Non-official* version of the

# Central Radiation protection instructions of the University of Kassel

File number 8.22.40.1 StrlSchG


*** This is a version of the radiation protection instruction automatically translated by means of DeepL, as published in the University of Kassel's newsletter 18/2023 (radiation protection instruction dated 19.10.2022 with supplements dated August 2023). Thus, this English version is not an official version, only the German version from the newsletter is legally binding.**

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# Part A: General part of the Radiation protection instructions of the University of Kassel

## A-1. General explanations and instructions

### 1. Introduction

**RADIATION PROTECTION CREATES SAFETY**

These radiation protection instructions lay down regulations to protect persons working at the University of Kassel, third parties and the environment from the harmful effects of ionizing radiation.

The radiation protection instruction is subdivided into

- a generally valid part (A-1 Item 1 - 19), which contains instructions for all exposed staff and guests at the University of Kassel.
- the annexes to the responsible persons (A-2, A-3, A-4) and
- activity-specific radiation protection anwei sung en for special activities (B-1 to B-4).

The parts of these radiation protection instructions relevant to the planned activity must be acknowledged against signature before the start of the activity as part of the initial instruction.

**DESTINATION**

These radiation protection instructions define the necessary technical and organizational measures to ensure that

- unnecessary and unjustified radiation exposures are avoided,
- unavoidable radiation exposures and the resulting hazards are kept as low as possible, and
- the applicable limit values according to § 78 StrlSchG are not exceeded.

These measures are applicable to all the measures listed under A-1 Item 3 and must be complied with at all times.

**LEGAL BASES**

The legal basis for these radiation protection instructions includes the legal regulations listed below. They apply in addition to the regulations of the radiation protection instructions in their currently valid version:

Policies, laws and regulations:

- EU Directive 2013/59/Euratom of December 5, 2013 EU Basic Safety Standards
- Atomic Energy Act (AtG)
- Radiation Protection Act (StrlSchG)
- Radiation Protection Ordinance (StrlSchV)
- Hessian Higher Education Act (HessHG)
- Guideline for the Technical Inspection of X-ray Equipment and Interference Radiators Requiring a License by Experts in Accordance with the Radiation Protection Act and the Radiation Protection Ordinance (Expert Inspection Guideline, SV-RL)

Permits and approvals:

- issued handling permits of the University of Kassel*.
- Type approvals

Affected legal standards of transport and environmental law:

- Dangerous goods law (including the Dangerous Goods Transport Act (GGBefG), Dangerous Goods Ordinance for Road, Rail and Inland Navigation (GGVSEB), Dangerous Goods Officer Ordinance (GbV), transport permits)
- Water law for the discharge of liquids exempted from nuclear law (including the Water Resources Act (WHG), Waste Water ordinance (AbwV), Indirect Discharger Ordinance (IndV)
- Waste legislation for the delivery of waste exempted from nuclear law (including the Closed Substance Cycle Waste Management Act (KrWG), Waste Management Act (AbfG))

* The texts of laws, ordinances, directives, etc. have deliberately not been repeated. The StrlSchG, the StrlSchV as well as the licenses are available in the respective valid version from the responsible radiation protection officer (4.4) as well as in the areas mentioned in the subject of the license.

**GENDER EQUALITY IN LEGAL LANGUAGE**

In these radiation protection instructions, the personal function designations commonly used in radiation protection are used. Insofar as these designations are in the feminine or masculine, this form is used as a generalization and refers to all genders. The function designations in these radiation protection instructions are abbreviated as follows, as in the underlying legal principles, and are used in the feminine or masculine form:

| | |
|---|---|
| **SSV** | Strahlenschutz**verantwortliche**<br>Radiation protection **supervisor**,<br>equivalent to the president of the University of Kassel |
| **SSBev** | Strahlenschutz**bevollmächtigte**<br>Radiation protection **authorized** |
| **SSB** | Strahlenschutz**beauftragte:r**<br>Radiation protection **officer** |

## 2. Permits and notifications, dealings with authorities

**PERMITS AND NOTIFICATIONS**

Activities requiring notification and approval (e.g. handling of radioactive substances, operation of facilities for the intentional or unintentional generation of ionizing radiation (X-ray facilities, interference radiators, laser facilities, ion accelerator etc.) are defined via § 5, § 12, § 17, § 19 StrlSchG and the corresponding legal standard (StrlSchV). The radiation protection authorized must be informed prior to ordering the corresponding substances or facilities in order to be able to ensure the notification and approval procedure in advance.

The licensing and notification requirements for the operation of X-ray equipment are regulated in accordance with § 19 StrlSchG.

The operation of X-ray equipment and interfering radiation sources not approved for the type requires approval by the licensing and supervisory authority (Section 12 para. 1 no. 4. and Section 19 para. 2 StrlSchG).

The operation of X-ray equipment and interfering radiation sources that are not subject to approval (§ 19 para. 1 StrlSchG) or type-approved (§ 19 para. 1 no. 1.a) StrlSchG with reference to § 45 StrlSchG) or those whose manufacture and initial placing on the market falls within the scope of the University of Kassel requires notification to the competent authority and the express consent of the responsible radiation protection authorized.

The licensing and notification requirements for the operation of facilities for the intentional or unintentional generation of ionizing radiation are regulated according to § 5, § 17 and Annex 3 StrlSchG in conjunction with Part C of the StrlSchV and the currently valid test concept.

**CORRESPONDENCE WITH AUTHORITY**

Any correspondence directly or indirectly related to radiation protection (e.g., license applications and notifications) with the competent authorities must be addressed to the radiation protection authorized (A-1 Item 4.2). This includes, e.g., application for a license to handle radioactive materials, license to erect, operate and test interference sources, disposal of radioactive materials, clearance.

The radiation protection authorized examines the license applications or notifications in accordance with the relevant legal provisions, in particular the suitability of the planned premises and the planned personnel, as well as the presence of the required measuring equipment and the facilities otherwise necessary for radiation protection.

Applications that meet with factual concerns of the radiation protection authorized and which cannot be resolved shall be forwarded to the radiation protection supervisor for a final decision with a written statement.

## 3. Scope

**TO WHOM DOES THE RADIATION PROTECTION INSTRUCTION APPLY?**

These radiation protection instructions apply to all persons working at the University of Kassel according to StrlSchG. This includes e.g.

- the handling of open or enclosed radioactive materials (definition of handling according to § 5 para. 39 StrlSchG),
- the operation or operation of equipment subject to licensing/notification requirements. This includes, among others, X-ray systems, interference sources, laser systems, plasma systems or accelerators as well as systems with ECD detectors,
- work outside the University of Kassel in controlled areas (so-called work in external facilities) as well as
- Persons who may be exposed to radiation as a result of the above-mentioned activities or presence in the above-mentioned area of application of the radiation protection instructions.

The spatial areas of application of the radiation protection instruction are specified in the individual licenses of the respective facilities.

If you are unsure whether any of your facilities are covered by radiation protection legislation, please contact the radiation protection authorized.

# 4. Organization of radiation protection

**RADIATION PROTECTION SUPERVISOR**

## 4.1. Radiation protection supervisor (SSV)

The regulations on responsibilities and competences are regulated in the "Distribution of responsibilities in the Presidential Board and representation of the members of the Presidential Board of the University of Kassel". Radiation protection supervisor (SSV) in the sense of § 69 StrlSchG is

**University of Kassel**
**- The President-**
**Mönchebergstr. 19**
**34109 Kassel**

The current schedule of responsibilities regulates the internal relations of the University of Kassel as well as the representations.

The duties and powers of radiation protection supervisors are defined in chapter 4 of the StrlSchG (§ 70ff) as well as in the applicable legal standard (§ 44ff StrlSchV).

The radiation protection supervisor

- is responsible for the organization of operational radiation protection at the University of Kassel.
- issues the Central Radiation Protection Instruction (in accordance with § 73 StrlSchG and § 45 StrlSchV) by means of the University of Kassel Bulletin. Thus, these instructions are binding for all employees of the University of Kassel as well as all employees listed under A-1 Point 3 (Scope) are binding.
- appoints suitable radiation protection officers (in accordance with Section 70 para. 1 StrlSchG), specifies in writing their internal decision-making areas and the powers required to perform their tasks (in accordance with Section 70 para. 2 StrlSchG) and monitors the radiation protection officers within the scope of their professional capabilities.
- Provides the resources necessary for radiation protection.

Insofar as the radiation protection supervisor does not want to carry out the necessary operational instructions and decisions as well as his or her radiation protection supervisor duties himself or herself, he or she may appoint radiation protection authorized supervisors (see A-1 Item 4.2) who act as an interface to the radiation protection officers and who have the required line com pe tence.

The internal implementation of the StrlSchG and the StrlSchV is carried out at the University of Kassel by the radiation protection supervisor with the help of the radiation protection authorized (see A-2) and the radiation protection officers (see A-3).

The radiation protection supervisor, through the radiation protection authorized, shall immediately inform the radiation protection supervisors of all administrative acts and measures concerning the guarantee of radiation protection.

The delegation of the execution of the tasks and the independent performance by the radiation protection authorized and the radiation protection supervisors relieves the radiation protection supervisor. However, the radiation protection

supervisor remains responsible for compliance with the duties imposed on her by the StrlSchG and the StrlSchV. Thus, the radiation protection supervisor of the University of Kassel is responsible for the implementation of the regulations described in Part 2 StrlSchV, or respectively, for their compliance.

The radiation protection supervisor of the University of Kassel is listed in Appendix A-2 named by name. Appendix A-4 presents the radiation protection organization at the University of Kassel in an organizational chart.

**ORDER SSBEV**

## 4.2. Radiation protection authorized (SSBev)

The radiation protection supervisor can delegate tasks to one or more radiation protection authorized persons that result for him/her from the current legal situation. For this purpose, the radiation protection authorized person must be granted the corresponding decision-making and directive powers and be provided with a sufficient time budget and the financial means to implement the tasks and duties assigned to him. The supervisory right and duty of the radiation protection supervisor remain unaffected. The appointment as radiation protection authorized shall be made in writing for an indefinite period of time and shall be revocable. The radiation protection supervisor shall notify the responsible licensing and supervisory authority of the appointment (Sec. 70 (4) StrlSchG). The personnel administration and the works council receive a copy of the appointment letter. The function as radiation protection authorized must be mentioned in the job description with a sufficient time share.

The radiation protection authorized person should have a university degree in natural sciences or engineering and possess the necessary expertise (Section 70 (3) StrlSchG and Section 47 StrlSchV). The radiation protection authorized representative uses the help of the administration, departments, institutes, divisions and scientific centers for her administrative tasks, depending on the competence.

**WHO IS SSBEV?**

The radiation protection authorized representative of the University of Kassel is listed in Appendix A-2 with her contact details. Appendix A-4 presents the radiation protection organization at the University of Kassel in an organizational chart.

**DUTIES AND POWERS OF SSBEV**

The radiation protection authorized

- performs all tasks specified in the written appointment for the radiation protection supervisor. The powers and responsibilities of a radiation protection authorized person in his or her respective area of responsibility and decision-making remain unaffected by the appointment of a radiation protection authorized person.
- has direct authority to issue directives and instructions to all facilities and persons within the scope of these radiation protection instructions; the authority to issue directives extends in particular to the radiation protection officers. The radiation protection authorized representative is directly subordinate to the radiation protection supervisor in radiation protection matters and is bound by instructions only to the radiation protection supervisor. Every person is obligated to provide her with information regarding radiation protection matters. The above-mentioned authority to issue instructions and orders includes the right of regular inspection, control, insight into the records to be kept in accordance with the StrlSchG and StrlSchV, compliance with the requirements of the authorities, plans, the

radiation protection areas, etc., as well as notification and reporting to the radiation protection supervisor.

- supports and advises the radiation protection supervisor in all matters of radiation protection. In this context, the radiation protection authorized representative is obliged to report to her on a regular basis (annual report).
- shall advise the works council and the individual facilities in its area of responsibility on matters of radiation protection at their request.
- ensures that the principles of radiation protection are observed in compliance with the state of the art in science and technology for the protection of individuals and the general public against radiation damage to life, health and property.
- coordinates radiation protection in the area of responsibility assigned to her, supports the radiation protection officers in regulating the operating procedure and, in coordination with them, assumes overarching functions. In cases of doubt, the decision is made by the radiation protection supervisor.
- conducts correspondence with the authorities.
- must be informed by the relevant departments in the case of investment projects that fall under the StrlSchG and must be included in the planning of radiation protection (see A-1 Item 4.8).
- supervises and coordinates personal dosimetry and medical examinations of the occupationally exposed persons concerned, organized by the radiation protection officers.
- maintains the inventory of open and sealed radioactive materials and the inventory of ionizing radiation facilities.
- is required in the event of significant incidents (cf. A-1 Item 13) and is involved in the coordination of appropriate measures.
- proposes selected persons for appointment as radiation protection supervisors to the radiation protection supervisor, if necessary after prior consultation with the direct superiors of the corresponding departments. After approval by the radiation protection authorized, the radiation protection supervisor notifies the responsible authority of the appointments including changes in the radiation protection organization. The personnel department and the works council are informed of the appointment in writing.
- maintains a list of all appointed radiation protection officers and keeps records of the specialist training courses completed and updates the specialist knowledge of all radiation protection officers. The radiation protection authorized person shall inform the Human Resources Department annually about the specialist knowledge training courses completed. She must be involved in coordinating the updating of the technical knowledge of employees.

**REPRESENTATIVE SSBEV**

### 4.3. Representative the radiation protection authorized

At least one permanent representative shall be appointed by the radiation protection supervisors for the radiation protection authorized. The appointment is made as described under A-1 Item 4.3 described. During the absence of the radiation protection authorized person, all tasks, rights and duties shall be transferred to her/his representative.

The representatives the radiation protection authorized at the University of Kassel are listed in Appendix A-2 named by name. Appendix A-4 presents the

radiation protection organization at the University of Kassel in an organizational chart.

## 4.4. Radiation Safety Officer (SSB)

Radiation Safety Officers direct and supervise activities to ensure radiation safety when handling radioactive materials or ionizing radiation.

**WHO IS SSB?**

The radiation protection officers of the University of Kassel are listed in part A-3 with their names and responsibilities. Appendix A-4 shows the radiation protection organization at the University of Kassel in an organization chart.

**ORDER SSB**

The radiation protection supervisor appoints the required number of radiation protection supervisors at the suggestion of the radiation protection authorized persons. In this context, it must be ensured that each operation of facilities for the generation of ionizing radiation (e.g., X-ray facilities) requiring approval or notification according to StrlSchG § 12 and § 19 is covered by the area of responsibility of a radiation protection officer.

The appointment of a radiation protection officer is made in writing for an indefinite period and is revocable.

The appointment letter shall specify the duties, authority, and internal decision-making area of the Radiation Safety Officer. This is described:

- organizational or spatial and
- By official position or,
- if the powers do not result from the official position, by designating them.

Before the appointment, the radiation protection supervisor must make sure that the persons to be appointed have the required expertise and technical knowledge and that no facts are known that speak against their reliability (Section 70 Para.3 StrlSchG). The declaration of reliability can, if necessary, be made by the personnel department or a certificate of good conduct for submission to an authority in accordance with § 30 Para. 5 of the Federal Central Register Act (BZRG). The function as radiation protection officer must be mentioned in the job description with a sufficient time share.

The Human Resources Department will notify the radiation protection authorized immediately when radiation protection authorized personnel leave the service or report sick.

**DUTIES AND POWERS OF THE SSB**

The duties and powers of the radiation protection officer are defined in chapter 4 of the StrlSchG (§ 70ff) as well as in the applicable legal standard (§ 43 StrlSchV).

The radiation protection officer

- performs all tasks and functions in his internal decision-making area that are assigned to him according to the StrlSchG, the StrlSchV, these radiation protection instructions and his appointment.
- is responsible in his area of decision-making for compliance with legal and operational radiation protection regulations and for the implementation and enforcement of the required radiation protection measures as well as the fulfillment of the licensing conditions.
- has supervisory authority in his area of responsibility and is authorized to issue instructions. This includes the right to enter rooms in his area of responsibility at any time and without further authorization, to

inspect documents and to issue orders, insofar as this is necessary to fulfill his duties as radiation protection officer. In particular, the radiation protection commissioner has the right to order immediate measures to avert danger. He must immediately inform the radiation protection supervisor and the radiation protection authorized person in writing about the measures he has taken.

- Everyone is obligated to provide him with information regarding radiation protection issues and must follow his orders.
- informs his representative and the radiation protection authorized continuously and comprehensively in writing, without special request, about all relevant processes from his area. This includes, in particular, all processes requiring approval and notification as well as notification obligations from the applicable regulations for the operation of facilities for the generation of ionizing radiation (e.g., X-ray facilities). The radiation protection authorized person must immediately notify the radiation protection authorized person in writing of any necessary changes in his or her internal decision-making area. Even if there are no changes, a comprehensive annual report on his area of responsibility must be prepared for the radiation protection authorized representative at the end of each year.
- is obliged to inform the radiation protection authorized immediately if he can no longer perform his duties. In this context, he may submit proposals for his successor or substitute.
- shall immediately notify the radiation protection authorized person in writing of all deficiencies and significant changes that affect radiation protection. If the radiation protection supervisor cannot agree with the radiation protection authorized person on a radiation protection measure proposed by him, he shall submit the proposal in writing to the radiation protection supervisor for a decision. If the latter also rejects the proposal, he shall inform the radiation protection commissioner in writing of the rejection of the proposal and give reasons for it and send a copy to the works council and the competent authority.
- keeps an operating log in which he enters the operating processes essential for radiation protection (cf. A-1 Point 12 and 13) and monitors the entries of the users.
- reports significant incidents (cf. A-1 Item 13) immediately to the supervisory authority via the radiation protection authorized. He carries out radiation protection measures in case of incidents and accidents as well as significant incidents or advises rescue forces.
- draws up special radiation protection or work instructions for his area of responsibility with information on the radiation protection areas, related access regulations, labeling including employment prohibitions and restrictions for his area of responsibility. These department-specific radiation protection and work instructions are to be prepared on the basis of the Radiation Protection Act, the Radiation Protection Ordinance (StrlSchV) and the present Central Radiation Protection Instruction and made known at short notice by posting or display. In the long term, these will be integrated into these central radiation protection instructions and published in the University of Kassel's newsletter.

- monitors the functioning of equipment and installations essential for radiation protection. He is responsible for the proper condition of the devices required for radiation protection. Calibration and test intervals for corresponding measuring instruments must be observed. The radiation protection officer arranges for the maintenance and, if necessary, the repair of these devices.
- applies for and updates, via the radiation protection authorized, the permits or notifications for the operation of facilities for the generation of ionizing radiation (e.g., X-ray equipment and- facilities) or interfering radiation sources in its area of responsibility.
- is obliged to ensure that personal dosimetry is carried out properly in his area of responsibility and checks compliance with the limit values. He is also responsible for the proper use and timely exchange of personal dosimeters for all persons to be monitored in his area of responsibility. If necessary, he applies for the dosimetric monitoring of further persons via the radiation protection authorized person and, if necessary, deregisters persons from monitoring via this person. Immediately after becoming aware of the pregnancy of a woman requiring personal dosimetric monitoring in his area of responsibility, he shall ensure that the occupational radiation exposure of the pregnant woman is determined on a weekly basis.
- ensures that a copy of the relevant permit, the currently valid radiation protection instructions (central and plant-related as well as any work instructions) as well as the Radiation Protection Act with ordinances and fire protection regulations of the University of Kassel are available at each handling location for permanent inspection by the users.
- holds the site-specific emergency and alarm plans as well as information on the assembly points of the University of Kassel (cf. A-1 Item 13) for its area of responsibility clearly visible to the users in the respective rooms.

