

Laboratory Safety Guidelines for Radiation

Professional standards of personal behavior in the laboratory ensure your and your coworker's safety. You are responsible that your work is safe for you, for others and for the environment.

Allowed activities

Table 1. Maximum activities for the C-laboratory (F 17.2):

| Nuclide | Activity during work | Activity in Storage |
|---------|----------------------|---------------------|
| C-14 | 35 MBq | 900MBq |
| H-3 | 1 GBq | 100GBq |
| P-32 | 3 MBq | 200MBq |
| S-35 | 35 MBq | 500MBq |
| U-nat | 40 kBq | 1.05MBq |

The total activity of each nuclide, including waste, must never be higher than the values above.

Table 2. Maximum activities for HPK C1:

| Nuclide | Activity for work and/or storage |
|---------|----------------------------------|
| C-14 | 9MBq |
| H-3 | 100MBq |
| P-32 | 2MBq |
| S-35 | 40MBq |
| U-nat | 900Bq |

The total activity of each nuclide, including waste, must never be higher than the values above.

If you want to work with radioactivity outside HPK C1, contact the radiation safety officer in advance for approval.

Before starting to work with C-14, contact the neighboring particle physicists as their instruments might be very sensitive to even small amounts of C-14.

Dose

Maximal allowed excess yearly dose:

for the general population: 1 mSv/year

for occupationally exposed users: 20mSv/year

Nursing women are not allowed to work with any radioactivity. Pregnant women and 16-18 year-old persons contact the radiation safety officer first.

Dosimetry

If you are working or planning to work with more than the following activities, you need a dosimeter. See the radiation safety officer to discuss the further procedure.

| Nuclid | Fullbody dosimetry | | Fingerring dosimetry | | Incorporation control |
|--------|----------------------|-------------------|----------------------|-------------------|----------------------------|
| | activity during work | turnover per year | activity during work | turnover per year | |
| H-3 | - | - | - | - | > 20000 MBq |
| | | | | | > 2000 MBq (volatile form) |
| C-14 | - | - | - | - | > 1800 MBq |
| | | | | | > 180 MBq (volatile form) |
| P-32 | > 200 MBq | > 400 MBq | > 200 MBq | > 400 MBq | > 400 MBq |
| | | | | | > 40 MBq (volatile form) |
| S-35 | - | - | - | - | > 8000 MBq |
| | | | | | > 800 MBq (volatile form) |

Ordering

If you need to order radiochemicals, the order must be placed by the radiation safety officer or deputy. Send an E-Mail to one of them with the exact details of your compound (provide a bookkeeping sheet).

Ordering of P32-labeled ATP via the radiation safety officer of the Institute of Biochemistry and transfer of small aliquots to HPK C1 is detailed in a separate SOP.

Bookkeeping

When you receive your radiochemical, the bookkeeping sheet is returned to you. Fill in every amount of activity that is used for experiments and note when residual amounts are disposed of. When the radiochemical is used up or fully disposed return the bookkeeping sheet to the radiation safety officer or deputy.

Waste

Separate radioactive from inactive, and solid from liquid waste.

Collect organic solvents separately from aqueous waste and collect chlorinated solvents separated from non-chlorinated ones.

For work in HPK C1 (e.g. H-3, C-14, P-32):

Label all your waste bags/bottles with nuclide name, activity, date, isotope stock number(s) and your name. Indicate buffer compositions. Fill in the log-sheets for solid and liquid radioactive waste and immediately after finishing your work, transfer the waste bag for solid waste to the larger Plexiglas waste containers for further decay.

Store the radioactive waste bags containing β -emitters in the Plexiglas waste containers.

Radioactive liquids are stored either in a plastic canister or in glass bottles. Put the glass bottles also in the Plexiglas container.

Each waste bag/bottle must be trackable.

Notify the radiation safety officer when you have waste to discard. Never discard any radioactive waste by yourself.

Details for handling of uranyl acetate waste are provided in a separate instruction.

Contamination control

Every time before you start and after you finish your work you must use the radioactivity monitor to check your workbench, apparatus and surroundings for contaminations.

