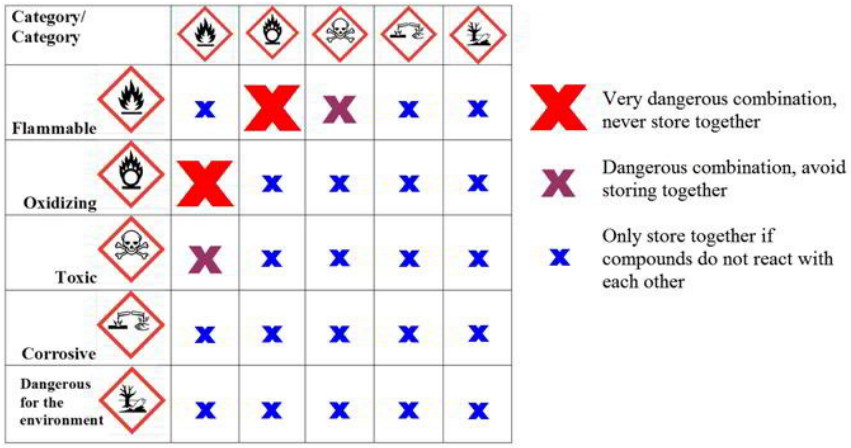

Figure 3. Dangerous and "safe" combinations of the different GHS categories.

Solvents: All solvents have to be stored in the safety cupboards ("plofkasten"), in different drip trays according to their safety label. This also applies to the solvent stock. Each drip tray should contain chemicals of only one danger category; its volume should be at least 110% of that of the largest bottle.
Liquid commercial chemicals should also be stored in these safety cupboards. Each tray is assigned to a single danger category and its volume should be at least 110% of that of the largest bottle. Acids and bases: have to be stored in separate cupboards under the fumehoods (this also applies to acids such as $SOCl_2$). However, if they are flammable (such as KOH in EtOH) bases and acids should be stored in the safety cupboard. This does not apply to HCl solutions as they are corrosive; its

ethylacetate and dioxane solutions go in the waste fume cupboard. Nitric acid (oxidizing) should be stored completely separate from all other liquids.
Solid commercial chemicals: Personal chemicals (only solids, registered in your name) can be stored under your own fume hood, as long as they are categorized as mentioned above in different drip trays.
Shared solid chemicals, such as salts, bases and silica, can be stored per category in the apothecary cupboard.
Toxic chemicals should not be stored in the lab but in the logistic centre. If they are used in the lab they should be returned to the logistic centre as soon as possible.
Oxidizing chemicals, however, have to be in a separate drip tray in the safety cupboard.
Freezer/Fridge: Commercial and "home-made" chemicals should not be in the same freezer/fridge. All the different categories have to be in different drip trays.

Liquids of contents 250 ml or less and solids of contents 1 kg or less hasn't to full fill these rules. However place them always in a drip tray.

During ordering of a chemical a location has to be given were it will be stored. This location should be in agreement with the above rules. After use of a chemical it should be returned to its location that is given on the label that can be found on the container.

"Home-made" chemicals: Home-made mixtures and solutions of chemicals should be labelled according CLP (Classification, Labelling and Packaging) regulation.
The bottle or container for general use should contain:

- Name and ratios of the chemicals inside the bottle or container
- Hazard pictograms
- The relevant signal word

For personal use also:

- Your name
- Date

If for solutions no GHS symbols are applicable, a **blank GHS sticker** should be used as a proof of checking its properties. If GHS classification of newly synthesized compounds is unknown, no stickers should be used. Stickers with GHS symbols as well as blank stickers are available from Peter van Dijk.

3.5. Waste

For waste originating from our laboratories the following main categories are distinguished: liquid waste, solid waste, glass waste, sharp objects. For a full overview, please refer to the faculty regulations mentioned in the introduction (also available in English)[7] and see the AMD website[7] on "Afvalstoffenregeling FNWI"/"Waste Management Regulations" and "Overzicht van de indeling voor gevaarlijke stoffen RU". On the whole, paper/cardboard that has not been in contact with chemicals, and the majority of special waste products such a ink cartridges, batteries and adhesives are collected per department in special containers in the technical area near to the lifts.

Labelling: All waste containers must be properly labelled; appropriate stickers are available in every lab area. See faculty waste disposal regulations) for an overview. IMPORTANT: the old labels must be removed or rendered illegible on all empty containers ready for disposal before being taken to the Logistic Transfer area; this also applies to glass bottles and jars in the glass waste.

