Laboratory rules

Must be read by all users of MST-Lab at USN

Version 3.0

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Contents

1. General information

1.1 Description of Lab Infrastructure

The USN MST-Lab is located at USN Campus Vestfold, at Forskningsparken with address Raveien 205, 3184 Borre. MST-Lab is part of the National Infrastructure for Micro- and Nanofabrication (NorFab). The key information about the lab and the tools is found on the NorFab webpages (https://norfab.no/labs/usn-mst-lab/). The MST-Lab infrastructure consists of several laboratories listed in Table 1. An overview of the facility layout is shown in Figure 1 (1st floor) and Figure 2 (ground floor). The infrastructure is available every day between 07:00 and 22:30. The alarm system in the building is activated at 23:00. All users must be out of the building before that time. Lab engineers are available during normal office hours (08:00 – 16:00). Contact information for people affiliated with the lab is on display at the entrance to the lab areas.

Table 1: List of rooms in the MST-Lab infrastructure

Room #	Room name	Description
G1-10	Chemical Storage	Storage of chemicals. Not accessible by regular users. Only lab engineers have key to these rooms.
G1-11	Chemical Storage	
G1-12	Chemical Storage	
G1-14	nanoCaps	Room is used by nanoCaps
G1-16	Mechanical Workshop	
G1-17	Sawing	Contains tools for cutting wafers or other substrates.
G1-21	Biolab	Certified for biosafety level 2
G1-22	Biochemistry	Chemistry lab
G1-26	Optical Lab	Room has curtains to keep the room dark. There is an indicator outside the room to indicate if laser is in use. Do not enter when the indicator light is on. Curtains are mainly to protect passersby from direct or reflected laser, especially to the eyes. Additionally- it blocks outside light so that sensitive equipment can detect faint optical signals
G1-27	Gas Chromatography	
G1-28	Glovebox	
G1-29	Hall effect Lab	Room has curtains to keep the room dark
G1-30	Bioelectronics	Contains equipment for ultrasound
G1-31	Facilities	Contains facilities for ventilation, humidifier, DI-water and water-cooling.
G1-32	nanoCaps	Room is used by nanoCaps
G1-33	Characterization Lab	The floor of the room is damped to minimize vibrations. The lab contains larger characterization tools like SEM, AFM, Probers
	Environmental test lab	Hall outside G1-10. Contains tools for thermal cycling, thermal shock, accelerated lifetime etc.
G2-33	MST-Lab	Cleanroom ISO class 5 and service corridor. Contains equipment for wafer processing (lithography, etch,

		deposition, characterization) and packaging (wafer- and chip-bonding, pick & Place, wirebonding)

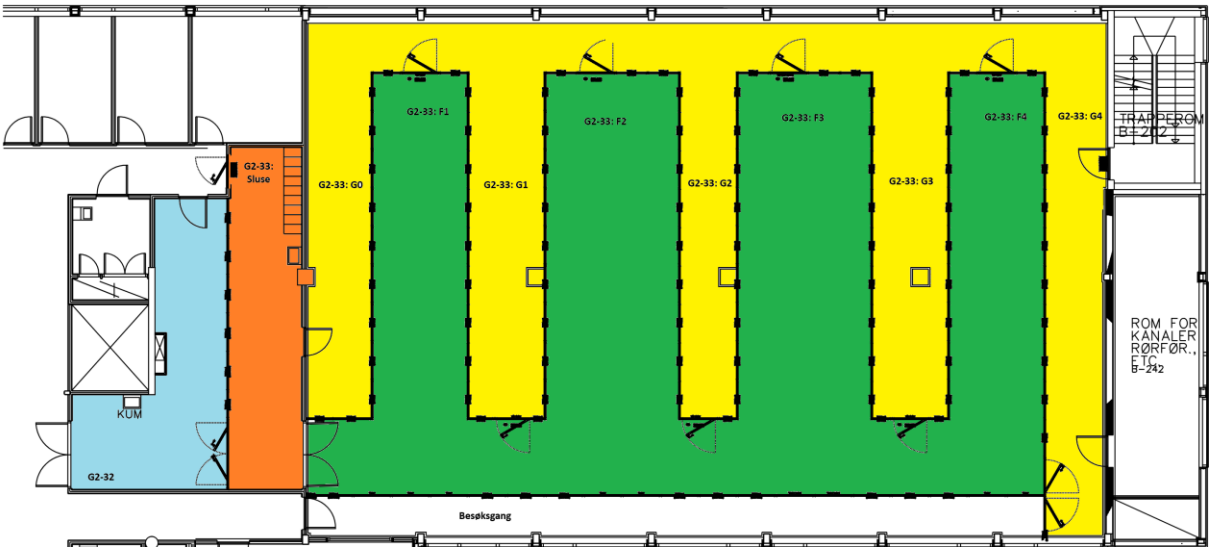

Figure 1: Top view over the 1st floor of the MST-Lab infrastructure. Green area is the cleanroom, yellow is the service corridor, orange dressing room and blue is the storage, where outdoor shoes are kept while working inside the cleanroom.

Figure 2: Top view over MST-Lab ground floor. Blue area is the general working area of the lab. Green is the biology and chemistry labs with specific rules for clothing. Yellow is the service area. Red area is chemical and gas storage. Dark blue space is rented to nanoCaps.

1.2 Safety information

The lab infrastructure is monitored by a Building Management System (BMS). The BMS-system includes alarms related to safety. If any alarm is triggered, there will be a loud siren and a blink in the alarm indicator (Figure 3). Check the closest alarm indicator for status. It is important that people do not enter the lab while there is an active alarm unless it is approved by lab engineers. Follow actions listed in Table 2.

Figure 3: Alarm indicator. These are in several locations within the MST-Lab infrastructure.

Table 2: Alarms in the MST-Lab infrastructure

Indicator	Potential Causes	Action
Red light blinking	- Fire - Gas-leakage - Toxic chemicals detected	**Evacuate through the closest emergency exit immediately**. Do not remove the cleanroom suits or lab coats. Go to the closest gathering point outside the main entrance and wait for further instructions.
Blue light blinking	- Temperature not within specified range in the cleanroom - Water leakage - Incorrect air pressure in the lab area - Other non-critical error	During normal office hours, the lab engineers will be notified automatically and will investigate the alarm within a short time. If the alarm continues for more than 5 minutes, contact one of the lab engineers. Be prepared to leave if needed. Outside normal office hours, contact the lab manager or engineer.