**EXPERTISE AND UPDATING OF EXPERTISE**

The prerequisite for an appointment as radiation protection officer is a valid technical qualification according to StrlSchG (§ 74 in conjunction with §§ 47, 48, 51 StrlSchV) as the applicable legal standard.

The required expertise in radiation protection is usually acquired through training suitable for the respective area of application, practical experience (expertise) and successful participation in a recognized course within the last 5 years.

The specialist knowledge is examined and certified upon written application to the competent body (specialist knowledge certificate).

According to the valid guidelines, the acquired expertise in radiation protection must be updated regularly (within 5 years). As a rule, this is fulfilled by participation in a recognized course for updating the respective expertise. The radiation protection officer is responsible for compliance with the updating deadlines.

For the assumption of travel expenses, the registration for the advanced training as well as the travel application must be submitted via the radiation protection authorized. The costs will be borne by the University of Kassel insofar as the specialist knowledge is necessary for the performance of the assigned duties. The radiation protection authorized person must be provided

with proof of the updated expertise by submitting the certificate without being requested to do so.

**SSB CONTACT DETAILS**

According to § 45 para. 2 no. 1 StrlSchV, the appointed radiation protection officers and their areas of responsibility must be named in the radiation protection instructions of the University of Kassel and must be permanently present or immediately reachable. For this reason, the University of Kassel publishes the contact details of the appointed radiation protection officers, among other things, on its website "Radiation Protection at the University of Kassel" at http://www.uni-kassel.de/go/Strahlenschutz/, in the business distribution plan and in the newsletter.

In order to ensure immediate availability, the radiation protection officer can consent to the private mobile number being published in his area of responsibility by means of a paper notice in addition to the above information. Furthermore, he/she can agree that all radiation protection officers as well as the building services of the University of Kassel receive the above-mentioned information in case of an emergency.

**REPRESENTATIVE SSB**

### 4.5. Representative of the Radiation Protection Officer

At least one deputy must be appointed for each radiation protection officer; additional deputies may be appointed if necessary. In the absence of the radiation protection commissioner, the substitution must be clearly clarified on site during the licensed activity or during the operation of a licensed facility. During the absence of the radiation protection commissioner, all duties and powers shall pass to his representative mutatis mutandis. The appointment shall be made as described in A-1 Item 4.4 described.

It is not necessary to appoint a representative if the radiation protection officer is also the only user in his area.

If the radiation protection officer and his representative are prevented from working at the same time, the authorized activities must be stopped until a radiation protection officer appointed for this area is on site. Exceptions can be specified in writing, for example (cf. A-1 Item 4.7)

The representatives of the radiation protection officers of the University of Kassel are listed in Appendix A-3 with their names and responsibilities. Appendix A-4 shows the radiation protection organization at the University of Kassel in an organization chart.

### 4.6. Prohibition of discrimination

Radiation protection authorized persons and radiation protection officers must not be hindered in the performance of their duties (in accordance with Section 70 (6) StrlSchG) and must not be disadvantaged either directly or indirectly because of their activities.

**RADIATION PROTECTION OFFICER**

### 4.7. Other commissioners in radiation protection

The radiation protection supervisor, the radiation protection authorized and the radiation protection supervisors may, in agreement with the person concerned, appoint further radiation protection authorized persons to carry out the obligations within their area of responsibility (e.g., carrying out internships in controlled areas). The tasks and obligations shall be communicated to the commissioned person in writing. The determination shall

be brought to the attention of the radiation protection authorized, the personnel department and the works council.

### 4.8. Duty to cooperate

**DUTIES FOR ACTIVITIES ACCORDING TO THE STRLSCHG**

All employees of the University of Kassel who are responsible for handling radioactive materials or equipment for the generation of ionizing radiation (e.g., X-ray equipment) or who work in equipment belonging to others, as well as their department heads, are obligated to inform the radiation protection authorized representative and the radiation protection officer responsible for this area.

- about the nature and extent of the planned handling of radioactive substances or ionizing radiation as well as related procurement processes and to obtain its consent;
- to familiarize themselves with the StrlSchG and the StrlSchV and to observe the corresponding protection regulations exactly;
- to provide the responsible radiation protection officer with all necessary information;
- Occupationally exposed employees and students must be designated to the Radiation Safety Officer prior to commencing work;
- ensure that the above-mentioned persons use suitable devices for protection against ionizing radiation, wear dosimeters for measuring the personal dose or carry out or have carried out other measures for determining the body dose, insofar as this is declared necessary by the respective radiation protection officer;
- plan, apply for and provide the necessary resources and costs for radiation protection measures, such as training, medical screening, dosimetry, etc. in good time.
- in the event of an emergency, incident or significant occurrence - irrespective of any immediate measures - to inform the responsible radiation protection officer immediately.

These duties also apply to cost center managers who have personnel responsibility, regardless of whether they are department managers.

### 4.9. Cooperation and information

**COOPERATION FOR THE PROTECTION OF EMPLOYEES**

In the performance of their duties, the radiation protection supervisor, the radiation protection authorized and the radiation protection supervisors shall cooperate with the staff council and the specialists for occupational safety and environmental protection and the physicians authorized according to radiation protection law and inform them about important matters of radiation protection.

## 5. Access to radiation protection areas

**ACCESS CONTROL TO RADIATION PROTECTION AREAS**

Rooms in which persons at the University of Kassel may be exposed to ionizing radiation have been set up as radiation protection areas. The establishment and monitoring of radiation protection areas is regulated by § 76 StrlSchG in conjunction with § 52ff StrlSchV. Persons who are allowed to enter these monitoring or controlled areas are specified by name by the responsible radiation protection officer or radiation protection authorized and must be instructed specifically for the plant (see A-1 Point 7). Only these persons receive

a key/activation of the access authorization cards for the above-mentioned areas. These keys/access authorization cards must not be passed on to third parties. They must be returned after completion of the work. All other persons are prohibited from entering unless this is expressly approved in the appendices to these radiation protection instructions.

**PREGNANT AND BREASTFEEDING WOMEN**

Persons (including employees and students) must inform the personnel department (employees) or the responsible examination board (students) and in any case the responsible radiation protection officer of any pregnancy with regard to the risks of radiation exposure for the unborn child before commencing work. A workplace-related risk assessment is carried out together with the Radiation Protection Officer, the Department of Occupational Safety and Environmental Protection and the company physician of the University of Kassel. This may result in protective measures (e.g. for students in the form of disadvantage compensation) that must be taken during pregnancy and breastfeeding.

§ Section 55 (2) StrlSchV regulates the access of pregnant persons to radiation protection areas. Access to controlled areas may only be granted if the radiation protection authorized or the radiation protection officer permits this in writing. Through suitable monitoring measures (see A-1 Item 9), it must be ensured that for an unborn child exposed to radiation due to the mother's employment, the limit of 1 millisievert (Section 78, Para.4, 2nd sentence StrlSchG) of the dose from external and internal radiation exposure is complied with from the time of notification of the pregnancy until its end and is documented. A mother is informed that in case of contamination occurring in her, the infant could incorporate radioactive substances during breastfeeding.

Pregnant or breastfeeding persons must not be employed to carry out necessary specific work procedures in accordance with § 74 StrlSchV (specially permitted exposures).

## 6. Occupationally exposed persons

**WHO IS AN OCCUPATIONALLY EXPOSED PERSON?**

According to radiation protection law, all persons who are exposed to ionizing radiation within their employment or work relationship, in the course of performing their activity (no accident!), belong to the group of "occupationally exposed persons". The exact definition is named § 5 Abs. 7 StrlSchG (in connection with StrlSchG § 2 Abs. 1 as well as § 4). Holders of a radiation pass also belong to the occupationally exposed persons as soon as they work in a third-party facility. An apprenticeship (which also includes students) or a voluntary or honorary exercise of comparable activities is equivalent to an employment relationship.

**INSTRUCTION**

Every occupationally exposed person must participate in a training course or an annual recovery training course before starting to work (see A-1 Item 7) by the radiation protection officer.

The protection of occupationally exposed persons is regulated by the special provisions of Section 2, Chapter 6, Part 2 of the StrlSchV (for example, dose guide values (§ 72), dose limitation in the event of limit values being exceeded (§ 73) or specially permitted exposures (§ 74)) and is part of the annual instruction of occupationally exposed persons (see A-1 Item 7).

In general, occupationally exposed persons are to be protected from external and internal exposure primarily by means of structural and technical devices,

suitable working procedures and minimization of the time of contact with radioactive substances (StrlSchV § 75).

**MEDICAL SUPERVISION**

For control and medical monitoring (see A-1 Item 8), occupationally exposed persons must be assigned to one of the categories specified therein in accordance with Section 71 Para. 1 StrlSchV before commencing their activities. If the effective dose (definition: § 5 para. 11 StrlSchG) changes during the calendar year, the assignment may have to be adjusted accordingly.

**SSR NUMBER**

All occupationally exposed persons require a unique personal identification number for entry in the radiation protection register of the Federal Office for Radiation Protection (BfS): the radiation protection register number (SSR number).

The SSR number is assigned by BfS, facilitates and improves the assignment and balancing of individual dose values from occupational exposure in the Radiation Protection Register.

It is derived by means of a non-traceable code from the social insurance number (§ 147 SGB VI) and the personal data of the employee to be monitored. The application for the SSR number and the transmission of the necessary personal data for occupationally exposed persons and holders of radiation passports (cf. B-3 Point 5) is carried out at the University of Kassel by the radiation protection authorized.

Personalized dosimeters can now only be ordered by specifying the SSR number.

## 7. Instruction of occupationally exposed persons

**WHO MUST BE INSTRUCTED?**

All occupationally exposed persons (see A-1 Item 6) must have knowledge of radiation protection before starting work. In addition, the following groups of persons must be instructed in accordance with Section 63 of the Radiation Protection Ordinance (StrlSchV) and must have access to the radiation protection areas in accordance with Section 55 of the StrlSchV (see A-1 Point 5):

- Persons who carry out cleaning, maintenance and repair work in radiation protection areas
- Janitors, craftsmen, technicians, window cleaners etc. who are employed by the University of Kassel and/or who perform service, maintenance or repair work in radiation protection areas
- Visitors who are permitted access to the radiation protection areas by the radiation protection authorized person or the responsible radiation protection officer in agreement with the licensing and supervisory authority or who are subject to StrlSchV § 55. This also applies if visitors are accompanied by a competent person.
- Trainees and students, insofar as their stay in the radiation protection areas is necessary to achieve their training objective.

**NECESSITY OF INSTRUCTION**

The knowledge of radiation protection is imparted by the responsible radiation protection officer within the framework of initial training or annual refresher training (in accordance with § 63 StrlSchV).

The mandatory instruction must be given orally in a form and language that is understandable to the person instructed. The content and time of the

instruction shall be documented by the radiation protection officer himself ver ant and signed by the person instructed himself/herself. The records must be kept for at least 5 years.

Radiation protection instruction can be part of other required instruction (e.g., occupational health and safety, immission control).

In the event of significant changes in the scope of tasks or activities, the instruction must be updated immediately.

**CONTENTS OF THE INSTRUCTION**

The instruction shall in particular include information on

- the working methods,
- the possible dangers,
- the safety and protective measures to be applied,
- the contents of the radiation protection law, the authorization or notification, the radiation protection instruction that are essential for the employment or the presence,
- possible dangers in the event of pregnancy and the obligation to report the occurrence of pregnancy,
- the processing and use of personal data for the purpose of monitoring dose limits and compliance with radiation protection principles; and
- the behavior in the event of an alarm, fire, emergency, incident or other significant occurrence (see A-1 Item 13)

Furthermore, all employees are obligated to participate in the plant-specific instructions of the operator of third-party plants. Each instructed person must be provided with the current radiation protection instructions (paper or electronic).

## 8. Medical surveillance of occupationally exposed persons

**MEDICAL EXAMINATION**

The need for control and medical surveillance of occupationally exposed persons (see A-1 Item 6) results from their classification according to § 71 StrlSchV. § Section 77 StrlSchV makes medical surveillance of occupationally exposed persons of category A mandatory, for persons of category B it is voluntary, unless contradictory conditions or obligations, e.g. in licenses or delimitation agreements of the competent authorities, conflict with this.

**WHAT TO DO?**

Application for initial examination shall be made to the radiation protection authorized. The examination or assessment must be repeated annually.

Coordination of medical examinations is the responsibility of the occupationally exposed employee.

**BRING TO THE EXAMINATION**

At the time of examination, the Occupational Radiation Exposure Information Form must be completed in full and signed by the radiation protection authorized representative.

The form can be downloaded from the website "Radiation Protection at the University of Kassel" at http://www.uni-kassel.de/go/Strahlenschutz/. For activities in external facilities, the radiation passport must also be presented during the examination and handed over to the authorized physician (in accordance with § 175 StrlSchV) for registration of the occupational health precaution.

**CONTACT**

The contact person for arranging examination appointments after invitation by the Human Resources Department is

Occupational Medicine-KS
Occupational medicine assistance Kassel
medical airport service GmbH (MAS)
Friedrich-Ebert-Str. 15
34117 Kassel

Phone: 0561 - 701 659-34
Web: www.medical-gmbh.de

**3 CERTIFICATES**

Promptly after the occupational health examination, the occupationally exposed person receives three medical certificates from the Occupational Health Department:

- **"for the employee (address field "PERSONAL")":**
  This certificate contains a medical assessment and any blood and urine test results for all types of screening performed.
  → This certificate is intended for the private records of the exposed person.
- **"for the employer":**
  This certificate only confirms participation with screening type, date and recommended follow-up date without examination result.
  → This certificate must be sent by the occupationally exposed person to the Human Resources Department of the University of Kassel.
- Medical certificate according to § 79 StrlSchV
  Address field: **Radiation protection supervisor,** under the personal data of the exposed person is written e.g. "STRAHLENSCHUTZBEAUFTRAGTER" and/or "Fr. Dr. BERTINETTI")":

  This certificate contains the result of the qualification examination. The radiation protection authorized person keeps the medical certificates for the duration of the activity in accordance with StrlSchV § 79 Para. 5 (cf. A-1 Item 10).
  → This certificate is usually sent directly to the radiation protection authorized by the occupational medicine department. If the occupationally exposed person receives this certificate, it must be sent promptly to the radiation protection authorized representative.

## 9. Monitoring of radiation exposure (dosimetry)

**MEASUREMENT SUPERVISION**

The radiation protection supervisor is obliged under Section 64 of the Radiation Protection Ordinance to ensure that the body dose is determined in accordance with Section 65 (1) of the Radiation Protection Ordinance for persons who are in a radiation protection area.

**DOSIMETRY**

The radiation protection officer is responsible for the metrological monitoring to determine the exposure in the radiation protection areas in accordance with § 56 StrlSchV. This also includes the practical implementation of official personal dosimetry (ordering, issuing dosimeters, archiving the results related to the radiation protection area, etc.).

The results of the official personal dosimetry for the occupationally exposed employees of the University of Kassel are documented, managed and stored by

the responsible radiation protection officer (see A-1 Item 10, § 167 and § 168 StrlSchG).

Dose readings exceeding the limit values - regardless of whether they have been officially or unofficially determined - must be reported to the responsible radiation protection authorized so that appropriate follow-up measures can be initiated. Abnormal values will be discussed with the person being monitored. Occupationally exposed persons who leave the services of the University of Kassel receive, upon request, a written certificate from the radiation protection officer on the radiation dose accumulated in the course of their employment (Section 64 para. 3 StrlSchV).

Dosimetry for employees of external companies or persons who are permitted access to radiation protection areas but who are not occupationally exposed persons is regulated by the responsible radiation protection officer.

**DETERMINATION OF EXTERNAL RADIATION EXPOSURE**

According to StrlSchV § 66 para. 1 sentence 1, each person working in the controlled area is given a dosimeter (e.g. film dosimeter) to determine the external radiation exposure (personal dose). The officially approved film dosimeters are personal and may not be used by other persons.

The dosimeter is to be worn in accordance with the requirements of the licenses issued by the authorities; if these do not contain any further specifications, the dosimeter is to be attached to the front of the torso by means of the clip at chest level (in accordance with Section 66 (2) StrlSchV). The bar code must be visible from the outside. The dosimeter is changed after the prescribed wearing period (typically 1 month) and must be returned to the radiation protection officer immediately after this period (even if not used). The radiation protection officer submits the dosimeters to the responsible measuring agency for evaluation (in accordance with Section 169 (1) StrlSchG).

Any additional dosimeters issued (e.g. digital dosimeters) must also be worn. Depending on the activity, partial body dosimeters (e.g. finger ring dosimeters) may be used. This must be discussed with the responsible radiation protection officer.

Misuse of personal dosimeters (e.g. wilful damage, irradiation or misappropriation) is prohibited and will be subject to disciplinary action. Unintentional irradiation of a dosimeter (e.g. contact of the dosimeter with radioactive waste by loosening the clip) must be reported immediately to the radiation protection officer. Furthermore, each employee should inform the radiation protection officer responsible for dosimeter issue on his/her own responsibility in case of longer absence or non-use of the radiation protection area (cost saving).

**DIFFERENT DOSIMETERS**

Depending on the type of radiation, two different types of dosimeters are used: OSL dosimeters and TLG dosimeters.

An **OSL** (Optically Stimulated Luminescence) dos**imeter** is suitable for the determination and official monitoring of personal dose from photon radiation in an energy range from 16 keV to 7 MeV.

A **TLG dosimeter** (thermoluminescence albedo dosimeter, in short albedo dosimeter) is suitable for the determination and for official monitoring in mixed radiation fields (neutrons, photons), in which the neutron portion of the personal dose can exceed 20% of the photon personal dose. The TLG dosimeters are "ready for use" in the plastic case and in no case "unpacked". For a correct evaluation of the TLG dosimeters, the occupationally exposed

person must specify in which application area the dosimeter was worn, e.g. in radiation fields from a reactor, accelerator, fuel cycle, radionuclide neutron source or accelerator.

**PREGNANT AND BREASTFEEDING WOMEN**

On behalf of the radiation protection supervisor, the radiation protection supervisor must ensure that the occupational exposure of a pregnant person is determined on a workweek basis and that internal occupational exposure is excluded (Section 69 StrlSchV).

**INCORPORATION SUSPICION**

If a person is suspected of incorporation of radioactive substances (see A-1 Item 13), or if this cannot be ruled out, the competent authority may order suitable investigations and measurements for clarification in accordance with Section 64 (4) StrlSchV.

Affected persons must tolerate the medical examinations and necessary measurements and determinations according to § 176 StrlSchV.

