



# Safety for users

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Prepared by: Safety group  
Approved by: Rema Malar

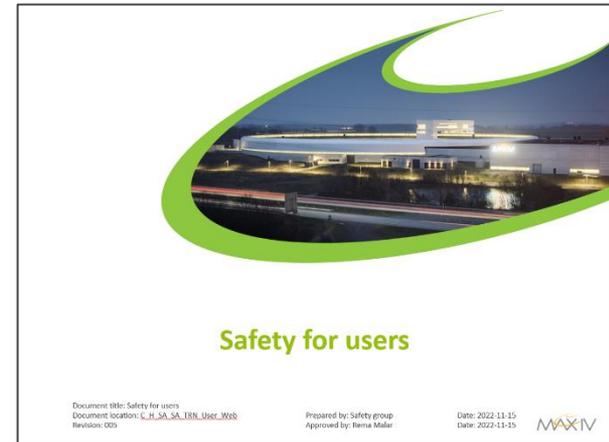
Date: 2024-04-17  
Date: 2024-04-17



# Introduction

“Safety for users” (this training) and the successful completion of the associated safety test is required to get basic access to the MAX IV facility and access to the beamline-specific areas of the beamline where you have beam time.

In addition to this training, each user is also required to attend an on-site introduction to the beamline by beamline staff at the start of the beam time.



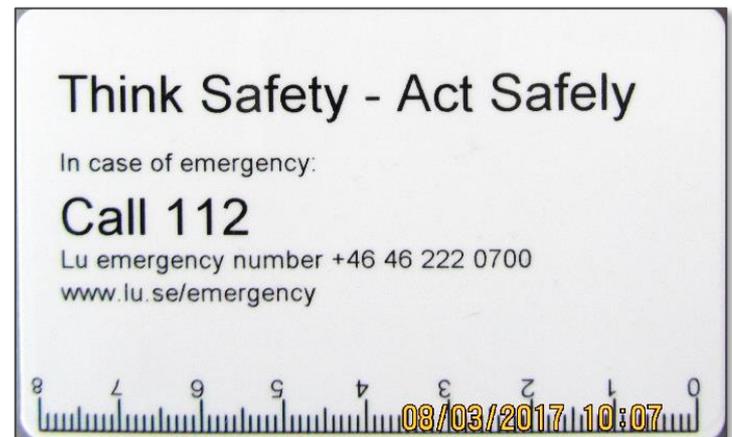
# MAX ID card

After the successful completion of the safety training a MAX ID card can be issued.

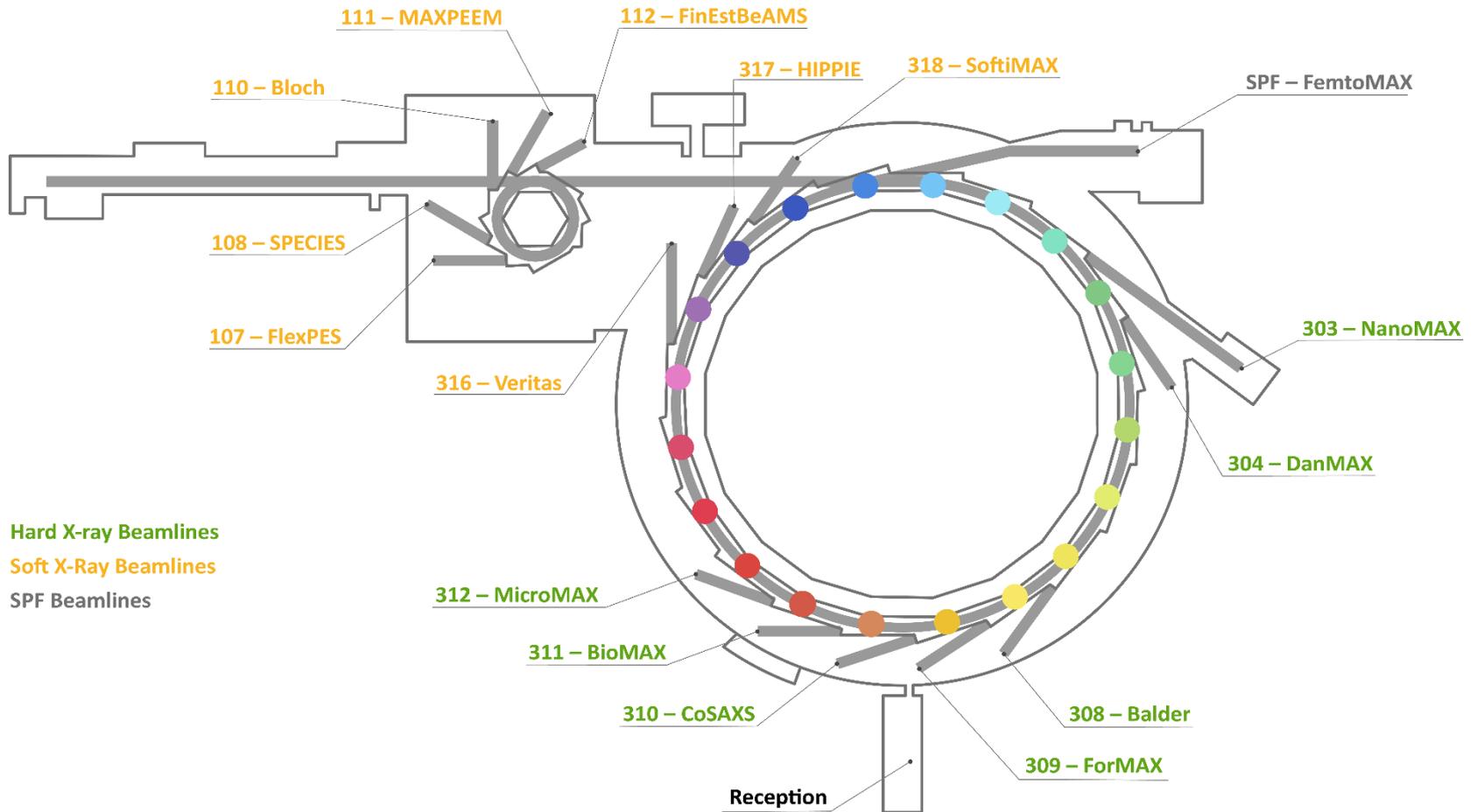
Your MAX ID card is personal. It should be worn at all times while at MAX IV.

You are not allowed to give or lend your MAX ID card to anyone else or to let anyone in who do not have a MAX ID card of their own.

In addition, users are not allowed to bring any visitors, including family and children, to the facility.



# Beamline map





# General safety

# Introduction

The MAX IV Laboratory is a working science lab with several potential hazards.

Your co-operation is needed to ensure a safe working environment. Users are encouraged to report deviations for all aspects of safety.

We want to emphasize the importance of also reporting damage to equipment that you accidentally cause. MAX IV ensures that this can be done without concerns of penalties to the individual user.



# Emergency

In case of an emergency, call:  
**Emergency phone number: 112**

Be prepared to answer:

- Who is calling?  
Name and telephone number.
- What has happened?  
Type of accident.
- Where has it happened?  
MAX IV-laboratoriet, Fotongatan 2,  
Lund.



# Evacuation

Evacuate the building when you hear the evacuation alarm (alarm bells or spoken message).

If possible, bring your experiment to a safe state.

Go to the assembly point. Encourage people you meet to evacuate.

The evacuation alarm is set off by the fire detection system or by manually pressing a fire alarm button.



# Fire safety

Locate nearest evacuation routes, fire extinguishers and first aid stations in advance.

Keep flammable materials at your workplace at a minimum.

Do not block evacuation routes.



# In case of fire, explosion or gas/chemical leak

Rescue those who are in danger

Warn persons threatened by the danger

If possible:

- Turn off nearby electric current and fans
- Try extinguishing the fire with suitable material or a fire extinguisher

Press a fire alarm button to start the evacuation alarm.