If needed, the emergency numbers in Norway are:

- Fire: 110
- Police: 112
- Ambulance: 113

- Emergency room (legevakt): 116117

USN has a portal about reporting incidents on the webpages (https://www.usn.no/english/about/speak-up/). The most relevant from the page is shown in Figure 4. In general, users are encouraged to speak to the lab engineers or lab manager if there are concerns. If there is an incident in the lab (accidents, larger spills, damages on persons etc), the lab group will register a case in the speak-up system and make sure it is handled and documented properly.

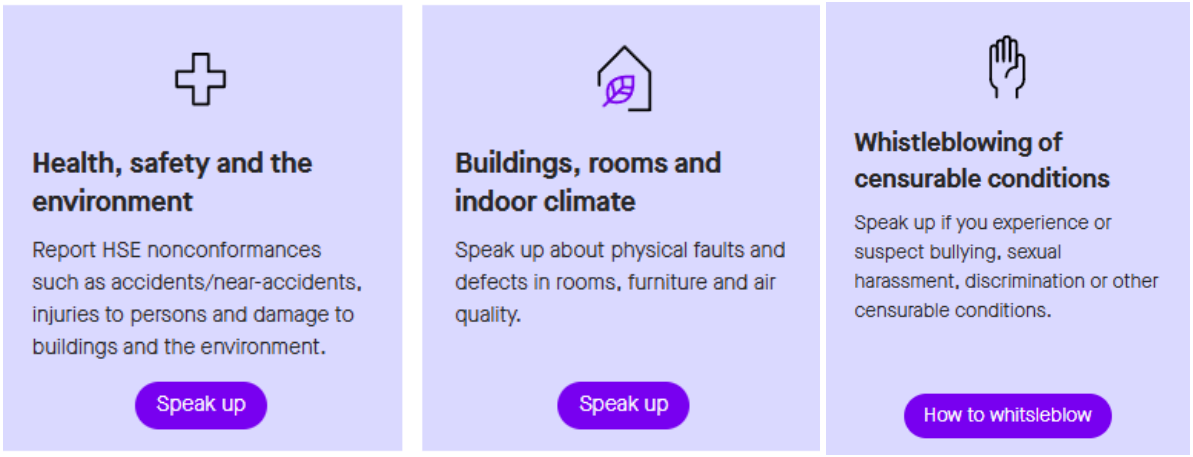

Figure 4: Most relevant sections from USN Speak Up webpage. Users need to log in using FEIDE to register a case.

1.3 General rules for working in the MST-Lab infrastructure

MST-Lab has a high focus on safety. These rules are worked out so that if all users follow them, the risks involved with the work are minimized. Some general rules that always apply:

- It is not allowed to bring any food or drink into the lab area. Violation of this rule can lead to withdrawal of access to the lab facilities.
- All users are expected to behave politely towards the engineers and other users.
- If any incident or accident occurs in the lab area, notify the engineer or the lab manager immediately.
- All emergency exits and escape routes must be kept clear.
- All activities must be evaluated before the work starts. The engineer group must evaluate the activity to check that the work is considered within the capability in the infrastructure and that the safety is well handled during the work. Activities are evaluated in the weekly meeting in the engineering group. Activities that the engineer responsible finds to be at low risk can be approved outside of that meeting. Details are described in section 3.

- All use of the tools must be booked in the LIMS-system. Users can make bookings when they have received training and obtained license for the tools. Use of tools without booking or license can lead to withdrawal of access to the lab. Obtaining license and booking are described in section 2.
- The lab space must be kept clean and tidy. No activity is complete until the lab space is cleared and the waste is handled in the correct manner. If lab space is occupied over time, there must be a visible label showing the user and potential precautions in the area.
- All users must use the correct protective equipment. It is important that each user knows when to use and when not to use gloves and facemasks. Details are described in section 3.
- It is recommended that all active users of the lab keep a change of clothes available in their office place. If corrosive chemicals are spilled onto the clothes, they must be taken off and discarded as chemical waste to prevent damage.
- Tools in the lab are generally constructed in a way so that movement is easy. If a movement while operating a tool is difficult (high friction), contact the lab engineer responsible. Use of high force can damage the equipment.
- No use of personal USB memory sticks on the tools. There are labeled sticks and a network solution to extract data.

The engineers are always open to suggestions from users on how to improve routines in the lab.

2. Obtaining access to the lab facilities

All new users must read and understand the rules for the lab (this document) before obtaining access. Existing users must read and stay updated on the evolution of the rules for the lab. The engineer group aims to go through the complete set of rules in a lecture once every semester. Existing users, including supervisors of students are encouraged to participate once a year to stay updated.

After reading and learning the lab rules, each user must sign a declaration form confirming that the rules are read and understood. The lab engineer will give a tour in the lab facilities.

After delivering the signed declaration form, the user must apply for user access in our booking system (LIMS).

Internal users

All internal students and employees receive an access card with identification which can open the doors into different parts of USN. This access card must be activated for the doors into the lab infrastructure.

All activation of cards into the lab facilities must go through the lab manager. The following information must be provided:

- Name
- E-mail address (USN mail address)
- Student/employee number
- Card number
- Time frame for access

External users

External users are in general encouraged to use the infrastructure within normal working hours and contact one of the lab engineers on arrival to get into the lab area.

The lab manager has some generic access cards that can be borrowed by external users. Cards must always be returned to the lab manager after completing work in the lab.

Frequent external users can get their own access card and enter the facilities within the opening hours. The lab manager will assist in obtaining the access card.

2.1 Booking system (LIMS)

All tools under MST-Lab are registered in our booking system, LIMS, which can be accessed at https://usn.norfab.no. All users of MST-Lab must obtain a user account in LIMS to be able to book tools when using the infrastructure. All users must provide their affiliation when registering in LIMS. For USN users, the campus and research group must be provided. External users are encouraged to contact the lab manager to obtain access to LIMS.