Liquid waste should be divided into different categories according to the flow chart in Appendix 2 and disposed in properly labelled 5-litre or 10-litre jerry-cans. The main categories relevant for our labs are: inorganic acids (10-litre jerry-can), inorganic lyes (10-litre jerry-can), non-halogenated

organic solvents, halogenated organic solvents, ethidium bromide solutions, toxic liquids, watery solutions originating from laboratories.

Solid heavy metals, to prevent ignition, are collected in liquid waste containers according to the liquid waste flow chart (see Appendix 2).

Solid waste, including silica from the chromatography columns, soiled paper and glass contaminated with chemicals, but with the exception of heavy metals, needles and special waste products (see above) such as ink cartridges, batteries and adhesives, are collected in a brown container with a beige lid. The appropriate labels should be attached to the container (label 5.12 and ADR label toxic).

Glass when contaminated with chemicals, can be collected separately in a similar brown container with beige lid or in a solid waste container (See above). The appropriate labels should be attached to the container (label 5.12 and ADR label toxic). Clean glass is collected in a glass waste container in the laboratory. Rinse glass first if it has been contaminated with chemicals, or let solvents evaporate in the fume cupboard. IMPORTANT: remove the original labels or render them illegible.

Needles and other sharp metal objects must be collected in a special waste container, a so-called "SharpSafe" (yellow with a white lid and a narrow opening - make sure they are properly attached). Preferably, this container is only used for needles without the covers, as putting the cover back on the needle is an additional risk and the covers take up extra space. To detach a needle from a syringe in a safe manner, the incisions in the SharpSafe lid can be used. A SharpSafe should NOT be used for glass; neither for syringes, tubing or any other non-sharp thing you might attach to a needle.

Waste is removed from the transfer rooms in the laboratory wings by the Logistic Centre, but only if their instructions as given here are strictly followed up:

- Do not fill the waste disposal jerry can to more than 80 % of its volume, and make sure that it is not contaminated on the outside.
- Attach an adhesive label describing the contents: halogen-rich, halogen-poor, etc.
- In addition, the appropriate ADR-sticker with the danger symbol, corresponding to the symbol in the bottom left corner of the 'content' label, should be attached. This is supplied by the Logistic Centre with the 'content' label, and additional stickers can be ordered from them logistiekcentrum@science.ru.nl.
- Close the lid of a SharpSafe properly (which is: irreversibly) before bringing it to the transfer room.
- For an empty metal container to be taken away as waste, remove any residual liquid, take off the lid and erase the labels including all the barcodes and, in particular the danger symbols, so that it can no longer be mistaken for chemical waste
- Empty plastic 5 L jerry cans can be re-used as waste vessels and will not be taken away by the Logistic Centre when empty. They can be stored on the lab only if they are clean and dry and the labels/danger signs are removed or erased, in particular the danger symbols, so they can not regarded as full. If an excess of empty jerry cans is piling up in the lab, they can alternatively be discarded in a special "plastic waste container" in the container room (HG03.004). Make sure that the jerry cans are clean and dry and that the labels/danger signs are removed.
- Chemicals without bar code will not be taken away.

Waste, such as paper, plastic, batteries, ink cartridges, glass, can be placed in containers in room HG03.004 or HG3.081. Polystyrene boxes can be placed on the floor in those rooms.

[7] For the links, see paragraph 5.2 at the end of this document.

3.6. Compressed gases

Pipes for hydrogen (10 bar), argon, nitrogen, carbon dioxide and helium have been fitted on the lab benches and/or in fume cupboards in line with expected use in the lab areas. If another gas (or hydrogen> 10 bar) is needed regularly for long periods, a large cylinder can be placed in one of the cylinder cupboards outside the lab, and connected using the interchangeable gas feed. Large gas cylinders of this type are available from the Logistics Centre or must be ordered.

IMPORTANT: the gas cylinder must be secured in an upright position. If a cylinder falls (for whatever reason) and the reduction valve is damaged, the cylinder can be launched like a torpedo. Be aware that if large volumes of nitrogen or helium (or any other relatively 'safe' gas) suddenly escape from a damaged cylinder or container in a closed, badly ventilated room, this can lead to an oxygen shortage and ultimately to suffocation.
If at all possible, use small cylinders (the so-called) 'lecture bottles' in the fume cupboard. Keep these small cylinders in the fume cupboard until they can be removed via the Logistic Transfer area.
Before using either large or small cylinders, check that the inspection date has not elapsed. Listen carefully to your mentor's instructions about using the reduction valve.
The Matheson Gas Data Book (Library: Geert Grooteplein 15 Application number: MB 56 b 10) is useful reading if you want to know more about the properties of various gases.

