Health, safety and environment
for staff and students

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1 ACTION PLAN FOR HSE, 2024-2026[1]

Action plan for HSE, 2024-2026

Department of Chemistry's action plan for Health, Safety and Environment and is based on the Faculty of Mathematics and Natural Sciences and UoB's action plans for the next period.

A two-part HSE action plan has been created – with sub-goals and main activities. The action plan contains clarification of responsibilities/deadlines and space for reporting.

The University of Bergen must have a culture in which health, safety, the environment and emergency preparedness are preventative and health-promoting. This means that UiB must ensure:

- a fully satisfactory working and learning environment
- diversity, openness and inclusion
- accessible, functional and safe workplaces and buildings
- continuous and systematic HSE work through the active participation of employees, safety representatives and leaders.

This means that HSE must be clearly organized at all levels and that the working environment must be surveyed, risk assessed and followed up in accordance with regulatory requirements and internal rules.

Priority areas

Priority area 1: **Good and inclusive working communities**

The department must have a strong and vibrant university democracy. Good procedures, channels and meeting places for communication will ensure participation. Generosity, openness, diversity, and dialogue are to characterize the department working community internally and in collaboration with our surroundings. The department has a strong international profile that includes colleagues and fellow students from all around the world. The working environment shall be inspiring, inclusive and health promoting, and the integrity and dignity of the individual should be safeguarded. This requires good understanding of and insight into conditions that affect our working and learning environment among all our employees, students, and leaders.

Sub-goal:

a. The institute will work to ensure that all central HSE information is also available in an English version
b. Follow-up of competence needs - follow-up plan
c. Facilitate good career development with a special focus on young researchers conscious use of employee interviews

[1] The action plan of action is valid for the time being. When an updated plan of the action plan is available, the HSE book will also be updateted.

Priority area 2: **Safe and functional workplaces**

UiB has a large, demanding portfolio of buildings. The use changes regularly and new buildings are being built. The relevant requirements concerning good building standards, universal design, indoor climate, and ergonomics must be taken care of. Digital tools, scientific equipment and research and teaching facilities must be safe and functional both on campus and when working from elsewhere.

Sub-goal:

a. Inventory – replacement of old furniture
b. Optimal ergometric solutions for everyone for the workstation both in the office and in the laboratory.
c. Update the chemical inventory – Stoffkartotek.uib.no

Priority area 3: **Good safety culture and emergency preparedness**

The department's work with safety and preparedness must, among other things, preventative and systematic HSE work, good knowledge of risk conditions and good procedures when working both on and off campus. This will contribute to reducing the consequences of adverse events in order to safeguard our values in everyday work and in extraordinary situations.

Sub-goal:

a. Carry out a risk assessment at the institute based on extraordinary situations that are not covered by the other risk assessments carried out at the institute
b. Continue the training from HSE I and HSE II courses into the laboratories and laboratory courses
c. Training card for students
d. Follow up safe job analysis (SJA) - written documentation
e. Continue to have focus on to prevent theft of chemicals and equipment using electronic locks and other aids where necessary
f. Use the HSE annual cycle to continue and strengthen learning and experience sharing related to the HSE work
g. List in the expedition of persons responsible for the instrument laboratory with mobile numbers and procedures for emergency stops

Priority area 4: **External environment**

UiB has undertaken to take environmental considerations into account in all operations and to document environmental commitment by reducing negative environmental impact from its own operations. UiB is now certified as Miljøfyrtårn. Work with the external environment must be part of the HSE work in line with Internal Control Regulations. The institute must make arrangements for staff and students so that they can make environmentally friendly choices. The institute focuses heavily on the environment and has it as an integral part of the HSE II course. In the current period, the institute will follow up the certification as Miljøfyrtårn and focus on the opportunity to make environmentally friendly choices.

Subgoal:

a. The institute must adopt digital solutions such as video and telephone conferences, online meetings, etc. where one has opportunities to reduce the number of flights
b. Green lab certification
c. Sign on fume cupboard with "Keep the fume cupboard closed when not in use"

The institute's action plan will be reassessed at the end of the period.

2 RESPONSIBILITY

2.1 Operating area of the Health, Safety and environment manual

The rules and procedures in this book apply to all staff, doctoral and master's students, as well as guest researchers and visitors. There are no exceptions.

These guidelines are intended to protect laboratory personal against accidents and harm to their health and to ensure that chemical laboratory work is carried out in a safer manner and in accordance with laws and regulations.

2.2 The head of the department responsibility

The head of the department has overall responsibility for the safety at the department. The head of department shall ensure that laws, regulations and regulations are followed, and that necessary training is provided.

2.3 Further responsibility at the department

The permanent scientific staff is responsible for their respective master's and doctoral laboratories.

Technical personnel are responsible for teaching areas and instrument laboratories.

A routine for allocation of responsibilities and assignments has been prepared for the laboratory courses at the department. The routine is available at Mitt UiB. The routine is aslo handed over to new employees.

If exceptions to the rules and procedures in this document are exceptionally necessary, it must be sought in writing and given approval by the head of department before it is implemented. Dersom det unntaksvis er nødvendig med avvik i regler og prosedyrer i dette dokumentet, skal det søkes skriftlig og bli gitt godkjenning fra instituttleder før det blir gjennomført.

2.4 The individual staff, master's and doctoral students, as well as guest researchers and visitors are responsible

Everyone who works at the Department of Chemistry is responsible for:

- Adhere to, and abide by, current rules and procedures and any specific guidelines / procedures for the laboratory and task in question.
- Show caution and be careful while performing the work.
- Use necessary protective equipment.
- Report to the responsible manager regarding conditions that are not satisfactory, equipment that is not working properly, etc.
- Report HSE non-conformities. HSE non-conformities are all adverse events and/or matters that have resulted or may result in harm to people, the environment and property.

2.4.1 Report HSE non-conformities

HSE section at UoB has prepared guidelines for notification of HSE non-conformities. These guidelines shall be followed and applied by employees of the Department of Chemistry.

The HSE non-conformities system is digital, and one logs in using the same user account and password logging as your mail account. Link to the system is also available on the website at the department, listed under HSE.

If you have accidents, adverse events, or nonconformities in the laboratory or elsewhere where it is natural that the Department of Chemistry is responsible for the person concerned, this must be reported in accordance with the University of Bergen and the Institute of

2.5 Assistance from HSE Section (HSE) and from Occupational health services (OHS)

- HSE assists with HSE-training
- HSE assists with mandatory HSE course for new employees
- HSE assists with mandatory Radiation protection course if one works with isotopes
- HSE assists with Animal Protection Course if one is working with animals
- OHS assists with health checks when applicable
- OHS assists with mapping of the working environment and risk assessments
- OHS assists with measurements of working environment
- HSE follows up our annual HSE report, which consists of sub-goals and an main activities

If you have any suggestions for changes in the action plan or need help from the HSE section, you can contact the HSE coordinator:

Lisbeth Glærum, room 3B3d/3021

2.6 Safety delegates

Safety delegates' tasks

Safety delegates represent all employees in working environment matters. The safety delegates has a supervisory role, as well as being an important collaborator for the Line Management.

Organisation

Safety delegates at UiB are divided into three levels:

- The University's chief Safety delegate
- Safety delegates at faculties
- Local Safety delegates

Election

At UiB Safety delegates at all levels is elected. Safety delegates are elected for a period of 2 years. Current Safety delegates are elected for the period of 2025-2026.

Local Safety delegate

Reidun Myklebust, room 4F6c/4049

Representative:
Tore Skodvin, room 4G/4053

2.7 Revision of Health, Safety and Environment manual

Revision of the HSE manual will be ongoing and the person responsible is HSE-coordinator:

Lisbeth Glærum, room 3B3d/3021

If you have suggestions or input for changes and adjustments to the manual, you can contact the HSE-coordinator.

3 TRAINING PLAN FOR HSE

Bachelor students
All students who start a laboratory course at the department must take HSE I. Students who need to take courses where more HSE information is needed must take HSE II before starting the course, this also applies to the bachelor project.

Master students
New master's students must complete HSE II before access to the laboratories at the institute is granted. In addition, you must receive further training if you are going to use any of the instrument laboratories at the institute.

Employees
Anyone using any of the laboratories at the department must take HSE II. In addition, you must receive further training if you are going to use any of the instrument laboratories at the institute. Scientific staff responsible for their own laboratories are responsible for individual training in their own laboratory regarding instrument training, routines and instructions not described in the HSE II course.

It is compulsory to conduct a fire safety course and a first aid course every five years. New employees must complete the course within six months. The HSE coordinator will contact new employees for registration.

All employees at UiB must have completed fire protection training which consists of a digital fire protection course and practical extinguishing. This requirement is enshrined in the Fire Act and the HSE regulations.

The new digital course will replace the theoretical part of the fire safety training, and will be repeated annually. Employees will receive an email notification when it is time to take the course again.

The course can be found by logging in with feide via the following link:
https://nettkurs.tiv.no/no/feidelogin.

Contact Lisbeth Glærum (lisbeth.glarum@kj.uib.no) for the practical part.

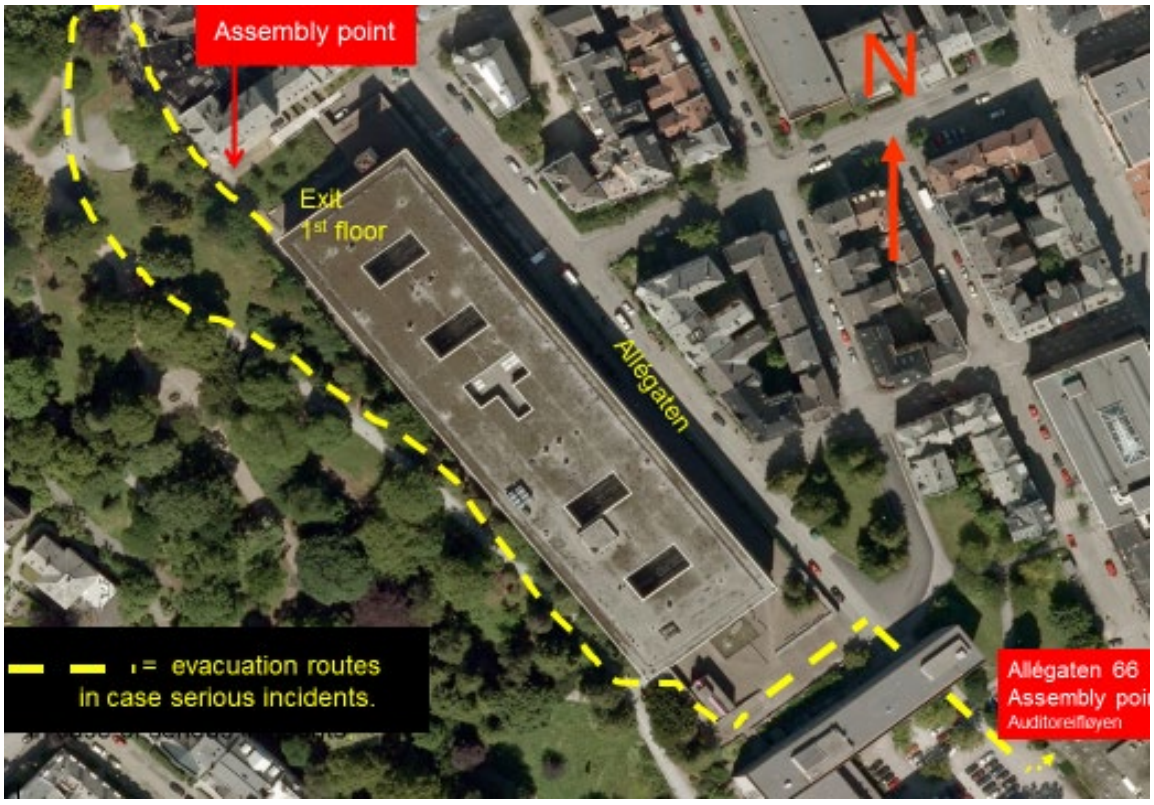
Everyone should be familiar with the contents of the safety manual for the department.

4 FIRE INSTRUCTION

The institute is required to have documentation which shows that fire protection training has been given to all employees. By fire protection training is meant basic training in the following:

1. Escape routes and mustering points.
2. Location of extinguishing equipment/manual fire alarms and instructions in their use.
3. Fire instructions and internal procedures.
4. Special risks in the building.
5. Duties relating to fire protection.
6. Any notification procedures.
7. The structure of UiB's fire protection organisation.

1. Valid escape routes are shown on floor plans posted on every level. Study the floor plan closely and memories the location of the nearest escape routes from the different parts of the floor. In the event of a fire alarm, all employees/students should muster at the specified mustering point so that head counts can be conducted.



2. Everyone must familiarize themselves with the location of extinguishing equipment (see floor plan on each level). The red boxes on the wall are manual fire alarms. Pressing these alarms triggers the first alarm and directly notifies the Operation Division, informing them of where in the building the alarm has been triggered.

Apparatus with CO2 as the extinguishing agent is intended for extinguishing fire in liquids, gases and electrical equipment. This is a clean extinguishing agent that enables these fire extinguishers are particularly suitable for use in environments such as laboratories, workshops, computers and electrical equipment.

Apparatus with sodium chloride intended for extinguishing metal fires.

Sand that is dry and without moisture.

3. When the first alarm is triggered, everyone must leave the building immediately via the nearest escape route and muster at the specified mustering point. When the alarm is triggered, it does not matter whether or not it is a fire drill. Unless otherwise notified, you must always react to a fire alarm and start evacuating the building.