Applying for access to LIMS (New user)

1. Go to the web-page of the MST-Lab (usn.norfab.no) and click on the link "Apply for access" (Figure 5).

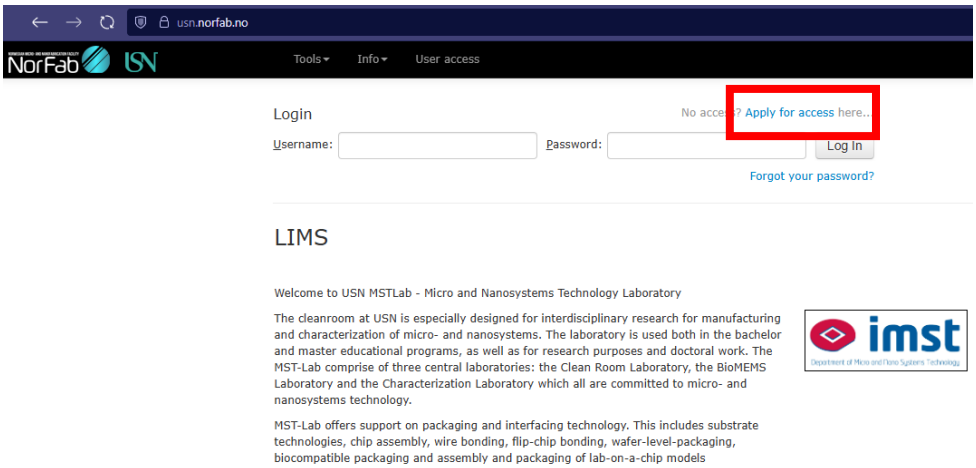

Figure 5: Login screen for the LIMS system at USN

2. Fill in First name and Last name in the form (Figure 6)
3. Select Type of User
4. For USN users, fill in the following:
    a. Company/University: "USN"
    b. Department: Campus you belong to
    c. Laboratory Group: Bachelor / Master / name of research group
5. External users fill in the following:
    a. Company/University: Your company name
6. Fill in Start date you need access from (start of semester)
7. Fill in End Date (end of semester or end of project period)
8. Press "Next"

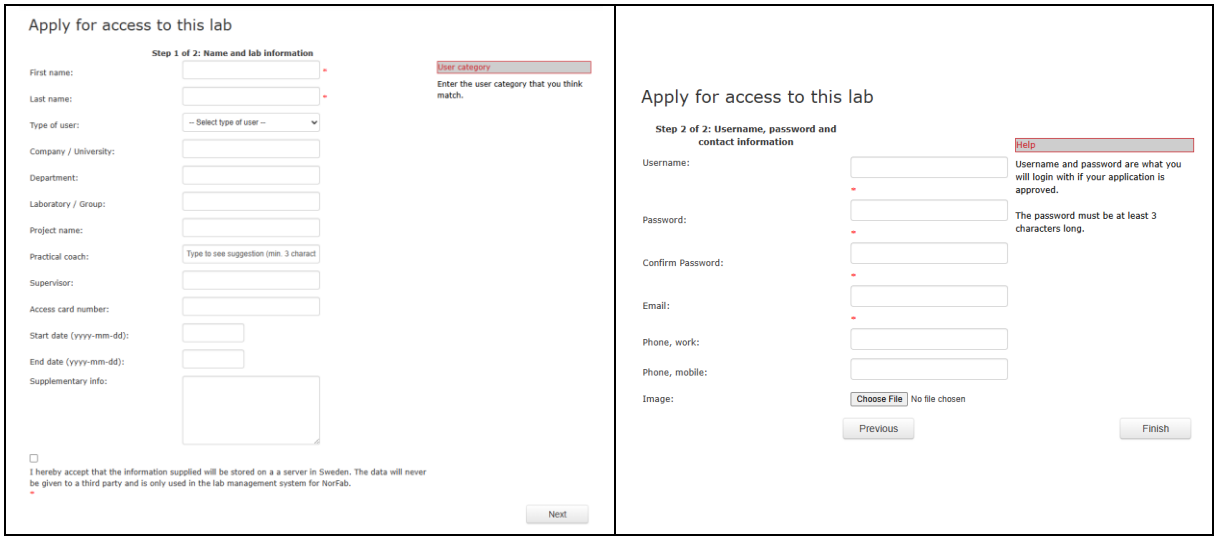

Figure 6: Form to be filled out when applying for access to LIMS

A new window appears as shown to the right in Figure 6.

9. Type a username (suggest using work e-mail address)
10. Define a password and confirm
11. Type e-mail. Use the e-mail from your company or the student mail address
12. Press "Finish"

After pressing Finish, a request is generated that will be evaluated by MST-Lab engineers. A confirmation e-mail will be sent when the application is evaluated. After receiving the confirmation e-mail, go to the LIMS webpage and log in.

Once logged in, check the following:

- Select "**User / My Profile**". We recommend that you add a phone number.
- Select "**User / My Projects**". You should find at least one project linked to your user.

Questions about the LIMS system must be addressed to the lab manager.

Obtaining license to tools

When logged into the system, select "**Tools / Apply for license / Apply for license**" as shown in Figure 7. Select tool from list. The list can be narrowed by selecting category for the tool.

In the next page, fill in the fields for Project and at least one date for user training. The application for license will be followed up by the responsible engineer. After training, the

engineer responsible can approve licenses, making the users capable of booking the tool by themselves.

Figure 7: Applying for license to tools in LIMS.

Projects in LIMS (USN Projects)

All bookings in LIMS must be linked to a user and a project to be valid. To get a new internal (USN) project into LIMS, the following information must be provided to the lab manager:

- **Project ID**: Same as the ID in Unit 4 (7 digits)
- **Project Name**: Same as in Unit 4
- **Project Category**: Financing: EU, NFR, RFF, Industry, Government or other
- **Charge type**: Depending on project category and how the usage of the lab will be paid. Must include flat rate/hourly rate and payment schedule.
- **Lab group:** Affiliation of the project leader(research group)
- **Project Leader:** Same as in Unit 4
- **Start date:** Same as Unit 4
- **End Date**: Same as Unit 4
- **List of project members**

Smaller services for external companies are defined under the category “External Customer”. External customers are invoiced by hourly rate at specific intervals.

Once the end date is passed, it is not possible to make bookings on the project. If extension is needed, the lab manager can provide it.

3. Safety Rules

Working in research can involve doing potentially dangerous activities. Every user has a responsibility to contribute to a safe environment for all. If a user is pregnant (or planning to be), it is strongly recommended to inform the lab engineer or lab manager. Extra precautions will be evaluated to ensure the risk of exposure to chemicals is minimized.

3.1 Cleanroom (G2-33)

The cleanroom is designed to keep contamination from dust at a minimum. Inside the cleanroom, the largest source for particle contamination is the user. All users have their own hanger in the dressing room where the full cleanroom suit is kept. The engineer will provide a set of cleanroom suites and a named hanger when needed.