When leaving the C-Lab you must check your hands. Measure them with the CoMo-Contamination detector, make sure the device is showing Bq/cm² (CS)). Likewise, the activity of materials removed from the C-lab must be below those listed in Table 2, and surfaces must be free of contamination. Activity limits that, when exceeded, define a surface as being contaminated are listed in the table below.

| Nuclide | Maximum allowed activity (Bq/cm ²) |
|---------|--|
| C-14 | 30 |
| H-3 | 1000 |
| P-32 | 3 |
| S-35 | 30 |
| U-nat | 10 |

Behavior in case of a surface / device contamination

Check if your gloves, hands and lab coat are contaminated, if yes proceed with the decontamination instructions for hand contamination.

Call / inform Christoph or Nina; call the ETH Emergency Desk in case you need additional help and follow their instructions:

Christoph: 33292, 077 405 69 00

Nina: 36410, 079 726 94 39

ETH Emergency Desk: 888

Identify the contaminated surface / device.

Mark the contaminated area with tape "radioactive".

Try to clean the surface (try to produce as little waste as possible).

Measure the activity of the contaminated surface and write it down.

If necessary, take appropriate safety measures:

α - radiation → lay 1cm thick Plexiglas on the contaminated surface

β - radiation → lay 1cm thick Plexiglas on the contaminated surface

γ -radiation → lay 5cm thick lead on the contaminated surface

Put a sheet with your name, date, time, isotope and measured activity and sign it.

Inform your colleagues, put a note on the entrance door that indicates the contamination.

Behavior in case of a hand contamination

If a contamination is present, do not touch the surfaces of the measuring devices! Leave at least 5mm distance!!!

Remove your gloves by turning them inside out, discard them into radioactive waste bag.

Wash your hands 3x with soap and COLD water.

Check if your hands are still contaminated, if yes, wash your hands again 3x.

If a contamination is still present, put on fresh gloves to avoid contaminating other devices or door handles.

If your lab coat is contaminated, put it into a plastic bag, label it with date, isotope, activity, your name and put into container for radioactive waste.

Call / inform Christoph or Nina; call the ETH Emergency Desk in case you need additional help and follow their instructions:

Christoph: 33292, 077 405 69 00

Nina: 36410, 079 726 94 39

ETH Emergency Desk: 888

Good laboratory practice

Work according to the AAAA-rule:

Exposure time as short as possible (Aufenthaltszeit)

Work as far away from the source as is possible and reasonable (Abstand)

Use a sufficient protective barrier (Abschirmung)

Use activities as low as reasonably possible (Aktivität)

Always wear a lab coat and gloves if you are working with radioactive material.

Everything that leaves the C-lab must be confirmed to be free of surface contamination. The samples must not have more than the allowed activities. If an apparatus is to be removed from the C-lab the Radiation Safety Officer (or deputy) must first confirm that it is free of contamination.

Choose a sufficient protective barrier for the type of radiation:

α -radiation -> glove

β -radiation -> 1cm Plexiglas

γ -radiation -> 5cm lead

All your storage tubes/bottles need to be labeled with nuclide name, activity, date and your name.

The outside of the freezer/fridge/cupboard you are storing the radiochemicals in must also be labeled with nuclide name, activity, date and your name.

Laboratory Emergencies

Phone Numbers

Always call the ETH Emergency Desk (24-hour service): 888
(from cell phone: 044 342 11 88)

If the emergency is life-threatening, directly call Medical Emergency/ Ambulance: 0-144, and also call 888.

Safety officers

Radiation safety: Dr. Christoph Giese (giesec@mol.biol.ethz.ch, phone: 33292);

Deputy: Nina Tremp (nina.tremp@mol.biol.ethz.ch, phone 36410)

Biological safety: Dr. Christoph Giese (giesec@mol.biol.ethz.ch, phone: 33292);

Deputy: Dr. Marc Leibundgut (leibundgut@mol.biol.ethz.ch, phone: 33148)

Chemical safety: Dr. Christoph Giese (giesec@mol.biol.ethz.ch, phone: 33292);

Deputy: Dr. Marc Leibundgut (leibundgut@mol.biol.ethz.ch, phone: 33148)

This handout only covers general safety guidelines. Before working with chemicals or equipment unfamiliar to you, consult the "Material Safety Data Sheets (MSDS)" and request training by a senior researcher authorized to run the equipment. For most institute instruments a responsible contact person has been assigned.

Hereby I confirm that I have read and understood these safety instructions.

Date

Name (printed)

Signature