   You must always assume that there is a fire when the alarm is triggered.

   During an evacuation of the building, the site protection officer will ensure that everyone evacuates. Everyone is obliged to leave the building and muster at the specified mustering point. Remember to take good care of any visitors!

4. Particular risks in the building include the use of flammable liquids and gas. You must therefore exercise caution when using such liquids and gases. Remember to turn off gas supplies when the first alarm is triggered!

5. It is important that the laboratory supervisor/person responsible for the laboratory informs new employees and temporary employees on fire instruction and that the area's chief fire / construction supervisor is contacted to provide the necessary training.

6. If the alarm is triggered during working hours, operations personnel will notify the fire service. If a fire occurs outside working hours, during the evening, night or weekend or

public holidays, persons present in the building must notify the fire service, either by meeting them outside the building or by calling them. The fire services will be automatically notified if the fire alarm is triggered.

- Remember that the lifts are not escape routes

7. When organizing the fire protection organization, a site fire protection officer must be appointed for each entity. If you have any questions about fire safety, contact the site fire protection officer, who will pass them on.

   The site fire protection officer reports to the building fire protection officer.

   Realfagbygget building Fire Protection Officer: Inger Johanne Fjellanger

   The building fire protection officer reports to the chief fire protection officer:
   UiB's Chief Fire Protection Officer: Arild S. Nessen, Phone: 926 53 379

8. NOTE: During a fire alarm/fire drill, the building fire protection officer for Realfagbygget will be wearing an **orange** vest and the site fire protection officer will be wearing a **yellow** vest.

   Realfagbygget's Site Fire Protection Officers, Department of Chemistry:

Function	Name, site fire protection officer	Phone work	Mobile
K. floor, north	Lisbeth Glærum Frida J. Lundevall	55 58 25 74 55 58 34 49	454 15 979
U. floor, north	Lisbeth Glærum Frida J. Lundevall	55 58 25 74 55 58 34 49	454 15 979
2. floor	Pascal Dietzel	55 58 33 68	
3. floor	Torgils Fossen Matthias Stadler	55 58 82 33 55 58 35 45	
4. floor	Tore Skovin Reidun Myklebust	55 58 33 54 55 58 33 67	
NMR-plattform	Egil Nodland Jarl Underhaug	55 58 33 57 55 58 34 74	952 16 056

9. Anyone who discovers a fire should:

- Try to put out the fire with the fire extinguishing equipment available.
- Alert other people in the building.
- Call the fire brigade on telephone number 110.

Evacuate the building:

- Leave the building immediately when you hear the alarm.
- Close all doors and windows to minimize the spread of flames and smoke.
- Use the nearest emergency exit. Do not use the lift.
- Make sure that your visitors, if any, also leave the building.
- Follow the instructions given by the person who is in charge of fire safety in your area.
- Do not re-enter the building unless you have received permission to do so from the head of fire safety for your building, the police or the fire brigade.

10. Summary fire instructions

Make sure you know

- Escape routes
- Location of fire extinguishers

At the laboratory

- The lab-personnel should inform
- Location of protective equipment and fire extinguishers
- Escape routes

5 GENERAL SAFETY RULES

5.1 Laboratory routines

Act in accordance with the information provided in handbooks, directive and HSE datasheets!

1. It is not permitted to eat or drink in the laboratory.
   Furthermore, food must not be stored in laboratories or stored with chemicals or other toxic substances. Foods should not be stored in laboratories, including refrigerators and freezers. Do not use laboratory equipment such as beaker, for food and drink. Neither should you use dishwashers for laboratory equipment to wash dishes

2. Lab coats must be worn in order to protect clothing and skin.
   Preferably use cotton lab coat. Synthetics fabrics can cause melting fires and cause unsightly burns. Static electricity in synthetic fabrics can cause a spark that can ignite flammable substances. Loose hanging, open or flaky coats can hang up and represent a dangerous relationship.

   Wear shoes in the lab that are close to your toes. This is to avoid damage if you spill chemicals, especially acids and bases. This also applies when a one use / discharges deep-cooled condensed gas.

3. Protective goggles is mandatory to wear in the laboratory.

4. Never taste chemicals or solutions.

5. Always label flasks with their contents, name and date.

   Containers containing chemicals should as a minimum have labels containing
   - name of the substance
   - amount, volume, concentration
   - date and signature

6. One should preferably not work in the laboratory alone.
   After 16:00 one should not work alone without agreement with the supervisor.
   When using hydrofluoric acid and implementation by other risk operations are you NOT allowed to work alone in the laboratory.

7. When using a pipette, you must use a pipette helper or a Peleus ball.

8. All work with chemicals should be done in a fume cupboard, the only exception is water solutions of non-toxic inorganic chemicals.

9. All chemical reactions to be performed in a fume cupboard (or glove box). Shall be carried out reactions under pressure ("Sealed-tube reactor), place a screen in front of the reaction rate.

10. Unknown substances must be presumed to be toxic.

11. Special waste must not be poured into sinks or together with ordinary waste (see waste handling guidelines).

12. Do not use equipment without proper training.

13. Gas burners must be put on low flame when temporarily not in use, and extinguished when no longer in use. **NB! It not allowed to use open flame in the chemical hood.**

14. Chemical bottles must not be carried by the neck/cap. Heavier bottles should be carried in separate ”carrying baskets”.

15. Wash your hands thoroughly when you have been in contact with chemicals. Even if you used gloves when contact with chemicals. Use soap or other cleaning agents.

16. Water and chemical spills must be cleaned up immediately.

17. Gas cylinders must always be attached to the wall with chains or bottle belt.

18. Reducing valves to pressure vessels (gas bottles) must never be lubricated with mineral oil.

19. Corridors and exits should always be neat; it is ESCAPES ROUTE. It must not be stored or put inventory, packaging or anything else that can prevent the free movement or pose a fire hazard.

20. Always remove your gloves when you leave the laboratory. Spills on gloves can be a source of contamination of harmful chemicals. It is forbidden to use laboratory gloves elsewhere than in the laboratory. Also note that lab coat is not allowed when visiting the canteen.

    The following rules apply to the use of disposable gloves:
    Replace the gloves often. Nitrile gloves provide poor protection against liquids and solutions. Replace gloves immediately in case of spills or wet spots.

21. It is important that the tubes are balanced by centrifugation. This is particularly important at high speeds with centrifugal pumps. Ensure the rotor is installed according to instructions and that any lid is attached to the rotor.

22. A liquid is boiled or cooked a while may boil violently and creates a risk of splashing. This can be avoided by using boiling stones. Pumice, porcelain shards or anthracite coal can be used as cooking stones. Be careful when placing the boiling stones in the heated liquid. It may cause the liquid to boil over in an explosive manner. It may be better to use a magnetic stirrer instead of boiling stones by boiling the solutions that are highly foaming.

23. Use only glass instruments designed to withstand vacuum, and check that the equipment has no defects. If equipment under vacuum imploding, the shards of glass flying through the air like an explosion. Apparatus put pressure must not be fully opened until the pressure has been equalized with the atmospheric pressure. This is especially important if the appliance is under pressure contain combustible gases, as these could ignite due to

the heat generated.

24. Examine glassware before use. Glass equipment with scratches, nicks and cracks should be discarded or delivered for repair. Glass equipment must have rounded / filte edges to avoid cuts. Be sure to use silicone grease where necessary; Slip equipment, exicator and glass roosters.
    NB: Avoid sudden changes in temperature when handling glass.

25. Familiarize yourself with the properties of the chemicals you use. You can find this information on the HSE data sheet.
    NB: It is mandatory to read through the data sheet before you use a chemical the first time.

26. Familiarize yourself with HSE legislation applicable to work one should perform. HSE portal will include information and possibly linking to relevant pages. One should follow the guidelines, procedures and instructions relating to the work it will perform.

5.2 Chemical inventory

The chemical inventory is a collection of electronic Health, Safety and Environment (HSE) data sheets for chemicals at UiB.

Employees and students at UiB have access to read and to print the HSE data sheets.
Use this link to log on to the chemical inventory "stoffkartotek.uib.no" (log on with feide)

USE OF CHEMICALS
You have a duty to know about chemical properties, hazards and safety measures before use.

The chemical inventory contains name, amount, storage location and HSE data sheets.

The data sheets contain information about the substances' potential hazard and how to handle them in the safest manner possible.

Everyone should be familiar with the contents of safety data sheets for chemicals one are using.

Never work with chemicals you do not now.

The chemicals register must be kept up-to-date in order to ensure that it is a useful and quality-assured source for carrying out risk assessments of your working environment.

Contact person: Lisbeth Glærum (lisbeth.glarum@kj.uib.no)

5.3 Safe job analyses

The Safe Job Analysis (SJA) method can be used to assess specific tasks and activities. Safe Job Analysis (SJA) is a systematic mapping of risk factors in a specific work operation

Mapping ahead
SJA shall be carried out in advance of the task / activity, so that measures can be put in place to remove or reduce the identified risk elements during pre-construction and during the execution of the task or operation. The analysis will help to design, construct and maintain safe procedures and equipment.

Mapping at the start of new tasks and activities
It is especially important to identify in non-routine work operations, when starting new tasks / activities / routines, when changing tasks / activities / routines, and when using new and unknown chemicals, biological agents and / or equipment.

Schematic overview of the process
A schematic overview of the process in the SJA method and the element that is included is prepared. The user (s) who will be performing the task or activity and the nearest tenant / parent should be part of the working group that will carry out the analysis, but it is also important to keep the unit's tenant well informed and up to date about the work.

5.4 Protective equipment

Necessary protective equipment must be available in the laboratory. When planning experiments, you must check whether any protective equipment is missing. The type of protective equipment required depends on which chemicals are to be used and how they are to be used, see relevant HSE data sheets.

Laboratory coats
Lab coats must be worn to protect clothing and skin.

Protective goggles
Protective goggles are mandatory to wear in the laboratory. Ordinary glasses are not suitable as safety glasses, because they cover too little area around the eyes. One should therefore wear safety glasses on top of the usual glasses. During particularly dangerous work, where you expect fast reactions, face shields must be used even if one works in the laboratory chemical hood.

The most important safety device in our laboratories are the laboratory chemical hood.

Laboratory chemical hood
Laboratory chemical hood should always be used if possible. Also be aware that volatile or flammable chemicals or toxic chemicals in **dry matter** must always be used in a well ventilated place. Local extractors and/or fresh air/filter masks may be used as an alternative to laboratory chemical hood if a risk assessment has been completed.

Full capacity is from 7 a.m. to 20 p.m. Monday to Friday, and from 8 a.m. to 16 p.m. Saturdays and Sundays.
Notice; outside operating hours it is not allowed to work in the fume cupboard.

Further information;
In order to ensure that they fulfil their intended function, it is important that you consider the fume cupboard a work station and not a storage place. Before you start check the fume hood is on max or on. And when in use it should not be open more than max working height (approximately 30 cm), marked on the fume cupboard with a green or yellow label.

In addition, the cabinet must be used correctly: That is, when the cabinet is in use, one should pull the front door as far down as possible. One works on the inside only with his hands and not the entire upper body.

The fan capacity is downgraded every evening. Full capacity is from 7 a.m. to 20 p.m. Monday to Friday, and from 8 a.m. to 16 p.m. Saturdays and Sundays. Notice; Outside operating hours it is not allowed to work in the fume cupboard.

Every fume cupboard shares the extract fan with at least two other fume cupboards in different laboratories (see yellow map of ventilation system on the wall above the fume cupboard). Because of this it is important to close the fume cupboard when you do not use it, to ensure that other users on the same fan get satisfactory protection.

So make sure to close the fume cupboard when you do not use it!

Filter/fresh air masks
If volatile or highly toxic chemicals must be used outside fume cupboards, or the cupboard does not have sufficient negative pressure for the work, a gas mask or fresh air mask must be used.

Ensure that the correct filter is used when using a filter mask. And remember that the filters are personal. Write the date and name when you start using it and store it in a container when not in use.

Examples:
6098, AXP3: Against organic vapors boiling above 65ºC. And protection of solid and liquid particles.

6099, ABEK2P3: Against organic vapors boiling above 65ºC, inorganic gases, acid gases, ammonia and amines, as specified by the manufacturer, in addition to solid and liquid particles.

Dust mask
A dust mask should be worn using toxic chemicals in dry matter outside a laboratory chemical hood. Every time you use chemicals outside the hood a risk assessment has been completed. Such protection loses it’s effect when it becomes damp; dust masks Must therefore be changed frequently.

Two main types:
> Air-Purifying Respirators
* Dust (P1, P2, P3)
* Gas / vapor filter

Gloves
Perhaps the most important thing when dealing with chemicals is to choose the right glove. First one must consider whether one needs to use protection and if so what glove to wear. No gloves is resistant to all chemicals so it is important to choose the right material. After that, one has to consider need for flexibility and sense of touch (large, bulky gloves can make it difficult to handle equipment properly) allergens in the gloves material (e.g rubber/latex gloves)

Main rule: Always remove gloves when you leave the laboratory. Spills on gloves can be a source of contamination from harmful chemicals.

Gloves must be used when handling concentrated, allergenic, toxic chemicals and chemicals which are otherwise harmful to health. There are many types of gloves available on the market. The choice of and use of gloves is important. Information are listed in HSE data sheet, section eight, and also there are a glove guide at the HSE-portal. The glove guide will help one to select the right protective glove. The guide is a table of the most common chemicals at UiB and contain penetration time of the chemicals and which glove one should choose/prefer. The Department also have glove guide for the most common chemicals in use at the department, see Appendix. Ansell has also guide where you type in the cas nr, and Ansell will list which glove they recommend.

