International Cooperation and Research

Report on International Cooperation and Research Activities at the Federal Office for Radiation Protection

Status 2013

Schriften

Bundesamt für Strahlenschutz

BfS-SCHR-53/14

Bitte beziehen Sie sich beim Zitieren dieses Dokuments immer auf folgende URN:

urn:nbn:de:0221-2014010911155

Zur Beachtung:
BfS-Berichte und BfS-Schriften können von den Internetseiten des Bundesamtes für Strahlenschutz unter http://www.bfs.de kostenlos als Volltexte heruntergeladen werden.

Salzgitter, Januar 2014

International Cooperation and Research

Report on International Cooperation and Research Activities at the Federal Office for Radiation Protection

Status 2013

Schriften

Compilation:

Annemarie Schmitt-Hannig

Josef Peter

Claudia Bernhard-Ströl

Angela Trugenberger-Schnabel

Claudia Hachenberger

Angelika Löbke-Reinl

Barbara Schulte-Büttner

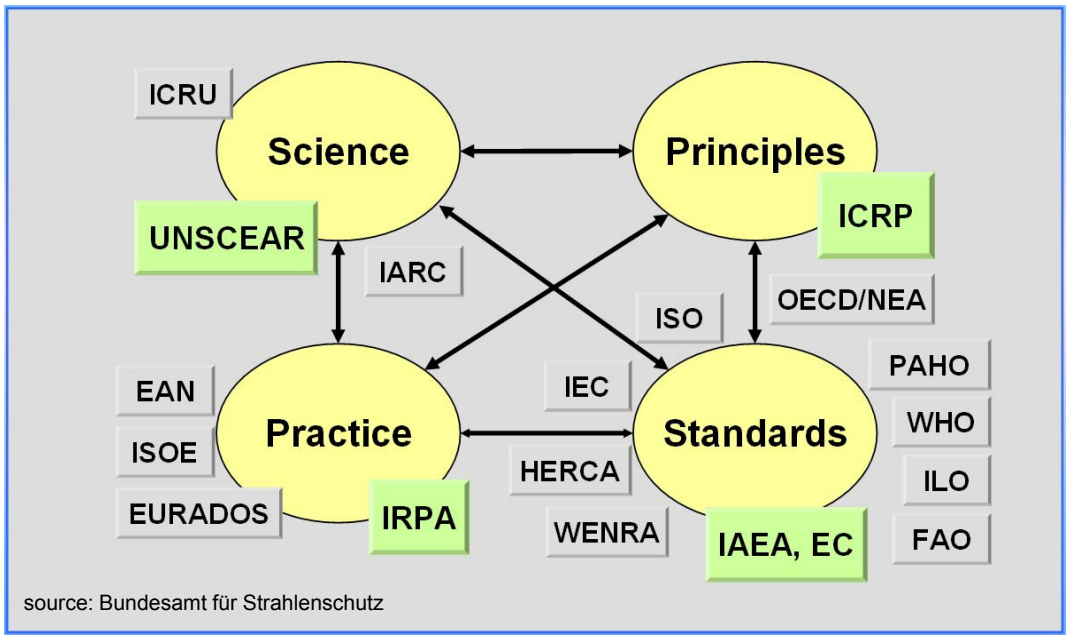
International Cooperation and Research

BfS International Cooperation and Research Activities

Introduction

In line with the 2010 recommendations of the German Council of Science and Humanities (Wissenschaftsrat), the BfS promotes international cooperation with scientifically and technically relevant organisations, authorities, advisory bodies and research institutions as well as joint research activities together with these institutions as an integral part of their everyday professional work. In this report, the various European and international networking activities of BfS are described.

International networking is part of the overall BfS strategy to identify new scientific and technological developments, at an early stage, in all relevant working areas, on European and global level, and to be actively involved in the evolution of safety principles and standards as well as in their practical implementation.



EAN - European ALARA Network
EC - European Commission
EURADOS - European Radiation Dosimetry Group
FAO - Food and Agriculture Organisation
HERCA - Heads of European Radiological Protection Competent Authorities
IAEA - International Atomic Energy Agency
IARC - International Agency for Research on Cancer
ICRP - International Commission on Radiological Protection
ICRU - International Commission on Radiation Units and Measurements
IEC - International Electrotechnical Commission
ILO - International Labour Organisation
IRPA - International Radiation Protection Association
ISO - International Organization for Standardization
ISOE - Information System on Occupational Exposure
OECD/NEA - Organisation for Economic cooperation and Development / Nuclear Energy Agency
PAHO - Pan American Health Organisation
UNSCEAR - United Nations Scientific Committee on the Effects of Atomic Radiation
WHO - World Health Organisation
WENRA - Western European Nuclear Regulators' Association

Figure: Interactions between international organisations with regard to radiation protection legislative framework

The figure shows the structure of the global organisation of radiation protection and interactions between organisations, bodies and networks which are relevant for the scientific and technical work of BfS in radiation protection, nuclear safety and waste management. The overview includes evaluation and validation of research results, discussion and elaboration of recommendations, development of common standards as a basis for legislative processes and their practical implementation. The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR, www.unscear.org) is collecting, validating and evaluating scientific data and research results provided by Member States worldwide. The Committee evaluates and reports latest scientific findings at its annual meetings. BfS is supporting UNSCEAR by providing scientific data and by chairing the Committee (58th and 59th session).

On the basis of UNSCEAR data, the International Commission on Radiological Protection (ICRP, www.icrp.org) elaborates recommendations on all aspects of radiological protection. Most of these address a particular area within radiological protection, while some publications, the so-called recommendations, describe the overall system of radiological protection. The International System of Radiological Protection has been developed by ICRP based on (i) the current scientific understanding of of radiation exposures and effects and (ii) value judgements (ICRP 103). These value judgements take into account societal expectations, ethics, and experience gained in the application of the system. Since many years BfS has been supporting ICRP activities by actively participating in ICRP Committees and chairing ICRP Task Groups.

The ICRP recommendations serve the International Atomic Energy Agency (IAEA, www.iaea.org) as a basis for establishing the International Basic Safety Standards which are supported by a number of UN organisations, such as the World Health Organisation (WHO, www.who.int). Also the European Commission's Euratom Basic Safety Standards, which are binding for EU Member States, are based on ICRP recommendations. Quite a number of other important organisations, such as the Nuclear Energy Agency (OECD/NEA, www.oecd-nea.org), HERCA (Heads of European Radiological Protection Competent Authorities, www.herca.org//) and European networks, such as the European ALARA Network (EAN, http://www.eu-alara.net/) are involved in the development and practical implementation of the standards for better radiation protection of workers, patients and the general public. BfS is actively involved in the professional work of all those committees, advisory bodies and networks steering and guiding these processes.

At BfS, tasks are completed with a high quality according to the current state of scientific and technical knowledge and on the basis of a federal authority radiation protection and safety culture. International cooperation and research activities contribute to this. An important aspect is the establishment of a participation culture in radiation protection, where people are participating in decision-making processes rather than acting as passive recipients. This is the basis for an open dialogue with stakeholders and the general public requiring broadening of the technical expertise in BfS beyond the classical areas, such as natural and engineering sciences and medicine. This also requires intensified cooperation with European radiation protection authorities, bodies and networks.

In implementing this strategy, it is a central concern of BfS to observe the current state of scientific and technical knowledge and to actively contribute to the further development. This is done by conceptual work and funding of relevant research topics within the framework of departmental research, by own research activities and by cooperation with national and international partners in European research projects and networks.

An important aspect of the BfS work is building and maintaining competence in all relevant areas of radiation protection, including cooperation with European and international organisations, bodies and networks.

In this report, the various European and international networking activities of BfS are described.

I Cooperation with international organisations, bodies and networks to develop integrative health protection and safety standards

I.1 UNSCEAR - United Nations Scientific Committee on the Effects of Atomic Radiation

The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR www.unscear.org) consists of scientists from 21 member states. As staff member of BfS and head of the German delegation to UNSCEAR, Dr. Weiss served as Rapporteur, Vice-Chair and Chair of the UNSCEAR Committee from 2006-2012. The Committee's mandate is to assess and report levels and effects of exposure to ionizing radiation. Governments and organizations throughout the world rely on these estimates as the scientific basis for evaluating radiation risk and for establishing protective measures. The radiation protection framework developed and established by ICRP is based on UNSCEAR data, An example of the BfS involvement in UNSCEAR work is the Global Survey of Medical Radiation Usage and Exposures, where data on medical exposures from all over the world were collected to estimate the annual frequency of diagnostic and therapeutic medical procedures and the doses associated with them, and to assess trends. The findings were published in the UNSCEAR report "*Sources and effects of ionizing radiation,* Annex A - Medical radiation exposures" in October 2010 (www.unscear.org/unscear/en/publications/2008_1.html).

A number of BfS staff members are involved in UNSCEAR work as members of the German UNSCEAR delegation and as members of specific working groups.

UNSCEAR Streamlining Data Collection

G. Frasch

Objectives

UNSCEAR has collected and analysed data on dose levels and trends for public, workers and patients over many years. In the past decade these world-wide data surveys suffered from decreasing response rates and lack of data quality. Within the framework of the European ESOREX project, the BfS executed four data surveys in the occupational sector in 30 European countries. Due to a different survey approach these data show substantially improved response rates and survey quality. In order to avoid the duplicity of data surveys and to harmonise the data structures, UNSCEAR launched a project for data streamlining, aimed at

1. participation in the European ESOREX surveys in order to avoid similar surveys from different institutions and

2. use of the data survey experience of ESOREX, for UNSCEAR's non-European surveys.

Results

Harmonisation and streamlining of data surveys in the occupational sector increase the credibility of international dose statistics. The occupational categories that are used in UNSCEAR, ESOREX and various other survey instruments have been compared in order to extract a best common denominator. The work is continued in the context of the ESOREX Platform Project (see below).

Impact to the work of BfS

International dose statistics on occupational exposure are of high value for benchmarking in optimisation management and scientific underpinning of radiation risk assessment.

The particular added value for the BfS is to avoid double work for the future, as there will be no more need to provide different dose statistics for different international surveys.

UNSCEAR's assessment of levels and effects of radiation exposure due to the nuclear accident after the 2011 great east-Japan earthquake and tsunami

F. Gering

Objectives

On 11 March 2011 the Fukushima-Daiichi nuclear power plant suffered major damage from the failure of equipment after the magnitude 9.0 great east-Japan earthquake and subsequent tsunami. It was the largest civil nuclear accident since the Chernobyl accident in 1986. Radioactive material was released from the damaged plant and tens of thousands of people were evacuated.

UNSCEAR is in the process of finalising a major study to assess the radiation doses and associated effects on health and environment. To date eighteen UN Member States have offered more than 80 experts to conduct the analytical work cost-free. When finalised, it will be the most comprehensive scientific analysis of the information available to date.

Results

An interim report to the General Assembly was issued in September 2012. The draft UNSCEAR Fukushima Report is scheduled to be discussed by the Scientific Committee at its 60th session (27-31 May 2013). When finalised, it will be presented to the General Assembly in October 2013.

Among others, the assessment is addressing the following questions:

- How much radioactive material was released and what was its composition?
- How was it dispersed over land and sea, and where are the hotspots?
- How does the accident compare with those at Chernobyl (1986), Three Mile Island (1979) and the Windscale Fire (1957)?
- What are the radiation effects on the environment and on foodstuffs?
- What is the likely radiation impact on human health and the environment?

Impact to the work of BfS

Many BfS staff members are involved in the scientific work covering nearly all topics mentioned above, often holding key positions within this UNSCEAR project.

I.2 ICRP / ICNIRP

The work of the **International Commission on Radiological Protection** (ICRP) helps prevent cancer and other diseases and effects associated with exposure to ionising radiation. ICRP also helps protect the environment.

ICRP is an independent, international organisation with more than two hundred volunteer members from circa thirty countries from all over the world. These members represent the leading scientists and policy makers in the field of radiological protection.

The International Commission on Radiological Protection issues recommendations to update, consolidate and further develop the system of radiation protection. These recommendations are elaborated in Task Groups, discussed within Committees and decided by the Main Commission.

ICRP has developed, maintained, and elaborated the **International System of Radiological Protection** used world-wide as the common basis for radiological protection standards, legislation, guidelines, programmes, and practice.

Since many years, BfS staff members have been actively involved in the work of ICRP Committees and Task Groups as members, corresponding members and by chairing ICRP Task Groups, e.g. the Task Group on Optimisation (2003), Task Group on Emergencies (2008) and Task Group on Geological Disposal of Long-Lived Solid Radioactive Waste (2011).

The **International Commission on Non-Ionizing Radiation Protection** (ICNIRP) is a publicly funded, non profit making body of independent scientific experts. It consists of a main **Commission** of 14 members and a supporting **Scientific Expert Group** (SEG). ICNIRP's principal aim is to disseminate information and advice on potential health hazards due to non-ionising radiation exposure. All frequency ranges are covered: static and time-varying electric and magnetic fields, radiofrequency (including microwave) radiation, and optical radiation (ultraviolet, visible and infrared - and lasers); in addition per definition, also infrasound, and ultrasound.

The scientific expertise of ICNIRP includes medicine, dermatology, ophthalmology, epidemiology, biology, photobiology, physiology, physics, biophysics, electrical engineering and dosimetry. Commission members do not represent their countries or institutes nor can they be employed by industry. Commission and SEG members are asked to declare any interests detrimental to ICNIRP's status as an independent advisory body; the *declarations of personal interest* are available on ICNIRP´s website. Chairman and Vice-Chairman are elected by the members of the main Commission. For the current term (2012-2016) BfS members are holding the position as Chairman and are in charge of the Secretariat hosted by BfS at Neuherberg/Munich.

Activities in ICRP Committees and Task Groups

ICRP Task Group on the Application of the Commission's Recommendations to Radon Exposure

T. Jung

Objectives

The objective of Task Group (TG) 81 is to prepare a report, to provide updated guidance on radiological protection against radon exposure. The report has been developed considering the recently consolidated ICRP general recommendations, the new scientific knowledge about the radon risk and the experience gained by many organisations and countries in the control of radon exposure.

Results

The report describes the characteristics of radon exposure, covering sources and transfer mechanisms, the nature of the risk, the exposure conditions, the similarities with other existing exposure situations and the challenges to manage radon exposure.

To control the main part of radon exposure TG 81 recommends an integrated approach focussing as far as possible, on the management of the building or location in which radon exposure occurs whatever the use of the building and the type of its occupants. This approach is based on the optimisation principle and a graded approach according to the degree of responsibilities at stake, notably in workplaces, and the level of ambition of the regulatory authorities. The report emphasises the importance of preventive actions.

The report also provides recommendations on how to control radon exposure in workplaces when workers' exposure can reasonably be regarded as being the responsibility of the operating management. In such a case workers' exposure may be considered as occupational and controlled using the corresponding requirements on the basis of the optimisation principle and the application, as appropriate, of the dose limit.

The report is close to its final stage and after approval by ICRP publication is planed for 2014.

ICRP Task Group on Cancer Risk from Alpha Emitters

B. Grosche

Objectives

ICRP Task Group 64 was appointed by ICRP Committee 1 (Radiation Effects), with representation of several members from Committee 2 (Doses from Radiation Exposure) and one member from Committee 4 (Application of the Commission’s Recommendations) to review risks from alpha emitting radionuclides. The Commission asked the Task Group to concentrate on radon initially. This report provides a review that summarises information on the epidemiology and dosimetry of radon and considers implication for protection. The author was next to Dr. Jay Lubin (NCI) one of the two corresponding members.

Results

The impact of the Task Group's work was basically on recommendations regarding radon in homes based on new developments in dosimetry and epidemiology. Based on these results, previous conversion factors from radon concentration to doses had to be revised, resulting in lower reference levels for radon in homes. The Task Group's work influences the respective recommendations of ICRP. The Task Group concluded that domestic radon exposures should be controlled directly on the basis of assessed concentrations and the associated risks. Optimisation of protection from radon exposures in homes can be informed using standard cost-benefit analysis techniques.

Impact to the work of BfS

On the pathway through IAEA BSS[1] and Euratom BSS the recommendation will have an impact on future national regulations regarding maximum levels of radon in dwellings and public buildings.

Standard cost-benefit analyses have been employed by BfS through respective funded research and through participating in the EU funded project RADPAR.

ICRP Task Group on Internal Dosimetry (INDOS)

A. Giussani, D. Noßke

INDOS develops biokinetic models as a basis for the assessment of doses by incorporated radionuclides. At present they are developing biokinetic models for workers which will be published in the series of ICRP documents on occupation intakes of radionuclides (OIR). The first OIR publication is scheduled for 2014. INDOS is also just beginning to develop age-dependent biokinetic models for members of the public (including infants, children, and adolescents). As a next task, they will revise former biokinetic models to assess the internal doses to embryo and foetus following intakes of radionuclides by the mother as well as those biokinetic models to assess doses to the infant from ingestion of mother's milk after intake of radionuclides by the mother.

BfS personnel are member, or corresponding member of INDOS.

ICRP Task Group on Dose Calculations (DOCAL)

D. Noßke

DOCAL develops dosimetric models for external and internal dosimetry and calculates dose coefficients for external and internal exposure. It publishes nuclear decay data, reference voxel phantoms for external and internal dose calculations, dose coefficients for external irradiation, and specific absorbed fractions (SAF values) which are used to calculate the doses to target tissues due to nuclear transformations in source regions of the body for internal dose calculations.

From BfS the author is a member of DOCAL. At present dose calculations of dose coefficients and bioassay data for the OIR reports are being calculated based on the biokinetic models developed by INDOS. BfS participates in these calculations with its own computer code DOSAGE and is part of the quality assurance procedures for these calculations within DOCAL.

The results and the knowledge acquired within INDOS and DOCAL are essential for the work of BfS, especially within the BfS Coordinating Office on Incorporation Monitoring.

ICRP Task Group on Doses to Patients from Radiopharmaceuticals

D. Noßke, A. Giussani

This Task Group develops methods for the calculation of dose coefficients for radiopharmaceuticals used in diagnostic nuclear medicine and publishes such dose coefficients which are considered as an international standard.

[1] Basic Safety Standards

As BfS staff members the authors are members, or corresponding members, of this Task Group. The results of this work are very important for BfS, especially for the dosimetric approval of applications for biomedical research involving humans according to § 23 of the German Radiation Protection Ordinance (StrlSchV). On the other hand, the experience from the § 23 StrlSchV work is a very important input to the work of this ICRP Task Group.

ICNIRP - International Commission on Non-Ionizing Radiation Protection

G. Ziegelberger

Much of the information provided by ICNIRP (www.icnirp.org) is published in the form of scientific reviews, statements and proceedings of scientific meetings. The most important publications, the **Exposure Guidelines**, are based on the comprehensive reviews combined with risk assessments carried out in collaboration with the World Health Organization, WHO.

ICNIRP´s Exposure Guidelines are based on the totality of the science. ICNIRP constantly monitors the scientific literature and is ready to update its recommendations in case of new relevant data. Since 2009 draft guidelines have undergone an **open consultation process** prior to publication. Drafts are available during a period of 90 days for review by anyone interested in the subject matter. This includes individual experts as well as international organisations engaged in radiation protection such as WHO, IRPA, ICRP, IEEE, CIE, IEC and others. ICNIRP´s Exposure Guidelines are well-recognised all over the world and are partially or completely adopted by about 50 countries as legally binding exposure limits.

In case of open questions, scientific uncertainties and a need for external expertise and input, ICNIRP organises international workshops. In the past BfS was a frequent co-organiser as these workshops proved to be of mutual benefit. Some examples are given:

International Workshop on UV exposure guidance: A balanced approach between health risks and health benefits, organised by ICNIRP, WHO and EURO*SKIN*, hosted by the BfS, Munich, October 2005

UV-exposure is well recognised as the main cause of skin cancer, but small amounts of sun exposure are essential to good health. Vitamin D, which is produced in the skin by exposure to UV-B, regulates calcium levels in the blood and is needed for bone and musculosceletal health. In addition, some epidemiological studies suggested that sun exposure might reduce the risk of certain cancers or increase the survival rates. The workshop brought together experts in the field of radioprotection and Vitamin D and took aim at a scientifically based recommendation on sun exposure which counterbalances health risks and benefits (UV exposure guidance: a balanced approach between health risks and health benefits of UV and Vitamin D. Proceedings of an International Workshop. Progress in Biophysics and Molecular Biology, Vol 92(1); September 2006).