The occupational health service (cf. A-1 Item 8) is informed in writing about the results of the annual radiation exposure of each occupationally exposed person at the University of Kassel.

## 10. Radiation protection file

**RECORDS AND DOCUMENTATION**

All data subject to documentation according to StrlSchG and subordinate legal standards (see A-1 Item 9) for the purpose of monitoring dose limits and compliance with radiation protection principles are recorded in a radiation protection file by radiation protection officers and/or radiation protection authorized persons and documented in accordance with the legal requirements. For this purpose, personal data is also processed and used electronically in accordance with the applicable legal requirements, e.g. in the Hessenbox. The legal basis for the processing of personal data is Art. 6 (1) c), (3) DSGVO in conjunction with the aforementioned regulations.

## 11. Basic rules of conduct

**THE IMPORTANT A'S OF RADIATION PROTECTION**

In order to keep the risk of harm from ionizing radiation as low as possible, three general principles for dealing with ionizing radiation have been laid down in a legally binding manner in the StrlSchG and the subordinate legal standard:

- Justification (§ 7 StrlSchG and § 3ff StrlSchV)
- Dose limitation (§ 9 StrlSchG)
- Optimization (§ 8 StrlSchG)

In addition to the general rules of conduct in the laboratory (see general laboratory regulations on the homepage of the Occupational Safety and Environmental Protection Department of the University of Kassel), the requirement of optimization is of particular relevance for all occupationally exposed persons.

In principle, any unnecessary radiation exposure and contamination of people and the environment must be avoided (Section 8 (1) StrlSchG). However, if this is indispensable, any exposure or contamination even below the valid limits (**ALARA principle**: As Low As Reasonably Achievable) must be kept as low as possible, taking into account the state of the art in science and technology (Section 8 para. 2 StrlSchG).

Possible measures to implement the principle include:

- Select activities used as low as possible to solve the set task (know measuring range)
- Keep your distance (e.g. use gripping tools)
- Reduce residence time (e.g. limit exposure time in the immediate vicinity of the device).
- Use of technical shielding
- Know the type of radioactive material and its physical properties.
- Testing for contamination to prevent shipment (see A-1 Item 9).

The basic rules of conduct in radiation protection areas are also part of the instruction of occupationally exposed persons (see A-1 Item 6).

## 12. Operating log

**WHAT MUST BE ENTERED IN THE LOGBOOK?**

An operating log must be kept in the areas of application of these radiation protection instructions. The operating processes essential for radiation protection must be entered in this operating log. The operating log must be readily available to the users and must be properly kept by all users and the radiation protection officer. For example, the following operating procedures must be recorded:

- Dates of performed instructions, control measurements, etc.
- On which dates the substitutes of the radiation protection officer with primary responsibility are responsible for the respective area (prevention of the radiation protection officer with primary responsibility)
- When did which user perform measurements
- Maintenance
- Deviations from the intended operation
- In the case of X-ray equipment, the following operating procedures in particular must be recorded
    - Acquisition, delivery, modification of the X-ray equipment/interference radiator
    - Maintenance and repair work, safety inspection
    - Result of the expert examination
    - Changing the X-ray tube

In the area of X-ray systems and equipment, it is possible to keep equipment-specific operating logs (so-called equipment logs). After consultation with the radiation protection authorized and the supervisory authority, electronic operating logs can also be used under certain conditions.

## 13. Emergency, incident and significant occurrence e

**MINIMIZE DANGERS**

When an emergency, incident or significant occurrence occurs, all necessary measures must be taken immediately (in accordance with § 107ff StrlSchV) to reduce the consequences so that the hazards to life, health and property are kept to a minimum. This can be done with the help of the radiation protection

officer; in any case, the radiation protection officer must be informed immediately after the measures have been taken.

The existence of preparatory measures for emergencies or incidents in accordance with Section 106 StrlSchV and the existence of preparatory measures for fire in accordance with Section 54 StrlSchV shall be ensured by the radiation protection supervisors.

The emergency and alarm plans, in accordance with the Occupational Health and Safety and Environmental Protection Manual of the University of Kassel, as well as the locations of the assembly points, are part of these radiation protection instructions in accordance with the fire protection regulations of the University of Kassel in the currently valid version. The current plans are deposited on the University of Kassel homepage under the keyword "Emergency Organization" in the section Occupational Health and Safety and Environmental Protection: https://goto.uni-kassel.de/go/notfallorganisation

These plans must be kept ready in a clearly visible place in the respective rooms by the responsible radiation protection officer for the specific plant. Irrespective of the above responsibilities and procedures, the rules of conduct listed below apply.

**DEFINITION**

An emergency, incident or other significant occurrence (formerly: safety-relevant event) is a deviation from the intended operating procedure or condition in which an increased radiation exposure occurs or can occur. Increased radiation exposures exist if the actual radiation exposure exceeds the values expected for normal operation by more than the usual fluctuation range, even if the limit values are not reached.

**EXAMPLES**

Significant incidents include, for example, the loss of radioactive materials, theft, water ingress, damage to equipment, accidents or suspected contamination of persons, e.g. by incorporation.

If such an incident occurs, the radiation protection officer must be informed immediately.

**ALARM**

In the event of an alarm, everyone goes to the appropriate assembly points via the escape routes and reports to the responsible radiation protection officer. This also applies to alarm drills!

**FIRE**

In the event of a fire, follow the instructions of the fire protection regulations of the University of Kassel. The current fire protection regulations are stored on the University of Kassel homepage under the keyword "Fire Protection Regulations" in the section Occupational Safety and Environmental Protection.

Generally speaking:

- Keep calm
- Report fire (manual fire alarm, emergency call 112, internal emergency call 0561 804-2222)
- Get yourself and helpless people to safety and seek the appropriate assembly points
- Only attempt to extinguish the fire in accordance with your capabilities and if the external circumstances permit this.
- Inform the responsible radiation protection officer or radiation protection authorized (see next section).

**EMERGENCY MESSAGE**

In general, the plant-specific alarm plans apply (cf. A-1 Item 13). Any emergency, incident or other significant occurrence must be reported immediately to the responsible radiation protection officer (cf. A-3). The radiation protection supervisor must then report the emergency in advance by telephone or e-mail, then in writing via the radiation protection authorized supervisor.

In cooperation with the radiation protection supervisor, the radiation protection supervisor informs the following in accordance with § 108 StrlSchV

- the relevant licensing and supervisory authorities,
- the person responsible for occupational safety, health and environmental protection, and
- the works council.

## 14. Procurement or disposal of radioactive materials

**PROCUREMENT**

Requirements for the procurement of radioactive materials (open or enclosed), X-ray equipment or devices, and interfering radiation sources require the involvement of the radiation protection authorized. This applies to orders as well as procurements, e.g. from other working groups within and outside the University of Kassel.

The radiation protection authorized checks the harmlessness and the nuclear law obligations for the procurement within the scope of its responsibility. Procurement processes are to be carried out only when the aforementioned prerequisites have been met.

The aforementioned procedure shall also be applied if the above-mentioned substances, equipment or facilities are to be brought into the University of Kassel, used there or disposed of only temporarily.

**DISPOSAL**

Disposal and delivery of radioactive materials, X-ray sources and radioactive waste that are no longer in use is carried out **exclusively** by the responsible radiation protection authorized person in cooperation with the radiation protection authorized person after consultation with the supervisory authority. Further regulations are contained in the activity-related radiation protection instructions B-1 to B-4 for further regulations.

## 15. Effects of third parties, loss of radioactive materials

**SAFEGUARDING MEASURES**

All organizational measures must be taken to prevent the theft/loss of radioactive materials, emitters and sources as well as unauthorized use and exposure to them. For this purpose, the following measures are recommended, also in combination within the scope of the spatial conditions:

- Radioactive materials and emitters must be stored in a theft-proof and fire-protected manner.
- Access control (see A-1 Item 5)
- certain activities are only permitted under the supervision of a responsible radiation protection officer

## 16. Behavior when radioactive materials are found

**RADIOACTIVE?**

In the event of a discovery of (potentially) radioactive materials, X-ray equipment or devices, and interfering radiation sources, the radiation protection authorized person and a radiation protection officer must be called in immediately. Potentially radioactive material is considered to be any material whose labeling or marking suggests radioactive material. This includes in particular chemicals containing uranium and thorium or welding electrodes, containers or small parts with labels such as "ECD", "emitter", "source" but also containers with radioactive signs.

Under no circumstances may these substances and devices be disposed of in conventional household waste or laboratory waste or wastewater.

## 17. Acknowledgement of the radiation protection instructions

**UPDATING THE RADIATION PROTECTION INSTRUCTION**

The radiation protection supervisor issues the central radiation protection instruction (in accordance with § 73 StrlSchG and § 45 StrlSchV) by means of the University of Kassel newsletter. Thus, these instructions are binding for all employees of the University of Kassel as well as for all employees listed under A-1 Point 3. and 6. are binding.

The radiation protection instructions as well as any changes thereto must be brought to the attention of the radiation protection authorized, the appointed radiation protection officers against signature. The radiation protection officers are obligated to inform the occupationally exposed persons (see A-1 Point 6) about the contents of the respectively valid radiation protection instructions, e.g. within the scope of the instruction. The persons confirm with their signature that they have received access to the radiation protection instructions, have taken note of the radiation protection instructions and have understood their contents.

## 18. Enactment

This new version of Part A1-A3 of the Central Radiation Protection Instruction of the University of Kassel replaces all previously applicable generally valid parts of the Central Radiation Protection at wei sung of the University of Kassel and comes into force after approval by the President on the day after publication in the University's Official Gazette.

- Drawn in the original -

Prof. Dr. Ute Clement

President of the University of Kassel

## 19. Abbreviations

| | |
|---|---|
| AtG | Atomic Energy Act |
| AbfG | Waste Act |
| AbwV | Waste Water Ordinance |
| BZRG | Federal Central Register Act |
| DGSVO | Basic Data Protection Regulation |
| HessHG | Hessian Higher Education Act |
| GGBefG | Hazardous Goods Transportation Act |
| GGVSEB | Dangerous Goods Ordinance Road, Rail and Inland Navigation |
| GbV | Dangerous Goods Officer Ordinance |
| IndV | Indirect Discharger Ordinance |
| KrWG | Closed Substance Cycle Waste Management Act |
| mSv | Millisievert |
| SSV | Radiation protection supervisor |
| SSB | Radiation protection officier |
| SSBev | Radiation protection authorized |
| StrlSchG | Radiation Protection Act |
| StrlSchV | Radiation Protection Ordinance |
| SV-RL | Guideline for the Technical Inspection of X-ray Equipment and Interference Radiators Requiring a License by Experts in Accordance with the StrlSchG and the StrlSchV (in short: Expert Inspection Guideline) |
| WHG | Water Resources Act |
| ZIL | Central Isotope Laboratory of the University of Kassel at the location Heinrich-Plett-Straße 40 |

## 20. Contact persons and activity-related radiation protection instructions

**CONTACT**

A-2 Radiation protection supervisor (SSV) and radiation protection authorized (SSBev) at the University of Kassel

A-3 Radiation Safety Officer (SSB) at the University of Kassel

A-4 Organigram of the radiation protection organization at the University of Kassel

**B-1 TO B-4** **Activity-related radiation protection instructions**

**CENTRAL ISOTOPE LABORATORY** B-1 Radiation protection instructions for handling open radioactive materials at the Heinrich-Plett-Str. 40 site at the University of Kassel

**EC DETECTORS** B-2 Radiation protection instructions for the use of Ni-63 electron capture detectors (ECD) in gas chromatographs at FB11 of Kassel University

**FOREIGN PLANTS** **Fehler! Verweisquelle konnte nicht gefunden werden.** Radiation protection instructions for employment requiring a permit in third-party plants or facilities

**X-RAY EQUIPMENT AND INTERFERING RADIATORS** B-4 Radiation protection instructions for handling X-ray equipment and interfering radiation sources

Attachments to the X-ray machines and interference radiators at the University of Kassel

Appendix B-4.1: Fine structure X-ray facility at FB 10, FG Organometallic Chemistry, Heinrich-Plett-Str. 40, IBC, R. 3109

Attachment B-4.2: Fine structure X-ray facility at FB 10, FG Technical Physics, Heinrich-Plett-Str. 40, INA, R. 0136

Appendix B-4.3: School X-ray facility at FB 10, FG Didactics of Physics, Heinrich-Plett-Str. 40, AVZII, R. 1292

Attachment B-4.4: Portable XRF instrument at FB 11, storage at FG Environmental Chemistry, Nordbahnhofstr. 1a, R. -1308

Attachment B-4.5: Portable X-ray unit at FB 11, storage in FG Animal Breeding, Nordbahnhofstr. 1a, R. -1608.

Attachment B-4.6: Portable XRF instrument at FB 14, Storage at FG Resource Management and Waste Engineering, Mönchebergstr. 8a, R. 1030

Attachment B-4.7X-ray diffractometer at the FB 14, FG Materials of Construction and Construction Chemistry, Mönchebergstr. 7, R. 221

Attachment B-4.8µ-computer tomograph at FB 14, FG Materials of Construction and Construction Chemistry, Mönchebergstr. 7, R. 225

Attachment B-4.9: Fine Structure X-Ray Facility at FB 15, Institute of Materials Engineering - Metallic Materials, Mönchebergstr. 3, R. 1103

Attachment B-4.10: Scanning electron microscope at FB 15, Institute of Materials Engineering - Metallic Materials, Mönchebergstr. 3, R. 1112

Attachment B-4.11: Electron beam melting facility at FB 15, Institute of Materials Engineering - Metallic Materials, Mönchebergstr. 3, R. 101

Attachment B-4.12: Electron beam machining facility at FB 15, Institute of Production Engineering and Logistics, Kurt-Wolters-Str. 3, R. 0309

Attachment B-4.13: X-ray fluorescence device at FB 15, Institute of Materials Engineering - Metallic Materials, Mönchebergstr. 3, R. -1103

Attachment B-4.14: Transmission electron microscope at FB 15, Institute of Materials Engineering - Metallic Materials, Mönchebergstr. 3, R. -1103

Attachment B-4.15: High-energy X-ray source at FB 15, Institute of Materials Engineering - Metallic Materials, Mönchebergstr. 3, R. -1101B

# A-2. Radiation protection supervisor (SSV) and radiation protection authorized (SSBev) at the University of Kassel

Radiation protection supervisors and radiation protection authorized persons and their representatives at the University of Kassel with contact details.

***RADIATION PROTECTION-***

| | | |
|---|---|---|
| ***RESPONSIBLE*** | **The president**<br>**Prof. Dr. Ute Clement** | Mönchebergstr. 19<br>34109 Kassel<br><br>0561 - 804 2233<br>praesidentin@uni-kassel.de |
| ***RESPONSIBLE REPRESENTATIVE*** | **The chancellor**<br>**Dr. Oliver Fromm** | Mönchebergstr. 19<br>34109 Kassel<br><br>0561 - 804 2191<br>kanzler@uni-kassel.de |
| ***AUTHORIZED*** | **Dr. Daniela Bertinetti** | Heinrich Plett Street 40<br>Central isotope laboratory<br>IBC, R. 1107<br>34132 Kassel<br><br>0561 - 804 4790<br>d.bertinetti@uni-kassel.de |
| ***AUTHORIZED REPRESENTATIVE*** | **Dr. Clemens Bruhn** | Heinrich Plett Street 40<br>FG Organometallic Chemistry<br>AVZ, R. 2253<br>34132 Kassel<br><br>0561 - 804 4653<br>c.bruhn@uni-kassel.de |
| | **Dr. Alexander Liehr** | Mönchebergstr. 3<br>FG Metallic Materials<br>R. 1206<br>34125 Kassel<br><br>0561 - 804 3645<br>liehr@uni-kassel.de |

Outside operating hours, in addition to the usual emergency numbers, the University of Kassel emergency number (manned 24 h) can be reached at 0561 - 804 2222 in the event of an alarm. Furthermore, the radiation protection authorized and their representative can agree to be reached via their private mobile numbers. These are located in a paper notice in the designated radiation protection areas.

# A-3. Radiation Protection Officer (SSB) at the University of Kassel

Alphabetical listing of the radiation protection officers (SSB) and their representatives at the University of Kassel with their respective responsibilities and contact details. For a quick overview of the responsibilities see A-4 Organigram of the radiation protection organization at the University of Kassel.

| **Albert, Dirk** | *Representation:* |
|---|---|
| Responsible for the **X-ray facility** at FB10<br>Institute of Physics, Technical Physics and Didactics of Physics | *Dr. Bruhn, Clemens* |
| FB10, Institute of Physics<br>Heinrich Plett Street 40<br>FG Technical Physics<br>INA, R. 0127<br>34132 Kassel | 0561 - 804 4141<br>dirk.albert@ina.uni-kassel.de |

| **Dr. Bruhn, Clemens** | *Representation:* |
|---|---|
| Responsible for the **X-ray facilities** at FB10<br>Institute of Chemistry, IBC, X-ray Laboratory, R. 3109. | *Mushroom, Astrid* |
| FB10, Institute of Chemistry<br>Heinrich Plett Street 40<br>FG Organometallic Chemistry<br>AVZ, R. 2253<br>34132 Kassel | 0561 - 804 4653 (office)<br>0561 - 804 4435 (X-ray room)<br>c.bruhn@uni-kassel.de |

| **Dr. Bertinetti, Daniela** | *Representation:* |
|---|---|
| Responsible for the approved handling and disposal of **open radioactive** materials at the Heinrich-Plett-Strasse site, Central Isotope Laboratory. | *1) Bertinetti, Oliver*<br>*2) Dr. Bruhn, Clemens*<br>*3) Albert, Dirk* |
| FB10<br>Heinrich Plett Street 40<br>Central isotope laboratory<br>IBC, R. 1107<br>34132 Kassel | 0561 - 804 4790<br>d.bertinetti@uni-kassel.de |

| **Bertinetti, Oliver** | |
|---|---|
| Representative of **Dr. Bertinetti, Daniela** and **Dr. Krooß, Philipp** | |
| FB10, Institute of Biology<br>Heinrich Plett Street 40<br>FG Biochemistry<br>IBC, R. 2307<br>34132 Kassel | 0561 - 804 4132<br>bertinetti@uni-kassel.de |

| **Dormann, Gabriele** | |
|---|---|
| Representative of **Sawallisch, Anja** | |
| FB11<br>North station str. 1a<br>FG Soil Biology and Plant Nutrition<br>WIZ, R. 305<br>37213 Witzenhausen | 05542 - 98 1672<br>dormann@uni-kassel.de |