Remember to always check that your gloves are whole and not discoloured.

It is also important to note that all glove types found in the store are personal protective equipment and should be labelled with name and date.

When using the barrier glove it can be difficult to have good hand grip. That can be solved using a TNT glove on the outside the barrier glove. Remember then that the TNT glove will be problem waste.

NOTICE that Touch N Tuff is not a protective glove – shall be used only as ”splash glove”.

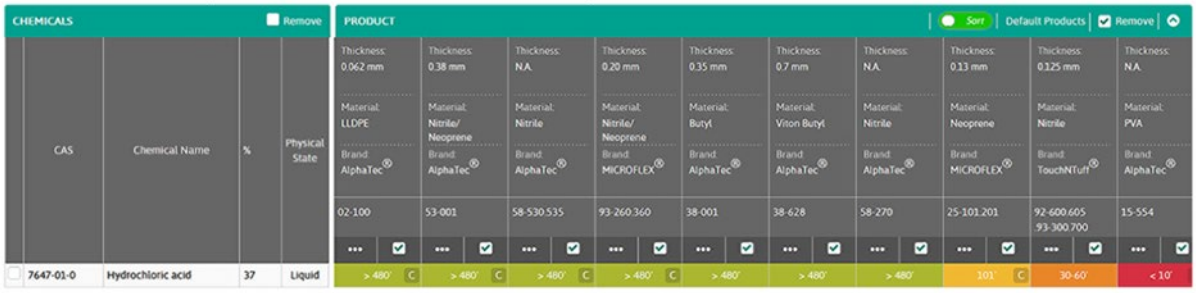
The following rules apply to the use of disposable gloves:
Replace gloves frequently.
Replace gloves immediately in the event of spills or wet patches.

A brief overview of the most used solvents at the institute and the type of glove you should choose:

Material				LLDPE	Nitrile	Nitrile /Neoprene	Neoprene /Natural Rubber	Nitrile
Thickness (mm)				0.062 mm 2.5 mil	0.56 mm 22 mil	0.20 mm 7.9 mil	0.7 mm 27.6 mil	0.12 mm 5.1 mil
Brand				AlphaTec®	AlphaTec® Solvex®	MICROFLEX®	AlphaTec®	TouchNTuff®
Product Group				02-100	37-185.165 /58-008	93-260.360	29-500	92-500.600.605 / 93-250.300.700
CAS	Chemical Name	%	PS					
107-06-2	1,2-Dichloroethane	100	L	> 480' C	10-30'	< 10'	< 10'	0' C
67-63-0	2-propanol	100	L	> 480'	> 480'	380' C	334' C	117' C
64-19-7	Acetic acid	100	L	158' C	190' C	30' C	156' C	7' C
108-24-7	Acetic anhydride	100	L	> 480'	10-30'	< 10'	60-120'	< 10'
67-64-1	Acetone	100	L	> 480' C	< 10'	3' C	9' C	< 10'
75-05-8	Acetonitrile	100	L	> 480' C	20' C	5' C	21' C	< 5' C
71-43-2	Benzene	100	L	> 480' C	32' C	5' C	5' C	< 10'
71-36-3	Butanol	100	L	> 480'	> 480'	> 480' C	> 480'	56' C
67-66-3	Chloroform	100	L	17' C	< 10'	3' C	< 10'	< 10'
75-09-2	Dichloromethane	100	L	65' C	< 10'	2' C	< 10'	< 10'
109-89-7	Diethylamine	100	L	> 480' C	55' C	6' C	9' C	1' C
60-29-7	Diethylether	100	L	> 480' C	60-120'	10-30'	5' C	< 1' C

An example for hydrochloric acid; Which glove should I use?

Glove material and penetration time for concentrated hydrochloric acid:



ART NR Ansell	Glove materiel	
02-100	Barrier	
53-001	Neoprene	
58-530	Sol-vex	
93-260	Microflex	

ART NR Ansell	Glove materiel	
92-600	TouchNTuff (TNT)	
15-554	PVA	

Further information is available at: [HSE portal- gloves]

If you need gloves for cold or hot work then it must be ordered through the storage room.

At the storage room you will find:

Barrier a 6-layer laminate glove with a thickness of 0.062 mm An extremely good protective glove for most chemicals, except for – halogenated solvents and ammonia.	
Sol-Vex a glove made of nitrile (synthetic rubber), with a thickness of 0.38 mm A good protective glove for working with aqueous solutions. •Is highly resistant to: oinorganic acids and bases, though not to concentrated sulfuric acid (H2SO4), nitric acid (HNO3) and hydrofluoric acid (HF) osimple solvents of the aromatic and aliphatic types, such as hexane, cyclohexane, etc.	
Neotop the gloves are made of neoprene (synthetic rubber), with a cotton lining and a thickness of 0.75 mm. A good protective glove when working with concentrated and dilute acids and bases	
PVA the gloves are made of polyvinyl alcohol (PVA) A protective glove for use when working with anhydrous solvents. •Is the only glove with a high resistance to halogenated solvents such as chloroform, dichloromethane, etc.	
Microflex a 3-layer glove made of nitrile/neoprene A good protection against harsh chemicals including acids, solvents and bases.	
Touch N Tuff a glove made of nitrile, with a thickness of 0.12 mm NOTICE that Touch N Tuff is not a protective glove	
Inner glove a glove made of cotton	

5.5 First-aid and emergency equipment

When you start the work at your laboratory you start to families where the first-aid equipment are and the where the emergency equipment are placed.

First-aid cabinet. Make a note of the location of the cabinet to avoid searching for it in case of injury. Check the content. If there are missing items you can refill from the storage room.

Eye-wash bottle. All laboratories have at least one eye-wash bottle. Make a note of its location to avoid having to search for it in case of injury. The water in the eye wash bottles should be changed regularly. If you need more then on ore new one it is available in the storage room.

Emergency shower. Make a note of where the nearest emergency shower is located to avoid having to search for it case of an accident. You will fine one in your laboratory or in the corridor.

Absorbent sand. All laboratories have at least one, often a white bucket with a red lid. Make a note of its location to avoid having to search for it in case of accident in the laboratory chemical hood.

Fire extinguisher. All laboratories have a 2 kg CO_2-based fire extinguisher. Make a note of its location and how to operate it. If you are working chemicals that required NaCl-based fire extinguisher are located. The fire extinguisher will be in your laboratory or in the corridor.

Emergency preparedness with experiment overnight.

File is on My UiB, Department of Chemistry, Filestorage, HSE, procedures and instructions for chemical institute

Emergency cabinet in the corridor. Make a note of where the nearest emergency cabinet is located. When collecting spills outside the chemical hood, a gas mask must be worn. You will also fine absorbent sand so you will need, gloves etc

The cabinet contain:

- Full-face mask with combination filter 6800S, 3M
- Filtering half masks. 4251, 3M
- Goggles
- Chemical suit
- Gloves, Barrier
- Rubber boots
- Absorbent sand

6 WASTE AND WASTE MANAGEMENT

All waste management begins with purchasing. When purchasing, one should check and make sure that one can get rid of any residuals through our regular routines. This is especially true for chemicals / compounds that are explosive and radioactive. All waste at the Department of Chemicals must be handled in accordance with current laws and regulations, as well as current guidelines for the University of Bergen. The central university has several waste schemes for the waste produced at the various units. The guidelines can be found on the HSE portal (On waste and waste management at UiB)

6.1 Responsibility for waste management

It is the person(s) who produce the waste at the department that is responsible for ensuring that the waste is handled properly according to the guidelines and sent in the correct return arrangement. Before purchase special types of chemicals (such as explosive chemicals), you must be sure that you can dispose of the waste properly.

6.1.1 Contact person for hazardous waste and problem waste

The contact person must be a local resource person at the department and be able to answer questions about the handling of hazardous waste and problem waste.

At the Department of Chemistry, it would be the HSE-coordinator:

Lisbeth Glærum, room 3B3d/3021

6.2 Poblematic waste

Type of waste

Sharp waste and glass waste	- needles, scalpel blades, knife blades - collected in cannula boxes (yellow plastic boxes)
Gels	- agarose with EtBr, polymerised acrylamide
Pathological	
Cytostatics	
Microbial. Infectious waste	

Packaging and return of problematic waste

The waste are placed in yellow boxes, and placed in the waste room, K011, inside the metal cabinet.

The key to the waste room is placed at the storage room, open between 09.00-11.00.

Follow the internal procedures and ensure that different waste categories are not mixed together in the same box!

The lid is adhesive i.e. when the lid is snapped in so it can not be removed again.

Do not fill the box so full that it can be difficult to click the lid in place.

Needle and / or plastic bottles with stabbing and cutting content is also being thrown through the yellow boxes.

Collection times
Problem waste is usually collected twice a month on Wednesdays in weeks with even numbers (see sign posted at the collection point for collection times).

If it is low or out of yellow boxes, contact: Lisbeth Glærum, 3021.

For our department, there is an exception, and it is for empty solvent bottles they can be disposed of in this way:

Just remember contaminated glass, which for example there has been chemicals on must be disposed of as problem waste. It happens through the yellow boxes on the waste room.

Exceptions are empty solvent bottles from the storage room.

Empty solvent bottles vaporized and with lid can waste handled through the brown box on the image.

Do not let empty solvent bottles accumulate on the laboratory and take up space.

But get rid of the bottles continuously as part of the laboratory routines.

It will provide a much safer and better working environment.

6.3 Hazardous waste

The purpose of these guidelines is to ensure that hazardous waste is handles in a manner that avoids contamination or injury to human or animals.

Type of waste

- Waste from laboratory and clinical environments
- Disinfectant liquids
- Concentrated acids and bases
- Waste containing mercury or cyanide
- Other heavy metals (cadmium, chrome, lead, zinc, barium, nickel, copper, cobalt)
- Organic solvent which do not contain halogen (xylene, toluene, ethyl acetate, …)
- Organic solvent containing halogen (dichloromethane, chloroform, bromoform, …)
- Waste containing arsen
- Cyanates (isocyanate, thiocyanate)
- Reactive substances (oxidising, reactive metals)
- Pesticides
- Cytostatica (this applies to the actual cytostatica. Waste generated in connection with cytostatica is catogorised as problem waste, the same for ethidium bromide)
- Photochemicals
- Oil waste (In the garage in the Realfagbygget by the grease pit there is a cabinet with two barrels inside. These barrels contain oil waste, and if one has such waste, one can pour it on the barrels)

Packaging

Preferably in original packing; other packaging must satisfy requirements for the storage of each type of waste.

As far as practicable, any hazardous waste should be disposed of with the least possible mixture, both of the chemicals and the various hazardous waste types.

Plastic boxer and plastic cans is available in waste room K011 (problem/hazardous waste) for collecting hazard waste.

Used solvent from production should be disposed of via jerry cans found in the waste room as mentioned:

Blue can: Organic solvents containing halogen.
Transparent can: Organic solvents that do not contain halogen.

Labeling, declaration, collection

The waste owner must fill in the form ”Registration form for hazardous waste at the University of Bergen”, and attach it to the packaging.

The form is electronic and it can be found here. Print out a copy and place it with the waste. It also a link at our website under HSE.

The registration form must include the waste number in accordance with the list or information according to the datasheet for the substance in question, name and concentration of the contents.

The waste owner must place declared waste at the collection point in proper manner.
The form is attached to the solvent can under the handle so that the waste number is visible.
On the red box, the form should hang down from the lid so that the waste numbers are visible
Realfagbygget's collection points is on the ground floor, K011.

A list of the waste numbers that are most commonly used at the department can be found at Mitt UiB.

Key to the room for a hazardous and problematic waste in Realfagbygget can be borrow in the storage room during open hours (9:00 to 11:00). The room is located K-floor.
The waste from the department can roughly be divided into five main types:

- Problematic waste
- Hazardous waste
- Consumer waste
- Explosive waste
- Radioactive waste

6.4 Consumer waste

UiB has introduced waste separation, and much of consumer waste comes under different recycling schemes.

This applies;

- Paper/Empty packaging (cardboard)
- Glass/metal
- PC-waste/EE-Waste
- Fluorescent tubes

One will now briefly describe the most common types of consumer waste.

6.4.1 Paper

There are separate paper boxes for recycling. The cardboard box is named "Miljøesken". All the offices at the institute have been given such a cardboard box. If you do not have the "Miljøesken", you can get it by contacting the Operations Manager at the Realfagbygget via Needs Notification. You can also have a box delivered to another room / instrument laboratory where you use paper for recycling.

When the box is full, empty the box in the container with blue lid labeled PAPER in the waste room.

6.4.2 Cardboard

All cardboard should go in this return arrangement (boxes, cartons, partitions, inserts, etc.). All cartons should be cut down, that is, flat when you put the cardboard in the machine that presses the cardboard together.

6.4.3 Glass and metal - household

All clean and odorless glass can be used to throw in the container in the waste room in the garage. The user must ensure that most of the glass can be used in this return arrangement.

Remember glass and metal from the laboratory is problematic waste.

6.4.4 PC-utstyr/EE-avfall

PC equipment and EE waste, ie old instrumentation goes in the same return arrangement.

Remember that the information on the hard drives in your PCs should not be misled. Steinar can take care of the hard drive.