3.7. Hazardous gases

Hazardous gases we define as gases or vapours that can cause serious injuries or even death upon inhalation and/or direct exposure to skin. A list of highly toxic gases can be found in paragraph 5.2. When you are planning to perform an experiment involving the use of a hazardous gas, comply with the following rules:

- Avoid the use of hazardous gases when possible. Only use hazardous gases when there is no alternative.
- Look up the MSDS data of the hazardous gas and take the possible precautions one should
- Inform the co-workers in your lab about the experiment and the possible dangers of the hazardous gas.
- Keep the fume hood sash closed as much as possible during the experiment.
- In case of an accident (sudden outburst of hazardous gas), alert your co-workers and evacuate the lab immediately. Cal 55555 and explain the situation (see section 4.2: guidelines for accidents). In any case, do not go back into the lab to attend to any possibly injured people!
- After completion of the reaction, follow the right quenching procedure (Hazardous Laboratory Chemicals Disposal Guide) to destroy any excess of hazardous gas.

3.7.1. Working with HF

Hydrogen fluoride (HF, g) is very hazardous to handle because it is highly corrosive and can cause deep tissue damage and systematic toxicity after exposure. Therefore an indicator card should be present on the fume hood where the experiment is performed and at all the lab entrances. Also be sure to warn everybody present on the lab at the start of the experiment.

If there is a need to work with HF (g) always contact Dennis Löwik (office: 03.016) for supervision and accompaniment during all of the experiments performed.

3.7.2. Working with Cyanides

Cyanide is a very toxic substance that is present in salts (eg NaCN), in acid (HCN, which in gas phase smells like almonds) and as reagents (e.g. cyanogen bromide, CNBr). Hydrogen cyanide is lethal at a concentration of 270 ppm and a concentration of 180 ppm is life threatening within several minutes.

When working with any form of cyanide (salt, acid or reagents) be sure to:

- Place a HCN detector in the fume hood
- Place a sign indicating working with HCN on the fume hood
- Inform the people in the surroundings around you

If an accident with cyanides occurs be sure to:

- Call in the qualified first-aiders
- Call 55555 and report the accident and the number of victims
- Make sure that a BHV-er evacuates the victim out of the area. **Do not do this yourself!**

3.8. Cryogenic liquids

Vessels of liquid nitrogen can be ordered from the Logistics Centre and will be delivered to the department via special transport. IMPORTANT: Be aware that liquid nitrogen can escape from a vessel very quickly (if a Dewar container is damaged and loses its cooling capacity). In a closed room, this can cause a lack of oxygen and ultimately suffocation. The laboratories where cryogenic liquids are used must therefore be adequately ventilated. Smaller rooms can be fitted with an oxygen sensor to warn if the oxygen level drops.

3.8.1. How to safely handle a cold trap

Another potential danger when using liquid nitrogen is the fact that oxygen from the air can condense into it. This should be taken into account when handling a cold trap. A cold trap is commonly used to condense solvents, thereby preventing harmful gasses from entering the attached pump (Figure 4). It is important to know how to install and more importantly, remove the cold traps, as formation of liquid oxygen (bp -183ºC) and explosion thereof can cause serious injury.

Installation:

- Make sure to **NOT** attach the vacuum pump to the top adapter as this will cause the vacuum pump to suck up condensed solvents when it reaches the level of the internal tube.
- Make sure the installation is airtight (close the system).
- Switch on the vacuum pump.
- Immediately place/fill the dewar flask with liquid nitrogen.

Removal:

- Remove the dewar flask with liquid nitrogen.
- Allow air into the system and switch off the pump.
- The cold trap is now safe to be disconnected with appropriate gloves to protect you from the cold.

DANGER: when air is allowed into the cold trap whilst still being cooled by liquid nitrogen, oxygen will condense inside the trap to form extremely dangerous mixtures of organic material and liquid oxygen which can potentially explode.