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| **Dürl, Gregor**<br>Responsible for the operation of the **mobile X-ray facility** at FB14, Department of Resource Management and Waste Engineering. | | *Representation:*<br>*Prof. Dr. Middendorf, Bernhard* |
|---|---|---|
| FB14<br>Mönchebergstraße 8a<br>FG Resource Management and Waste Engineering<br>R. 1030<br>34125 Kassel | 0561 - 804 7101<br>duerl@uni-kassel.de | |

| **Gehrke, Matthias**<br>Responsible for the **X-ray facilities** at FB14<br>Department of Materials Engineering in Civil Engineering and Construction Chemistry, Mönchebergstr. 7, R. 221 | | *Representation:*<br>*Prof. Dr. Middendorf, Bernhard* |
|---|---|---|
| Responsible for the **micro-computed tomograph** (µ-CT)<br>at FB14/FB15 in R. 225, Mönchebergstr. 7 | | *1) Prof. Dr. Middendorf, Bernhard*<br>*2) Dr. Krooß, Philipp*<br>*3) Dr. Liehr, Alexander* |
| FB14<br>Mönchebergstraße 7<br>FG Materials of Construction and Construction Chemistry<br>R. 0219<br>34125 Kassel | 0561 - 804 2611<br>gehrke@uni-kassel.de | |

| **Dr. Jung, Lisa**<br>Responsible for the operation of the **mobile X-ray unit** Amadeo P-90/20VB at FB11,<br>FG Animal Breeding, Farm Animal Ethology and Animal Husbandry | | *Representation:*<br>*none* |
|---|---|---|
| FB11<br>North station str. 1a<br>FG Animal Breeding, Farm Animal Ethology and Husbandry<br>R. -1608<br>37213 Witzenhausen<br>FG Metallic Materials | 05542 - 98-1645<br>lisa.jung@uni-kassel.de | |

| **Dr. Liehr, Alexander**<br>Representative of **Dr. Krooß, Philipp** | |
|---|---|
| FB15<br>Mönchebergstraße 3<br>FG Metallic Materials<br>R. 1206<br>34125 Kassel | 0561 - 804 3645<br>liehr@uni-kassel.de |

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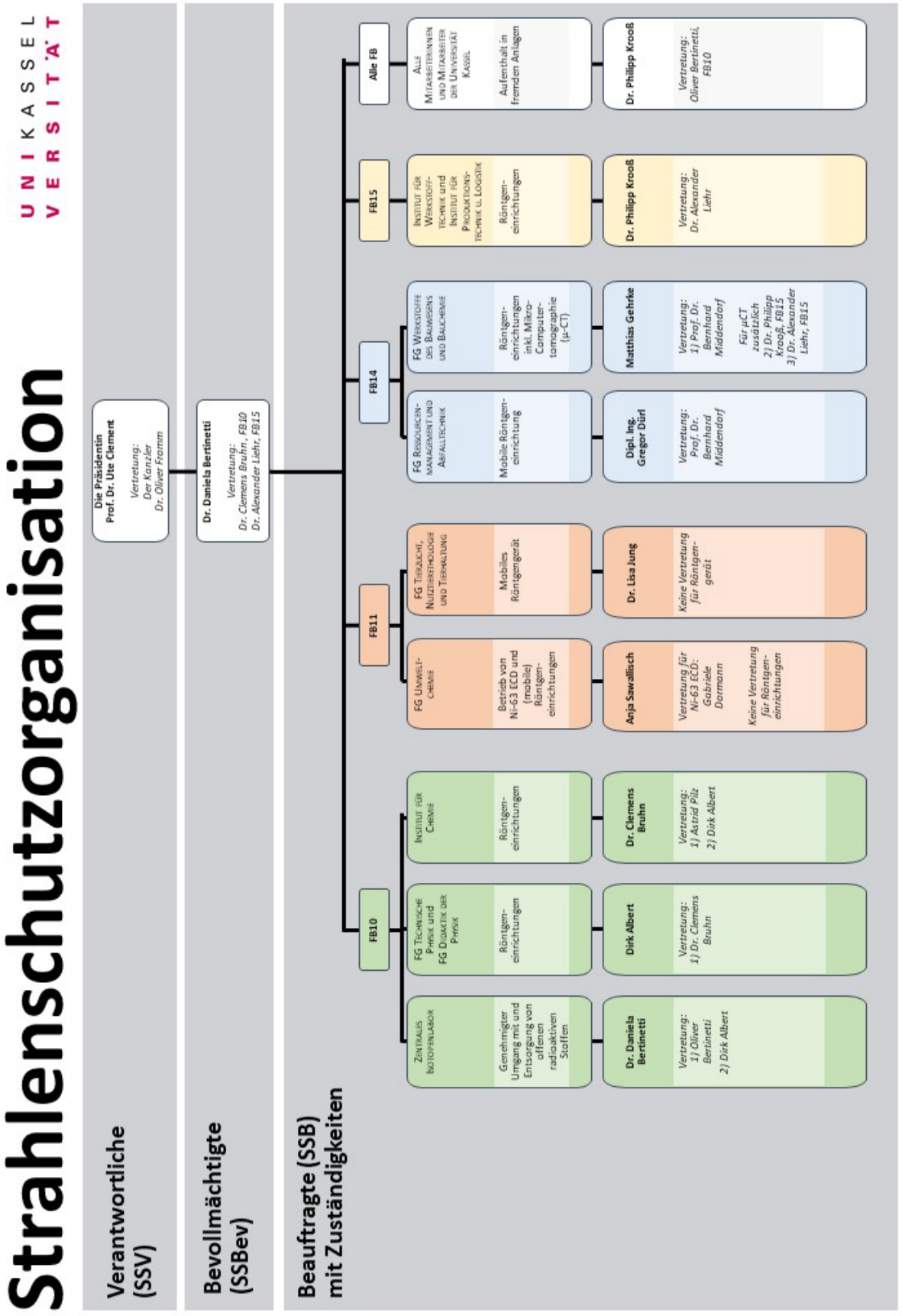
| | |
|---|---|
| **Dr. Krooß, Philipp**<br>Responsible for **stays in foreign facilities** for all employees of the University of Kassel | *Representation:*<br>*Bertinetti, Oliver* |
| Responsible for the operation of the **X-ray facilities** at FB15, Institute of Materials Engineering and Institute of Production Engineering and Logistics (Mönchebergstr. 3, R. 1112 and R. 1103, Kurt-Wolter-Str. 3, R. 0309) | *Dr. Liehr, Alexander* |
| FB15<br>Mönchebergstraße 3<br>FG Metallic Materials<br>R. 2214<br>34125 Kassel | 0561 - 804 2419<br>krooss@uni-kassel.de |
| **Prof. Dr. Middendorf, Bernhard**<br>Representative of **Gehrke, Matthias** and **Dürl, Gregor** | |
| FB14<br>Mönchebergstraße 7<br>FG Materials of Construction and Construction Chemistry<br>R. 1109<br>34125 Kassel | 0561 - 804 2602<br>middendorf@uni-kassel.de |
| **Mushroom, Astrid**<br>Representative of **Dr. Bruhn, Clemens** | |
| FB10, Institute of Chemistry<br>Heinrich Plett Street 40<br>FG Organometallic Chemistry<br>AVZ, R. 2239<br>34132 Kassel | 0561 - 804 4350 (office)<br>0561 - 804 4435 (X-ray room)<br>apilz@uni-kassel.de |
| **Sawallisch, Anja**<br>Responsible for operation of Ni-63 ECD's, handling of **open radioactive materials** at FB11, FG Environmental Chemistry and FG Soil Biology. | *Representation:*<br>*Dormann, Gabriele* |
| Responsible for operation of **(mobile) X-ray equipment** at FB11, FG Environmental Chemistry | *none* |
| FB11<br>North station str. 1a<br>FG Environmental Chemistry<br>WIZ, R. 1504<br>37213 Witzenhausen | 05542 - 98 1625<br>sawall@uni-kassel.de |

Outside operating hours, in addition to the usual emergency numbers, the University of Kassel emergency number (manned 24 h) can be reached at 0561 - 804 2222 in the event of an alarm. Furthermore, the radiation schutz officers can agree to be reached via their private mobile numbers. These can be found in a paper notice in the area for which the respective radiation protection officer is responsible.

# A-4. Organigram of the radiation protection organization at the University of Kassel



# Part B: Activity-related part of the Central Radiation protection instruction of the University of Kassel

## B-1. Radiation protection instructions for handling open radioactive materials at the Heinrich-Plett-Str. 40 site at the University of Kassel Radiation

### 1. Introduction

When handling open radioactive substances, occupationally exposed persons are exposed to the possibility of external (e.g. through radiation sources, contamination of clothing, work objects) and / or internal radiation exposure (e.g. through incorporation, absorption via the skin, etc.) from radioactive substances. This activity-related part of the radiation protection instruction (B-1) supplements the generally valid part of the Central Radiation Protection Instruction of the University of Kassel (A-1, A-2, A-3, A-4) about radiation protection rules to be observed when handling open radioactive materials.

Radiation safety officers are required to provide information to all persons working in the area of application below (B-1 part 3) and / or may be exposed to radiation, must be informed of the contents of the generally applicable radiation protection instructions and of these activity-related radiation protection instructions before they start their work. The persons confirm with their signature that they have been given access to the radiation protection instructions, have taken note of the radiation protection instructions and have understood their contents.

### 2. Approval

The handling of phosphorus-32 (P-32) and tritium (H-3) is approved by the Regional Council Kassel with the approval notices (Ref.: 33.1-99 f261.2-28/17-Ro of 18.12.2017 and 33.1-99 f 261.2-29/17-Ro of 02.05.2018). Within the scope of this handling permit, the University of Kassel has a release order (reference: RPKS - 33.1-99 f 01/2-2021/1 of 19.05.2021) for the unrestricted release of radioactive substances in solid and liquid form subject to the above-mentioned conditions.

In addition to the handling permit, there is also an access exception permit for candidates of the Kassel professional fire department (Ref.: 33.1-99 f261.2-17/18-Ro dated July 26, 2018).

## 3. Scope

**WHERE MAY OPEN RADIOACTIVE MATERIALS BE HANDLED?**

The controlled area is a marked (signs: "Controlled area, Radioactive"), spatially defined area with a possible occupational radiation exposure of more than 6 millisievert (mSv)/year or corresponding organ equivalent doses (according to § 52 para. 2, No. 2. StrlSchV) when staying 40 hours/week and 50 weeks/year.

The handling of open radioactive materials (see permit) may only take place in the rooms listed below in the controlled area at the Heinrich-Plett-Strasse 40 site.

The control area comprises the following premises at the Heinrich-Plett-Strasse 40 site in the IBC building:

- 1st floor (premises of the Central Isotope Laboratory):
  R. 1100 and R. 1101 (sluice area) R. 1102 (P-32 individual laboratory)
  R. 1103 (P-32 and H-3 evaluation laboratory)
  R. 1104 (chemicals storage area)
  R. 1105 (H-3 individual laboratory)
  R. 1106 (waste storage area).
  R. 1109 (P-32 large-scale laboratory),
  R. 1111 (darkroom for development)

  **Attention:** Room R. 1105 of the Central Isotope Laboratory is reserved exclusively for performing experiments with H-3 labeled substances. P-32 contamination of this room may make it impossible to perform H-3 experiments for more than 100 days. Therefore, no substances containing P32 may be stored, used or disposed of in this room.

- EG (solid waste storage):
  R. 0401
- Basement (decay facility for P-32 contaminated laboratory wastewater):
  R. 0301

A description of the Central Isotope Laboratory equipment (labs and equipment) can be found at http://www.uni-kassel.de/go/Strahlenschutz/.

## 4. Radiation protection Officer (SSB)

**WHO IS SSB?**

The radiation protection officers of the University of Kassel are listed in part A-3 and part A-4 with their names and responsibilities.

**TASKS AND DUTIES**

In addition to the information provided under A-1 Item 4.4 the radiation protection officers responsible in the above-mentioned scope of application are assigned the task of monitoring compliance with the following protection regulations:

The radiation protection officer

- is responsible for compliance with the conditions in the approval and release notification, insofar as these relate to the organizational process (e.g. contamination control).

- is responsible for ordering, storage and transport as well as disposal of radioactive materials

## 5. Access to the control area of the Central Isotope Laboratory (ZIL)

In addition to the general access regulations under A-1 Item 5 the entrances to the controlled areas must be kept locked at all times.

**WHAT TO CONSIDER WHEN ENTERING THE ZIL**

Access to the controlled area is via a personnel airlock (R. 1100). In this are located

- Coat hooks and a small table to store the utensils you bring.
- A hand-foot-clothes contamination monitor (familiarize yourself with how it works).
- Personalized Red Coats.
  There is "red coat mandatory" in all laboratory rooms of the Central Isotope Laboratory. Be sure to always wear your lab coat with the personalized dosimeter (see A-1 Item 8)! While performing experiments, it is mandatory to wear suitable protective clothing in addition to the red smock (e.g. gloves, sturdy street shoes, no open-toed shoes, in accordance with the general laboratory regulations).

Transit traffic or stays in the controlled area without a compelling reason are not permitted.

Rooms marked with the sign "Caution / Radioactive / Do not enter" are not to be entered under any circumstances (suspicion of contamination).

## 6. Rules of conduct when handling open radioactive materials

**WHAT MUST BE OBSERVED WHEN HANDLING OPEN RADIOACTIVE MATERIALS**

In addition to the basic rules of conduct (see A-1, item 11) when handling ionizing radiation, further rules relevant to the handling of open radioactive substances are described below.

In order to keep the risk of damage caused by ionizing radiation as low as possible, strict attention must be paid to cleanliness!
All users of the isotope laboratory are obliged to check themselves and their workplaces with the aid of a contamination monitor **during and after an** experiment for any contamination and to decontaminate these in accordance with the decontamination instructions (see A-1, item 9).

As a general rule, the workplace must always be left in a clean, decontaminated and tidy condition. If equipment used in the Central Isotope Laboratory is to be removed from the controlled area, its harmlessness must first be determined by the radiation protection officer.

"Cold" experiments (without the use of radioactive nuclides) may not be performed in the Central Isotope Laboratory unless they serve to prepare a "hot" (radioactive) experiment and are required by law if the work exceeds the exemption limit according to Annex IV, Table 1, Column 2 or 3 StrlSchV.

Persons with open wounds or skin diseases (especially on the hands) are prohibited from handling open radioactive substances (increased risk of

internal radiation exposure). In cases of doubt, the authorized physician decides (see A-1 Point 8) with the involvement of the radiation protection officer.

If internal exposure is suspected (e.g., incorporation - see A-1 Item 9) by radioactive substances, the radiation protection authorized person and the radiation protection authorized person must be notified immediately.

**SAFE HANDLING THROUGH GOOD PLANNING**

All usersside ...

- must inform themselves in detail about the radioactive substance (e.g. information on the bulletin board of the Central Isotope Laboratory).
- discuss in advance all work with the radiation protection officer during which radioactive substances could be released.
- consult with the radiation protection officer if dose rate measurements are to be performed on test setups. The results are to be evaluated together with the radiation protection officer.
- may only carry objects and documents that are absolutely necessary for the activity.
- must keep the time of handling open radioactive materials to a minimum (optimization principle).
- must use appropriate shielding (Plexiglas) when using high energy beta emitters and photon emitters.
- shall organize and perform their work in such a way that it does not endanger other persons.
- when carrying out experiments with radioactive substances on work surfaces, must protect these from contamination (e.g. with foils).
- may only use storage containers for radioactive substances that are marked, e.g., by the word "radioactive" and indicating the respective radionuclide.
- the handling of radioactive substances, which may produce gaseous radioactive substances or aerosols, is generally prohibited.
- are responsible for immediately reporting any defects in radiation protection, control or measuring equipment to the radiation protection officer.
- must be able to perceive all alarm signals from control or measuring equipment. Thus, for example, wearing headphones in the control area is prohibited.

## 7. Students in the Central Isotope Laboratory

In the Central Isotope Laboratory of the University of Kassel, internships and master's theses can take place as part of the training of students in the natural sciences. The following rules must be observed:

**INTERNSHIPS AT ZIL**

All students who handle open radioactive materials as part of an internship receive instruction in working in the Central Isotope Laboratory prior to the start of the internship (see A-1 Item 7). The respective supervisor must be known by name to the radiation protection officer and assumes responsibility for the student and compliance with the protection regulations for the duration of the internship. The student may only enter and stay in the Central Isotope Laboratory with his or her above-mentioned instructed supervisor. In exceptional cases, the supervisor of another instructed person according to StrlSchG or StrlSchV (holder of a personalized coat with badge) may supervise the students in the isotope laboratory; in this case, the supervisor assumes responsibility for the students.

Students, like academic staff, are assigned an SSR number (A-1 Item 6) and are monitored in the controlled area using dosimeters (B-1 point 8).

**MASTER THESES AT ZIL**

For students who handle open radioactive substances as part of their master's thesis, the same rules apply as for research assistants.

## 8. Monitoring the dose in the controlled area

**DOSIMETRY**

OSL dosimeters (GD01 whole-body dosimeters) are used, which are replaced monthly and evaluated by Mirion Technologies Dosimetry Service (AWST).

For dosimeters, the regulations specified in the central radiation protection instructions of the University of Kassel (see A-1 Point 9) apply to dosimeters.

## 9. Contamination control

Between the individual work steps and in particular when leaving the controlled area, **without any** exception

- Hands, shoes, the protective equipment and, if necessary, personal clothing,
- the workplace and equipment as well as
- Check items brought along (pad, pen...) for contamination.

**WHAT TO DO IN CASE OF CONTAMINATION?**

If contamination is detected, remain calm and take the following measures to avert a hazard from further spread or incorporation:

**CONTAMINATION OF PERSONS**

Contamination of protective equipment and persons

- Remove contaminated (protective) clothing (gowns, shoes). Act prudently so that further contamination is avoided (e.g. contamination of radiation protection measuring instruments, telephone, door handle, light switch, fitting).
- Involve a qualified person (radiation protection authorized person, radiation protection authorized person) (in person/ by telephone).

- To remove contamination from the face and hands, wash the relevant areas under running water with soap solution in such a way that nothing from the contaminated area can reach the adjacent areas. The cleaning agents must be selected in such a way that the skin is not attacked or damaged even with repeated use. If radioactivity is still detectable after the first cleaning, a second cleaning must follow. If after this the contamination has not decreased further (<10%) and is less than 10 Bq/cm², further decontamination can be dispensed with. If not already done, the radiation protection authorized person and the radiation protection authorized person must now be informed in any case.

**SURFACE CONTAMINATION**

In case of surface contamination of larger extent (activity or quantity).

- the room must be marked with the sign "Caution / Radioactive / Do not enter".
- the responsible radiation protection officer must be consulted (in person/by telephone).
- spilled or splashed liquids on surfaces (tables, floors, equipment, etc.) are to be soaked up locally with absorbent cloths. The contaminated areas are not to be enlarged by wiping over large areas. All cleaning utensils are to be collected separately and disposed of properly after checking their contamination.

Contaminated objects must not be removed from the radiation protection area .

**EDITION: CONTAMINATION CONTROL**

All rooms in the controlled area are randomly checked for contamination at regular intervals by the radiation protection authorized person and/or the radiation protection authorized persons. The users will be informed of any increased radiation exposure detected and future strategies for avoiding this will be decided jointly. The results of all contamination checks can be viewed at the radiation protection authorized.

## 10. Ordering, storage and transport of radioactive materials

**ORDER**

Radioactive substances are ordered exclusively by the responsible radiation protection officer. The receipt, issue, whereabouts and delivery of radioactive substances shall be documented (cf. B-1 Item 11).

**STORAGE**

Radioactive materials, while not in use, are to be stored in Room 1109 (P-32 preparations) or Room 1106 (H-3 preparations) in the labeled refrigerators of the isotope laboratory and secured against access by unauthorized persons (see A-1 Item 15).