Entering the cleanroom

1. Leave outdoor shoes and other outdoor clothes (coat, jacket) in room G2-32 before entering the dressing room. It is recommended to wear a single layer of clothes under the cleanroom suit.
2. Make sure your hands are clean. There is a sink available if a handwash is needed.
3. Users with long hair must either bind up the hair in a ponytail or similar or use a hairnet.
4. Users are strongly encouraged to not use make-up when working in the cleanroom since the makeup is a source for contamination.
5. Put on cleanroom head cover first (if suit has separate headcover).
6. Put on the cleanroom suit. Make sure that the suit does not touch the floor while putting it on. The headcover must be on the inside of the suit.
7. When putting on lab boots, make sure that they are only touching the ground on the clean side of the stepover.
8. If needed, put on surgical mask
9. Put on gloves. If lithography or other wet-chemical processing is planned, put on a double set of gloves. Gloves must always be worn when inside the cleanroom.

Leaving the cleanroom

1. Take off the lab boots while stepping over to the dirty side. Leave the covers on the step-over
2. Take off the cleanroom suit. Make sure the suit does not touch the ground. Hang the suit on your dedicated hanger.

3. Take off the head cover and place it on your hanger
4. Tie the lab boots to the rest of the suit on your hanger
5. Remove the gloves and throw them into the trash bin as the last step before leaving the dressing room.
6. Exit from the dressing room and get your outdoor shoes and outdoor clothes from G2-32.

Bringing devices into the cleanroom.

3.2 Chemistry- and Biolab (G1-22 and G1-21)

Users must wear lab coats when working in the Chemistry- and Biolab areas. The lab coats are found in the dressing-room (Biolab) or in the hallway outside the chemistry lab. Each user has a named hanger with the lab coat for the area. The lab coats are for use in the lab area, not in the area outside the lab.

Entering the Chemistry- and Biolab

1. Make sure your hands are clean. Use the closest WC-facility if needed before entering the lab area.
2. Users with long hair must ensure the hair is either tied up in a ponytail or similar, or use a hairnet.
3. Put on the lab coat before entering the lab area
4. Enter the lab area.

Leaving the Chemistry- and Biolab

1. Make sure the lab space is in a clean and tidy state
2. Wash your hands before leaving the lab area
3. Take off the lab coat in the dressing room or in the hallway outside the lab

3.3 Use of protective equipment

Correct use of protective equipment is essential for maintaining safety in the lab area. Incorrect use can lead to both contamination of lab space, samples and equipment in addition to uncertainties. Therefore, it is important that each user knows what protective equipment to use, when to use it and when not to use it.

Use of gloves

The tools in the characterization lab are potentially sensitive to contamination from the human body. To minimize the risk of contamination and the risk of exposure to potentially toxic samples, follow this sequence when starting to use the tools:

1. Make sure your hands are clean. Use the closest WC facility if needed.
2. Make sure the lab space around the tool is clean. If needed, put on gloves and wipe the area with a paper cloth wetted by alcohol. Remove the gloves after wiping.
3. Initial preparations of the tool. (Vent the chamber, load the software, recipe etc)
4. Put on gloves.
5. Prepare and load your sample into the tool. Make sure the gloves which have been in contact with the sample are not used for the keyboard and computer mouse.
6. Take off the gloves.
7. Do the characterization.
8. Put on new gloves and unload the sample.
9. If needed, clean the lab space, including the tool, using a paper cloth wetted by alcohol.
10. Take off the gloves and throw them into the trash bin.

Figure 8: Correct use of gloves in the lab area.

In some cases, such as when working with wet chemicals, a double set of gloves is recommended.

Use of protective goggles in the lab area

The eyes are sensitive to chemicals, and small amounts of chemicals can have a severe impact if they get into the eyes. Therefore, all use of liquids while working in the lab area requires the user to wear protective goggles. Users already wearing glasses can be exempted from this rule if the responsible lab engineer regards the glasses to give

sufficient protection. It is strongly recommended to use protective glasses in addition to regular glasses to ensure maximum protection. Users wearing contact lenses are strongly encouraged to remove them before entering the lab and use glasses instead.

Use of face mask

A face mask will prevent particles from powders and chemical fumes from being inhaled. Working with nanoparticles and toxic chemicals will require wearing a face mask. The different face masks are listed in Table 3. If the work requires wearing a face mask, warning signs must be placed on the entrance doors while the work is ongoing. Everyone must put on a face mask before entering the lab area. The face mask must be removed when leaving the lab area.

Table 3: List of different protective masks available in the lab

Protection Type	Description	When to use
 Surgical Mask	• Protects the sample from the user	• Cleanroom, when doing extra sensitive work • Biolab to prevent contamination of samples
 Face Shield	• Protects against splashes of chemicals • Part of full protection	• Working with strong acids/bases
 FFP1	• Protects the user from large particle dust (>1µm) • Does not protect against fumes	• Grinding in dry environment, carpenter work (sanding) • Not very relevant to normal labwork

 FFP2	• Filters out smaller particles and aerosols, including biological material • Does not protect against fumes	• Handling powders (not nanomaterial) and biologic material
 FFP3	• Protects against nano-sized particles and aerosols. • Does not protect against fumes	• Handling nanomaterials
 Half Mask	• Covers mouth and nose. • Breathing through filter • Protects against particles and fumes depending on the attached filter type (see Figure 9)	• Working with toxic fumes • Working with nanomaterial
 Full Mask	• Covers the whole face, including eyes. • Breathing through filters • Protects whole face against particles and fumes depending on the attached filter type (see Figure 9)	• Working with toxic chemicals and there is a risk of splashes to the face

 Full mask with air supply	• Available for use in emergency situations	• Rescuing people inside in a fire situation • Working in an area known for containing toxic gases