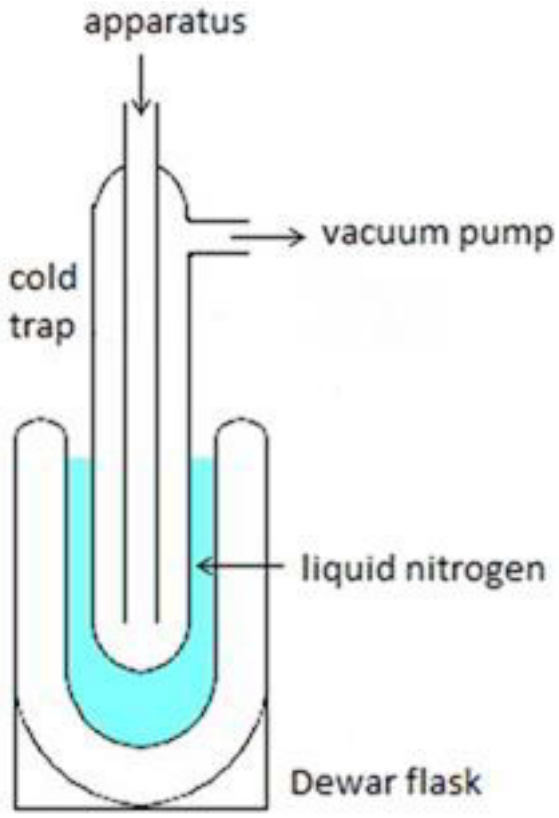

Figure 4: Cold trap.

3.9. Chromatography columns

Chromatography using silica in glass columns should be carried out in a fume cupboard. Silica is made up of minute particles which can penetrate the lungs causing silicosis (occupational lung disease) (see also hazard category Irritating/Sensitising/Damaging in paragraph 3.2); columns should be filled and emptied in the fume cupboard. Inspect the glass for cracks before it comes under pressure, and protect yourself from glass splinters by packing the column in a net. Use a pressure valve if the column is to be pressurised.

3.10. Distillation

Listen carefully to your mentor‘s instructions every time you distil a new solvent; check that the correct drying agent has been used, and whether the solvent needs to be pre-dried. Make sure that the cooling is switched on, never turn off the nitrogen taps, and let the solvent cool to room temperature before refilling. If in doubt, ask your mentor. All distillation set-ups must be constructed so that the heating mantle can be taken out from under the set-up in an emergency by removing the lab jack.

3.11. Cleaning glass filters

Cleaning glass filters with a mixture of sulfuric acid and hydrogen peroxide can cause an explosion if the filter is rinsed with an organic solvent such as acetone and then not properly dried. This makes it a very risky procedure, which should only be used if it is the only possible way to clean the glass filter. Even then, it should only be applied by experienced staff.

3.11.1 Procedure for cleaning glass filters with sulfuric acid and hydrogen peroxide

The last few years a number of incidents occurred during cleaning glass filters with a mixture of sulfuric acid and hydrogen peroxide. To avoid such incidents use the following procedure.

Use this procedure only if the glass filter can not be cleaned by any other method and if excess waste is removed. Make sure that all the glassware used in this procedure is free of acetone or any organic solvent. Only a very small amount of acetone is enough to cause a big explosion.

Procedure:

- Place the filter on a filtering flask.
- Rinse the filter with (a lot of/excess) water.
- Place the filter in a beaker filled with a layer of water.
- Make sure the beaker is absolutely free of acetone (rinse it with water if you’re not completely sure)
- Fill the filter with sulfuric acid and a small amount of hydrogen peroxide.
- If the filter is clean dispose the content of the filter in the sink and rinse with water.
- Place the filter on a filtering flask.
- Rinse the filter with water.

3.12. Autoclaves

Materials that need to be sterilised before use should be sterilised in a special pressure cooker or, if large amounts need sterilising, in an autoclave. All materials originating from safe microbiological procedures must also be sterilised after use in line with the strict regulations governing safe microbiological procedures. Depending on the nature of the materials, they can be sterilised using dry sterilisation (only in the autoclave) or they can be post-sterilised, whereby the temperature and the times are adjusted to correspond with the amount and nature of the materials.
Place all objects to be sterilised in drip-trays or pans. Check glass bottles carefully for tiny cracks before starting. In the case of liquids that are being sterilised in closed bottles check that the screw top has not been screwed on tight, so that the pressure caused by heating can escape. Beware of delayed boiling after the post-sterilisation process. Liquids can easily boil over, particularly if the bottles are full and the autoclave or pressure cooker is opened while the temperature is still high.

3.13 Biochemistry

Biochemistry and cell biology involve fewer safety risks than organic chemistry, but for some biochemical assays, hazardous chemicals are required and thus it is important that you know how to work with them. Compounds that alter biochemical structures are often toxic or carcinogenic. Moreover, chemicals might be needed for purification or other experimental purposes. Always be aware that biochemical experiments bring possible risks even though performed at SL-1 safety level, and make sure you know how to safely handle the compounds you need.

