MTC safety regulations

AMR Arbetsmiljörådet
MTC Work Environment Council
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Introduction 3
Chapter 1: Work environment at MTC 4
Chapter 2: Rules and regulations 5
Chapter 3: Organisation of Work environment protection at KI and MTC 8
Chapter 4: Risk assessment in the laboratory 10
Chapter 5: Genetically modified microorganisms (GMM) 12
Chapter 6: Handling of chemicals 13
Chapter 7: MTC Chemical Storage Guidelines 15
Chapter 8: Chemical spills and waste 16
Chapter 9: Microbiological risks and risk groups 18
Chapter 10: The Biosafety level 2 (BSL 2) laboratory 20
Chapter 11: Chemical hoods and Microbiological Safety Cabinets 21
Chapter 12: Personal Protective Equipment (PPE) 23
Chapter 13: Good Microbiological Practice (GMiP) 25
Chapter 14: Human blood and other samples of human origin 27
Chapter 15: Infectious waste, sharp objects and household waste 29
Chapter 16: Work with isotopes 32
Chapter 17: Animal experiments 33
Chapter 18: Microbiological spills 34
Chapter 19: Incidents and accidents 35
Chapter 20: Fire 36

Introduction

The aim of this document is to provide basic information on laboratory safety at MTC.

The content of this document is directed towards you as a worker in a laboratory, irrespective of working area and previous experience in this setting.

There is always a need for a common base of basic values and knowledge in the area of laboratory safety.

Solna 2016
AMR

Acknowledgements

We would like to thank Professor Roland Möllby for his tireless work with Work Environment Issues at Karolinska Institutet over the years. Roland built up the first courses in Laboratory Safety for PhD students at KI. Thanks to his efforts, Laboratory Safety courses have since become a standard feature of the KI curriculum. Roland has been a driving force in the KI Work Environment Group, the MTC Work Environment Council and undergraduate education, whilst running a successful research group at MTC.

Chapter 1: Work environment at MTC

Objectives

To create a safe, proactive and health-promoted work environment at MTC.
To create local regulations within the work environment area that fulfil local, national and international regulations.

Rules and regulations

Why do we (you and I) have to follow rules and regulations on the work environment?

Nobody should be scared to go to their work because of hazards/risks at the workplace.

These hazards/risks could be of chemical nature (toxicity etc.), of biological nature (e.g. infectious materials, cancer cells), of radioactive nature, etc. Everybody should be able to trust that we all follow safety regulations that minimize risks at the workplace.

Maybe you are not worried yourself since you know the hazards that you deal with, but other people do not necessarily share that knowledge, e.g. visitors, cleaning personnel, repairmen, janitors and administrative personnel.

To avoid damages to yourself, your colleagues, your family or the environment.

Such damages may happen at any workplace, but in the laboratory there are extra hazards to consider. Dangerous chemicals may e.g. stick to your clothes and affect both a second and a third party that may come in contact with you.

Microbiological agents pose a special concern in this regard, as their inappropriate handling may put not only you and your colleagues, but also your friends and family at risk of contracting an infectious disease.

Note: Even if <u>you</u> are immune to the microorganisms in your laboratory, your children or parents might not be!

There are international/national/local regulations.

You have to follow existing regulations. If accidents happen because of (systematic) violations of these, the criminal law may be applied. This in turn may lead to fines or even incarceration for responsible persons. For delegation of responsibilities, see next chapter.

The loss of prestige to you/your laboratory/the department/KI, if it becomes generally known that the national law and/or local regulations have been regularly broken, may be considerable.

Imagine tabloid headlines! Imagine what granting bodies and individual donors will think!

Chapter 2: Rules and regulations

Work environment issues are regulated by European Union directives and Swedish legislation. The latter are interpreted by Swedish authorities into Provisions (Föreskrifter), mainly from the Swedish Work Enviroment Authority (Arbetsmiljöverket), although additional authorities may be involved, such as the Swedish Chemicals Agency (Kemikalieinspektionen), the National Board of Health and Welfare (Socialstyrelsen) and the Swedish Board for Agriculture (Jordbruksverket). These provisions are directly applicable to our work at MTC/KI, but are often extended and explained by Karolinska Institutet centrally and/or by each department at KI.

Authorities that make regulations affecting our laboratory safety are:

- The Work Environment Authority
- The National Board of Health and Welfare
- The Swedish Board of Agriculture
- The Swedish Chemicals Agency
- Animal welfare authorities including the Swedish Agency for Marine and Water Management

This introduction is designed to inform you about the "local" regulations that apply at MTC and KI. These regulations comply with Swedish Provisions. after that all provisions have been considered.

Who is responsible for the safety at Karolinska Institutet?

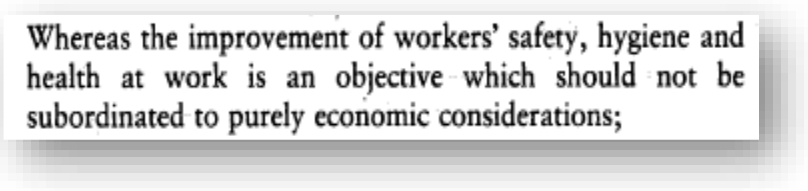
The Vice-Chancellor (rektor) is legally responsible for all activities at KI, including work environment issues. However, the various Heads of Department (prefekter) at KI have been delegated with work environment responsibilities. At MTC our Head of Department has delegated in turn this responsibility to each group leader.

Who is responsible for the safety in your laboratory?

YOU are! However, your direct group leader / principal investigator has been delegated overall responsibility for your group and all its members.

What are the responsibilities?

Already in the European Union directives it is clearly stated that the safety at work may not be set aside because of economic reasons:


Whereas the improvement of workers' safety, hygiene and health at work is an objective which should not be subordinated to purely economic considerations;

It is also clearly stated that the group leader cannot blame ignorance in discussion on safety matters, since "employers shall be obliged to keep themselves informed of the latest advances in technology and scientific matters". This means that the responsible group leader must learn about all hazards and risks associated with the work activities by his/her group members before the work starts.

Some responsibilities of the group leader / principal investigator / project leader

- Be informed and well aware of hazards and risks in the work place
- Keep a proper list of chemicals in KLARA and a list of microorganisms in the office
- Make sure there are **proper risk assessments** and sign them
- Make sure all people that are involved in the activities are informed about the risks
- Decide upon and provide protective equipment
- Control that work performance is safe
- Check available emergency routines
- Make sure that everybody knows the emergency routines (e.g. spills and fire)
- Listen to the employees and communicate information ”upwards and downwards”

Some responsibilities for the laboratory worker and colleagues

- Be fully aware of all risks in the laboratory
- Be fully aware of any needed protective measures
- Use protective measures required
- Fully comply with applicable rules
- Inform your group leader on any unsafe activities in the lab
- Report incidents and accidents
- Inform co-workers
- Be aware of emergency routines

Safety delegates (skyddsombud)

- Represent and are elected by the employees
- Can shut down a lab if he/she considers the work therein to be dangerous to staff
- Becomes gradually educated through repeated courses
- Often involved to prevent accidents and to help if incidents/accidents happen
- Partake in Work Environment Council meetings.
- Has no formal “responsibility” for the work environment
- Has a responsibility to work actively to prevent accidents/incidents
- Participates in safety inspections (skyddsronder)
- Has paid time for safety work and may not be “punished” because of wrong or unpopular decisions

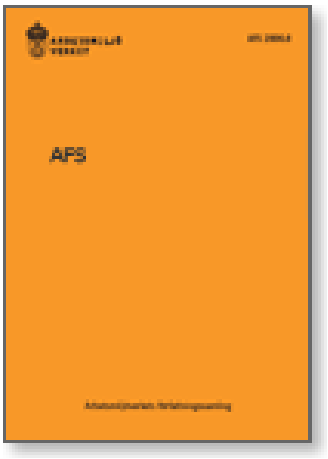
How do you find the safety regulations at KI and/or at MTC?

