Instructions for Radiation Protection

Strahlenschutzunterweisung nach §63 StrlSchV (Strahlenschutzverordnung, 2018)

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Lawtext: https://www.gesetze-im-internet.de/strlschv_2018/
Radiation protection

- X-ray devices
- Stray radiation
- Radioactive isotopes

Humans
Environment/nature
Guidelines

- “Strahlenschutzverfügung” (President, UHH)
- “Sicherheitsordnung” incl. Section “H. Strahlenschutz”
- “Betriebsanweisungen” / Code of practice
- “Strahlenschutzanweisungen” / Code of practice
  - Radiation passport (HH RA 31/06)
  - Radioactive materials (HH RA 42/17)
- “Merkblätter” / Handout-Memos
  Emergency plan (Alarmierungsplan)

- AGUM System:
  safety (including radiation safety) relevant information stored centrally on University web site.

  uni-hamburg.agu-hochschulen.de
Radioactive preparations

GENERAL CODE OF PRACTICE FOR HANDLING AND STORING RADIOACTIVE MATERIALS

RISK TO PERSONNEL AND THE ENVIRONMENT

- The effects of large doses (>1 Sv) of ionizing radiation on human beings can include acute deterministic effects (damage to organs, damage to radiation exposure, death). Small doses of radiation can cause stochastic damage (cancers, leukemia, genetic damage).

SAFETY MEASURES AND CODE OF CONDUCT

- Radioactive materials are to be handled exclusively for work-related purposes.
- The basic radiation safety rules apply: justification of the use (minimization of the activity), minimization of the exposure, maximization of the distance from the source, optimization of the shielding.
- The following regulations apply: German Radiation Protection Ordinance (Strahlenschutzverordnung, StrlSchV), see Bayerisches Landesamt für Strahlenschutz und Umwelt (BfS) Internet, the radiation protection regulations issued by the president of the University, and section "H" of the safety regulations (Strahlenschutzverordnung) of the Institute of Experimental Physics.
- All persons exposed to radiation must be provided with the radiation safety officer. Attendance by a radiation safety officer is mandatory.
- Transport of radioactive materials on the DESY campus is allowed exclusively with the agreement of the radiation safety officer.
- Transport of radioactive materials outside the DESY campus is subject to the German Road Transport Regulations (StVO) or special regulations (StVZO) and may only be arranged by the radiation safety officer.
- Radioactive materials must be stored in well-shielded, lockable cabinets (safe). In addition to the safe, the main storage room for radioactive materials, safe are also available in the laboratories in order to minimize exposure during transportation.
- Radioactive substances are only excluded by the radiation safety officer for work purposes. The recipient must sign it, and the radiation safety officer must confirm it with signature and date.
- The preparation of radioactive materials can only be arranged via the radiation safety officer.
- In controlled area (radiation dose in excess of 5 mSv/year), personal dosimetric monitoring must be carried out. Even if the radiation dose per year is less, personnel dosimetric monitoring can be requested.
- Disposal of radioactive substances above a certain level of activity must undergo an official yearly inspection (StrlBlatt). If the inspection is to be carried out, the source must be handled over to the radiation safety officer.
- The radiation protection equipment (shielding, transport containers) must be notified.
- Unborn children deserve special protection. Corresponding safety measures can only be implemented if the radiation safety officer has been informed about the pregnancy.

WHAT TO DO IN THE EVENT OF MALFUNCTIONS

WHAT TO DO IN THE EVENT OF ACCIDENTS: EMERGENCY NUMBER EXT. 2500

- In the event of a malfunction or accident (e.g. a high level of radiation exposure, contamination of persons or rooms, damage to radiochemical samples and radioactivity), inform the radiation safety officer, staff, and the supervisor.
- In the event of an accident, first, the fire if this is possible without putting yourself at risk. Every fire must be reported to the Technical Emergency Service (tel. 0505).
- In the event of a serious incident, dial emergency number ext. 2500.
- Evacuate persons from the hazardous area without putting yourself at risk.
- Treat minor injuries using the first aid kit (see details in the logbook).
- Inform the radiation safety officer and first aid officers.
- List of emergency doctors: http://www.ukl.de/dgus/DE/0W/0faces/D

MAINTENANCE

Before using a machine, always check its functionality and safety measures.
- Maintenance and repair must be carried out by trained profession staff.
- The equipment must undergo a technical inspection 5-6 years.

CONSEQUENCES OF NON-COMPLIANCE

- Health consequences: injuries and sickness.
- Disciplinary consequences: written warning.
Responsibility: President of UHH
Delegates duties to:

Chancellor of UHH
Nominates:

“Strahlenschutzbevollmächtigte”
FB-Physik: Prof. Dr. D. Horns
Nominates:

“Strahlenschutzbeauftragte”
FB-Physik: M. Tluczykont, S. Martens,
G. Rapior, O. Windmüller, M. Wieland

Implement radiation safety rules
Requires expert knowledge

Contact person – talk to me!
Enabling safe working!
**Organisation of radiation protection**

**• Strahlenschutzbeauftragte at InstExpPh:**

| Name              | Type       | Bahrenfeld | Vorlesungsvorbereitung | Medizinerpraktikum | Dosimetrie / Strahlenpässe (Fremde Anlagen) |
|-------------------|------------|------------|------------------------|--------------------|---------------------------------------------|
| Gerald Rapior     | StrlSchV   | ✔          |                        |                    |                                             |
| Stephan Martens   | StrlSchV   | ✔          |                        |                    |                                             |
| Marek Wieland     | RöV        | ✔          |                        |                    |                                             |
| Ole Windmüller    | StrlSchV,RöV | ✔          |                        |                    |                                             |
| Martin Tluczykont | StrlSchV,RöV | ✔, ✔      | ✔                      | ✔                  | ✔                                           |