Evacuate the building. Do not use elevators.

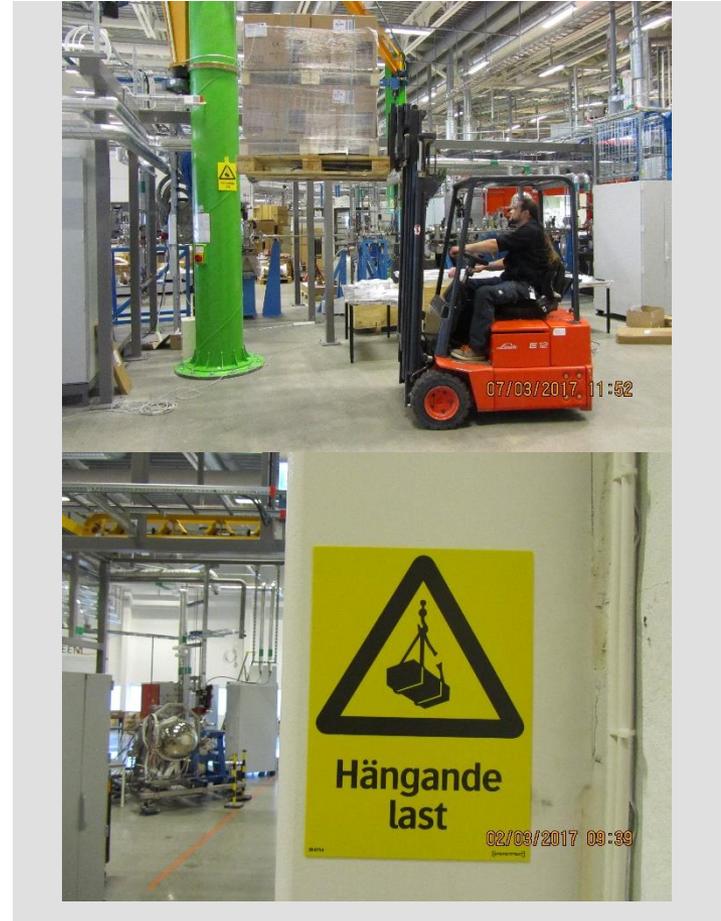
Meet up with the emergency services upon their arrival.



# Trucks, lifts, cranes and on-going construction

Trucks, overhead cranes and other heavy machinery are frequently used at MAX IV – only persons with special training are allowed to operate these machines.

- Be aware of your surroundings
- Keep a safe distance from working machines
- Do not walk under a hanging load
- Respect barriers and warning signs – they are there for a reason



# Lasers and magnetic fields

Laser warning signs are posted outside areas where lasers are used.

Blue warning lights are lit when high-power lasers are used in controlled areas.



High magnetic fields from some of the laboratory's installations may interfere with medical implants such as pacemakers.

Discuss with your local contact to get more detailed information if you carry such a device.

Respect the warning signs.



# Electricity

Only persons approved by MAX IV are permitted to perform electrical work at the laboratory.

Equipment that is not CE certified (home-built, modified or old) must be approved by MAX IV before installation.

Do not block electrical installations.

Never use damaged cords or equipment.

Make smart looking connections. Avoid wire tangles and cables lying on the floor.



# Security

All the facility's external doors are connected to the burglar alarm.

Use only doors with a card reader to enter or exit the buildings.

Do not let unauthorized persons inside.



# General safety, fire safety and security

If you have questions or want more information, please contact

Björn K Nilsson

Fire safety officer

+46 (0)730-38 29 42

Stefan Wiklund

Security safety officer

+46 (0)709-32 33 43





# Radiation safety

# Statutory and regulatory requirements

The acts, ordinances and regulations of primary relevance to MAX IV regarding ionizing radiation are listed below for reference (in Swedish).

- Strålskyddslag (SFS 2018:396)
- Strålskyddsförordning (SFS 2018:506)
- SSMFS 2018:1

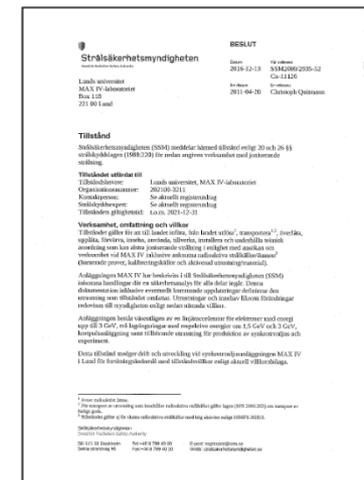
There is also a MAX IV specific licence issued by the Swedish Radiation Safety Authority (SSM) concerning operations at the facility.

Radiation safety related procedures, plans, instructions etc. are part of the MAX IV management system.



Strålsäkerhetsmyndigheten

Swedish Radiation Safety Authority



# Risks in a radiation environment

The biological impact of ionizing radiation can be classified as acute or delayed.

- Acute damage occurs at high doses (above 1000 mSv) received over a short period (weeks) and the result is damaged or dead cells. This could lead to reduced functionality or failure of an organ or in severe cases death.
- The risk of delayed damage, i.e. cancer, depends on the received dose. The risk of radiation-induced terminal cancer is 5% per 1000 mSv. The risk also depends on age – fetuses and infants have a higher risk compared to adults.

4800 mSv

Median lethal dose  
(acute damage)

8 mSv

Chest CT scan

3-4 mSv

Average annual dose  
in Sweden

0.3 mSv

Average additional  
annual dose for MAX  
IV employees

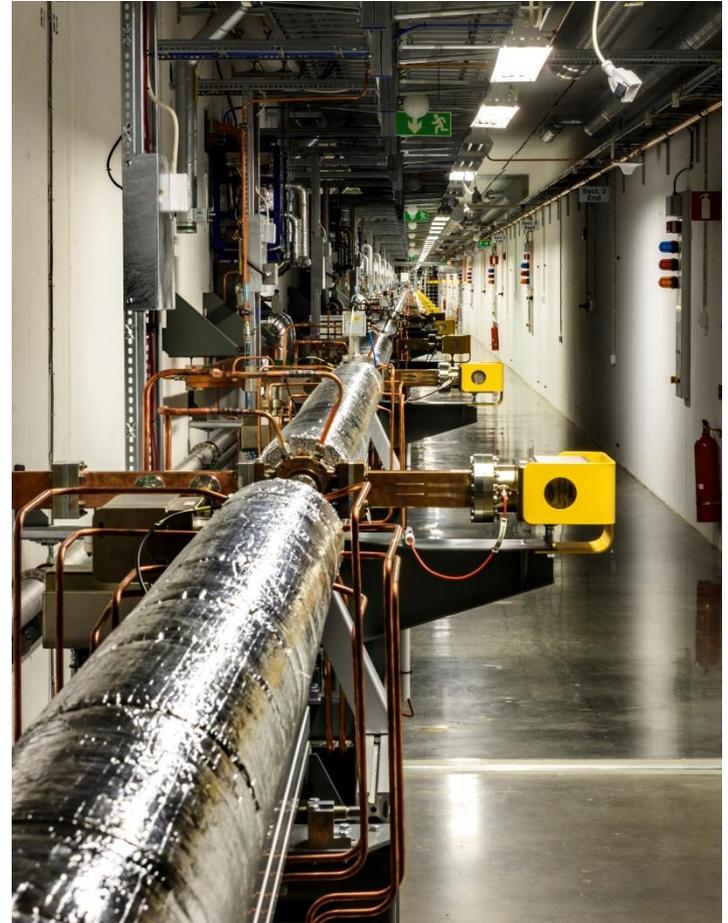
0.05 mSv

Transatlantic airplane  
flight

# Sources of ionizing radiation at MAX IV

There are four main sources of ionizing radiation at MAX IV:

- High-energy electrons lost from the accelerators result in primarily photon and neutron radiation.
- The radiation above can induce radioactivity in the components of the accelerators and nearby materials.
- Synchrotron radiation, which is used for research at the beamlines.
- The linac structures and RF cavities inside the accelerator areas and the klystrons outside these areas generate radiation during operation.