MTC has some rules (these in fact) and links on the MTC intranet, but several rules and regulations are also available on the KI homepage under “Laboratory Safety”[1].

[1] https://internwebben.ki.se/en/laboratory-safety

The direct rules that MTC and KI have to follow are collected in the different "Prescriptions" (AFS) from the Swedish Work Environment Authority. Several of these are available also in English.

Some relevant provisions for MTC



- **AFS 2005:01**
  Microbiological Work Environment Risks – Infection, Toxigenic Effect, Hypersensitivity
  With updates in AFS 2012:07
  (Mikrobiologiska arbetsmiljörisker - smitta, toxinpåverkan, överkänslighet)

- **AFS 2005:05**
  Cytostatics and other drugs with longstanding toxic effect
  (Cytostatika och andra läkemedel med bestående toxisk effect)

- **AFS 2011:02**
  Contained use of genetically modified microorganisms
  (Innesluten användning av genetiskt modifierade mikroorganismer)

- **AFS 2011:18**
  Occupational exposure limits
  (Hygieniska gränsvärden)

- **AFS 2014:43**
  Chemical safety risks
  (Kemiska arbetsmiljörisker)

Chapter 3: Organisation of Work environment protection at KI and MTC

At KI level

Work Environment Committee (skyddskommitté)

In Accordance with work environment regulations, KI has a central work environment group (arbetsmiljönämnden). In addition, KI has decided that every department should have their own local work environment council (arbetsmiljörådet)

Biosafety Committee

KI has a special committee that handles biosafety issues, including GMM permits. The committee also creates regulations, like for handling of blood and human specimens, vaccination policy, infection risks for pregnant employees, etc. Each department has a biosafety contact person that communicates regularly with the committee.

Environment and Security unit at KI

There are several individuals at KI dedicated to laboratory safety issues that advice on these matters to the departments. These persons are:

- Laboratory Safety Coordinator
- Biosafety Coordinator
- Chemical Safety Coordinator
- Fire Safety Coordinator

At MTC level

Head of Department and Group leaders

The Head of Department has been delegated with the overall responsibility for the work environment in his/her department. These responsibilities have in turn been delegated by the Head of Department to each Group leader.

MTC Work Environment Council

The MTC Work Environment Council (Arbetsmiljörådet, AMR) has representatives from all employee groups and gives advice to the Head of Department on work environment issues. In addition, AMR

- makes local regulations
- performs yearly work environment safety inspections
- evaluates incident and accident reports
- informs and advices staff on safety issues

Chemical Delegate

Two (at present) chemical delegates (kemikalieombud) have been appointed at MTC by the Head of Department. He/she is responsible for chemical safety at MTC and also for the KLARA register, see below.

Biosafety contact person

One Biosafety contact person has been appointed at MTC by the Head of department. He/she provides advice to group leaders and other investigators at MTC on how to risk assess biological agents

(Chapter 4) and how to make GMM applications (Chapter 5). He/she also has the task to make sure that appropriate forms and permissions for general biological safety issues are at hand at MTC.

The biosafety contact person is the formal liaison between MTC and the Biosafety Committee at Karolinska Institutet.

Laboratory responsible

The work environment council has a contact person (laboratory responsible person) in each research group/laboratory. He/she is responsible for sharing and providing updated information within the group on safety issues. The Work Environment Council arranges a meeting with the laboratory responsibles every semester in order to facilitate and promote the exchange of such information.

In addition, there should be at least one person in each group responsible for the group's chemical inventory in KLARA (kemikalieinventerare). These two functions may be carried out by the same person.

Safety delegates

There must a safety delegate (skyddsombud) in any workplace with more than five employees. Thus, MTC has appointed safety delegates that help employees (e.g. you) in work environment and safety issues. See also Chapter 2: Rules and regulations.

Introduction of new employees

All new employees at MTC are systematically introduced to KI/MTC rules and regulations. A computerised **safety instruction program** covering laboratory safety and common rules has to be passed before access to MTC laboratories can be granted.

Language ability

In order to maintain a safe environment, it is necessary that everyone working at MTC is able to read and understand the safety instruction program and the safety regulations described therein. Furthermore, each individual must be able to orally discuss these items, at any time, either in Swedish or English. Failure to do so may prevent the individual from working in the laboratory.

Summary of responsibilities and advisory functions

Level	Responsible	Advice
KI	Vice-Chancellor	Work Environment Committee
MTC	Head of Department	Work Environment Council Biosafety contact person
Research group	Group/research leader	Lab. responsible person
Laboratory	Employee / Research student	Safety delegate / Student representative

Chapter 4: Risk assessment in the laboratory

The risk assessment shall be carried out in order that everyone shall have a safe work environment, and to raise risk awareness.

According to the Swedish Work Environment Authority´s provision "Chemical risks at work, AFS 2011:19", risk assessments should be carried out **before** work with risk chemicals begin. Risk assessments are conducted to identify chemical hazards and these should be examined and assessed as frequently as conditions require in order to prevent accidents and injuries at work.

The Swedish Work Environment Authority's provision “Microbiological Work Environment Risks – Infection, Toxigenic Effect, Hypersensitivity, AFS 2005:01 with updates in AFS 2012:07” regarding microbiological work environment risks, describe how and when, to make a documented risk assessment for microorganisms which have not been genetically modified. For genetically modified organisms (**GMM**), the Swedish Work Environment Authority's provision “Innesluten användning av genetiskt modifierade mikroorganismer (Contained use of genetically modified microorganisms), AFS 2011:02”, states that a risk assessment **must always be carried out** (Chapter 5).

The risk assessment

The group leader is responsible to make sure that valid risk assessments are produced and updated. A valid risk assessment shall specify the identity of the persons that made the assessment. The assessment has to be printed out and then approved and **signed by** (but not necessarily produced by) **the group leader**. Risk assessments should be kept within the premises they refer to at a well-known place, be easily available and updated when/if new circumstances arise. It is important that all parties in the workplace are informed and understand the risks involved.

A written risk assessment is preferably performed in a risk assessment tool (see below). It can also be performed on a blank piece of paper provided that it contains the following content below.

The risk assessment should contain/provide information on:

- Method description
- Premises
- Substances/products
- Classification
- Risky moments and situations
- Exposure
- Personal protection
- Preventions
- Actions in case of accident or spill
- Estimated total risk
- Name of the risk assessor
- Signature (group leader)

Risk assessments of risk chemicals

The chemical registry KLARA used at KI contains a **module for risk assessments** and it also provides a practical instruction, risk phrases and Safety Data Sheets. It is highly recommended to perform all risk assessments on hazardous chemicals in KLARA. After completion, the risk assessment should be printed, signed and stored in the laboratory file. A note on a new or edited risk assessment shall be sent to the AMR coordinator.

Risk assessments must be performed before the use of hazardous chemicals.
Hazardous chemicals are those labelled with a hazard pictogram.

