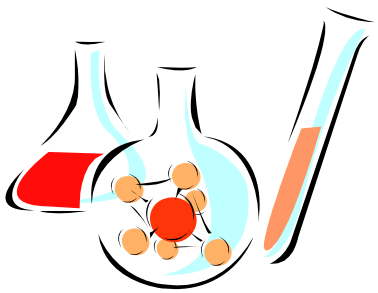
Department of Science, Systems and Models

# Laboratory Safety in Chemistry and Biology

## (Short version)



Roskilde University

2013

# Foreword

This short version of the laboratory safety guide in Chemistry and Biology has been prepared jointly by the supervisors and technicians employed in the Department of Science, Models and Systems, Roskilde University.

Lise Maarup, Annette Christensen, Tove Atlung and Torben Lund

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# 1. INTRODUCTION

This safety guide is meant as an aid to students to provide basic information about everyday procedures and safety regulations in the laboratories of the Department of Science, Models and Systems, Roskilde University.

This guide does not contain all of the information needed for dealing with specific substances, but is meant to provide general guidance on concepts and problems relevant to laboratory safety.

Detailed knowledge of the procedures and materials with which you are working is essential for preventing accidents and for minimizing the severity of accidents when they occur.

THEREFORE YOU SHOULD:

1. KNOW WHERE THERE ARE HAZARDS AND RISKS.

To minimize possible damage you should

2. KNOW WHAT TO DO IF AN ACCIDENT OCCURS.

It is crucial that:

-unnecessary exposure is avoided.
-dangerous situations are avoided.
-the extent of any accident is minimized.

For these reasons it is necessary that general procedures and rules of safety are followed.

**THEREFORE READ THE FOLLOWING PAGES – THEY WERE WRITTEN TO ENSURE YOUR SAFETY!**

## 2. SAFTY INFORMATION FOR STUDENTS AT NATBACH

Please note that as a student at Nat-Bach you have a responsibility for your own safety and for the safety of others when working in the laboratory.
RUC provides approved laboratories that comply with safety regulations for the students to work in, (*however no requirements or inspection procedures regulate which chemicals, equipment or experimental procedures students use in their daily work.)*
*With regard to the way you conduct your work in the laboratory, you are subject to the same rules and regulations as the employees of RUC.*

**Safety is also *your* responsibility:**
At some point during your education at Nat-Bach you will probably work with chemicals that in some way or another pose a health or safety hazard.
**It is your responsibility** to obtain and study any relevant information on potential health and safety hazards posed by a certain chemical that you intend to use, before commencing any work involving that chemical.
**It is your responsibility** to inspect whether any experimental apparatus is correctly assembled using the correct components, prior to use. If necessary, ask a supervisor or laboratory technician to inspect and approve the apparatus.
**It is your responsibility** to thoroughly evaluate the possible hazards connected with a new experimental procedure, before performing it for the first time.
**You should not expect** that your supervisor informs you of all relevant health and safety aspects of your work in the laboratory.
**You can expect** that your supervisor will advise you on health and safety aspects concerning a new experimental procedure, if you ask for such advice. However you should be the one who takes the initiative on these matters.

**Advice:**

Always perform an analysis of the risks involved prior to performing any new procedures in the laboratory – if you have any doubts or questions then contact your supervisor or the technician affiliated to your laboratory.

If you are **pregnant**, you should always inform your student advisor, project or course supervisor as soon as possible, in order for the necessary precautions to be implicated. (At-guidelines on the Working Environment of Pregnant Women A.1.8 January 2009).
Your supervisor, in cooperation with the Safety Committee, is responsible for ensuring that any laboratory work is performed in such a way that it does not pose a risk to the development of your child. Any pregnant woman is on her part obligated to cooperate with employees and/or students in ensuring a safe working environment and to follow any special guidelines.

It is forbidden to bring preschool children inside the laboratory.

**Remember to stop and think before it is too late!**

**January 2013**

# 3. SAFETY EQUIPMENT IN THE CHEMISTRY AND BIOLOGY LABORATORIES

| ENGLISH: | DANSK: |
|---|---|
| - FIRE EXTINGUISHERS | BRANDSLUKKER) |
| - FIRE BLANKETS | BRANDTÆPPE |
| - EMERGENCY SHOWERS | NØDBRUSER |
| - FIRST AID BOXES | NØDHJÆLPSKASSE |
| - EYE-WASH BOTTLES (½ L 0.9% saltwater for eye rinsing) | ØJENSKYLLEFLASKE |
| - VARIOUS TYPES OF GLOVES | HANDSKER |
| - SAFETY GOGGLES (CHEMSITRY LABS) | SIKKERHEDSBRILLER |
| - PLASTIC CONTAINERS FOR WASTE (marked accordingly) | AFFALDSDUNKE |
| - JARS FOR GLASS WASTE | AFFALDSBEHOLDERE TIL GLASAFFALD |