# Area designations

Ionizing radiation is produced when the accelerators at MAX IV are in operation. The resulting radiation levels differ between the areas. At MAX IV the areas belong to one of three categories:

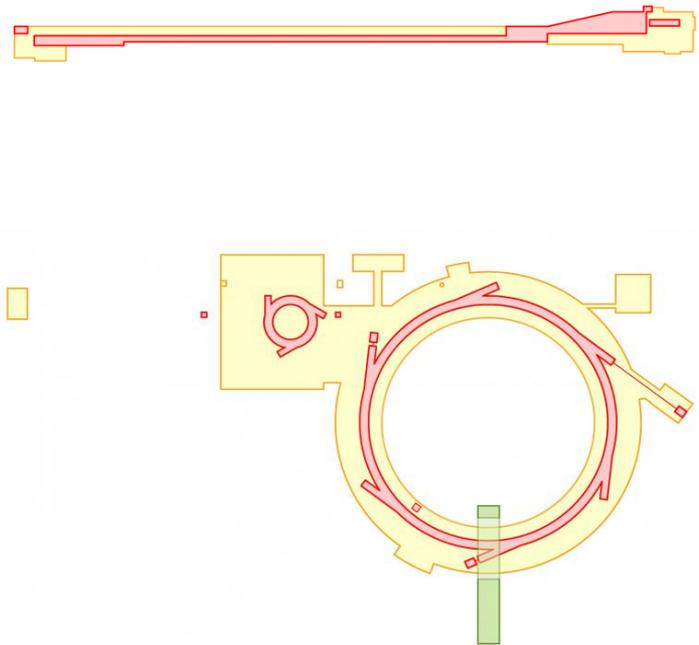
- Controlled areas (high radiation level area)
- Supervised areas (increased radiation levels may be present)
- Non-designated areas

All entry points to controlled (“kontrollerat”) and supervised (“skyddat”) areas are labelled as shown to the right.



# Areas

- In the basement the controlled areas (red) are the gun test room, the linac tunnel, the SPF and the SPF beamline hutch. The remaining areas in the basement are supervised (yellow).
- On the ground floor the controlled areas (red) are the 1.5 GeV and 3 GeV ring tunnels, the beamline hutches, the two entrances to the linac tunnel and the cavity test room. The remaining areas are supervised (yellow), except the main office building, which is a non-designated area (green).



# Personal dosimeters

Users at MAX IV are in general not assigned a personal dosimeter.

If you anticipate that you will spend more than 3 months at MAX IV per year, you should be assigned a personal TL-dosimeter (TLD). Contact the radiation safety team if this is the case. If not, no personal dosimeter is required.

For those who have been assigned a personal dosimeter, it must be worn in the supervised and controlled areas (the main office building is a non-designated area and is thereby exempt). The personal dosimeter should be stored at one of the dosimeter boards when not in use.

The requirements regarding personal dosimetry for users were updated 2024-03-04.



TLD



# Dosimeters in controlled areas

It is mandatory to wear an electronic dosimeter with alarm function within controlled areas such as a beamline experimental hutch. These are available at the entry points.

The electronic dosimeters are always on and you should only check that the battery is OK, i.e. check that information is shown in the display of the dosimeter.

The electronic dosimeter is required regardless of whether you have been assigned a personal dosimeter or not.



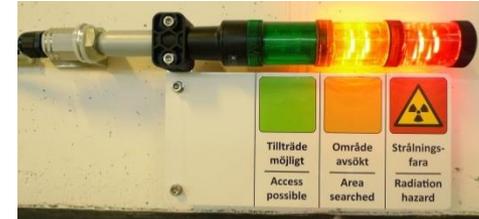
# Access to controlled areas

Controlled areas, i.e. accelerator areas and beamline hutches, are areas where the radiation levels may be significant.

No one under the age of 18 is allowed to enter the controlled areas at MAX IV.

All entry points, including concrete doors, leading into a controlled area are marked “Kontrollerat område” (controlled area) and are equipped with information lights above the door.

Instructions are posted at the entrances to the hutches describing how to enter and under what conditions entry is allowed. The instructions include contact information to radiation safety on-call.



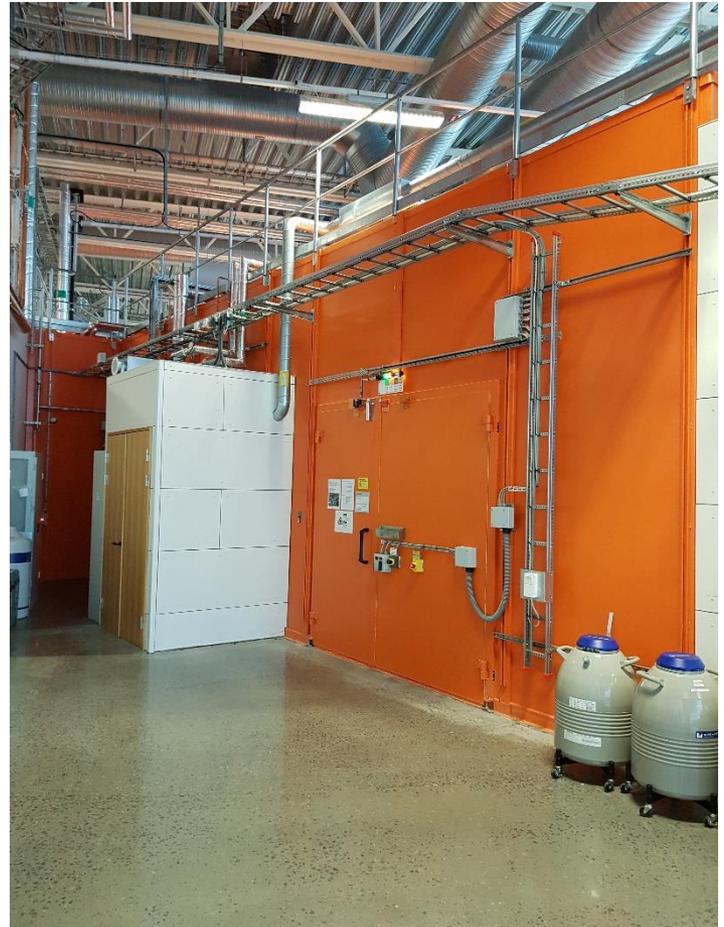
# Access to controlled areas

After successful completion of this training (“Safety for users”) users at hard X-ray and SPF beamlines are allowed to access the experimental hutches at the beamline where they have beam time. Soft X-ray beamlines do not have experimental hutches.

Access to the other controlled areas at the MAX IV facility, i.e.

- optics hutches,
- experimental hutches of other beamlines, or
- accelerator areas

is not allowed.



# Entry to an experimental hutch

The doors to the hutches are locked and a MAX ID card is needed to unlock them. Access is only allowed if the green information light above the door is lit.

The door is unlocked by swiping the access card at the tag reader. The door will not unlock if radiation may be present in the area or if you do not have access. Green and red lights next to the tag reader indicate if the attempt to unlock the door was successful or not.

In the event of an emergency, it is always possible to unlock the door by pressing the black emergency door release button or by turning the emergency thumb turn.



# Inside an experimental hutch

Panels located within the hutch contain sirens and warning lights for radiation hazard (red) and search status (orange).

One of the sirens is active during the search procedure. The other siren is active for 30 seconds when the search has been completed and for 30 seconds when the beam shutters are opened.

If you should see the red lights lit while inside the hutch, you must immediately exit the hutch and tell others to do the same. Press an emergency stop and contact radiation safety on-call after exiting the hutch.