6.4.5 Fluorescent tubes

There is a separate return scheme for fluorescent lamps, energy-saving bulbs and light bulbs. Fluorescent lamps and energy-saving bulbs contain mercury vapor (Hg vapor), so the pipes must be emptied of the vapor to prevent damage to the environment. In the case of light bulbs, they contain elemental lead (Pb) which must be handled safely. It is the operation that replaces fluorescent lamps and most of the energy-saving bulbs. But if you have light bulbs or energy-saving bulbs, contact the Operations Manager at the Realfagbygget via Lydia and have the waste delivered by agreement and in the right way.

6.4.6 Consumer waste

In ordinary boss / residual waste, what does not fall under the return schemes mentioned above goes.

6.5 Explosive waste

If explosive or peroxide-forming compounds are to be used, all handling of the substances must be in accordance with UiB's guidelines in the Rules Collection and on the HSE portal (explosive waste). See and handle these chemicals in chapter. Chapter 9.7.2 Compounds Explosive on Purchase.

6.6 Radioactive waste

For radioactive waste, follow the central guidelines for UiB (HSE portal, waste from ionizing radiation sources).

For futher information, contact the institute contact person for ionizing radiation, Inger Johanne Fjellanger, 4047, or contact person for hazardous waste and problem waste, Lisbeth Glærum, 3021.

7 GUIDELINES WORKING WITH GAS

The Department of Chemistry has placed gas cylinders over large parts of the department, this deployment being done on exemption from the fire service. Gas and gas cylinders pose a significant risk and must be handled with special care.

Normally, transportable gas cylinders must not be kept in laboratories. However non-routine work may require the use of transportable gas cylinders in the laboratory.

Falling bottles are a danger to people in the area. They represent a potential hazard through leakage through damage to the bottle valve, regulator and other equipment connected to the bottle.

Regulators, non-return valves and flame arrestors connected to the gas cylinder must be adapted to the gas in question. (That is, one only uses hydrogen equipment for hydrogen gas, etc.).

Valves must be opened and closed slowly. All equipment must be kept clean and free of contaminants.

All equipment used for compressed gas should be checked and serviced regularly. Such inspection should also include hoses, flexible pipe connections and end fittings.

Note: The pressure regulator should not be used as the gas flow regulator by constantly changing the pressure set point. The job of the regulator is to keep the desired pressure constant. When the system is to be out of operation, one first closes the bottle valve and then blows a pressure off the control system. Finally, turn the adjusting screw counterclockwise until it goes free.

Gas cylinders must only be handled and used by qualified personnel.

7.1 Transport, handling and working with gas cylinders

Do not use gas cylinders before you are completely certain of their contents and have familiarized yourself with the properties and hazards of the gas in question. Important safety information is provided on labels and on product data sheets which must be available to the user. Cylinders or bundles of cylinders which show signs of leakage or which show signs of mechanical damage or fire damage must not be used. Contact the supplier.

7.1.1 Safety

Gas cylinders must be secured in accordance with applicable regulations:

Wall-mounted bracket with a strap or chain to fasten the gas cylinder in such a way that it cannot tip over.

The protective hood must not be removed before the cylinder has been placed in the area of use and secured against falling.

The entrance door to the room must have a hazard sign.

The hazard sign must be removed/covered if the gas cylinders are removed.

Product data sheets for the relevant gases must be available wherever transportable gas cylinders are used.

7.1.2 Transport

During transportation, the reduction valve must be removed and the protective hood and any blind nuts must be attached.

A special trolley with fastening chains must be used for transporting cylinders.

Cylinders which are not in use must be stored in a separate fireproof room. The main store is on level K. The key is available at the store room.

Cylinders must not be placed in stairwells or corridors.

Empty cylinders (minimum residual pressure 1.5-2 bar) must be returned to the main store on level K, in accordance with the agreement with Nippon.

7.1.3 Handling

Caution and respect are key terms when handling gas cylinders.

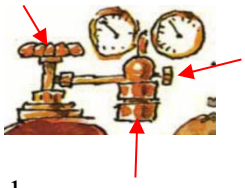
- The gas cylinders must not be thrown, tipped over exposed to knocks or bumps.
- Nor must the gas cylinders be lifted or dragged by the valve hood.
- Cylinders must not come into contact with oil, fat or chemicals
- And, not least, the use of open flames is forbidden when handling gas cylinders.

7.1.4 Pressure regulator

1

Opening the gas supply

Check that the pressure regulator is closed by turning the pressure-adjusting



3

Screw (2) anti-clockwise until it turns freely.

The cylinder valve (1) can now be opened slowly and cautiously. Never use a hammer, pipe wrench, valve claw or wrench extension. Never stand directly in front of the 2 manometers on the pressure regulator when the cylinder valve is being opened. Once the valve is fully open, check whether the connection is sealed. Next, open the pressure to the regulator by turning the pressure-adjusting screw (2) clockwise and set the desired pressure from the regulator. Finally, open the outlet valve (3).

Shutting off the gas supply

When the apparatus is to be taken out of operation, ensure that the pressure is blown out of the regulation system (the pressure regulator). First, close the cylinder valve (1). Once the pressure has been blown out of the regulation system (the manometers display 0), turn the pressure-adjusting screw (2) anti-clockwise until it turns freely, and, finally, shut the outlet valve (3).

7.1.5 Storage

Cylinders must not come into contact with hot springs and must not be exposed to temperatures above 45 ° C.

Compressed gas cylinders must be shielded from direct sunlight.

Another rule is that full and empty bottles should be kept separate from each other.

The same goes for gas cylinders containing different types of gases. The distance between oxygen bottles and bottles containing flammable gas must be at least 5 meters.

Most accidents that occur in handling, transporting and storing gas cylinders are pinch damage. It is therefore important to wear protective safety shoes, clothing and gloves.

7.1.6 Gas collection and return

The gas cylinders are delivered to the gas cylinder storage in the basement - fourth door to the right of the garage door, (directly above the "laundry hall"). Here, the user should return empty and retrieve ordered bottles.

Gas voucher must be delivered to Frida Johanne Lundevall.

One must return empty bottles to the bottle storage before the new ones arrive, so that the empty ones are returned immediately. The department has many bottles, and the bottle rents are expensive. Everyone has a responsibility to keep the number of bottles to a minimum.

NOTE: Remember that the bottle cap should be mounted on the bottle during transport. The cap must be mounted on the bottle before being removed from the fuse (belt) in the laboratory. Gas bottles without bottle caps are not returned. Gas cylinders must be transported on gas cylinder trolley. The trolley is found outside of the storage room, and MUST be returned immediately after use.

7.1.7 Ordering gas

All gas must be ordered from
Frida Johanne Lundevall, room 3042

In order to receive gas, you must write a requisition, which must contain:
1. Date.
2. Name, quantity and purity of the gas.
3. Where the bottle should stand (what room).
4. Who has to pay for it.
5. Signature.

7.1.8 Labeling of the laboratories

All laboratories where gas cylinders are used must be labeled.

The sign shall be on the outside of the door (hallway) and shall bear the inscription:
Gas under pressure
Combustible gas

Toxic gas under pressure
Toxic flammable gas depending on what gas you have in the laboratory.

In addition, each laboratory should be labeled with the type of gas.

One can have several signs on the same door. This is mandated by the Directorate for Social Security and Preparedness (DSB).

User must check if such notice signs is missing when you have ordered e.g a new type of gas to the laboratory. If not, contact: Lisbeth Glærum, 3021

7.2 Hazards with gas

All gases used will be stored and transported on gas bottles or other types of containers or tanks for this purpose.

The gas can come in the following ways:

- Compressed gas: The gas is constantly in the gas phase in the bottle. The pressure gradually decreases as a taper of the gas.

  This applies to: argon, helium, hydrogen, carbon monoxide, methane, nitrogen and oxygen.

- Condensed gas: The gas is partially condensed into liquid in the gas bottle. The pressure is constant until all the liquid is drained off.

  This applies to: ammonia, nitrous oxide (nitrous oxide), hydrogen sulfide, carbon dioxide and chlorine.

- Gas dissolved under pressure in liquid solvent: The gas is released from the solvent during draining. The pressure is constant until the bottle is almost empty.

  This applies to: acetylene.

- Deep-cooled condensed gas: The gas is condensed into liquid in special containers. Pressure builds up by evaporation. NOTE! If deep-cooled liquid gas is enclosed in a container or conduit without the possibility of pressure relief, there is a risk of explosion. Therefore, tanks and containers for this purpose should be equipped with pressure relief devices.

  This applies: nitrogen and helium. The problems and hazards are similar for dry ice (CO2), except in solid form.

7.2.1 Pressure increase

A common danger factor for all gases is that uncontrolled heating can result in such a large increase in pressure that a bottle, container or tank explodes. Therefore, all gases are classified as "dangerous goods". *One consequence of this is that gas bottles must not be stored at temperatures higher than 45 ° C.* Even without heating you can get a sudden and uncontrolled relief of the pressure from a compressed gas container. The amount of energy that is then released can send a gas bottle off like a rocket.

7.2.2 Flammable gas

Gases which on combustion burn in air are classified as "flammable goods". In order for a gas to ignite and burn explosively, the following conditions must be met:

There must be a certain mixing ratio between the gas and air. The lowest percentage of gas that can be ignited is called LEL (= Lower Explosive Limit). At lower concentration, the mixture is too lean to entertain the combustion. The highest volume percentage of gas that can be ignited is called UEL (= Upper Explosive Limit). At higher concentration the mixture is too fat to burn.

In the area between LEL and UEL, the mixture is flammable and explosive.

With increasing temperature, the value of LEL decreases, while the value of UEL increases so that the explosive area is expanded from below as well as from above. The same will usually be the case for increasing pressure. The values usually given for LEL and UEL apply to atmospheric pressure and room temperature.

LEL and UEL for flammable gases in use at the department:

Gas	LEL vol %	UEL vol %	Ignition-temp. °C
Hydrogen	4	75	585
Methane	4,5	15	539
Propane	2,1	9,5	470
Carbon monoxide	12,5	74,2	605
Hydrogen sulfide	4	46	270
Acetylene	2,3	82	300

7.2.3 Danger of suffocation

Oxygen is absolutely necessary to maintain life. For medium work, the oxygen demand is approx. 5 liters per minute or 25 liters of atmospheric air at 21 vols. % oxygen. If the air is diluted with any gas other than oxygen, the oxygen content is reduced. By reduction to, for example, half of the normal, i.e. approx. 11 vol. %, unconsciousness occurs after a short time. At approx. 6 vols. % oxygen occurs unconscious immediately upon suffocation.

Danger of air dilution and oxygen deficiency are always present where either inert gases such as nitrogen, helium or argon are used as a protective atmosphere or when leaked from packaging. Evaporation from deep-cooled gas will always be heavier than air and difficult to ventilate.

The lower limit of oxygen content without using fresh air apparatus is considered to be 17 vol. %, at atmospheric pressure.

Gases that can cause a choking hazard are:

Nitrogen (N2)
Argon (Ar)
Helium (He)
Carbon dioxide (CO2)
Nitric oxide (N2O)
Ammonia (NH3)
Hydrogen (H2)
Methane (CH4)
Propane (C3H8)

7.2.4 Oxygen enrichment

Oxygen comes in a special position when it comes to fire danger. The gas is not itself combustible, but is a necessary condition for all combustion. As a result, in pure or sufficiently enriched oxygen atmosphere, all combustion occurs faster and more violently than in air. A number of common metals that do not normally burn in air (eg iron, aluminum and zinc) can ignite and burn fresh in oxygen. Necessary ignition temperature will also be lower in pure or enriched oxygen atmosphere. Oxygen enrichment has no significant effect on LEL, but will usually increase UEL, thus expanding the explosive area.

7.2.5 Toxic gas

A number of gases are suffocating even at low concentrations in air, although the oxygen content is normal. This is because the gases, through their chemical toxic effect, destroy or paralyze the respiratory organs themselves, so that the body cannot take advantage of the oxygen in the air.

Acute intoxication after brief exposure: With sufficiently toxic gas and sufficiently high concentration.

Chronic poisoning after prolonged exposure: With less toxic gas and adequate concentration.

For less concentration of toxic gas in the air, the gas mask with the right filter gives full protection for a limited time. At higher concentrations fresh air breathing apparatus must be used from the first moment.
Under toxic gases comes:

Ammonia	(NH_3)
Chlorine	(Cl_2)
Carbon monoxide	(CO)
Hydrogen sulfide	(H_2S)

7.2.6 Low temperatures

Liquid, deep-cooled gases have very low temperatures. Skin contact with such gases or with cooled wires and fittings can cause frostbite damage that is as severe as burns.

Low temperatures can lead to cold fragility and set special requirements for the materials that can be used.

At the department of Chemistry, two types of liquefied, deep-cooled gases are used: nitrogen (N) and Helium (He).

7.2.7 Get to know the different type gases that we use at the department

It is not only the gas properties that represent a hazard. Gas stored in cylinders has a higher pressure than the regular atmospheric pressure. In a 50-litre gas cylinder with an interior wall surface of approx. 1 m2, with an ordinary filled pressure of 200 bar, there will be a total force corresponding to 2000 tons against the cylinder wall. Even in an empty cylinder with a residual pressure of 2 bar, the force against the cylinder wall will correspond to 20 tons.

Compressed gas

These are gases which are perpetually in gas form in the cylinder. The pressure of al gases will increase equally and evenly, in line with rising temperatures.
If the cylinder is stored at normal temperature, we can estimate the volume gas it contains at all times.