# 4. SAFETY REGULATIONS FOR LABORATORY WORK

- Always remember to wear lab coat in the laboratory.
- Coats and bags must be placed outside the lab. They may never be brought into the laboratory.
- It's forbidden to smoke or bring food and drinks into the laboratory.
- Make sure you know where the safety equipment is placed, such as eye-wash bottles, emergency showers and the fire extinguisher.
- Never run or rush about in the laboratory – this can result in unfortunate accidents.
- Form a general view of what you are going to do and what equipment you need.
- Always check the safety data sheets on the chemicals you plan to use before you begin. You can find them at http://www.kemibrug.dk if they are not in the laboratory.
- Be attentive to those around you and to what they are working with.
- All contact with chemicals, whether via skin, ingestion or inhalation, should be avoided.
- Safety goggles should be worn whenever there is even a small risk of getting caustic or irritating substance in your eyes or when working with potentially explosive substances or processes. **Safety Goggles should always be worn in the chemistry lab!**
- Safety gloves should be used with care. Change the gloves frequently and always after contamination. Wash your hands frequently and always before you leave the laboratory. Only use gloves if necessary. Be aware that it is necessary to have a bare hand to operate equipment, door handles etc.
- Clean up any spills immediately.
- Chemical waste should be handled according to the rules in this Laboratory Handbook. See also Supplement I. for If in any doubt, consult a technician or safety representative.
- Keep your workplace / fume hood clean and tidy.
- Glassware placed in the wire dishwashing basket should be free from all chemical waste, which means: wash with appropriate solvent e.g. water or acetone, remove labels, marking tape, etc. Place a note in the dishwashing basket with your name and room number and bring it to the dishwashing room. Project groups should wash up after themselves.

  When the glassware has been washed and dried, pick up the wire basket, and place the clean items back in their appropriate drawers/closets.
- Mark your things clearly with your name, date and content with a sticker indicating the necessary H- and P-phrases and the appropriate hazard pictograms. H = Hazard. P = Precautionary.

# 4A. SIKKERHEDSREGLER FOR LABORATORIARBEJDE

- Husk altid at tage kittel på i laboratoriet
- Tasker og overtøj placeres udenfor, undtaget notesblok, analyseforskrift og evt. pung.
- Det er forbudt at indtage eller medbringe mad, drikke samt ryge i laboratoriet
- Orienter' dig om, hvor der findes værnemidler så som nødbruser, øjenskylleflasker og brandslukker, hvis uheldet skulle være ude.
- Stress eller løb aldrig i et laboratorium, det kan medføre ulykker.
- Få overblik over hvad du skal foretage dig, og hvad du skal bruge
- Læs altid kemikaliebrugsanvisninger inde arbejdet påbegyndes. Find dem på **http://www.kemibrug.dk/** hvis ikke de findes i laboratoriet.
- Vær orienteret om hvad din "nabo" arbejder med
- Enhver kontakt (hud, indånding eller indtagelse) med kemikalier skal undgås.
- Beskyttelsesbriller skal altid anvendes ved enhver arbejdsproces, hvor der blot er den mindste fare for at få ætsende eller irriterende stoffer i øjnene eller risiko for eksplosioner**. Beskyttelsesbrille skal altid bære i kemilaboratoriet.**
- Brug handsker med omtanke.
- Skift handsker ofte og altid efter spild, vask hænder jævnligt og altid når laboratoriet forlades.
- Brug kun handsker når det er nødvendigt.
- Det er nødvendigt med en handskefri hånd til betjening af apparatur, håndtag o.l.
- Ved spild af kemikalie, tør op straks.
- Kemikalieaffald håndteres efter regler i den laboratoriehåndbog. Se også Supplement I. Spørg hvis du er tvivl.
- Hold din arbejdsplads/stinkskab ren og ryddelig.
- Glasvarer der lægges til opvask skal være fri for alle rester af kemikalier, dvs. skyl med egnet opløsningsmiddel eks. acetone eller vand, samt fjern skrift, etiketter, tape og lign.
- Læg en seddel i opvaskekurven med navn og rum nr. og anbring den i vaskerummet.
- Projektgrupper vasker selv op.
- Efter endt opvask/tørring hentes kurvene, og tingene sættes på plads i skabe og skuffer.
- Mærk dine ting tydeligt med navn, dato og indhold, samt nødvendige H- and P-sætninger og det dertilhørende farepictogrammer. H = Hazard. P = Precautions.

# 5. WORKING IN THE (ORGANIC) CHEMISTRY LABORATORY.

Working in a chemistry laboratory is fun and exciting and not especially dangerous as long as you work thoughtfully and follow some simple laboratory rules. Organic and inorganic syntheses involve, however, a range of possible risks that you should be aware of and attempt to minimize through good laboratory habits. In the following section, a list of laboratory rules will be presented.

Danger points can be divided into two main categories:

1. Accidents that result in acute damage:
   a) explosions, fire, gashes from sharp instruments
   b) acute chemical effects such as corrosion, which can include eye damage, inhalation of toxic vapours, etc.

2. Chronic damage that results from exposure to organic chemicals over long time periods.

One of the most common injuries that can occur in an organic chemistry laboratory is eye damage, that may result when one least expects it. Eye protection in the form of safety glasses or a face screen is therefore obligatory. If an accident occurs, the eyes should be rinsed with water from a rinse bottle or tap. It is essential that rinsing takes place as quickly as possible following an accident. For longer rinse periods a rinse bottle should be used. Rinse with water only! Treatment with large amounts of water is also obligatory for burns and corrosion by strong acids, bases, as well as strong oxidants and reductants. Rinsing should continue for between one-half to one hour.

| Type of Chemical | Begin to rinse: | Rinse times: |
|---|---|---|
| Dust or dirt in the eyes | As soon as possible | Until all particles are removed; seldom less than 1 minute |
| Acids | Within 5 seconds | 2-4 minutes |
| Bases and organic acids | Within 1 second | At least 10-20 minutes; rinse also during transport to the doctor |

The suggested rinse times apply when most of the rinse water reaches the eye.
*Always contact your doctor
*Continue rinsing until you arrive at your doctor’s office or hospital.