International Workshop on risk factors for childhood leukaemia, organised by ICNIRP, WHO and BfS, Berlin, May 2008

The causes of most leukaemias are still unknown, but both genetic and environmental factors have been implicated in the aetiology of the disease. Ionising radiation is regarded as an established environmental risk factor, but the increased incidence of childhood leukaemia near nuclear facilities is puzzling experts because the exposures in relation to the case numbers are too low to be considered causal. Similarly, a consistent pattern of a two-fold increase in childhood leukaemia is observed in epidemiological studies associated with average exposure to residential low-frequency magnetic fields above 0.3-0.4 µT. The apparent inconsistencies between empirical findings and the lack of supportive experimental data were considered at the workshop in the light of other possible risk factors. The workshop brought together experts from different disciplines and backgrounds in order to summarize the current knowledge on the complex origin of childhood leukaemia (Risk Factors For Childhood Leukemia. Proceedings of an International Workshop of ICNIRP/WHO/BfS. Radiation Protection Dosimetry 132(2); December 2008).

International Conference on Non-Ionizing Radiation and Children's Health, jointly organised by COST Action BM0704, ICNIRP, BfS, WHO and EURO*SKIN*, Ljubljana, Slovenia, May 2011

At this workshop NIR comprised electric and magnetic fields and optical radiation. Many research studies addressed possible effects of NIR on human health, but the evidence for such effects remains uncertain, particularly with regard to the health of children. A multidisciplinary approach bringing together expertise in the fields of medicine, epidemiology, biology, electrical and telecommunications engineering, computational physics

and risk management was adopted. The reviews, research papers and discussions at this workshop did not reveal new health-related age-specific sensitivities of children, however, some uncertainties are methodologically difficult to address, and remain unsolved particularly for childhood leukemia. While the scientific evidence for adverse effects of exposure to UV radiation is much clearer and it is accepted that excessive and/or prolonged/repeated exposure is a significant risk factor in causing skin cancers and eye diseases, research is needed to further clarify mechanisms of disease that would provide a better basis for methods of protection, particularly with regard to young people (Proceedings published in Progress in Biophysics & Molecular Biology (107)3:311-482; 2011).

The UV Index and its role in risk communication – How to strengthen sun protection measures? ICNIRP/WHO/BfS Workshop, Munich, December 2011

The adequacy of the UV Index (UVI), a simple measure of ambient solar ultraviolet (UV) radiation, has been questioned on the basis of recent discussions on the importance of vitamin D for human health, the mutagenic capacity of radiation in the UVA wavelength, and limitations in the behavioural impact of the UVI as a public awareness tool. A UV Index greater than 3 was confirmed as indicating ambient UV levels at which harmful sun exposure and sunburns could occur and hence as the threshold for promoting preventive messages. There is currently insufficient evidence about the quantitative relationship of sun exposure, vitamin D and human health to include vitamin D considerations in sun protection recommendations. The role of UVA in sunlight-induced dermal immunosuppression and DNA damage was acknowledged, but the contribution of UVA to skin carcinogenesis could not be quantified precisely.

Though it has been shown that the UV Index can raise awareness of the risk of UV radiation to some extent, the UVI does not appear to change attitudes to sun protection or behaviour in the way it is presently used. Changes in the UVI itself were not warranted based on these findings, but rather research testing health behaviour models, including the roles of self-efficacy and self-affirmation in relation to intention to use sun protection among different susceptible groups, should be carried out to develop more successful strategies towards improving sun protection behaviour (Validity and Use of the UV Index: Report from the UVI Working Group. Health Phys 103(3):301-306; 2012).

Non-Ionizing Radiation Protection in Medicine, ICNIRP/WHO Workshop, hosted by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) in Bonn, Germany, December 2012.

The workshop on “NIR in Medicine” covered medical as well as cosmetic applications from all frequency ranges of the non-ionising electromagnetic spectrum as well as ultrasound. The benefit from NIR use in medicine, such as MRI for diagnostic and interventional imaging, was well recognised, especially in view of the alternative use of ionising radiation. However, while a key aspect of ionising radiation protection is optimisation through dose reduction, the development of NIR technologies still focuses on image quality improvements without consideration of the ever increasing exposure levels for both health care workers and patients. Also the increasing use of NIR applications such as ultrasound and intense pulsed light (IPL) by lay persons in the cosmetic and wellness business call for a closer look at health and safety aspects.

The workshop reviewed the current status of radiation protection as well as trends in development, identified gaps in knowledge of possible health effects and addressed patient as well as medical staff safety (Medical Physics, in press).

I.3 WHO Collaborating Centre for Ionising and Non-Ionising Radiation

The WHO Radiation and Environmental Health Programme evaluates health risks and public health issues related to environmental and occupational radiation exposure. The aim is to look for solutions to protect human health from ionising radiation hazards by raising awareness of the potential health risks associated with ionising radiation, and the importance of its safe and rational management.

source: BfS

WHO is promoting research and providing recommendations for emergency medical and public health re-

sponses to radiation accidents and terrorist acts, and is providing advice to national authorities to deal with radiation exposure issues effectively.

WHO Collaborating Centre for Ionizing and Non-Ionizing Radiation

B. Grosche

Since its foundation in 1989, the Federal Office for Radiation Protection jas been a formally recognised World Health Organization Collaborating Center (WHO OCC); for the first years only for radiation applications in medicine, since 1997 also for non-ionising radiation, and now the whole area of ionising and non-ionising radiation.

In this capacity, BfS is giving active support to WHO's work. BfS and WHO collaborate in five areas:

- radiation risks in the low-dose range
- biological dosimetry network
- non-ionising radiation
- radon risk communication
- medical radiation exposure.

Here, we report on the following topics:

- Radon Handbook
- BioDoseNet
- WHO-Fukushima International Health Risk Assessment Group
- Global Initiative on Radiation Safety in Health Care Settings
- INTERSUN programme
- International EMF Project

WHO Indoor Radon Handbook

M. Kreuzer

Objectives

In 2005, WHO established the International Radon Project to identify effective strategies for reducing the health impact of radon and to raise public and political awareness about the consequences of long-term exposure to radon. Participants and contributors from more than 30 countries worked together towards a global understanding of a wide range of issues associated with indoor radon. Several members of the BfS contributed to this group. The BfS organised a two-day project meeting at Munich in 2007 including more than 80 participants.

Results

A key product of the WHO International Radon Project was the WHO Handbook on indoor radon, which was published in September 2009, in parallel with a German press conference organised by the BfS and BMU. The handbook focuses on residential radon exposure, emphasising its impact from a public health point of view. It includes detailed recommendations on radon health risk reduction, sound policy options for prevention and mitigation of radon, methods of cost-effectiveness and strategies for risk communication. The BfS contributed in writing to the handbook and was member of the small editorial group.

WHO recommended a reference level of 100 Bq/m^3 to minimise the health hazards due to indoor radon exposure. This value had been adopted from the recommendations of the BfS. The ICRP (International Commission on Radiation Protection) largely confirmed the major results of the WHO handbook.

Impact to the work of BfS

The BfS has longlasting experience in radon epidemiology (involved in several publications on the risk of lung cancer due to indoor radon), in radon measurement and mitigation, in cost-effectiveness methods and risk communication.

Based on the recommendations of the WHO handbook the BfS developed an action plan for radon and several leaflets on health effects, measurement, etc. for the public. It initiated several UFOPLAN-projects on

- estimation of cost-effectiveness for various strategies of reducing radon in Germany,
- radon mapping in Germany,
- estimation of the radon concentrations in homes based on geological and constructional informations

and

- estimation of attributable fraction of radon-related lung cancer deaths in Germany.

It is involved in the ICPR task group on radon and in the expert group on Basic Safety Standards.

Further, BfS will be involved in a WHO follow-up project of the WHO which will be dedicated to develop radon information for building professionals. This project is likely to start in 2013.

BioDoseNet - Biological dosimetry network

H. Romm

Objectives

In December 2007, the biological dosimetry unit of BfS was invited by the Radiation and Environmental Health Section of the WHO, to join a meeting of experts at the WHO. The purpose of the meeting was to prepare the establishment of a global network of biological dosimetry service labs that would become active after a possible major radiation accident. Next to BfS, experts from cytogenetic laboratories in Canada, France, Germany, Japan, Ukraine, United Kingdom and USA were invited. All of them have experience in the field of biological dosimetry. The results of the meeting were published (Blakely et al. Radiation Research, 2009, 171, 127-139).

The WHO's global biodosimetry network was established in 2008 in the USA and was called BioDoseNet. The BfS is a member of BioDoseNet, represented by the author. He is a member of the Steering Committee and engaged in working groups for web-based scoring of dicentrics and the automation of chromosome analysis.

The cytogenetic laboratory of BfS is appreciated as reference laboratory by the WHO, as it has long-term biodosimetry experience, practical knowledge in international inter-comparisons, in particular in the establishment of the European network.

The participation in an international biodosimetry network is of great importance in order to be prepared for a major radiation accident, because one single lab would be quickly at its limits in such an event. Thus, mutual assistance of other service laboratories is crucial.

Results

Since 2010, the Biological Dosimetry unit of BfS has been an official partner of the WHO Collaborating Centers and has participated with practical contributions and training staff from other labs to expand the capacity of the network.

BfS has contributed as a consortium partner of the EU project “Towards a European Network of Excellence (NoE) in Biological Dosimetry (TENEB)” with a survey about the capacity and equipment of European Biodosimetry Units. This survey demonstrated the feasibility of the establishment of a European Biodosimetry network; and it showed the interest of the emergency preparedness and radiation protection authorities in such a network (Wojcik et al., Radiation Protection Dosimetry, 2009, 138: 397-401). In order to determine the existing capacity of its members, an in-depth survey was conducted with the TENEB poject. A survey similar to this was also conducted within WHO’s BioDoseNet (Maznyk et al, Radiation Protection Dosimetry, 2012, 151: 611-20)

Based on the TENEB results, the European Commission launched the call for the RENEB project (Realising the European Network of Excellence in Biological Dosimetry) of which BfS is the co-ordinator.

In 2009, BfS was co-author of the technical report issued by the IAEA in 2011: "EPR 2011: Cytogenetic Dosimetry: Applications in Preparedness for and Response to Radiation Emergencies"

In 2010, BfS participated at the “joint shipment exercise” of WHO, IAEA and PAHO, which will contribute to the improvement of the shipment capacity for international assistance missions, sending biological samples in time and in a proper condition (M. Di Giorgio et al. Radiation Research, 2011, 175: 638–649).

BfS contributed together with other Biodosimetry Units (USA, Canada) at the „International Conference on Cytogenetic Biodosimetry and Network“ 2010 at the University of Hirosaki, Japan to support and strengthen the capacity of the Asian Network.

BfS was involved in global exercises of web-based scoring of dicentric chromosomes (Livingston et al., Radiation Measurements, 2011, 46: 912-15).

The WHO network benefits directly from the progress of the EU projects MULTIBIODOSE and RENEB, as well as from the progress on standardisation and harmonisation of biodosimetry methods in the ISO working group.

In 2011 and 2012, the BfS organised an international training course on radiation protection, including one week practical training in methods of biological dosimetry.

Further information about the BiodoseNet is given at the website http://www.biodosenet.org and in the recent publications (Christie et al, Health Physics, 2012, 98: 168-171).

Impact to the work of BfS

In February 1982 the forerunner of the BfS was assigned by decision of the Federal Committee of Nuclear Energy - Radiation to conduct biological dosimetry for the Federal Republic of Germany. Thus, biological dosimetry is since a constant task of BfS. The results of the collaboration with WHO complements this task and assists in getting prepared for a major radiation accident.

WHO-Fukushima International Health Risk Assessment Group

L. Walsh

Objectives

The Japanese Fukushima Daiichi nuclear power station was severely damaged by the natural disaster on 11th March 2011 causing releases of radioactive material into the environment. The World Health Organisation (WHO), with the help of independent international experts, undertook a preliminary health risks assessment for members of the public and power plant workers, based on doses assessed up to the end of September 2011.

The BfS, as a WHO-Collaborating Centre for Radiation Protection and Health, contributed a staff member to the international expert group. The author took part in both the first and second meetings of the expert group at the WHO head-quarters (HQ) in Geneva in December 2011 and March 2012 and also in the smaller editorial board meeting at WHO-HQ in September 2012. In addition to contributing to the writing of the report, the author made substantial contributions to the selection of risk assessment methodology and performed actual risk calculations of the radiation related risks (for incidence of all solid cancer, leukaemia, thyroid cancer and female breast cancer) for affected members of the public and power plant workers.

Results

The result of this work was a report (WHO- Preliminary Health Risk Assessment from the Nuclear Accident after the 2011 Great East Japan Earthquake and Tsunami. Geneva:; 2013, available as an online pdf at the WHO web-site) that was published on 28 February 2013 immediately after a WHO-press release. The main results and conclusions of the WHO report have been widely reported in the press since then and the preparation of scientific papers based on the report is currently underway.

Impact to the work of BfS

The results of the WHO-report will flow into the BfS official duties, by increasing the specialist knowledge of BfS staff and the resulting ability of staff members to undertake a disemination of information (both internal and external to BfS) on the radiation related health risks for members of the public and power plant workers

affected by releases from the Fukushima Daiichi nuclear power station during and after the disaster on 11th March 2011.

RSHCS - Global Initiative on Radiation Safety in Health Care Settings

J. Griebel

Objectives:

WHO's vision is the safer and more effective use of radiation in healthcare through good practice promotion and prevention of unnecessary radiation exposures. To achieve this vision, WHO established the WHO Global Initiative (GI) on Radiation Safety in Healthcare Settings (RSHCS). This initiative aspires to bring together health authorities, international organisations, UN agencies, specialised institutions, professional bodies, scientific societies, academic institutions, NGOs and individual experts in a concerted action to improve implementation of radiation safety standards in medical settings. The initiative further seeks to complement the activities developed under the International Action Plan for Radiation Protection of Patients and the International Action on Plan on Occupational Radiation Protection established by the IAEA.

Results:

Since 2008, BfS has contributed to several technical meetings concerning both the conceptual framework of the initiative itself as well as important topics identified by the initiative. In these meetings, the BfS representative served as an expert in the area of medical radiation protection, provided invited presentations and served as a chairman.

A major topic addressed under the global initiative is the principle of justification of medical exposures. In a special topic meeting, practical tools were discussed to properly implement this important principle in medical radiation protection and to raise awareness throughout the medical community. It was concluded that referral guidelines and appropriateness criteria are important tools for applying the principle of justification, intended to guide radiologists and referring physicians in making initial decisions. They exist and are used in some countries for preventing unnecessary radiation exposures and optimising costs to the health care system. However, they are not available in other countries. Promoting evidence-based medicine, the global initiative decided to provide a platform for harmonising referral criteria and making them available for other member states. It was further agreed that clinical audit of radiological practices is critical for promoting of good medical practice (GMP). However, there is a need for guidance on how to implement clinical audits combining assessment of clinical efficiency with radiation safety aspects.

To provide the conceptual framework for this meeting, a thorough discussion of the principle justification was provided by the BfS representative, focussing on the role and responsibility of referrer and radiological practitioner and hereby addressing various scenarios such as the application of X-rays in healthcare and in officially approved screening programmes. Last, but not least, the problems with opportunistic screening as well as self-referral and self-presentation were considered.

In two further technical meetings, risk communication was addressed with special focus on paediatric imaging. Justification of radiological medical procedures is particularly critical in paediatric health care. Support to health professionals, patients, and families to make informed decisions includes tools for radiation risk communication. Unfortunately, health professionals often have only a low awareness of radiation doses in radiological medical procedures as well as of the nature and magnitude of the related radiation risks.

Although the communication between child, parents and medical doctor is pivotal in paediatric imaging, it was well agreed that risk communication involves other groups of persons, too. So, the communication between referrer and radiological practitioner is also essential.

Impact to the work of BfS

For BfS/BMU, the global initiative offers the great potential to identify – at a very early stage - important developments in the area of medical radiation protection on a worldwide scale and to take part in the respective process of formation of opinion in this area.

Perception and understanding of these developments have a strong impact to both the conceptual and the practical work of BfS in medical radiation protection. In particular, it sensitises for upcoming problems and provides a framework to react adequately. A most recent example is the initiative of BfS concerning individual health assessment (e.g. whole body CT screening, CT screening of lung and colon).

INTERSUN programme

R. Matthes, G. Ziegelberger

Objective

The scope of the project is to reduce the global burden of disease resulting from exposure to ultraviolet radiation (UV). It was set up as a consequence from the outcome of the United Nations Conference on Environment and Development (UNCED) in 1992. Under Agenda 21 it was declared that there should be activities on the effects of UV radiation. The programme is aimed at providing information, practical advice and sound scientific predictions on the health impact and environmental effects of UV-exposure encouraging countries to take action to reduce UV-induced health risks, and providing guidance on effective sun awareness programmes. These goals fit perfectly the long-term goals of the Federal Office for Radiation Protection (BfS).

The main concern at that time was the predicted increase in ultraviolet radiation reaching the earth's surface as a consequence of the man-made depletion of the stratospheric ozone layer. In cooperation with the Federal Environment Agency and Germany's National Meteorological Service the BfS started the operation of a network of solar radiation monitors based on four stations in 1993. Since then, the network has been extended to a nationwide network of solar radiation monitoring stations with other associated institutions.

Results

In cooperation with the INTERSUN Programme and several national and international organisations, a UV-Index was developed in 1995. Intended as a worldwide harmonised measure of solar UV levels at the earth´s surface, it also serves as an essential vehicle to raise public awareness. Until today the UV-Index was continuously refined, especially concerning its communication aspect (HEALTH PHYS 103(3):301-306; 2012).

In recent years discussion has focused on the balance between avoiding skin cancer and maintaining optimal vitamin D status. This topic was addressed at a workshop organised by BfS in cooperation with WHO and other partners held in 2005 ("Progress in Biophysics and Molecular Biology", 92(1); July 2006 - ISSN 0079-6107) and also in 2011 (HEALTH PHYS 103(3):301-306; 2012).

Another important activity of the programme is to review the data on the effects of UV-exposure on biological systems pertinent to the evaluation of human health risks. These reviews are published as Environmental Health Criteria documents. Their purpose is to give an overview of the known biological effects of UV, identify gaps in knowledge, and provide direction for further research. The most recent publication (1994) will need to be updated in the coming years.

Impact to the work of BfS

Results from this work give input to the BfS' risk communication strategy and activities for skin cancer prevention.

International EMF Project

R. Matthes, G. Ziegelberger

Objective

In order to protect public health and in response to public concern, the World Health Organization (WHO) established the International EMF Project in 1996 to assess the scientific evidence of possible health effects of electromagnetic fields (EMF) in the frequency range from 0 to 300 GHz. This project was mainly driven by the world wide public debate about possible health risks associated with the increasing use of wireless technologies, especially cellular mobile telephony. Since then, BfS has cooperated with WHO in this project and is a member of the advisory committee that oversees the project.

The key objectives of the project cover quite broadly the NIR responsibilities of BfS. They include:

- the provision of a response to concerns about possible health effects of exposure to EMF,
- assessment of the scientific literature,
- research recommendations to reduce gaps in knowledge,
- assessment of the health risk,

- development of acceptable regulations for EMF exposure.

Results

Since the start of the programme, BfS has organised, jointly with WHO and other international organisations, science review meetings on different aspects of EMF exposure, including its impact on the environment. Beside the assistance in drafting fact sheets and information brochures for the project, the most important aspect for BfS was the evaluation of the scientific evidence, the health risk assessment and the recommendation of research agendas to reduce uncertainties in this respect.

The published research agendas from WHO have widely been integrated in the German Mobile Telecommunication research programme. In turn, the results served as the national contribution to the currently ongoing health risk assessment for radiofrequency fields. Although mainly triggered by RF problems, the project also dealt with static and extremely low frequency (ELF) fields. The respective health risk assessments have already been reviewed by now and the Environmental Health Criteria Documents are already published (EHC 232 for static fields and EHC 238 for extremely low frequency fields). Together with other major national and international reviews they are used by the International Commission on Non-Ionizing Radiation Protection to develop recommendations for limiting exposure in order to protect people from established health hazards. The BfS cooperates with both international bodies and incorporates their advice into its national protection concept.

A further important part of the WHO cooperation is related to risk communication. Beside the above mentioned brochures and leaflets, BfS incorporated risk communication projects in the national telecommunication research programme. In addition school material with respect to mobile telephony for the education of young children was developed and provided to the International EMF Project for international consideration. The next step of the WHO project is the review of the literature on RF health effects and its publication as Environmental Health Criteria Document.

Impact on the work of BfS

The published research agendas from WHO have widely been integrated in the German Mobile Telecommunication research programme. Results were incorporated in BfS' risk communication strategies.

I.4 IAEA - International Atomic Energy Agency

The structure of the International Atomic Energy Agency (IAEA)

The International Atomic Energy Agency IAEA is an international organisation within the system of the United Nations. The IAEA reports to both the UN General Assembly and Security Council. The five departments of the IAEA are:

- Nuclear Applications
- Nuclear Energy
- Safety & Security
- Safeguards
- Technical Cooperation

The BfS is linked mainly to the department for „Safety & Security", which „works to provide a strong, sustainable and visible global nuclear safety and security framework, protecting people and the environment from the harmful effects of ionizing radiation" (www.iaea.org).

