

## **Gesellschaftlicher Umgang mit Strahlenrisiken – ein Forschungsfeld des BfS** **How does society deal with radiation risks? An important research field at BfS**

Contrasting scientific risk assessment und societal risk perception always reveals differences –depending on the type of risks, its individual controllability, societal habituation and others. Radiation protection measures as well as information and communication activities have to be designed aiming specifically at particular radiation risk perception, knowledge and behaviour. At BfS, the research focus “risk communication” deals with the issues how society perceives radiation risks and what kind of risk behaviour can be observed. It investigates where knowledge about risks originates, and how opinions are formed; which information needs specifically exist related to single radiation protection topics; how radiation protection behaviour can be promoted and how barriers can be overcome towards an improved protective behaviour.

Knowledge elaborated within the BfS research topic “risk communication” sheds light on society’s dealing with risks, which is, besides the technical knowledge about radiation risks, an important puzzle piece for a holistic radiation protection approach. Results allow communicators and radiation protection experts to be aware of differences in risk assessment and to consider them in practical communication.

## **Stromnetzausbau – eine Herausforderung für den Strahlenschutz?** **Power grid expansion - a challenge for radiation protection?**

In order to increase the proportion of renewable energies in the electricity supply, power grids in Germany are being expanded. During this process, health and radiation protection issues should be taken into consideration right from the beginning. In order to reduce the existing scientific uncertainties in risk assessment and to be able to answer open questions, the German Federal Office for Radiation Protection (BfS) will conduct an accompanying research programme "Radiation Protection in the Process of Power Grid Expansion". The BfS has identified eight main topic areas where there is a need for research. Mainly, a monitoring of the exposure of the population by magnetic fields and a precise estimation of perception thresholds for electric fields and contact currents is planned. Ongoing research on childhood leukaemia and neurodegenerative diseases will be continued. Furthermore, the risk communication and information of the public will be improved. The research programme started in June 2017 with a kick-off meeting and an online consultation. Currently, 36 research projects are planned.

**Sonne ja – Hautkrebs nein: Vorbeugung sinnvoll gestalten**

**Say YES to sun - and NO to skin cancer: Prevention in a meaningful way**

Sun is pleasant. But Sun's ultraviolet (UV) radiation poses serious health risks including skin cancer. In Germany, the skin cancer incidence has been rising continuously for years. Climate change aggravates the situation even further. Thus, prevention of UV-related diseases, in particular skin cancer, is an extremely important radiation protection and health objective. UV protection measures are mainly behavioral driven – but without adapted environmental / structural conditions individual sun protection can fail, for example if you are supposed to seek shade, but there is no shade. Therefore, skin cancer prevention in a meaningful way is to combine behavioral and structural prevention measures. For this goal, the UV Protection Alliance – a cooperation of well-known companies, organizations and authorities from radiation protection, medicine, science as well as occupational health and safety - has published the policy paper "Prevention of health damage caused by the sun – structural prevention in urban and rural areas". Primary goal is to include behavioral and structural prevention of UV-related diseases in the German Prevention Act.

**Forever young? Kosmetik mit Laser, Ultraschall und Co.**

**Forever young? Non-ionizing radiation used on human beings for cosmetic or other non-medical purposes.**

Permanent hair removal (Epilation), removal of Tattoos, skin rejuvenation, fat reduction, electrical muscle stimulation (EMS) or electrical brain stimulation – sources of non-ionizing radiation such as Laser, Intense Pulsed Light sources (IPL) or devices emitting high-frequency electromagnetic fields, low frequency electric or magnetic fields or ultrasound, are increasingly used for cosmetic and other non-medical purposes. Complications and unwanted side effects such as burns, scarring or damage of muscles can occur, if for example the treatment parameters are not adjusted to the treated person, or if contraindications are not taken into account. So far, requirements to professional expertise are not defined. In fact, it is up to the clients to find out, whether a professional provider is qualified or not.

In the future, the requirements for the operation of such devices, as well as the requirements regarding the expertise of professional providers, shall be regulated in a binding manner. For this purpose, with participation of the BfS, the Federal Ministry of Environment is preparing a regulation on the protection against harmful effects of non-ionizing radiation when used on human beings for cosmetic or other non-medical purposes. If possible, this regulation shall enter into force at the end of 2018.