+ INF (M. Langer, K. Groth)
+ ILP (U. Pape, F. Holweg)
+ DESY (M. Salmani, +D3)
Radiation at the Institute for Experimental Physics

HH-RA 42/17

Radioactive materials:
– stored in safes at different locations
– can be used in experiments
Radiation at the Institute for Experimental Physics

Radioactive materials:
- stored in safes at different locations
- can be used in experiments
Labelling requirements
Labelling requirements

Storage rooms for radioactive material:
Additional labelling for fireworks
Facilities / devices (X-rays or stray radiation)

- Need permission (in most cases)
- Checked by a service company every 5 yrs
- Modifications of facilities:
  - Contact StrlSchB
  - StrlSchB organizes *inspection* by company
  - StrlSchB contacts work safety agency for modification of *permission*
Purchasing / Acquisition and transport of radioactive materials

- **Contact StrlSchB**
- Handling of radioactive materials: permission for specific nuclides
- Further regulations exist for:
  - Transport
  - Disposal
- **Always contact the StrlSchB!**
Basic principles of radiation protection

ALARA principle:
“As low as reasonably achievable”

“Die 4 A's”

| Aufenthaltsdauer | Exposure time | minimize |
|-----------------|---------------|----------|
| Abstand         | Distance      | maximize |
| Abschirmung     | Shielding     | optimize |
| Aktivität       | Activity      | minimize |
Radiation areas

Einzelpersonen der Bevölkerung:

≤ 1 mSv/a
(Summe aus Direktstrahlung und Ableitungen)

Kontrollbereich
(effektive Dosis > 6 mSv/a)

ggf. mit Sperrbereich
(Ortsdosisleistung:
≥ 3 mSv/h)

Überwachungsbereich
(effektive Dosis > 1 mSv/a)
Limits on exposure to radiation
“Dosisgrenzwerte”

- “Beruflich strahlenexponierte Personen”
persons with radiation exposure at work
  - Kategory A: 6 mSv – 20 mSv per year
    regularly inside “Kontrollbereich” / radiation controlled area
  - Kategory B: < 6 mSv per year
    occasionally inside “Kontrollbereich” / radiation controlled area

Only exposures at work are relevant for StrlSchV / RöV!
Limits on exposure to radiation
“Dosisgrenzwerte”

- “Beruflich strahlenexponierte Personen” persons with radiation exposure at work
  - Kategory A: 6 mSv – 20 mSv per year regularly inside “Kontrollbereich” / radiation controlled area
  - Kategory B: < 6 mSv per year occasionally inside “Kontrollbereich” / radiation controlled area
- Private radiation exposure:
  - Medical diagnostics ~ 2 mSv per year
    - Tooth: <0.01 mSv
    - Thorax X-ray: ~0.08 mSv / exposure
    - CT: 2-25 mSv / exposure
  - Natural sources ~ 2 mSv per year
  - Round-trip by plane to New York: ~ 0.1 mSv
  - Cigarettes – Pb210, Po210: 11 cigarettes per day = 6 mSv organ dose per year
Limits on exposure to radiation “Dosisgrenzwerte”

• Special limits:
  - Persons under 18 years: < 1mSv / year
  - Women: Organ dose at uterus <2mSv / year
  - Pregnant women: exposition of child <1mSv/year

• Limits for pregnancy are valid starting with StrlSchB *knowing* about it
Dosimetrie & Strahlenpässe

- **Official dosimetry:**
  - for persons who work inside “Kontrollbereich”
  - If you work with radioactive material and need a dosimeter, contact me!
  - Ordering a dosimeter takes about 4 weeks!

- **Work at “outside-UHH facilities” - Radiation passports (Strahlenpässe):**
  - “Arbeit in fremden Anlagen” = work in foreign facilities, *i.e. other than UHH*
  - For persons exposed to radiation at work outside UHH (BESSY, Rossendorf, DESY, ...)
  - Must follow directives of radiation safety at foreign facility. E.g. safety lecture specific to facility is mandatory
  - **Mandatory:** need to be updated before going to the “Fremde Anlage”
Radiation passports

• **Procedure for registration** (~2 weeks):
  - Fill in required information + signatures
  - StrlSchB sends passport to “Amt für Arbeitsschutz” for registration
  - Sent back to me

• **Procedure for passport maintenance**
  - **Passports stay in Office 16, Building 68**
  - **Mandatory regular update** by me
  - If needed for beamtime: **handed out against signature** by me
    (Also access to my office: M. Matysek, W. Weppner, D. Horns)
  - Handout along with **OSL-Dosimeter against signature**
  - Note: exceptions exist, where Albedo Dosimeters need to be ordered (~2 weeks !)
  - When back from beamtime, **return passport and dosimeter immediately**

• **Strahlenschutzanweisung zu Genehmigung HH-RA 31/06**
Thanks
Dose and Radiation protection areas

- **Unit: Sievert** $[\text{Sv}] = \text{J/kg}$
  - Dose $[\text{mSv}]$
  - Dosisleistung (dose rate) $[\mu\text{Sv/h}]$
  - Takes into account energy deposit and biological effective harmfulness of radiation types

- “Überwachungsbereich” (monitoring area)
  $\rightarrow$ 1 – 6 mSv per year

- “Kontrollbereich” (control area)
  $\rightarrow$ 6 – 20 mSv per year

- “Sperrbereich” (prohibited area)
  $\rightarrow$ > 3 mSv/h