Department Safety and security

One part of the activities of the International Atomic Energy Agency (IAEA) is to develop Safety Standards which present international good practices, and increasingly, reflect best practices, to help users striving to achieve high levels of safety. They reflect an international consensus on what constitutes a high level of safety to protect people and the environment from harmful effects of ionising radiation. These standards are developed by an open and transparent process. To insure the high quality of the safety standards, they pass a rigorous, multi-stage development and revision process through the competent Safety Standards Committee. This process started at the level of the Nuclear/Radiation/Transport/Waste Safety Standards Committee (NUSSC/RASSC/TRANSSC/WASSC) depending on the topic of the respective standard.

NUSSC - Nuclear Safety Standards Committee

E. Westermeier

Objective and scope

The Nuclear Safety Standards Committee (NUSSC) is a sub-committee of the Commission on Safety Standards (CSS) at the IAEA and advises the Deputy Director General on the nuclear installation programme for the development, review and revision of standards related to nuclear safety and the programme for their application. NUSSC was established in 1996 as a successor of a comparable committee called NUSS.

NUSSC meets twice a year for four or five days. To date, 47 countries, i.e. the EU and six international organisations are members of NUSSC. For almost thirty years (with three years interruption) the BfS has taken part in the consultations of NUSS and NUSSC.

Implications and objectives of the BfS participation

In order to achieve a high level of safety it is important to cooperate in the development of the safety standards. Therefore, BfS supports the development of new IAEA Safety Standards and its revisions in participating in Consultancy and Technical Meetings. The final drafts are then discussed in NUSSC which takes care of a high quality and the consideration of the international state of the art in science and technology. BfS participates at the meeting and supports the nominated German member of NUSSC (BMU). In addition, the IAEA Safety Standards are used as a reference to analyse if there are any gaps in the German regulations. Thus, the results from the NUSSC committee are integrated in the work of BfS.

IAEA Safety Guide on Regulatory Body Functions and Processes

E. Westermeier

Objectives and scope

Currently the BfS is involved in developing a new Safety Guide DS473 "Regulatory Body Functions and Processes". This guide should merge the following existing Safety Guides:

- GS-G-1.2 "Review and assessment of nuclear facilities by the regulatory body",
- GS-G-1.3 "Regulatory inspection of nuclear facilities and enforcement by the regulatory body",
- GS-G-1.4 "Documentation for use in regulating nuclear facilities",
- GS-G-1.5 (Parts of) "Regulatory control of radiation sources",
- SSG-12 (Parts of) "Licensing Process for Nuclear Installations",
- WS-G-5.1 (The regulatory component of) "Release of sites from regulatory control upon termination of practices",

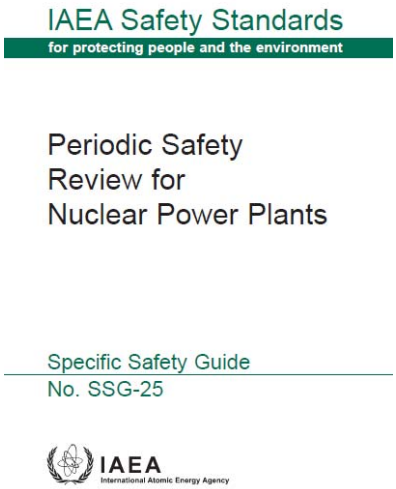
This new Safety Guide will be a coherent and consistent document in line with the intention behind the Long Term Structure of the IAEA Safety Standards.

Implications and objectives of the BfS participation

BfS provides its experiences to elaborate a useful guide. This Safety Guide will be an important document also for the German supervisory handbook.

IAEA Safety Guide on Periodic Safety Review of Nuclear Power Plants

H.P. Berg



Objectives and scope

BfS was involved when the first Safety Guide on Periodic Safety Review (PSR) of Nuclear Power Plants (NPPs) issued 1994 (50-SG-O12) was elaborated and revised in 2003 (NS-G-2.10). IAEA Member States' experience in the implementation of Periodic Safety Reviews were collected in a TECDOC issued 2010. In parallel a further revision of the Safety Guide has been started with the aim to provide additional recommendations on:

- Follow-up PSRs (i.e. 2nd, 3rd, etc.),
- Use of PSR as a tool or the results as an input in assessing long-term operation,
- Modified safety factor to address management systems and safety culture,
- More detailed description on global assessment.

This process was supported by many Consultancy Meetings with experts from 5 countries including Germany represented by BfS and two Technical Meetings both headed by BfS as the General Chair.

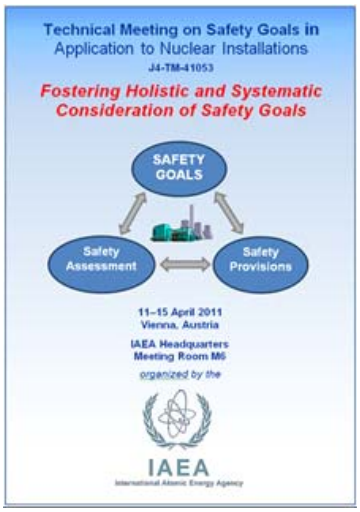
Currently, almost all IAEA Member States with nuclear power plants are performing Periodic Safety Reviews, many of them use the safety factor approach recommended in the Safety Guide.

Implications and objectives of the BfS participation

BfS provided their experience because Germany was elaborating or updating regulations for Periodic Safety Reviews (PSRs), too, although using another approach which is explained in the TECDOC-1643. PSRs have been initiated as a complementary tool to assess the cumulative effects of plant ageing and plant modifications, operating experience and technical enhancements. Although alternative approaches are possible the main benefit of PSR is to gain a full overview of all aspects regarding the safety status of the plant under consideration at a given time (snapshot). The PSR is now established internationally as a key regulatory instrument for maintaining nuclear safety of the NPP until the next PSR. The current version of the Safety Guide was issued in March 2013 as SSG-25.

IAEA TECDOC on Development and Application of a Safety Goals Framework for Nuclear Installations

H.P. Berg



Objectives and scope

The growing importance of establishing a technically consistent holistic framework for qualitative and quantitative safety goals for nuclear power plants (NPPs) and other nuclear installations on the basis of synergetic considerations of quantitative risk metrics and qualitative concepts of ensuring nuclear safety has been widely recognised in recent years.

Safety goals can be expressed in several ways and may relate to individual facilities and activities or to whole sites: they can range from a high level principle (e.g. dose exposure based on a fraction of the chance of cancer incidence) through to extremely detailed requirements (e.g. the maximum fuel clad temperature), with intervening layers of goals (e.g. levels of radioactive release into the environment). The aspect of coherency and consistency of the set of safety goals is particularly noticeable when safety goals for different types of nuclear technology are considered. It is difficult to en-

sure a consistent level of safety. This is not achieved until there is clarity of how the detailed technical safety goals can be related and explicitly derived from higher level technology neutral goals.

Having defined a set of safety goals, it is necessary to understand:

- how the safety goals are related,
- how the more technical safety goals reflect the higher levels,
- how the safety goals reflect the operational state of the facility and its lifecycle stage, and
- how the more technical level safety goals demonstrate that the higher levels are actually met.

These aspects will be provided in detail in the TECDOC. A further Consultancy Meeting in December 2013 has the aim to provide a final draft of the TECDOC including national examples.

Implications and objectives of the BfS participation

BfS has participated in almost all Consultancy Meetings since 2010 and both Technical Meetings in 2011 and 2013 in order to develop a common understanding of the development and application of a safety goals framework and to analyse whether this approach also fits in the German regulatory framework. For that purpose, BfS has elaborated a draft for the application of this framework to the German situation.

IAEA TECDOC on Guidance on Performing Integrated Risk Informed Decision Making Process

H.P. Berg

Objectives and scope

The Integrated Risk Informed Decision Making (IRIDM) process is a systematic way of taking account of all the relevant factors in making integrated decisions on a wide range of safety and/or security issues that could arise for any type of nuclear facility, where risk considerations are taken into account. This process will be described in a new TECDOC, also providing examples of applying this process.

In applying the IRIDM process, all the relevant factors have to be identified and assessed to provide an input into the decision making process. These factors typically include mandatory requirements (such as legal requirements and regulation), the insights from the deterministic analysis (such as defence in depth and safety margins), the insights from the risk assessment (usually obtained from a PSA for a nuclear facility) and other considerations that are relevant to the issue being addressed (such as radiation doses to workers and members of the public, operational and management procedures and cost-benefit analysis). The inputs to the decision making process include the results of and information from qualitative and quantitative analyses. The IRIDM process takes account of the relative importance of all the factors identified in making the decision.

The IRIDM process is particularly applicable to situations where there are a number of options available to address a safety issue and there are a number of disparate factors (i.e. it is a multi-attribute problem) that need to be considered in order to select the optimum, balanced solution. It is particularly powerful when there is no obvious optimum answer and there are a number of potential options, each of which does not provide a complete solution to a problem.

Implications and objectives of the BfS participation

BfS has participated in almost all Consultancy Meetings since 2010 and the Technical Meeting in 2012 in order to develop a common understanding on the IRIDM process and its practical application. The topic has become of increasing importance in Germany because the "Safety Requirements for Nuclear Power Plants of November 22, 2012" require deterministic and probabilistic assessments in case of safety significant modifications or in the case of analysing findings from safety relevant events or phenomena that have occurred and can be applied to nuclear power plants in Germany.

CNS - Convention on Nuclear Safety

C. Kopisch

Objective and scope

The International Convention on Nuclear Safety (CNS) aims at increasing the safety of civil nuclear power plants worldwide. The Convention came into force on 24 October 1996. Germany has been Contracting Party since 20 April 1997. The Convention obliges the Contracting Parties i.a. to submit a National Report on the implementation of the Convention every three years and to participate in a Review Meeting.

The National Report describes how the obligations of the Convention are implemented through the national laws and regulations and the measures taken in nuclear facilities. Prior to the Review Meeting, the National Reports are made available to all Contracting Parties. Each Contracting Party can submit questions and comments relating to the National Reports of all other states. Each state should answer the questions directed to it in writing and submit the answers prior to the Review Meeting.

During the Review Meeting the presentations of the Contracting Parties, the questions posted both in writing before and orally at the group discussion provide the option to critically review the respective national practice for implementing the Convention in terms of nuclear safety and – where necessary – to propose improvements. These discussions take place in individual Country Groups and are confidential. The rapporteur summarises the results of the Country Groups' sessions in a report which is then presented to all attending Contracting Parties in the plenary session. In addition, the Contracting Parties regularly review the codes of practice of the CNS and decide on measures to improve the transparency, formulation and effectiveness of the review process.

Implications and objectives of the BfS participation

BfS has participated in this activity from the beginning und acts as the national CNS contact point for all CNS' activities. BfS supports the BMU in collecting data as well as in writing and editing these data for the National Report of Germany. In addition, the BfS supports the BMU in answering questions to the German National Reports and in preparing questions to the National Reports to other Contracting Parties. Moreover, BfS participates at the Review Meetings. Since 1999, BfS has been making substantial contributions to formulating the rules of procedure of the Convention. Furthermore, BfS took over organisational tasks in the meetings (e.g. rapporteur of the Country Groups' sessions) and was actively involved in improving the CNS process.

PRIS – Power Reactor Information System of the IAEA

C. Link

Objective and scope

The Power Reactor Information System (PRIS) is a comprehensive database focusing on nuclear power plants worldwide. It contains information on power reactors in operation, under construction or those being decommissioned. PRIS contains two kinds of data: general and design information, i.e. reactor specification data (e.g. status, location, operator, owner, suppliers, milestone dates) as well as data on operating experience, i.e. performance data including energy production and energy loss data, outage and operational event information.

PRIS has been developed and maintained by the IAEA.

Data collection started in 1970 and was computerised in 1980. In 2009, the web-based PRIS-STATISTICS reporting system was developed, making PRIS reports globally available online. PRIS is available to both the general public via a public website (http://www.iaea.org/pris) and registered users via PRISWEB (http://prisweb.iaea.org). The PRISWEB for registered users comprises the Web-Enabled Data Acquisition System (WEDAS) used by PRIS data providers for inputting data on their nuclear power reactors to the database. In addition the PRISWEB for registered users comprises PRIS Statistics (PRISTA), i.e. a web-based reporting tool used by registered users to produce reports and statistics from PRIS.

Using PRIS data, IAEA produces two official Agency publications each year:

- "Nuclear Power Reactors in the World" (published since 1981 as RDS-2, one of the IAEA's most popular annual publications)

- “Operating Experience with Nuclear Power Stations in Member States” (OPEX)

Implications and objectives of the BfS participation

As a Member State of the IAEA, Germany is obliged to submit the data necessary for the PRIS database. BfS has been appointed as Liaison Officer for PRIS since 10 years having comprehensive access rights to the data base. The Liaison Officer is responsible to coordinate and supervise the data submission to the data base. In case of requests to the IAEA regarding the PRIS, the Liaison Officer is the contact point for Germany. Especially requests to become a registered user of PRIS are processed via the Liaison Officer. Every two years a Technical Meeting (TM) with experts from Member States is arranged by IAEA where the current status and latest developments in PRIS are discussed and feedback and recommendations for future developments of the data base are provided. The Liaison Officer regularly participates at the TM, gives feedback to the IAEA and follows up the continuously updating and improving of PRIS.

CNPP – Country Nuclear Power Profile of the IAEA

C. Link

Objective and scope

The Country Nuclear Power Profile (CNPP) compiles background information on the status and development of nuclear power programmes in IAEA Member States. The main objectives are to consolidate information about the nuclear power infrastructures in participating countries, and to present factors related to the effective planning, decision making and implementation of nuclear power programmes that together lead to safe and economical operations of nuclear power plants.

The CNPP reports provide a descriptive and statistical overview of the overall economic, energy, and electricity situation in each country. Organisational and industrial aspects of nuclear power programmes are summarised. In addition, the CNPP reports provide information about the relevant legislative, regulatory, and international framework. Topics such as reactor safety, nuclear fuel cycle, radioactive waste management and research programmes are also discussed. Statistical data about nuclear plant operations, population, energy and electricity use is included.

The preparation of Country Nuclear Power Profiles (CNPP) was initiated in 1990s. The CNPP is regularly updated based on information voluntarily provided by participating IAEA Member States. The CNPP is published once a year as a book (since 1998) and/or CD-ROM. Starting with the edition 2012 a new web-based interface has been developed. The current edition of 2013 can be found at:
http://www-pub.iaea.org/MTCD/Publications/PDF/CNPP2013_CD/pages/index. htm.

Implications and objectives of the BfS participation

BfS has participated in this task more than ten years and collects the required data and provide them according to the CNPP structure set by IAEA. For data collection a close cooperation with experts at BfS as well as at BMU and BMWi is performed. Every three years a Technical Meeting (TM) with experts from Member States is arranged by IAEA. At the TM the current issues of the CNPP project and its further development considering situation and plans in Member States which operate nuclear power plants as well as in Member States planning or considering construction of the first nuclear power plant are discussed. The last TM took place in March 2013 and was chaired by BfS. The elaborated recommendations for improving the web-based interface have been agreed among the participants.

DRiMa - International Project on Decommissioning Risk Management

B. Rehs

Objective and scope

Since 2004 two IAEA projects (“Evaluation and Demonstration of Safety during Decommissioning of Nuclear Facilities / DeSa” from 2004 – 2007 and “International Project on Use of Safety Assessment in the Planning and Implementation of Decommissioning of Facilities using Radioactive Material / FaSa” from 2008 – 2011) have taken place to investigate aspects of safety assessment related to decommissioning projects. BfS has

participated in the meetings and several working groups of the FaSa Project. The outcomes of these projects showed that management of project risks is important to successfully perform decommissioning. At the International Decommissioning Network (IDN) annual meeting in 2011 the participants agreed to establish a project dealing with aspects of risk management during decommissioning.The IDN is a panel for the exchange of decommissioning experience between operators and regulators, which was founded by the IAEA in the year 2007.

The IAEA Project “International Project on Decommissioning Risk Management (DRiMa)” started in December 2012 and will focus on risk management relevant to operating organisations, although the outcomes of the project may be relevant also for other organisations and institutions involved in decommissioning. (http://www.iaea.org/OurWork/ST/NE/NEFW/WTS-Networks/IDN/idnfiles/DRiMa_TM_2012/DRiMa_ToR.pdf).

Taking into account existing international standards on risk management, this project aims, amongst others, at identifying good practices based on member states experience, providing recommendations on the application of risk management during planning and execution of decommissioning, at illustrating the role of risk management in key decision making during the lifecycle of nuclear facilities or at illustrating the optimisation of risk treatment strategies and how these can minimise threats and maximise opportunities during decommissioning. Other objectives are to improve the capabilities of member states in this field and enhance the exchange of information between member states on lessons learned.

The scope of the DRiMa project is to provide recommendations on the use of the generally accepted risk management methodology and of the results obtained from it in the planning and execution of decommissioning. The project will focus on the generally accepted methodology for risk management and its application to the decommissioning process for facilities using radioactive material. Furthermore the project will consider all types of risk that can affect the progress of a decommissioning project by considering risk as a multi-dimensional entity. The project will also review and define the factors that influence risks, such as assumptions or constraints. Finally the project will illustrate its areas of application through examples and test cases, based on information related to real decommissioning projects provided by member states.

The three-year DRiMa project will be conducted in the form of annual meetings and additional working group meetings as well as activities between annual meetings as deemed appropriate to achieve the project’s objectives. The project’s work will be conducted mainly within the framework of various working group activities. Two working groups dealing with aspects of risk management methodology and its application during decommissioning - a working group on risk management at strategic level and a working group on risk management at operational level. In addition, depending on the outcomes of the phase of experience collection process, a decision will be made on establishing test case working groups to test and illustrate risk management during decommissioning. The project is open to any experts and organisations from IAEA Member States that are or will be involved in the planning, evaluation, implementation or regulation of decommissioning of facilities that use radioactive material.

Implications and objectives of the BfS participation

The participation of the BfS at the DRiMa Project continues the activities of BfS in the former FaSa Project. It offers the possibility of sharing experiences in application of risk management during decommissioning and to be a part of a valuable forum for the exchange of experience, knowledge and lessons learned between countries with ongoing decommissioning programmes and countries that are at the planning stage of decommissioning. Furthermore BfS is planning to participate at the annual meetings of the International Decommissioning Network (IDN).

FINAS - Fuel Incident Notification and Analysis System

E. Westermeier

Objective and scope

The Fuel Incident Notification and Analysis System (FINAS) is an international system jointly operated by the International Atomic Energy Agency (IAEA) and the Nuclear Energy Agency (OECD/NEA)

FINAS was initiated in 1992 as a database system which collects safety related events with the intention to exchange lessons learned. Since 2008, FINAS is operated as a Web-based system. The system is similar to the Incident Reporting System (IRS) used for nuclear power plants.

The purpose of the FINAS is to improve the safety of fuel cycle facilities which are operated worldwide. This objective could be achieved by exchanging detailed information, in particular on safety significant events.

For each safety significant event, its description, cause analysis, lessons learned including the implemented corrective actions provide valuable information to the regulators. These information are archived in the FINAS-Database.

FINAS meets every two years for two days at the NEA or the IAEA Headquarters in Paris, France or Vienna, Austria. 26 countries are members of the FINAS. Since 1992, FINAS has collected more than 140 events in nuclear fuel cycle facilities stored in a database. For each of these events the respective member state has elaborated a report describing the event and explaining the lessons learned including the corrective actions. A main goal is to exchange these lessons learned and to derive general recommendations for a safe operation of the facilities.

Implications and objectives of the BfS participation

Each country had to designate a FINAS national coordinator to be responsible for receipt and distribution of information received from FINAS and for the transmission of information to FINAS administrations. BfS has been assigned by BMU as a member of FINAS since the implementation of this group. Relevant information on German events is presented by BfS and international experience from safety related events can be collected and evaluated. Moreover, the international community can benefit from the input of the German experience. The lessons learned regarding the safety of fuel cycle facilities are integrated in the work of BfS in supporting the BMU.

TRANSSC - Transport Safety Standards Committee

F. Nitsche

Objective and scope

The Transport Safety Standards Committee (TRANSSC) is a standing body of senior experts in transport safety, established by the Deputy Director General of IAEA, Head of the Department of Nuclear Safety and Security. TRANSSC advises the Deputy Director General on the transport safety programme for the development, review and revision of standards relating to transport safety and the programme for their application. A key objective of TRANSSC is to provide feedback and recommendations to the Agency on the transport safety programme and areas for improvement, and to achieve consensus, quality, coherence and consistency in the development of IAEA safety standards.