**TRANSPORTATION**

Within the plant, radioactive substances may only be transported in such a way that contamination or increased radiation exposure is excluded. Fragile vessels containing liquid or easily atomizable radioactive substances must be transported in unbreakable containers.

The shipment of radioactive materials requires special measures to be taken in consultation with the radiation protection officer.

# 11. Documentation

**... FROM CONTAMINATION-MEASUREMENTS**

Upon entering the Central Isotope Laboratory, each user must sign the calendar on display and, upon leaving the Central Isotope Laboratory, confirm that all workplaces used, working materials, and the person himself/herself have been examined for contamination after handling open radioactive substances (cf. A-1 Item 9) and that no contamination has been detected. This calendar is part of the operating log of the Central Isotope Laboratory (cf. A-1 Item 12).

**... FROM CONSUMPTION OF RADIOACTIVE SUBSTANCES**

The consumption of radioactively labeled substances for an experiment must be documented. For this purpose, a list of purchased open radioactive substances is available in room 1109, sorted by calibration date. The withdrawal of radioactive substances is to be entered with date, volume withdrawn and name abbreviation in the respective department column. The accounting of the procured radioactive substances is carried out via the entries in this list.

# 12. Collection, separation and disposal of radioactive waste n

**AVOID GARBAGE**

In view of the bureaucratic, political and social challenges involved in the topic of "radioactive waste", you will only generate as much radioactively contaminated waste as is **unavoidable** within the scope of the experiment.

**SEPARATE GARBAGE**

In the Central Isotope Laboratory, a fundamental distinction must be made between radioactive and non-radioactive waste. Perform contamination measurements for this purpose. Non-radioactive, solid waste is to be disposed of in the domestic waste containers on the floor, liquid waste is to be treated like laboratory wastewater according to its contents.

Radioactive waste must be separated according to liquids and solids and according to the nuclide used (P-32 or H-3) (cf. B-1 Item 12.1 and 12.2). Tightly closed vessels with up to 10 ml liquid content (e.g. scintillation vials with water or cocktail) are disposed of as solids.

Basically:

- The separation of radioactive waste is carried out directly at the test site by führ ung by the user.
- Radioactive waste may not be diluted or divided into exemption quantities for disposal or disposition.
- The isotope and the reference date must be indicated on the waste package. For H-3 wastes additionally the estimated activity.
- Care must be taken to avoid uncontrolled discharge (effluent) of radioactive materials.
- The disposal of radioactive waste of long-lived isotopes (H-3) is expensive, so appropriate prudence in handling the waste is requested.
- Temporary storage of radioactive waste within the Central Isotope Laboratory takes place in Room 1106 (Waste Storage Area).

- Users are not permitted to bring radioactive waste out of the controlled area (see item A-1 Point 14).

**LIQUID RADIOACTIVE WASTE**

## 12.1. radioactive liquids

Radioactive liquids are stored and disposed of differently depending on the nuclide used. Collect radioactive liquids (waste) in canisters (see below) only in the canisters provided by the radiation protection authorized person or the radiation protection authorized person (capacity 5 L). Note the type of nuclide and the period of use (start and end date) on the waste sheets on the respective canister.

If the radioactive liquid waste contains other chemical substances (e.g. ethidium bromide contamination, flammable liquid waste or organic solvents), these must be filled into separate canisters. In this case, be sure to note the chemical substances on the waste sheet.

***Liquids with P-32***

Laboratory wastewater (non-flammable, aqueous), which only needs to be treated separately due to P-32 contamination, is fed to the "Central Collection and Decay Facility" in the basement. Two of the designated and labeled sinks/drains are located in the right side area of each of the two center lab benches in Room 1109; one sink is located in the left lab bench in Room 1105 (see labels). These effluents are stored for at least 10 half-lives after filling and are only fed to the neutralization plant as non-radioactive waste after release by the supervisory authority.

Liquids contaminated with P-32 containing other chemical substances must be handled as described above.

***Liquids with H-3***

H-3 contaminated radioactive liquids must not be placed in any drains or sinks, but are collected in provided glass bottles or canisters. Disposal is coordinated with the supervisory authority via the responsible radiation protection officer.

**RADIOACTIVE SOLID WASTE**

## 12.2. radioactive solids

Radioactive, combustible solid waste (including contaminated protective clothing and protective materials) is collected separately according to P-32 and H-3. Plexiglas tabletop waste containers are provided for this purpose at the respective workplaces. The plastic bags will be sealed after the experiment has been carried out (an appropriate welding device for sealing the bags is available in R. 1106) and labeled with a felt-tip pen. The labeling must comply with the instructions given in the release note (cf. B-1 Item 2, minimum nuclide contained and the date of waste generation). The decay time of at least 10 half-lives begins with the date of the last partial quantity filled in. Under no circumstances may radiation warn signs or other indications of radioactivity enter the waste.

Sharp-edged and pointed objects (glass, cannulas, etc.) are to be collected in marked drop containers specific to nuclides.

***Special features for combustible solid waste with P-32***

The sealed plastic bags are temporarily stored in R. 1106 in the large Plexiglas container or behind other shielding. These are periodically transferred and labeled by the responsible radiation safety officer into the P-32 plastic garbage cans (60 L drums) provided for final disposal.

For the subsequent declaration of the full tons by the radiation protection officer, the entries in the data sheets of the delivered radioactive materials are important. Therefore, make your entries in them with the utmost care.

***Combustible solid waste with H-3***

As soon as the experiment is finished, the solid waste (also tightly closed vessels with up to 10 ml liquid or pasty content) is collected in plastic bags and sealed (in R. 1106 an appropriate sealing device is available for sealing the bags). The nuclide contained and the date of waste generation are noted on the bag with a felt-tip pen. The individual partial quantities are temporarily stored in provided plastic garbage cans until final disposal. The amount of radioactive material in the solid waste is to be entered on the appropriate list by or from the user.

## 13. Equipment instructions

The instructions for use of the following devices are available on the homepage (intranet) of the Central Isotope Laboratory. The radiation protection authorized person or the radiation protection authorized person will instruct you on the use of the devices prior to their use.

http://www.uni-kassel.de/go/Strahlenschutz/

For the measurement of local doses, dose rate, surface contamination but also sample material the following measuring devices are available:

- **Hand-foot-clothing monitor LB147 (Berthold)**
  Use in the personnel airlock as a hand-foot-clothes contamination monitor. The hand-held detector can be used to measure materials such as pens, lab books, etc. before leaving the controlled area.
- **UMo LB 123 (Berthold)**
  Use in control area for contamination control of equipment (exchangeable probes available, e.g. Proportional counting tube probe, thus use as dose rate measurement possible)
- **2x LB124 SCINT (Berthold)**
  Surface contamination monitors, handheld monitors. A sample exchange container/drawer is available as an additional accessory for activity measurement on small samples.
- **Hidex 300 SL (Hidex)**
  Automatic *liquid scintillation counter for* the detection of e.g. H-3, C-14, P-32, Ni-63 with the corresponding scintillation liquids.
- **3x DMC3000 with beta module (mirion)**
  Electronic personal dosimeter with alarm indication (acoustic, visual

and vibration) for monitoring of maintenance personnel, students and professional firefighters.

## 14. Internship for candidates of the professional fire department Kassel

**GENERAL**

In the Central Isotope Laboratory of the University of Kassel, the practical training of professional fire department trainees takes place as part of their GABC training. This training serves as preparation for "Radiation protection in case of emergency exposures" (StrlSchG Part 3) and refers to § 113 "Information, training and further training of the emergency forces in the context of emergency preparedness".

The permit ref.: 33.1-99 f261.2-17/18-Ro regulates the conditions and requirements for aspirants of the professional fire department Kassel as occupationally exposed persons during their stay in the controlled area of the University of Kassel (see A-1 Item 6).

**SUPPLEMENTARY RULES FOR OPERATION**

Irrespective of the general rules of conduct and other instructions in these radiation protection instructions (see A-1), the following rules must be observed specifically during the internship:

- The candidates must have theoretical knowledge in the field of radioactivity and radiation protection before starting their work. The internship-related radiation protection instruction (see A-1 Item 7) by the radiation protection officer is a prerequisite for all participants to take part in the practical training and thus to gain access to the controlled area.
- Each candidate is monitored in the same way as occupationally exposed persons in the controlled area of the University of Kassel using an OSL dosimeter. Each small group is additionally monitored with an electronic personal dosimeter (cf. B-1 Item 13). In addition to B-1 Item 13 no occupational medical precaution is required for the candidates, since the expected value of the effective dose is below 1 mSv per calendar year if the work rules are observed.
- The (personal) protective equipment for the candidates (gowns, gloves, safety goggles, Plexiglas cabinets) will be provided by the University of Kassel for the internship.
- The practical training section in the controlled area is to be performed only under the constant supervision of one of the several radiation protection officers.
- The radiation protection officers are obliged to comply with the radiation protection instructions and to ensure compliance by the candidates.

## 15. Enactment

This new version of the activity-related part B-1 of the Central Radiation Protection Instruction of the University of Kassel replaces all previously applicable Radiation protection instructions for handling open radioactive materials at the Heinrich-Plett-Str. 40 site at the University of Kassel and

comes into force after approval by the President on the day following publication in the University of Kassel's official gazette.

- Drawn in the original -

Prof. Dr. Ute Clement

President of the University of Kassel

# B-2. Radiation protection instructions for the use of Ni-63 electron capture detectors (ECD) in gas chromatographs at FB11 of Kassel University

## 1. Introduction

When handling open radioactive substances, occupationally exposed persons are exposed to the possibility of external (e.g. through radiation sources, contamination of clothing, work objects, etc.) and / or internal radiation exposure (e.g. through incorporation, absorption via the skin, etc.) from radioactive substances. This activity-related part of the radiation protection instruction (B-2) supplements the generally valid part of the Central Radiation Protection Instruction of the University of Kassel (A-1, A-2, A-3, A-4) about radiation protection rules to be observed when handling Ni-63-ECD.

Radiation safety officers are required to provide information to all persons working in the area of application below (B-2 Part 3) and / or may be exposed to radiation, must be informed of the contents of the generally applicable radiation protection instructions and of these activity-related radiation protection instructions before they start their work. The persons confirm with their signature that they have been given access to the radiation protection instructions, have taken note of the radiation protection instructions and have understood their contents.

*The electron capture detector, or* ECD, is used in combination with gas chromatography primarily in environmental and trace analysis for the detection of sulfur-containing, nitrated and halogenated compounds. An ECD contains a radioactive source in the form of a thin metal foil coated with the radioactive nickel isotope Ni-63. This foil is located in the measuring cell of the detector. The analysis gas mixture flowing from the separation column into the detector is passed over this Ni-63 coated foil and exposed to the chemical constituents in the analysis gas.

According to the StrlSchG, Ni-63 is considered to be an open radioactive material, since the Ni-63 on the foil can escape from the detector into the environment if the detector is handled improperly or due to certain chemical ingredients in the analysis gas (e.g., damage to the Ni-63 foil located in the detector). For this reason, there is the potential for danger from incorporation of released Ni-63. Release can occur through improper handling such as rinsing with aggressive chemicals, overheating, or opening the detector.

When using an ECD, there is no external radiation exposure due to the low beta energy ($E_{max}$ = 66 keV) of Ni-63.

## 2. Approval

With the approval notice (Ref.: 33.1-99 f261.2-15/13-Ro) dated April 18, 2016, the handling of Ni-63 electron capture detectors (ECD) has been approved by the Kassel Regional Council.

## 3. Scope

**WHERE MAY ECD BE OPERATED?**

ECD may only be operated at the Witzenhausen site, Nordbahnhofstr. 1a, Building 3190, 37213 Witzenhausen in Room No. -1309 (UG).

When ECD is operated as intended, there is no radiation protection area that can be entered.

The entrance to the room must be marked with a radiation warning sign (DIN 25430) and the sign indicating the hazard group (based on DIN 4066).

## 4. Radiation Safety Officer

**WHO IS SSB?**

The radiation protection officers of the University of Kassel are listed in part A-3 and part A-4 with their names and responsibilities.

**(ADDITIONAL) TASKS AND DUTIES**

In addition to the information provided under A-1 Item 4.4 the radiation protection officers responsible in the above-mentioned scope of application are assigned the task of monitoring compliance with the following protection regulations:

The radiation protection officer

- Performs contamination testing on the ECD if contamination is suspected.
- monitors the discharge of radioactive substances via air and water.
- is responsible for the proper storage and securing of the ECD.
- arranges for the annual contamination test ("leak test") on the EC detectors (in accordance with the approval requirement, see work instruction "Contamination measurement by means of wipe test method").
- is responsible for the correct labeling of ECD, storage containers and rooms.
- Organizes the exchange, purchase, ensures the proper delivery or disposal of ECD.
- Is responsible for appropriate record keeping and required reporting to the viewing authority via the Radiation Safety Officer.
- bears responsibility for radiation protection measures in the event of incidents, accidents and significant occurrences.

## 5. Access to radiation protection areas

**AUTHORIZED PERSONS**

Only authorized persons may enter the above-mentioned area of application and work on the gas chromatographs with ECD. Authorized persons are instructed persons who are determined by the radiation protection officer. A list of authorized persons, which is posted and updated accordingly, can be helpful.

**MEASURES AGAINST UNAUTHORIZED ACCESS**

The radiation protection officer must ensure that theft or other loss of the radioactive substances and unauthorized exposure to them is excluded. Since the ECD is permanently installed in the GC, it is sufficient to ensure that the gas chromatograph cannot be stolen. For this purpose, the installation locations must be locked if no instructed persons are present.

## 6. Rules of conduct for the operation of ECD

**OPERATION**

Gas chromatographs with ECD may only be operated if a radiation protection officer is present or immediately available.

**COMPLIANCE WITH THE OPERATING INSTRUCTIONS**

The detectors must not be exposed to any effects which could cause the radioactive material to be released from the Ni-63 foil (e.g. high temperature or chemically aggressive substances). In particular, suitable measures such as automatic heater shutdown when the temperature exceeds the max. temperature must be taken to ensure that the maximum permissible temperature for the corresponding detector is not exceeded during operation of the device. ECD may only be purged with non-corrosive gases in accordance with the manufacturer's operating instructions.

Opening the detector housing and cleaning the detector, e.g. with liquid cleaning agent, is not permitted.

**DERIVATION**

The exhaust gases are to be led from the EC detector outlet via a hose into the exhaust air or directly to the outside.

**MARKING**

Gas chromatographs with ECD are clearly marked from the outside with a radiation warning sign. The marking must not be removed or covered.

## 7. Repairs to and installation and removal of ECD

**REPAIR**

Repairs or maintenance work on the detector may only be carried out by the manufacturer's customer service. The radiation protection officer must be informed of the commissioning of the customer service in good time.

**INSTALLATION OR REMOVAL**

For the purpose of sending in for repair, storage or replacement, the removal or installation of Ni-63-ECD may be necessary. This is only legal with the approval of the responsible authority via the radiation protection authorized and may only be carried out by the customer service under the supervision of the radiation protection be authorized.

## 8. Acquisition, delivery and exchange of ECD

**ORDER**

The order for an ECD must be made in good time to the manufacturer via the radiation protection authorized protection be at .

If an extension of the handling permit is required, the permit application must be submitted to the responsible supervisory authority via the radiation protection officer before the order is placed. Delivery may not take place until the ECD permit has been obtained.

**LEVY**

The distribution of an ECD or GC with ECD to other persons must be agreed by the radiation protection authorized with the radiation protection authorized. A contamination-free ECD may only be given to persons who have the necessary authorization (enclose certificate of contamination-free status).

**DISPOSAL**

Disposal of an ECD is made via the radiation protection authorized to the manufacturer or to the state collection point for disposal (see approval auflage).

## 9. Suspected contamination and incorporation

**"LEAKAGE" OF THE ECD**

In the event of suspected contamination, the following applies in addition to the requirements listed under A-1 Point 9 and 13 described procedures, that the radiation protection authorized person initiates all necessary measures (e.g., blocking of the EC detector, taking of wipe samples, notification of the maintenance service) and immediately notifies the radiation protection authorized person.

If an ECD is contaminated, it must no longer be operated. The radiation protection officer will arrange for all necessary measures to be taken. If leakage is suspected, the ECD must be packed tightly to prevent contamination.

**SUSPICION OF INCORPORATION**

If there is a suspicion of incorporation of Ni-63 in a person, an incorporation control (determination of activity on urine samples) must be carried out, which the person concerned must tolerate according to § 176 StrlSchV (obligation to tolerate).

## 10. Enactment

This new version of the activity-related part B-2 of the Central Radiation Protection Instruction of the University of Kassel replaces all previously applicable Radiation protection instructions for the use of Ni-63 electron capture detectors (ECD) in gas chromatographs at FB11 of Kassel University and enters into force after approval by the President on the day after publication in the official gazette of the University of Kassel.

- Drawn in the original -

Prof. Dr. Ute Clement

President of the University of Kassel

# B-3. Radiation protection instructions for employment requiring a permit in third-party plants or facilities

## 1. Introduction

When handling enclosed and open radioactive substances and when improperly operating facilities for generating ionizing radiation, occupationally exposed persons have the possibility of external radiation exposure (e.g. through radiation sources, contamination of clothing, work objects, etc.). In the case of open radioactive materials, there is also the possibility of internal radiation exposure (e.g., through incorporation, absorption through the skin, etc.) from radioactive materials. If the possible radiation exposure due to the stay in radiation protection areas takes place outside the University of Kassel, it is an employment requiring a permit in third-party facilities or installations.

This activity-related part of the radiation protection instruction (B-3) supplements the generally valid part of the central radiation protection instructions of the University of Kassel (A-1, A-2, A-3, A-4) to include radiation protection rules for all employees who, for professional reasons, work in radiation protection areas outside the University versity of Kassel (so-called third-party facilities and installations). The radiation protection officers are obligated to provide all persons working in the area of application below (B-3 Part 3) and / or may be exposed to radiation, must be informed of the contents of the generally applicable radiation protection instructions and of these activity-related radiation protection instructions before starting their work. The persons confirm with their signature that they have been given access to the radiation protection instructions, have taken note of the radiation protection instructions and have understood their contents.

## 2. Approval

With the approval notice (reference RPKS 33.1-99 f 01/7-2022/1) dated 27.07.2022, the employment of employees of the University of Kassel in external facilities and equipment is approved by the Regional Council Kassel for 5 years.

## 3. Scope

**TO WHOM DOES THE PERMIT APPLY?**

The approval applies to all employees of the University of Kassel who work outside the University of Kassel in radiation protection areas as occupationally exposed persons according to § 25 StrlSchG.

**WHERE DOES THE PERMIT APPLY? DELIMITATION CONTRACT!**

The above-mentioned approval applies to third-party facilities and installations with which the University of Kassel has concluded a demarcation agreement prior to commencement of the activity. This demarcation agreement regulates the non-plant-related radiation protection between the University of Kassel and the plant-related radiation protection of the operator of a third-party plant or facility. In particular, the agreement stipulates that the instructions of the radiation protection supervisor and the radiation

protection supervisor be at tors of the third-party plant or facility, which they make in fulfillment of their duties pursuant to Section 33 of the Radiation Protection Ordinance (StrlSchV), must be followed.