## **Röntgen in Deutschland: Computertomographie sorgt weiterhin für Anstieg der Bevölkerungsdosis**

### **X-raying in Germany: Computed tomography makes for an increase in collective dose**

In Germany, as well as in other industrialized nations, every person receives X-rays in the course of his or her life, and this usually several times. Medical radiation protection is therefore of great importance. One aspect of this is the regular estimation of the medical radiation exposure of the population. In Germany, this is an official task of the BfS. From the perspective of radiation protection, especially the evaluation of temporal changes is essential. Therefore, the data presented here refers to the years 2007 to 2014. In 2014, about 140 million X-ray procedures were performed in Germany, with circa 40% dental examinations. On average, almost constantly, 1.7 procedures per inhabitant and year were performed in 2007 to 2014. Besides dental diagnostics, X-ray examinations of the skeleton and thorax were performed most frequently, i.e. examinations associated with relatively small doses. For most categories of X-ray examinations, the frequency has decreased over time. However, the number of CT examinations grew by about 40%. Mainly due to this, the mean effective dose per inhabitant increased during 2007 to 2014 (1.6 mSv in 2014). The relatively high frequency of X-ray procedures reflects the high standard of health care in Germany. Nevertheless, the frequency of X-ray applications could be reduced without affecting patient care. In this context, the principle of justification of radiologic procedures is of particular importance which is to be applied consistently in each individual instance, especially in case of CT examinations.

## **Weiterhin positive Entwicklung im beruflichen Strahlenschutz**

### **Positive development in occupational radiation protection continues**

The Radiation Protection Register (SSR) is a facility of the Federal Office of Radiation Protection (BfS) and functions as central dose register for the monitoring of occupational radiation exposure in Germany.

In 2016, the SSR monitored 438,390 persons of Germany from various working areas: medical sector, nuclear power engineering, industry, research, aviation and workplaces with high exposure to naturally occurring radionuclides such as radon. The medical sector represents with 298,494 monitored persons by far the largest group followed by aviation (43,051 persons), industry (36,949 persons), nuclear power engineering (14,604 persons), research (19,489 persons), and workplaces with high exposure to radon (347 persons).

However not all monitored persons are indeed exposed to occupationally related radiation. Taken into account only actually exposed persons (i.e. workers with doses above the detection limit), the aircraft crew members represent the largest group (42,742 persons) among all working areas. This is a consequence of the specific working environments: Aircraft crew members are continuously exposed to cosmic radiation as soon as they leave the ground since there is no technical possibility of

shielding against the cosmic radiation. For medical workers, in contrast, radiation exposure can be reduced or even avoided by appropriate radiation protection measures.

Comparing the average annual effective doses for different working groups, a significant decrease has been achieved in most of the working areas over the last 10 years. This demonstrates nicely the effort of efficient occupational radiation protection measures in these sectors.

In contrast, workplaces with high exposure to radon do not show any consistent trend, rather than a strong fluctuation throughout the past ten years. This might be a consequence of the small amount of persons monitored up to now in this field leading to statistical effects. Since these workers even more showed the highest average dose values of all occupational exposed persons, the new radiation protection act increases the attention to radon at workplaces on a broad scale.

### **Vom Radonschutz in Deutschland**

#### **About radon protection in Germany**

A comic strip illustrates how a family in Rhineland-Palatinate gets in contact with the dangers of high radon concentration in houses.

The story begins with the mother's report that radon is measured at her workplace. Thereupon the family becomes aware that long lasting radon exposures increase lung cancer risk.

An expert from the Federal Office for Radiation Protection recommends them to measure the room air concentration of radon. For about hundred Euro they receive a package for radon measurements containing four passive radon detectors, which should be placed at various locations within the house for a period of a view months. After measuring for half a year, they send the detectors back to the provider.

Because it turns out that radon concentrations in some rooms are relatively high, the Federal Office for Radiation Protection recommends them to take action to reduce the radon concentrations in their home. A technical expert helps them to identify cracks, joints, some at junctions with pipework, and small holes that can be sealed. The aim is to prevent that radon expands from the cellar to the living rooms. The story will continue.

### **Weitere Informationen zum Radonschutz**

#### **Further information concerning radon protection**

Further information depict the regulation of radon protection in Germany. Protection from radon and its risks for health are regulated in Radiation Protection Act and in the Radiation Protection Ordinance. The aim is to prevent as far as possible or to significantly impair the entry of radon into buildings, in particular in areas where a high radon concentration can be expected in many buildings.

Under Radiation Protection Act, a reference value provides a standard for the suitability of protection measures. For new private buildings, owners are committed to largely prevent by taking structural measures that radon can enter the building.

Working places within radon affected areas that are situated on the ground floor or the basement, have to be examined and monitored. If the estimated dose value due to radon continuously lies above the dose limit of six mSv per year and cannot be reduced in the long term, then the employer needs to implement and follow the regulations of occupational radiation protection. As a consequence, the radon dose of all exposed employees has to be continuously measured and transferred to the Radiation Protection Register (SSR), where the annual and lifetime body dose limits are observed.