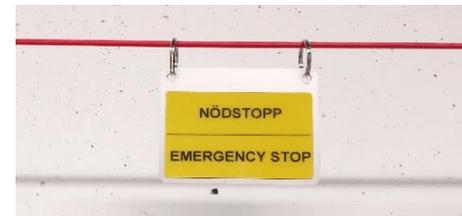


# Inside an experimental hutch

Emergency stops are located inside beamline hutches as well as outside by the entry points to the hutches. The emergency stops shut down all relevant sources of ionizing radiation. Contact radiation safety on-call if you have pressed an emergency stop.

In some hutches additional pull rope emergency stops are installed along the walls.

If an electronic dosimeter alarm is triggered, you must immediately exit the hutch and tell others to do the same. Contact radiation safety on-call in case of a dosimeter alarm.



# Exit from an experimental hutch

At the hard X-ray beamlines the doors to the experimental hutch are locked by electromagnetic locks. To unlock the door from the inside, press the button with the key symbol. In the event of an emergency, it is always possible to unlock the door by pressing the black emergency door release button.

At the SPF beamlines, the doors are opened using a standard door handle.

Close the door if you are the last person to exit the hutch.

Return the electronic dosimeter.

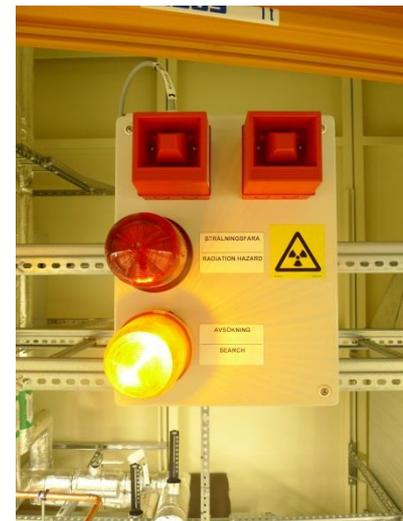


# Search of an experimental hutch

To ensure that no one remains inside the hutch, it has to be searched before radiation is permitted. An on-site practical training is required to be allowed to search the experimental hutch at the beamline where you have beam time.

The orange warning lights inside and orange information lights outside the hutch flash during the search and are lit when the search is completed. During the search, sirens inside the hutch are active.

If you are inside the hutch when someone else starts a search you should quickly exit the area. If this is not possible, you should press an emergency stop, which will abort the search.



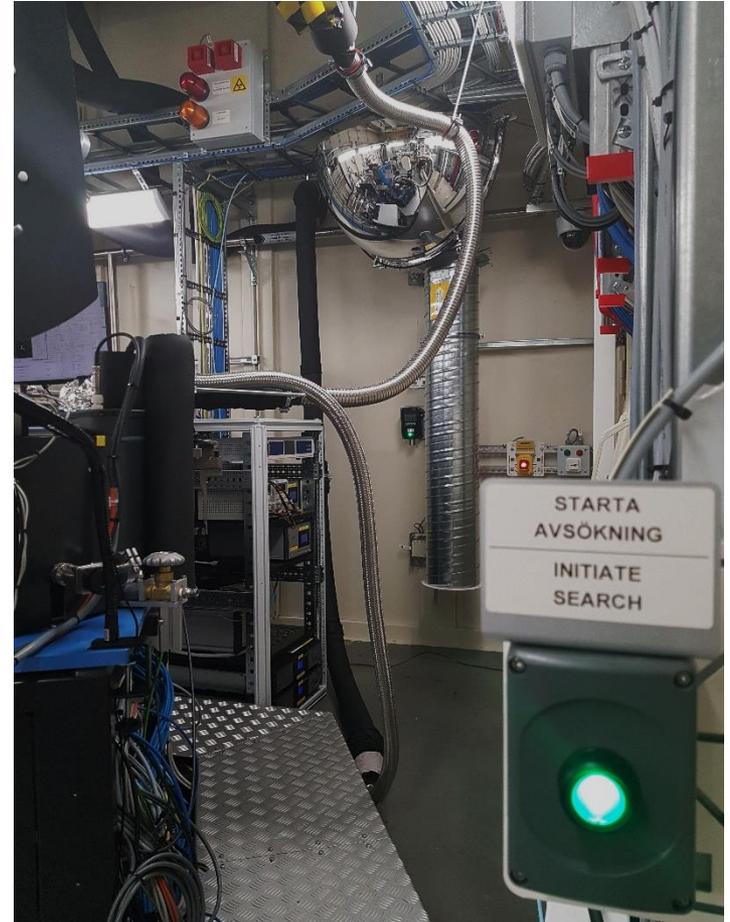
# Performing a search

By performing and completing a search you are personally responsible that no one is left inside the area. The radiation levels in the experimental hutch can be lethal when there is beam in the hutch.

Inform everyone inside the hutch that it will be searched and that they must exit the area before the search is initiated.

Close all doors (the main access door that you will use to exit can stay open). If a door is opened during the search, or if the light curtain detects an object, the search is aborted.

Radiation is permitted in the hutch after a 30 second warning period.



# Performing a search

Instructions on how to perform a search are posted at the main entrance to the hutch and presented during the on-site training. The overall procedure is:

1. Press the (green) initiate search button inside the hutch.
2. Ensure that no one is present in the hutch and press the (blue) search buttons as they start flashing.
3. Press the (white) exit during search button, exit the hutch and close the door.
4. Press the (yellow) complete search button.



# User chicane

It is not allowed to open the regular chicanes without a radiological work permit. For temporary cabling a user chicane should be used. The user chicane can only be opened when the hutch is not searched.

Pressing the key button next to the chicane will deactivate the magnetic lock during 10 seconds. Open the chicane while the green light is lit.

Ensure that the magnetic lock is active when the chicane has been closed. It is not possible to initiate a search unless both sides of the user chicane are closed.

Instructions are posted on the chicane.



# Radiological work permits

It is not allowed to move, modify or remove shielding material, equipment or signage that may affect radiation safety without prior approval from the radiation safety team.

Examples are shielding material, regular beamline chicanes and equipment related to the personnel safety system. In some cases the equipment is labelled. However, this is not always the case.

Users should not need to perform any such work. If the need should arise, a radiological work permit must be issued by the radiation safety team. Contact the beamline staff for more information.



# Local X-ray sources

The end stations of certain soft X-ray beamlines are equipped with local X-ray sources.

Before using such equipment you are required to read the associated local instructions and confirm that you will follow them by signing the appropriate certificate list.



# Additional rules

- It is forbidden to bring radioactive material, sources or any equipment that may emit ionizing radiation (e.g. X-ray tubes, UV lamps) to MAX IV without the prior approval of the radiation safety team.
- Temporarily cordoned-off areas may be employed to protect personnel from exposure to increased radiation levels. Such areas will be marked using radiation hazard signs and access is prohibited.
- Pregnant users are welcome, but can not be required by their employer to come to MAX IV.



# Radiation safety team

If you have questions or want more information, please contact the radiation safety team.

Radiation safety on-call:

(at MAX IV during operation)

+46 (0)703-97 32 96

Email us: [radiation@maxiv.lu.se](mailto:radiation@maxiv.lu.se)

Johanna Paulsson – *Assistant group manager*

Konstantin Batkov

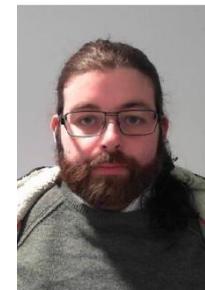
Magnus Hörling

Jimmy Malmqvist

Josefin Reftlér

Anders Rosborg

Brian Wakely





# Biosafety

# Applicable regulations

The regulations below are in Swedish and are listed for reference.