Respiratory Filters

Classes and Standards

Class	Maximum allowed gas concentration	Standard
1 2 3	1000 ml/m³ (0.1 Vol.-%) 5000 ml/m³ (0.5 Vol.-%) 10000 ml/m³ (1.0 Vol.-%)	EN 14387
1 2 3	1000 ml/m³ (0.1 Vol.-%) 5000 ml/m³ (0.5 Vol.-%) 10000 ml/m³ (1.0 Vol.-%)	EN 14387
1 2 3	1000 ml/m³ (0.1 Vol.-%) 5000 ml/m³ (0.5 Vol.-%) 10000 ml/m³ (1.0 Vol.-%)	EN 14387
1 2 3	1000 ml/m³ (0.1 Vol.-%) 5000 ml/m³ (0.5 Vol.-%) 10000 ml/m³ (1.0 Vol.-%)	EN 14387
–	Group 1 (100 ml/m³ max. 40 min.) Group 1 (500 ml/m³ max. 20 min.) Group 2 (1000 ml/m³ max. 60 min.) Group 2 (5000 ml/m³ max. 20 min.)	EN 14387
–	Maximum allowed time of use 20 minutes	EN 14387
–	Maximum allowed time of use 50 hours	EN 14387
–	Local guidelines	DIN 58620 EN 14387
–	Local guidelines	DIN 3181*
1 2 3	Max. filter penetration 20% Max. filter penetration 6% Max. filter penetration 0.05%	EN 143 EN 14387

*only colour mark and type standardized

Respiratory Filters

Applications and Markings

Colour mark	Type	Application
	A	**Organic gases and vapours** (boiling point > 65 °C)
	B	**Inorganic gases and vapours** (not CO), e.g. chlorine, H_2S, HCN
	E	**Sulfur dioxide and acidic gases and vapours**
	K	**Ammonia and organic ammonia derivatives**
	AX	**Organic gases and vapours** (boiling point < 65 °C) of low boiling substance groups 1 and 2
	NO-P3	**Nitrogen oxides** e.g. NO, NO_2, NO_X **and particles**
	Hg-P3	**Mercury vapours and particles**
	CO*	**Carbon monoxyde**
	Reactor P3*	**Radioactive iodine and particles**
	P	**Particles**

*only colour mark and type standardized

Figure 9: Filters available for half and full masks.

Full Protective Clothing

Some chemicals can have a severe impact on skin contact. Therefore, full protective clothing is required. This is the case when working with, for instance, HF (hydrogen fluoride) and other strong acids. The lab space must be clearly labeled when this kind of work is ongoing. Other users must keep distance from the ongoing work.

3.2 Risk Assessment

All lab activities must be described in an activity form. The form is found on LIMS under "***Info / General Documents***" (see Figure 10) and contains all relevant information about the activity. A completed activity form must be handed in to the lab engineer responsible. It is recommended to deliver the form a week before the work starts. The engineer group evaluates new activities once a week. The user must be prepared to wait before approval. If the lab engineer considers the activity as low-risk, it may be approved sooner outside of the weekly meeting.

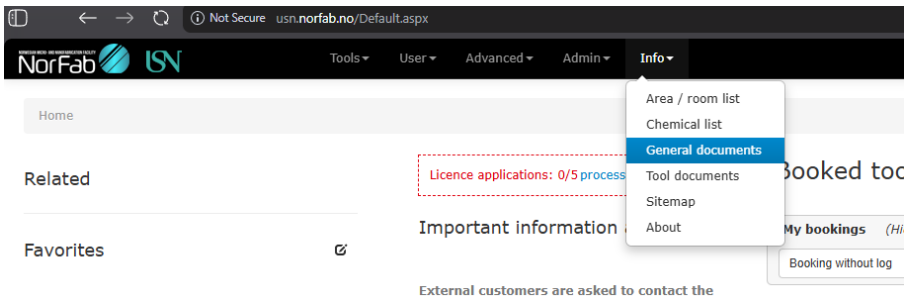

Figure 10: How to find activity form in LIMS

After evaluating the activity, it can be classified as low-risk or high-risk. Low-risk activities can be performed all the time the lab facilities are open. High-risk activities must be performed in the normal office hours. If an activity must go on for longer time, the lab engineer must be informed, and the lab space must be clearly marked.

3.3 Chemicals

All chemicals used in lab infrastructure must be registered in Workplace Safety (https://auth-stoffkartotek.usn.no/). All USN users will have reading access using their FEIDE login (see Figure 11). In Workplace Safety, Safety Data Sheets (SDS) and exposures are stored.

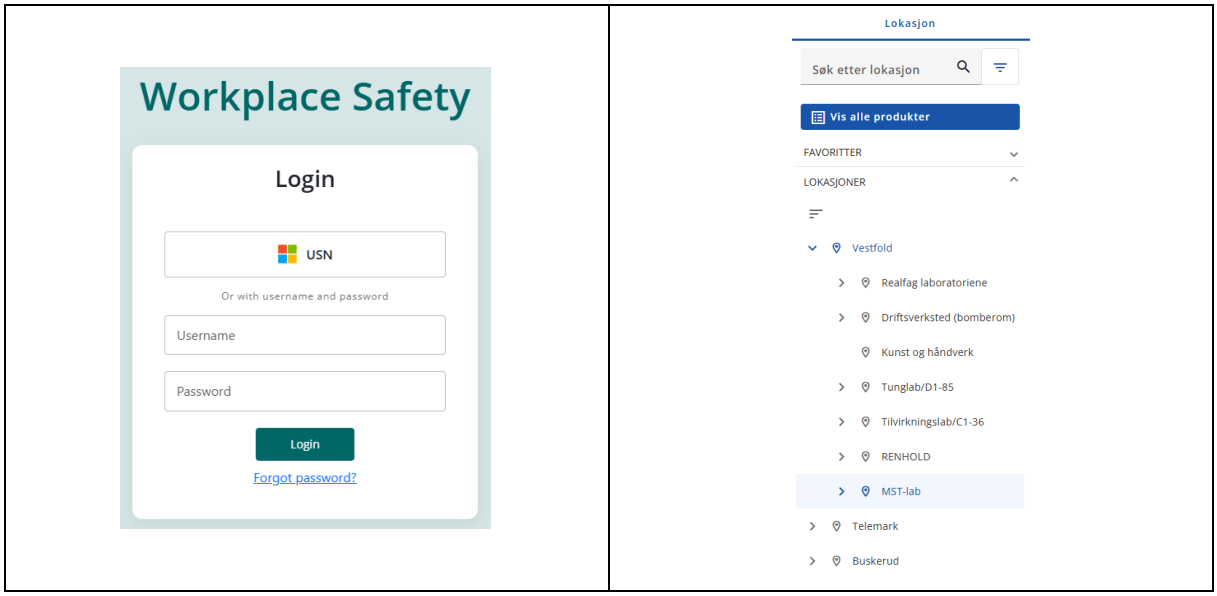

Figure 11: (Left) Login window for Workplace Safety. Press "USN" to log in. Use FEIDE login the first time. (Right) Structure of locations where chemicals are stored.