Risk assessments on infectious microorganisms

Microorganisms are classified into 4 different risk groups based on their association with and resulting severity of disease in humans. Microbial agents not associated with disease in healthy adults are classified under risk group 1. Microbial agents classified under risk groups 2-4 are associated with increasing hazard to both the laboratory worker and the community. In appendix 2 B to the provisions on microbiological work environment risks ("Microbiological Work Environment Risks – Infection, Toxigenic Effect, Hypersensitivity, AFS 2005:01 with updates in AFS 2012:07[2]"), there is a list of bacteria, viruses, fungi and parasites classified in risk groups 2-4, to be used as a guideline during risk assessment.

Risk assessments must be performed before the use of microorganisms in risk groups 2-4.
A risk assessment might also be necessary for microorganisms classified under risk group 1.

The Biosafety Committee at KI has created **a risk assessment form** for microorganisms, called **BARA** (Biological Agents Risk Assessment). The form can be used to assess the risk of handling microorganisms (including cell cultures), as well as the handling of other biological material, such as blood. Note that there is a separate form for handling microorganisms in animal experiments, which is called BARA-Animals.

- Note that the BARA form should **not** be used for microorganisms that have been genetically modified (Chapter 5 on GMM).

Summary on Demands for Risk assessments

	Demands	Forms
Chemicals	Only for risk chemicals	KLARA
Microorganisms	Only for risk groups 2-4	BARA
Genetically modified organisms (GMM)	All	The Work environment authority forms for GMM (chapter 5)

Note that MTC requires relevant and correct risk assessments in each laboratory.
Failure by the group leader to provide these upon inspection may lead to **a fine of 20 000 SEK** per month until this requirement has been fulfilled.

[2] http://www.av.se/lagochratt/afs/afs2005_01.aspx

Chapter 5: Genetically Modified Microorganisms (GMM)

The handling of Genetically Modified Microorganisms (GMM) shall be authorized by, or reported to, the Swedish Work Environment Authority. GMM refers to all microorganisms **and cell cultures** that have been genetically modified in an unnatural manner. It is not necessary that the genes have been integrated in the genome, or have been constructed by the user for the agent to be considered a GMM. The regulations for handling GMM are found in the provisions 'Contained Use of Genetically modified Microorganisms'[3,4] (in Swedish and English).

Definition of GMM (according to the laws SFS 2000:271)

GMM (Genetically Modified Microorganism): A microorganism, of which the genetic material has been altered in a manner that would not occur naturally, through mating or natural recombination.

Microorganism: Each microbiological unit, cellular or non-cellular, which can reproduce or transfer genetic material, including viruses, viroids, and animal or plant **cell cultures**.

Exceptions: What is not a GMM?

- Organisms that are created through mutagenesis (using e.g. radiation or chemicals)
- Microorganisms that are created through cell fusion of prokaryotic species exchanging genetic material through known physiological processes
- Microorganisms that are created through cell fusion of eukaryotic species, including the creation of hybridomas and fusions of plant cells
- Microorganisms that have been genetically modified in nature, such as antibiotic-resistant bacteria isolated from a patient

The group leader has the responsibility that Risk assessments for GMM are performed and applications for GMM are submitted, and that the MTC Biosafety contact person is fully informed about the process.

The Biosafety contact person at MTC provides group leaders and MTC staff with advice on making the GMM risk assessments and on making the GMM applications. It is however each group leader's responsibility to make, keep and update these documents. The filled-in forms are submitted to the KI Biosafety coordinator (biosakerhet@ki.se).

Classification of negligible risk, low risk and risk-filled activities

The handling of GMM is divided into three risk levels: F (negligible risk), L (low risk) and R (risk-filled activity). Examples of how this division is made can be found below. Note that the risk assessment regulates which risk level to be applied.

- *E. coli* (laboratory adjusted strain) carrying an insulin gene on a regular plasmid: negligible risk (F)
- Human cell culture carrying a GFP (green fluorescent protein) gene on a regular plasmid: negligible risk (F)
- *Listeria monocytogenes* carrying a human gene: low risk (L) since *Listeria* belongs to risk group 2

- Risk assessments must be performed for all work involving GMM
- Work with GMM must always take place according to a notification / permit

[3] http://www.av.se/lagochratt/afs/afs2011_02.aspx
[4] https://www.av.se/globalassets/filer/publikationer/foreskrifter/engelska/contained-use-of-genetically-modified-micro-organisms-provisions-afs2011-2.pdf

Chapter 6: Handling of chemicals

This is well described on Karolinska Institutets homepage under Laboratory safety/Chemical safety.

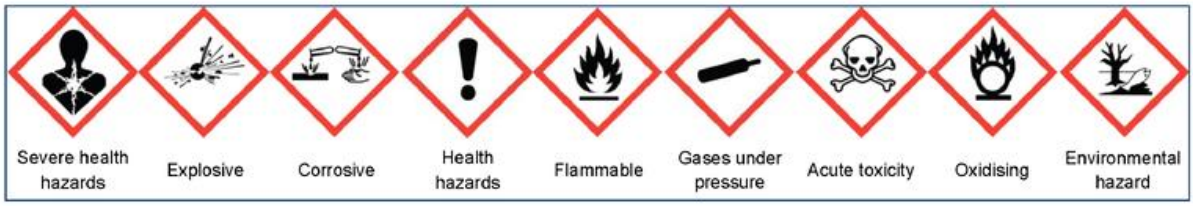
Written information on risks and safety

A safety data sheet (SDS), which was received from the supplier of a risk chemical, shall be kept readily available to the employees concerned. It is recommended to be stored together with the risk assessments.

A risk chemical may not be used until the risk assessment is available.

Groups of risk chemicals

Risk chemicals are dived into nine groups, each with its own pictogram. For further information, please click on a pictogram below[5].



1) Peroxide-forming (oxidising) chemicals are regulated in a separate document[6] with instructions for the management of these products.

2) Several chemicals are classified as Cancerogenic/Mutagenic/Reprotoxic – CMR (included in the Health Hazard pictogram). When working with **CMR-classified chemicals**[7]**,** in the case of harmful levels of exposure, a register has to be established that is kept for 40 years at the department.

3) F**lammable products** (for example organic solvents and gases):
Maximum 50 L per fire cell is allowed; otherwise they should be stored in **fire-classified cabinets**. A common example is ethanol.

All chemicals at KI shall be **registered in KLARA**

The KLARA Product database

According to the law (AFS 2011:19 and SFS 1998:901) all organizations and companies must keep a register of chemical products and biotechnical organisms that may pose a risk to health and/or environment.

At Karolinska Institutet, this registry shall be conducted in KLARA and kept up to date by an annual inventory at the beginning of each year by each group.

[5] http://echa.europa.eu/web/guest/chemicals-in-our-life/clp-pictograms
[6] https://internwebben.ki.se/en/peroxide-forming-chemicals
[7] http://internwebben.ki.se/en/cmr-classified-chemicals

In KLARA it is possible to:

* Search for chemical products in the product database (about 40,000 items)
* Keep a chemical register and make inventories
* Read about risks and risk phrases
* Perform risk assessments and print them

All employees and students at KI campus (with the correct IP address) should have access to the product database, where information and safety data sheets for chemical products can be found.

In order to add chemicals to the group list a **personal login** is required, and each group has at least one such person, usually the lab. responsible person. For practical questions about KLARA contact the MTC Chemical responsible person.