3.13.1 Ethidium bromide

Ethidium bromide is a DNA stain which binds to DNA through interchelation and can therefore act as powerful mutagen. Always work on the designated bench and make use of gloves when handling ethidium bromide. Only touch contaminated materials with your gloves and discard your gloves immediately after use. Consider wearing only one glove in case you have to handle both contaminated and non-contaminated materials. Ethidium bromide-containing waste needs to be discarded into the solid waste container.

3.13.2 Acrylamide

Acrylamide is widely used as a cross linking agent for electrophoresis separation procedures (e.g. SDS-PAGE). Acrylamide is easily absorbed by the skin and acts as a neurotoxin and (possibly) as carcinogen. When handling acrylamide powder, always work in a fume hood. Chances of ingesting or absorbing acrylamide are limited when working with ready-made solutions of the compound (common in most labs). Nonetheless, one should always wear gloves when working with acrylamide and discard your gloves immediately after use. It is recommended to use a dedicated part of the lab for working with acrylamide in order to minimize the risk of cross-contamination. Once FULLY polymerized, acrylamide gels are significantly less toxic. They can be discarded in the solid waste containers.

3.13.3 Organic solvents

When using organic solvents for e.g. staining/destaining of protein gels or trizol/phenol purification, handle them in the fume hood as much as possible even when working with low quantities. Also always make use of the proper liquid waste container (halogen rich, i.e. compounds containing F, Cl, I or Br, or halogen poor). Contaminated waste materials should go into the solid waste container. If you are not sure how to handle a certain chemical, consult someone who does.

4. Faults, fire and accidents

4.1. General

- **Alarm:** First alert all people in your surrounding and then ring **55555** in the event of an accident (fire, electrocution, medical emergency). If the normal telephones are out of order, the green telephone should be used. State your name and department and give a brief account of what has happened. Explain concisely what is going on and more specifically, the type of help you require. Call in the qualified first-aiders where necessary. TIP: If you store 0243655555 in your mobile phone under the name ALARM RU, you will be able to raise the alarm in any situation wherever you are on the campus.
- **Faults:** In the event of minor problems (faults in one or more fume cupboards, overflows, blown fuses), contact the Department of Property Management (UVB). Ring 33333, state your name, department and explain the problem; it will be resolved as soon as possible. Follow-up your telephone call with an e-mail (33333@science.ru.nl), sending a copy to the PAM-mers (Peter van Dijk, Theo Peters or Helene Amatdjais-Groenen).
- **Personal accidents** must always be reported to the PAM-mers (Peter van Dijk, Theo Peters or Helene Amatdjais-Groenen) and the Department of Occupational Health & Safety and Environmental Service.
- **Accidents resulting in material damage:** report immediately to the PAM-mers (Peter van Dijk, Theo Peters or Helene Amatdjais-Groenen), internal & Housing Affairs and the Department of Occupational Health & Safety and Environmental Service.
- **The use of fire extinguishers** must be reported immediately to the UVB. The UVB will make sure that all used equipment is replaced.
- **Dangerous situations:** report them to the Lab steward or Safety steward (see the lists in the various departments) or directly to your manager and the PAM-mers (Peter van Dijk, Theo Peters or Helene Amatdjais-Groenen).
- **Dangerous activities:** make the person concerned aware of what he/she is doing and explain why it is dangerous. Alert the mentor, Safety Steward and the PAM-mers (Peter van Dijk, Theo Peters or Helene Amatdjais-Groenen).
- **Minor inconveniences:** (noise, dirt, bad smells in the lab areas) contact the PAM-mers (Peter van Dijk, Theo Peters or Helene Amatdjais-Groenen) or internal & Housing Affairs (tel. 52600) or the UVB service desk (tel. 33333).
- **Faulty equipment:** warn the person responsible for the equipment.

4.2. Guidelines in case of a power failure

During a power failure there is not enough ventilation inside the labs and surrounding areas to provide a safe working environment. But also after a power failure safety cannot be immediately guaranteed. Everything might look normal inside the labs while certain systems are not running. For example, point ventilation and air-conditioning can be still non-operational, which causes dangerous situations even when the fume hoods are running again.

So in case of a power failure, even if everything seems to be back operational immediately, handle as follows:

- Close any bottles containing chemicals, especially those in fume hoods.
- Turn off equipment that can be harmed or do harm when the power comes back. Pay special attention to equipment cooled with water since the water pressure can fall during a power failure. Turn off heating and/or vacuum while leaving the cooling itself running.
- Close all fume hoods (and cupboards).
- Make sure everyone leaves the lab and office spaces, assemble in the 3rd floor corridor.
- Contact your safety steward or one of the PAM-mers; one of them will call 33333. Together they will decide when the labs can be entered again.