When logged in, it is possible to search for chemicals in storage using the search field close to the upper right corner of the screen (see Figure 12). It is also possible to search global databases to find SDS for chemicals that are not in storage.

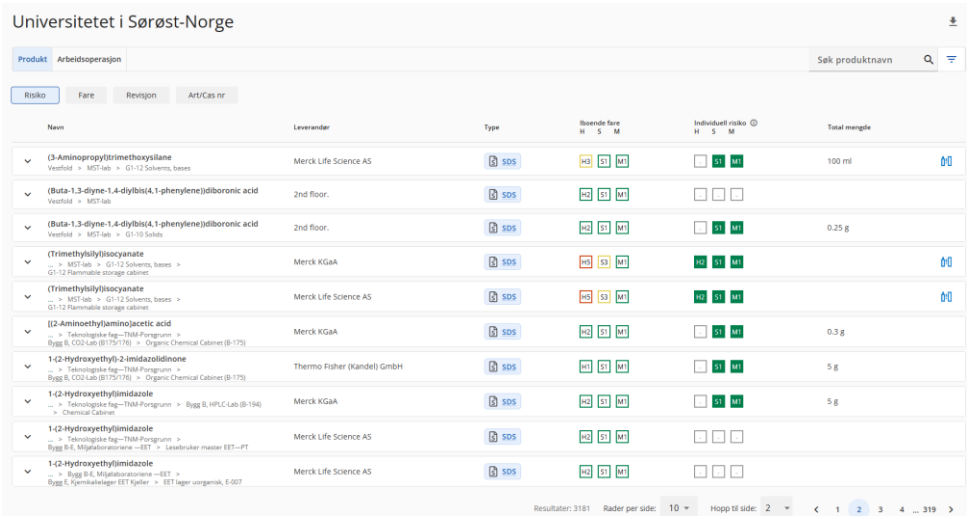

Figure 12: List of chemicals in Workplace Safety

Safety Data Sheets (SDS) contain important information about chemicals. The structure of a SDS is shown in Figure 13

Figure 13: Sections in a Safety Data Sheet (SDS)

It is important that all users are familiar with the SDS for the chemicals used in their activities. Most important are sections 2, 4, 6, 7, 8, 9 and 10. In section 2, pictograms such as those listed in Figure 14 are found. It is important that all users are familiar with those symbols.

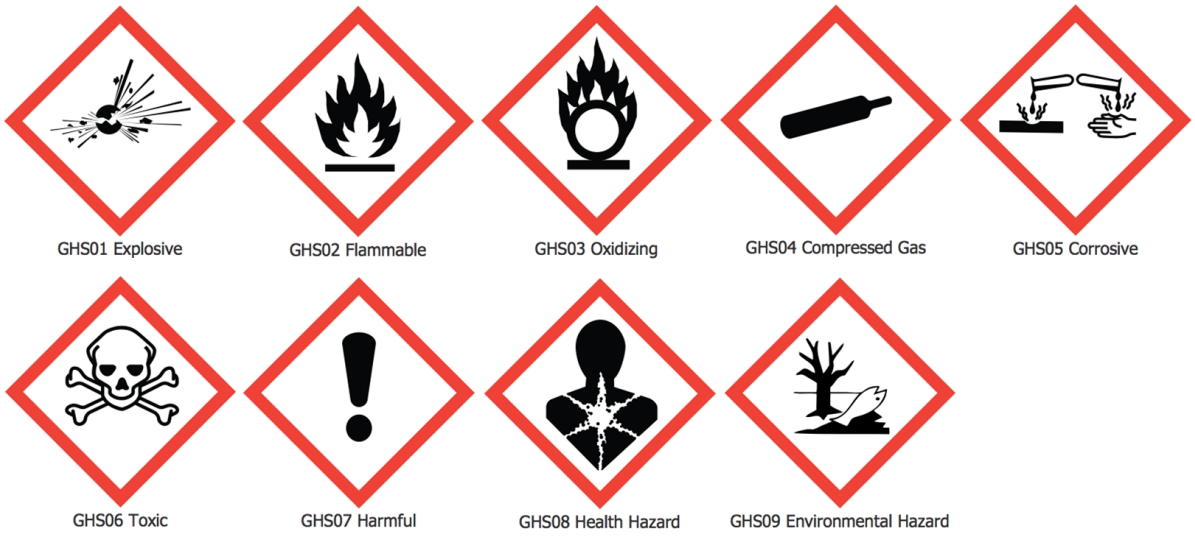

Figure 14: Pictograms used in SDS

Exposure registration

In section 2 of the SDS, there is a list of hazard statements. If the statements include any of the ones listed in Table 45, all use of the chemical must be registered as exposure. The exposure is registered in Workplace Safety as shown in Figure 15.

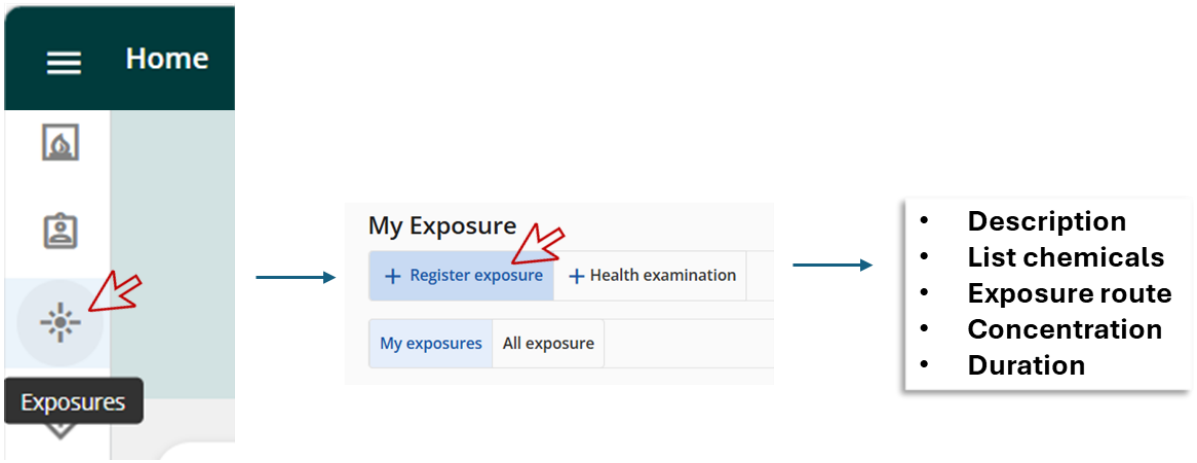

Figure 15: Registering exposure in Workplace Safety.