KLARA product database[8]

Labelling and signs

Packages and containers holding risk substances shall, when the substances are in use, stored or constitute waste, besides its name always be labelled with the respective pictogram. For your personal tubes and flasks, pictogram labels are available at the service unit.

List of chemicals

Each workplace shall have one or more lists, which together provide information as to which risk chemicals are handled there.

The list of risk chemicals shall

- be kept up to date
- have a supplementary list with risk chemicals added since the printout
- be updated at least once a year.
- shall be printed out from the KLARA register
- not contain any chemicals that are no longer stored
- be kept easily seen at the entrance of the laboratory

- **Before you start work** with risk chemicals a **risk assessment** shall be conducted using KLARA. The risk assessment should be printed, signed (group leader) and kept easily available in the premises were the activity takes part. More information here: http://internwebben.ki.se/en/risk-assessment-chemicals[9] and in Chapter 4.

There is a lot of helpful information on "Internwebben" under
Laboratory safety, Chemical Safety[10].

[8] https://secure.port.se/alphaquest/app_kikem/pcmain.cfm
[9] http://internwebben.ki.se/en/risk-assessment-chemicals
[10] https://internwebben.ki.se/en/chemical-safety

Chapter 7: MTC Chemical Storage Guidelines

This guide is not exhaustive, and users need to refer to other sources as well, for example information in the specific Material Safety Data Sheets (MSDS) or information provided by Karolinska Institutet[11].

Some basics

A) Store "like with like": different types of chemicals need to be stored separately:

1. Acids: strong acids should not be stored with bases or alcohols.

2. Bases: should not be stored in the same cupboard as acids

3. Flammable solvents: Examples are alcohols, toluene and other organic solvents with a flash point of 32ºC and below.

Flammable solvents should be stored in ventilated and fire-classified cabinets, clearly labelled and positioned away from entrances, emergency exits and escape routes. Keep as little flammable solvents in the labs as possible **(maximum 50 L per fire cell)** and prevent contact with sources of sparks.
Flammable solvents **SHOULD NEVER** be stored with oxidising agents, reducing agents or concentrated acids.

4. Volatile and malodorous chemicals such as formaldehyde, mercaptans and amines should be stored in ventilated cabinets. If you do not have a ventilated cabinet, these noxious chemicals can be stored in sealed secondary containers that should only be opened in a chemical hood.

5. Oxidising agents should be stored away from organic matter such as wood and paper. Oxidising agents must never be stored with flammable solvents or reducing agents since fires and explosions can result after any spillage, even without a naked flame or heat.

B) Less is best: Store the minimum stock levels of hazardous chemicals required in the laboratory. Working volumes of flammable solvents should be minimised (500 mL or less) and used in the chemical hood.

C) If required, store solvents in spark-proof refrigerators or freezers.

D) Do **not** use chemical hoods for chemical storage!

[11] https://internwebben.ki.se/en/storage-chemicals

Chapter 8: Chemical spills and waste

Chemical spill

In case of a spill of chemicals[12], this should be handled according to the circumstances.

In case of **risk chemicals**, it is important to take immediate action to prevent personnel from being injured. Standard procedures might be:

1) Leave and lock the area
2) Warn your colleagues
3) Read the risk assessment and/or safety data sheet for the current chemical (outside the laboratory)
4) If possible, take care of the spill yourself
5) If necessary, contact a specialist for advice, e.g. the chemical delegate

Never let the cleaning staff clean up a chemical spill! They do not have skills for this.

6) Each corridor has a wagon that contains equipment to take care of spills, called the Emergency wagon. Fetch this wagon and other necessary equipment.
7) Put on necessary protective clothing, e.g. lab coat, gloves, cap, mask, glasses or face shield, etc.
8) Enter the laboratory, absorb the spill with absorbent material (paper towels, vermiculite, etc.), pick it up, sweep the floor for broken glass or other material and put everything into a separate container.
9) Label the container well and leave it in the chemical waste room (see below)
10) Report the spill incident as an incident on the MTC forms (Chapter 19)

Note: Practice of emergency routines, e.g. for spills, must be performed in each research group, so that all laboratory workers are fully aware about the above principles at all times.

Chemical waste[13]

A safe and efficient waste management is based on knowledge, responsibility and collaboration throughout the entire chain. Everyone must take responsibility so work injuries, environmental damages and costs can be minimized.

The individual producer of the waste has a major responsibility that it does not end up in the environment and that outside persons do not become exposed to hazardous substances.

The basic principle[14]

Some chemicals may be discarded as household waste. Any waste that contains risk chemicals must be sorted and labelled correctly so it can be transported safely on its way to the destruction facility.

[12] https://internwebben.ki.se/sites/default/files/nodlagesrutin_spill_utslapp_en_20120612.pdf
[13] https://internwebben.ki.se/sites/default/files/avfall_avlopp_en_20120604.pdf
[14] A number of innocuous substances (water, buffers, etc) are used in reusable glassware. After use, this glassware is put into blue plastic crates that are picked up by the dish-washing personnel for washing before reuse.

Laboratory chemical waste consists of all pure chemicals and preparations with a chemical content that differ from normal household waste. Normally they should be collected in proper containers and delivered to the room for chemical waste (at present (2015) room nr A208c). To get access to the room please contact the service unit. It is important that the chemicals are properly packed and labelled; if not in the original container, special labels are available in the room. Note that empty original containers may also need to be discarded in the room for chemical waste.

Emissions to waste water[15]**.** Certain fluids may be poured out in the sink into the general waste water system. This is described in the KI rules for laboratory waste management. All other chemicals should be handled according to information in the safety data sheet (see KI chemical register KLARA). A quick user guide[16] for the disposal of the most common chemicals is also available on the KI home page

Culture media supplemented with antibiotics

Special rules apply for all handling of antibiotic compounds in the laboratory; see moment 2 in Document Laboratory Waste[17].

[15] https://internwebben.ki.se/sites/default/files/avfall_avlopp_en_20120604.pdf
[16] https://internwebben.ki.se/en/node/5333
[17] https://internwebben.ki.se/sites/default/files/avfall_avlopp_en_20120604.pdf

Chapter 9: Microbiological risks and risk groups

Microorganisms, definition of

In the (Swedish) legislation, microorganisms in the laboratory comprise **prions**, virus, bacteria, fungi, parasites and **cell cultures (!).** Although cell cultures are seldom infectious to humans, they could for instance carry a microbiological agent of an infectious nature, a fact that has to be considered in the risk assessment.

Laboratory associated infections (LAI)

There are few regular statistical investigations on LAI:s, why the real frequencies of their occurrence is mainly unknown, but case reports appear from many laboratories, also from MTC.

During 2010-11 there was an outbreak[18] of 109 cases, with one death, of a strain of *Salmonella Typhimurium*, used for teaching and practising purposes, in 38 different states in the USA. Laboratories with a good training in Biosafety showed less number of cases.

Working with microorganisms always constitutes a risk of contamination and/or infection of the worker (yourself), the surrounding workers (your colleagues), the environment (air and waste /waste water) and persons outside the laboratory (your family, friends, etc.). It lies within your responsibility and personal interest to diminish the risks for such events.

The main routes of infection in the laboratory

- Direct contact with infectious material on skin or mucous membranes.
- Indirect contact on skin through contact with contaminated materials, such as door handles, pipettes, centrifuges, unclean bench surfaces, pens, mobile telephones, etc.
- Cuts and punctures with contaminated sharps, such as scalpels, scissors or needles
- Through air in the form of aerosols and dust (= dried aerosols), which are inhaled and transported to the lungs. Aerosols are always created to some extent when handling liquids in the laboratory, especially during vortexing, centrifugation, suspending organisms, and pouring off liquid material.