By multiplying the cylinder volume in litres by the pressure in bar, we can find out the gas volume in litres.

Compressed and condensed gas

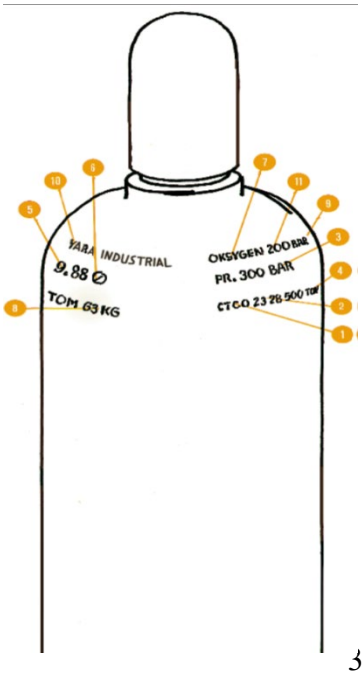
These are gases which are partially condensed to liquid inside the gas cylinder. This means that, when the cylinder is upright, the lower part is filled with liquid and the upper part with gas.

As long as the temperature remains constant, the pressure will also remain constant, regardless of how large a part of the cylinder volume is filled with gas or liquid.
If we release the gas quickly enough, we will not be able to add sufficient heat from outside the cylinder to evaporate the liquid. Heat must then be taken from the actual liquid, which involves a loss of heat and pressure, leading to a reduction in the gas blow down.

Gas dissolved under pressure

It is important to note that acetylene cannot be compressed directly in an empty gas cylinder, since the gas is unstable and would then decompose explosively. The acetylene contents can only be estimated by weighing the cylinder, and subtracting the tare weight, i.e. using the same method as for condensed gas.

Labelling



Every gas cylinder must contain a label indicating which gas or combination of gases it contains.

In addition, the label may list special hazards associated with the gas and provide information about simple precautions to be taken in that connection.

The label must also include information about the gas cylinder itself (the cylinder is stamped in accordance with NS-EN 1089-1):

1) Name of the manufacturer
2) Manufacture number/year of manufacture
3) Test pressure in bar
4) Production controller's stamp

5) Date of last inspection (month/year)
6) Audit workshop's stamp
7) Name of the gas
8) Tare weight in kilograms
9) Volume in litres
10) Cylinder owner's name and serial number
11) a) Fill pressure in bar for compressed gases
    b) Fill weight in kg for condensed gases

Stamped labelling must not be removed or rendered illegible.

The gas bottle: A reliable work companion - when used properly

N_2

The following gas, nitrogen, are supplied as compressed gas and are neither toxic nor combustible. Green.

Ar

The following gas, argon, are supplied as compressed gas and are neither toxic nor combustible. Black.

CO_2

When CO_2 is delivered in gas cylinders, it is compressed and condensed. The gas is not flammable - on the contrary, it is used to extinguish fires. Gray.

NH_3

Like carbon dioxide, ammonia is supplied in cylinders that are both compressed and condensed. Fortunately, ammonia gives a warning in the form of strong and unpleasant odors well before the concentrations become dangerous. Yellow.
Hydrogen is supplied as compressed gas. Although not toxic, it is highly flammable and easily flammable. It gives an almost invisible flame when it burns which can be difficult to detect. Red.

H_2

Hydrogen is also the lightest of all gases. When oxygen is supplied in gas bottles it is compressed, colorless and odorless. Although not combustible, it is unique to the conditions of ignition and fire. The gas is heavier than air, which normally contains 21 volume percent oxygen. By increasing the oxygen content by only 25% by volume, ignition the possibility of, for example, work clothes, increases dramatically.

O_2

A variety of metals and other substances that are not normally flammable in air will ignite

Acetylene

in pure oxygen. The risk of ignition is particularly high when oxygen comes into contact with lubricants such as oil, grease or mechanical packaging.
Because this gas is unstable, special precautions must be taken to enable the storage of acetylene under pressure in gas cylinders.

Nevertheless, there is a risk that external influences such as the gas cylinder being exposed to heat or the recirculation of burning gas through the bottle valve will start decomposition inside the cylinder. If decomposition is not detected and stopped and the temperature inside rises, it can cause the cylinder to explode.

Warning signals for the decomposition are local heat, or the gas from the cylinder contains soot.

In such cases, do the following:
Close the cylinder valve and cool the cylinder by spraying it with water from a safe and protected position. Continue spraying until the water no longer evaporates from the cylinder when you stop spraying for a moment and the cylinder stays cold and wet. The gas cylinder must not be used again, but it can be moved to a safer place. Make sure the cylinder stays cold for at least 24 hours to ensure that decomposition does not restart.

The pressure higher than 1 bar must not be used for acetylene because the risk of decomposition increases with the pressure as well as with the temperature. Like hydrogen, the gas is very explosive when mixed with air.

Working pressure in an acetylene distribution system must be maximum 1 bar. Given that the pipe diameter is maximum 25 mm, the test pressure must be 1.5 times the working pressure

7.2.8 In case of fire

During a fire, gas cylinders will be exposed to excessive heat. Combined with the strength of the cylinder's material being weakened, this can cause the cylinder to explode like a bomb.

Furthermore, if a flammable gas or fire-intensifying gas (for example, oxygen) is released, this will amplify the fire itself. In case of fire it is important to protect the cylinders from the heat. The safest way to do this is to remove the cylinders from the area threatened by the fire. If this is impossible, keep the cylinders cool by spraying them with water or foam. Cylinders must still be sprayed even after being removed from the fire site. In the worst case, the area must be evacuated. Also note that fires in cylinder valves, cylinders containing combustible gas, can usually be extinguished with a CO2 apparatus or powder apparatus. If this is not possible, the area must be evacuated. If gas cylinders, either full or empty, have been involved in a fire, cylinders must be labeled and returned to the gas supplier.

Depending on the area of application, one or more of the following components can be included in the distribution system:

Flame arrestor (to prevent burning gas from returning).

Manometer (to control the pressure in the system).

Filter (to prevent foreign particles from contaminating sensitive apparatus).

Volume gauge (to measure the amount of gas).

Non-return valve (to prevent gas from flowing in the opposite direction).

Pressure-relief option (to open air or a safe location).

Distribution systems must be tested for pressure and air tightness before being used for the first time and after audits and replacements.

7.3 Use of deep-cooled gas (cryogenic gas)

Transport of and work involving liquid nitrogen
Liquid nitrogen (-196oC) can cause serious injury.

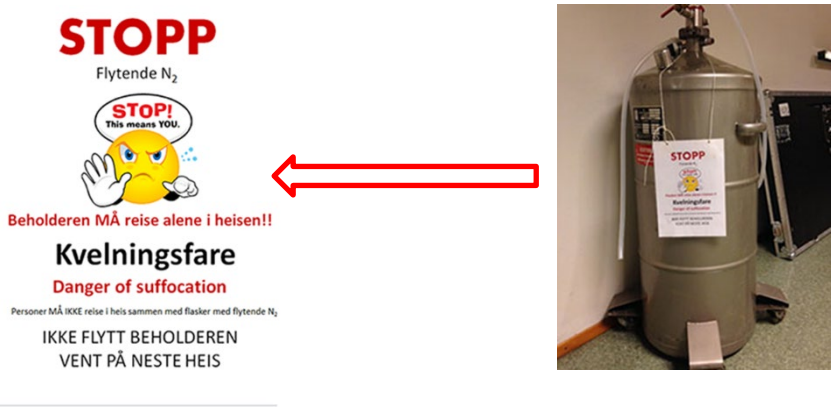
Frozen pipes can explode during defrosting and, among other things, cause injury to the eyes and result in blindness.

On contact with skin, liquid nitrogen can cause frost injuries which can develop into second or third-degree burns.

A lack of oxygen can arise when nitrogen evaporates in enclosed/airtight spaces (lifts, closed cars). Remember that 1 litre of liquid nitrogen expands to 700 l of nitrogen gas. Because nitrogen is heavier than oxygen, it would be particularly dangerous if you were to lose consciousness and fall to the floor. It is therefore necessary to take some precautions when working with and transporting nitrogen.

Precautions/Instructions
Never fetch nitrogen alone. The door should be open. Use protective equipment such as a face mask, special gloves, overalls and appropriate shoes. The person who fills the nitrogen must follow the instructions posted in the filling area.

If you are using big containers, these must have lockable wheels and must be secured with straps during loading and transport. If you are using a lift, it must be empty.



You must ensure that you have a suitable container, preferably with handles, when you are transport small amounts of liquid nitrogen from one lab to another. Do not carry a styrofoam box half-full of nitrogen close to your body – use a trolley instead.

When freezing material in liquid nitrogen, you must always use test tubes that are designed for this purpose. Use gloves designed for use with nitrogen and a face mask.

If an accident occurs and you get liquid nitrogen on your skin, you MUST NOT RUB the wound but apply LUKE WARM water instead.

Always seek medical attention in the case of deep frost or tissue injuries.

Always remember: It is not allowed to equipment without training.

Responsible for the liquid nitrogen at the department:

Egil Nodland Rom 3051C

8 RISK CONDITIONS USING TECHNICAL AIDS

There are factors that must be under control when using equipment in the laboratories. Use of technical aids such as electrical equipment (all hazards from electrical current to mechanical factors), vacuum and pressure equipment, radiation of various types, cutting and crushing equipment, gas burners and so on can pose a particular risk of accident. In order to minimize the risk, no one shall use equipment without prior training and must have familiarized themselves with the instructions for using the equipment.

8.1 Treatment, washing and cleaning of glassware.

Carefully examine all glassware before using it. Defects are often shaped like small stars and can be difficult to spot. Equipment with cracks and notches, large or small, should not be used but discarded.

In particular, make sure that all beaker and other glassware have a rounded edge. It is especially important to check abrasive equipment and not to use abrasive equipment that lacks edges.

Most of the glass equipment used in the laboratory is heat resistant “Pyrex glass”. Volumetric glassware, on the other hand, is usually made of natural glass, which is not heat resistant.

All glassware should be washed with water and synthetic detergents after use.

After cleaning, all defective glass equipment must be disposed of in special yellow waste containers marked and not in ordinary waste.

Furthermore, glass tubes used in appliances must always be rounded at the ends, or any sharp edges should be treated with gas flame. To insert a glass tube into a cork, the glass tube must first be lubricated with silicone grease, water or other suitable lubricant. To protect the palm from damage, wrap a rag or towel around the glass tube. Remember that the glass tube should be carefully screwed into the cork, it should not be pushed in.

Never use flat bottom glass equipment or flat bottom flasks where vacuum and pressure are part of the equipment.

Glass bottles covered by cork should not be exposed to heat or sunlight.

Chemical bottles must not be worn around the neck or body. The body heat may be sufficient for overpressure to reach dangerous levels. Bottles must be transported (carried) in special plastic buckets.

When using used bottles of chemicals, one must especially look for when the cork is made of glass, that both cork and throat are free of chemicals before the cork is inserted. Never use force on glassware that has "sprouted firmly ".

When pipetting, regardless of which liquid or solution one uses, always use a suction balloon, or allow the measurement to take place with a burette or measuring cylinder.

When cleaning glass equipment one has to be aware if there are chemical residues in the glass equipment that can react explosively with water (eg sodium, potassium, peroxide, acetyl chloride), these must be removed appropriately before washing with water.

Glass equipment containing contaminated organic residues, which are difficult to remove with water or organic solvents, can usually be cleaned with strong oxidizing agents (nitric acid). Be aware that violent reactions may occur (danger of explosion). Work must therefore be carried out in a laboratory chemical hood with the use of protective equipment such as goggles, face shield, suitable gloves and work clothes.

8.2 Vacuum and pressure equipment

Use only glass appliances designed to withstand vacuum and make sure that all equipment is defective. Never use flat bottom flasks.

If equipment under vacuum cracks (implosion), fragments can be thrown around as if in an explosion. Long-term pressure test equipment should be equipped with a safety valve and pressure gauge.

Make sure the hoses are resistant to overpressure and are resistant to the substances in question. Replace the hoses for the smallest signs of defect, e.g. check by bending the hose to see if it has any cracks.

Use hose clamps.

Wear face shields or goggles during vacuum or under-pressure operations.

8.2.1 Vacuum pumps and rotavapors

Vacuum pumps should be used for distillation and concentration operations where large quantities of volatiles are present.

The vacuum pump should have a cooling trap. The reason why one uses a cooling trap if one needs to separate two liquids that are volatile as for example ether. When using rotavapor and pump, one can have a cooling trap such as ice under the receiving flask.

When the pump is used for volatile, toxic or corrosive substances the pump should always be used in chemical hood. Even if not in use the rotavapor should be placed in chemical hood.