The functions of TRANSSC are:

- To advise on the transport safety programme for the development of the transport safety standards issued in the Agency's Safety Standards Series, covering Safety Fundamentals, Safety Requirements and Safety Guides, both thematic and facility specific, and to advise on priorities.
- To recommend activities and areas for improvement to enhance the overall programme and particularly to advise on the programme for the application of the safety standards.
- To review reports on feedback from the Secretariat and TRANSSC members on the application and use of transport safety standards and to advise on enhancing their usefulness to achieve high levels of safety, as well as on the timely review of, and the need for revision of published transport safety standards.
- To review proposals for the development of relevant new standards and to approve the document preparation profiles (DPPs) prior to their submission to the Commission on Safety Standards.
- To review draft transport safety standards, considering the value of each draft standard and the needs of users of the standards.
- To approve the text of relevant draft safety standards prior to their submission to Member States for comment and prior to their submission to the Commission for endorsement.
- To advise on transport safety standards, relevant regulatory issues and activities for supporting the use and application of the Agency's safety standards, and, upon request, on related issues.
- To review, upon request, draft publications in the Nuclear Security Series, in the Nuclear Energy Series and in other IAEA series where there is an interface with transport safety standards.

Among these tasks the main function of TRANSSC is to review and revise the IAEA Regulations for the Safe Transport of Radioactive Material (Safety Requirements TS-R-1) and its supporting documents (Safety Guides TS-G-1.1 to TS-G-1.6) which will be published by the IAEA after final approval by the Board of Governors. These documents are regularly updated by an established review and revision process to take into account latest developments in radiation protection, research and development, use of radioactive material in science, medicine and industry and feedback from practical applications of these IAEA Transport Regulations in member states. The IAEA Transport Regulations are implemented worldwide through the United Nations (UN) Recommendations on the Transport of Dangerous Goods and the International Modal Transport Regulations for Dangerous Goods. According to this special implementation process they become directly national binding regulations in member states. In Germany and in all other European Countries e.g. TS-R-1 (2009 Edition) is in force since 2011 and the latest Edition of the IAEA Transport Regulations published in late 2012 (Safety Requirements SSR-6) will be in force in 2015.

Implications and objectives of the BfS participation

The IAEA Transport Regulations contain specific provisions and requirements for all aspects of safe transport of radioactive material and in particular all provisions which are the basis for the work of BfS as the competent authority for package design approval and shipment approval in Germany. Therefore permanent membership of BfS a TRANSSC is necessary to fulfil the function as competent authority in Germany. On the one hand it allows to provide input to TRANSSC and the future development of IAEA Transport Regulations based on own experience and interests, experiences from users in Germany, results from transport related research work as well as challenges resulting from new technical developments. On the other hand participation at TRANSSC also allows to take into account latest international experiences and latest developments regarding the state of science and technique in the field of safe transport of radioactive material for the own work as a competent authority.

RASSC - Radiation Safety Standards Committee

A. Schmitt-Hannig

Objectives

The RASSC (Radiation Safety Standards Committee http://www-ns.iaea.org/committees/rassc) advises on the development of IAEA Safety Standards relating to radiological protection, covering the process from planning to publishing a safety standard (http://www.iaea.org). Advanced drafts are discussed and assessed in the Committee and eventually submitted to the IAEA Commission on Safety Standards (CSS) for final consultation. The Committee is composed of experts from regulatory authorities responsible for radiological protection as well as of a great number of experts from technical and/or research institutions and international organisations and associations. The Committee's work is aimed at achieving international consensus, even in complex topics, and a high level of quality, coherence and consistency of international safety standards.

Results

More than 50 IAEA draft Safety Standards documents have been reviewed by RASSC in that last 3 years, among them the International Basic Safety Standards (BSS). The BSS apply to all activities and all facilities involving the use of, or exposure to, ionising radiation. The BSS is internationally regarded as one of the key IAEA safety standards because of the breadth of its coverage and the extent of its use in Member States. The review process took more than 5 years and RASSC participants contributed in a number of meetings and specific technical working groups.

Impact to the work of BfS

The IAEA Safety Standards are covering a wide range of topics in radiation, nuclear, transport and waste safety and therefore concern the work of BfS in many ways. They also have an impact on developments in radiation protection in the European Union.

The commitment of BfS as an observer in RASSC offers the potential

- to identify important topics and new developments which may also affect radiation protection in Germany;
- to consider international activities related to radiation, nuclear transport and waste safety which may be useful for European approaches and initiatives, and their further development;

- to exchange ideas and experiences and learning from approaches to radiation protection in other parts of the world;
- to develop, together with colleagues from all over the world, a common approach to radiation, nuclear transport and waste safety, in order to reach the same high level of protection everywhere in the world;
- to support, in general, IAEA efforts to develop and implement Safety Standards.

Thus, international achievements and experiences can be integrated in BfS areas of activity supporting national and European approaches.

IAEA Safety Guides on Occupational Exposures

A. Giussani

Objectives

The IAEA is planning to review its Safety Guides on Occupational Exposures in order to account for the changes introduced by the new Basic Safety Guides (interim edition of 2011). Currently there are 6 documents (IAEA SG-RS-G-1.1, IAEA SG-RS-G-1.2, IAEA SG-RS-G-1.3, IAEA SG-RS-G-1.4, IAEA SG-RS-G-1.6, IAEA SG-GS-G 3.2) that should be merged into a new one. To this end, an expert group has been formed, including among others members from IAEA, from ILO, from the Belgian SCK.CEN, the Japanese NIRS, the British HPA, and from the Indian research center in Babha. BfS was invited to join the group, too.

Impact to the work of BfS

Once established, the new Safety Guide (like the current guides) will be a key reference document for the BfS activities in the field of Occupational Exposure within the BfS Coordinating Office on Incorporation Monitoring.

Development of guidance material on the management of the radiation programme for itinerant workers

G. Frasch

Objective

In 2003, the IAEA drafted a report on radiation protection of outside workers (itinerant workers, contractors ...), i. e. exposed workers who work temporarily in control areas atdifferent undertakings. This draft will now be updated in order to appear as a Technical Report in the IAEA Safety Standards Series. The Technical Meeting provides for exchange of information on international practices and problems as to radiation monitoring of outside workers. In Europe, there are about 100,000 outside workers of whom an increasing number is working in undertakings such as nuclear power plants, but also medical and industrial facilities, located abroad. Outside workers do there maintenance work, reparation, renovation, cleaning or construction and installation work, etc. and increasingly also dismantling and decommission.

Results

There is consensus that outside workers should receive the same radiological protection as a facility‘s permanent personnel. Thus, outside workers need particular dose control and documentation to ensure that the respective admission requirements and dose limits are kept. However, there are different challenges to the radiation protection of domestic outside workers and those that work abroad, i.e. in foreign countries. With globalisation, the number of active international and also intercontinental radiation workers is increasing. Working trans-border is accompanied by regulatory and radiation monitoring problems, for example when the country of origin and the country of destination differ in terms of

- applicable dose limits (20 mSv / year, or 50 mSv / year AND 100 mSv/5Jahre),
- applicable reference periods (calendar year or rolling 12-months),
- regulatory requirements,

- occupational documents are not acknowledged (e.g. official / unofficial dose data, medical examination, radiation protection training, etc.).

Impact to the work of BfS

In addition to regulatory issues there are language communication difficulties, different radiation protection training standards and safety cultures. Another issue that is unclear and often unregulated is the registration of radiation doses received abroad in the official dose registry of the worker‘s home country. The BfS provides input to solutions of these problems through expertise on the topics

- monitoring of outside workers in Germany,
- harmonisation of radiation passbooks data in Europe (via HERCA/WG1),
- survey on trans-border itinerant workers in OECD (via EGOE).

The Technical Meeting consists of participants from 11 countries and the international organisations ILO, NEA, EC and IAEA. Next step on the development of the Technical Report will be a consultant meeting in 2013 to finalise the draft guidance material.

RANET - Response and Assistance Network

H. Romm

Objective

The IAEA needs to be prepared to respond timely, appropriately and efficiently to any situation that may have actual or potential radiological consequences to health, property or the environment and which would require the IAEA’s involvement. In addition, it should be able to respond to radiation safety and/or security related requests from Member States, relevant international organisations and the media/public with urgency.

An extra resource to the IAEA’s Response System is foreseen through the Response and Assistance Network (RANET). Its major objectives are:

- to strengthen the IAEA’s capability to provide assistance and advice, and/or to co-ordinate the provision of assistance as specified within the framework of the Assistance Convention, and
- to promote emergency preparedness and response capabilities for nuclear or radiological emergencies/incidents among IAEA Member States.

The BfS can contribute to RANET by Biological dosimetry

- Dose reconstruction in triage mode based on cytogenetic endpoints for classification of individuals who need or don´t need medical treatment due to irradiation,
- Identification of “worried well” (individuals who show radiation symptoms without being irradiated with correlative doses),
- Individual dose estimation as follow up monitoring of selected persons and
- Activation of the European Network of Biodosimetry.

Results

The biological dosimetry unit of BfS is a partner of the WHO BiodoseNet and was a co-author of the technical Report “Cytogenetic dosimetry, applications in preparedness for and response to radiation emergencies, emergency preparedness and response, EPR-Biodosimetry 2011, IAEA, Vienna 2011.

Implementation of the results

The biological dosimetry unit of BfS is a service lab in case of a radiation accident. Protection of the general population from ionising radiation is of ultimate concern.

DIRATA - Database on Discharges of Radionuclides to the Atmosphere and Aquatic Environment

A. Heckel

Background and aim

DIRATA is a database containing the values of radioactive discharges from nuclear installations to the surrounding air and to the aquatic environment powered by IAEA approximately since the 1990ties. It is a worldwide centralized repository of data submitted by IAEA Member States, and each site dataset includes annual discharge and detection limits. Regulatory limits are given whenever available and a limited amount of information on the location of the site (country, geographical coordinates, water body into which radioactivity is released, number, names and types of installations) is also included. The nuclear installations comprise nuclear power plants, reprocessing facilities, fuel processing facilities as well as sites of naturally occurring radioactive material (NORM) and medical facilities. These data are open to the public.

In case of the European Countries, most data are rendered from the database of the European Commission to DIRATA. Additional data for single radionuclides as well as data on the sampling, processing and measuring procedures for obtaining these discharge data are given by the National Contact Points of the different countries. These have also access to the DIRATA for submitting, evaluating and changing the data concerning their relevant country. One of the tasks of the National Contact Points is to advise the DIRATA operators on the type and way of the submitted data and discuss possible difficulties. For this purpose meetings were held in IAEA Headquater in 2002, 2004, 2006 and 2008.

The German National Contact Point is located at the division “Emission and Immission”, group SW 1.4 “Guidance Office for Effluent Air” of the Federal Office for Radiation Protection.

Results

The DIRATA data concerning the discharges to the surrounding air and to the aquatic environment from nuclear installations in Germany has been checked by the German National Contact Point and some of it has been corrected. Additional data on the sampling, processing and measuring procedures and on the legal base for these determinations in Germany has been given.

A representative of the German National Contact Point attended the meeting in 2004 and presided the meetings of 2006 and 2008. This opportunity was used for suggesting some types of radionuclides and submitting procedures suited to the situation in Germany.

Impact on the work of Federal Office for Radiation Protection

The group “Guidance Office for Effluent Air” of the Federal Office for Radiation Protection prepares and condenses the data on radioactive discharges from nuclear power plants in Germany for the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

The participation in DIRATA allows the evaluation and correction of the German data submitted from the database of the European Commission and to DIRATA and is a platform to an actual international representation of the values of the radioactive discharges in Germany.

WASSC - Waste Safety Standards Committee

K. Kugel

Objectives

The WASSC (http://www-ns.iaea.org/committees/wassc) advises on the overall radioactive waste safety programme, primarily in the development and revision of the radioactive waste safety standards.

Results

WASSC meets regularly twice every year. During its meetings, WASSC discusses safety standards, provides recommendations for their improvement, agrees the next steps in their development, and eventually approves safety standards under elaboration for submission to the main Commission (CSS) for final endorsement prior to their establishment by the Board of Governors of the IAEA (for Safety Requirements) or the Director General (for Safety Guides).

Safety Standards were categorised in the following areas:

- predisposal of radioactive waste,
- decommissioning,
- rehabilitation and contaminated areas and
- disposal of radioactive waste.

Documents for approval at the meeting are distributed to committee members in advance, and comments are to be sent before the meeting.

Impact to the work of BfS

The IAEA Safety Standards are covering also a wide range of topics in waste safety and therefore concern the work of BfS. The commitment of BfS as an observer in WASSC offers the potential

- to identify important topics and new developments which may influence also the waste safety in Germany;
- to consider international activities related to waste safety which may be useful for European approaches;
- to exchange ideas and experiences;
- to observe the development of safety standard documents in order to avoid conflicts with German approaches,
- to support, in general, IAEA efforts to develop and implement Safety Standards.

Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management – cooperation and developments between review meetings

K. Kugel

Background and status

On 1 October 1997, the Federal Republic of Germany signed the "Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management" (Joint Convention), which entered into force on 18 June 2001. Germany is among the 69 Contracting Parties of the "Joint Convention".

Objectives

The objectives of this convention are:

- to achieve and maintain a high level of safety worldwide in spent fuel and radioactive waste management,
- to ensure that during all stages of spent fuel and radioactive waste management there are effective defences against potential hazards with radiological consequences.

At periodic meetings taking place every three years the contracting parties discuss how the member states fulfil the objectives. The contracting parties are obliged to submit written reports that have been discussed and reviewed at these conferences.

On the basis of the national report, the member states have the opportunity to critically examine the respective national waste management policy, e.g. with regard to legal and administrative bases or the implementation of the waste management policy in individual projects. This needs to be done during the review meeting in the form of questions, either submitted in writing or orally.

Four review meetings were held since the Joint Convention entered into force. The first review meeting took place in Vienna at the IAEA from 3 to 14 November 2003. 31 member states with altogether 343 delegates took part in it. From 14 to 23 May 2012 already the fourth review meeting took place with 603 delegates form 53 member states and from Euratom.

Cooperation and developments between review meetings

During the fourth review meeting, an Open-ended Working Group (OEWG) discussed several proposals for the improvement of future review meetings, as well as other arrangements to ensure continuity between re-

view meetings and facilitate coherence between the review processes of the Joint Convention and of the Convention on Nuclear Safety.

Impact to the work of BfS

According to its tasks, the Federal Office for Radiation Protection (BfS) is responsible for those parts of the report dealing in particular with the classification and stock of radioactive waste and the single stages of waste treatment including interim storage and disposal.

Special topics of the review meetings are among other things:

- status of the construction of the Konrad repository
- status of the plan-approval procedure on the sealing of the Morsleben repository
- status of investigations on the recovery of waste from the Asse II mine

Following the Fukushima accident, many Contracting Parties have carried out an immediate initial analysis for their spent fuel and waste management facilities and have analysed their severe accident management strategies to identify any deficiencies. Particular attention was given to the issue of the safety of spent fuel stored in pools. More detailed assessments are planned.

NEWMDB - Net-Enabled Radioactive Waste Management Database

S. Steyer

Objectives

The NEWMDB contains information on national radioactive waste management programmes, radioactive waste inventories, radioactive waste disposal, relevant laws and regulations, waste management policies, and plans and activities.

The principal objectives for the NEWMDB are:

- to improve access to radioactive waste management data;
- to provide a system for maintaining the international "memory" of such information;
- to provide readily accessible reference material to both the Member States and the Agency's Technical Assistance programme, Waste Management Technical Review and Assessment Programme (WATRP), and other programmes;
- to provide a means to research and assess the development and implementation of national systems for radioactive waste management in Agency Member States, and
- to provide a tool to Member States that supports the reporting requirements of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention).

Data sources

The sources of data in the NEWMDB and their relative accuracy are extremely important considerations. NEWMDB data are considered primary information, because the data are supplied by designated government representatives who have both access and authorisation to the information in their respective countries. A small amount of data is supplied directly by the IAEA based on publicly available sources. A secondary source of data for Member States that do not report are the National Reports to the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management. Russia, Korea, and China, are contracting members to the Joint Convention and make their information available to the public. These so-called National Reports are also considered primary data, because they are officially sanctioned by the Member State governments.

Waste matrices and translation tables

NEWMDB is based on a structure that is meant to facilitate flexible reporting. This is necessary because regulation of radioactive waste varies greatly from country to country. Also, the degree of detail provided is a choice of the country. While some Member States provide high levels of detail concerning their waste management programmes, some provide only summary information.

Furthermore, because of the variation in radioactive waste regulations, definitions used by one country are usually incompatible with the majority of other countries. This leads to a problem when trying to sum or compare the inventories from country to country, from regions (i.e., South America or European Union), or when attempting to determine a global total.

Therefore, an important part of NEWMDB reporting is the *Waste Class Matrix*. The Waste Class Matrix provides each Member State a method of reporting their waste classes along with a translation into the IAEA proposed standard classification scheme. Inventory data are then entered according to each respective country's "native" waste classification scheme, and then translated into the IAEA standard classes for comparisons.

Impact to the work of BfS

BfS has participated in the development of the NEWMDB since 1999 and provided inventory data since 2001. Through the participation in the NEWMDB the data on radioactive waste in Germany is made available worldwide and enables the comparison with other Member States.

GEOSAF - Safety of Geological Disposal

J. Wollrath

Objectives

The IAEA initiated the International Project on Demonstrating the Safety of Geological Disposal (GEOSAF) to examine the evolution of arguments, assessments and supporting evidence developed to provide a reasonable level of assurance of safety to all interested parties. The project gives particular attention to the systematic review of such arguments, assessments and supporting evidence by regulatory bodies. The main aim of GEOSAF is to work towards harmonisation of approaches worldwide to demonstrate the safety of geological disposal. GEOSAF provides a global forum for exchanging experience and ideas between organisations and authorities responsible for such safety demonstration, and for related regulatory review and approval. It also aimed at providing a platform for knowledge transfer. GEOSAF encompasses all types of geological disposal facilities, including those designed for high level waste, spent fuel if declared as a waste, conditioned high level waste from reprocessing, longer lived intermediate level waste, and other waste not suitable for disposal in near surface facilities.

Results

The first part of the GEOSAF project started in 2008 and had its last plenary meeting in May 2011. Based on the ground of the work of the European Pilot Study (EPS), on an example of the Regulatory Review of a Safety Case for Geological Disposal of Radioactive Waste and on two IAEA safety standards the project contributed to the development of a questionnaire devoted to review the Safety Case that would structure a foreseen IAEA review procedure.

On the request of the participants a follow-up project started in 2012. The 2-year project aims at harmonising approaches on the safety of geological disposal facilities for radioactive waste through the development of an integrated Safety Case covering both operational and long-term safety.

Impact to the work of BfS

BfS contributes to the success of the project by providing its experience in developing Safety Cases for German repository projects.

HIDRA - Human Intrusion in the Context of Disposal of Radioative Waste

J. Wollrath, I. Böttcher

Objectives

In 2012, the IAEA has initiated the International Project on Human Intrusion in the Context of Disposal of Radioative Waste (HIDRA) to provide guidance on how to address human actions in the Safety Case and safety

assessment of radioactive waste disposal in the future, and then using those assessments to optimise siting, design and waste acceptance criteria within the context of a Safety Case. The objectives of the two-year project include

- Sharing of experience and practical considerations for development and regulatory oversight of assessments of impacts of future human actions, primarily human intrusion, in the context of the Safety Case during the lifecycle for a disposal facility,
- Provision of specific information regarding technical, societal and design considerations to support development of a structured process or methodology for developing scenarios for site-specific application,
- Description of the role of assessments of future human actions for siting, design and development of waste acceptance criteria in the context of the Safety Case,
- Provision of suggestions for communication strategies to describe the rationale for assessments of future human actions and for interpretation of the results of those assessment for the public, and
- Provision of recommendations, as appropriate, for clarification of existing IAEA requirements and guidance relevant to the assessment of future human actions and human intrusion.

Impact to the work of BfS

BfS takes part in two task groups dealing with technical criteria and societal analysis. First results will be discussed in the first plenary meeting taking place in November 2013.

MODARIA - Modelling and Data for the Radiological Impact Assessment

H. Walter

Objectives

The general aim of the MODARIA Programme is to improve capabilities in the field of environmental radiation dose assessment by means of acquisition of improved data for model testing and comparison, reaching consensus on modelling philosophies, approaches and parameter values, development of improved methods and exchange of information.

MODARIA continues some of the work of previous international exercises in the field of radioecological modelling (BIOMOVS, VAMP, BIOMASS, EMRAS) and focuses on areas where uncertainties remain in the predictive capability of environmental models.

The activities within the framework of the MODARIA Programme emphasise on improvement of environmental transfer models for reducing associated uncertainties or developing new approaches to strengthen the evaluation of the radiological impact to man, as well as to flora and fauna, arising from radionuclides in the environment.

Special emphasis has been laid on the lessons learned from Fukushima in the scientific areas of contamination in urban areas, decision support systems and remedial measures.