In order to minimize both acute and chronic effects of exposure to organic chemicals (particularly solvents that have a high vapour pressure), all handling of such substances must take place in a well-functioning fume hood. Be aware that the fume hood’s indicator light should be on green. Avoid all skin contact with chemicals, since many chemicals, including most organic solvents can penetrate skin. If you spill such chemicals on your gloves they should be changed since gloves only act to slow down the rate of penetration (see section 5 on gloves). Dry and cracked skin is penetrated more easily by chemicals. Hand lotion can help in this regard. Upon finishing work in the laboratory always wash your hands.

Many accidents with organic syntheses occur as a result of ignorance, partly about how the synthesis should be conducted and partly about the reagents used. It is therefore essential that you study carefully the steps involved in the synthesis that you are planning to carry out, the chemistry and Hazards and Precautions of the reagents that you will be using. You can find the information in the Material Safety Data Sheets (MSDS) of the reagents. The MSDS can be found on the internet e.g from **http://www.kemibrug.dk/.** From the MSDS you can obtain information on whether the reagents can tolerate water, oxygen, and heat, what to do in case of a spill, etc. **Another golden rule is that new syntheses the first time should only be performed on a small scale.**

Good laboratory practice can prevent many accidents. Be sure to plan your work routine ahead of time. Organic and inorganic syntheses should not be performed when no one is around, in the event that you should need to call for help. Therefore before conducting such work, ensure that there is someone working in a nearby laboratory or office that can be called in case of emergency.

Finally, there is only one person that is responsible for your health, namely yourself. But since we are many working together at the Department of Science, Systems and Models, we have a responsibility to look after each other.

In addition to the more general guidelines mentioned above that specifically refer to the chemistry laboratory, you should refer to the general laboratory rules that are described in SECTION 3 AND 3A..

## 6. GLOVES

RULES OF THUMB FOR USING GLOVES

1) Always check whether there are holes in your gloves before using them.
2) Never use gloves that are too small.
3) Never wear gloves for too long a period, **and only wearthem when necessary.**
4) Never put gloves on over wet hands (e.g., from washing, lotion, etc.)
5) Remember always to put a glove on one hand to hold your samples and leave the other hand bare to open doors, drawers, and work with lab equipment.

Gloves can provide good protection if they are used properly, but they can also give a false sense of security if they are used incorrectly. In some circumstances it can be more dangerous to work with gloves than without.

No gloves can provide 100% protection against organic solvents or chemicals, but they do work as a barrier that reduces contact between such substances and your skin.

Disposable gloves: May only be used once – then disposed of!!!

Glove Materials:

| | |
|---|---|
| Natural rubber (latex) | (disposable ) |
| Nitrile rubber | (disposable) |
| Polyvinyl chloride (PVC) | (disposable) |

**Use of Gloves**: Use gloves with thoughtfulness! That means that you should only use gloves when needed. It is not necessary to wear gloves when you handle harmless chemicals like

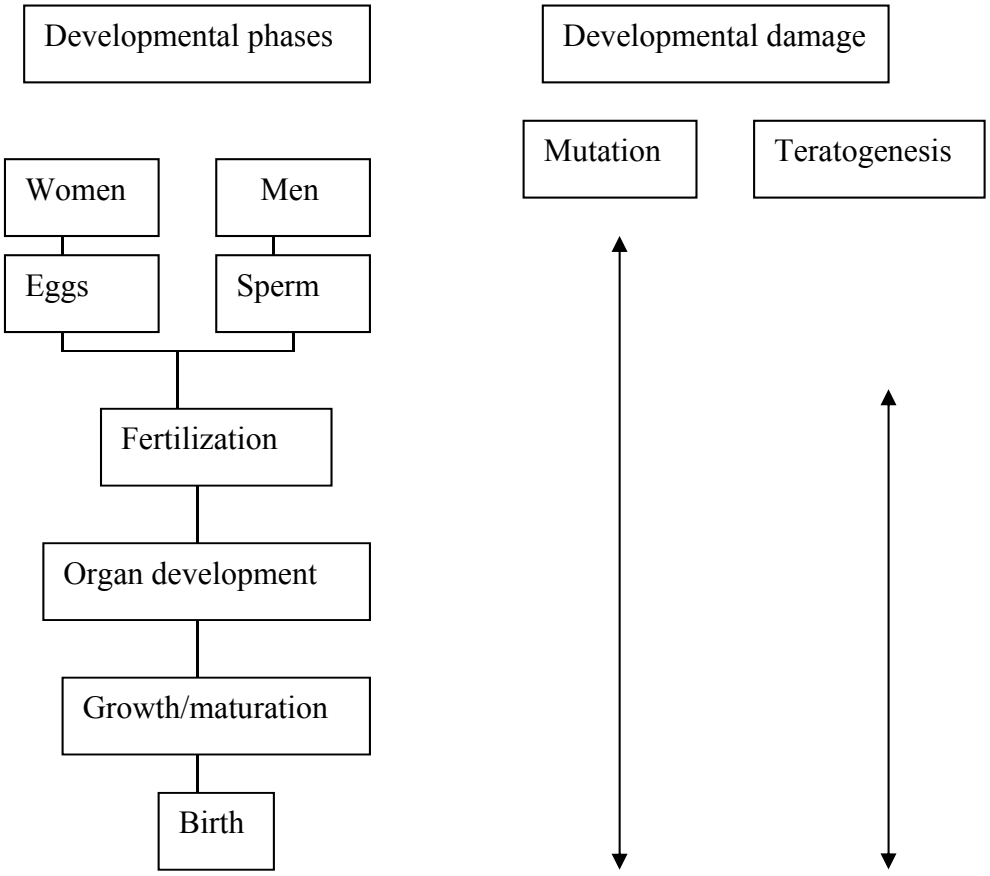
NaCl, glucose etc. and dilute aqueous solutions (< 0.2 M) of HCl and NaOH), or harmless biological samples. However, when you handle concentrated acids and bases, many organic compounds including organic solvents you should protect your skin with disposable gloves.