Without a demarcation agreement, work in third-party plants or facilities within Germany is prohibited.

## 4. Radiation Safety Officer

**WHO IS SSB?**

The radiation protection officers of the University of Kassel are listed in part A-3 with their names and responsibilities.

**(ADDITIONAL) TASKS AND DUTIES**

In addition to the information provided under A-1 Item 4.4 the radiation protection officers responsible in the above-mentioned scope of application are assigned the task of monitoring compliance with the following protection regulations:

- Management of radiation passports (cf. B-3 Point 5) of employees of the University of Kassel. The radiation protection officer must ensure that persons under his supervision only work in radiation protection areas belonging to third parties if they are in possession of a radiation passport that is fully maintained and registered with the competent authority (Section 68 (1) StrlSchV).
- In cooperation with the radiation protection authorized, review drafts of delineation agreements and compliance with agreements entered into in delineation agreements.
- The radiation protection officer must ensure that the personal dose is also officially monitored in the third-party plant or facility.
- Correspondence with the third-party facility, preparation of the demarcation boundary ation contract as specified by the third-party facility, and sending the reviewed demarcation contract to the radiation protection supervisor for forwarding to the radiation protection supervisor.
- Compliance with the requirements of the demarcation agreement.
- Ordering of suitable dosimeters (cf. B-3 item 6 and point 7).

## 5. Radiation passport

The radiation passport of an occupationally exposed person is used for monitoring and balancing the radiation exposure in professional life. The radiation passport is applied for via the radiation protection authorized at the corresponding licensing authority. It is an official document and the personal property of the passport holder. In exceptional cases (see § 68 StrlSchV), the need for a radiation passport may be waived.

Entries in the radiation passport are made by the responsible radiation protection authorized person or the radiation protection authorized person of the University of Kassel, as well as the external plant or facility, the occupational health service and the supervisory authority.

The completely maintained radiation passport is to be presented at the foreign plant or facility. After the end of the operation, the operator's entries (e.g. non-official dose) must be checked for completeness.

The contents of the explanatory notes on the radiation passport - completion of the radiation passport to be registered, registration of the radiation passport, maintenance of the radiation passport before the start of the employment of reference persons, maintenance of the radiation passport during the employment of reference persons and retention of unusable or no longer required radiation passports - are part of the instruction and must be observed by the radiation passport holder and the person performing the radiation passport.

**DOCUMENTATION**

In addition to the radiation passports, a radiation protection file (cf. A-1 Item 10) must be kept. In this file, in addition to the above-mentioned data, all information necessary for keeping the radiation passports (copy of the radiation passport), contents and times of the briefings as well as periods of the stays in the external facilities are documented. In order to fulfill the licensing requirement, the radiation protection authorized sends the supervisory authority the additions and departures of reference persons, including personal data, once a year.

## 6. Rules of conduct around visiting foreign facilities

**OBLIGATION TO NOTIFY**

The employees are obliged to inform the responsible radiation protection officer if a stay in a foreign facility is requested and / or planned. The radiation protection officer then takes care of the necessary organizational measures (e.g., border contract, ordering suitable dosimeters, creating or updating the radiation passport). Depending on the foreign facility, the preparation may take longer than 3 months, therefore early notification is absolutely necessary. If the organizational measures have not been completed, it is not possible to stay in the foreign facility.

**INSTRUCTION BY THE OPERATOR**

Employees must take part in the measures taken by the operator of the third-party facility in preparation for their work assignment, e.g:

- Plant-related radiation protection training
- Familiarization with local conditions such as escape routes, controlled area access
- Body counter examination, excretion analysis
- Obtaining an operating certificate from the operator
- Receiving dosimeters from the operator
- Issue of protective clothing
- Work release by the responsible radiation protection personnel

The instructions of the radiation protection officer and the written operating instructions of the operator of the third-party facility must be followed.

It is prohibited to enter areas in a third-party facility that do not necessarily have to be entered in order to perform the activity.

Work areas marked with a restricted area sign may only be entered under the control of the operator's radiation protection officer or a competent person appointed by him.

For activities subject to special radiation protection monitoring, their start, interruptions and end must be reported immediately to the responsible radiation protection officer.

After completion of the activities, the radiation protection personnel must be notified so that the workplace and the work equipment can be released again or, if necessary, decontamination can be arranged.

**PERSONAL RESPONSIBILITY**

If the instruction does not take place the first time the employee enters the external facility, even after inquiring with the responsible radiation protection officer, the employee must consult with the responsible radiation protection officer of the University of Kassel before starting work.

**DOSIMETER OBLIGATION**

Depending on the accrual contract, it may be necessary for employee:s to have two dosimeters (cf. A-1 Point 9) during their stay in the foreign facility, one from the foreign facility and one from the University of Kassel.

**RETURN OF THE DOSIMETERS**

The dosimeters provided by the University of Kassel are to be handed over to the radiation protection officer as soon as possible after return. In case of a late delivery to the evaluation center, additional costs will be incurred, which will then have to be charged to the working group. In the case of a considerably late return, it may not be possible to carry out an evaluation. In this case, the supervisory authority can impose administrative offenses, which must be paid privately by the employee if he or she is at fault.

**FOREIGN PLANTS ABROAD**

The dose limits according to German radiation protection law also apply to members of the University of Kassel abroad. It is the personal responsibility of visitors to foreign facilities to ensure that these limits are also observed abroad. If questions arise, the responsible radiation protection officer can be consulted at any time. If a personal dose is determined in a foreign facility, this must be reported immediately to the responsible radiation protection officer.

## 7. Air travel with dosimeter

**TWO DOSIMETERS FOR AIR TRAVEL**

If air travel is carried out with dosimeters, the responsible radiation protection officer must be informed in advance so that two dosimeters can be ordered. In each case, there is an "official" personal dosimeter and a "non-official" dosimeter for background radiation (exposure through flight or through screening of hand luggage).

They wear the official personal dosimeter as described under A-1 Point 9 during their stay in the foreign facility. The "non-official" dosimeter remains in your hotel room during this time. Except during your stay at the foreign facility, treat both dosimeters identically and always store them in the same place. Please carry both dosimeters in your hand luggage during the outward and return flight. Both dosimeters will be evaluated by the official measuring station after your return and the difference will correspond to your received occupational exposure in the foreign facility.

## 8. Enactment

This new version of the activity-related part B-3 of the Central Radiation Protection Instruction of the University of Kassel replaces all previously applicable Radiation protection instructions for employment requiring a permit in third-party plants or facilities and shall enter into force after approval by the President on the day following publication in the University of Kassel's official gazette.

- Drawn in the original -

Prof. Dr. Ute Clement

President of the University of Kassel

# B-4. Radiation protection instructions for handling X-ray equipment and interfering radiation sources

## 1. Introduction

**TO WHOM DOES THIS RADIATION PROTECTION INSTRUCTION APPLY?**

In the event of improper operation of X-ray equipment and interference sources, there is a possibility of external radiation exposure for occupationally exposed persons or third parties.

This activity-related part of the radiation protection instruction (B-4) supplements the generally valid part of the central radiation protection instructions of the University of Kassel (A-1, A-2, A-3, A-4) for all persons at the University of Kassel who operate or handle X-ray systems or sources of interference or who may be exposed to radiation in accordance with the German Radiation Protection Act (StrlSchG), which require approval / notification .

Radiation safety officers are required to provide information to all persons working in the area of application below (B-4 Part 2) and / or may be exposed to radiation, must be informed of the contents of the generally applicable radiation protection instructions and of these activity-related radiation protection instructions before they start their work. The persons confirm with their signature that they have been given access to the radiation protection instructions, have taken note of the radiation protection instructions and have understood their contents.

**DESTINATION**

If used improperly, the operation of X-ray equipment and interference sources can cause the risk of external radiation exposure with possible danger to the life and health of the employees or third parties involved.

Therefore, all necessary technical and organizational measures must be implemented and constantly adhered to so that

- unnecessary radiation exposures are avoided,
- unavoidable kept as small as possible and
- the radiation exposure limits according to § 78 StrlSchG and § 65 StrlSchV are not exceeded.

It must be checked whether other procedures that do not involve radiation exposure do not lead to the same result.

## 2. Permits and scope

In the appendices to B-4 the approvals of the X-ray facilities and interfering radiators of the University of Kassel are named with their respective areas of validity.

## 3. Radiation Safety Officer

**WHO IS SSB?**

The radiation protection officers of the University of Kassel are listed in part A-3 and part A-4 as well as the appendices to B-4 Device-specific named with your responsibilities.

**(ADDITIONAL) TASKS AND DUTIES**

In addition to the information provided under A-1 Item 4.4 the radiation protection officers responsible in the above-mentioned scope of application are assigned the task of monitoring compliance with the following protection regulations:

- Checking the functionality of the X-ray equipment or the interference source as well as the warning and safety devices.
- Compliance with work conduct regulations by those otherwise engaged in the work.
- Ensure that licensing documents, expert inspection reports, and radiation safety instruction attachments are current.
- Early notification of significant changes through the radiation protection authorized.
- The frequency of the inspections must be coordinated with the needs of the company. Any defects found must be documented and their immediate rectification must be arranged.

Device-specific measures are described in the appendices to B-4 can be found.

## 4. Access to radiation protection areas

In addition to the general access regulations of the Central Radiation Protection Instruction (A-1 Item 5), the accesses to controlled areas must be marked during the switch-on time and during operational readiness. The marking must clearly contain at least the words **"No access - X-ray".**

For plant-specific special regulations, see appendices to B-4.

## 5. Medical surveillance of occupationally exposed persons

Supplementary to A-1 Item 8 the following applies: If the rules of the radiation protection instruction are observed, assignment to category A or category B of occupationally exposed persons and occupational medical precautions in accordance with § 71 StrlSchV are not required.

## 6. Instruction and briefing of occupationally exposed persons

For the general regulations and explanations on "Instruction of Occupationally Exposed Persons" at the University of Kassel, please refer to the Central Radiation Protection Instruction (A-1 Item 7).

In addition to this, specifically:

- If new X-ray equipment and/or interference sources are put into operation in accordance with the StrlSchG or StrlSchV, care must be taken to ensure that the initial instruction in accordance with § 97 and § 98 p. 1 StrlSchV in proper handling is carried out by an appropriately qualified person from the manufacturer or supplier. A German-language instruction manual must be available for the instruction.

- Any other person who is to work on the device at a later date must also be instructed in its proper handling before starting work. This follow-up instruction can also be provided by a suitably qualified colleague.
- Initial and follow-up referrals must be documented and signed by both the person referring and the person referred.

## 7. Basic rules of conduct

For the general regulations and explanations on the "Basic rules of conduct" at the workplace, please refer to the Central Radiation Protection Instruction (A-1 Item 11).

In addition to this, specifically:

- The responsible radiation protection officer must always be available on site or reachable at short notice.
- Only instructed persons may operate X-ray equipment whose operation is subject to approval or notification or interfering radiation sources whose operation is subject to approval, or use X-rays.
- Before commissioning and after completion of operation, a visual inspection for damage must be carried out
- Users must be able to hear all alarm signals from control or measuring equipment. Thus, for example, wearing headphones while operating the equipment is prohibited.

For plant-specific special regulations, see appendices to B-4.

## 8. Operation, repairs, changes in the test setup

The devices may only be operated in the manner prescribed by the manufacturer. Repairs, modifications to the setup or other interventions that could influence radiation protection may only be carried out by competent persons who have the necessary expertise in radiation protection. Afterwards, it must be checked whether a renewed expert examination (see B-4 Point 9) must be carried out.

## 9. Expert inspection

Radiation protection measurements by experts must be performed in accordance with Section 172, Paragraph 1, Sentence 1, No. 1, StrlSchG and Section 88, Paragraph 4 StrlSchV prior to commissioning as part of the notification and approval procedure for X-ray facilities requiring approval or notification . As a rule, the expert inspection must be updated every five years, but the expert may set different deadlines. The period specified in the expert ver permanent inspection report is decisive for the notified/approved operation. If the plant-specific radiation protection instructions (see attachments to B-4), then the SSB responsible is responsible for adherence to the deadlines as well as the organization and planning of the ver permanent inspection and maintenance dates.

For special inspections/maintenance, refer to the plant-specific radiation protection instructions (see appendices to B-4). As soon as significant changes (cf. expert test guideline) are made to the test setup, the expert permanent

test must be performed again and a notification of significant change must be submitted to the supervisory authority!

Examples of significant changes include:

**SIGNIFICANT CHANGES**

- Replacement of the entire X-ray equipment or the X-ray source
- Change of the place of operation
- Installation of an additional device (e.g. table, wall stand)
- Replacement of the switchgear or generator
- structural changes
    - New and reconstruction of the walls of the X-ray room
    - Replacement and modification of the doors of the X-ray room
- Change of the operating data
    - other useful beam direction
    - higher duty cycles
    - Higher operating voltage

## 10. Significant event

In addition to the information provided under A-1 Item 13 the following regulations and declarations apply in addition when handling X-ray equipment and sources of interference:

- To prevent unauthorized interference with the X-ray equipment and sources of interference by third parties, the entrance door must always be locked when leaving the empty X-ray laboratory.

## 11. Termination of operation

If an X-ray facility, the operation of which requires approval or notification, or an interfering radiator, the operation of which requires approval, is taken out of operation, the responsible radiation protection authorized person and the radiation protection authorized person must be notified immediately.

## 12. Enactment

This new version of the activity-related part B-4 incl. the appendices to Part B-4 of the Central Radiation Protection Instruction of the University of Kassel replaces all previously valid Radiation protection instructions for handling X-ray equipment and interfering radiation sources and shall enter into force after approval by the President on the day following publication in the University of Kassel's official gazette.

- Drawn in the original -

Prof. Dr. Ute Clement

President of the University of Kassel

## 13. Attachments to B-4: Radiation protection instructions for specific X-ray equipment and interfering sources.

### Appendix B-4.1: Fine structure X-ray facility at FB 10, FG Organometallic Chemistry, Heinrich-Plett-Str. 40, IBC, R. 3109

| **Device information:** | |
|---|---|
| Designation | X-ray laboratory of the Institute of Chemistry, IBC, R. 3109 |
| Device designation | 1) StadiVari (diffractometer, internal number RöV: FB10/-7)<br>2) IPDS2 (diffractometer, internal number RöV: FB10/-4) |
| Inventory numbers | 1) # 7298370<br>2) # 7048140 |
| Approval notice | 1) 25.1/cn - KS054281-12163/2015 dated 24.10.2016.<br>2) 35.1/cn - KS054281 - 7480/2014 of 05.05.2015 |
| Brief description | The diffractometers are used for fine structure analysis on single crystals and powder samples with the aid of X-rays. They correspond in their design to a full protection instrument. |
| **Responsibilities:** | |
| SSB and representation SSB | See A-3 and notice board |
| Institute | Institute for Chemistry |
| Department and field | FB10, FG Organometallic Chemistry |
| Subject area management | Prof. Siemeling |

**Supplementary activity- and/or plant-specific special regulations:**

**Access to radiation protection areas:** supplementary to A-1 Item 5 and B-4 Item 4 applies**:**

When operating the high protection device / full protection device, there is no accessible monitoring area

**Basic rules of conduct: supplementary** to A-1 Item 11 and B-4 Item 7 applies:

- No modifications may be made to the high protection device / full protection device that could change the radiation protection. The conversion of shields, bridging of interlocks or similar interventions are not permitted.
- If there is any suspicion of damage to the high protection device / full protection device or functional restriction of a protective device, the device must no longer be used and the radiation protection officer must be informed immediately.
- The markings on the high protection device / full protection device must not be removed.
- Questions regarding the operation of the high protection device / full protection device must be directed to the responsible radiation protection officer.
- The Radiation Protection Ordinance is available at the workplace.

**Expert inspection:** supplementary to B-4 Item 9 applies:

| | |
|---|---|
| Organization of expert inspection and maintenance appointments | SSB |
| Maintenance is carried out by | Stoe company, Darmstadt |
| Maintenance cycle | If needed |
| Other | A record must be kept of the time and result of the expert inspection and maintenance performed. |

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## Continuation to
## Attachment B-4.1: Fine structure X-ray facility at FB 10, FG Organometallic Chemistry, Heinrich-Plett-Str. 40, IBC, R. 3109

| **Operating log:** supplementary to A-1 Item 12 applies: | |
|---|---|
| Location of the operating log | In each case on the device |

**Supplementary data**
none

## Attachment B-4.2: Fine structure X-ray facility at FB 10, FG Technical Physics, Heinrich-Plett-Str. 40, INA, R. 0136

| **Device information:** | |
|---|---|
| Designation | Fine structure X-ray equipment |
| Number of plants | 2 |
| Device numbers | 1) Philips PW1830 DY-1001 (internal number RöV: FB10/-6)<br>2) X'PERT pro MRD DY-3091 (internal number RöV: FB10/-8) |
| Approval notice | 1) 35.1 BS054281-021 Rö5/2009-Cn of 19.01.2009<br>2) 35.1/cn-KS054281-12172/2015 dated 23.02.2015 |
| Brief description | The diffractometers are used for fine structure analysis on semiconductor layers with the aid of X-rays. They correspond in their design to a full protection device. |
| **Responsibilities:** | |
| SSB and representation SSB | See A-3 and notice board |
| Institute | Institute of Physics |
| Department and field | FB10, FG Technical Physics |
| Subject area management | Prof. Dr. Reithmaier |
| **Supplementary activity- and/or plant-specific special regulations:** | |
| **Access to radiation protection areas:** supplementary to A-1 Item 5 and B-4 Item 4 applies**:** | |
| When operating the high protection device / full protection device, there is no accessible monitoring area | |
| **Basic rules of conduct:** supplementary to A-1 Item 11 and B-4 Item 7 applies: | |
| - No modifications may be made to the high protection device / full protection device that could change the radiation protection. The conversion of shields, bridging of interlocks or similar interventions are not permitted.<br>- If there is any suspicion of damage to the high protection device / full protection device or if the function of a protective device is impaired, the device must no longer be used and the radiation protection officer must be informed immediately.<br>- The markings on the high protection device / full protection device must not be removed.<br>- Questions regarding the operation of the high protection device / full protection device must be directed to the responsible radiation protection officer.<br>- The radiation protection instructions and the legal basis are available at the workplace. | |
| **Expert inspection:** supplementary to B-4 Item 9 applies: | |
| Organization of expert inspection and maintenance appointments | SSB |
| Maintenance is performed by | authorized company |
| Maintenance cycle | If needed |
| Other | A record must be kept of the time and result of the expert inspection and maintenance performed. |
| **Operating log:** supplementary to A-1 Item 12 applies**:** | |
| Location of the operating log | Room 0136 |
| **Supplementary data** | |
| none | |

## Appendix B-4.3: School X-ray facility at FB 10, FG Didactics of Physics, Heinrich-Plett-Str. 40, AVZII, R. 1292

| **Device information:** | |
|---|---|
| Designation | School X-ray facility |
| Number of plants | 1 |
| Device numbers | Phywe 35KV-09058.99 (internal number RöV: FB10/-1.2) |
| Display confirmation | 35.1BS00054281-36.Rö 387/2012-Ka of 05.10.2012 |
| Brief description | The diffractometer is used in a practical workshop for fine structure analysis with the aid of X-rays. It is a full protection device with type approval. |
| **Responsibilities:** | |
| SSB and representation SSB | See A-3 and notice board |
| Institute | Institute of Physics |
| Department and field | FB10, FG Didactics of Physics |
| Subject area management | Prof. Dr. Rita Wodzinski |

**Supplementary activity- and/or plant-specific special regulations:**

**Access to radiation protection areas:** supplementary to A-1 Item 5 and B-4 Item 4 applies**:**

When operating the full protection device, there is no accessible monitoring area

**Basic rules of conduct:** supplementary to A-1 Item 11 and B-4 Item 7 applies:

- No modifications may be made to the full-protection device that could alter the radiation protection. The conversion of shields, bridging of interlocks or similar interventions are not permitted.
- If damage to the full-protection device is suspected or the function of a protective device is impaired, the device must no longer be used and the radiation protection officer must be informed immediately.
- The markings on the full-protection device must not be removed.
- Questions regarding the operation of the full protection device should be directed to the appropriate SSB.
- The radiation protection instructions and the legal basis are available at the workplace.