The MODARIA Programme is being set up to continue the IAEA's activities in the field of testing, comparing and developing guidance on the application of models to assess exposures to humans and radiological impacts on the environment. The results of radiological assessments are used, for example, in the evaluation of the radiological relevance of routine and accidental releases of radionuclides, to support decision making in remediation work and for the performance assessment of radioactive waste disposals.

The following working groups have been established:

- **WG1** Remediation strategies and decision aiding techniques
- **WG2** Exposures in contaminated urban environments and effect of remedial measures
- **WG3** NORM
- **WG4** Analysis of radioecological data in IAEA Technical reports to identify key radionuclides and associated parameter values for human and wildlife exposure assessments

- **WG5** Uncertainty an variability analysis for assessment of radiological impacts arising from routine discharges of radionuclides
- **WG6** Addressing environmental change in long-term safety assessment of radioactive waste disposal facilities
- **WG7** Harmonisation and intercomparison of models for accidental tritium releases
- **WG8** Biota data modelling
- **WG9** Models for assessing radiation effects on populations of wildlife species
- **WG10** Modelling of marine dispersion and transfer of radionuclides accidentally released from land-based facilities

Results

MODARIA was implemented in November 2012 when the first general meeting and the meeting of the WGs took place. Concerning the WGs the detailed working plans for the next three years were established.

The BfS decided to focus its interest on the WGs 1, 2, 4, 8 and 9. The project is in the very beginning, and the new activities defined at the first meeting. This includes among others, the identification of necessary data-sets, the development of scenarios, the identification of models to be used in the scenarios or the compilation of handbooks (e.g. IAEA TECDOC).

Most of the WGs decided to conduct their next individual meeting in spring or summer 2013. More detailed results, therefore, are to be expected later in 2013.

In most WGs the participants agreed to develop scenarios and apply models related to the Fukushima accident in order to study effects on population, biota and topography.

Implementation of the results

The scientific cooperation will be of benefit for models or procedures applied within the BfS and will help to harmonise radiation exposure procedures in the national and European context.

IAEA Nuclear Security Activities

E. Kröger

Objective

The Working Group „Defence Against Nuclear Hazards“ (AG-NGA) is involved in a broad spectrum of international work directly linked to Nuclear Security at the International Atomic Energy Authority (IAEA), including taking part in international conferences and helping draft and finalise documents in the IAEA Nuclear Security Series at Consultant Meetings (CM) and Technical Meetings (TM, www-ns.iaea.org/security).

The aim of this work is twofold. On the one hand, the international engagement of AG-NGA at conferences and at CMs and TMs keeps the BfS and the BMU informed of international progress and focus in the field of the defence against nuclear hazards. On the other hand, the platform of the IAEA allows the BfS and the BMU to share their knowledge and experience on the topic with a wide range of international partners.

AG-NGA has been involved in the following IAEA international conferences:

- International Conference on Illicit Nuclear Trafficking, Edinburgh 2007
- International Conference on Nuclear Security, Vienna 2009

AG-NGA has been involved in the drafting or finalising of the following IAEA Nuclear Security Documents (not a compete list):

- Nuclear Security Detection Systems and Measures
- Recommendations for Detection and Response to Criminal and Unauthorized Acts involving Nuclear and other Radioactive Materials out of Regulatory Control
- Threat Assessment and Risk-Informed Approach for the Implementation of Nuclear Security Measures for Nuclear and other Radioactive Material out of Regulatory Control
- Nuclear Forensics in Support of Investigations

- Radiological Crime Scene Management

Results

Conference contributions have been well received in the past, resulting in intensified information exchange at the conferences, as well as with international partners after the conferences.

Drafting and finalising documents at the IAEA results in a direct comparison of international and German national best practice. This comparison serves to improve both through an exchange of ideas.

The drafting of the document on the topic of “Radiological Crime Scene Management” led to the involvement of AG-NGA in the drafting of an IAEA training course on the same topic, which is ongoing.

Implementation of results

The insight gained by AG-NGA into international progress and focus in the field of the defence against nuclear hazards is shared with the BMU. In the event that concrete gaps in knowledge or skills are identified on this topic, AG-NGA will evaluate the necessity for further training, improved written procedures or procurement for the improvement of the defence against nuclear hazards at BfS.

I.5 OECD/NEA

The Nuclear Energy Agency (NEA) (http://www.oecd-nea.org/nsd/) is an intergovernmental specialised agency within the Organisation for Economic cooperation and Development (OECD). The goal of the NEA in the area of nuclear safety and regulation is to assist member countries in ensuring high standards of safety in the use of nuclear energy, by supporting the development of effective and efficient regulation and oversight of nuclear installations, and by helping to maintain and advance the scientific and technological knowledge base. The NEA is the steering committee of several sub-committees e.g. the Committee on Nuclear Regulatory Activities (CNRA) and Committee on the Safety of Nuclear Installations (CSNI).

CNRA - Committee on Nuclear Regulatory Activities

M. Krauß

Objective and scope

CNRA (http://www.oecd-nea.org/nsd/cnra/index.html) is an international committee made up of senior representatives from regulatory bodies. It was created in 1989 to guide the NEA programme concerning the regulation, licensing and inspection of nuclear installations with regard to safety. The CNRA's main tasks are:

- to exchange information and experience among regulatory organisations;
- to review developments which could affect regulatory requirements;
- to review current practices and operating experiences.

CNRA is responsible for the programme of the NEA concerning the regulation, licensing and inspection of nuclear installations with regard to safety. CNRA constitutes a forum for the effective exchange of safety-relevant information and experience among regulatory organisations. To the extent appropriate, CNRA reviews developments which could affect regulatory requirements with the objective of providing members with an understanding of the motivation for new regulatory requirements under consideration and an opportunity to offer suggestions that might improve them and assist in the development of a common understanding among member countries.

In particular it shall review current management strategies and safety management practices and operating experiences at nuclear facilities with a view to disseminating lessons learnt. In accordance with the NEA Strategic Plan for 2011-2016 and the Joint CSNI/CNRA Strategic Plan and mandates for 2011-2016, CNRA promotes cooperation among member countries to use the feedback from experience to develop measures to ensure high standards of safety, to further enhance efficiency and effectiveness in the regulatory process and to maintain adequate infrastructure and competence in the nuclear safety field.

CNRA promotes transparency of nuclear safety work and open public communication. CNRA maintains an oversight of all NEA work that may impinge on the development of effective and efficient regulation.

CNRA focuses primarily on the regulatory aspects of existing power reactors and other nuclear installations and the construction of new power reactors; it may also consider the regulatory implications of new designs of power reactors and other types of nuclear installations. Furthermore it examines any other matters referred to it by the Steering Committee. CNRA collaborates with, and assists, as appropriate, other international organisations for cooperation among regulators and consider, upon request, issues raised by these organisations. CNRA organises its own activities. It sponsors specialist meetings and working groups to further its objectives.

In implementing its programme CNRA establishes cooperative mechanisms with the Committee on the Safety of Nuclear Installations (CSNI) in order to work with CSNI on matters of common interest, avoiding unnecessary duplications. The Committee shall also co-operate with the Committee on Radiation Protection and Public Health and the Radioactive Waste Management Committee on matters of common interest.

The CNRA runs at present the following working groups:

- Working Group on Inspection Practices (WGIP)
- Working Group on Operating Experience (WGOE)
- Working Group on Public Communication of Nuclear Regulatory Organisations (WGPC)
- Working Group on the Regulation of New Reactors (WGRNR)

Implications and objectives of the BfS participation

A focus of the support of BMU lies on international cooperation in the field of nuclear safety. This ranges from the exchange of information and experience with the nuclear regulatory authorities of the neighbouring countries, within the European Union and within the OECD/NEA member countries up to the joint development of safety principles and safety standards within the scope of international organisations, in particular the International Atomic Energy Agency (IAEA). Members of the department SK of all sections are active according to their individual expertise in the international exchange and participate in the corresponding committees and working groups of international organisations.

A delegate of BfS participates in the meetings of CNRA supporting the delegate of BMU since 1994. These meetings take place every 6 months.

CSNI - Committee on the Safety of Nuclear Installations

M. Krauß

Objective and scope

The Committee on the Safety of Nuclear Installations (CSNI) (http://www.oecd-nea.org/nsd/csni/index.html) is an international committee made up of scientists and engineers. It was set up in 1973 to develop and coordinate the activities of the NEA concerning the technical aspects of the design, construction and operation of nuclear installations insofar as they affect the safety of such installations. The Committee's purpose is to foster international cooperation in nuclear safety amongst the OECD Member countries. CSNI constitutes a forum for the exchange of technical information and for collaboration between organisations which can contribute, from their respective backgrounds in research, development, engineering or regulation, to these activities and to the definition of its programme of work. It also reviews the state of knowledge on selected topics of nuclear safety technology and safety assessment, including operating experience. It initiates and conducts programmes identified by these reviews and assessments in order to overcome discrepancies, develop improvements, and reach international consensus in different projects and international standard problems, and assists in the feedback of the results to participating organisations. Full use is also made of traditional methods of cooperation, such as information exchanges, establishment of working groups and organisation of conferences and specialist meeting.

The greater part of CSNI's current work programme is concerned with safety technology of water reactors. The principal areas covered are operating experience and the human factor, reactor coolant system behaviour, various aspects of reactor component integrity, the phenomenology of radioactive releases in reactor accidents and their confinement, containment performance, risk assessment and severe accidents. The Committee also studies the safety of the fuel cycle, conducts periodic surveys of reactor safety research programmes and operates an international mechanism for exchanging reports on nuclear power plant incidents.

The CSNI runs at present the following task and working groups:

- CSNI Task Group on Defence in Depth of Electrical Systems and Grid Interaction (DIDELSYS)
- CSNI Task Group on Sump Clogging
- Working Group on Integrity of Components and Structures (WGIAGE)
- Working Group on Analysis and Management of Accidents (WGAMA)
- Working Group on Risk Assessment (WGRISK)
- Working Group on Human and Organisational Factors (WGHOF)
- Working Group on Fuel Safety (WGFS)
- Working Group on Fuel Cycle Safety (WGFCS)

Implications and objectives of the BfS participation

A focus of the support of BMU lies on international cooperation in the field of nuclear safety. This ranges from the exchange of information and experience with the nuclear regulatory authorities of the neighbouring countries within the European Union and within the OECD/NEA member countries, up to the joint development of safety principles and safety standards within the scope of international organisations, in particular the International Atomic Energy Agency (IAEA). Members of the department SK of all sections are active according to their individual expertise in the international exchange and participate in the corresponding committees and working groups of international organisations.

A delegate of BfS has participated in the meetings of the Nuclear Energy Agency's Committee on the Safety of Nuclear Installations (CSNI) since 1994; in contrast to CNRA BfS has an observing role in CSNI, supporting the delegate of BMU. The official German representatives are from BMWi (Bundesministerium für Wirtschaft und Energie) and GRS (Gesellschaft für Reaktorsicherheit). CSNI meets every 6 months.

OECD/NEA Expert Groups and Working Parties

EGOE - Expert Group on Occupational Exposure (chair)

G. Frasch

Objective

The Expert Group on Occupational Exposure was founded in 2007 by the Committee for Radiation Protection and Public Health (CRPPH) of the OECD. The objective of the EGOE is to broadly identify and scope out issues in occupational radiation protection across many work sectors that could be usefully and strategically addressed by the CRPPH from a policy and regulatory perspective on an international level. Since 2007 EGOE executed three case studies:

- Occupational Radiation Protection Principles and Criteria for Designing New Nuclear Power Plants (published 2010)
- Dose Constraints in Occupational Radiation Protection (published 2011)
- Management of Information and Regulatory Issues on International Outside Workers and Integrated Risk Management at Nuclear Power Plants (*working title - under preparation*).

Impact to the work of BfS

The work of EGOE was closely connected to the International Action Plan of the IAEA, the development of the new IAEA Basic Safety Standards and the work of ISOE. EGOE consists of experts from about 30 OECD/NEA countries, observers from international organisations (e.g. IAEA, ILO, ISOE, and EC) and consultants. The BfS holds the chair of EGOE. The BMU supports the work of CRPPH through contractual membership. With the participation in the EGOE activities, the BfS receives international information on relevant developments in occupational radiation protection and influences these developments through an international network.

EGIRES – Expert Group on Implementation of International Recommendations for Emergency Situations

E. Wirth

Objective

The ICRP re-enforces in its Publication 103 the principle of optimisation of protection, which should be applicable in a similar way to all exposure situations. To assist in judging optimisation, the ICRP has extended its concept of dose constraints to be used in all exposure situations, although this concept is called “reference level” in conjunction with emergency and existing exposure situations. The new emphasis on dose constraints and reference levels in Publication 103 has been one of the topics that have generated the most questioning and confusion during the development of these new recommendations also in Germany. Current practices show large variability in interpretation and use of reference levels in emergency exposure situations, mostly depending on the national approaches. The Expert Group on the Implementation of International Recommendations for Emergency Situations (EGIRES) of the NEA was charged to investigate issues in, and approaches to, the implementation of the new ICRP recommendations and revised BSS for emergency exposure situations, specifically nuclear/radiological emergencies including accidents and consequence management for malicious acts. The group met three times and finalised the draft of its recommendation in February 2013 which has been accepted by the member states without changes in May 2013.

Impact to the work of BfS

The work is of interest for a joint understanding approach of the recommendation of the ICRP in the field of emergency preparedness. BfS was asked by BMU to take care on this joint interpretation.

WPNEM - Working Party on Nuclear Emergency Matters

F. Gering

Objective

The NEA has a long tradition of expertise in the area of nuclear emergency policy, planning, preparedness and management. Through its technical programmes, the NEA offers its member countries unbiased assistance in the nuclear preparedness area, with a view towards facilitating improvements in nuclear emergency preparedness strategies and nuclear emergency response at the international level.

Results

The mission of the Working Party on Nuclear Emergency Matters (WPNEM - www.oecd-nea.org/rp/wpnem) is to improve nuclear emergency management systems (planning, preparedness, response, recovery) within member states and to share its knowledge and experience widely. Within this framework, the WPNEM develops its programme of work based on identifying and analysing emergency management systems gaps or vulnerabilities. Part of its work programme focuses on exploring and developing new concepts and future procedures to enhance national and international preparedness and response management. A central aspect of these efforts have centred on preparing and conducting the International Nuclear Emergency Exercise (INEX) series, the latest INEX-4 series being conducted in many countries worldwide in 2011-2012.

Participants are emergency management experts from NEA member countries with recognised knowledge and skills in the nuclear field. Participants share information, data, knowledge and experiences to test emergency managements systems and theories, identify gaps and provide recommended strategies to improve nuclear emergency management worldwide.

Impact to the work of BfS

Since many years a BfS staff member represents Germany within this working party and actively contributes to many tasks, e.g. the preparation and evaluation of the latest exercise series INEX-4.

WPDD - Working Party on Decommissioning and Dismantling

B. Rehs

Objective and scope

The OECD Nuclear Energy Agency set up its Working Party on Decommissioning and Dismantling (WPDD) of the Radioactive Waste Management Committee (RWMC) in 2001 (http://www.oecd-nea.org/ rwm/wpdd/). The WPDD provides a focus for the analysis of decommissioning policy, strategy and regulation, including the related issues of management of materials, release of buildings and sites from regulatory control and associated cost estimation and funding. Beyond policy and strategy considerations, the WPDD also reviews practical considerations for implementation such as techniques for characterisation of materials, for decontamination and for dismantling.

The WPDD brings together senior experts in decommissioning from 21 OECD and observer countries: Belgium, Canada, Czech Republic, Finland, France, Germany, Hungary, Italy, Japan, Korea, Netherlands, Norway, Poland, Romania, Russia, Slovak Republic, Spain, Sweden, United Kingdom and the United States, with involvement also from other international organisations such as the European Commission and the International Atomic Energy Agency (IAEA). Its membership includes policy specialists, regulators, implementers, researchers and waste management experts. It has a specialist sub-group devoted to the exchange of information and experience on costing issues, the Decommissioning Cost Estimation Group (DCEG).

The WPDD tracks decommissioning developments worldwide and develops reports and position papers on emerging issues. Its overarching aim is to contribute to the development of best practice through circulation of its reports and through dialogue between policy makers, practitioners, regulators, researchers and international organisations.

The WPDD meets once each year, at a host location that rotates among the member countries. Each meeting normally includes a topical session on an issue of special interest, and a session focussing on the framework for decommissioning in the host country. After the meeting, the host country normally arranges a visit to a local facility undergoing decommissioning.

In meetings, workshops and joint projects, the WPDD collaborates with other groups working in the field of decommissioning. These include the NEA's programme for the exchange of scientific and technical information on the decommissioning of nuclear installations (CPD), as well as the NEA Forum on Stakeholder Confidence (FSC), to help reflect on the links between decommissioning, decision-making and public confidence, and with the RWMC Regulators' Forum on regulatory issues.

Implications and objectives of the BfS participation

Members of the BfS have attended in the WPDD meetings since the year 2002. The BfS contributions are arranged with the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and the BMU is informed actively by the BfS on important issues within WPDD. The BfS provides input to the work of the WPDD in different working fields, for example more recently within the working group on "The Management of Large Components from Decommissioning to Storage and Disposal". Furthermore the BfS informes the WPDD about current issues regarding the decommissioning in Germany and is involved in Topical Sessions by giving lectures. The BfS calls attention to the work of the WPDD to German interested parties by translating WPDD information material into German language. In the year 2012 a member of the BfS was participating in meetings of the WPDD Core Group, which is a sub-group of WPDD members who schedule the working programme of the WPDD and organise the WPDD meetings.

The attendance in meetings of the WPDD is an important part of the international activities of the BfS regarding decommissioning. It gives a good overview of the decommissioning activities worldwide and additionally of the relevant activities of other supranational institutions such as IAEA or EU. Due to the membership in the WPDD, the BfS has contact to a wide range of international experts in the field of decommissioning and is part of one of the most experienced network of decommissioning experts.

WGIP - Working Group on Inspection Practices

M. Schneider

Objective and scope

The Working Group on Inspection Practices (WGIP) is one of the four permanent Working Groups of the Committee on Nuclear Regulatory Activities (CNRA).

Safety inspections are a major element in the regulatory authoritys efforts to ensure the safe operation of Nuclear Power Plants. Considering the importance of these issues, the CNRA established the WGIP in 1990 as a permanent Working Group. The purpose of the WGIP is to constitute an international forum to facilitate the exchange of information and experience related to regulatory safety inspections among NEA member countries. To this end, the WGIP

- promotes cooperation and learning in order to mutually enhance regulatory effectiveness and efficiency by reviewing the effectiveness of existing regulatory inspection practices, preparing reports and disseminating lessons learnt, and by sponsoring and holding international workshops on regulatory inspection practices;
- considers which inspections and practices are appropriate to address the future regulatory challenges as identified by the CNRA;
- considers the lessons learnt from regulators, regulatory inspections and current operating practices.

The scope of work of the WGIP is to examine regulatory inspection practices by the regulatory body. In this context, inspection is any examination, observation, measurement, or test to assess structures, systems, components, materials, operational activities, processes, procedures, and personnel and organisational competence. Regulatory inspection is inspection by or on behalf of a regulatory body. The responsibility of the regulatory body is to verify by inspection that licensees operate safely, that their activities fully comply with all applicable regulations, and that safety is given the highest priority. Regulatory inspection must therefore be supplemented by reviews and by other regulatory controls to yield an integrated assessment of safety and provide a basis for enforcement, which is an essential part of the regulatory oversight process.

The WGIP meets twice a year for three or four days at the NEA or the OECD Headquarters in Paris, France. Since its conception in 1991, the WGIP has dealt with more than fifty topics on nuclear regulatory inspection practices. These include reports produced by the WGIP on general inspection issues and specific areas of concern. In addition, proceedings from international workshops, which WGIP conducts every two years with two to three topics related to regulatory inspection, were produced. A main goal is the formulation of commendable inspection practices. While this has always been a major part of the WGIP work, this was formally incorporated in the mandate in 1999. The reports or the proceedings produced by the WGIP are approved by the CNRA and published on the NEA website http://www.oecd-nea.org/nsd/docs/indexcnra.html.

Implications and objectives of the BfS participation

Almost since the beginning of the WGIP, a representative of BfS has been a full member nominated by BMU. The main purpose is to participate in the international cooperation concerning regulatory inspection practices, to bring in the German approach in supervisory activities of the regulatory body, especially in regulatory inspection issues, and naturally, to learn and to take advantage from international experience in this field. This requires active participation in the Working Group, e.g. by presentations about the “National Inspection Programme in Germany” and the “German Post-Fukushima Activities” which have been given recently. Nevertheless, the German contribution to the international discussion about regulatory inspection can not be provided by the BfS participation unaccompanied. This is due to the fact that the main competences in regulatory inspection lie within the authorities of Federal States (“*Länder*”), because they are mainly in charge of executing the Atomic Energy Act concerning licensing and supervision of nuclear power plants. To integrate their knowledge into the international cooperation, BfS also acts as some kind of a “national coordinator”. This comprises, among others, the request of their assistance in preparing reports made by the WGIP, e.g. in supporting answering respective questionnaires to specific inspection topics. Furthermore, they are encouraged by the BfS member to attend in Workshops organised by the WGIP, both via the Working Group Supervision of NPP Operation of the Technical Committee for Nuclear Safety or by direct activating.