Table 4: List of hazard statements which require exposure registration

H-statement	Interpretation
H340	Can cause genetic effects
H350	Can cause cancer
H350i	Can cause cancer by inhalation
H351	Suspected of causing cancer
H360	May damage fertility or unborn child
H361	Suspected of damaging fertility or unborn child
EUH201	Contains lead

Ordering of chemicals

If a user has need for specific chemicals which are not in storage, the lab engineer must make the purchase. The user must provide the following information before ordering is performed:

- Safety Data Sheet (SDS). SDS can be found by searching global databases in Workplace Safety.
- Amount needed and how the chemicals will be used.
- Where or how to store the chemicals (inert atmosphere, glovebox)
- What project will take the cost of the purchase.

It is not allowed to bring unmarked chemicals into the lab infrastructure. If chemicals or samples are to be brought into the lab, sufficient documentation must follow. Containers with unknown chemicals or lacking sufficient labels will be removed by the lab engineers.

General rules when working with chemicals

Figure 16: General rules when working with chemicals

Spill procedure

If spills of chemicals occur, the general procedure on how to handle it is shown in Figure 17. The SDS contains detailed information on how to handle it. It is important that the lab engineer is contacted immediately if a spill occurs.

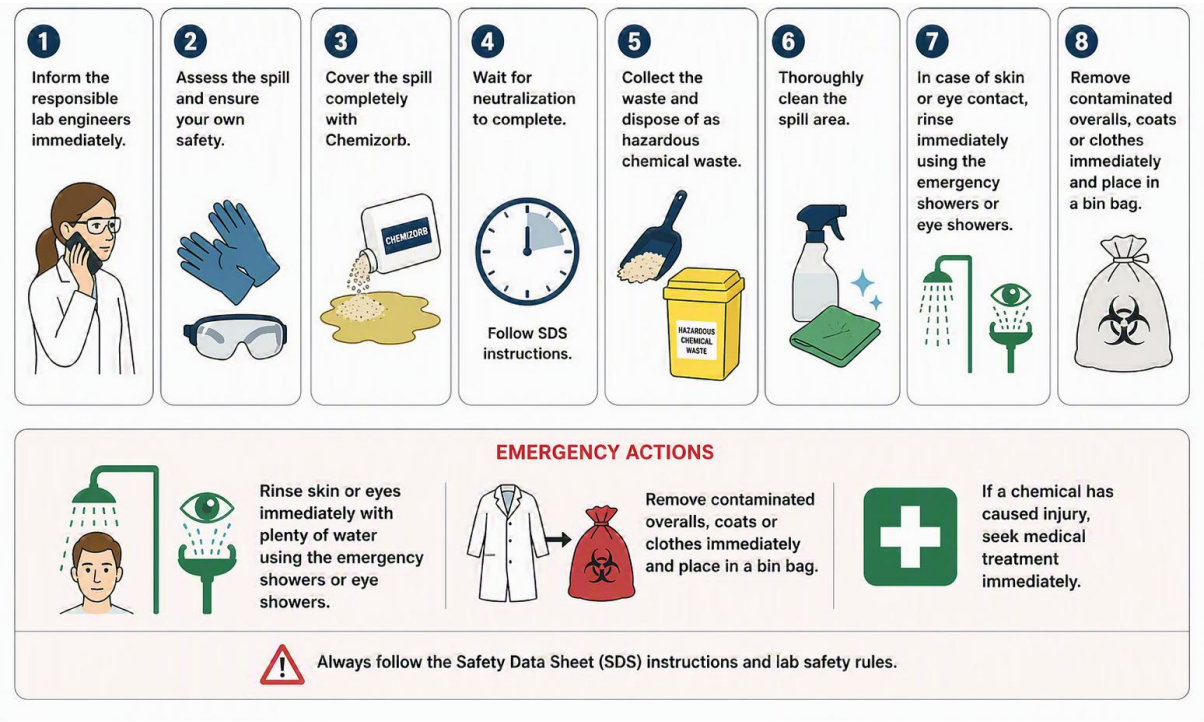

Figure 17: General spill procedure

Waste handling

Norway has rules for sorting of waste to enable recycling and prevent pollution. When using potential toxic chemicals, it is vital that the waste is handled the correct way. The general rule for waste handling is illustrated in Figure 18. Waste handling is a part of the risk evaluation for each activity in the lab.

Figure 18: Illustration of waste handling

Chemical Work Areas

Fume hoods

A fume hood is an exhaust–ventilated workstation with a transparent, height adjustable sash designed to protect users from hazardous fumes and chemicals splashes.

Air is continuously drawn into the hood to prevent exposure to hazardous substances. Reduced performance may occur if:

- the sash is opened too high, or
- there is a failure in the ventilation system

Figure 19: Incorrect and correct use of fume hoods

For safe use:

- Keep the sash at the lowest practical height for your work, between you and the chemicals
- Ensure that the ventilation is working properly by checking that the yellow band is moving
- Keep the fume hood clean and tidy, and limit the amount of equipment inside

Wet benches
A wet bench is an exhaust-ventilated work surface designed for safe handling of chemicals.

The height and depth of the wet bench allow for comfortable work in an upright position and help contain spills and splashes.

Glovebox
Chemicals that are highly sensitive to air and/or moisture must be stored and handled in an inert environment. A glovebox is a sealed enclosure that isolates the internal workspace from the external environment, maintaining low oxygen and humidity levels.

The glovebox is filled with an inert gas (argon), allowing safe handling of air- and moisture-sensitive materials without contamination or degradation.

3.4 Nanomaterial

Nanomaterials appear as films, fibres, tubes, rods, particles etc. Independent of composition and shape a substance is regarded as a nanomaterial if its smallest dimension falls within the size range of 1-100 nm. As the effects of nanomaterials on health and environment are unknown, they should be regarded as harmful and handled carefully.

The biggest risk of exposure of nanomaterials is by inhalation. As of today, there is no national set limit values for safe exposure to nanomaterials, but The Norwegian Labour Inspection Authority refers to the limit values recommended by The National Institute of Occupational Safety and Health (NIOSH) as listed in Table 5 .