**Expert inspection:** supplementary to B-4 Item 9 applies:

| | |
|---|---|
| Organization of expert inspection and maintenance appointments | SSB |
| Maintenance is carried out by | Authorized company |
| Maintenance cycle | If needed |
| Other | A record must be kept of the time and result of the expert inspection and maintenance performed. |

**Operating log:** supplementary to A-1 Item 12 applies**:**

| | |
|---|---|
| Location of the operating log | Room 1292 |

**Supplementary data**

none

## Attachment B-4.4: Portable XRF instrument at FB 11, storage at FG Environmental Chemistry, Nordbahnhofstr. 1a, R. -1308

| **Device information:** | |
|---|---|
| Designation | Hand-held X-ray fluorescence instrument S1 Titan, model 800, Bruker (internal number RöV: FB11/-2) |
| Number of plants | 1 |
| Device numbers | 800N9132 |
| Approval notice | RPKS-33.1-99 r 0717/17-2021/4 |
| Brief description | The hand-held XRF instrument is used for the analysis of natural or finely ground wastes, soils, plants, composts, coals and their mixtures. In the laboratory, the instrument is operated in conjunction with a shielded sample chamber. |
| **Responsibilities:** | |
| SSB and representation SSB | See A-3 and notice |
| Institute | Kassel University |
| Department and field | FB11, FG Environmental Chemistry |
| Subject area management | Prof. Dr. Ludwig |

**Supplementary activity- and/or plant-specific special regulations:**

**Access to radiation protection areas:** supplementary to A-1 Item 5 and B-4 Item 4 applies**:**

The device may only be operated within Germany.

The user of the device must ensure during the beam times that no persons are within the danger zone 1.50 m to the side of the useful beam path and 15 m in the main beam direction of the beam exit window. It must be ensured that the useful beam is not directed at the body trunk and limbs of the user or another person during use.

For mobile operation of the X-ray equipment, a copy of the license, the applicable radiation protection instructions, the Radiation Protection Act, the Radiation Protection Ordinance, the operating instructions for the X-ray equipment, the expert certificate (if available) and the last expert test report must be carried.

**Basic rules of conduct:** supplementary to A-1 Item 11 and B-4 Item 7 applies:

- The device may only be operated by the radiation protection officer.
- To minimize risk, women must not work with the device during pregnancy and must not stay in the vicinity during measurement operation
- Operators must check the device and window film for damage before each use - replace the film if necessary (even if dirty).
- After that, the automatic shutdown test is performed without sample material.
- Before using the instrument, make sure that the sample material is located in front of the radiation exit window. The exit window should be covered as completely as possible by the sample.
- If possible, measure in the direction of shielding materials.
- Holding the specimen by hand is not permitted. For the measurement of small parts, a suitable holder with a shielded specimen chamber must be used.

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## Continuation to
## Appendix B-4.4: Portable XRF instrument at FB 11,
## Storage at FG Environmental Chemistry, Nordbahnhofstr. 1a, R. -1308.

**Basic rules of conduct:** supplementary to A-1 Item 11 and B-4 Item 7 applies:

- An LED indicates when X-rays are being generated. Do not lift the analyzer from the specimen until the LED has gone out.
- If the next measurement does not follow immediately: Leave the "ready to measure" state.
- In case of significant incidents: Inform the radiation protection officer.
    - Pull battery and secure against restarting

**Expert inspection:** supplementary to B-4 Item 9 applies:

| | |
|---|---|
| Organization of expert inspection and maintenance appointments | SSB |
| Maintenance is carried out by | Bruker Nano GmbH, Am Studio 2D, 12489 Berlin |
| Maintenance cycle | If needed |
| Other | Records must be kept of the time and result of the expert inspection and maintenance performed (see operating log). |

**Operating log:** supplementary to A-1 Item 12 applies**:**

| | |
|---|---|
| Location of the operating log | is carried along with the device |

Records shall be kept of the operation of the X-ray equipment in accordance with Condition I.2.9. The accounting shall contain the following information:

a) Radiation protection officer for on-site supervision
b) Place of operation / place of use (premises, property, address, coordinates, ...)
c) X-ray equipment used
d) Maintenance and repair work (name of person responsible)
e) Time and result of the expert tests
d) Date of operation of the X-ray equipment
e) Time of the functional test performed
e) technical errors or suspicion of technical errors
f) significant events according to Sec. 1 (22) StrlSchV in the sense of exceptional event sequences or operating conditions.

The records must be kept and presented to the responsible supervisory authority upon request.

**Supplementary data**
When measuring with the XRF instrument, the transportable, shielded sample chamber should be used, if possible, to ensure the greatest possible radiation protection.

Unauthorized startup of the device is ensured by password protection. The password must not be passed on to unauthorized persons.

Outside operating hours, the analyzer is kept locked and protected against unauthorized access.

Removing the battery can ensure that the device is reliably out of operation and that no X-rays can be generated.

## Attachment B-4.5: Portable X-ray unit at FB 11, storage in FG Animal Breeding, Nordbahnhofstr. 1a, R. -1608.

| **Device information:** | |
|---|---|
| Designation | Portable battery-powered high-frequency X-ray system Amadeo P-90/20VB (internal number RöV: FB11/-3) |
| Number of plants | 1 |
| Device numbers | NHUM20B-22205-024 |
| Approval notice | RPKS-33.1-99 r 0717/1002-2023/1 |
| Brief description | As a rule, mobile operation takes place on the premises of the University of Kassel or, in the case of practical investigations, in extra rooms in stable buildings where the radiation protection officer is on site. In exceptional cases, mobile stables may also be used, in which the restricted and safety areas are cordoned off. |
| **Responsibilities:** | |
| SSB and representation SSB | See A-3 and notice board |
| Institute | Kassel University |
| Department and field | FB11, FG Animal Breeding |
| Subject area management | Prof. Dr. Dirk Hinrichs |

**Supplementary activity- and/or plant-specific special regulations:**

**Access to radiation protection areas:** supplementary to A-1 Item 5 and B-4 Item 4 applies**:**
The device may only be operated within Germany.
The controlled area is cordoned off (e.g. by chains, flutter tape) during operational readiness and during operation of the X-ray equipment and marked with "X-ray - No entry". A supervisor prevents unauthorized persons from entering the controlled area.

The radiation protection officer must ensure that no persons remain within the hazardous area in the direction of the beam and to the side of the useful beam or the scattered beam diaphragm during the beam times. A minimum distance of 1.50 m must be maintained to the side of the useful beam. It is not permitted to stand in the main beam direction during operation. It must be ensured that the useful beam is not directed at the body trunk and limbs of the user or another person during use. All persons who are in the controlled area must wear appropriate protective clothing (e.g. X-ray protective apron, protective goggles, radiation protective gloves) as well as a suitable dosimeter from an approved measuring station. Radiation protection gloves must be worn at least during examinations where there is a risk that parts of the hand may come into contact with the useful radiation beam.

For mobile operation of the X-ray equipment, copies of the approval and the last expert inspection report, the applicable radiation protection instructions, the Radiation Protection Act, the Radiation Protection Ordinance, the operating instructions for the X-ray equipment in German and the issued expert certificate (if available) must be carried along. If possible, these documents should be carried in laminated form, since disinfection must be possible for reasons of epidemic protection.

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## Continuation to
## Annex B-4.5: Portable X-ray device at FB 11, storage in FG Animal Breeding, Nordbahnhofstr. 1a, R. -1608.

**Basic rules of conduct:** supplementary to A-1 Item 11 and B-4 Item 7 applies:

- The device may only be operated by the radiation protection officer.
- To minimize risk, women must not work with the device during pregnancy and must not be in the vicinity during measurement operation.
- Holding the "**specimen**" (e.g. farm animals) by hand is not permitted. Suitable holders for the specimens to be X-rayed must be used for X-raying.
- Holding the **X-ray device** by hand is not permitted. A suitable stand for the X-ray device must be used for X-raying.
- In case of significant incidents: Inform radiation protection authorized persons and radiation protection authorized persons.
    - Pull battery and secure against restarting

**Expert inspection:** supplementary to B-4 Item 9 applies:

| | |
|---|---|
| Organization of expert inspection and maintenance appointments | SSB, expert testing is carried out by TÜV |
| Maintenance is performed by | Oehm and Rehbein GmbH, Neptunallee, 18057 Rostock, Germany |
| Maintenance cycle | If needed |
| Other | Records must be kept of the time and result of the expert inspection and maintenance performed (see operating log). |

**Operating log:** supplementary to A-1 Item 12 applies**:**

| | |
|---|---|
| Location of the operating log | is carried along with the device |

Records shall be kept of the operation of the X-ray equipment in accordance with Condition I.2.13. The accounting shall contain the following information:

a) Radiation protection officer for on-site supervision incl. dosimeter ID
b) non-occupationally exposed person (supervisor)
c) Place of operation / place of use (company premises, property, address, coordinates, ...)
d) X-ray equipment used
e) Maintenance and repair work (name of person in charge)
f) Time and result of the expert tests
g) Date of operation of the X-ray equipment
h) Time of the functional test performed
i) Technical errors or suspected technical errors
j) special events according to § 1 para. 22 StrlSchV in the sense of extraordinary event sequences or operating conditions.

The records must be kept (for time limits, see approval) and submitted to the responsible supervisory authority upon request.

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## Continuation to
## Annex B-4.5: Portable X-ray device at FB 11, storage in FG Animal Breeding, Nordbahnhofstr. 1a, R. -1608.

**Supplementary data**

If possible, measurements should take place in a shielded room to ensure the greatest possible radiation protection. Measurements should be taken at the greatest possible distance from the radiation source.

Unauthorized startup of the device is ensured by password protection. The password must not be passed on to unauthorized persons.

Outside operating hours, the analyzer is kept locked and protected against unauthorized access.

Removing the battery can ensure that the device is reliably out of operation and that no X-rays can be generated.

## Attachment B-4.6: Portable XRF instrument at FB 14, Storage at FG Resource Management and Waste Engineering, Mönchebergstr. 8a, R. 1030

| **Device information:** | |
|---|---|
| Designation | Handheld X-ray fluorescence unit Niton XL3t<br>(internal number RöV: FB14/-6) |
| Number of plants | 1 |
| Device numbers | 103756 |
| Approval notice | 35.1/ cn - KS074319 - 27877/2019 of 03.06.2019 |
| Brief description | The hand-held XRF instrument is used for the analysis of lumpy or finely ground waste, soils, construction waste, slags, substitute burn materials and utility materials. In the laboratory, the instrument is operated in conjunction with a shielded sample chamber and a PC as a stationary analyzer. |
| **Responsibilities:** | |
| SSB and representation SSB | See A-3 and notice |
| Institute | Institute for Water, Waste, Environment |
| Department and field | FB14, FG Resource Management and Waste Engineering |
| Subject area management | Prof. Dr. techn. David Laner |

**Supplementary activity- and/or plant-specific special regulations:**

**Access to radiation protection areas:** supplementary to A-1 Item 5 and B-4 Item 4 applies**:**
The device may only be operated within Germany.

The user of the device must ensure during the beam times that no persons are within the danger zone 1.50 m to the side of the useful beam path and 15 m in the main beam direction of the beam exit window. It must be ensured that the useful beam is not directed at the body trunk and limbs of the user or another person during use.

For mobile operation of the X-ray equipment, a copy of the license, the applicable radiation protection instructions, the Radiation Protection Act, the Radiation Protection Ordinance, the operating instructions for the X-ray equipment, the expert certificate (if available) and the last expert test report must be carried.

**Basic rules of conduct:** supplementary to A-1 Item 11 and B-4 Item 7 applies:

- To minimize risk, women must not work with the device during pregnancy and must not stay in the vicinity during measurement operation
- Within the university premises, Mönchebergstr. 8a, the device may only be operated by skilled or instructed persons.
- Outside the premises of the University of Kassel, the device may only be operated by the radiation protection officer.
- Operators must check the device and window film for damage before each use - replace the film if necessary (even if dirty).
- After that, the automatic shutdown test is performed without sample material.

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## Continuation to
## Appendix B-4.6: Portable XRF instrument at FB 14,
## Storage at FG Resource Management and Waste Engineering, Mönchebergstr. 8a, R. 1030.

**Basic rules of conduct:** supplementary to A-1 Item 11 and B-4 Item 7 applies:

- Before using the instrument, make sure that the sample material is located in front of the radiation exit window. The exit window should be covered as completely as possible by the sample.
- If possible, measure in the direction of shielding materials.
- Holding the specimen by hand is not permitted. For the measurement of small parts, a suitable holder with a shielded specimen chamber must be used.
- An LED indicates when X-rays are being generated. Do not lift the analyzer from the specimen until the LED has gone out.
- Use backscatter shield (RSS) when measuring low density samples.
- If the next measurement does not follow immediately: Leave the "ready to measure" state.
- In case of significant incidents: Inform the radiation protection officer.
    - Pull battery and secure against restarting

**Expert inspection:** supplementary to B-4 Item 9 applies:

| | |
|---|---|
| Organization of expert inspection and maintenance appointments | SSB |
| Maintenance is carried out by | analyticon instruments GmbH; Dieselstraße 18<br>61191 Rosbach v. d. Höhe |
| Maintenance cycle | If needed |
| Other | A record must be kept of the time and result of the expert inspection and maintenance performed. |

**Operating log:** supplementary to A-1 Item 12 applies**:**

| | |
|---|---|
| Location of the operating log | is carried along with the device |

Records shall be kept of the operation of the X-ray facility outside Mönchebergstr. 8a in accordance with Subsidiary Provision C-10. The records must contain the following information:

a) Radiation protection officer for on-site supervision
b) Place of operation / place of use (premises, property, address, coordinates, ...)
c) X-ray equipment used
(d) the time and duration of the responsibility of the radiation protection officer referred to in (a) and for the X-ray equipment referred to in (c)
e) Time of the functional test performed
e) technical errors or suspicion of technical errors
f) significant events according to Sec. 1 (22) StrlSchV in the sense of exceptional event sequences or operating conditions.

The records must be kept and presented to the responsible supervisory authority upon request.

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## Continuation to
## Appendix B-4.6: Portable XRF instrument at FB 14,
## Storage at FG Resource Management and Waste Engineering, Mönchebergstr. 8a, R. 1030.

**Supplementary data**

For measurements with the XRF instrument, the transportable, shielded sample chamber should be used to ensure the greatest possible radiation protection.

Unauthorized startup of the device is ensured by password protection. The password must not be passed on to unauthorized persons.

Outside operating hours, the analyzer is protected against unauthorized access in a lockable case.

## Attachment B-4.7X-ray diffractometer at the FB 14, FG Materials of Construction and Construction Chemistry, Mönchebergstr. 7, R. 221

| **Device information:** | |
|---|---|
| Designation | X-ray diffractometer Bruker AXS D4 (internal number RöV: FB14/-1) |
| Number of plants | 1 |
| Device numbers | # 202654 attachment 715943 |
| Approval notice | Not applicable, as full protection device with type approval |
| Brief description | The diffractometer is used to investigate the phases together composition of materials, which must be present as a fine powder for the investigation. |
| **Responsibilities:** | |
| SSB and representation SSB | See A-3 and notice board |
| Institute | Institute for Structural Engineering |
| Department and field | FB14, FG Materials in Construction and Construction Chemistry |
| Subject area management | Prof. Dr. B. Middendorf |
| **Supplementary activity- and/or plant-specific special regulations:** | |

**Access to radiation protection areas:** supplementary to A-1 Item 5 and B-4 Item 4 applies**:**
When the full-protection device is in operation, there is no accessible monitoring area.

**Basic rules of conduct:** supplementary to A-1 Item 11 and B-4 Item 7 applies:

- No modifications may be made to the full-protection device that could alter the radiation protection. The conversion of shields, bridging of interlocks or similar interventions are not permitted.
- If there is any suspicion that the full-protection device has been damaged or that the function of a protective device has been impaired, the device must no longer be used and the radiation protection officer must be informed immediately.
- The markings on the full-protection device must not be removed.
- Questions regarding the operation of the full-protection device should be directed to the responsible radiation protection officer.
- The radiation protection instructions and the legal basis are available at the workplace.

**Expert inspection:** supplementary to B-4 Item 9 applies:

| | |
|---|---|
| Organization of expert inspection and maintenance appointments | SSB |
| Maintenance is performed by | Service Bruker AXS |
| Maintenance cycle | If needed |
| Other | A record must be kept of the time and result of the expert inspection and maintenance performed. |

CONTINUED ON NEXT PAGE

## Continuation of
## Annex B-4.7: X-ray diffractometer at FB 14,
## FG Materials of Construction and Construction Chemistry, Mönchebergstr. 7, R. 221

| **Operating log:** supplementary to A-1 Item 12 applies**:** | |
|---|---|
| Location of the operating log | Room 221 |

**Supplementary data**
none

## Attachment B-4.8µ-computer tomograph at FB 14, FG Materials of Construction and Construction Chemistry, Mönchebergstr. 7, R. 225

| **Device information:** | |
|---|---|
| Designation | High-resolution 3D X-ray imaging system<br>Micro Computer tomo graf (µ-CT) Zeiss Xradia Versa 520<br>(internal number RöV: FB14/-4) |
| Number of plants | 1 |
| Device numbers | V520 25 209 15 |
| Approval notice | Ref: 35.1/ cn - KS074319 - 35058/2015 of 24.10.2016 |
| Brief description | The µ-computed tomograph is used to acquire tomographic images. |
| **Responsibilities:** | |
| SSB and representation SSB | See A-3 and notice |
| Institute | Institute for Structural Engineering |
| Department and field | FB14, FG Materials in Construction and Construction Chemistry |
| Subject area management | Prof. Dr. B. Middendorf |

**Supplementary activity- and/or plant-specific special regulations:**

**Access to radiation protection areas:** supplementary to A-1 Item 5 and B-4 Item 4 applies**:**
When the full-protection device is in operation, there is no accessible monitoring area.