4.3. Guidelines in case of chemical spills

For chemical spills, the 'Hazardous Laboratory Chemicals Disposal Guide' can be consulted here: Hazardous Laboratory Chemicals Disposal Guide. A supply of the Bentonite absorber material frequently recommended in this Guide is available on each wing, please make sure of its location before you start chemical work.

There are several classes of chemical spills:

- Minor Chemical Spill
  Defined as: spillage of small quantities of chemicals. Act as follows:
  - Alert people in immediate area of spill.
  - Wear protective equipment, including safety goggles, gloves, and long-sleeve lab coat.
  - Avoid breathing vapours from spill.
  - Confine spill to small area.
  - Use appropriate kit to neutralize and absorb inorganic acids and bases. Collect residue, place in container, and dispose as chemical waste.
  - For other chemicals, use appropriate kit or absorb spill with vermiculite, dry sand, or diatomaceous earth. Collect residue, place in container and dispose as chemical waste.
  - Clean spill area with water.

- Major Chemical Spill
  Defined as: spillage of large quantities of chemicals (i.e. solvents >1 L, solids > 1 kg), or when anyone is injured or contaminated. Act as follows:
  - Attend to injured or contaminated persons and remove them from exposure.
  - Alert people in the laboratory to evacuate.
  - If spilled material is flammable, turn off ignition and heat sources.
  - Call **55555**, state place and nature of the spill.
  - Close doors to affected area.
  - Have person knowledgeable of incident and laboratory assist emergency personnel.

- Special spills
  - Spills in the eye:
    - Immediately rinse eyeball and inner surface of eyelid with water continuously for 15 min, using the eye showers or the eye wash bottles available in every lab.
    - Forcibly hold eye open to ensure effective wash behind eyelids.
    - Obtain medical attention.
    - Report incident to your mentor and to one off the PAM-mers.
  - Mercury spills

    Remember: mercury vapors are odorless, colorless, and tasteless. Because of the health effects of mercury, the extremely difficult and time-consuming procedures required to properly clean spills, every effort should be taken to prevent accidents involving mercury. Always store mercury in unbreakable containers and stored in a well-ventilated area. Wear protective clothing: lab coat, gloves and safety goggles!

    - Dam the mercury (using rags or other disposable items) to prevent spreading. Divert the mercury from drains, cracks and crevices.
    - Keep persons who are not involved in the clean-up away from spill area to limit exposures and to prevent the spread of contamination.
    - If you have come in contact with the mercury, avoid spreading the contamination to other areas. Put contaminated clothing/shoes into a trash bag and wipe off any visible mercury beads into the bag. After cleaning up shampoo and shower yourself.
    - Use a chemical to coat the mercury or form an amalgam with the mercury, this will keep the mercury from vaporizing and being released into the air. Use sulfur powder for this. As an alternative a mercury collector can be used. Ask one of the PAM-mers.
    - Report incident to mentor and to one off the PAM-mers.

4.4. Guidelines for accidents

The guidelines on how to deal with an accident are shown below:

- Alert your surroundings
- If external assistance is needed ring 55555 otherwise call for a first aider or PAM-mer
- Once you have called the alarm number, the Rapid Intervention Team/Internal Emergency Team will arrive within 4 minutes.
- Follow instructions given by the Internal Emergency Team.
- Report the accident to the Department of Occupational Health & Safety and Environmental Service so that an internal investigation into preventive measures can be carried out if necessary (see Section 5.2 for the link to the report form).

4.5. Guidelines in the event of fire

There are various ways of raising the alarm in the event of fire:

- By telephone: ring the alarm number 55555.
- Manually: push the button on the manual fire alarm (red box with glass front, see Figure 5).
- Automatically: the smoke alarms are activated.

Figure 5. Manual fire alarm

The alarm centre (manned 24 hours per day, 7 days per week for the entire university and the hospital) will respond to the alarm. An automatic emergency call will be put through to the Internal Emergency Team during working hours (8.30-16.30 hrs.), and outside office hours, the Nijmegen fire service will be alerted. If necessary, the evacuation alarm will sound on the floor of the wing where the alarm was raised and any other wings/floors affected. The emergency escape route doors will automatically unlock; they can always be opened by activating the nearest green box. The partitioning fire doors along the central corridors will close automatically if necessary.