### **BfS-Detektive auf schwieriger Spurensuche: der Ruthenium-Vorfall** **Small amounts of ruthenium-106 measured in many parts of Europe – where does it come from?**

The slightly increased levels of radioactivity in air measured at several trace analysis laboratories in Europe from the end of September to the beginning of October 2017, were by far not dangerous to the health of population.

Ruthenium-106 results from the fission of uranium in a nuclear reactor and thus can occur during the reprocessing of nuclear fuel elements. The only known use is for treatment of a special kind of eye cancer. Calculations performed by the BfS indicated that ruthenium was released most probably in the Southern Ural region in Russia. Data from the CTBTO and the Russian weather service Roshydromet showed, that areas west and south of the Ural cannot be the sources of the ruthenium-106.

Experts from six European countries, among them BfS staff from the Section "Radiological Situation Assessment", as well as Russian experts set up an international scientific commission in 2018 to determine the cause of the increased ruthenium-106 activity concentration levels. Up to this day, the source of release cannot be clearly determined, and the commission deems additional measurements necessary.

### **BfS als langjähriges WHO-Kollaborationszentrum erneut bestätigt** **New agreement signed between BfS and WHO**

The Federal Office for Radiation Protection (BfS) has been WHO Collaborating Centre for many years. It has now been confirmed again as "International WHO Collaborating Centre for Ionising and Non-Ionising Radiation and Health" until January 25, 2022.

WHO Collaborating Centres are institutions that have been appointed by the Director General. As part of an international co-operation network, they actively support the WHO programs at all levels.

As collaborating centre, BfS supports WHO in altogether eight areas of activity dealing with the determination and evaluation of radiation risks, their communication, and the development of international safety standards and technical guidelines:

Activity 1: Assessment of low dose radiation health effects  
Activity 2: Radiation Emergency Preparedness and Response  
Activity 3: Electric, magnetic and electromagnetic fields  
Activity 4: Optical radiation  
Activity 5: Radon  
Activity 6: Medical Radiation Exposure  
Activity 7: Development and implementation of standards and guidelines  
Activity 8: Risk Communication

### **Kooperation und Vernetzung – aktive Zusammenarbeit des BfS mit den europäischen Forschungsplattformen**

#### **Cooperation and networking - active cooperation of the BfS with the European research platforms in the field of radiation protection**

Since its foundation in 1989, the Federal Office for Radiation Protection (BfS) is making an important contribution to maintain and further improve the high level of protection of humans and the environment against the harmful effects of ionising radiation at the national as well as at the European level. BfS is a founding member of and active contributor to European research platforms, such as MELODI, ALLIANCE, NERIS, EURADOS and EURAMED and is so co-determining the key aspects of the future European research landscape in the field of radiation protection. A central element of all platforms is a common, long-term research strategy (Strategic Research Agenda, SRA) at European level. BfS is actively involved and taking a leading role in developing and reviewing the SRAs of different platforms.

The platforms in a nutshell:

MELODI is dedicated to low dose radiation risk research requiring multidisciplinary approaches and long-term commitment. A key priority is to reduce uncertainties in health risk estimates.

ALLIANCE coordinates research on the behavior of radionuclides in the environment at the European level to more reliably determine radiation exposure of humans and the environment.

NERIS is establishing a forum for dialogue and methodological development between organisations taking part in decision making in nuclear and radiological emergencies in Europe.

EURADOS is supporting scientific understanding and technical development of methods of dosimetry of ionising radiation in radiation protection, radiobiology, radiotherapy, and medical diagnostics.

EURAMED is leading European research activities in medical radiation protection and assuming an umbrella function to advance the European radiation protection safety culture in the medical area.



## **DIE ABTEILUNGEN DES BfS STELLEN SICH VOR**

### **Divisions of BfS introduce themselves**

#### **Abteilung WR: Wirkungen und Risiken ionisierender und nichtionisierender Strahlung**

##### **Division WR: Effects and Risks of Ionizing and Non-ionizing Radiation**

The division „Effects and risks of ionizing and non-ionizing radiation” is responsible for two different topics. The first one concerns ionizing radiation and here 1) research on biological effects and/or on underlying mechanisms and health risk in humans through epidemiological studies, 2) biological dosimetry in case of unknown exposure or emergency, 3) assessment and overall evaluation of risk, 4) risk communication and 5) further development of radiation protection concepts based on new research findings. Major research activities concern the effects of low dose ionizing radiation, individual sensitivity, biomarker for exposure and effects, non-cancer effects and radon/uranium. The second focus of the division is non-ionizing radiation, including electric, magnetic and electromagnetic fields, ultrasound, and optical radiation such as solar and artificial UV radiation, infrared and visible light. Major tasks in this field are 1) assessment and evaluation of the exposure of the general population, 2) assessment and evaluation of biological effects and health risks, 3) risk communication, and 4) further development of radiation protection and regulation concepts, prevention measures (e.g. UV) and strategies for precaution. Major research activities concern exposure and effects related to power grid expansion, electro mobility, 5G-standard, artificial and solar UV, lighting systems, laser and cosmetic application of non-ionizing radiation.