If you spill any chemicals/solutions on your hands, remember always to wash your hands.

## 7. DANGEROUS CHEMICALS WITH CHRONIC EFFECTS:

This group includes chemicals that in one way or another can affect you (both men and women), your children or your grandchildren if you are exposed to their action to a sufficient degree at an unfortunate point in time.

Reproductive toxicity: Reduced fertility, spontaneous abortion, premature birth, low birth weight, birth defects, childhood cancer




**ORGANIC SOLVENTS** **Always handle in fume hood!**

Organic solvents are a large group of chemical compounds that are composed of a carbon skeleton, are volatile (have a high vapour pressure) and are lipid soluble. This means that they have some technical properties that make them suitable for industrial purposes.

Organic (and inorganic) chemicals have widely variable toxicological properties.

A large number of aromatic hydrocarbons, such as benzene and styrene, as well as aliphatic hydrocarbons, such as chloroform, methylene chloride, tetrachloromethane and ethylene chloride, have been found to have mutagenic, carcinogenic and/or teratogenic effects.

Additional toxicological effects include damage to the central nervous system (e.g., hexane, phenol) and damage to the liver and kidneys (e.g., halogenated hydrocarbons).

The most common uptake route is via the lungs, but substantial amounts of these chemicals can be taken up across the skin. Rarely uptake across the stomach or intestines occurs. Uptake by the lungs is dependent on the chemical's vapour pressure. The higher the vapour pressure, the more easily the chemical is taken up by the lungs.

Following uptake by the lungs, the organic solvent is transported to other parts of the body via blood, where it is preferentially taken up by fatty tissue. Since circulation in fatty tissue is minimal, the solvent will accumulate slowly but will also be released slowly once it has been taken up.

Acute symptoms caused by over-exposure to organic solvents can include feelings of exhilaration, confusion, headache, nausea, vomiting, difficulty breathing and unconsciousness.

More long-term effects of organic solvents can result in various chronic ailments such as headaches, memory failure, intense urge to sleep, muscle weakness, loss of feeling in arms and legs, as well as changes in ability to concentrate, learning ability and emotional instability.

Chlorinated solvents are not explosive or flammable but generally are cytotoxic (liver damaging). Non-chlorinated solvents are flammable and explosive. The tendency of a chemical to burn or explode is dependent on mixing with oxygen in the air and on the chemical's flash point.

## CARCINOGENIC CHEMICALS

Carcinogens are chemicals that increase the risk of cancer in persons exposed to them. A substance is considered to be carcinogenic to humans if epidemiological investigations or well-conducted animal studies show evidence for cancer, for example, benzidine is the most carcinogenic substance known (cancer can occur after a single exposure). Formalin has been widely debated to be carcinogenic, since all of the animal studies had been negative until the animals were allowed to inhale the chemical, which showed that inhalation resulted in nasal cancer.

**Examples of chemicals believed to be carcinogenic:**

- Benzene, chloroform, formaldehyde (formalin), acrylamide, dichlormethane

## TERATOGENS (reproductive toxicity):

Teratogenic chemicals are chemicals that can result in foetal deformities. The teratogenic effect occurs in women during pregnancy. An example is the drug thalidomide, that caused many children to be born with deformed limbs.

**Examples of teratogenic chemicals:**

- EDTA, Daunomycin,

## MUTAGENIC CHEMICALS:

Mutagenic chemicals are able to change chromosomes in living cells. When the chromosomes are changed this means that hereditary characteristics are changed.

Mutation in:

1. Germ cells can result in spontaneous abortions or hereditary diseases.
2. Somatic cells can result in deformities or cancer.

Examples of mutagenic chemicals:

- Daunomycine, N-ethyl-N-Nitro-N-Nitrosoguanidine, 4-Nitroquinoline-N-Oxide, Methyl-Methane-Sulfonate (very mutagenic)

**RADIOACTIVE CHEMICALS:**

There is a list of safety rules that must be followed when working with radioactive chemicals. These rules can be found at BSCW General Biology information. If in doubt, ask your supervisor/safety representative.

## 8. SAFETY WHEN WORKING WITH MICROORGANISMS AND HUMAN BLOOD

**Working with HARMLESS microorganisms:**

Work with yeast cells or other well-defined fungal species and bacterial strains, such as *Lactobacillus* sp., *Escherichia coli* laboratory strains or weakened *Salmonella typhimurium* in the Ames test, presents no risk as long as the usual practices of good laboratory hygiene and the general laboratory rules are followed.