As already mentioned above, a total of more than fifty topics on nuclear regulatory inspection practices have been discussed in the WGIP. In recent years, the focus hase been mainly on inspection topics which are encompassed by Safety Management issues, e.g. Inspection of Ageing and Equipment Qualification, Inspection

of Competency of Control Room Operators, Inspection of Licensee's Oversight of Contractors and Inspection of Licensee Maintenance Programmes and Activities. Naturally, the results and the lessons learned from the topics discussed are integrated in the work of BfS, e.g. in supporting the BMU in its federal oversight or in its other international cooperation duties, at least in the enhancement of the knowledge base of both BfS and BMU. Furthermore, the reports and proceeding of the WGIP are published and the main results in form of commendable inspection practices may be incorporated in the work of the competent supervisory *Länder* authorities.

IGSC - NEA Integration Group for the Safety Case

J. Wollrath

Objective and scope

The Integration Group for the Safety Case (IGSC) is a discipline-oriented working party of the Radioactive Waste Management Committee (RWMC). The IGSC is composed of senior technical specialists knowledgeable in the development or review of Safety Cases for deep geological disposal projects within waste management agencies, regulatory authorities, and research and development institutions. BfS is actively taking part in this initiative. The IGSC provides advice to the RWMC on major and emerging issues in order to facilitate the elaboration of waste management strategies at national and international levels and to enable the management of radioactive waste and materials to benefit from progress of scientific and technical knowledge.

The IGSC is the main technical advisory body to the RWMC regarding methodologies and strategies for characterising and evaluating disposal sites and for repository design as well as for developing and documenting safety assessment and safety cases for geological repositories to accommodate various waste types. In principle, the scope of its activities is the whole range of elements to be addressed in a Safety Case.

Activities of the IGSC have traditionally focused on long-term safety. However, as some national programmes approach licensing, a higher degree of integration is required, not only for all elements related to long-term safety, but also of engineering and operational considerations. That is, operational constraints may affect decisions on, for example, repository layout or design of engineered components – which then must be incorporated in a safety case. It is, therefore, recognised that to achieve confidence in (and acceptance of) a repository, it must be shown not only that the system will be safe over the long-term, but also that it can be built and operated safely.

In undertaking its mission the IGSC

- Define, oversee and carry out a work programme of technical activities related to the development, evaluation, and communication of Safety Cases as a basis for confidence and decision-making within the development of repositories for long-lived radioactive waste. Emphasis is on the identification and pursuit of issues and on the development of technical tools for which there is pan-national interest, and on publishing the group's findings where this is found appropriate.
- Facilitate multilateral communication and information exchange among IGSC members, and promote a frank interchange in an open dialogue among peers. In particular, the IGSC provides a neutral forum for dialogue with a view to identify emerging issues and trends, review the state of the art, and promote further understanding and common views, including the development of tools.
- Promote the exchange of information and strive for common understanding, shared approaches and methods for the development and documentation.

Impact on the work of the BfS

BfS is taking part in IGSC initiatives to share its experience with the other national waste management programmes, to aid to define and evaluate the state-of-the-art of Safety Case development, and to learn from the experiences of other waste management programmes.

OECD/NEA Working Party on Nuclear Criticality Safety: Expert Groups on Burn-up Credit Criticality and on Assay Data of Spent Nuclear Fuel

I. Reiche, B. Ruprecht

BfS participates in the Expert Group on Burn-up Credit Criticality and the Expert Group on Assay Data of Spent Nuclear Fuel of the OECD/NEA Working Party on Nuclear Criticality Safety.

Objective of the Expert Group on Burn-up Credit Criticality

The Expert Group on Burn-up Credit Criticality coordinates activities to improve the application of burn-up credit. Burn-up credit is a method that can be used in the criticality safety assessment of the transport, storage and disposal of spent nuclear fuel. Burn-up credit means to take into account the change in the nuclide content of nuclear fuel during irradiation in the reactor for the criticality safety demonstration for transport, storage or disposal configurations containing this spent fuel.

Impact on the work of the BfS

The expert group specifies benchmark calculations and writes guidance on the use of burn-up credit. BfS participates in these discussions and benchmark calculations. This helps BfS keep and improve its knowledge in this field. The work done by OECD/NEA and the international community has significantly contributed to establishing burn-up credit as a standard method for criticality safety assessment of the transport and storage of spent nuclear fuel with a sound technical basis, available for any country using nuclear power. At BfS the results of the expert group are directly used in the assessment of criticality safety for the design approval of transport containers for spent nuclear fuel.

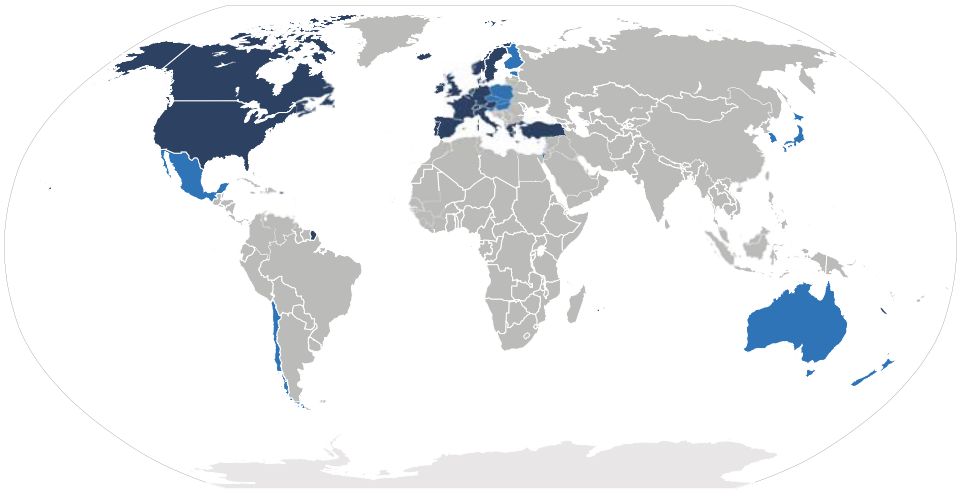
Objective of the Expert Group on Assay Data of Spent Nuclear Fuel

The Expert Group on Assay Data of Spent Nuclear Fuel coordinates activities for collection and evaluation of post irradiation examination (PIE) data for the assessment of the nuclide content of spent nuclear fuel. PIE data are necessary for the validation of depletion calculations, especially for application in burn-up credit. This group has published a State-of-the-art Report on PIE data and is currently organising the efficient collection, storage and evaluation of all publicly available PIE data.

Impact on the work of the BfS

BfS participates in the discussions of this group. The information made available by this group are essential for BfS for assessing the validation base of burn-up credit applications and for validating the calculation tools used by BfS.

.



OECD member states

source: Wikimedia Commons, author Cflm001, license CC BY-SA 2.0

OECD/NEA Joint Research Projects

TGAM - Task Group on Accident Management

M. Schneider

Objective and scope

The Task Group on Accident Management (TGAM) is an ad hoc task group of the Committee on Nuclear Regulatory Activities (CNRA).

Accident management is a priority area of work for the NEA to address lessons being learnt from the accident at the Fukushima Dai-ichi Nuclear Power Plants (NPP). Based on the joint recommendations of CNRA, the Committee on the Safety of Nuclear Installations (CSNI) and the Committee on Radiation Protection and Public Health (CRPPH), the CNRA has established the TGAM in 2012 to review the regulatory framework for accident management. The task group has been requested to assess the member country needs and challenges in light of the accident from a regulatory point of view. CNRA provided the following topics for the task group to consider:

- Enhancements of on-site accident management procedures based on lessons learned from the Fukushima Dai-ichi accident.
- Decision-making and guiding principles in emergency situations.
- Guidance for instrumentation, equipment and supplies for addressing long-term aspects of accident management.
- Guidance and implementation when taking extreme measures for AM.

The objective of the TGAM is to identify measures that should be considered to enhance the regulations and regulatory guidance for operators' accident management activities. Emphasis should be placed on identifying commendable practices of regulatory bodies that support enhanced onsite accident management response and decision-making by the operators. The task group will:

- Act as a focal point for the timely and efficient exchange of information on the activities of national regulatory authorities related to changes to onsite accident management requirements, regulatory guidance, and oversight activities.
- Identify commendable practices that are being implemented to address lessons learnt as a result of the Fukushima Dai-ichi nuclear power plant accident in the area of accident management.
- Identify areas and issues, and associated priorities that would benefit from in-depth evaluation or research.
- Identify short-term and long-term follow-on activities, and associated priorities for the task group, and make recommendations for activities that may be better conducted under the mandate of current CNRA, CSNI, and CRPPH working groups.

The first constitutive meeting of the TGAM was held in October 2012 at the OECD Headquarters in Paris, France. The primary timeframe for the TGAM as an ad hoc institution was scheduled by the CNRA for approximately two years. It is planed to meet periodically, typically twice or three times per year. The first expected outcome is an initial report to be prepared by the task group. The report will build on the existing bases for accident management capabilities and procedures to respond to accidents affecting a NPP and what should be considered as an accident progresses to a severe accident. It is anticipated to include the identification of commendable practices of regulatory bodies in this field. The initial report is expected to be provided to the CNRA for review and approval in December 2013. Further milestones and outcomes for additional work of the TGAM will be discussed with the CNRA during periodic updates in June and December 2013.

Implications and objectives of the BfS participation

BMU shares the assessment of the NEA that accident management is a very important topic to address lessons being learnt from the Fukushima Dai-ichi accident. Therefore, since the beginning of the TGAM, a representative of BfS as well as one of GRS has been nominated as full member of the task group by BMU. The overall purpose is to participate in the international cooperation in accident management issues, to exchange information, and to follow the new developments in accident management discussed on the basis of the ex-

periences from Fukushima. This includes, among others, the consideration of spent fuel pools, accidents in multi-unit facilities, shutdown reactors and long-term accidents. Within the framework of the international discussions concerning accidents and accident management, the main target for BfS is to bring in the respective German approach, namely to keep in mind that priority should be assigned to preventive arrangements while ensuring an appropriate balance with mitigative arrangements. Therefore, the BfS member is engaged mainly in the subgroup of the TGAM which concentrates on overall topics as the definition of an “Integrated Accident Management” and overarching goals and objectives.

The TGAM has recently started work and no results have been published yet. At the moment (date march 2013), the work is concentrated on preparing the initial report. A survey has been developed as a data gathering pool for the purpose of identifying commendable practices. The aim is to provide the initial report to CNRA for review and approval in December 2013. The report will be published. The outcome of the discussions and the results of the report will be integrated in the work of BfS, e.g. in supporting the BMU in its federal oversight or in its other international cooperation duties in this area, at least in the enhancement of the knowledge base of both BfS and BMU. Furthermore, the commendable practices identified may be provided to the competent licensing and supervisory *Länder* authorities and be incorporated in their work.

WGFCS - Working Group on Fuel Cycle Safety

E. Westermeier

Objective and scope

The Working Group on Fuel Cycle Safety (WGFCS) is one of the seven sub-committees of the Committee on the Safety of Nuclear Installations (CSNI) at the OECD/NEA. It was founded in 1972.

The main object of the Working Group on Fuel Cycle Safety (WGFCS) is to advance the understanding of relevant aspects of nuclear fuel cycle safety in member countries. In pursuit of these goals, the working group:

- Constitutes a forum for exchange of information and experience of activities related to nuclear fuel cycle safety in member countries.
- Encourages and supports WGFCS member countries to contribute frequently and regularly to the FINAS by their reports. In case of an event of common interest, the working group will organise a specific forum to share lessons-learned and promote their implementation.
- Indicates where further research and analysis is needed and denote priority actions to be undertaken. The WGFCS will prepare technical reviews of work in all phases of the nuclear fuel cycle where such reports are needed for further development. In doing so, care will be taken to avoid duplication of effort or scope with other CSNI working groups, or with other international bodies.

Implications and objectives of the BfS participation

The WGFCS meets once a year for two days mostly at the NEA or the OECD Headquarters in Paris, France. Twenty countries and six international organisations are members of the WGFCS. Recent topics of the WGFCS are the safety assessment of these facilities, the aging management, the long-term storage of radioactive waste and the criticality safety in Fuel Cycle Facilities. In meetings and workshops the WGFCS group informs and discusses these topics and, as a result of these consolations, the group gives recommendations and submits a report.

BfS is a full member of this working group since 1993. The purpose is to participate in the international cooperation and present the German approach in each safety related topic. Another purpose is to learn and take advantage from international experience in this field. This requires active participation in the Working Group, e.g. by information, presentations and discussion about safety related events. The results and the lessons learned are integrated in the work of BfS and were supporting the BMU needs.

FIRE - Fire Incidents Records Exchange Project

H.P. Berg

Objective and scope

OECD FIRE is a database project in the frame of the Working Group on Risk Assessment (WGRISK) and is one of the eight permanent Working Groups of the Committee on Nuclear Regulatory Activities (CNSI).

The project was formally launched in January 2003, starting with nine countries. In the current third phase of the database project 12 countries are participating.

The main purpose of the project is to encourage multilateral cooperation in the collection and analysis of data relating to fire events. The objectives of the OECD/NEA Fire Project are:

- to collect fire event experiences (by international exchange) in an appropriate format in a quality-assured and consistent database;
- to collect and analyse fire events over the long-term so as to better understand such events and their causes, and to encourage their prevention;
- to generate qualitative insights into the root causes of fire events in order to derive approaches or mechanisms for their prevention and to mitigate their consequences;
- to establish a mechanism for efficient operation feedback on fire event experience including the development of policies of prevention, such as indicators for risk-informed and performance-based inspections;
- to record characteristics of fire events in order to facilitate fire risk analysis, including quantification of fire frequencies.

Coding guidelines and a quality assurance manual have been developed and validated by the project's participants. The project participants have set up structures within their country to collect and validate data for the project, which is now widely seen as the reference international database for fire events.

After having established the project quality guidelines and the quality-assurance procedure, data acquisition has proceeded according to plan. An updated version of the database is provided to all participants every year. Currently, the event database contains 415 fire events. Two meetings of the project steering body are held each year with the NEA's support.

Implications and objectives of the BfS participation

BfS has been a full member of this working group since 1993, nominated by the OECD. The purpose is to participate in this international cooperation and to learn and take advantage from the open exchange between the members of OECD FIRE. This requires active participation in the working group, e.g., by information, presentations and discussions. Experiences of BfS in using the OECD FIRE Database resulted in improvements of the coding guideline and in the enhancement of a user friendly database. Currently, BfS leads the elaboration of a Topical Report on Event Combinations of Fires and Other Events to be completed in 2014.

WGIAGE Task Group on HEAF

H.P. Berg

Objective and scope

The OECD FIRE project has indicated that more than 10 % of the fire events are HEAF induced fire events. Therefore, OECD FIRE proposed an activity aimed to share experience between NEA member countries on high energy arcing faults (HEAF). The goal of the activity is to develop deterministic correlations to predict damage and to establish a set of input data and boundary conditions for more detailed modelling. In that context, the Task Force should identify needs for possible experiments/testing to achieve these goals.

The proposal was endorsed by the CSNI Integrity and Ageing working group (IAGE), one of the eight permanent Working Groups of the Committee on Nuclear Regulatory Activities (CNSI).

The kick-off meeting for this activity started in May 2009, the Task Force finalised its report in 2012 after six meetings. The submission of the report to the CSNI is foreseen for the CSNI meeting in June 2013.

Implications and objectives of the BfS participation

BfS as a member of the project steering body of OECD FIRE (see below) has also be nominated by the OECD for the Task Force because of the experiences with applying the OECD FIRE Database for several purposes. One BfS application have been transformer fires where in most cases high energy arcing faults were the leading cause for these types of fires. BfS has, in particular, provided its experience (www.intechopen.com/articles/show/title/investigation-of-high-energy-arcing-fault-events-in-nuclear-power-plants) and supported the review of the report.

PRISME Project

H.P. Berg

Objective and scope

OECD PRISME is an Experimental Project in the frame of the Committee on the Safety of Nuclear Installations (CNSI).

The PRISME project consists of a series of fire and smoke propagation tests in a dedicated facility at the French *Institut de radioprotection et de sûreté nucléaire* (IRSN) centre at Cadarache. The facility is used to investigate room-to-room heat and smoke propagation, the effect of network ventilation and the resulting thermal stresses to sensitive safety equipment of such room configurations.

The project aims to provide such critical information as the time that elapses before target equipment malfunctions and to qualify computer codes modelling heat and smoke propagation phenomena. The objective is to answer questions concerning smoke and heat propagation inside an installation, by means of experiments tailored for code validation purposes. In particular, the project aims to provide answers to the following questions:

- What is, for a given fire scenario, the failure time for equipment situated in the nearby rooms that communicate with the fire room by the ventilation network and/or by a door (which is open before the fire or opens during the fire)?
- Is it valid to assume that no propagation occurs beyond the second room from the fire room when the rooms communicate through doors and beyond the first room when rooms communicate only by the ventilation network?
- What are the safety consequences of the damper or door failing to close, or of an intervention delay which is too long?
- What is the best way to operate the ventilation network in order to limit pressure-driven phenomena and releases to nearby rooms?
- Is it the admission damper closing following fire detection? Is it the extraction damper closing when the temperature threshold of filters has been reached or when the filters are plugged?

The results obtained were used as a basis for qualifying fire codes (either simplified zone model codes or computerised fluid dynamics codes used in the fire safety analysis of nuclear installations and plants). After qualification, these codes could be applied for simulating other fire propagation scenarios in various room configurations with a good degree of confidence. The information will be useful for designers in order to select the best fire protection strategy. For the operators, this data could be useful for establishing the suitable operation of the plant, such as the operation of the ventilation network (e.g. closing dampers to reduce the ventilation flow rate or to stop the ventilation) in case of a fire.

Several propagation modes have been studied in the first phase of this project from January 2006 to June 2011: through a door; along a ventilation duct that crosses the room containing the fire and that ventilates an adjacent room; along a ventilation duct when flow is reversed within; and through leakages between several rooms.

The PRISME 2 project is a follow-up of the PRISME project, scheduled from July 2011 to June 2016 and will address some of the outstanding safety issues particularly with respect to the appreciable uncertainties that currently exist in risk assessments for nuclear power plants due to gaps in knowledge and modelling capabilities on fire growth and propagation, on fire extinction phenomena, on the prediction of damage to equipment and on the treatment of plant and operator response to a fire event. The PRISME 2 project will also provide valuable information on outstanding questions with respect to fire probabilistic safety assessments, in partic-

ular regarding how heat and smoke propagate from one room to another and the impact of smoke on safety critical systems.

Two meetings of the project are held each year.

Implications and objectives of the BfS participation

BfS has been a member of this project group since 2006, nominated by the OECD. The purpose is to participate in this international cooperation and to learn and take advantage from the open exchange between the members of OECD FIRE. This requires active participation in the working group, e.g., by information and discussions on required fire scenarios for a realistic modelling of fires. Therefore, the experimental project is supported by a further working group, in the first phase called Benchmarking Group, now Analytical Working Group. BfS is also member of these working groups.

HEAF Project

H.P. Berg

Objective and scope

As a result of the Task Force of HEAF the OECD HEAF project has been established in 2012 and had its third meeting in November 2013. Two meetings of the project are held each year.

This experimental project will be performed by USNRC as an OECD International Testing Program for High Energy Arc Faults (HEAF) called Joan of ARC (Joint Analysis of Arc Faults), the other participants in the project provide equipment such as switchgears for the tests and perform evaluations of the results. Currently, Canada, France, Japan, Korea and Germany will provide components for the experiments. The different instrumentation that is envisioned to be used and the theoretical test set up are determined, first pre-tests are performed and the draft test plan has been developed that will evaluate conditions that may influence failure characteristics and advance the understanding of physical dynamics of HEAFs. The experimental programme will start in the second half of 2013 and is scheduled until the end of 2014, the evaluation of the experiments will last longer. It is not yet decided if a second series of experiments with transformers will be performed afterwards.

