

English ? Deutsch ?

- This lecture is given in English
- Falls Englisch für Sie keine verständliche Sprache ist, kontaktieren Sie mich bitte, um eine Strahlenschutzunterweisung **in deutscher Sprache zu vereinbaren !**

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Dangers, Organization, Law

Who ?

- Occupationally radiation exposed person
Beruflich strahlenexponierte Person
 - Operation of X-ray devices
 - Work with radioactive sources
 - Work with radiation at institutes outside of the University

Why ?

- **Mandatory instruction**
persons working with radiation at work
- Goal: work safely / within framework of laws
→ **avert dangers of radiation**
- You must
 - 1) **Get instruction before starting work with radiation**
 - 2) **Repeat instruction every year**
- **Without this instruction, working with radiation is forbidden**

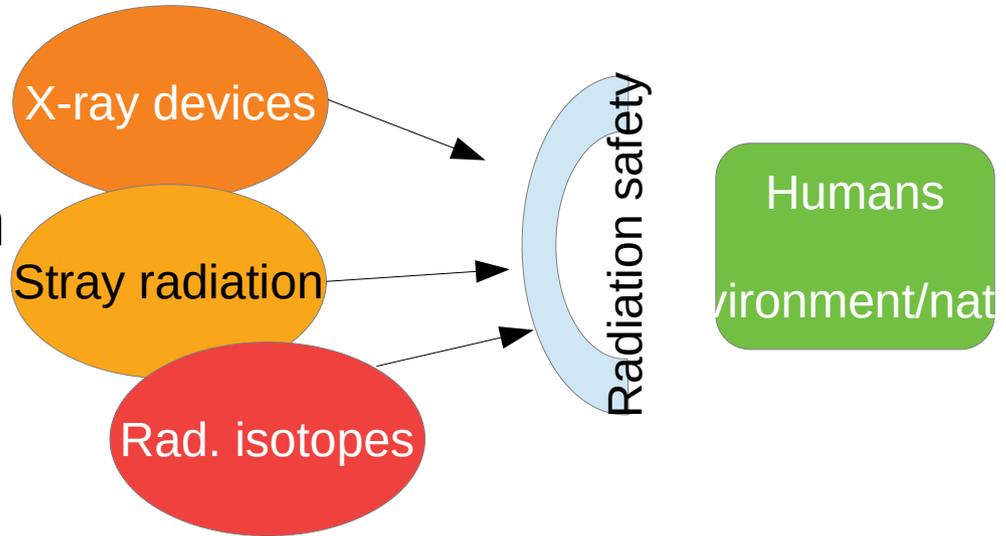
How ?

- Semi-online:
 - Watch the lecture video
 - Ask questions if needed to martin.tluczykont@uni-hamburg.de
 - Certificate is needed in paper form:
 - 1) After successful test, print out certificate on paper
 - 2) Sign certificate on paper
 - 3) Put certificate on paper into an envelope and send to Martin Tluczykont, IExpPh, Geb. 68
- In person: come to my office (68/16)

If I don't have your signature, you are not allowed to work with radiation.

Dangers of radiation

- Ionizing radiation affects chemical bonds
- Protection of every person
 - Employees
 - Students, guests, ...
 - Unborn child
- Damage to human body
 - Stochastic: prob. of damage/disease rises with dose (e.g. cancer)
 - Deterministic: dose threshold (burns, death of tissue, loss of body parts, death)



Guidelines

- “Strahlenschutzverordnung” (President, UHH)
- “Betriebsanweisungen” / Code of practice
- “Strahlenschutzanweisungen” / Rad.Safety di
 - Radiation passport (HH RA 54/21)
 - Radioactive materials (HH RA 42/17)
 - X-ray devices (HH RoeA 40/18 & 41/18 & 35/17)
- “Merkblätter” / Handout-Memos
Emergency plan (Alarmierungsplan)

www.desy.de/~tluczyn/Strahlenschutz

Organisation

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



Interface to
“Amt für
Arbeitsschutz”

Implement radiation safety rules
Requires expert knowledge

Contact person – talk to me !

Enabling safe working !