- AFS 2018:4 – Smittrisker
- AFS 2005:6 – Medicinska kontroller i arbetslivet
- AFS 2007:5 – Gravida och ammande arbetstagare



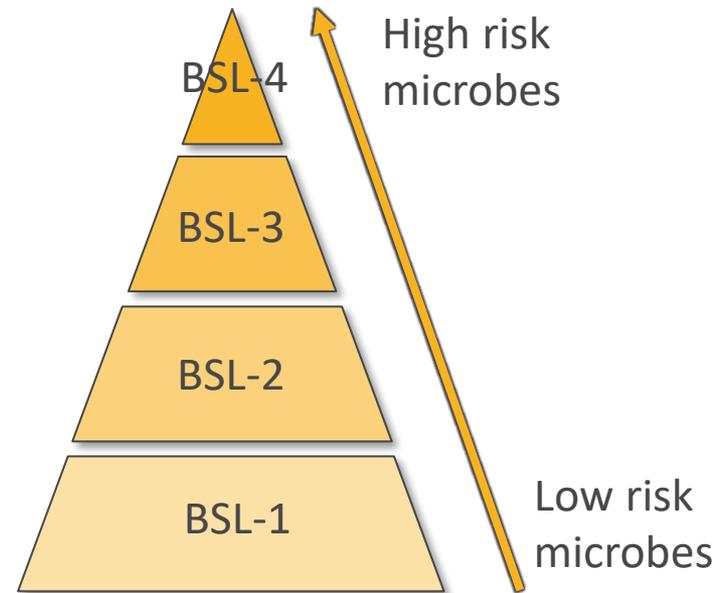
# Biosafety levels

**Biosafety level 4** is the highest level of biosafety precautions.

**Biosafety level 3** is appropriate for work involving microbes which can cause serious and potentially lethal disease via the inhalation route.

**Biosafety level 2** is suitable for work involving agents of moderate potential hazard to personnel and the environment.

**Biosafety level 1** is suitable for work with well-characterized agents which do not cause disease in healthy humans. These agents should pose minimal potential hazard to laboratory personnel and the environment.



# MAX IV: Biosafety level 1

The Biological support lab (Biolab) is open to users and restricted to Biosafety level 1.

It is allowed to handle biological agents fulfilling the criteria for biosafety level 1 at the beamline-attached preparation laboratories but major manipulation of biosamples must be done in the Biolab. Request in access to the Biolab should be made at least two weeks in advance. A separate training from the Biolab manager and approved experimental risk assessment are needed for the access.



Biohazard

# Handling biological agents at MAX IV

- All samples have to be properly labeled and stored in closed containers.
- Only qualified and trained personal are allowed to work with biological agents
- Any incidents or accidents must be reported immediately to the MAX IV Safety group
- If necessary, waste must be decontaminated
- Transportation of biological agents is only allowed with in closed containers that are labeled as Biohazard
- Personal Protection Equipment (PPE) must be used as appropriate
- Hands have to be disinfected and cleaned when leaving the lab or in case of a contamination
- All waste should be discarded through the appropriately designated routes, i.e. sharp, chemical, biological waste containers

# Sample declaration

- All biological samples must be declared in the proposal phase in DUO.
- The samples you bring must correspond to the samples you declared in DUO. This will be checked by your local beamline contact.
- All hazardous samples must be risk assessed and approved by the Safety team. Contact [EST@maxiv.lu.se](mailto:EST@maxiv.lu.se) to receive risk assessment form.
- The users are required to provide ethical authorisation of the research if human samples, cell tissues and their derivatives are to be studied in a proposal
- Any changes of samples must be declared in DUO prior starting the beamtime. All hazardous samples must be declared in DUO and risk assessed two weeks before your beamtime starts. You are not allowed to work with hazardous samples until it has been approved by the safety team.

# Contact information

If you have questions or want more information please contact the biosafety responsible:

Biolab Manager

Yang Chen

+46 (0)722-35 64 46

At MAX IV between 8:30-16:30

[yang.chen@maxiv.lu.se](mailto:yang.chen@maxiv.lu.se)





# Chemical safety

# Applicable regulations

Many regulations in Sweden are in effect for a safe chemical work environment.

Below, the most important are listed for reference:

AFS 2014:43 – Chemical Hazards in the Working Environment

AFS 2018:1 – Occupational exposure limit values

- Local regulations at MAX IV stems from the many regulations and are mandatory to follow during your visit.
- Please adhere to local work instructions, notes and signs posted around the facility.



Folkhälsomyndigheten



Swedish Civil  
Contingencies  
Agency



# Chemical hazard

The term chemical hazard includes both hazardous chemical substances and mixtures when they occur as a chemical product and in other manners.

Other manners may be as exhaust fumes or other air pollution, or in or on a material, plant or technical device.

- Acid spill on aluminium foil (non-hazardous metal) is a classic “hidden” chemical hazard, as the reaction is exothermic and generates flammable hydrogen gas which may ignite/explode.



*Hydrogen gas is generated as one of the products between aluminium and an acid.*

# Chemical hazard labelling

Since 1 June 2015 all newly produced chemicals must be labelled and classified according to Classification, Labelling and Packaging (CLP.)

The label on hazardous chemicals, originates from Globally Harmonized System (GHS), consist of several important parts as: hazard pictograms, signal word, hazard statements (H) and precautionary statements (P).

Safety Data Sheets (SDS) are readily available from vendors and are a necessity when performing a proper risk assessment.

**Components Of A GHS-Compliant Label**

**product identifier** **AMMONIA**

**signal word** **DANGER**

**hazard statement** **TOXIC IF INGESTED**

**precautionary statements** Wash hands thoroughly after handling. Keep container tightly closed when not in use. Keep away from heat, sparks and open flames - may explode when exposed to high heat. Use in an open area that is well-ventilated. Breathing in ammonia is irritating and corrosive. Wear protective gloves and safety goggles to prevent burns and irritation.

**supplier information** ABC Chemicals - 123 Main Street - Cincinnati, OH - www.abcchem.com - 800-733-5252

**pictograms**

See Safety Data Sheet (SDS) for further details regarding safe use of this product.

**Sigma-Aldrich** [www.sigmaaldrich.com](http://www.sigmaaldrich.com)

**SAFETY DATA SHEET** Version: 6.0  
Revised Date: 21.06.2023  
Print Date: 21.06.2023  
According to Regulation (EC) No. 1907/2006  
GENERIC EU MSDS - NO COUNTRY SPECIFIC DATA - NOT FOR DATA SHEET

**SECTION 1: Identification of the substance/mixture and of the company/undertaking**

**1.1 Product identifiers**  
Product name : Acetone  
Product Number : 34850-H  
Brand : Sigma-Aldrich  
Inser-No. : 606-001-00-0  
REACH No. : 01-2118871330-49-XXXX  
CAS-No. : 67-64-1

**1.2 Relevant identified uses of the substance or mixture and uses advised against**  
Identified uses : Laboratory chemicals, Manufacture of substances

**1.3 Details of the supplier of the safety data sheet**  
Company : Merck US Life Science AB  
Box 3033  
DE 69126 SCLM  
Telephone : +46 08 742 4200  
Fax : +46 08 742 4243  
E-mail address : TechnicalService@merckgroup.com

**1.4 Emergency telephone**  
Emergency Phone # : +(46) 852350403 (CHERTREC)  
Vår skatt för liv, exponering eller missö - 112

**SECTION 2: Hazards identification**

**2.1 Classification of the substance or mixture**  
Classification according to Regulation (EC) No 1272/2008  
Flammable liquids (Category 2), H227  
Eye Irritation (Category 2), H319  
Specific target organ toxicity - single exposure (Category 3), Central nervous system, H336  
For the full text of the H-Statements mentioned in this Section, see Section 16.

**2.2 Label elements**  
Labelling according Regulation (EC) No 1272/2008  
Pictogram

Signal Word : Danger

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Merck-Aldrich - 34850-H  
The Life Science business of Merck operates as MilliporeSigma in the US and Canada

# GHS hazard pictograms

The GHS hazard pictograms consists of 9 pictograms with an explaining text.