The guidelines for what to do if you discover a fire are as follows:

First phase:

- Warn everyone in the vicinity and ask for help
- Close the doors to the fire
- Ring the alarm number 55555
- Clearly state:
  - your name
  - the location (room number) of the fire
  - what is on fire
  - special details
- Close the doors to the fire
- Warn everyone in the vicinity
- Escort people at risk to a safe place (behind fire-proof doors in the corridors)
- If possible, try to extinguish the fire
- Be aware of your own safety
  - Never enter a room filled with smoke
  - Do not use water to extinguish a fire in electrical equipment
  - Close all doors and windows when leaving the laboratory
  - Never use the lift if you suspect fire in the building, or if the evacuation alarm sounds
  - Follow instructions given by the Internal Emergency Team (BHV) and the external emergency services.

Second phase:

- Once the alarm has been raised (first phase), the Internal Emergency Team will arrive within 4 minutes. Follow their instructions once they are in place.
- The Internal Emergency Team (BHV, also known as Company Emergency Response Organization, CERO) is made up of people trained to work with pressurized air and in first-aid. They fulfil a coordinating role to save lives, evacuate the danger zone and bring the fire under control.
- The Internal Emergency Team is in close in contact with the internal and external emergency services that have been called in.
- Coordinated emergency help is laid down the Internal Emergency Team emergency plan, and the evacuation procedure in the Internal Emergency Team evacuation plan (see also IM emergency plan 1)

Third phase:

This phase is not directly relevant to laboratory workers

- The external emergency services, fire service, GGD and police arrive on site.
- On arrival, the fire brigade takes charge.
- The Internal Emergency Team (BHV) already in attendance shows the external emergency services the way and assists.

4.6. Guidelines for evacuation

Evacuation can be initiated by an alarm or by members of the Rapid Intervention Team/Internal Emergency Team. The evacuation alarm is a continuous signal (a ‘slow whoop’), which is tested every first Monday of the month at 12:00h.

In the event that the premises must be evacuated, the following supplementary guidelines apply:

- Switch off equipment, gas and power in the lab if it is safe to do so. Calmly leave the fire compartment (every area has several escape routes, see figure 5) and assemble in the restaurant. If the evacuation alarm is sounding there too, the whole building must be evacuated; leave the building calmly and assemble in the Linnaeus building.
- Do not use the lift when evacuating; use the stairs instead.
- Tell the emergency services anything they want to know about the lab area concerned.

IMPORTANT: it is vital that all staff and students forced to evacuate a lab during a fire register their names at the assembly point so that the emergency services know who has been brought to safety.