R.S. Representatives @ IExpPh

Name	Type	Bahrenfeld	Vorlesungs- vorbereitung	Mediziner- praktikum	Dosimetrie / Strahlenpässe (Fremde Anlagen)
Gerald Rapior	Sources		✓		
Massimiliano Antonello	Sources	✓			
Marek Wieland	Devices	✓			
Ole Windmüller	Sources Devices			✓	
Martin Tluczykont	Sources Devices Passports	✓	✓	✓	✓

Others on site:

INF (M. Langer, K. Groth)

ILP (U. Pape, F. Holweg)

DESY (D3)

Licences

- Different existing licences (only IEXP)
 - Radioactive materials
Activity limits for isotopes HH RA-41/22
 - “Fremde Anlagen” (e.g. DESY, XFEL, BESSY..) HH-RA 54/21
 - School X-ray devices HH-RöA 35/17
 - Stray radiation devices HH-RöA 40/18
 - X-ray tubes HH-RöA 41/18
- If new source / new device needed:
 - Own developments require close cooperation with StrlSchB
 - Organization of external technical Test
 - Official request for inclusion into license

Sicherheits und Schutzmassnahmen

Safety and protection measures

Radiation dose unit: Sievert [Sv] = J/kg

- Dose [mSv]
- Dosisleistung (dose rate) [μ Sv/h]
- Takes into account energy deposit and biological effective harmfulness of radiation types

Radiation areas

Einzelperson der Bevölkerung (general population) $< 1\text{mSv/a}$

Überwachungsbereich (monitoring area) $1\text{-}6\text{ mSv/a}$

**Kontrollbereich (controlled area)
 $6\text{-}20\text{ mSv/a}$**



If $> 1\text{mSv/a}$



**Sperrbereich
(prohibited area)
 $>3\text{mSv/h}$**

Principles and rules

StrlSchGrundsätze und Grundregeln

Strahlenschutzgrundsätze (principles):

- Rechtfertigung (justification)
- Dosisbegrenzung (respect dose limits)
- Dosisoptimierung (minimize dose below limits)

ALARA principle:

“As low as reasonably achievable”

“Die 4 A's”

Aufenthaltsdauer	Exposure time	minimize
Abstand	Distance	maximize
Abschirmung	Shielding	optimize
Aktivität	Activity	minimize

Exposure categories and natural exposure

Only exposures at work are relevant for StrlSchV !

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

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persons with radiation exposure **at work**
 - Category A: 6 mSv – 20 mSv per year regularly inside controlled area
 - Category B: < 6 mSv per year occasionally inside controlled area
- **Private radiation exposure:**
 - Civilizational ~ 1.9 mSv per year
 - Medical diagnostics (1.7mSv/a): Teeth 0.01mSv, Thorax 0.08mSv, CT 2-30 mSv
 - Tchernobyl, test-fallout etc.
 - Natural sources ~ 2.1 mSv per year (Radon, terrestrial rad., food, cosmic rays)
 - Round-trip by plane to New York: ~ 0.1 mSv
 - Cigarettes – Pb210, Po210: 11/day = 6 mSv organ dose per year

Exposure categories and natural exposure

- **Special limits:**
 - Persons under 18 years: $< 1\text{mSv} / \text{year}$
 - Pregnant women: exposition of child $< 1\text{mSv}$ for duration of pregnancy
 - Limits for pregnancy are valid starting with StrlSchB *knowing* about it
 - Protection of child: let StrlSchB know
 - Special care when handling open sources

Arbeitsmethoden

Working methods
(specific to IExp)

Radiation at the Institute for Experimental Physics

HH-RA 42/17
Strahlenschutzanweisung
(directive)



Radioactive materials:

- stored in safes at different locations
- can be used in experiments



Radiation at the Institut für Experimentelle Physik

HH-RA 42/17
Strahlenschutzanweisung
(directive)



Radioactive materials:

- stored in safes at different locations
- can be used in experiments



Kobalt 60						
27Co060/01	245	kBq	04.02.74	1.1	kBq	19.11.14 21.10.14 A
27Co060/02	295	kBq	06.03.74	1.4	kBq	19.11.14 21.10.14 A
27Co060/04	70	kBq	09.02.73	0.3	kBq	19.11.14 21.10.14 A
27Co060/05	3700	kBq	27.12.83	63.6	kBq	19.11.14 09.10.14 F
27Co060/06	389	kBq	01.04.79	3.0	kBq	19.11.14 09.10.14 F
27Co060/10	91800	kBq	25.12.98	11339.5	kBq	19.11.14 21.10.14 A
27Co060/11	87000	kBq	25.12.98	10746.5	kBq	19.11.14 21.10.14 A
27Co060/12	3700	kBq	27.05.90	0.8	kBq	19.11.14 21.10.14 A
27Co060/16	185	kBq	01.07.75	1.0	kBq	19.11.14 11.11.14 M
27Co060/17	185	kBq	01.07.75	1.0	kBq	19.11.14 11.11.14 M
27Co060/18	185	kBq	01.07.75	1.0	kBq	19.11.14 11.11.14 M
27Co060/19	118	kBq	26.04.68	0.3	kBq	19.11.14 21.10.14 A
842000				22160.2	kBq	
Strontium 90						
38Sr090/05	37000	kBq	27.11.92	21743	kBq	19.11.14 09.10.14 F
38Sr090/06	37000	kBq	19.07.96	23745	kBq	19.11.14 09.10.14 F
38Sr090/07	1850	kBq	01.07.59	485	kBq	19.11.14 24.10.14 N
38Sr090/08	9250	kBq	01.07.59	2423	kBq	19.11.14 21.10.14 A
38Sr090/09	185	kBq	01.07.75	71	kBq	19.11.14 11.11.14 M
38Sr090/10	185	kBq	01.07.75	71	kBq	19.11.14 11.11.14 M
38Sr090/11	185	kBq	01.07.75	71	kBq	19.11.14 11.11.14 M
38Sr090/12	37000	kBq	20.07.11	34133	kBq	19.11.14 13.03.14 G
38Sr090/13	100000	kBq	20.07.11	92250	kBq	19.11.14 13.03.14 G
DESY-Sr90 15	7400	kBq	01.01.14	7244	kBq	19.11.14 22.10.14 G
220000				182236	kBq	
		Aktivität bei Kauf		Aktivität heute		geprüft Ort
Ruthenium 106						
44Ru106/01	4000	kBq	27.09.94	0.00	kBq	19.11.14 21.10.14 A
8000				0.00	kBq	
Cadmium 109						
48Cd109/01	474	kBq	01.09.90	0.001	kBq	19.11.14 21.10.14 A
48Cd109/02	4720	kBq	01.10.92	0.027	kBq	19.11.14 21.10.14 A
8000				0.03	kBq	
Cäsium 137						
55Cs137/01	740	kBq	01.07.90	423	kBq	19.11.14 21.10.14 A
55Cs137/02	371	kBq	20.07.73	144	kBq	19.11.14 21.10.14 A
55Cs137/03	333	kBq	01.07.79	148	kBq	19.11.14 21.10.14 A
55Cs137/04	7400	kBq	15.03.82	3493	kBq	19.11.14 21.10.14 A
55Cs137/09	410	kBq	01.12.82	197	kBq	19.11.14 21.10.14 A
55Cs137/10	453	kBq	01.12.82	217	kBq	19.11.14 24.10.14 N
55Cs137/16	422	kBq	01.04.79	186	kBq	19.11.14 09.10.14 F
55Cs137/18	3700	kBq	01.07.60	1061	kBq	19.11.14 09.10.14 F
55Cs137/19	370	kBq	01.07.60	106	kBq	19.11.14 09.10.14 F
55Cs137/23	55	kBq	01.07.70	20	kBq	19.11.14 21.10.14 A
55Cs137/24	333	kBq	01.07.78	144	kBq	19.11.14 21.10.14 A
55Cs137/25	333	kBq	01.07.83	162	kBq	19.11.14 21.10.14 A
62000				6299.47	kBq	
Barium 133						
56Ba133/02	429	kBq	01.04.79	41	kBq	19.11.14 09.10.14 F
56Ba133/05	200	kBq	01.07.60	6	kBq	19.11.14 22.10.14 A)G
1300				46.33	kBq	
Europium 152						
63Eu152/01	451	kBq	01.04.84	92	kBq	19.11.14 09.10.14 F
100				91.71	kBq	
Wismut 207						
83Bi207/04	392	kBq	01.10.80	193	kBq	19.11.14 09.10.14 F
500				193.04	kBq	
Radium 226						
88Ra226/03	37000	kBq	01.07.60	36138	kBq	19.11.14 21.10.14 A
74000				36138	kBq	
		Aktivität bei Kauf		Aktivität heute		geprüft Ort
Thorium 228						
90Th228/02	3848	kBq	18.01.71	0.000	kBq	19.11.14 21.10.14 A
90Th228/03	1850	kBq	19.05.78	0.00	kBq	19.11.14 21.10.14 A
90Th228/04	1850	kBq	17.01.90	0.2	kBq	19.11.14 09.10.14 F