Please note that many pathogens survive for very long times in the dried form, i.e. in the dust (while others die upon drying).

- Waste generated by microbiological work may constitute a specific problem, see chapter 15. Please remember that **no living organisms** (including cell cultures and non-infectious microorganisms) may be disposed **in the sink** to the general waste water system.

Infectious dose

Different microorganisms need various numbers of cells or particles to be able to cause an infection. This number is called the infectious dose and varies a lot between different microorganisms; the infectious dose of Hepatitis B virus is about 5 particles, maybe even less for *Mycobacterium tuberculosis*, while almost 50 000 particles are needed to cause an infection with *Bacillus anthracis*.

[18] http://www.cdc.gov/salmonella/2011/lab-exposure-1-17-2012.html

Relative risk

The relative risk of acquiring an infection with a specific agent is a function of the **infectious dose** of the actual strain used and the **opportunity for exposure**.

Risk for Laboratory associated infections = opportunity for exposure / infectious dose

Risk groups

In order to help the designation of laboratories and assessments of risks, medically important microorganisms have been divided into four risk groups.

- **Risk group 1**, no or very low individual or community risk
  Unlikely to cause human or animal disease
- **Risk group 2**, moderate individual risk, low community risk
  Can cause disease, usually not serious. Treatment and prevention available
- **Risk group 3**, high individual, low community risk
  Serious disease. Treatment and prevention usually available
- **Risk group 4**, high individual and community risk
  Serious disease, readily transmissible. Treatment and prevention usually not available

The work environment authority has issued lists of microorganisms belonging to the different risk groups (AFS 2005:1, app. 2B)[19] (in Swedish).

Biosafety levels

Laboratories are classified into four BioSafety Levels (BSL 1-4) and in order to work with an organism of a certain risk group, you need a laboratory at a Biosafety level of at least the same magnitude.

Risk group	Biosafety level needed
1	1
2	2
3	3
4	4

During practical work, non-infectious microorganisms are dealt with in BSL-1 laboratories. Many microorganisms handled at MTC belong to risk group 2, and thus need a BSL-2 laboratory. Risk group 3 microorganisms are dealt with in BSL-3 laboratories, which are considered as "special" laboratories, or "safety laboratories". BSL-4 laboratories are very rare, only about five of them exist in Europe in 2015.

At MTC a BSL-3 laboratory is in use, at present (2015) for work with HIV and Chikungunya virus. All other laboratories deal with a mixture of infectious and non-infectious microorganisms, including GMM at various risk levels. Therefore, MTC has decided that **all laboratories at MTC must function at the BSL-2 level, and** as such comply with BSL-2 laboratory features and working descriptions. The demands for the various Biosafety levels are specified in the AFS:2005:1, app. 3C[12].

[19] http://www.av.se/lagochratt/afs/afs2005_01.aspx

Chapter 10: The Biosafety level (BSL)-2 laboratory

The laboratory[20]

The microbiological laboratory designed for work with microorganisms in risk group 2[21] needs certain features:

- A clearly visible biological hazard sign at the entrance to the lab (see above)
- Restricted access; only fully-informed personnel are allowed.
- A dead end, i.e. no passage to activities at other safety levels, including office space.
- Effective and directed ventilation, i.e. air goes out from the laboratory to the outdoor air.
- Possibilities for an effective and safe waste handling, like space for waste sorting, available autoclave in the building.
- Floor resistant to water and chemicals "in one piece" and floor mats walled-up against the wall. No water outlets in the floor.
- Possibility to connect microbiological safety cabinets to outgoing air at proper locations.
- Easy to clean and to disinfect surfaces and minimal "dust traps"
- Hooks for laboratory coats at the exit door.
- Wash basin (preferably hands-free) with soap, disinfectant and towels, at the entrance/exit door.
- A landline telephone fixed on the wall at low level for emergency calls.

Protective equipment

The use of a laboratory coat is mandatory. Other protective gear is dependent on the risk assessment(s).

Against airborne infections

Various forms of protective ventilation devices are often used to avoid airborne spread of microorganisms and chemicals, see chapter 11.

Personal protective equipment (PPE)

A number of protective items may be used in the BSL-2 laboratory, see chapter 12.

[20] https://internwebben.ki.se/sv/node/19353
[21] Note that this classification of laboratories in safety levels (BSL 1-4) is valid only for infectious risks in the laboratory.

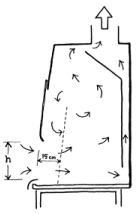
Chapter 11: Chemical hoods and Microbiological Safety Cabinets

Since a lot of work in the microbiological and chemical laboratory may contain risks for airborne infections and toxic gases/fumes/dust, the use of ventilated work areas constitute an important part of the protective measures in the laboratory. They all aim at eliminating the risk for airborne exposure to infectious agents or to chemicals during the work. Besides, MSC type II cabinets also protect the product (cell cultures, DNA preparations, etc.) from contamination.

Chemical hood

The chemical hood (dragskåp) sucks out air from the laboratory directly to the outer air and is used to protect the worker from volatile chemicals, fumes, gases, smells, etc.

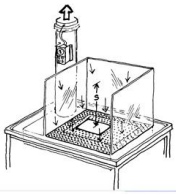
Dragskåp
Chemical hood



Ventilated bench

It is a bench with a down flow of air through holes in the bench surface. It is used in work with e.g. chemicals in powder form, in microbiological work to limit the spread of unavoidable aerosol formation of bacterial suspensions, working with gases that are heavier than air, etc.

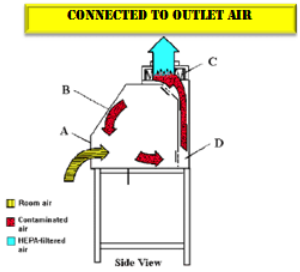
Ventilated bench



Microbiological Safety Cabinet type I[22] (MSC I)

Most commonly used protections against airborne infectious material are the Microbiological Safety Cabinets of type I and type II (MSC I and MSC II). Please remember that all protection in these safety cabinets is dependent upon a continuous and free airflow; the protective function of these cabinets is severely impaired if the outlets are blocked by e.g. laboratory material or waste.

MSC I



A. front opening
B. sash
C. exhaust HEPA
D. exhaust plenum

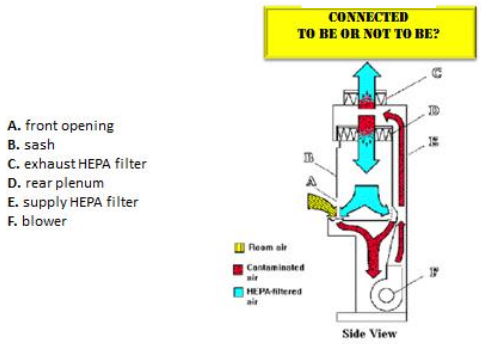
MSC I functions like a chemical hood, which gives a very good **personal protection**. However, the outgoing air is filtered through a HEPA filter, to remove all microorganisms, which also protects the outer environment.

[22] https://www.av.se/globalassets/filer/halsa-och-sakerhet/mikrobiologiska-sakerhetsbankar-pm.pdf

Microbiological Safety Cabinet type II (MSC II)

MSC II circulates HEPA-filtered air within the cabinet, and sends a sterile laminar airflow over the working area inside the cabinet. Only about 25 % of the airflow is exchanged during work. When handled correctly, this results in good **product and personal protection**. Since the outgoing air passes a HEPA filter, this air may be let out into the laboratory, but in order to avoid the outlet of chemical gases and smells, the MSC II is preferably connected to the outlet ventilation.