8.3 Radiation

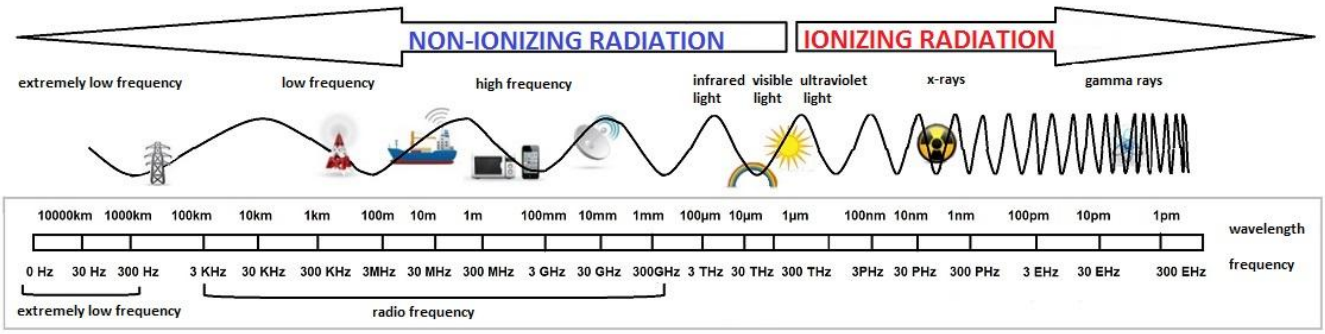
There are several types of electromagnetic radiation. Radiation from electromagnetic sources has different frequencies, wavelengths, energy levels, the visible response to eyes, and has different effects on the human body.

For use in the laboratory, visible light, ultraviolet and infrared radiation, microwaves, lasers and ionizing radiation are of interest.

The wavelength, λ , is one of the physical factors that can be used to distinguish the different types of radiation.

The definition of the different types of radiation is:

X-ray and radiation : shorter enn 10 nm
Ultrafiolett (UV) : 10 - 400 nm
Synlig lys (VIS) : 400 - 700 nm
Infrarød (IR) : 700 - 1 000 000 nm (1mm)
Mikrobølger : 1 mm - 1 m
Radiobølger : 1 - 10 000 m
Elektriske bølger : lengre bølgelengder



Since the different types of radiation have different biological effects, a brief description is given of the different types of radiation and what to pay attention to when using instrumentation where radiation is used.

8.3.1 Non-ionizing radiation

Non-ionizing radiation is radiation with an energy below 10 nm (12.6 eV), and this radiation does not have enough energy to break down chemical bonds when it meets biological materials.

Non-ionizing radiation is divided into two main areas - optical radiation and electromagnetic fields. Optical radiation covers infrared radiation, visible light, blue light and ultraviolet radiation. Electromagnetic fields covers static fields up to radio frequency fields (radio waves), including radio transmitters, mobile phones, microwave ovens, computer screens and fields from power lines.

The health hazards of working with artificial optical radiation and electromagnetic fields must be risk assessed prior to starting work.

Optical radiation has a short range in biological tissue, and the main effect is thermal heating of the tissue. Health damage to the skin and damage to the cornea can occur. Especially when working with laser sources and with a lot of blue light (used for hardening dental materials in fillings), precautionary measures must be taken. Eye protection suitable for laser and blue light is an important measure to prevent this, and the requirement in the regulation is that safety glasses must be constructed and designed to prevent acute or chronic effects of non-ionizing radiation to the eyes.

8.3.1.1 Ultraviolet radiation (UV):

Ultraviolet radiation (UV) is invisible radiation from both natural and artificial sources and often comes together with visible light. Ultraviolet radiation can be divided into 3 areas:

	Area	Wavelength in nm
Near	UV-A	315-400
Mid	UV-B	280-315
Far	UV-C	100-280

UV-C (100 - 280 nm) can cause major damage to DNA, and this radiation should be avoided completely. The effect of UV-B (250 - 315 nm) is similar but is milder - yet UV-B can cause cancer and other skin damage. UV-A (315-400 nm) is considered relatively harmless. (The reason we can withstand solar radiation is that UV-C and most of the UV-B radiation is absorbed into the upper part of the atmosphere).

Biological effects of ultraviolet radiation include damage to the tissues of the eyes and skin. A typical such damage is sunburn, which occurs from natural radiation from the sun. In the worst case, UV rays on the skin can cause cancer. Exposure to eyes is especially dangerous because one can neither see nor feel UV radiation. One can get infections of the cornea and conjunctiva which are very painful and at worst it can cause permanent damage. There are many sources of UV radiation. The sun is the largest natural source, but one also has many artificial sources such as various welding and cutting equipment, spectroscopic sources, mercury vapor lamps, xenon and some photocopiers to name a few.

When working with UV radiation, always make sure that the source of radiation is well shielded and that one does not expose skin and eyes to radiation. Where necessary (eg when welding), use appropriate protective equipment to protect both skin and eyes.

8.3.1.2 Infrared radiation (IR)

Infrared radiation consists of electromagnetic radiation with a wavelength longer than that of visible light. IR radiation often divides into 3 areas:

	Area	Wavelength in nm
Near	IR-A	700-1400
	IR-B	1400-3000
Far	IR-C	3000-1000 000

IR light (heat radiation) can cause burns to the eyes and skin, besides special lens damage (cataracts, glass blower cataracts). When using equipment that uses IR radiation, make sure that the source of the radiation is well shielded. If such measures are not sufficient, personal protective equipment must be worn.

8.3.1.3 Microwaves

These rays are considered to be in the electromagnetic range from 100 - 30,000 megahertz (MHz) or in wavelengths from 3 m to 1 cm. This covers the commercial areas for television and radio as well as the various radar bands. Injuries that can be caused by microwaves are burns due to the conversion of electromagnetic energy to heat energy inside the tissue. Microwaves can penetrate relatively far into the tissues, therefore any damage occurs more in the internal organs than on the skin surface. The size of the damage depends on the wavelength of the radiation and the type of tissue the beam is going through. The most affected organs are the eyes and testicles.

8.3.2 Ionizing radiation

Ionizing radiation is radiation that has sufficient energy, in the form of particles or electromagnetic radiation, to knock out electrons from atoms and / or molecules that are hit, such that an ion is formed in biological material.

In order to support this, radiation must have energy of 12.6 eV (electron volts), corresponding to a wavelength of 100 nm or shorter. In the human body, this radiation will have high enough energy to break the chemical bonds in the genetic material in cells and thus damage it.

There are two main types of ionizing radiation:

Particle Radiation-α-, β-, neutron and proton radiation.
Electromagnetic radiation (photos radiation) - X-ray and γ-radiation.

Knowledge and good working procedures and routines are essential precondition for working safely with ionizing radiation sources. Everyone working with ionizing radiation shall be registrated in the exposure register (Stoffkartotek.uib.no).

Those who work with radiation must take a compulsory course and get approval before such work can be started.

Contact person at the Department of Chemistry are:

Radiation protection officer: Inger Johanne Fjellanger, 4047

Ionizing radiation can cause tissue damage and serious health problems. The University of Bergen has drawn up guidelines for working with open radioactive sources. The guidelines can be found at HSE-gateway, Ionizing radiation. All work on ionizing radiation at the Institute of Chemistry shall be in accordance with the guidelines for work on such radiation.

Instrumentation that requires local radiation protection coordinators

The X-ray machine used by the department are fail-safe, and the primary beam is totally shielded during operation. If the machine is opened or malfunctions, the system stops immediately, and no radiation is generated.

NMR-instruments and other equipment that generate strong magnetic fields should have a warning sign on the laboratory door that warn people with pacemakers or other metal objects implanted in the body.

8.4 Electrical appliance

Electric current through the body can be fatal. Under unfavorable circumstances, 220 V can be considered fatal. Power shocks often come from taking both hands simultaneously in a live circuit, or between the circuit and the ground.

Ensure that electrical equipment is properly grounded.

Do not use wires that have poor or damaged insulation. Exposed wiring is dangerous even when at low output voltages.

Electrical devices that cause a shock should be removed immediately. Broken contacts and plugs must be replaced immediately.

General operating rules when using electrical equipment:

- Never connect the power source until the rest of the circuit is fully connected.
- Always unplug the power source before switching the circuit.
- Never work with one cord in each hand or touch the ground point with the other when working with live circuits.

REMEMBER – if a accident remove the person from the power source. It is dangerous touching a person in contact with a live current source. Disconnect the power or unplug it by pulling on your clothes. Make sure you don't get bumped yourself. NB Remember that the current hurts.

If cardiac arrest: Immediately start CPR. Defibrillators are available in the building. The closest one is next to the expedition on the 3rd floor.

8.4.1 High Voltage

High voltage makes electrical equipment potentially deadly. Many types of electronic equipment have voltages over 500 V. Photomultiplier circuits and lasers can produce over 1000 V. This means that grounding of all electrical and electronic equipment is absolutely necessary. In instrumentation that produces high voltage, there must be built-in circuit breakers that switch off the high voltage when opening the cabinet of the instrument if this is still on. The residual potential of capacitors used in high voltage circuits must be grounded securely, otherwise the contactor of the capacitor or electrodes may receive an extreme electric shock.

NOTE Never turn off the circuit breakers to make adjustments inside the instrument when this is on! Even if one has turned off the circuit breakers, there will still be high voltage on the components.

8.5 Instrumentation

An overview of instruments at the Department of Chemistry can be found at Mitt UiB. In addition, there is an overview on the institute's websites under resources. The laboratories are also marked with who is in charge.

All of our instrument labs require training before access to the laboratory. At Mitt UiB you will also find information on sample preparation and instructions.

Many moments that can be dangerous when using equipment at the institute are the use of liquid nitrogen and helium. In addition, when gas and gas cylinders are used, and one must also take into account the hazards involved in using them. Other hazards to consider are that much of the equipment uses high voltage. In addition, one often works with high vacuum equipment. Other things to keep in mind are that hot and cold surfaces can often occur.

All service must be performed by authorized personnel.

9 MISCELLANEOUS INFORMATION AND PROCEDURES

9.1 Pregnant and breastfeeding women

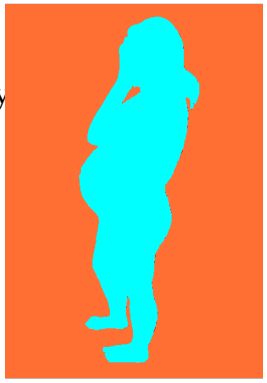


Photo: Colourbox.com

At UiB it is desirable that pregnant employees and students participate in work and as long as possible. Adaptation and follow-up with pregnancy is therefore necessary

Further information is also available at HSE-portal.

Pregnant and breast-feeding women should not be exposed to certain chemicals:

Shall not work with or be exposed to potentially harmful chemicals such as chemical classified and labeled with reproductive categories H360-362.

Have to be extremely careful with substances classified «May cause cancer» (H350,H350-351), and «May cause genetic effects» (H340-341) and «Toxic» (H300,310,330,301,311,331). They may choose not to work with these substances.

Shall not handle or be exposed to cytostatics. Breastfeeding women may choose not to work with cytostatics.

9.2 Exposure register

UiB is obliged to keep a register of employees and students who are or may be exposed to substances that may cause serious illnesses over time.

In order to be able to document any occupational illnesses or injuries it is vital that case history information and working environment information are collected and that they are available to employees. For example, if you are working with carcinogenic substances in the laboratory, the exposure can be automatically registered on a fixed day when the work is occurring. You choose the record keeping criteria yourself, such as duration and frequency.

As a module from the chemical inventory in Stoffkartotek.uib.no, Exposure is a personal register where you can register a single exposure as well as repeated exposures.

Statutory register for employees and students who:

- Are or may be exposed to carcinogenic or mutagenic chemicals (Carc. 1A, Carc. 1B, Muta. 1A or Muta. 1B). Equivalent to CLP H-statements H340, H350 and H350i.
- Work with ionizing radiation
- Are or have been exposed to biological factors (infection risk group 3 and 4)
- Work with lead/lead compounds
- Have been or can be exposed to dust containing asbestos fibres
- Exposed to hazardous substances with mining work

Guest researchers:

It is the main employer's responsibility to register the exposure. UiB shall register exposure for guest workers who have a D-number allocated by the Norwegian Tax Administration.

How to do it:

Local instructions can be found at Mitt UiB
User manual also available on the HSE portal

9.3 Hearing Protection

The fewest tasks at the department require the use of hearing protection, but in some cases it may still be necessary, for example at the workshop and various instrument laboratories.

When using an ultrasonic bath, hearing protection is required.

Laboratories may also have ultrasonic cleaning systems. Ultrasound is acoustic oscillation with frequency above 20 kHz. They propagate through gases and liquids and solids. Humans cannot perceive ultrasound, but ultrasound systems often produce audible noise which can be annoying. In case of prolonged exposure in the boundary area between the audible sound and the ultrasound, employees can suffer hearing damage (eg at 16 kHz), especially at high sound pressure levels.

If you think you need hearing protection, contact your nearest superior or HSE coordinator.

9.4 Mobile phone at the laboratory

When taking the cellphone with you into the laboratory, you must have control of:

Mobile phones can be a severe distraction. Be aware that you are not disturb when you work in the laboratory. Phones should be left outside the laboratory if this is perceived to be a risk or else turned to silent. This should be considered in the risk assessment for all the work in the area.

When using gloves, one may forget to remove the gloves before touching the phone. If you have had your cellphone in the lab then you should clean it before leaving the lab if you are not sure it has been in a clean zone. Check out this video on youtube that highlights some of the issues you need to address.

It is possible that a mobile phone may ignite flammable vapours under certain conditions. Therefore great care must be taken in the laboratory and, where there is a risk of ignition, phones and other devices must be left outside the lab. This should be considered in the risk assessment for the work. Also is believed that mobile phones and other portable electronic devices may interfere with sensitive equipment. If the risk assessment identifies this as an issue phones/devices should be left outside the laboratory.

9.5 Listening to music through earbuds/headphones

Individuals working in laboratories or workshops must be able to participate in normal communication and be able to hear what is happening in their working area, including fire alarms.