**Working with genetically modified microorganism (GMO):**

Work with GMO's of well characterized non pathogenic bacteria and yeast cells presents no greater risk, but must be carried out in gene technology approved class 1 (GMO1) laboratories and follow the GMO1 laboratory rules (see section 9). Most biology laboratories at NSM are GMO1 classified. These laboratories have a special sign on the door.

**Working with unknown microorganisms, human blood and blood cells:**

Working with unknown microorganisms (from fallout, fingerprints, sputum, soil, waste-water samples) can present a health risk in that there may be disease-causing bacteria present, and therefore a risk of infection. More stringent laboratory rules corresponding to the GMO1 rules must be followed when working with unknown microorganisms.

When working with human blood and blood cells it must be assumed that the blood donor can be a carrier of hepatitis (a contagious infection of the liver) or AIDS. The same rules should therefore be followed as when treating disease-causing microorganisms – i.e., more stringent laboratory rules corresponding to GMO1 rules.

# 9. SAFETY WHEN WORKING IN GENE TECHNOLOGY LABORATORIES (CLASS 1)

**Regulations for working in Gene technology (GMO1) Class 1 laboratories**

**1)** All experiments conducted in the laboratory, regardless of its classification, should be conducted following the regulations for a Class 1 laboratory. Gene technology experiments that are classified higher than Class 1 may not be conducted in a Class 1 laboratory.

**2)** Laboratory doors should be kept closed at all times, and unnecessary traffic to and from the laboratory should be limited.

**3)** Outdoor clothes should be placed on hangers in the corridor, and bags should be placed in an office, the adjoining meeting room, or in a locker.

**4)** Lab coats must be worn in the laboratory and only used for this kind of work. Lab coats should be removed when leaving the laboratory for breaks, office work, or the work is finished. Lab coats must be placed on hangers in the laboratory. Clothing is assumed to be contaminated, and therefore is handled following the regulations for disinfection after work lasting more than a couple of hours or if there is the possibility of a spill.

**5)** Gloves must be worn if contact with biologically active material is anticipated.

**6)** Tobacco, food and drink, as well as cosmetics may not be used in the laboratory.

**7)** Mouth pipetting is forbidden. Suitable pipetting aides or automatic pipettes should be used.

**8)** Biologically active material may not enter drains or sewers. Equipment and waste are treated following the regulations for disinfection (see section 10).

**9)** Care should be taken to minimize the formation of aerosols, and use of syringes with needles should be avoided if possible.

**10)** A waste tray should be used when handling more than 1 liter of biologically active material in the hood.

**11)** The laboratory must be kept clean and in good order.

**12)** Hands must be washed after contamination with biologically active material, before work-breaks, and when the work is finished.

**13)** The workplace should be decontaminated with 70% ethanol daily and immediately after any spills of biological material.

**14)** Research that takes place when the person responsible for it is not present in the laboratory must be marked with the person's name, date and contact information in case of emergency

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# 10.GUIDELINES ON CORRECT HANDLING OF WASTE

**Biological waste:**
Biologically active "hazardeous" material (GMO, unknown microorganisms, human blood and human cells) must be inactivated first, for example by autoclaving.

Harmless liquid waste is flushed into the sink. Harmless solid biological waste is placed in a biological waste bag in the lab or in the autoclave room in 15.1.

**Needles and other sharp objects**: Should be stored in the needle box found in the laboratory.

**Waste glass**: Pasteur pipettes, empty containers etc. are stored in a clearly marked **waste glass container** in the laboratory.

**Batteries**: Should be placed in a box by the workshop 171 003

**Contaminated waste**: Does not include metals or glass. Used gloves, towels etc. that have been contaminated with hazardous chemical material should be immediately disposed of in the laboratory waste dumpster located next to bldg. 16/17 or in the chemical waste deposit room 15.0-029 (remember correct labelling) depending on the nature of the material.

**Remaining laboratory waste**:
The remaining waste (hand washing towels, paper, disposable plastic with harmless chemicals or biological) is disposed of in the normal wastebaskets in the laboratory.

Filled needle boxes, biological waste bags etc. are deposited in the **laboratory waste dumpsters** located next to bldg 16 /17.