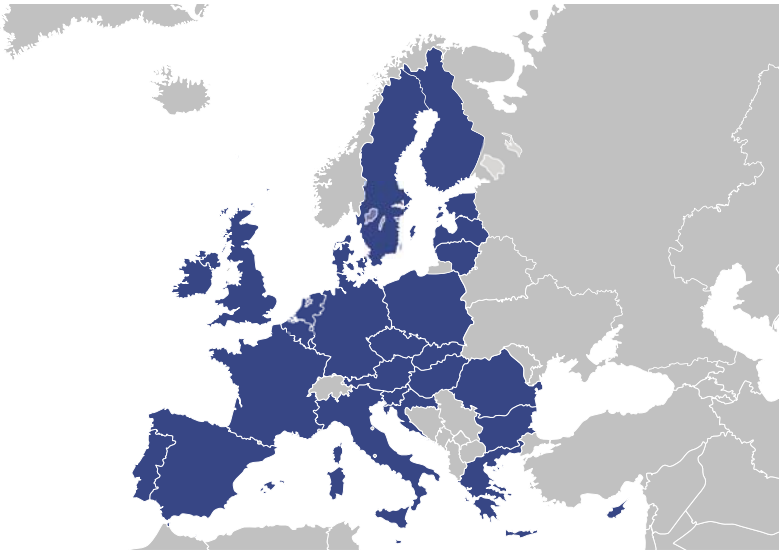
Implications and objectives of the BfS participation

All members of the Task Force of HEAF including BfS are now members of the OECD HEAF project. The main task is to participate in the discussions the experimental programme and to draw conclusions from the results with respect to improvements of the safety level of the nuclear power plants and work safety.

I.6 EU / EURATOM

The EURATOM Treaty

Within the growing European Community with currently 28 member states, cooperation in radiation protection gains importance. A look into the past however reveals that it has already a long history. The foundation was laid by establishing the European Atomic Energy Community (EAEC or Euratom) in the treaty of 1957, signed by Belgium, France, Germany, Italy, Luxembourg and the Netherlands. Although other communities were merged in 1993 and 2009, the nuclear programme has maintained a legally distinct nature from the European Union.



source: Wikimedia Commons, author: Kolja21, license CC BY 3.0

EURATOM article 31

K. Gehrcke

Objective of the Group of experts (GoE) established according to Article 31 of the EURATOM-Treaty

It is laid down in Article 31 of the Treaty establishing the European Atomic Energy Community that a Group of scientific experts shall be attached to the Commission and shall have advisory status. The 'Article 31 Group of Experts' advises the Commission on all questions regarding the establishment of basic safety standards for the protection of the health of workers and the general public against dangers arising from ionising radiation in accordance with Article 31 of the Euratom Treaty. It assists the Commission in the preparation of legislation or in policy definition. Moreover, the Treaty itself requires the Commission to consult the Group when revising and supplementing the basic standards for the protection of workers and the general public against the dangers arising from ionising radiation. Thus, when putting forward proposals concerning the basic standards, the Commission convenes the Group so that it may formally obtain an expert opinion to enable it to guide its decisions and make the requisite choices. Such decisions are collectively given by the Group whose members, each being appointed on a personal basis, speak on their own behalf and act independently of all external influence.

The Commission may convene the Group not only on the occasions specifically laid down in the Treaty, but also whenever it considers such action to be necessary.

The GoE is regularly invited to give its views on current problems of radiation protection, for example on measures with regard to food, feed and cosmetics imported into the EU after the Fukushima accident.

One of the most important tasks of the past years was the contribution of the GoE to the development of the new Euratom Basic Safety Standards Directive, forming the basis for a uniform protection of the health of workers and the general public within the European Union in the future.

Euratom Basic Safety Standards Directive (EBSS)

Euratom is bound by the Treaty to establish uniform basic safety standards.

There are at present five Euratom directives addressing different radiation protection issues defined as basic safety standards in the Euratom Treaty. As these issues have developed over a long period of time, there are inevitably quite a few inconsistencies and a need to recast the standards in order

- to introduce the necessary subject-matter amendments in order to respond to the latest scientific data and operational experience,

- to clarify the requirements and to ensure coherence within the body of European legislation,
- to ensure coherence with the international recommendations,
- to cover the whole range of exposure situations and categories of exposure.

The recast of the five radiation protection directives, which has recently been finalised, yields a voluminous single Euratom Basic Safety Standards Directive, with over 100 articles and numerous annexes which has to be transposed by the EU Member States into national legislation after coming into force.

BfS staff has been involved in the recast process by giving scientific advice, sharing operational experience or commenting on numerous versions of the draft directive.

EURATOM article 35 and 36 - reporting to the European Commission on environmental radioactivity

J. Peter

Objectives

According to article 35 and article 36 of the EURATOM treaty the radioactivity in the environment has to be measured and reported,

- **Art.35: „**Each Member State shall establish the facilities necessary to carry out continuous monitoring of the level of radioactivity in the air, water and soil and to ensure compliance with the basic standards"
- **Art.36:** "The appropriate authorities shall periodically communicate information on the checks referred to in Article 35 to the Commission so that it is kept informed of the level of radioactivity to which the public is exposed."

For practical reasons the measurements in soil are replaced by measurements in milk, which was a good indicator of soil contamination at least in the past decades. For Germany, the BfS is responsible for collecting all the relevant measurement values for radioactivity in air, water, milk and diet. Results are published by the European Commission in a series of reports entitled "Environmental Radioactivity in the European Community".

Impact on the work of the BfS - The REM database

In October 1987 it was decided to establish the REM database (Radioactivity Environmental Monitoring) to store and provide all measurement data starting from 1 January 1984. The database server is maintained by the European Joint Research Centre (JRC) in Ispra, Italy.

German reporting on environmental radioactivity to the EC is closely connected to national reporting. The main part of data is taken from the IMIS database and transferred to the server at Ispra by a client programme provided by the JRC.

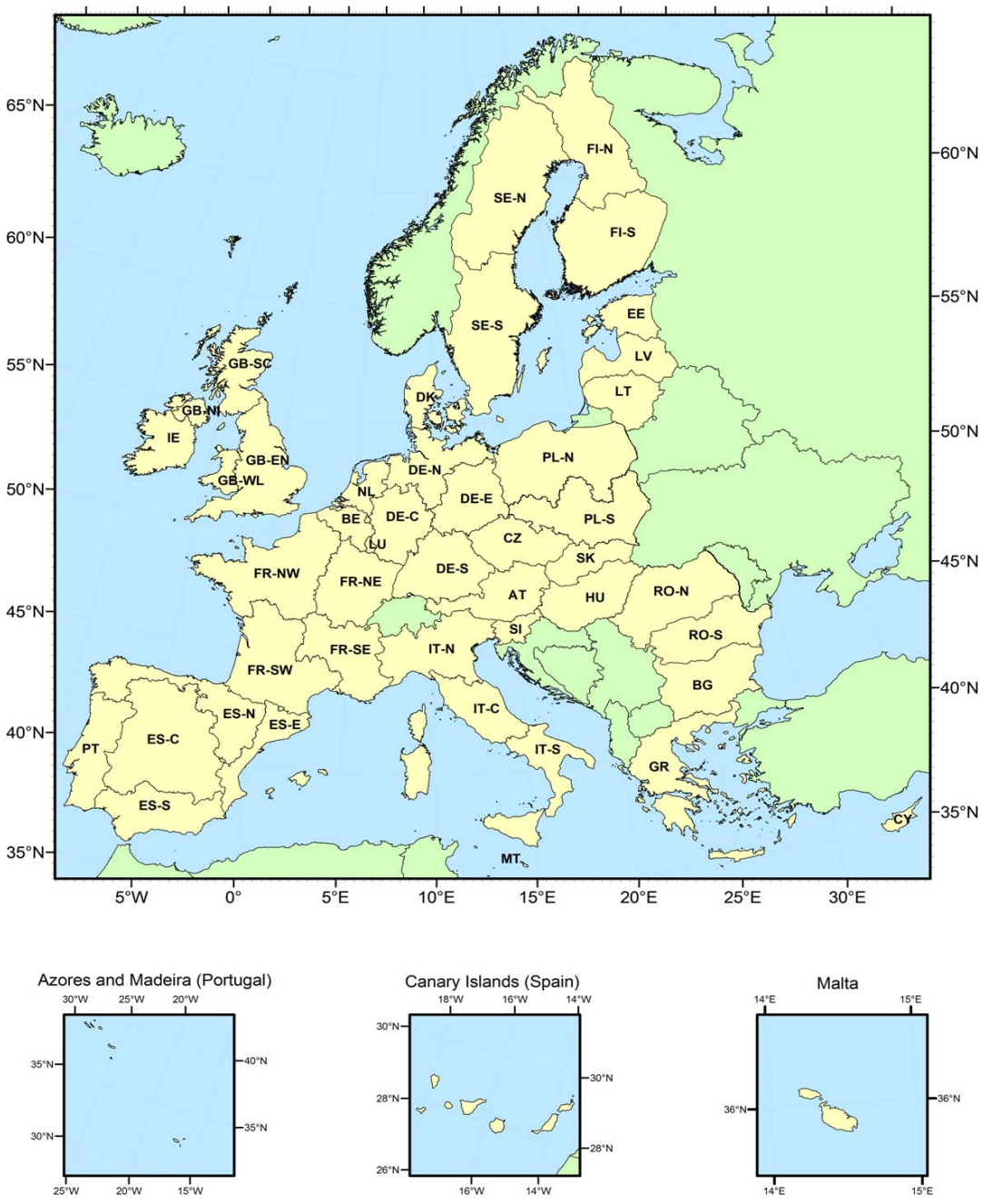
As the time and effort for the editorial staff at the JRC increased excessively due to the increased number of member states, quality assurance and control have to be assigned to the member states, i.e. in the case of Germany to the BfS.

Results - Reports on „Radioactivity Environmental Monitoring"

A report on "Environmental Radioactivity in the European Community" has been published for every year,up to now in print or on CD. Due to the changing structure of the EU and staff limitations in the past few years, reports were often published with a delay of some years. In future, reports will be publicly available on the internet.

For the purpose of data aggregation and presentation, Germany is divided into four regions:

- Germany-North (DE-N), including the Länder Bremen, Hamburg, Mecklenburg-Vorpommern, Niedersachsen und Schleswig-Holstein;
- Germany-Central (DE-C) consisting of Hessen, Nordrhein-Westfalen, Rheinland-Pfalz und Saarland;
- Germany-South (DE-S) including Baden-Württemberg and Bayern plus
- Germany-East (DE-E) consisting of Berlin, Brandenburg, Sachsen, Sachsen-Anhalt and Thüringen.



By courtesy of JRC, European Commission, „Reports on Radiactivity in the European Community“

Figure: Definition of geographical regions for the purpose of reporting on environmental radioactivity (DENSE NETWORK)

For each region, the commission provides quarterly averages of important nuclides in air, milk and mixed diet, given that reporting levels are exceeded. This so called DENSE NETWORK also provides yearly averages, monthly maximum values, as well as the numbers of samples, and sample locations.

Opposed to the DENSE NETWORK which by averaging should give an overview of the radiological situation, the SPARSE NETWORK is intended to indicate and present time trends. At selected measurement points, monthly averages are being taken with lower detection limits compared to the DENSE NETWORK. For example in the time series of Cs-137 in air the accidents in Chernobyl and Fukushima can be clearly identified.

Several problems have emerged during the rapid growth of the union:

- Diversity of data has increased significantly (measurement methods, data management)
- Size of member-states varies largely (e. g. Malta vs. Germany)
- Means of data storage and retrieval differ (manual entry vs. automatic database).

Some measures to deal with these challenges have already been taken.

- A software tool (REM Data Submission Tool) was created for both manual entry or automatic submission of data to the REM database
- A work group was founded where aims and problems of reporting are discussed.

Establishing a work group

As the biennial meetings of representatives on the topic „Article 35/36 EURATOM“ have grown to more than forty participants, detailed technical discussions are no longer possible. For this reason, a smaller work group has been established with each of the members representing several countries of the EU. The BfS representative thus speaks for Germany, Poland, Lithuania, Latvia, and Estonia. The work group meets twice a year.

Important topics are the future direction of reporting in the EU („dose calculation or environmental monitoring“), review of monitored media (currently air, surface water, drinking water, milk and mixed diet) and providing easy access data to the European population.

Future strategies

Although many aspects of the development of European radioactivity monitoring and reporting still have to be discussed, some issues appear to have been settled by now, i.e.:

- Quality control and quality assurance have to be taken over completely by the member states
- Data transfer should be automated
- Creation of reports out of the REM database should be automated

It is expected that the amount of information on environmental radioactivity available on a European scale will increase and will possibly replace national reporting in the future. The BfS is determined to play an active role in this process.

A compilation of reports published up to now can be found at

http://www.bfs.de/en/bfs/publikationen/berichte/umweltradioaktivitaet/eu_bericht.html

EURATOM article 37

B. Rehs

Objective and scope of Article 37 of the EURATOM-Treaty

Due to their radioactive releases, nuclear facilities may have an impact on the neighbouring countries. Therefore, Article 37 of the EURATOM-Treaty requires that each Member State is to inform the European Commission about any plan for the disposal of radioactive waste. In this context, a plan is a licence which regulates the releases by air or water and the disposal from the installation of solid radioactive waste for normal operation. For each plan such General Data are to be provided as will make it possible to determine whether the implementation of such plan is liable to result in the radioactive contamination of water, soil or airspace of another Member State. The General Data also comprise information on relevant accidents as analysed in the licence procedure. Details about the data that must be provided are summarised in the Commission Recommendation of 11 October 2010 (2010/635/Euratom). Only after the Commission – after consulting the group of experts - delivered its opinion such disposal may be authorized by the competent authority of the Member State concerned.

Implications and objectives of the BfS participation

In Germany, the General Data are provided to the European Commission by the BMU. Since 1999, the BfS gives support on this task. BfS coordinates and governs the content of the General Data to be submitted. Therefore, BfS is evaluating the documents submitted by operator and licencing authority to BMU in order to fulfil the obligations of Article 37 of the EURATOM-Treaty.

The Group of Experts examines the General Data and advises the Commission. The members of the Group are appointed for a term of five years, renewable, by the Scientific and Technical Committee. The Group of Experts meets regularly and also gives advice how to improve and develop the Commission Recommendations regarding Article 37 of the EURATOM-Treaty. Until November 2011, BfS was appointed as a personal member to this Group of Experts.

ECURIE - European Community Urgent Radiological Information Exchange

C. Höbler

ECURIE and the aim of BfS involvement

ECURIE is the European system for alerting of EU and other European States and for the urgent exchange of information in the event of a radiological emergency or for a secure way to distribute *ECURIE Advisory* messages. The legal basis of the system is the Council Decision 87/600/Euratom, which lays down the requirements for the exchange of information within the EU in a radiological emergency situation.

It is the responsibility of the National Competent Authorities (NCA) to determine whether to activate the ECURIE arrangements and that the Commission, other ECURIE States and the IAEA should be alerted. The ECURIE and USIE ("Unified System for Information Exchange in Incidents and Emergencies" of the IAEA) systems are interconnected.
The National Contact Point (NCP) receives the first alert and is required to respond to the alert within 30 minutes at all times but cannot enter new data in the system.

In Germany the department RS II 5 of the BMU is an NCA, the Emergency Centre of BBK works as an NCP .

The BfS is responsible for supporting the BMU and collecting in a timely manner all important emergency information with the IMIS (Integrated Measuring and Information System) and RODOS (Realtime Online Decision Support System) systems and distributing this information by the ELAN (Electronic Situation Display) system. This requires the technical management of national emergency information workflows and the development of the technical information interfaces from the IMIS/ELAN to the ECURIE and USIE systems.

RSII5 is responsible as "First ECURIE Correspondent" for decisions concerning the ECURIE arrangements. The BMU is not able to specify technical requirements and inclusions for the international information exchange of ECURIE with IMIS/ELAN. It was decided that the section SW2.2 should support this work as "2. ECURIE Correspondent". This section is a member of the joint EU working group of ECURIE and EURDEP (EEWG). The working programme includes the interfacing to the USIE system of the IAEA.

It is a part of the IMIS development to know and harmonise the requirements of the international information exchange continuously. One subject is to maintain the development of international concepts and standards for best work with the German regulations and national systems.

Results of cooperation

Since almost 15 years, SW2.2 has supported the EC and the JRC to migrate the international concepts and systems ECURIE and EURDEP. It was successful in a way that

- the concept of the web-based ECURIE and USIE systems are similar to the German ELAN,
- SW2.2 was able to contribute a lot of enhancements to the international ECURIE and EURDEP developments and
- the technical conditions were increased to an international standard IRIX ("International Radiation Information Exchange" V1.0 web-service standard of IAEA).

The BfS is maintaining the IRIX development. SW2.2 was involved in the international working group for communication as result of the action plan of IAEA from 2005.

The German systems now have conditions for an easy and correct interfacing to send or receive international data and information.

Influences on BfS tasks

The department SW2 "Emergency Response" needs quick and direct access to emergency information from all national and international sources. This access is important to fulfil the requirements for creating situation

reports for disaster scenarios, which is the important function of the department SW2.
The national KOALA developments of the IMIS systems are strongly coupled to the technological standards of the international systems at EU and IAEA. The cooperation in the EEWG and the influences on the international workflows were essential for the further development of IMIS and were, on the other hand, very helpful for the international communication concepts.
The knowledge of, and discussion with colleagues of foreign authorities was very useful to increase the efficiency of the BfS workflows in emergency response.

As one result of participation in ECURIE the BfS was able to build the future IMIS system in the way to have an operational implementation of IRIX services for automatic exchange of emergency information with all NCAs directly and over ECURIE and USIE.

I.7 HERCA - Heads of European Radiological protection Competent Authorities

HERCA (*Heads of European Radiological protection Competent Authorities*) is a voluntary association in which the Heads of Radiation Protection Authorities in Europe work together in order to identify common issues and propose practical solutions for these issues. HERCA is working on topics generally covered by provisions of the EURATOM Treaty. The programme of work of HERCA is based on common interest in significant regulatory issues.

The goal of HERCA is to contribute to a high level of radiological protection throughout Europe. In order to achieve this goal, the association has established and maintained a European network of chief radiation protection regulatory authorities, with the definite wish to involve all such regulatory authorities, throughout Europe.

HERCA consists of a *Board of Heads* and *topical working groups*. The Board of Heads is the highest decision-making body of HERCA. It is composed of national representatives appointed by the corresponding radiation protection authority. The topical working groups are composed of experts from the different Radiation Protection Authorities.

Working Group “Medical Applications”

J. Griebel

Objectives

The *Working Group “Medical Applications”* covers all radiation protection issues arising from medical applications of ionising radiation for diagnosis and therapy. The objective is on harmonizing the implementation of radiation protection regulation on medical applications in Europe. Current topics of the working group in which BfS/BMU is especially engaged are:

- exposure of asymptomatic individuals,
- stakeholder involvement of CT manufacturers.

The BfS representative is co-chair of the *Working Group “Medical Applications”* and chair of the *Work Package “Stakeholder Involvement of CT Manufacturers”*.

Results

One important result was the publication of a “Position Paper on Screening“, which was approved by the Board of Heads of HERCA at its 9th meeting on 31 May 2012. In this position paper, which was prepared by the representatives of Germany (BfS) and UK (HPA), the importance is outlined to clearly distinguish between an officially approved screening programme, such as breast cancer screening programmes using X-ray mammography, and radiological procedures as part of an individual health assessment. From a regulator’s perspective, the paper highlights special requirements for the latter and addresses the impact on the work of radiation protection authorities in Europe.

A further important outcome refers to Work Package “Stakeholder Involvement of CT Manufacturers”. Upon the initiative of HERCA, COCIR CT manufacturers have developed voluntary commitments contributing to the reduction of CT dose, which have been welcomed by HERCA. COCIR is the trade association representing

the medical imaging, electromedical and healthcare IT industry in Europe. In a press release from 09 January 2012, both HERCA and COCIR underlined the importance of the voluntary commitments of the CT manufacturers as a promising step towards furthering the common goal of CT patient dose optimisation. The aim is to offer patients maximal benefits from the industry's cutting-edge medical technologies, whilst minimising their radiation exposure.

Impact on the work of BfS

The Engagement of BfS/BMU in HERCA offers the great potential

- to identify – at a very early stage - important developments in the area of medical radiation protection in Europe,
- to exchange ideas and experiences, avoiding unnecessary duplication of work and learning from one another's best practices,
- to develop a common approach to radiation protection in Europe and a way it is transposed into regulation, and
- to take part in the discussion and, where appropriate, expression of a consensus opinion on significant regulatory issues.

Thus, the engagement in HERCA has a strong impact on both the conceptual and the practical work of BfS in medical radiation protection. Hereby, further upcoming hot-topic issues are:

- concerning the recast of the medical device directives, its potential impact on level 2 justification in the field of new technologies, and
- concerning referral guidelines and the development of clinical decision support systems, the potential impact on level 3 justification, in particular with respect to the role and responsibility of the radiological practitioner.