MSC II



In some cases there may only be a need for protection against splashes to the eyes and other mucous membranes. For this purpose a splash protection glass shield or personal goggles/visor or face shield would suffice (chapter 12), while a MSC II would merely constitute a complicated and expensive alternative.

Laminar flow cabinet

Certain (old type) cabinets flush air through a HEPA filter as a sterile laminar flow above the product against the worker. This constitutes a good protection of the product but actively flushes any potentially damaging chemical and/or microorganism onto the worker. Such cabinets should **not** be used in connection with microbiological work.

Laminar flow

Positioning in the laboratory

Each passage outside a hood or a safety cabinet negatively affects the airflow. Thus, the ventilated work space shall always be positioned in the laboratory so as to minimize the movements of personnel in its vicinity. Besides, the work in these is often of a delicate nature, why a position in a quiet corner may be of double benefit.

Should you use MSC I or II for personal protection against microorganisms?	
Class I advantages	Class II advantages
Safer because of less tendency to air turbulence	Production protection gives a more versatile use, e.g. during cell culture
Easier to work inside	Does not necessarily need connection of out-going air, i.e. easier to place in the laboratory
More robust – less risk for breakdowns	
Less noise	
Cheaper	

Chapter 12: Personal Protective Equipment (PPE)

In order to protect the worker in the laboratory certain personally worn equipment may be necessary, so-called Personal Protective Equipment (PPE).

Laboratory coat

At MTC all laboratories are classified as BSL-2 (chapter 10). In BSL-2 laboratories a laboratory coat shall be worn to protect the worker and his/her clothes from being contaminated with chemicals and/or biological agents.

The coat shall always be worn in the laboratory and removed before leaving it. However, if you are quickly crossing your own corridor, for example from the lab to the apparatus room, you might keep the lab coat on for practical reasons.

When leaving the laboratory, the coats should be left on suitably located hooks near the wash basin and the entrance/exit door. If you leave your coat at other places in the laboratory, like on the back of your chair, the coat may pose a contamination risk to other workers and visitors in the laboratory.

Laboratory coats are provided by MTC and can be picked up in corridor B1 and should also be left there for cleaning when necessary.

Gloves[23]

According to risk assessment it may be deemed of value to protect your hands by using gloves. Such risks may be during the handling of toxic chemicals, wounds on your hands, working with human blood and tissues (chapter 14), etc.

Note that gloves are not necessarily needed for normal handling of risk group 2-classed microorganisms.

NOTE:

If you use gloves and if you come into direct contact with toxic chemicals or infectious organisms, the gloves should immediately be washed according to standard procedures, alternatively replaced.

A contaminated glove will spread the chemical/microorganism as efficiently as an unprotected hand, e.g. to a keyboard, a telephone or a pipette.

Contaminated gloves are not clean/sterile!!

[23] https://internwebben.ki.se/en/protective-measures-biosafety#gloves

Gloves may not be used outside the laboratory. However, if you are crossing your own corridor, for example between labs, you might keep one glove on, but you must not touch anything with a (contaminated) glove in the corridor. If gloves are deemed necessary in the apparatus room (or equivalent lab which you enter), do not forget to put on a new pair of gloves.

During **transport** outside the laboratory you should use a secondary closed container[24] to protect against accidents, yourself and other people in the corridors, but **not gloves**.

Another use of gloves may be to protect the product from contamination with human debris. This use is not within the scope of these regulations, but the above rules are still valid. (The risks of contaminating a clean glove upon use are also valid.)

Types of gloves

In the MTC plastic shop two kinds of gloves may be purchased:

- "Examination gloves" are made of vinyl and mainly used to protect the product.
- "Laboratory gloves" are usually orange, made of nitrile and are mainly used to protect the worker against certain chemicals and biological agents. They are e.g. tested for non-penetration of microorganisms.
- Many other types of gloves may be needed for special purposes, but have to be purchased from outside according to the KI frame agreement[25] on gloves.

Please note that the use of gloves

- Constitutes a risk for developing contact allergy
- May cause a false feeling of safety and thus increase the risk of spreading chemicals and/or biologicals within the laboratory
- May make it more difficult to perform sensitive operations
- Bring costs to the group
- Is not allowed outside the laboratory

"It is better to have a clean laboratory without gloves
than a contaminated laboratory with gloves"

Mask/goggles/face shield

The above may be used to protect against splashes in the laboratory. The group leader must provide these if the risk assessment so states. They are also usually important when handling spills and other accidents with chemicals and/or infectious organisms.

Note
If there is a need for protection against airborne infectious organisms and/or toxic chemicals then ventilation masks with specific filters may be needed.

[24] A secondary container should be sealable and not break or open upon an accidental drop to the floor. Simple but sturdy and well sealable lunchboxes are often sufficient.
[25] https://internwebben.ki.se/sites/default/files/handskavtalet_2013.pdf

Chapter 13: Good Microbiological Practice (GMiP)

The most important part of your protection against microbiological agents or toxic chemicals lies in how you manually handle the material. In fact, almost every experiment **could** theoretically be performed at home in your kitchen, **if** you could rely upon a continuous and completely safe handling of the material, e.g. no touching, no contamination of yourself or your clothes, no aerosol creation and a safe waste treatment. This is what the GMiP is about.

Some elements of GMiP in the BSL-2 laboratory

- Order and cleanliness
- No rings, no bracelets, and no untied hair
- Protective clothing in (but not outside) the working area
- No eating, drinking, smoking, touching face
- Appropriate personal protective equipment (PPE)
- Proper waste handling
- Limited access, no passing through
- Routines for dealing with unwanted events

- Work in a proper way so as not to contaminate the material nor yourself
- Minimize aerosol formation and risks for spillage and splatter
- Avoid sharp objects
- After use, transfer syringes (and other sharp objects) immediately to containers intended for infectious waste/sharps[26] without recapping syringe needles
- Wash and/or disinfect the hands
  - upon skin contact with infectious agents or toxic chemicals
  - after using gloves
  - when work is finished

Note: Only work with risk-containing activities that are properly assessed (in risk assessments)

Other issues of importance

- Proper risk assessments, signed and available
- Properties of the microbiological agents being handled are known, all agents used are listed (including cell cultures)
- Everybody is trained in laboratory safety
- Only certified personnel are allowed
- Incident reporting and emergency routines exist

[26]"Smittförande, skärande/stickande"

Note

The GMiP does not develop by itself – it needs

- Education/training
- Practice
- Available equipment
- Repeated inspections

Chapter 14: Human blood and other samples of human origin

Many biomedical laboratories of various kinds work with human samples, most commonly blood samples, but also other tissues, primary cell cultures, faeces, saliva, urine, sputum, etc.

For this type of work, special instructions are available at the KI homepage:

Rules for the handling of blood and other human sample materials[27]

Definition

In this context ***human blood*** is defined as blood products/tissues and material that has come into contact with blood/blood products/tissues that have not been decontaminated. This includes therefore, blood plasma, spinal fluid, sputum, primary cell cultures, etc.

Note
Since the work with *human blood* is so widespread, and it does not normally contain a cultivation of microorganisms ***per se***, a BSL-2 laboratory is not formally required for this type of work. However, the main precautions are very similar.