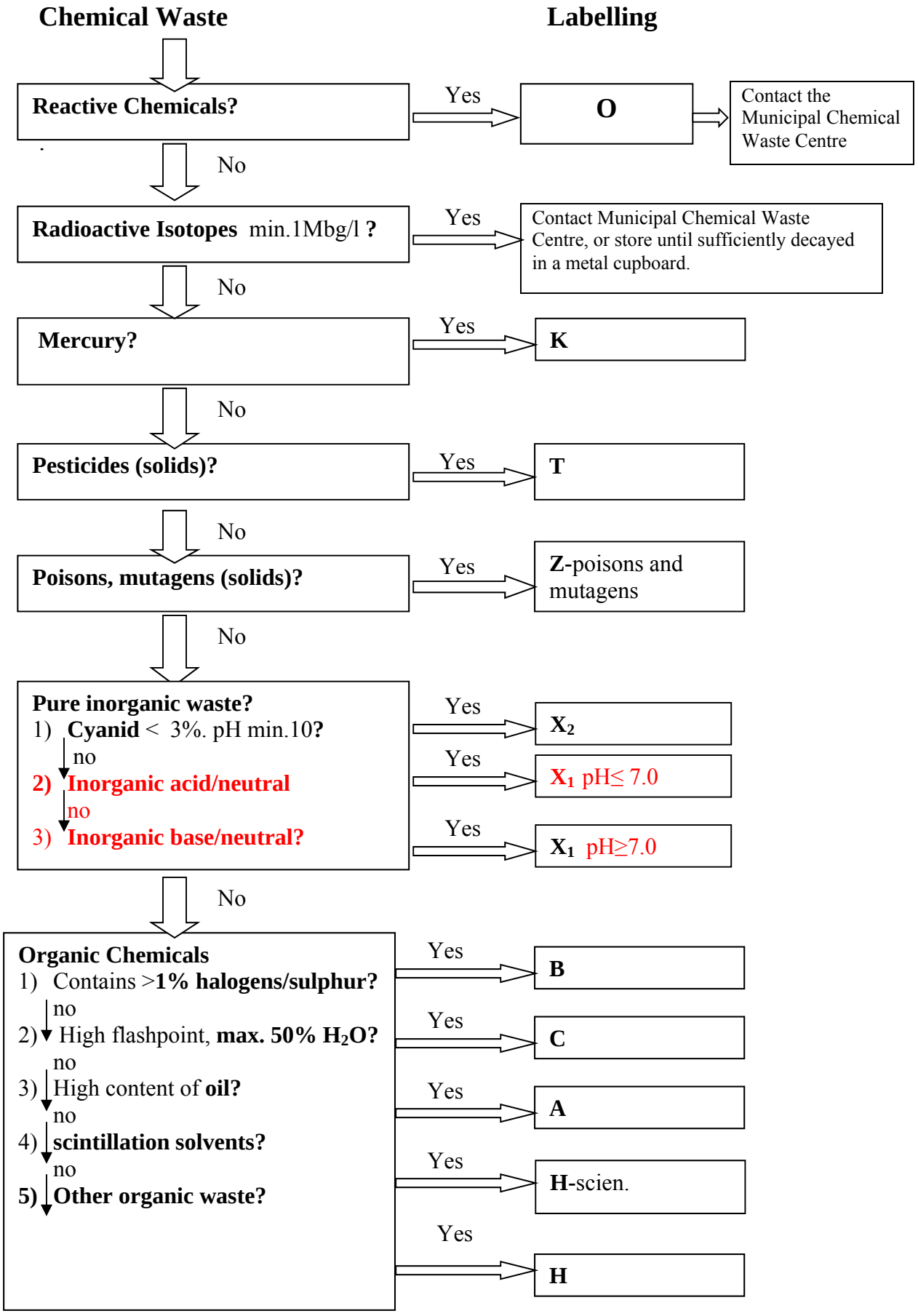
## Chemical waste:

1) **Waste containers**: Only plastic containers should be used.

2) **Labels** on the waste container should **clearly indicate the class of waste**.

3) **Sorting of waste**:
   All waste is sorted into a number of unambiguous categories defined by the Chemical Disposal Centre and marked with a single-letter code. Using the table below it should be possible to determine the correct waste category for most substances. If in doubt – ask.
   When sorting waste it is important to keep in mind that the waste is destroyed by means of incineration, (at Stena Miljø.)

**See the chemical waste handling Scheme on the next page!**


Chemical Waste
Labelling
Reactive Chemicals?
Yes
O
Contact the Municipal Chemical Waste Centre
No
Radioactive Isotopes min.1Mbg/l ?
Yes
Contact Municipal Chemical Waste Centre, or store until sufficiently decayed in a metal cupboard.
No
Mercury?
Yes
K
No
Pesticides (solids)?
Yes
T
No
Poisons, mutagens (solids)?
Yes
Z-poisons and mutagens
No
Pure inorganic waste?
1) Cyanid < 3%. pH min.10?
no
2) Inorganic acid/neutral
no
3) Inorganic base/neutral?
Yes
X2
Yes
X1 pH≤ 7.0
Yes
X1 pH≥7.0
No
Organic Chemicals
1) Contains >1% halogens/sulphur?
no
2) High flashpoint, max. 50% H2O?
no
3) High content of oil?
no
4) scintillation solvents?
no
5) Other organic waste?
Yes
B
Yes
C
Yes
A
Yes
H-scien.
Yes
H

## Regulations for disinfection and waste in GMO1 laboratories:

In the case of a spill, the liquid is removed with absorbent paper and a disinfectant that is appropriate for the specific type of spill should be used (usually 70% ethanol).

For surface disinfection e.g., of table tops, 70% ethanol is used.

Disinfection of accessories:

Contaminated glassware should be disinfected either by 1) or 2) before being washed:

1) Autoclaved
2) Placed in a bath containing idofor overnight, and then rinsed with water.

Remains of bacterial cultures:

These should be collected in appropriate containers and disinfected by either 1) or 2):

1) Autoclaving the container with its contents followed by disposal in the sink.
2) Addition of excess iodofor, storage overnight, followed by disposal in the sink.

Solid waste should be collected in the laboratory in autoclavable plastic bags. The bags are closed and brought directly to the autoclave. After autoclaving, the waste is disposed of via the department's usual biological waste system.