Finding radioactive sources

- You might find a source
 - Some unknown source
 - Some source thought to be lost N years ago
 - ...
- You must contact me or another SSB immediately we will declare the source finding.
- What you must not do:
 - DO NOT throw it away
 - DO NOT Hide it
 - DO NOT deposit it in front of the radiation safety lab, my door, or any other door

It is not against the law to find a source
Not declaring it, is

Labelling requirements



Lab courses

- Lab course students who work with radiation need a radiation safety instruction, too
- Contents:
 - Possible dangers of radiation
 - Basic principles (ALARA, AAA)
 - Special limits for pregnant women
- Instruction can be done by teacher, provided the present instruction was taken less than one year ago
- Students must confirm by signature

Facilities / devices (X-rays or stray radiation)

- **Prerequisites:**
 - **Prüfung** = technical check by expert company before start, repeat every 5 years
 - **Genehmigung (License)** or Anzeige (notification)
 - **Unterweisung** = this lecture
 - **Anweisung** = radiation safety directive (see slide 7)
 - **Einweisung** = operation instruction by instructed operator (1st: by company; subsequent: by instructed person)
 - **Betriebsbuch** = operation log – must be available on site
- Modifications of facilities (relevant to radiation safety):
 - Contact StrlSchB
 - StrlSchB organizes **inspection** by company
 - StrlSchB contacts work safety agency for modification of **license/notification**

Radiation passports

- **Work in facilities outside of UHH**
(DESY, HZDM, ...)
- **Must follow directives** of radiation safety at facility, e.g. specific instruction
- **Procedure for registration** (~2-4 weeks):
 - Fill out and sign (at 16/68)
 - Registration at Hamburg Office of radiation safety
 - Registered pass comes back within 4 weeks
- **Procedure for passport maintenance**
 - **Passports stay in code-box**, in front of office 16, Building 68
 - If needed for beamtime:
 - **take it and sign the list**
 - **take a dosimeter (OSL or Albedo – ask me!)**
 - **return passport and dosimeter when back**



Dosimetry

- **Official dosimetry (amtliche Dosimetrie) @ IEXP:**
 - for persons who work inside monitoring or controlled areas (“Überwachungsbereich”, “Kontrollbereich”)
 - If you work with radioactive material
 - Few in stock, ordering a dosimeter takes about 4 weeks
 - Exchange and evaluation **monthly**
- **Dosimetry with radiation passport**
 - Official dosimetry: UHH
 - Additional dosimetry: foreign facility
- **Passport / Dosimeter: Requires “SSR number”**



**DO YOU HAVE AN
SSR-Number?**

YES



Good !

NO



**Please send me
An email with:**

1. Social sec. Number
(Sozialversicherungs-
Nummer)
2. Full name
3. Birthdate / place
4. Title

**Your personal data are processed for the
purpose of radiation safety only.**

Now, you need to do something!

- Do you have questions ?
martin.tluczykont@physik.uni-hamburg.de
Tel.: 040 8998 2993
- Do the test on moodle
- **Print out radiation safety instruction certificate**
- **Sign the certificate**
- Send **original, signed certificate in paper-form** to:

Martin Tluczykont, IexpPh, Geb. 68

! **If I, the SSB, don't have the original,
On-paper, signed certificate
You are not allowed to work with radiation** **!**

Thanks