#### **Abteilung MB: Medizinischer und beruflicher Strahlenschutz**

##### **Division MB: Medical and Occupational Radiation Protection**

Fundamental and operational aspects of medical and occupational radiation protection are dealt with by an interdisciplinary team consisting of physicians, physicists, mathematicians, chemists, and biologists within the department. The activities include departmental research, consultancy of citizens, patients, professionals, and authorities, cooperation with national and international organisations, and the accurate processing of licensing procedures. The following working groups are in charge of these multiple activities:

- Determination and assessment of patients's radiation exposures in diagnostics and therapy
- Medical reports on radiation hygiene issues and in approval procedures
- External und internal dosimetry, biokinetics
- Occupational radiation protection, radiation protection register
- Incorporation monitoring
- Safety of radiation sources, radiological incidents, type approval

Actual activities of the working groups are presented in the annual report of the BfS for the year 2017/18.

**Abteilung UR: Umweltradioaktivität**

**Division UR: Environmental Radioactivity**

The naming of a division „Environmental Radioactivity“ (UR), raises the question: is the environment radioactive? Along with an experimental investigation of ionizing radiation in the environment the various methods used by the different laboratories maintained by division UR to detect ionizing radiation and radioactive elements, gives the answer. A dosemeter systems provides the ambient dose equivalent rate which varies between 50 nanosievert per hour and 100 nanosievert per hour. A part of which is owing to the gamma-radiation emitted by the radioactive elements in the soil and another contribution is related to the secondary cosmic radiation field in the atmosphere. There are also radioactive elements in the soil which are identified by radiochemical methods and/or by detecting the emitted radiation as there is alpha-, beta- or gamma-radiation. Thus, radioactivity is everywhere in the environment, from natural sources and artificial sources like nuclear power plants. Monitoring the occurrence of radioactive substances in the environment, investigating how such substances lead to radiation exposure of the population and the formulation of measures and regulations to protect the population – these are the main tasks of division UR.

**Abteilung RN: Radiologischer Notfallschutz**

**Division RN: Emergency Preparedness and Response**

In case of an accident in a nuclear installation, the dispersion of radioactivity must be predicted, measured and the resulting radiation exposure assessed. The BfS has a measuring network with approx. 1800 probes which continuously record the radiation background in Germany. These data, together with other radioactivity data, go into the BfS operated "Integrated Measuring and Information System IMIS". Measurements and the results from extensive modelling are used by disaster control authorities to identify areas of protective measures for the population in case of an emergency.

Environmental monitoring in Germany is completed by a network of air radioactivity monitoring stations, one of which is the Schauinsland station. There, highly sensitive sample collectors are installed which can detect extremely small amounts of radioactive trace substances. Particulate and noble gas measuring systems for monitoring the comprehensive Nuclear Test Ban Treaty (CTBT) are operated by BfS at the same site.

Hazards from radioactive substances originate not only from accidents in nuclear facilities but can also be associated with criminal activities. The BfS therefore cooperates closely with the Federal Criminal Police Office and the Federal Police and assists in coping with situations in which radioactive substances have been handled or misused without authorization.



**Abteilung Z: Die Zentralabteilung des BfS**  
**Division Z: Central Office Division**

In recent years and decades, society and work environments underwent profound changes. Ageing in Germany is becoming more and more apparent. Being an integral element of the state, public administration must develop solid responses to these challenges.

The Central Department [Zentralabteilung] provides the scientific and technical divisions of BfS with the resources required to perform their tasks and supports the scientific and technical work with its services.

In view of the challenge mentioned above, becoming and remaining an attractive employer is of fundamental importance for BfS.

This has been the focus of Central Department's major efforts in the past. For example, this has led to a development concept for human resources. This measure has the purpose of providing effective qualification and training for BfS personnel and open horizontal and vertical career possibilities.

Thus, human resources development is strategically planned for a long period of time and – along with occupational health management – a key component of BfS's attractiveness as an employer.

BfS headquarters remain in Salzgitter, while almost all of its scientific and technical departments are located at one of BfS's six sites across Germany. Therefore, Central Departments performs the role of a bracket for the six sites, integrating them into a whole.

Digitisation and technology, e.g. videoconference, are utilised wherever and whenever possible.

Currently BfS has 513 employees.