Water baths should be filled and refilled with deionized water only. Water baths should be changed as necessary, and 5 g EDTA (or 25 ml of a 0.5 M EDTA solution) should be added whenever the water is changed.

Work clothes that are contaminated with biologically active material should be collected in the laboratory in tightly closed containers, brought to the autoclave and treated with steam flow-through for 10 minutes, without pressure, before being sent for washing or being returned to the students.

Transport of biologically active material to the autoclave room:

Accessories, closed bags of solid waste and closed containers with remains of bacterial cultures are transported to the autoclave on a laboratory cart marked with a yellow sign "BIOLOGISK AKTIVT MATERIALE, GENTEKNOLOGI KLASSE 1". Biologically active gene technology material may not be left outside of the classified area.

## 11. Globally Harmonised System (GHS) for labeling of chemicals

- The UN-developed system „GHS“ stands for „Globally Harmonized System of Classification and Labeling of Chemicals“.
- With GHS, globally harmonized criteria have been created for the classification and labeling of chemicals. GHS wants to ensure internationally comparable high standards for health and consumer protection, occupational health and safety, and environmental protection.
- GHS regulates
  - criteria for the classification of physical, toxicological, and environmental relevant properties
  - classification and labeling
  - harmonised hazard communication (e.g. harmonised label statements and harmonized safety data sheets) of chemicals.
- GHS establishes globally harmonized criteria for hazard communication. In the overview, this relates to the introduction of new or modified:
  - hazard classes,
  - hazard categories,
  - hazard pictograms,
  - signal words,
  - hazard statements,
  - precautionary statements.
- GHS offers the opportunity to bring product safety to a high level all over the world.

GHS will thus contribute to improving measures for protecting human health and the environment on a global scale.

**New Labelling Elements**

New Symbols and pictograms + warning text

R & S sentences (Risk and Safety) are replaced by new H & P sentences (Hazard and Precaution)

Signal word (Danger or Warning)

The signal word on the label gives information about the relative hazard level of a substance or mixture and alerts the reader to a potential hazard.

Hazard pictogram

- Square set on a point,
- Red border,
- White background,
- Black symbols.

CLP (EU-GHS): Regulation (EC) No 1272/2008 on classifi cation, labelling and packaging of substances and mixtures

## PHYSICAL HAZARDS

| Hazard classes and hazard categories* | Label elements \| NEW | | Label elements \| OLD** | |
|---|---|---|---|---|
| Explosives<br>• Unstable explosives<br>• Explosives, divisions 1.1 to 1.3<br>Self-reactive substances, mixtures, types A, B<br>Organic peroxides, types A, B |  | H200<br>H201, H202, H203<br>H240, H241<br>H240, H241 Danger |  | (R2, R3) Explosive |
| Explosives, division 1.4 |  | H204 Warning | No classification | |
| Flammable gases, category 1<br>Flammable aerosols, category 1<br>Flammable liquids, category 1 |  | H220<br>H222<br>H224 Warning \| Danger |  | (R12)<br>(R12)<br>R12 Extremly flammable |
| Flammable liquids, category 2<br>Flammable solids, category 1<br>Flammable solids, category 2 | | H225<br>H228<br>H228 Warning \| Danger |  | R11<br>(R11)<br>(R11) Highly flammable |
| Flammable aerosols, category 2<br>Flammable liquids, category 3 |  | H223<br>H226 Warning | No symbol | (R10)<br>R10 Flammable |
| | | | No classification<br>flashpoint 56-60°C | |
| Pyrophoric liquids, category 1<br>Pyrophoric solids, category 1<br>Substances, mixtures which in contact with water emit flammable gases, categories 1, 2 and category 3 |  | H250<br>H250<br>H260<br>H261<br>H261 Warning \| Danger |  | R17<br>R17<br>(R15)<br>(R15)<br>(R15) Highly flammable |
| Self-reactive substances, mixtures, type B<br>Self-reactive substances, mixtures, types C, D and types E, F<br>Self-heating substances, mixtures, category 1 and category 2 | | H241<br>H242<br>H242<br>H251<br>H252 |  | R12<br>R12 Extremely flammable |
| Organic peroxides, type B<br>Organic peroxides, types C, D<br>Organic peroxides, types E, F | | H241<br>H242<br>H242 |  | R7<br>R7<br>R7 Oxidising |
| Oxidising gases, category 1<br>Oxidising liquids, categories 1, 2 and category 3<br>Oxidising solids, categories 1, 2 and category 3 |  | H270<br>H271, H272<br>H272<br>H271, H272<br>H272 Warning \| Danger |  | R8<br>(R8), R9<br><br>(R8), R9 Oxidising |
| Gases under pressure<br>– Compressed gases<br>– Liquefied gases<br>– Refrigerated liquefied gases<br>– Dissolved gases |  | H280<br>H280<br>H281<br>H280 Warning | No classification | |
| Corrosive to metals, category 1 |  | H290 Warning | No classification | |

Merck KGaA · 64271 Darmstadt, Germany
e-mail: contact@merck-chemicals.com
www.merck-chemicals.com