- These pictograms will be seen on various places at the facility and it is important that you recognize and understand their meaning.



**Explosive**



**Flammable**



**Oxidising**



**Acute toxicity**



**Serious health hazard**



**Corrosive**



**Gas under pressure**



**Health hazard**



**Hazardous for the environment**

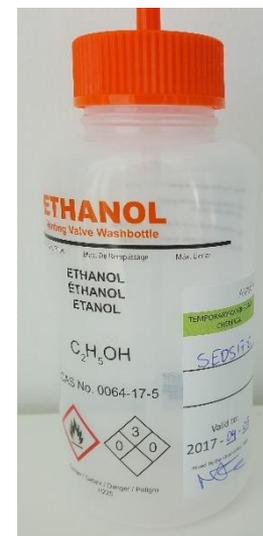
# Permanent chemical hazards at MAX IV

There are several areas with permanent chemical hazards which you need to be aware of:

- Experimental halls (A-, C-, D-buildings)
  - Gas bottles & gas cabinets
  - Aerosol cans
  - 0.5 L organic solvents bottles
  - Truck charging stations
- Gas- and flammable solvent bottles bears a tag with an area specific permit. Do not move these bottles to other areas.
- You are welcome to use chemistry labs at MAX IV. Before gaining access to chemistry labs you need to conduct hands-on training. Please contact [SupportLabs@maxiv.lu.se](mailto:SupportLabs@maxiv.lu.se) prior to your arrival in order to schedule time for hands-on training.



Labels on gas- and flammable solvent bottles.



## Laddningsplats



### Skyddsåtgärder vid arbete med Batterier

#### Explosionsrisk - Knallgas

1. Förbud mot rökning och öppen eld
2. Undvik kortslutningsgnistor
3. Avled statisk elektricitet genom att alltemellanåt beröra jordat föremål
4. Använd isolerade verktyg

#### Frätande vätska

Använd tättslutande skyddsglasögon och skyddshandskar

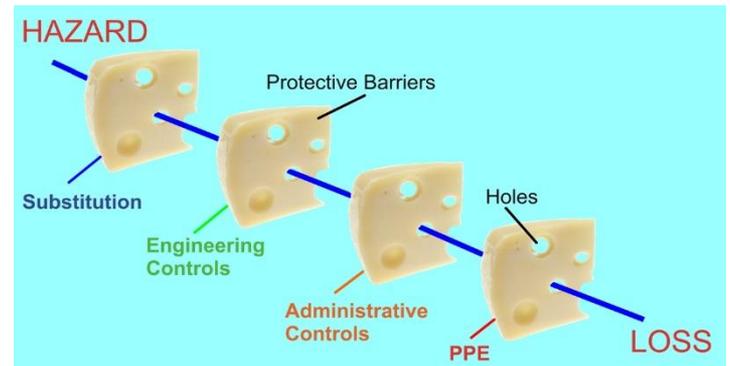
Truck charging area sign.

# Personal Protection Equipment (PPE)

Technical solutions as a fume hood or ventilated point suction are examples of protective barriers for your safety.

Local work instructions are also a type of safety barrier and it's important that these are followed.

PPE is the last line of defense against chemical hazards when all other available options have been executed/implemented.



*Examples on protective barriers to control hazards.*

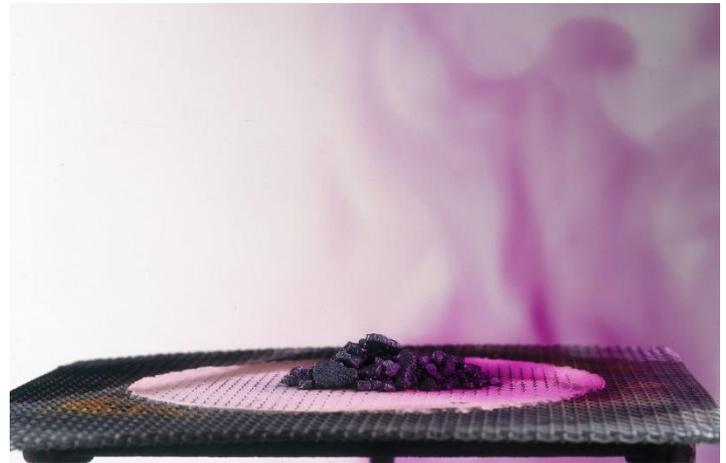


*Examples of signs with advised PPE to use*

# Working with chemicals

Hazardous work with chemicals is only allowed at the chemical labs.

- There are limits on what type of work you are allowed to do at the beamline preparation labs. Always consult with the beamline staff if you are unsure.
- Contact [SupportLabs@maxiv.lu.se](mailto:SupportLabs@maxiv.lu.se) well in advance, if you require access to the chemical labs.
- Always follow local instructions and special work instructions.



# Chemical Safety (CS) team

If you have questions or want more information, please contact the CS team.

Chemical safety officer

**+46 (0)705-25 92 34**

At MAX IV between 8:30-16:00

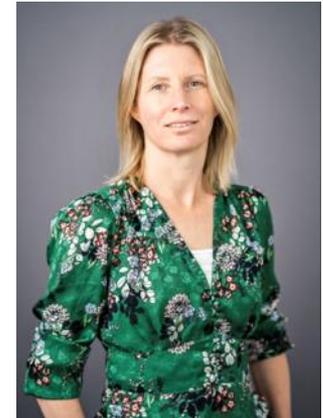
Email us: [chemsafety@maxiv.lu.se](mailto:chemsafety@maxiv.lu.se)

Katarina Liljenberg

+46 (0)703-452 698

Susanna Johnmark

+46 (0)730-728 769





# Experimental safety

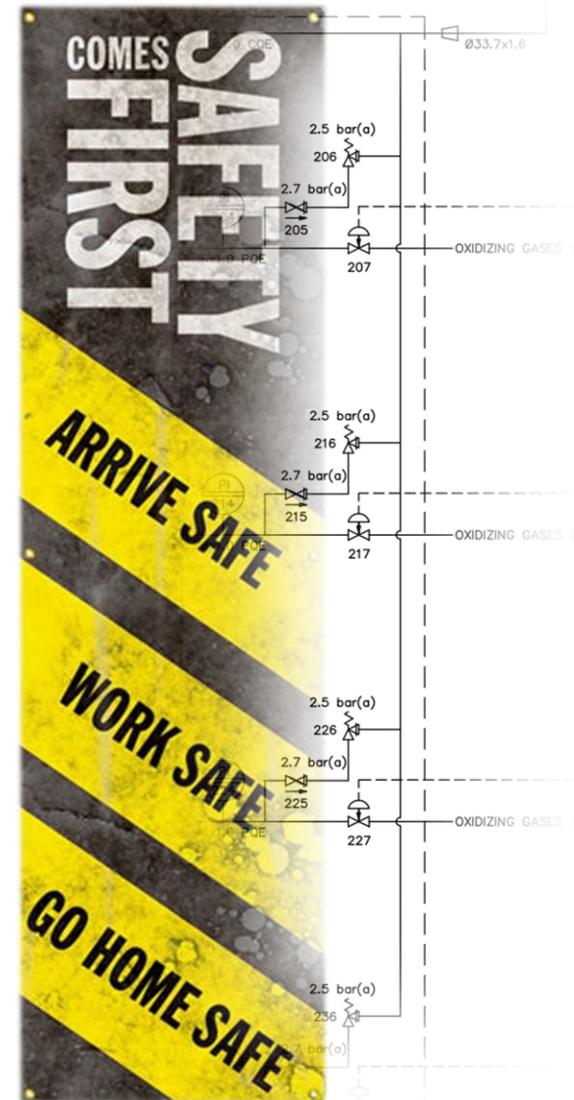
# Introduction

The leading Principal Investigator (PI) are expected to have managed the following topics beforehand ([web link](#)):