**Basic rules of conduct:** supplementary to A-1 Item 11 and B-4 Item 7 applies:

- No modifications may be made to the full-protection device that could alter the radiation protection. The conversion of shields, bridging of interlocks or similar interventions are not permitted.
- If there is any suspicion that the full-protection device has been damaged or that the function of a protective device has been impaired, the device must no longer be used and the radiation protection officer must be informed immediately.
- The markings on the full-protection device must not be removed.
- Questions regarding the operation of the full-protection device should be directed to the responsible radiation protection officer.
- The radiation protection instructions and the legal basis are available at the workplace.

**Expert inspection:** supplementary to B-4 Item 9 applies:

| | |
|---|---|
| Organization of the expert examination | SSB |
| Organization of maintenance appointments | Dr. Alexander Liehr (FB15), MSc. Cristin Umbach (FB14) |
| Maintenance is carried out by | Service Zeiss |
| Maintenance cycle | If needed |
| Other | A record must be kept of the time and result of the expert inspection and maintenance performed. |

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## Continuation of
## Annex B-4.8: µ-computer tomograph at FB 14,
## FG Materials of Construction and Construction Chemistry, Mönchebergstr. 7, R. 225

| **Operating log:** supplementary to A-1 Item 12 applies: | |
|---|---|
| Location of the operating log | Room 225 |

**Supplementary data**
none

## Attachment B-4.9: Fine Structure X-Ray Facility at FB 15, Institute of Materials Engineering - Metallic Materials, Mönchebergstr. 3, R. 1103

| **Device information:** | |
|---|---|
| Designation<br>Device numbers | X-ray fine structure device / X-ray diffractometer<br>1.) Stresstech X3000 (internal number RöV: FB15/-3)<br>2) Panalytical, Empyrean (internal number RöV: FB15/-4)<br>3.) D5000 (internal number RöV: FB15/-5)<br>4) Type F1/Huber 1 (internal number RöV: FB15/-6)<br>5.) D500-1 (internal number RöV: FB15/-7)<br>6) Type F2/F3 (internal number RöV: FB15/-8)<br>7.) Huber 2 (internal number RöV: FB15/-9)<br>8) Huber 3 (internal number RöV: FB15/-10)<br>9.) D500-2 (internal number RöV: FB15/-11)<br>10.) Seifert XRD 3003 Micro (internal number RöV: FB15/-12)<br>11) Huber 4 (internal number RöV: FB15/-17)<br>12.) Pulstec µX-360s (internal number RöV: FB15/-18) |
| Approval notice | 1) 35.1 BS 074123-018 Rö 03/2006 - Cn of 15.03.2006<br>2.) 35.1 BS00074123-20th Rö 13/2012 Cn of 15.10.2012.<br>3.) BS 53349010 Rö 2/00-Cn/Bn of 26.05.2000<br>4.) 64.1-BS74123007 Rö 01/2004 -Cn/Bi- of 22.04.2004<br>5.) 35.1/ cn - KS074123 - 23827/2016 of 08.11.2016<br>6.) BS 53349015 Rö 7/00 -Cn/Bn- from 26.05.2000<br>7.) BS 53349011 Rö 3/00 -Cn/Bn- from 26.05.2000<br>8) 35.1 BS 074123-017 Rö 02/2006 - Cn from 15.03.2006<br>9.) 35.1 BS00074123-24 Rö 1/2014-Cn of 29.04.2014<br>10.) 64.1-BS74123009 Rö 64/2004 Cn/Sz of 30.04.2004<br>11.) 35 1/ ka - KS074123 -32582/2018 dated 25.07.2018<br>12.) 35.1/ cn - KS074123 -27325/2019 dated 15/07/2019 |
| Brief description | The diffractometers are used for fine structure analysis (residual stresses, texture and phase analysis) on crystalline materials using X-ray diffraction. They correspond in their design to full-protection instruments. |
| **Responsibilities:** | |
| SSB and representation SSB | See A-3 and notice board |
| Institute | Institute for Materials Engineering |
| Department and field | FB15, FG Metallic Materials |
| Subject area management | Prof. Dr.-Ing. Niendorf |
| **Supplementary activity- and/or plant-specific special regulations:** | |
| **Access to radiation protection areas:** supplementary to A-1 Item 5 and B-4 Item 4 applies**:**<br>When operating the high protection device / full protection device, there is no accessible monitoring area. | |

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## Continuation to
## Annex B-4.9: Fine structure X-ray facility at FB 15,
## Institute of Materials Engineering - Metallic Materials, Mönchebergstr. 3, R. 1103

**Basic rules of conduct:** supplementary to A-1 Item 11 and B-4 Item 7 applies:

- No modifications may be made to the high protection device / full protection device that could change the radiation protection. The conversion of shields, bridging of interlocks or similar interventions are not permitted.
- If there is any suspicion of damage to the high protection device / full protection device or if the function of a protective device is impaired, the device must no longer be used and the radiation protection officer must be informed immediately.
- The markings on the high protection device / full protection device must not be removed.
- Questions regarding the operation of the high protection device / full protection device must be directed to the responsible radiation protection officer.
- The radiation protection instructions and the legal basis are available at the workplace.
- When operating the Pulstec µX-360s (internal number RöV: FB15/-18), make sure that the responsible radiation protection officer is on site.

**Expert inspection:** supplementary to B-4 Item 9 applies:

| | |
|---|---|
| Organization of expert inspection and maintenance appointments | SSB |
| Maintenance is carried out by | instructed technician |
| Maintenance cycle | According to demand |
| Other | A record must be kept of the time and result of the expert inspection and maintenance performed. |

**Operating log:** supplementary to A-1 Item 12 applies**:**

| | |
|---|---|
| Location of the operating log: | Components of the operating log:<br>1. equipment folder (approval, test reports, functional tests); tube book; equipment briefings; and user log file: Room 1103<br>2. equipment log (adjustments, maintenance, repairs): Room 1206 |

**Supplementary data**
none

## Attachment B-4.10: Scanning electron microscope at FB 15, Institute of Materials Engineering - Metallic Materials, Mönchebergstr. 3, R. 1112

| **Device information:** | |
|---|---|
| Designation | Scanning electron microscope |
| Device numbers | CamScan MV 23OO TE with spectral analysis add-on (internal number RöV: FB15/-1) |
| Approval notice | 64.1-BS53349025 Rö 03/2004-Cn of 22.04.2004 |
| Brief description | The scanning electron microscope is used for surface observation, structural analysis, fractography and elemental analysis. |
| **Responsibilities:** | |
| SSB and representation SSB | See A-3 and notice |
| Institute | Institute for Materials Engineering |
| Department and field | FB15, FG Metallic Materials |
| Subject area management | Prof. Dr.-Ing. Niendorf |

**Supplementary activity- and/or plant-specific special regulations:**

**Access to radiation protection areas:** supplementary to A-1 Item 5 and B-4 Item 4 applies**:**
The plant is considered to be an interfering radiator

**Basic rules of conduct:** supplementary to A-1 Item 11 and B-4 Item 7 applies:

- No modifications may be made to the high protection device / full protection device that could change the radiation protection. The conversion of shields, bridging of interlocks or similar interventions are not permitted.
- If there is any suspicion of damage to the high protection device / full protection device or if the function of a protective device is impaired, the device must no longer be used and the radiation protection officer must be informed immediately.
- The markings on the high protection device / full protection device must not be removed.
- Questions regarding the operation of the high protection device / full protection device must be directed to the responsible radiation protection officer.
- The radiation protection instructions and the legal basis are available at the workplace.

**Expert inspection:** supplementary to B-4 Item 9 applies: no repeat test required

| | |
|---|---|
| Organization of expert inspection and maintenance appointments | Dipl.-Ing. Rolf Diederich |
| Maintenance is carried out by | authorized company |
| Maintenance cycle | annual |
| Other | A record must be kept of the time and result of the expert inspection and maintenance performed. |

**Operating log:** supplementary to A-1 Item 12 applies**:**

| | |
|---|---|
| Location of the operating log: | Room 1112 |

**Supplementary information**
none

## Attachment B-4.11: Electron beam melting facility at FB 15, Institute of Materials Engineering - Metallic Materials, Mönchebergstr. 3, R. 101

| **Device information:** | |
|---|---|
| Designation | Electron beam melting system |
| Device numbers | Arcam EBM A2X (internal number RöV: FB15/-15) |
| Approval notice | 35.1/ cn - KS074123 - 34653/2016 of 08.11.2016 |
| Brief description | The electron beam melting system is used for powder bed-based additive manufacturing of metallic components by means of electron beam. |
| **Responsibilities:** | |
| SSB and representation SSB | See A-3 and notice |
| Institute | Institute for Materials Engineering |
| Department and field | FB15, FG Metallic Materials |
| Subject area management | Prof. Dr.-Ing. Niendorf |
| **Supplementary activity- and/or plant-specific special regulations:** | |

**Access to radiation protection areas:** supplementary to A-1 Item 5 and B-4 Item 4 applies**:**
The plant is considered to be an interfering radiator

**Basic rules of conduct:** supplementary to A-1 Item 11 and B-4 Item 7 applies:

- No modifications may be made to the high protection device / full protection device that could change the radiation protection. The conversion of shields, bridging of interlocks or similar interventions are not permitted.
- If there is any suspicion of damage to the high protection device / full protection device or if the function of a protective device is impaired, the device must no longer be used and the radiation protection officer must be informed immediately.
- The markings on the high protection device / full protection device must not be removed.
- Questions regarding the operation of the high protection device / full protection device must be directed to the responsible radiation protection officer.
- The radiation protection instructions and the legal basis are available at the workplace.

**Expert inspection:** supplementary to B-4 Item 9 applies:

| | |
|---|---|
| Organization of expert inspection and maintenance appointments | SSB |
| Maintenance is carried out by | authorized company |
| Maintenance cycle | if required |
| Other | A record must be kept of the time and result of the expert inspection and maintenance performed. |

**Operating log:** supplementary to A-1 Item 12 applies**:**

| | |
|---|---|
| Location of the operating log: | Room 101 |

**Supplementary data**
none

## Attachment B-4.12: Electron beam machining facility at FB 15, Institute of Production Engineering and Logistics, Kurt-Wolters-Str. 3, R. 0309

| **Device information:** | |
|---|---|
| Designation | Electron beam machining system |
| Device numbers | Pro Beam AG & co KGaA SEM 108 (internal number RöV: FB15/-14) |
| Approval notice | 35.1/ cn - KS062768 - 34650/2016 of 10.04.2017 |
| Brief description | The electron beam melting system is used for powder bed-based additive manufacturing of metallic components by means of electron beam. |
| **Responsibilities:** | |
| SSB and representation SSB | See A-3 and notice |
| Institute | Institute of Production Engineering and Logistics |
| Department and field | FB15, FG Separating and Joining Manufacturing Processes |
| Subject area management | Prof. Dr.-Ing. Böhm |

**Supplementary activity- and/or plant-specific special regulations:**

**Access to radiation protection areas:** supplementary to A-1 Item 5 and B-4 Item 4 applies**:**
The plant is considered to be an interfering radiator

**Basic rules of conduct:** supplementary to A-1 Item 11 and B-4 Item 7 applies:

- No modifications may be made to the high protection device / full protection device that could change the radiation protection. The conversion of shields, bridging of interlocks or similar interventions are not permitted.
- If there is any suspicion of damage to the high protection device / full protection device or if the function of a protective device is impaired, the device must no longer be used and the radiation protection officer must be informed immediately.
- The markings on the high protection device / full protection device must not be removed.
- Questions regarding the operation of the high protection device / full protection device must be directed to the responsible radiation protection officer.
- The radiation protection instructions and the legal basis are available at the workplace.

**Expert inspection:** supplementary to B-4 Item 9 applies:

| | |
|---|---|
| Organization of expert inspection and maintenance appointments | SSB |
| Maintenance is carried out by | authorized company |
| Maintenance cycle | if required |
| Other | A record must be kept of the time and result of the expert inspection and maintenance performed. |

**Operating log:** supplementary to A-1 Item 12 applies**:**

| | |
|---|---|
| Location of the operating log: | Room 0309 |

**Supplementary data**
none

## Attachment B-4.13: X-ray fluorescence device at FB 15, Institute of Materials Engineering - Metallic Materials, Mönchebergstr. 3, R. -1103

| **Device information:** | |
|---|---|
| Designation | X-ray fluorescence device |
| Device numbers | Seifert ID 3000 (internal number RöV: FB15/-19) |
| Approval notice | Dec. 53/ cn - KS074123 - 65735/2020 (2021) |
| Brief description | The X-ray fluorescence instrument is used to determine the chemical composition of sample material. It corresponds in its design to full protection devices. |
| **Responsibilities:** | |
| SSB and representation SSB | See A-3 and notice board |
| Institute | Institute for Materials Engineering |
| Department and field | FB15, FG Metallic Materials |
| Subject area management | Prof. Dr.-Ing. Niendorf |
| **Supplementary activity- and/or plant-specific special regulations:** | |

**Access to radiation protection areas:** supplementary to A-1 Item 5 and B-4 Item 4 applies**:**

When operating the high protection device / full protection device, there is no accessible monitoring area

**Basic rules of conduct:** supplementary to A-1 Item 11 and B-4 Item 7 applies:

- No modifications may be made to the high protection device / full protection device that could change the radiation protection. The conversion of shields, bridging of interlocks or similar interventions are not permitted.
- If there is any suspicion of damage to the high protection device / full protection device or if the function of a protective device is impaired, the device must no longer be used and the radiation protection officer must be informed immediately.
- The markings on the high protection device / full protection device must not be removed.
- Questions regarding the operation of the high protection device / full protection device must be directed to the responsible radiation protection officer.
- The radiation protection instructions and the legal basis are available at the workplace.

**Expert inspection:** supplementary to B-4 Item 9 applies:

| | |
|---|---|
| Organization of expert inspection and maintenance appointments | SSB |
| Maintenance is carried out by | instructed technician |
| Maintenance cycle | According to demand |
| Other: | A record must be kept of the time and result of the expert inspection and maintenance performed. |

**Operating log:** supplementary to A-1 Item 12 applies**:**

| | |
|---|---|
| Location of the operating log: | Room -1103 |

**Supplementary data**

none

## Attachment B-4.14: Transmission electron microscope at FB 15, Institute of Materials Engineering - Metallic Materials, Mönchebergstr. 3, R. -1103

| **Device information:** | |
|---|---|
| Designation | Transmission electron microscope |
| Device numbers | TEM CM 200 (internal number RöV: FB15/-20) |
| Approval notice | Dec. 53/cn - KS074123 - 37683/2021 |
| Brief description | The transmission electron microscope (TEM) is used to determine material properties of metal alloys. |
| **Responsibilities:** | |
| SSB and representation SSB | See A-3 and notice board |
| Institute | Institute for Materials Engineering |
| Department and field | FB15, FG Metallic Materials |
| Subject area management | Prof. Dr.-Ing. Niendorf |

**Supplementary activity- and/or plant-specific special regulations:**

**Access to radiation protection areas:** supplementary to A-1 Item 5 and B-4 Item 4 applies**:**

When operating the high protection device / full protection device, there is no accessible monitoring area

**Basic rules of conduct:** supplementary to A-1 Item 11 and B-4 Item 7 applies:

- No modifications may be made to the high protection device / full protection device that could change the radiation protection. The conversion of shields, bridging of interlocks or similar interventions are not permitted.
- If there is any suspicion of damage to the high protection device / full protection device or if the function of a protective device is impaired, the device must no longer be used and the radiation protection officer must be informed immediately.
- The markings on the high protection device / full protection device must not be removed.
- Questions regarding the operation of the high protection device / full protection device must be directed to the responsible radiation protection officer.
- The radiation protection instructions and the legal basis are available at the workplace.
- The transmission electron microscope may only be operated under the constant supervision of a radiation protector or by himself.

**Expert inspection:** supplementary to B-4 Item 9 applies:

| | |
|---|---|
| Organization of expert inspection and maintenance appointments | SSB |
| Maintenance is performed by | instructed technician |
| Maintenance cycle | According to demand |
| Other: | A record must be kept of the time and result of the expert inspection and maintenance performed. |

**Operating log:** supplementary to A-1 Item 12 applies**:**

| | |
|---|---|
| Location of the operating log: | Room- 1103 |

**Supplementary data**

none

## Attachment B-4.15: High-energy X-ray source at FB 15, Institute of Materials Engineering - Metallic Materials, Mönchebergstr. 3, R. -1101B

| **Device information:** | |
|---|---|
| Designation | High energy X-ray source |
| Device numbers | MetalJet E1 + 160 kV (internal number RöV: FB15/-21) |
| Approval notice | RPKS-33.1-99 r 01/58-2021/9 |
| Brief description | The high-energy X-ray source is used to determine material properties (X-ray fine structure analysis) of metal alloys. |
| **Responsibilities:** | |
| SSB and representation SSB | See A-3 and notice board |
| Institute | Institute for Materials Engineering |
| Department and field | FB15, FG Metallic Materials |
| Subject area management | Prof. Dr.-Ing. Niendorf |

**Supplementary activity- and/or plant-specific special regulations:**

**Access to radiation protection areas:** supplementary to A-1 Item 5 and B-4 Item 4 applies**:**
When operating the high protection device / full protection device, there is no accessible monitoring area

**Basic rules of conduct:** supplementary to A-1 Item 11 and B-4 Item 7 applies:

- No modifications may be made to the high protection device / full protection device that could change the radiation protection. The conversion of shields, bridging of interlocks or similar interventions are not permitted.
- Suitable technical measures (e.g. interlock) must be taken to ensure that entry to room -1101B is only possible when the X-ray equipment is switched off.
- If there is any suspicion of damage to the high protection device / full protection device or a functional restriction of a protection device, the device must no longer be used and the radiation protection officer must be informed immediately. The protective device must be checked by the SSB at regular intervals and at least every six months; this must be documented.
- The asset ledger must be kept without gaps until the asset is retired.
- The markings on the high protection device / full protection device must not be removed.
- Questions regarding the operation of the high protection device / full protection device must be directed to the responsible radiation protection officer.
- The radiation protection instructions and the legal basis are available at the workplace.
- The radiation protection officer must be present or reachable at short notice during operation.
- During operation of the X-ray equipment, room -1101 may only be entered after consultation with a radiation protection officer. Staying in the room while the X-ray equipment is switched on is only permitted if it is directly related to the operation of the X-ray equipment and is absolutely necessary for the operation. In this case, the time spent in the room and the number of persons must be limited to the minimum required.

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## Continued from
## Annex B-4.15: High-energy X-ray source at FB 15,
## Institute of Materials Engineering - Metallic Materials, Mönchebergstr. 3, R. -1101B

| | |
|---|---|
| **Expert inspection:** supplementary to B-4 Item 9 applies: | |
| Organization of expert inspection and maintenance appointments | SSB |
| Maintenance is performed by | instructed technician |
| Maintenance cycle | According to demand |
| Other | A record must be kept of the time and result of the expert inspection and maintenance performed. |
| **Operating log:** supplementary to A-1 Item 12 applies**:** | |
| Location of the operating log: | Room -1101B |
| **Supplementary data**<br>none | |