Portable music devices should only be worn in low risk areas, where there is no risk from contamination or distraction.

Headphones must not be worn in laboratories as they will completely cover the ears and cannot easily be adjusted to allow one ear to be uncovered.

Use of a small radio when you want music in the laboratory.

And individuals must only wear one earbud and must not remove or adjust earbuds with contaminated hands or gloves. Earbuds should not be worn if machinery with moving parts is being operated, e.g., centrifuges, lathes, drills, etc., to ensure the risk of entanglement is not increased. Earbuds must never be worn where reduced situational awareness could result in an accident or incident.

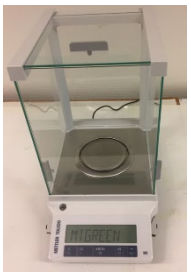
9.6 Use of laboratory balances and scales

Laboratory balances and scales are often used when working in the laboratory and it is important to use the equipment properly and part of the work is to prepare the equipment for the next user. Reliable analytical results begin with accurate weighing. Proper sample preparation and careful data handling are crucial.

9.6.1 Balances

Our analytical balances have a wide range of readability – from 0.01 mg to 0.1 mg, and capacities from 54 g up to 520 g that cover all of your analytical workflows.

Preparing the balance for use
Before weighing anything on the analytical balance you must make sure that it is leveled and zeroed. To check the leveling on the balance, look at the leveling bubble on the floor of the weighing chamber. If it is not centered, center it by turning the leveling screws on the bottom toward the back of the balance.


Analytical balance

Once the balance is leveled, close all the chamber doors and press the control bar on the front of the balance. After a few seconds, a row of zeros will appear.
This indicates that the balance is zeroed and ready for use.

Weighing a liquid, powder, or granular substance
These substances must always be weighed using an appropriate weighing container.
1. Place the weighing container on the balance pan and close the doors.
2. Tare the container by briefly pressing the control bar. The readout will read zero with the container sitting on the pan. This allows the mass of your sample to be read directly.
3. Add the substance to be weighed. Be careful not to spill chemicals on the balance. If need be, you can remove the container from the weighing chamber while you add the sample provided that noone presses the control bar before you weigh your sample.
With the sample and its container sitting on the pan, close the chamber doors and read the display to find the mass of your sample.


Precision balance

Weighing a solid object directly on the balance
If the object you need to weigh is a solid object, you can weigh it directly on the pan. Be sure the balance is zeroed. Open the chamber doors, carefully place the object on the balance pan, close the doors, and read the mass of your object.

Cleaning up and shutting down the balance
When you are done with the balance, make sure you have properly cleaned up any chemicals that you may have spilled on the balance. Use a brush or a ethanol wetted cloth. Cleaning is important so that the next user does not come in contact with unknown chemicals.

Take care of the balances! If you move the balance, remember to level it again.
Brush up/wipe up spill immediately after use and reset the balance.

In room 3048 (3F8a) there is an analytical balance with 6 digits (0.00001), Mettler Toledo AX205. The users of this balance have to bring the needed equipment and is responsible to remove it after use and leave the balance closed, cleaned and zeroed.

9.7 Purchasing at the department

All orders at the institute must go through approved orders.

Purchases of chemicals, laboratory supplies and equipment shall be carried out through the department store. And when ordering chemicals, they will also be registered in the chemical inventory, Stoffkartotek.uib.no

The warehouse is located on the U-floor and has opening hours Monday-Friday from 9:00 to 11:00.

Orders can also be made via mail to lager.kj@uib.no. The form to use when ordering is on the website at the Department of Chemistry, links for employees, teams and at Mitt UiB for students.

Product category	**Name**	**Room nr.**
Office supplies	Karianne Søreide	3003
Chemicals, equipment and computer supplies	Lisbeth Glærum	3021
Data	Tore Skodvin	2032
Ethanol*	Lisbeth Glærum	3021
Gas	Frida J. Lundevall	3042
Liquid nitrogen	Egil Nodland	207

*When purchasing ethanol one will need a requisition by supervisor

Egil Nodland is located in Thormøhlensgate 55A where the NNP are located.

9.7.1 Ethanol

If you need to pick up ethanol, you must have a requisition from your supervisor.

The requisition shall state:

- Date
- Amount
- Signature

The requisition is delivered to: Lisbeth Glærum, room 3031

Ethanol should be stored in locked cabinets at the individual laboratories. It is the requester who is responsible for compliance.

9.7.2 Compounds that are explosive upon purchase or become explosive upon storage

The users who use these substances must learn to recognize them and handle them properly. Where possible, one should find replacement.

Containers with explosive chemicals should be labeled where it should be noted:

- EXPLOSIVE
- Date of goods received

- Date opened for the first time
- Signature of the person who first opened the item
- Date and signature of when the chemical (s) were last checked

The chemicals that are classified as explosives should be checked every quarter (every 3 months), looking for the substances to be moist. If they start to dry out, refill with suitable liquid. (The compounds should certainly not go dry as the danger of explosion becomes imminent). This is the responsibility of the user. Explosives should be stored in well-ventilated chemical cabinets away from chemicals with which they are incompatible.

Explosive compounds cannot always be delivered as hazardous waste, then they must be destroyed. Contacts the institute's contact person for hazardous waste and problem waste. The most common explosive chemicals are listed in the enclosed table, see Appendix 4.3 In the case of explosive and peroxide-forming chemicals one has to remember, that these chemicals must have special labeling and the users should regularly check the substances according to given guidelines, see chapter. 4.13 and 4.14 and UiB's Rules Collection and the HSE Portal: (The Rules Collection and HSE Portal: Explosive and Potentially Explosive Chemicals

Some organic and inorganic compounds may react with oxygen to form potentially explosive peroxides. Those who use such connections must learn to recognize them and deal with them properly. One labels them in the same way as explosive chemicals.

In the storage room you can get strips that you can use to check the amount of peroxides. One should also test the compounds before one start to use it again after storage. If one finds peroxides one can dispose of according to normal routines if the concentration is below 3000 ppm. One can also remove peroxide and then use it again if the concentration is lower than 400 ppm. At Mitt UiB you will find instruction.

10 WORK WITH CHEMICALS

Most substances and products used in the laboratory are more or less dangerous to health. Everyone who works in a laboratory should familiarize themselves with the health hazards of the substances they use at all times in their work. Even though a particular substance is not listed as dangerous, it should still be treated as a dangerous substance.

If working with unknown substances, one should start with small amounts of the substance and carefully monitor the reaction, heat generation, etc. One should always have considered whether a dangerous substance or material can be replaced with one that is harmless, less dangerous or less annoying. Volatile substances present an obvious risk of inhalation. Low volatiles may also pose an inhalation risk associated with heating and aerosol forming processes.

Solids can pose an inhalation risk in cases where the substance is of such a character that dust or vapor (sublimation) can be formed. Toxins can have at most different properties. Some immediately reveal their presence through odor, taste, irritation of mucous membranes, tears, pain sensation, etc. Toxins can cause direct damage to skin or other absorption organs (strong acids, corrosive gases, etc.). Other toxins will not cause immediate discomfort, but may still

represent a serious threat. Some toxins can accumulate in organs in the body and cause damage to them, (eg lead, mercury and other heavy metals). There are a number of substances that have been shown to be carcinogenic. Substances that can cause cancer can also cause damage to the cells' mutation (mutagenic effect). Substances that are referred to as teratogenic substances during pregnancy can cause fetal defects even at doses that are harmless to the mother.

Some organic solvents may have the aforementioned health effects by causing acute and chronic damage to the central nervous system. Even low concentrations can cause damage if exposure is prolonged (10-20 years). There are indications that exposure of several solvents simultaneously (blend exposure) carries an extra high risk. All organic solvents appear dry on the skin, and frequent skin contact can thus cause skin irritation and eczema. Chromium (Cr), nickel (Ni), arsenic (As), cobalt (Co) and their salts, photographic developers, formaldehyde (HCHO), certain benzene derivatives, oil / condensate and synthetic dyes, etc. can cause allergies and eczema.

Despite the many damaging effects work on chemicals can provide, the adverse effects can be almost or completely eliminated if one is careful, follows the specified safety rules and uses the necessary protective equipment. Always read thru the safety data sheet. All work with highly toxic substances that are in liquid and / or gaseous form or which can pass into such form must be carried out in a fume hood. The same applies to work with organic solvents other than on a micro scale. When working with substances that are allergenic or that for other reasons can cause damage by skin contact, gloves must be worn and / or careful hygiene must be used.

Among the most common highly toxic chemicals can be mentioned:

- hydrocyanic acid (HCN)
- alkali cyanides (NaCN el. KCN)
- cyanogenhalider (CNBr, CNCl)
- hydrogen sulphide (H2S)
- arsenic (As4O6)
- arsenic hydride (AsH3)
- lead salts
- chlorine (Cl2)
- phosgene (COCl2)
- carbon monoxide (CO)
- nitrous gases (N2O, NO, NO2)
- phosphine (PH3), alkyl phosphines (PR3)
- carbontetraklorid (CCl4)
- benzen (C6H6)
- mercury (Hg)

Carbontetrachloride, Benzen and Mercury it is not allowed to be used at the institute without clarification from the HSE coordinator.

10.1 Concentrated acids and bases

All work with acids and bases should always be performed in a laboratory chemical hood. Other protective equipment should also be used when working with concentrated acids and bases: glasses, laboratory coat, gloves and shoes (with toe) (boots and apron for larger quantities, and smoking acids).

Concentrated acids and bases and their vapors are dangerous to health. Cooking / cooking with e.g. royal water and concentrated nitric acid (HNO3) will emit highly toxic nitrous gases. Spraying of concentrated acids and bases can cause serious eye and skin damage.

Dilution of strong acids and bases can cause strong heat generation. The work must therefore be carried out in heat-resistant glass apparatus or other suitable material. Water should never be poured into concentrated acid. Dilution of acid should be done by adding acid to water. Dissolution of solid alkali oxides or hydroxides in water must never occur in fully enclosed equipment due to strong heat generation. Use equipment that can withstand heat generation.

NB! In all the laboratories a white bucket with red lid has been placed containing universal absorbent that can be used on most types of spills, including acids and bases. One can refill the absorbent at the storage room.

Spills of acids and bases spills with low concentration one can use paper.

10.1.1 Hydrofluoric acid (HF), treatment of hydrofluoric acid residues

Hydrofluoric acid is very corrosive either in solution or as steam. Hydrofluoric acid penetrates the skin and produces severe necrosis in underlying tissues (including bone tissue). Often you will only see some discoloration of the skin for the first time, but severe pains and burns will eventually occur. Inhalation of vapor may cause etching in the respiratory organs and, in the worst case, edema in the lungs. Pulmonary complications may appear after 1-2 days. One should as far as possible avoid using hydrofluoric acid, find alternative.

Characteristics:

- Colorless - highly corrosive acid.
- Fuming steam.
- Strong, smelly odor.

If one must use hydrofluoric acid one must:
Hydrofluoric acid should only be used during normal working hours and always be two persons.
Before you start:

- Read thru safety data sheet.
- The Safety Manual's information on hydrofluoric acid
- Keep suitcases with first aid medication in the laboratory.
  The suitcase should contain: (You will find the suitcase at Expedition Office)
  - HF antidote gel (special ointment, at least 2 tubes)
  - Calcium (Sandoz) shower tablets (at least 50/100 pcs

When you work:

- Always use fume cupboards.

- Use a laboratory with emergency shower facilities.
- To increase safety, at least 2 people must be present in the laboratory.
- Use protective equipment: glasses, face shield, plastic apron and rubber boots.
- Keep neutralizing liquids ready in the fume hood

After work:
- Always clean equipment in fume hoods with neutralizing liquid like CaCo3
- The first aid suitcase can be delivered at: Room 3003 and shall be returned to the same place immediately after use. The person providing the first aid suitcase is also responsible for looking after and possibly getting the medication replaced.

If accidents happens:
- Visit the hospital right away
- Take the suitcase to the hospital with you
- Safety data sheet for hydrofluoric acid
- The safety manual's information on hydrofluoric acid
- The Poison Information Center's first aid leaflet.
- The Poison Information Center's guidelines for doctors and other health professionals.
- General first aid equipment (the list of total contents of the fluoric acid box is glued to the inside of the lid of the first aid suitcase).

10.1.2 Perchloric acid ($HClO_4$), use of perchloric acid

Characteristics:
Colorless, vaporous, unstable liquid.
Fire and explosion hazard
Working with perchloric acid poses a potential risk of fire and explosion. Perchloric acid is an extremely strong and reactive oxidizing agent, in addition it is a strong dehydration reagent. It can form extremely explosive compounds with many flammable materials and metals. The anhydrous form of the acid can explode spontaneously.

Perchloric acid must be stored under fireproof conditions and away from oxidizable material, including wood and all organic chemicals. One should store as little as possible of the acid in the laboratory.

Use of perchloric acid at the Department of Chemistry
Use of perchloric acid must be done with extreme caution, and only in special perchloric acid extractors. The acid must not come into contact with wood, paper, acetic anhydride, grease, oil, alcohols, bismuth or bismuth alloys, as these are incompatible.

The Department of Chemistry do not have waterwall fume hood which one should have when using perchloric acid, so one must follow the department's routine carefully.

When using perchloric acid, thick rubber gloves and a face shield must be worn. The screen on the extractor must be down as the acid is volatile and can easily damage the respiratory system.