- Have an approved Experimental Safety Risk Assessment (ESRA) related to your experiment
- Declared **all** samples in DUO matching the ESRA
- Booked access to the support labs (if applicable)

The following slides will guide you through the experimental safety related aspects of your stay at MAX IV:

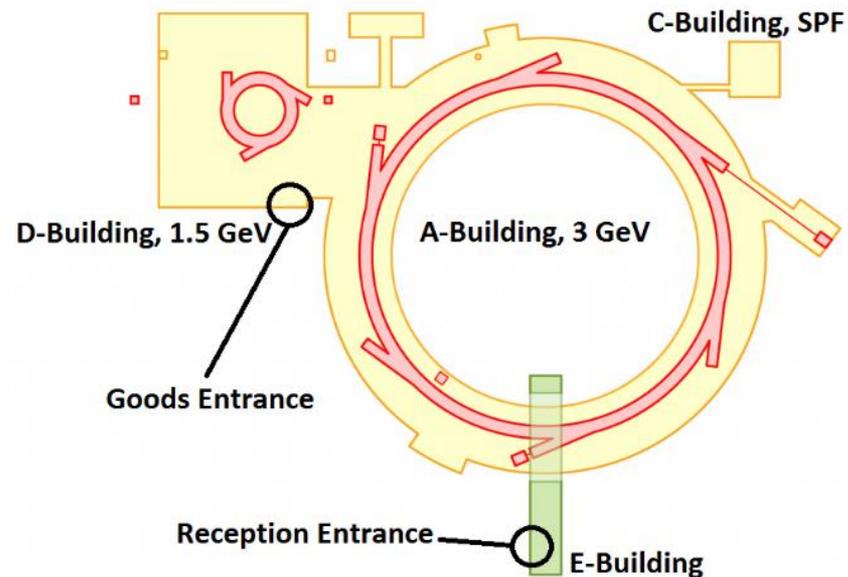
- Bringing samples/chemicals to our facility
- Your ESRA experiment category: Red, Yellow, Green
- Gatekeeping
- Signing the Experimental Safety Approval Form (ESAF)
- Safety during your experiment



# Bringing or sending chemicals to the facility

It is your responsibility that you bring your samples to our facility in good order and in accordance with legal requirements. Contact a safety responsible at your home institute for guidance.

- You are not allowed to bring gases to our facility without an approval from EST.
- If you plan to order and/or send chemicals to our facility, this needs an approval beforehand from the Chemical Safety (CS) team, contact them well in advance of your planned experiment.
- Hazardous chemicals/ bulky equipment are not allowed in the E-building (main office building) and the reception area. They must be dropped off at the goods entrance and later be picked up from inside the D-building after picking up your badge at the reception.



# Experimental safety categories

When your ESRA have been approved it have been assigned one of these three categories: Green, Yellow or Red.

Each category indicates specific increasing levels of controls/restrictions that is required for the execution of the experiment.



# Experimental safety categories - Green

If your experiment has been classed as Green the following implies:

- The suggested mitigations in the ESRA combined with the technical and administrative controls at the beamline mitigates the risks.
- Your samples and/or experimental setup pose a low risk for exposure for you or other people at MAX IV.
- No gatekeeping is required; experiment can start after the ESAF sign-off.
- We recommend at least 2-3 people to be present at the beamline when running the experiment on-site to prevent fatigue and lone hazardous work.

<b>Risk Level</b>	<b>Green</b>
<b>Safety Procedures</b>	No additional requirement
<b>Beamline Area Access</b>	No Restriction
<b>Gatekeeping</b>	No
<b>24/7 Attended Operation</b>	No

# Experimental safety categories - Yellow

If your experiment has been classed as Yellow the following implies:

- The suggested mitigations in the ESRA combined with the technical and administrative controls at the beamline partly mitigates risks. Additional risk mitigations are suggested by EST.
- Your samples and/or experimental setup pose a medium risk for exposure for you or other people at MAX IV. May involve gas experiments.
- Gatekeeping will be done.
- We recommend at least 2-3 people present at the beamline when running the experiment on-site to prevent fatigue and avoid any hazardous lone work.

<b>Risk Level</b>	<b>Yellow</b>
<b>Safety Procedures</b>	Additional risk mitigations assigned by EST
<b>Beamline Area Access</b>	Restrictions may apply
<b>Gatekeeping</b>	Yes
<b>24/7 Attended Operation</b>	No

# Experimental safety categories - Red

If your experiment have been classed as Red the following implies:

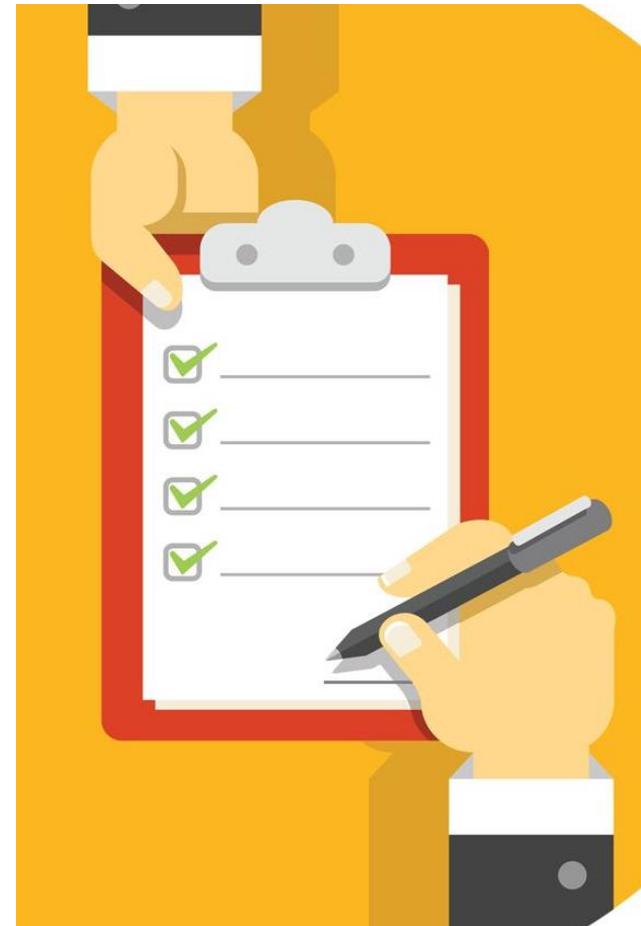
- The suggested mitigations in the ESRA combined with the technical and administrative controls at the beamline partly mitigates risks. EST asses that the risks are still high and/or your experiment involves techniques that are hard to risk assess.
- Your samples and/or experimental setup pose a medium/high risk for exposure or could lead to a serious incident in case of an accident for you or other people at MAX IV. Usually involves gas experiments.
- Gatekeeping required.
- 2 people **MUST** be present at the beamline 24/7 when running the experiment to prevent fatigue and avoid any hazardous lone work.

<b>Risk Level</b>	<b>Red</b>
<b>Safety Procedures</b>	Additional risk mitigations assigned by EST
<b>Beamline Area Access</b>	Authorized personnel only
<b>Gatekeeping</b>	Yes
<b>24/7 Attended Operation</b>	Yes

# Gatekeeping

Experiments categorized as a Yellow or Red will go through the process of gatekeeping.

- When all experimental setup and required mitigations have been put in place, the Local Contact (LC) will call for the Floor Coordinators (FCs) to execute the gatekeeping which involves the LC and the leading PI on-site.
- The FCs will go through a checklist and the gatekeeping is finalized by all parties signing the Experimental Safety Approval Form (ESAF) and posting it on the beamline information board.
- Red experiments may only start their gatekeeping during office hours. Yellow gatekeeping can be done at any time.



# Experimental Safety Approval Form (ESAF)

Signing the ESAF form and posting it on the BL information board is a final requirement before allowing the experiment to start.