Table 5: Nanomaterial recommended exposure limits

Type of nanomaterial	NIOSH recommended limit value
Carbon nanotubes (8 hour working day)	1 µg/m3
Carbon nanofiber (8 hour working day)	1 µg/m3
TiO2 (10 hour working day)	0,3 mg/m3

Working with nanomaterial

All work which includes nanomaterial must be performed in a way to minimize the risk of spilling and exposure. All work must be performed inside a fume hood. Material must be transported inside closed containers. Before loading samples of nanomaterial into a characterization tool. Specific routines for the tools must be followed to immobilize the material. The general guidelines are illustrated in Figure 20.

All work with nanomaterial must be registered as exposures in Workplace Safety.

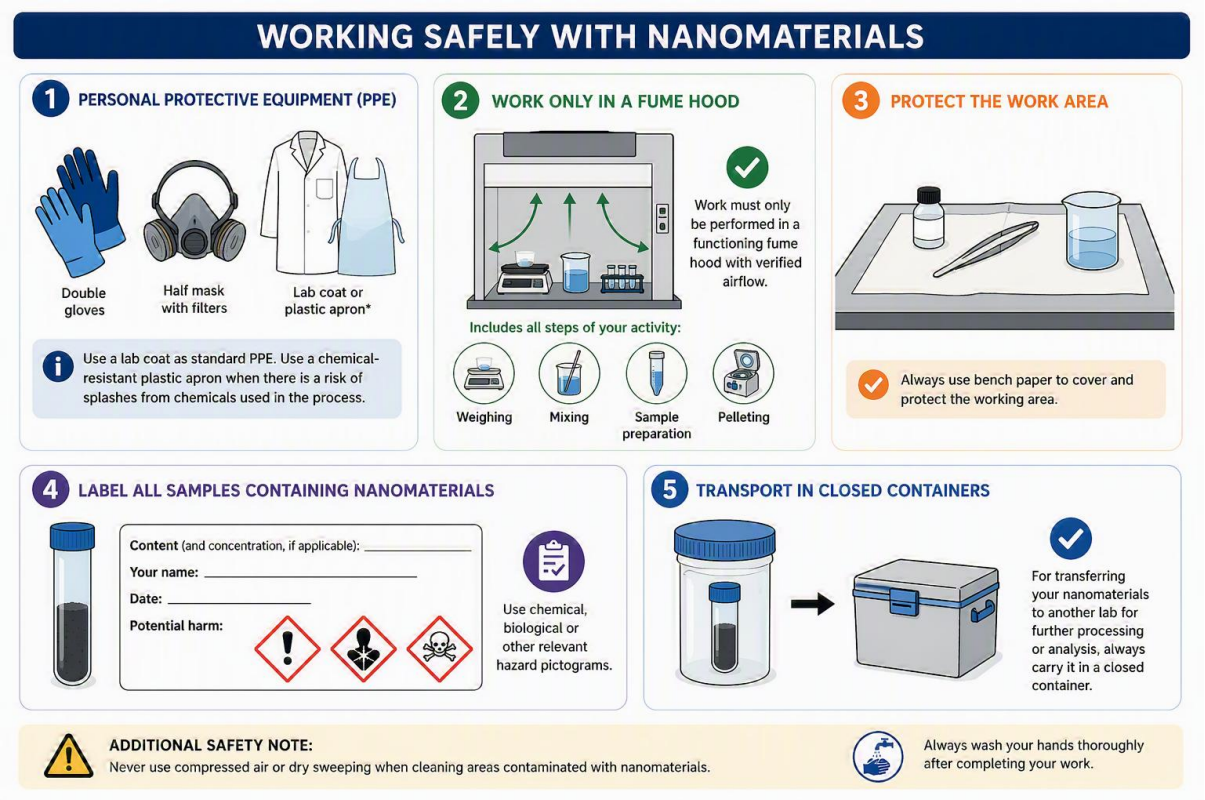

Figure 20: Working safely with nanomaterials

3.5 Biologic material

Biological material can be:

- microorganisms (bacteria, virus, fungi, parasites)
- cell lines
- biological toxins
- human or animal infectious material (like blood, tissue, RNA/DNA, or body fluids)

Such material can be naturally occurring or genetically modified, which may have the potential to cause infection, allergy, toxicity or otherwise create a hazard to humans, animals, or plants (content).

New biological material

Before ordering or bringing in any biological material into the lab:

- A material safety datasheet (MDS) must be provided
- An activity form describing the planned activities must be completed and approved
- If no MDS is not provided by the material supplier, it must be created manually using templates in LIMS.

Biosafety levels and containment

The biology lab is classified as a biosafety level 2 (BSL2) facility. Only work with Risk Group 1 (RG1) and Risk group 2 (RG2) is permitted. Risk group classification must be verified in the MDS.

A risk assessment must be completed and approved before starting a new activity involving RG2 biological material (LIMS).

BSL-1 (RG1)	
Biological agents of risk group (RG) 1 pose minimal risk to the worker or the environment.	
Examples	**Handling requirements**
• Baker's yeast • E. coli K12 • Normal skin flora.	• Can be handled on open benches • Standard lab hygiene procedures apply
BSL-2 (RG2)	

Biological agents of RG2 pose moderate risk to personnel and the environment.	
Examples	**Handling requirements**

• Human cell lines (HEK293 and HeLa)
• Some influenza viruses
• Mycoplasma.
	• Must be handled in a Biological Safety Cabinet (BSC)
	• Required PPE:
	  • Lab coat (green labelled)
	  • Gloves
	  • Sleeves
	• Use face mask and goggles if there is a risk of splashing or aerosols
	• Work slowly to minimize aerosol formation

3.6 Transfer of Data from characterization tools

Measurement data from characterization tools are stored on a dedicated server (NAS). The NAS is available from computers in the cleanroom and characterization lab which are connected to the local network:

- Open Windows Explorer (Windows utforsker)
- In the address field, type \\169.254.151.130
- Username: ".\student"
- Password: "Stud3ntFiler22"
- Go to the folder "USN-renrom\IMST" and create a folder with your username

The server can be connected from the outside by connecting the network cable in room G2-14 to your laptop:

- Open Windows Explorer (Windows utforsker)
- In the address field, type \\128.39.204.142
- Username: ".\student"
- Password: "Stud3ntFiler22"
- Copy files from your dedicated folder

Some of the tools in the infrastructure are old and the computer is not connected to the network. For those tools there are dedicated USB-sticks which can be used. The USB-sticks must only be used on the computers inside the cleanroom. **It is not allowed to use personal USB-sticks on computers in the lab area.**