Risks involved

A contamination of the worker's blood with the material constitutes the main risk in the laboratory dealing with *human blood*. This may happen through blood spill or splashes on damaged skin (wounds, fissures, eczemas) or on mucous membranes (eyes and mouth). Furthermore, contaminated sharp objects (syringes, scalpels, etc.) may penetrate the worker's skin[28].

Main causes for infection are

1) Hepatitis B virus (HBV)
2) Hepatitis C virus (HCV)
3) HIV

The most infectious agent is Hepatitis B.
As little as 0.0005 mL (a non-visible micro drop) of blood, from a patient in the acute stage, may contain an infectious dose.

Besides, there may be patients with Hepatitis D and G, HTLV 1 and 2 (human lymphotropic virus) etc. Also bacteria and parasites in the blood have been reported to be transferred to laboratory workers in this way.

[27] https://internwebben.ki.se/sites/default/files/rules_for_the_handling_of_blood_and_other_human_sample_materials_1.pdf
[28] Please note that handling of human blood very often involves the use of sharp objects

Also please note that even if the patient does not suffer from any of the above agents/diseases, the patient may still be infected by any of the several unknown/suspected agents that we do not have proper tests for.

Thus, **all human blood is treated as potentially infectious** according to the "blood regulations"

Measures

Risk assessment shall be performed in BARA.

- Gloves should be used during handling of human blood samples.
- All involved personnel, including cleaning and service personnel, shall be vaccinated against Hepatitis B[29], which is provided free by KI[30] (call Previa).
- Splash protection is highly recommended, like a sheet of (plexy) glass or face shield/goggles
- The use of safety cabinets is not necessary.
- Working area for human blood should be properly marked for this purpose.

Handling instructions

are necessary besides the risk assessment and shall contain at least

1) Where handling of the *human blood* may be performed.
2) Who is responsible.
3) Who is educated to work with *human blood.*
4) How new staff members will get training about infection risks, routes of transmission and protection measures, including vaccinations, before they begin their work.
5) Choice of protective equipment.
6) Which procedures should be used, such as GMiP.
7) Management of solid and fluid waste materials.
8) Incident procedures, including contact details.
9) Procedures for transporting materials within and outside of KI, if applicable.
10) Other staff that may require information about the risks and how this will be executed.

Accidents

Spill of human blood on a surface should be wiped up by a cloth drenched in "45+" (surface disinfectant, based upon isopropanol and a cleaning tensid, 70 % ethanol or equivalent disinfectant. Note that ethanol will poorly dissolve a dried up blood stain.

If human blood splashes into an open wound or in your eyes or mouth: Rinse with water or saline, wash and disinfect the area carefully.

The same goes for needle sticks and cuts where human blood is inoculated.

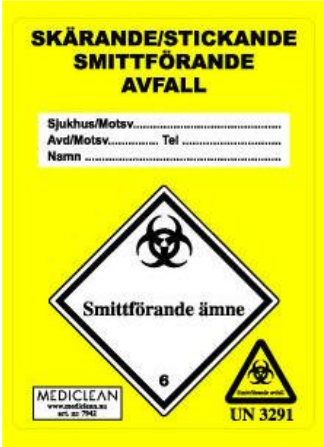
Do not forget to report the incident/accident (chapter 19)!

[29] https://internwebben.ki.se/sv/vaccinationer
[30] https://internwebben.ki.se/sv/node/4338

Chapter 15: Infectious waste, sharp objects and household waste

(KI has a comprehensive document on liquid and solid waste)[31]

No living microorganisms from the laboratory work (cultivated or present in *human blood*/biological samples) may reach the outside of the laboratory through the sink outlet.



1) **Infectious waste** includes *human blood* and blood products, micro-organisms, cell cultures and materials that have come into contact with these items (gloves, pipettes, tubes, paper towels, etc.). It also includes liquid cultures in glass or plastic flasks, agar plates, etc.
   a. **Infected material for washing** includes glass or plastic containers and any kind of items (e.g. scissors, forceps, glass pipettes, mortars) contaminated with viruses, bacteria, parasites, eukaryotic cells or other potentially infectious materials.
      i. Put infected items into a yellow box, to be autoclaved. The box should be labelled with your room number. N.B. No closed bottles!
      ii. These boxes are collected by the dish-washing personnel and autoclaved before the content is washed.
   b. **Infected material to be discarded** includes all disposable material, as well as tissue/cell cultures and human samples.
      i. Put everything into the big *yellow bin* (hazardous waste container). The *yellow bin* has a lid lying loosely upon the box during normal use. Note that only liquids in small quantities can be added, together with absorbent material (e.g. paper towels), larger amounts are treated as in point 1) above. Bins should be placed on the floor.
      ii. These bins are irreversibly closed by pressing the lid hard onto the bin. When the bin is full or weighs >12 kg, it is carefully closed, labelled and signed (see label above) before it is placed out in the corridor.
      iii. The bins are collected in the corridor by the service personnel and stored in MTC infectious waste room before it is finally transported to Uppsala for incineration.

Exception
At MTC **all disposable laboratory plastic ware** that has been used and **might** have become contaminated (pipettes, tips, tubes, plates etc.), whether contaminated or not, shall be discarded in the *yellow bin* for safety's sake.

[31] https://internwebben.ki.se/en/node/5330

c. **Liquid waste** that contains living microorganisms (including cell cultures).
   i. Small amounts produced during e.g. cell culture work shall be put into a specific plastic container (usually a white cylinder). When the container is filled to two thirds it is closed by a lid and deposited in the *yellow bin* that goes to autoclaving before being discarded.
   ii. Small amounts, e.g. living cultures in plastic test tubes, are deposited in the *yellow bin* together with absorbent material if needed.
   iii. Larger amounts, e.g. a litre of bacterial culture in a glass flask, are deposited in the yellow box that goes to autoclaving before the content is being discarded and the glass flask washed up for re-use.

Note
The *yellow bin* is for infectious waste, sharps and disposable laboratory plastic ware **only** – NOT for empty cardboard boxes or containers, plastic bags, etc. (=> Household waste)

2) **Sharps** includes cutting material that may harm the worker also after use. Examples are cannulas, syringes with a fixed needle, scalpels, lancets, suture needles, microscope slides, broken glass.
   a. *Sharps* are to be immediately put into specially designated, waste containers, placed on the table or inside the safety cabinet. These *sharps* waste containers are made of sturdy plastic to avoid perforations. Infectious and non-infectious *sharps* go to the same container.
   b. When the *sharps* waste container is full to 65 % it is closed and placed into the general *yellow bin* for infectious and sharps waste.
   Note that minor *sharps* waste may be placed directly into the *yellow bin.*

Note!
Needles shall NEVER be recapped – discard directly in *sharps* waste!

3) **Household waste**[32] includes everything that is not contaminated (by microorganisms or by risk chemicals), like empty cartons, empty containers, plastic bags, etc.
   a. Most of this is discarded in large waste paper baskets in the laboratory.
   b. These are emptied by the cleaning personnel, and thus must not contain anything that **might** have become contaminated, since the cleaning personnel cannot know the difference (see Exception square above).
   c. However, a number of items are collected separately for recycling purposes[33] and transported by yourself to the MTC waste room A208, e.g.:
      i. Hard plastic packaging
      ii. Soft plastic (like folios, bags)
      iii. Cardboard (empty cartons) (may be collected from the corridor by the service personnel)

[32] A number of innocuous substances (water, buffers, etc) are stored in reusable glassware. After use, such glassware is put into blue plastic crates that are picked up by the dish-washing personnel for cleaning before reuse.
[33] https://internwebben.ki.se/sites/default/files/avfall_sorteringsguide_solna.pdf

iv. Coloured glass to be discarded is collected separately
v. Non-coloured glass to be discarded is collected separately
vi. Metal (like aluminium foil and empty tins)
vii. Several other items are also recycled separately at MTC, like batteries, electric devices, electric bulbs, printer toners cartridges, paper, cardboard, etc.