## PHYSICAL HAZARDS

| Hazard classes and hazard categories* | Label elements \| NEW | | Label elements \| OLD** | |
|---|---|---|---|---|
| Explosives<br>• Unstable explosives<br>• Explosives, divisions 1.1 to 1.3<br>Self-reactive substances, mixtures, types A, B<br>Organic peroxides, types A, B |  | H200<br>H201, H202, H203<br>H240, H241<br>H240, H241 | Danger |  (R2, R3) | Explosive |
| Explosives, division 1.4 |  | H204 | Warning | No classification | |
| Flammable gases, category 1<br>Flammable aerosols, category 1<br>Flammable liquids, category 1 |  | H220<br>H222<br>H224 | Warning \| Danger |  (R12)<br>(R12)<br>R12 | Extremly flammable |
| Flammable liquids, category 2<br>Flammable solids, category 1<br>Flammable solids, category 2 | | H225<br>H228<br>H228 | Warning \| Danger |  R11<br>(R11)<br>(R11) | Highly flammable |
| Flammable aerosols, category 2<br>Flammable liquids, category 3 |  | H223<br>H226 | Warning | No symbol (R10)<br>R10<br>No classification<br>flashpoint 56-60°C | Flammable |
| Pyrophoric liquids, category 1<br>Pyrophoric solids, category 1<br>Substances, mixtures which in contact with water emit flammable gases, categories 1, 2 and category 3 |  | H250<br>H250<br>H260<br>H261<br>H261 | Warning \| Danger |  R17<br>R17<br>(R15)<br>(R15)<br>(R15) | Highly flammable |
| Self-reactive substances, mixtures, type B<br>Self-reactive substances, mixtures, types C, D and types E, F<br>Self-heating substances, mixtures, category 1 and category 2 | | H241<br>H242<br>H242<br>H251<br>H252 | |  R12<br>R12 | Extremely flammable |
| Organic peroxides, type B<br>Organic peroxides, types C, D<br>Organic peroxides, types E, F | | H241<br>H242<br>H242 | |  R7<br>R7<br>R7 | Oxidising |
| Oxidising gases, category 1<br>Oxidising liquids, categories 1, 2 and category 3<br>Oxidising solids, categories 1, 2 and category 3 |  | H270<br>H271, H272<br>H272<br>H271, H272<br>H272 | Warning \| Danger |  R8<br>(R8), R9<br>(R8), R9 | Oxidising |
| Gases under pressure<br>– Compressed gases<br>– Liquefied gases<br>– Refrigerated liquefied gases<br>– Dissolved gases |  | H280<br>H280<br>H281<br>H280 | Warning | No classification | |
| Corrosive to metals, category 1 |  | H290 | Warning | No classification | |

## HEALTH HAZARDS

| Hazard classes and hazard categories* | Label elements \| NEW | | | Label elements \| OLD** | | |
|---|---|---|---|---|---|---|
| **Acute toxicity, categories 1, 2**<br>• Oral<br>• Dermal<br>• Inhalation |  | H300<br>H310<br>H330 | Danger |  | R28<br>R27<br>R26 | Very toxic |
| **Acute toxicity, category 3**<br>• Oral<br>• Dermal<br>• Inhalation | | H301<br>H311<br>H331 | |  | R25<br>R24<br>R23 | Toxic |
| **Germ cell mutagenicity, categories 1A, 1B**<br>**Carcinogenicity, categories 1A, 1B**<br>**Reproductive toxicity, categories 1A, 1B**<br>**STOT**, single exposure, category 1**<br>**STOT**, repeated exposure, category 1** |  | H340<br>H350<br>H360<br>H370<br>H372 | Danger |  | R46<br>R45, R49<br>R60, R61<br>R39<br>R48 | Toxic |
| **Respiratory sensitisation, categories 1, 1A, 1B**<br>**Aspiration hazard, category 1** | | H334<br>H304 | |  | R42<br>R65 | Harmful |
| **Germ cell mutagenicity, category 2**<br>**Carcinogenicity, category 2**<br>**Reproductive toxicity, category 2**<br>**STOT**, single exposure, category 2**<br>**STOT**, repeated exposure, category 2** |  | H341<br>H351<br>H361<br>H371<br>H373 | Warning |  | R68<br>R40<br>R62, R63<br>R68<br>R48 | |
| **Acute toxicity, category 4**<br>• Oral<br>• Dermal<br>• Inhalation |  | H302<br>H312<br>H332 | Warning |  | R22<br>R21<br>R20 | |
| **Skin corrosion, categories 1A, 1B, 1C** |  | H314 | Danger |  | R34, R35 | Corrosive |
| **Serious eye damage, category 1** | | H318 | |  | R41 | Irritant |
| **Skin irritation, category 2**<br>**Eye irritation, category 2**<br>**Skin sensitisation, categories 1, 1A, 1B**<br>**STOT**, single exposure, category 3**<br>• Respiratory tract irritation |  | H315<br>H319<br>H317<br>H335 | Warning |  | R38<br>R36<br>R43<br>R37 | Irritant |
| • Narcotic effects | | H336 | | No symbol | R67 | |

## ENVIRONMENTAL HAZARDS

| | | | | | | |
|---|---|---|---|---|---|---|
| **Hazardous to the aquatic environment, acute, category 1**<br>**Hazardous to the aquatic environment, chronic, category 1** |  | H400<br>H410 | Warning |  | R50<br>R50/53 | Dangerous for the environment |
| **Hazardous to the aquatic environment, chronic, category 2** | | H411 | — |  | R51/53 | |
| **Hazardous to the ozone layer, category 1** |  | H420 | Warning |  | R59 | Dangerous for the environment |