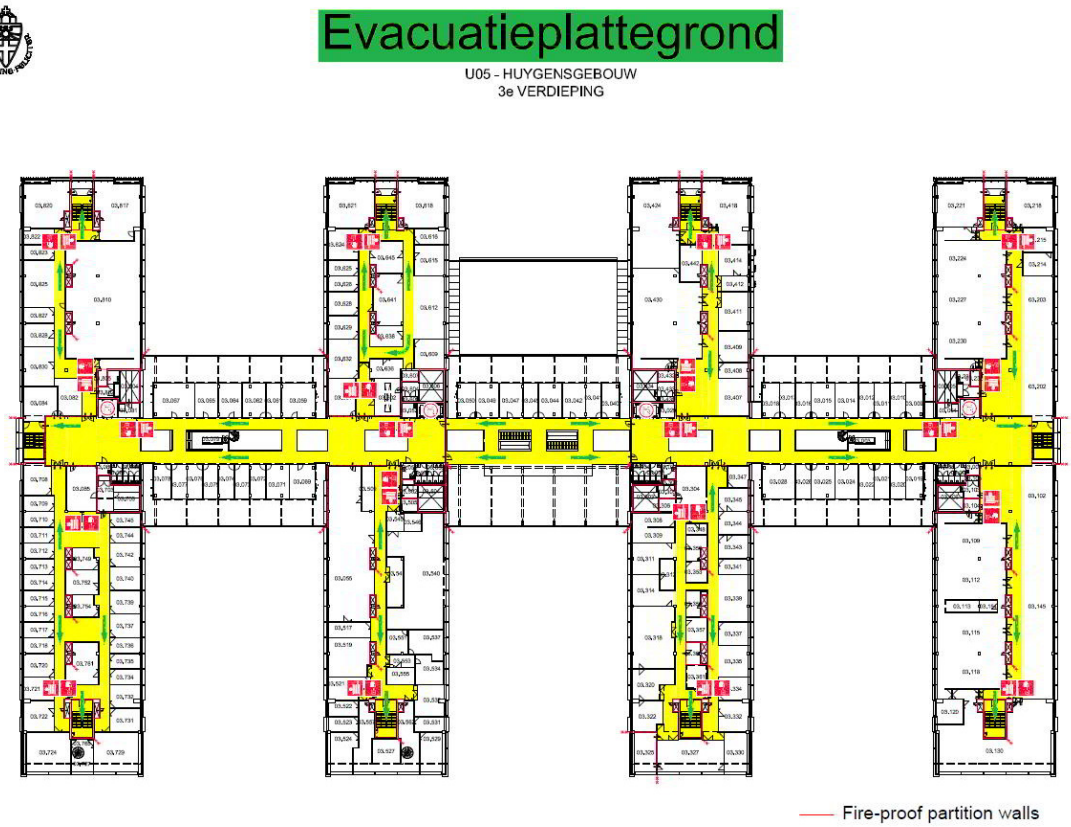

Figure 6. Floor plan of the 3rd floor of the Huygens building, showing the fire-proof partitions around the fire compartments in red, as well as fire alarm buttons, hose reels and the flight routes to the emergency stairways.

5. Important information

5.1. List of abbreviations

Table 3. List of abbreviations

Abbreviation	Explanation
AMD	Arbo- en MilieuDienst - Department of Occupational Health & Safety and Environmental Service
ARBO	ArbeidsOmstandigheden - Working Conditions
BHV	Bedrijfs HulpVerlening - Internal Emergency Team or Company Emergency ResponseOrganization (CERO)
CERO	Internal Emergency Team or Company Emergency Response Organization (BHV)
CLP	Classification, Labelling, and Packaging
CRM	Carcinogenic (causes cancer), Reprotoxic (dangerous to unborn foetus) and Mutagenic (causes permanent changes to genetic material
EHBO	Eerste Hulp Bij Ongelukken - First Aid
FNWI	Faculteit Natuurwetenschappen en Informatica - Faculty of Science
GHS	Globally Harmonised System of Classification and Labelling of Chemicals
HP	Hazard and Precautionary statements
HR	Personeel- en Ontwikkelings Afdeling (P&O) - Human Resources Department
IHZ	Interne en Huisvestingszaken - Internal and Housing Affairs
OC	OnderdeelCommissie - Representative Council (Faculty)
OR	OndernemingsRaad - Workers Council (University
PAM-mer	Preventiemedewerker Arbo en Milieu (formerly: ARBO en Milieu-contactpersoon) Environment, Health & Safety Officer

PBM	Persoonlijke Berschermingsmiddelen - Personal protection equipment
PPE	Personal protection equipment
RU	Radboud Universiteit Nijmegen - Radboud University Nijmegen
SEH	SpoedEisende Hulp - Hospital Emergency Aid Department (A&E unit)
TWA	TijdGewogen Gemiddelde (TGG) - Time Weighted Average
VMT	Veilige Microbiologische Technieken - Safe Microbiologal Procedures

5.2. Important internet links

Information concerning Arbo at the intranet from FNWI
https://www.radboudnet.nl/veiligengezond/

Information concerning Health, Safety and Sustainability at the intranet from AMD
http://www.radboudnet.nl/amd/english/.

Laser safety
http://www.microscopyu.com/articles /fluorescence/lasersafety.html

Waste management
The faculty waste management regulation was devised with the RU Department of Occupational Health & Safety and Environmental Service and can be found on
https://www.radboudnet.nl/amd/english/sustainability/environment/

Information on substances (Chemwatch)
http://jr.chemwatch.net/

Accidents
Accident report form for reporting accidents and incidents to the Department of Occupational Health & Safety and Environmental Service
https://www.radboudnet.nl/amd/english/safety/occupational/
Don't forget to inform the PAM'mers.

Overview of highly toxic gases
http://en.wikipedia.org/wiki/List_of_highly_toxic_gases

Hazardous Laboratory Chemicals Disposal Guide (advice in case of chemical spills)
Hazardous Laboratory Chemicals Disposal Guide.pdf

Durability at the University
http://www.ru.nl/duurzaamheid/duurzaamheid/duurzaamheidsagenda/
http://www.ru.nl/sustainability/

Appendix 1 Breakthrough times for various glove materials.

For latex gloves supplied by VWR: VWR Chemical Resistance Gloves Chart.pdf
For nitrile gloves supplied by Kimberley: Resistance Guide for Kimberly Clark Nitrile Gloves.pdf

Appendix 2. Flow diagram for liquids in laboratories; decision chart to determine whether a substance may be discharged into the drain