Note
Laboratory glassware to be discarded, e.g. broken, is **not** to be recycled as in points iv. and v. above[34].

[34] https://internwebben.ki.se/sites/default/files/avfall_sorteringsguide_solna.pdf

Chapter 16: Work with isotopes

Work with open radioactive sources at Karolinska Institutet may only be conducted at laboratories that have received a local license for doing so. Everyone who works with radionuclides at MTC should sign that they have read KI´s local radiation protection rules[35].

In order to work with radioactive isotopes, you have to make contact with the MTC isotope group (see MTC home page). Work with chromium or iodine isotopes is only allowed in MTC isotope rooms, but in certain cases permission may be granted to work with e.g. tritium in other locations.

You also need to complete a course on radiation protection[36] given by KI.

[35] https://internwebben.ki.se/sites/default/files/null/stralskydd_ki_engelska_2012.pdf
[36] https://internwebben.ki.se/en/radiation-protection

Chapter 17: Animal experiments

All animal experiments are performed in the animal house.

In order to perform animal experiments, you need

- Certificate from the KI course on Laboratory animal science[37]
- Ethical permits[38] from the regional animal ethical committee
- Risk assessment (chapter 4) if any risks (infectious and/or chemical) are involved[39]
- GMM application/permit for experiments using GMM (genetically modified microorganisms)[40] (chapter 5)
- Two MTC documents signed
    - Work at Animal House 1, KI, MTC
    - For Principal investigators (PI) using the MTC Animal facility

When working with animals the risks involved may be higher and/or different than in the laboratory using the same material. Examples are allergic problems, difficulties in handling the animals (they bite!), animals spreading chemicals and microorganisms in the air and by the urine, production of more toxic metabolites, etc.

Note that **risk assessments specific for animal experiments** have to be made in all cases, both for "normal" risks and for GMM

All personnel handling the animals have to be fully informed about any hazards and risks involved!

[37] https://internwebben.ki.se/en/courses-laboratory-animal-science
[38] https://internwebben.ki.se/en/ethical-evaluation-animal-experiments
[39] For infectious microorganisms the special risk assessment form BARA-Animals should be used.
[40] A separate risk assessment for animal work with GMM must always be performed

Chapter 18: Microbiological spills

Microbiological spills should be handled according to each unique circumstance.

In case of **infectious microorganisms**, it is important to take immediate action to prevent personnel from being infected. Standard procedures might be

1. Warn your co-workers in the laboratory and other relevant personnel
2. Vacate the affected area and close it off to others
3. Read the risk assessment (BARA form) (outside the laboratory)
4. If necessary, contact a specialist for advice, e.g. your laboratory responsible person, group leader, MTC biosafety contact person or a member of the work environment council.
5. If it is possible, take care of the spill yourself.

Never let the cleaning staff handle a microbiological spill! They are not trained for this.

6. Each corridor has an Emergency wagon equipped with material to handle spills. Fetch this wagon and other necessary equipment.
7. Put on necessary protective clothing, e.g. lab. coat, gloves, cap, face mask, goggle or face shield, shoe protection. The degree of protection depends on the infectious routes of the spilled organism, the amount spilled, etc.
8. Enter the laboratory after a minimum of 10 min, add proper disinfectant (often 70 % alcohol or Virkon) on the spill and let it work for at least another 10 min.
9. Absorb the spill with absorbent material (paper towels, vermiculite, Versi-dry, etc.), pick it up carefully, sweep the floor for broken glass or other material and put everything into the *yellow bin* as infectious waste.
10. Report the spill as an incident on the appropriate MTC form (Chapter 19).

Note: Practice of emergency routines, e.g. for spills, must be performed in each research group, so that all laboratory workers are aware of the above principles.

Chapter 19: Incidents and accidents

Report more is good!

Report less is bad!

If there has been a mistake or error that might have affected the personnel, the laboratory or the environment, but there has not been any real physical damage to any person, this event is referred to as an **incident**. However, when an injury has occurred which has affected an individual, this event is referred to as an **accident**.

Note: The above refers to events that happen while at work at MTC/KI, as well as events that happen during travel between home and MTC.

Exception: Needle perforations that are not known/suspected to be contaminated by infectious agents, human blood (or equivalent) or by toxic chemicals shall be reported as incidents.

Incidents

All incidents should be reported on the MTC incident report form, available on the intranet. This form should be signed by the worker, the group leader and the safety delegate. Thereafter it is given to HR/Personnel, who brings the event up at the next meeting of the Work Environment Council, so that eventual shortcomings related to the work environment can be rectified as soon as possible.

Note that even evident mistakes or small errors should be reported; if the same problem happens several times, the procedures/rules might need to be changed.

Do not be discouraged to report an incident, even one due to clumsiness. Incident reports are highly appreciated. They may reveal shortcomings in the work environment that can be improved.

Accidents

Accidents have to be reported, in order

- to prevent further accidents from occurring
- to ensure that possible compensation becomes payable to the individual/s concerned

Note that **all** work-related accidents and illnesses that occur shall be reported, regardless of whether they have led to absence (as yet) from work or not.

Important steps [41]

- The group leader/supervisor shall be notified as well as the safety delegate
- The HR/personnel department helps to fill in relevant documents and to inform MTC, KI and Work Environment Authority.
- Special documents are needed to obtain possible financial compensation from KI and/or insurance.

[41] https://internwebben.ki.se/en/near-accidents-and-occupational-injuries-laboratory

Chapter 20: Fire

MTC has an evacuation alarm which sounds or flashes when activated by a smoke or heat detector. It is **NOT** however, connected to the rescue services but rather to Akademiska Hus. This means that, when the alarm sounds, the emergency services will not be dispatched until someone calls SOS Alarm on 112.

What to do

- For a suspected and/or a small fire – try to extinguish it and call Akademiska hus[42].
- For an evident and/or large fire – make sure everybody around is informed, call SOS Alarm 112 and evacuate.

Save people – Warn everybody – Call the fire brigade Extinguish the fire!

Fire extinguishers

A fire detected early is often extinguishable. Fire extinguishers are located at the "fire point" in every corridor. If the fire is no larger than a waste-paper basket, and there is no risk of personal injury, attempt to put it out. Our fire points also contain fire blankets. MTC repeatedly offers its staff courses in the handling of fire extinguishers.

Note that different kinds of fires may need different types of fire extinguishers – check the labels.

Evacuation

When the fire alarm sounds, you must go **immediately** to your **assembly point** outside Forensic Medicine.

Make sure in advance that **you know** where your assembly point is situated! Make sure in advance that your corridors and exits not are blocked!

All evacuation routes are signed and easy to follow.
All necessary information is available at each fire point. Do **not** use the elevators!

Keep together by group at the assembly point, in order to easily check that everybody is out of the building.

Note that **all** MTC (emergency) doors can be opened in case of emergency.

[42] Akademiska hus: Office time: 08-685 76 56; Non-office time: 08-685 76 87