- By signing, the leading PI on-site confirms that they have been given the BL safety introduction by the LC and that all samples have properly been declared in DUO/ESRA (including backup samples).
- For experiments categorized as Yellow or Red, this is signed between the FC, LC and the PI after the gatekeeping.
- For experiments categorized as Green, the LC and PI signs after the BL safety introduction and any minor mitigations have been addressed.

Experimental Safety Approval Form, ESAF

SAFETY CATEGORY		RED			
PROPOSAL ID		20000000			
TITLE		Red Test			
START DATE & TIME		2023-12-14			
FINISH DATE & TIME		2023-12-14			
BEAMLINE					
LOCAL CONTACT	NAME	LC Name			
	CONTACT NUMBER	LC Phone			
LEADING PRINCIPAL INVESTIGATOR ON-SITE	NAME	Leading PI On-Site Name			
	CONTACT NUMBER	Leading PI On-Site Phone			
SAMPLES	Nanomaterials, Class	Yes, Nano class 1			
	Chemicals	Yes			
	Gases	Yes	Flammable: Yes	Oxidizing: No	Toxic: Yes
	CMR classed	Yes			
	Biological	No			
HAZARD PICTOGRAMS					
SUMMARY OF OTHER HAZARDS	Gas, vapour and liquid pressure equipment/vessels Laser Ultrasounds/sonic Heating ribbon The experiment involves bringing our own equipment to MAX IV			LINK TO ESRA FORM 	
	LAB ACCESS	Yes			
SAMPLE REMOVAL	The User				
SIGNATURES					
Pending		LC Name	Leading PI On-Site Name		
EST	FC	LC	Leading Principal Investigator On-Site		

ESAF 20000000/11013

Example of a RED ESAF Sheet

# Safety during your experiment – I

Working with gases and in-situ experiments:

- Only MAX IV staff are allowed to transport, change and connect gas bottles at the beamline.
- When hazardous gases are in use, there are gas alarms present to warn you in case of any danger. Special response instructions will be given by your LC on-site if your experiments involve hazardous gases.
- When working with hazardous gases and *in-situ* experiments two persons are required to be present at the beamline 24/7.
- In case of any serious accident, call 112.



# Safety during your experiment – II

“Precautionary Principle” for Nanomaterials:

In the absence of complete scientific evidence, the potential threat of research materials on human health and the environment is assumed to be such that *precautionary measures must be taken* until the material is known to be safe.

- All nanomaterials need to be declared in the special NM section of the ESRA.
- Handling of NM in powder form is not allowed in any open space. It is not allowed to handle more than 1 g/sample of NM in powder form at the facility.



NM-Matrix	Hazard/ Exposure to Human Body	Risk
Dry powder	Fire, explosion and catalytic reactions. Inhalation, skin and ingestion.	High
Aerosol	Inhalation, skin and ingestion	High
Liquid colloids/ suspensions	Spill containment and reactivity. Skin and ingestion.	Moderate
Embedded in solid matrix	Abrasion, machining, grinding, etc. Inhalation, skin and ingestion.	Low

# Safety during your experiment – III

## Working with Liquid Nitrogen (LN2)

Chemistry labs, preparation labs and experimental hutches are areas where Oxygen deficiency poses a hazard when using Liquid Nitrogen (LN<sub>2</sub>).

- Your LC should brief you on how LN<sub>2</sub> is allowed to be handled at the BL during the beamline safety introduction.
- Always use required PPE as instructed by your LC.
- You as a user are not allowed to fill or transport large LN<sub>2</sub> dewars at the facility. Call the FCs if you need any help during off-hours, otherwise it's your LC that will support you with this.
- In case of any Oxygen alarm goes off, your first action is to evacuate the area out to the experimental hall. Try to keep doors open. Tell others to evacuate the beamline out to the experimental hall and then call the FCs.
- In case of any serious accident, call 112.



# Pregnancy and breastfeeding

This information is relevant if you are pregnant, have given birth within 14 weeks prior to the work being carried out, or if you are breastfeeding.

Your own employer is responsible for performing a risk assessment of your planned work. Please send the risk assessment to EST well in advance of your experiment.

EST will check if there is any additional risks to be aware of at the facility, not taken account for in your own risk assessment and communicate this back to you.

The same rules will apply for you as our own staff, more information can be found on this page, under the header “Information for pregnant or breastfeeding women”:

<https://www.maxiv.lu.se/user-access/safety/safety-requirements-for-employees/>

# Experimental Safety Team (EST)

Make sure to check the online pages for more information:

<https://www.maxiv.lu.se/user-access/safety/safety-requirements-for-users/>

You are always welcome to contact EST via email [est@maxiv.lu.se](mailto:est@maxiv.lu.se)



**Marcin Bielawski**  
ASSISTANT GROUP MANAGER/EST  
+462226773  
Marcin.Bielawski@maxiv.lu.se  
E100042  
marbie  
• Safety •



**Jacinta Xto**  
RESEARCH ENGINEER  
+46462229025  
Jacinta.Xto@maxiv.lu.se  
E100044  
jacxto  
• Safety •



**Johnny Kvistholm**  
TECHNICIAN  
+46462226615  
Johnny.Kvistholm@maxiv.lu.se  
D110061-7  
johkvi  
• Safety •



# Waste handling

# What is hazardous waste?

## **Hazardous Chemical Waste**

Waste containing, or consisting of, substances with hazardous properties i.e health hazards, harmful, oxidizing, flammable, toxic or hazardous to the environment.

Examples: Chemicals, samples and disposables which has been in contact with such. Spills and absorbents. Gloves and other disposable PPE

## **Hazardous Biological Waste and Infectious Waste**

Biological samples and disposables which has been in contact with such.

## **Hazardous Miscellaneous Waste**

I.e. small electronics, spray cans, batteries, lamps etc.

# Types of hazardous waste at beamlines and prep labs

Only relatively harmless chemicals may be used outside of chemical labs. Some hazardous chemical waste can still occur at a beamline, such as:

- Used chemicals
- Used samples
- Gloves and other disposable PPE
- Absorbents
- Disposables

# Types of hazardous waste containers at beamlines and prep labs - I

Different kinds of hazardous chemical waste needs to be packaged in different ways.

Examples of approved packaging:

Sysav Kemi cardboard box with chemically approved plastic bag.

Used for:

- Chemically contaminated gloves
- Tissue paper, pipet tips
- Spills
- Absorbents/wipes



# Types of hazardous waste containers at beamlines and prep labs - II

Do not overfill box. It must be able to close.

Ensure that container is always stored in properly ventilated compartment connected to fume hood.



# Types of hazardous waste containers at beamlines and prep labs - III

MAX IV provided plastic containers.

Used for:

- Liquid waste
- Solid waste
- Disposables which have been in contact with odorous chemicals

Glass containers for hazardous waste can be provided by request.

Contact [chemsafety@maxiv.lu.se](mailto:chemsafety@maxiv.lu.se)

or +46-(0)46-222 66 55



# Types of hazardous waste containers at beamlines and prep labs - IV

Safety container for sharps. Available in different sizes.

Used for:

- Sharps
- Needles
- Cannulas
- Scalpels
- Razor blades

Safety containers can be provided by request.

Contact [chemsafety@maxiv.lu.se](mailto:chemsafety@maxiv.lu.se)

or +46-(0)46-222 66 55



# Labelling hazardous waste

Always mark your hazardous waste for safer and easier disposal.

Labels for hazardous waste are available at Chemical labs, beamlines and prelabs.

<b>Laboratorieavfall / Chemical waste</b>	
Lösningsmedel / Solvent:	_____
_____	_____
Innehåll / Content:	_____
_____	_____
_____	_____
Namn / Name:	_____
Avd / Dept:	_____
Tel / Phone:	_____ Datum / Date: _____