First aid, perchloric acid
Skin:
Rinse immediately with large amounts of water for at least 20 minutes. Remove soiled clothing and continue rinsing.
Contact hospital if necessary, then bring the safety data sheet.

Eyes:
Rinse immediately with large amounts of water. Continue rinsing during transport to hospital (eye department).
All eye injuries must be taken to hospital. Remember the safety data sheet.

Mouth:
Immediately give water (approx. 500 mL) or preferably milk to drink.
Contact the hospital.
Vomiting must not be induced in the injured person.

Inhalation:
Remove the casualty from the source of exposure. Make him blow his nose thoroughly. Keep the victim completely still in a semi-sitting position and keep him warm.
Contact the hospital.

10.2 Flammable organic liquids and solvents

Fires in the laboratory are usually due to work on flammable substances. Organic liquids pose a particular risk. Many of these liquids are volatile and produce combustible gases. The gases are heavier than air and can accumulate along floors or laboratory benches and this steam represents a major fire hazard.

Some of the most common flammable organic liquids are:
Ether, hexane, acetone, methanol, ethanol, petroleum ether, tetrahydrofuran, toluene

Ignition of the liquids / gases can occur in many ways: by open flame, hot surfaces, smoking, frictional heat, static electricity and sparks from motors and appliances, from switches, battery and from chemical reactions. Therefore, store and use as little flammable liquids as possible in the laboratory. Storage should be carried out in fireproof cabinets. Do not leave bottles of flammable liquids without cork.

Always work in fume cupboards when handling organic liquids and solvents. It is forbidden to use a open flame in the fume hood.

Do not work with open flames near flammable liquids or where vapors may accumulate from such liquids. In particular, heating of flammable liquids, distillation and the like.

Instead, heating should take place, for example, using a water bath, steam, IR lamp or other proper electrical heat source.

Extraction work using a separating funnel often results in overpressure with the risk of liquid splashing. Ensure that the separating funnel is always kept under the shake with the stem facing up, and frequently release excess pressure in the separating funnel by opening the valve / tap. Always work in deduction. Filtration of boiling hot solutions of substance dissolved in

combustible organic solvents is extremely dangerous due to the strong evaporation and the work must only take place in fume hood where no open flame is used.

10.3 Cyanide (CN), use of cyanide and cyanide salts

Characteristics:
Hydrogen cyanide, HCN (hydrocyanic acid): Colorless gas or liquid, "bitter almond" smell.
Sodium salt, NaCN: White crystals.
Potassium salt, KCN: White granular powder.

Health damage:
Cyanide exists as hydrogen cyanide (hydrocyanic acid) or as salts thereof, as well as acetone cyanohydrin ((CH3)2COH(CN)). They are all highly toxic and harmful to health, and ingestion of small amounts can be life-threatening. Poisoning can occur by absorption via the skin or as vapor/dust via the lungs.

Handling:
Cyanide must always be stored in locked cabinet with restricted access.

First aid, cyanide and cyanide salts
Acute cyanide poisoning can quickly have very serious consequences. It is therefore important that first aid measures can be initiated immediately.
Make sure that where there is a risk of inhaling cyanide dust or gas at the scene of the accident, the support crew must be protected against cyanide poisoning with their own protective equipment.

Inhalation:
Remove the casualty from exposure. (Remove clothes and shoes). If the injured person is breathing, oxygen is given continuously until a doctor takes over, if available. One can optionally give amyl nitrite, crush the wrapped ampoule between the fingers. Hold it 2-3 cm from the nose and let the injured person inhale. Repeat every 5 minutes until the doctor takes over. If respiration has stopped, give artificial respiration. The mouth-to-mouth method, which is the most effective, will cause danger to the first aider. A device with a bag and nozzle that can be used to blow air in should be used if possible.

Skin:
As in inhalation. In addition, rinse the exposed skin area thoroughly with water. It is important that the substance is removed immediately from the skin.

Mouth:
As in inhalation. In addition, immediately give 240-300 mL of water or milk to drink if the injured person is conscious. Vomiting is not a disadvantage if the injured person is conscious.

10.4 Hydrogen sulphide (H2S), use of hydrogensulphide

Characteristics:
Colorless, extremely flammable gas with a characteristic odor of rotten eggs.

Health damage:
Hydrogen sulfide is highly toxic. Concentrations down to 1 ppm have an unpleasant smell, but the ability to feel unpleasant odors disappears after a very short exposure. One cannot

therefore use the sense of smell to register increasing concentration. Can cause death at concentrations of 700 ppm or more. Severe hydrogen sulphide poisoning can be more serious than cyanide poisoning at the same concentration.

Fire hazard:
The gas is extremely flammable and must not be exposed to static electricity. See chapter 7.2; Hazard with gas

First aid:
Where there is a risk of inhaling hydrogen sulphide at the scene of the accident, it is important that the support crew protect themselves against the gas with suitable protective equipment.

Inhalation:
Remove the casualty from exposure. NB! Make sure that the person helping does not get hurt himself. Keep the injured person completely still and warm. Take care of free airways. Transport the injured person to the hospital.

Eyes:
Remove the casualty from exposure. Rinse immediately with large amounts of lukewarm water for at least 15 minutes. Keep the eyelid well apart. Contact the hospital.

Skin:
Remove the casualty from exposure. Rinse immediately with plenty of water. Remove soiled clothing and continue rinsing. Contact the hospital.

10.5 Diisocyanates (-(NCO)2) and isocyanater (-NCO)

It is forbidden to use these compounds before you have completed a course that provides training in use, see the HSE portal for information.

As far as possible, one must try to replace these substances with less dangerous substances, but if one has to work with diisocyanates and isocyanates, work instructions must be drawn up. The work instructions must then be approved by the head of department before the work can begin.

10.6 Carcinogenic chemicals

Carcinogenic substances must be stored in closed packaging. All work with such substances, and weighing, must, if there is a risk of steam or dust, etc., be carried out in a fume cupboard. Cleaning of work tools must be done with attention. It may be necessary to wear special work clothes during work.
Waste must be brought to a safe place, see chapter 6.3 on handling hazardous waste.

10.7 Lead (Pb) and lead compounds

Lead and lead salts are highly toxic. A distinction must be made between the inorganic and organic lead compounds as they have different health effects.
Tetramethyl- (CH3)4Pb, tetraethyl- (CH3CH2)4Pb and other alkyl lead compounds (R1R2R3R4)Pb are considered organic lead compounds. These are more fat-soluble than the inorganic compounds and can penetrate the skin. Some of the substances are volatile and can

be inhaled. The organic salts lead acetate and lead stearate are counted together with the inorganic salts. These are absorbed into the body mainly by inhalation or swallowing.
Lead can cause damage to the central nervous system, kidneys, genetics and reproduction. Fetuses can suffer brain damage at blood lead levels that are harmless to the mother. It should be noted that several lead compounds are classified as carcinogenic.

All work with lead salts must be done in well-ventilated fume hoods.

First aid
Inhalation:
Remove the casualty from exposure. Make him blow his nose thoroughly. Keep the injured person warm and calm. Contact the hospital.

Eyes:
Rinse thoroughly with water. Contact an ophthalmologist.

Skin:
Rinse with water, then wash with soap and water. Remove contaminated clothing and shoes and wash the skin underneath.

Mouth:
Rinse the mouth with water and give water or preferably milk to drink. Contact the hospital.

10.8 Sodium (Na), treatment of sodium residues

Characteristics:
Silver colored metal. Reacts strongly with water, decomposes and produces hydrogen. The reaction heat can cause ignition (hydrogen and oxygen from air).

Work with sodium at the Deaprtment of Chemistry
Those who work with sodium should familiarize themselves with where the fire extinguishers for class D fires (metal fires) are installed at the institute.
If you are going to work with larger quantities of sodium, you should take one of the fire extinguishers into the laboratory during the work (and hang it back in place when the work is finished).
There are a total of 8 fire extinguishers for class D fires at the Institute of Chemistry:
1 device is installed on the 4th floor, outside the course halls in the north.
3 appliances are installed on the 3rd floor.
3 devices are installed on the 2nd floor.
1 device is installed in the warehouse in U-etg.
For small sodium fires, dry sand can be a suitable extinguishing agent.
If one has used one of the fire extinguishers; notify: to have it refilled.

When handling sodium, always wear protective gloves and a face shield. Use small amounts. Corrosion of the respiratory system can lead to laryngeal edema with shortness of breath. Splashes in the eyes can lead to blindness. Can also cause burns on the skin.

Destruction, sodium
After each time you have used sodium, you should destroy the remains, so that you do not get too large a quantity when you have to destroy it.

Have approx. 600 ml Na-dried diethyl ether in a large beaker (3-5 L). The sodium residues are added to the ether. Then carefully add a few drops of 96% ethanol, wait and see if you get evolution of H2 gas.

- If little or no reaction, use more ethanol.
- If strong or violent reaction (foaming or the ether begins to boil), add more ether. The ether cools the reaction and dilutes the ethanol.

Gradually, you add more and more ethanol so that you keep the reaction going. When you do not get gas evolution even if you add large amounts of ethanol, you can start adding small amounts of water to the mixture.

- If there is little or no reaction, add a little more water.

When all gas evolution has ceased, the solution can be diluted with large quantities of water. Then separate the ether and water layers. The water layer is set aside for evaporation of ether residues. When the ether has evaporated, the water layer is emptied under constant dilution with water. The ether layer is handled as hazardous waste. (see chapter 6.3)
NB! During the destruction of sodium, a thick "porridge" of strong lye is formed. This lye is highly corrosive (see Acids and bases), so do not get it on yourself.
The destruction must be done by a qualified person.

First aid, sodium
Inhalation:
Remove the casualty from exposure. Make him blow his nose thoroughly. Contact the hospital.

Eyes:
Rinse thoroughly with water. Contact the hospital (Eye department).

Skin:
Rinse with plenty of water, wash with soap and water. Remove contaminated clothing and shoes and wash the skin underneath. Contact the hospital.

Mouth:
Rinse your mouth with water and give a glass of water to drink. Contact the hospital.

10.9 Flammable organic liquids and solvents

Fires in the laboratory are most often caused by work with flammable substances. Organic liquids pose a particular risk. Many of these liquids are volatile and give off flammable gases. The gases are heavier than air and can collect along floors or laboratory benches, and this vapor then represents a major fire hazard.

Some of the most common flammable organic liquids are:

- methanol and ethanol
- acetone
- ethyl acetate
- dichlorometane
- tetrahydrofuran
- hexane

- petroleum ether
- toluene
- ether
- isopropanol

Ignition of the liquids/gases can occur in many ways: by open flames, hot surfaces, smoking, frictional heat, static electricity and sparks from motors and appliances, from switches, batteries and from chemical reactions.

Store and use as few flammable liquids as possible in the laboratory. Storage should take place in fireproof cabinets. Do not leave bottles of flammable liquids uncapped.

Always work in a fume hood when handling organic liquids and solvents.

Do not work with an open flame near flammable liquids or where vapors from such liquids may accumulate. In particular, the heating of flammable liquids, distillation etc. never be done where ignition by, for example, glowing wires or sparks can occur.

Heating should instead take place, for example, using a water bath, steam, an IR lamp or another suitable electric heat source.

Extraction work with the use of a separatory funnel often leads to overpressure with the risk of liquid splashing. Make sure that the separating funnel is always held with the stem facing up during the shaking, and frequently release excess pressure in the separating funnel by opening the valve/tap. Always work in a fume hood.

Filtration of boiling hot solutions of substances dissolved in flammable organic solvents is extremely dangerous due to the strong evaporation and the work must only take place in a fume hood where no open flame is used.

10.10 Mercury (Hg), treatment of mercury residues

Mercury vapours are very toxic. Mercury spills are extremely difficult to clear up. In small rooms with poor ventilation, the concentration of mercury vapour may exceed the acceptable limit for a working environment (administrative norm). Mercury must be stored in water and specially labelled on delivery.

Spills/accidents

Mercury spills must be cleared up immediately. Spills can be cleared up using a mercury pipette equipped with a drip catcher and placed in a container for collecting mercury. It' is also possible to neutralise mercury spills using chemicals. Zinc powder bonds with mercury to form amalgam; sulphur powder bonds with mercury to form sulphide. The texture of the mercury is thereby altered, making it easier to clean up.

11 ATTACHMENT 5.4 More on gloves

Sammenligning av Sol-Vex (nr. 37-675)og Neotop

Bruksområde	Sol-Vex (nr. 37-675)	Neotop
Fortynnede uorganiske syrer og baser		
Konsentrerte baser		
Konsentrert H_2SO_4 og HNO_3		
Eddiksyre, vannfri (konsentrert)		
Metanol		
Etanol		
Høyere alkoholer		
Sykloheksan, Heksan		
Vannløsninger av aminer		
Aminer	Sjekk spesielt	Sjekk spesielt

Amines and gloves

Product / Glove	Barrier	Sol-Vex	Neotop	Touch N Tuff	PVA
	02-100	37-675	29-500	92-500/600	15-series
	PE	Nitrile	Neoprene	Nitrile, disposable	PVA
	Breakthrough Time (minutes)				
Methylamine (Gas dissolved in water)		> 480			
Ethylamine		87			
Dimethylamine					
Diethylamine	> 480	17	11	1	11
Trimethylamine (45% aqueous)					
Triethylamine		> 480	25	41	> 480
Monoethanolamine		> 480	> 480		
Diethanolamine					
Triethanolamine		> 480			

0	1	2	3	4	5	6
< 10	10	30	60	120	240	>480
Not recommended	Splash only					