HERCA WG 1: European radiation passbook & outside workers

G. Frasch

The Working Group on European Radiation Passbook and Outside Workers of HERCA (the Heads of European Radiological Protection Competent Authorities) developed a harmonised European Radiation Passbook and a guidance document. This radiation passbook is a model template, recommended to be used in the EU Member States, either paper based or electronically in a national data system for the individual monitoring of outside workers. The terminology used is coherent with the new EURATOM BSS. The content of the passbook shall be printed in the respective national language plus in English. It is laid out to provide all information necessary to attain access to a controlled area in a Member State. It contains mandatory data fields (in black colour) for the information required in every Member State and optional data fields (in grey colour) for information that may only be necessary in an individual but not in all Member States. The radiation passbook consists of eight sections:

- details of the radiation worker,
- issuing details of the radiation passbook,
- general information (for foreign undertakings and depending on the nationality of the outside workers employer),
- current employer,
- medical surveillance,
- official dose record up to the radiation passbook issue date,
- operational dose in the undertaking's controlled area(s),
- information regarding training in radiological protection.

In addition to the radiation passbook template, a guidance document is provided to support the implementation and practical use of the passbook. This document addresses regulatory bodies, the employer of the outside worker and the undertaking of the foreign controlled area. It includes

- the responsibilities of employer and undertaking regarding the radiological protection of outside workers against the risk of ionising radiation,
- aspects to be fixed by contractual agreement between employer and undertaking regarding the employment of an outside worker,
- roles of employer and undertaking regarding the radiation passbook,
- purpose and implementation of a radiation passbook,
- medium used for the radiation passbook,
- who should be given a radiation passbook,
- language and terminology,
- issuing body of the radiation passbook,
- procedure for issuing the radiation passbook, and
- data to include in the radiation passbook.

The European Radiation Passbook provides a harmonised format, terminology and data structure for all EU Member States. FENETRAP \tEuropean Network on Education and Training in Radiation Protectionurthermore it allows the Member States to document additional, country-specific information. As it is both harmonised for international use within the EU and flexible for national specifics it is of very practical value for internationally working itinerant workers. HERCA encourages also non-European countries to make use of this radiation passbook template.

HERCA has also launched a pilot project with the perspective to develop a radiation passbook information system based on electronic data exchange between EU Member States.

Working Group “Non-medical Sources and Practices”

A. Schmitt-Hannig

Objectives

The HERCA Working Group on Non-Medical Sources & Practices covers all radiation protection issues concerning the justification and optimisation of non-medical applications of ionising radiation. The focus of the WG is on the harmonisation of radiation protection regulation and practices in Europe especially concerning justification and optimisation processes.

The Working Group is currently working on the following topics:

- lamps containing radioactive material (information paper to be produced)
- portable X-ray technologies, possibly through an information/ position paper
- consideration of the continued justification of gamma blood irradiators
- justification processes within participating countries
- discussion of topics which may need actions for harmonisation with regard to requirements of the draft Euratom Basic Safety Standards

Results

Previous achievements by this working group include the publication of the following statements:

c) HERCA press release on Interim Statement about the regulatory status of small amounts of radioactive substances added to lamps

d) HERCA statement on the justification of full body-scanners using X-rays for security purposes

Impact on the work of BfS

The engagement of BfS, together with BMU, in this HERCA Working Group offers the potential

- to identify important developments in the area of justification and optimisation of non-medical applications of ionising radiation in Europe which may need actions for harmonisation;
- to exchange ideas and experiences, avoiding unnecessary duplication of work and learning from approa-

ches to best practices already developed by others,

- to develop a common approach to radiation protection in Europe and means to harmonise efforts, where necessary, and express consensus opinions on significant regulatory issues.

Thus, the engagement in HERCA has a strong impact on the conceptual and practical work at BfS and BMU with regard to justification and optimisation of non-medical applications of ionising radiation.

Task Force “Education and Training in Radiation Protection”

A. Schmitt-Hannig

Objectives

Radiation protection training and education (E&T) has been of utmost interest to HERCA from the beginning of the Association. Nevertheless, the topic was recognised as beeing covered by the ongoing programme - sponsored by the European Commission it was agreed not to duplicate this effort.

HERCA‘s Interest in E&T activities was expressed at the occasion of the most recent HERCA meetings, in particular in the activities of ENETRAP following previous contacts from this consortium.

In a context where

- the legal framework in which the recognition of Radiation Protection Experts (RPEs) & Radiation Protection Officers (RPO) will be embedded, as described in the revised draft of the Euratom Basic Safety Standards, will require clear guidance to the Member States;
- the final requirements for RPE and RPO in the future Directive are still under discussion;
- where there is, in some European countries, only one training scheme for the qualified expert while in others a double level system already exists;
- the harmonisation, whenever possible, of the requirements for education and training (E&T) of persons in charge of tasks in radiation protection is of importance for HERCA participating authorities if the mutual recognition of persons who wish to work abroad is aimed at,

the Board of Heads of HERCA approved on its 10th Meeting (30-31/10/2012) to set up a Task Force (TF) on Education & Training in Radiation Protection (TF E&T-RP). In carrying out its activities, special attention should be paid not to duplicate the work already done by others, rather the TF should take advantage of it. In this sense, the TF should take advantage of the work already carried out by ENETRAP & EUTERP. The conclusions of the TF will be presented at the 12th HERCA meeting end of 2013.

The mandate given to this TF includes activities such as

- investigating what others have done or are doing, take advantage of this work and build on it;
- in no way duplicate or substitute activities or systems that have been formally attributed to other organisations or institutions such as the IAEA, WHO or EC, but act in a complementary way, with the aim of reaching maximum mutual benefits;
- taking into account the advice of EUTERP and the results of the ENETRAP projects;
- following the discussions in the Atomic Questions Group on the RPE and RPO and taking into account the results of this discussions and the final version in the new Directive;
- identifying among the work that has already been carried out parts that can be recommended to implement by HERCA members and others where more flexibility is needed. This could serve as a guideline for national administrations, bearing in mind that the possibilities for harmonisation are different for RPE’s, RPO’s and workers.

Impact to the work of BfS

The engagement of BfS together with BMU in this HERCA TF offers the potential

- to identify important developments in activities related to education and training in radiation protection in Europe which may need actions for harmonisation;
- to exchange ideas and experiences, avoiding unnecessary duplication of work and learning from approaches to best practices already developed by others,

- to develop a common approach to education and training in radiation protection in Europe and means to harmonise efforts, where necessary.

Thus, the engagement in this HERCA TF has a strong impact on conceptual and practical work of BfS and BMU with regard to education and training in radiation protection.

WG Emergencies - Working Group on Emergencies

J. Lieser

Objectives

The working group started in 2011 with a two-year mandate concerning accidents happening at more remote sites, considering the Fukushima accident and accidents originating from within the boundaries of the HERCA member countries.

Results

In the meantime, the following results have been achieved:

- Recommendations to European authorities and delegations in case of a nuclear accident far away from Europe,
- Minimum emergency kit for embassies,
- Analysis of how particular decisions of EU authorities were perceived in Japan,
- Relevant public reactions and behaviour with regard to regulatory decisions.

A joint working group with Western European Nuclear Regulators Association (WENRA) for identification of key players and operational mechanisms was established.

This joint working group is discussing strategies for a harmonized approach.

This work is based on a new concept, called “top-down approach”, for decision making in different countries. This concept means not to harmonise the limits, which seems not to be achievable, but to trust the country where the accident occurred (“accident country”) and to make decisions similar to those made by that country, especially in the early phase. A joint second opinion by several other countries (which were not affected) could be an additional option.

To achieve this, a network of experts is necessary, which shall be established within the European countries with a platform for communication and information exchange.

I.8 Other Cooperations

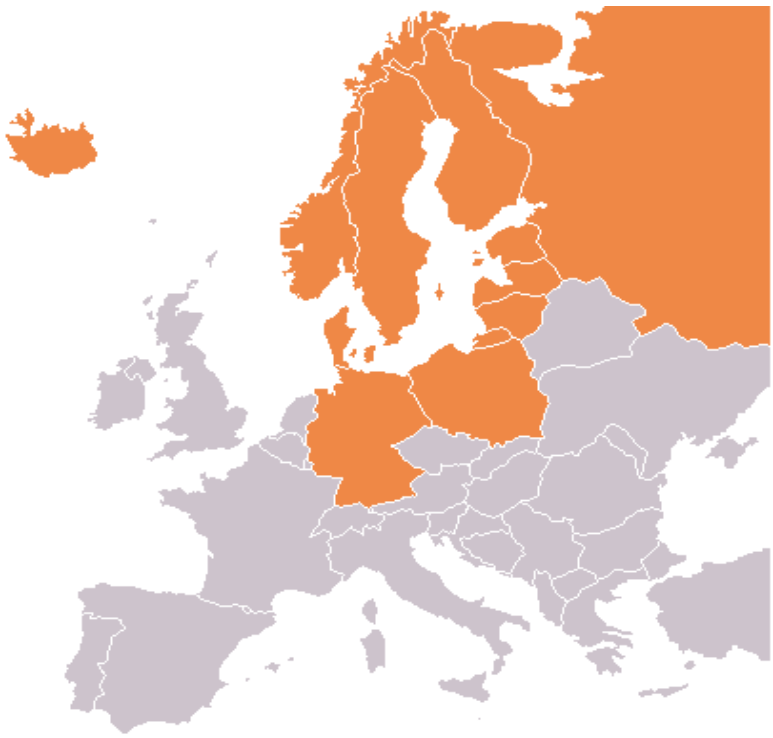
There are some other cooperations, which are neither part of activities within the European Community nor in the framework of international organisations. This includes bilateral cooperations and projects with selected countries e.g. Austria, Switzerland, France or the Czech Republic. Most often, these cooperations take place on a representative level of ministries and BfS staff is consulted as needed.

This chapter also includes cooperations with organisations consisting of members with special concerns like the Council of the Baltic Sea States.

CTBTO - Comprehensive Nuclear-Test-Ban Treaty Organization

C. Schlosser

The Provisional Technical Secretariat (PTS) of the Preparatory Commission (PrepCom) for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) has the task to implement, maintain, operate and further develop in cooperation with the State Signatories the verification regime to monitor for nuclear explosions. This verification regime consists of the global International Monitoring System (IMS), the International Data Centre (IDC) in Vienna as well as provisions for On-Site Inspection (OSI). The radionuclide component with



source: Wikimedia Commons
author Paolos, license CC BY-SA 3.0

detection and analysis of specific radionuclides is an essential part of this verification regime. The detection of fission products can be used to clearly identify a nuclear test. The radionuclide monitoring network is built up with 80 stations to detect particulate bound radioactivity. Forty of these stations will also be equipped with systems to detect radioactive Xenon. Measurements of radioactive Xenon isotopes are of great importance as they allow the detection of underground nuclear tests. From underground tests only very volatile elements, like noble gases, have a good chance to escape from the explosion cavity to the atmosphere. In Germany the responsibility for this treaty and related tasks is up to the Foreign Ministry.

With its expertise in the field of radionuclide monitoring the BfS has supported and advised the PTS and the Foreign Ministry in a multifaceted way since the ratification of this treaty by Germany in 1998 and even before during the treaty negotiations in Geneva. Within the expert meetings (Working Group B) at the CTBTO in Vienna radionuclide experts from the BfS are as advisers member of the German delegation.

One major task of the BfS is it‘s responsibility for the reliable and continuous operation of the Radionuclide Station 33 (RN33) at Mountain Schauinsland near Freiburg as part of the International Monitoring System (IMS) according to the requirements of the treaty. RN 33 is equipped with the particulate system RASA and the noble gas system SPALAX. With its experience the BfS has made contributions to optimise the station performance and operation.

The BfS is in charge of analyses and assessment of the data from the radionuclide network. It provides advice to the National Data Center (NDC, Federal Institute for Geosciences and Natural Resources in Hannover) and the Foreign Ministry in all questions related to the radionuclide techniques and detections, e.g. after the explosions from possible nuclear weapon tests of the Democratic People's Republic of Korea (DPRK) in 2006, 2009 and 2013.

The BfS, as part of the IMS, made substantial contributions to the development of noble gas techniques to ensure reliable applications to the verification system and installation of the noble gas network. This engagement mainly started with hosting, operating and supervising the intercomparison exercise of 4 noble gas systems from Sweden, France, Russia and the USA at the BfS in Freiburg 1999-2002. This was the hour of birth of the “International Noble Gas Experiment” (INGE), a cooperation of many international institutions with the BfS as one of the leading ones. The outcome of this group fundamentally contributes to the acceptance of the noble gas technologies as verification tool by the State Signatories. As a result app. 75% of the noble gas network is now installed and 30 % of the stations have been certified by now.

With its noble gas laboratory the BfS supports the PTS in the development and implementation of a quality assurance system for noble gases. Because of its world wide acknowledged expertise in noble gas monitor-

ing, the BfS noble gas laboratory was chosen as a “support laboratory” for the PTS. The development of methods to produce traceable and certified standards for radioxenon activity concentrations is a major task in this cooperation.

Other tasks of the BfS are working on, and supporting of, the PTS with the characterisation of the global radioxenon background, the development of methods to discriminate between radionuclide signatures from civil sources against nuclear tests and data interpretation. New reliable methods have to be developed and tested for being in compliance with the high requirements of the CTBT. One major finding of the studies was the influence of radiopharmaceutical isotope production on the global radioxenon background. The four major isotope production facilities release more radioxenon into the atmosphere than 400 nuclear power plants. This has an influence on the background level and detection capabilities on both hemispheres. In close cooperation with the operating companies of isotope production facilities discussions and efforts are on the way to lower this releases and thereby the radioxenon background in the atmosphere.

On Site inspections require corresponding mobile radionuclide techniques. In this field the BfS supports the OSI division with the provision of staff and equipment for exercises.

According to the Treaty the data and products from the CTBTO are not open to the public. BfS strongly supports the use of the IMS data for civil and scientific applications. The nuclear power plant disaster in Fukusima in 2011 clearly illustrated the relevance of the monitoring data for nuclear emergency response and information of the public about possible health and safety aspects. The IMS of the CBTO is the only global network for radionuclide monitoring and gave a world wide view on the radioactivity levels in ground level air. It’s an essential supplement of the national network data and information. It allowed prognoses about the dispersion of the radioactive cloud and the expected radioactivity and health impacts far away from the source. Therefore it was decided to use a limited set of data after the Fuskushima event for a limited time, among the State Signatories a highly controversial discussed issue.

EGNRS – Expert Group on Nuclear and Radiation Safety - of the Council of the Baltic Sea States

E. Wirth

The Expert Group on Nuclear and Radiation Safety (EGNRS) of the Council of the Baltic Sea States (CBSS) is a forum, established in 1992, for exchange of information and coordination of efforts to enhance and strengthen nuclear and radiation safety in the region. The national nominated participants in the EGNRS mainly have their expertise knowledge in the field of radiation protection, nuclear safety and radiological emergency planning. For strengthening the radiation safety in the Baltic sea area, the EGNRS put special effort on cooperation in a variety of different fields. The Group addressed especially problems in emergency preparedness, potential terrorist events involving radioactive material and illicit trafficking. Concrete common projects concern the exchange of monitoring data and information, regional agreement on assistance and exercises on nuclear and radiological preparedness. National reports on major nuclear and radiation safety issues in the CBSS member states are presented and discussed in each meeting. The BfS operates the central server for the exchange of environmental monitoring data of the Baltic Sea States. As member of CBSS, the Ministry for Foreign Affairs attaches importance on an active role of Germany in this permanent working group. For the BfS it is a very welcome opportunity for a stronger cooperation with neighbouring states in the Baltic sea region.

OSPAR - Convention for the Protection of the Marine Environment of the North-East Atlantic

C. Strobl, A. Heckel, I. Krol

source: Wikimedia Commons
author: Eric Gaba license:CC BY-SA 2.5

Background and aim

The international cooperation for the protection of the Marine Environment of the North East Atlantic is based since the early 1970ies on the Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft (Oslo 1972) and the Convention for the Prevention of Marine Pollution from Land-Based Sources (Paris 1974). Both conventions were replaced by the Convention for the Protection of the Marine Environment of the North-East Atlantic (Oslo-Paris-Convention, OSPAR) which came into force 25 March 1998. This convention

- defines the precautionary principle, the “polluter pays” principle and the conceptions of the best available technology as well as the best environmental practice;
- establishes them as guiding principles;
- enables the adoption of recommendations and binding decisions requiring a legally binding national implementation and
- allows regionally adapted measures.

Additionally the convention binds the contracting parties to take all measures to prevent and to remove pollutions. Therefore the contracting parties have to take all necessary steps in order to protect both the marine environment from negative impacts of human activities and the human health, to preserve the marine ecological systems and, if possible, to restore affected marine zones. In 1998 and 1999 the OSPAR-Commission – the highest body one representative of each signatory state belongs to – resolved upon political objectives and guidelines for the implementation of the convention in the form of strategies to hazardous substances, to radioactive substances, to the combating of eutrophication, to the biological diversity as well as to environmental targets and to management mechanisms of offshore activities.

A new strategy in the field of radioactive substances in the North East Atlantic was adopted at the ministerial meeting of the OSPAR-Commission in Sintra (Portugal) in July 1998 . Accordingly the contracting parties have to ensure that discharges, emissions and losses of radioactive substances will be reduced until 2020 in such a way, that increases of concentrations of discharges, emissions and losses which are above the existing concentrations, are close to zero for artificial radioactive substances and near background levels for naturally occurring radioactive substances.

This strategy forms the working basis for a corresponding committee, whereby each committee has the possibility to build ad hoc-working groups, if necessary.

In the case of radioactive substances the technical work takes place in the “Radioactive Substances Committee (RSC)” which develops special programmes and measures in order to:

- prevent and remove pollutions in the marine environment caused by anthropogenic discharges of radioactive substances including waste and
- reduce or eliminate radioactive discharges in the marine environment by using the best available technology.

The results and decisions of the committees are directly reported to the OSPAR-Commission and are principally binding to the OSPAR signatory states after discussion and adoption at the annual meeting of the OSPAR-Commission.

Results

Report of radioactive discharges from nuclear installations

In Germany the discharges from nuclear installations are reported to the responsible licensing authorities by the operators after specification by kind and activity due to legal regulations, assessment and documentation of the radioactive discharges in quarterly and annual reports. Furthermore the reported data is verified in the responsible guidance offices for airborne and liquid discharges of the Federal Office for Radiation Protection; also the radiation exposure caused by the airborne and liquid radioactive discharges in the surrounding of each German nuclear installation is calculated and reported to the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and to the European Commission. Additionally the annual discharges of radioactive substances into OSPAR-regions are reported to RSC, and the compliance and implementation of PARCOM Recommendation 91/4 is documented every four years in a national report. In this report the contracting partners have to provide information not only about the discharges but also about the techniques used for retention in nuclear installations and about the degree of retention.

Report of radioactive discharges from gas- and oil-industry

Discharges of naturally occurring radioactive substances of the gas platform A6-A, which are annually detected since 2008, are reported to OSPAR.

Report of radioactive discharges from nuclear medical installations

A reporting obligation relating to discharged activities from nuclear medicine installations or diffuse inputs by patients released from hospitals, which could reach the North East Atlantic by river systems, does not exsist in Germany at the moment.

Impact on the work of Federal Office for Radiation Protection

Due to the missing reporting obligation relating to discharged activities from nuclear medicine installations or diffuse inputs by patients released from hospitals, a theoretical and experimental estimation of the input of radioactive substances by nuclear medicine applications into OSPAR-regions actually takes place within the framework of a research programme financed by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)

Nuclear Forensics International Technical Working Group

E. Kröger

Aim

The Working Group „Defence Against Nuclear Hazards“ (AG-NGA) has been involved in the Nuclear Forensics International Technical Working Group (ITWG) on a yearly basis since 2007.

The objective of the ITWG is to advance the scientific discipline of nuclear forensics and to provide a common approach and effective technical solutions to competent national or international authorities that request assistance (www.nf-itwg.org). AG-NGA supports this work in a variety of ways, including sharing best practice in the form of presentations and documents (for example on radiological crime scene management) and by contributing to written documents (through the ITWG Guidelines Task Group).

In addition, the ITWG provides a forum through which AG-NGA can gain insight into subtopics of international importance within nuclear forensics and learn about how other countries responded to events involving nuclear or other radioactive material out of regulatory control. ITWG provides a link to international partners that are also involved in the technical side of nuclear forensics. The work of AG-NGA within the ITWG plays an important role in keeping these communication links open.

Results

Contributions in the form of presentations have been well received in the past, resulting in intensified information exchange.

Drafting and finalising documents within the ITWG Guidelines Task Group (at the yearly meetings and via e-mail throughout the year) allow AG-NGA to share best practice with the international technical community for nuclear forensics. Selected guidelines will become the basis for future IAEA-documents and for this reason it is important to be able to contribute to the drafting of the ITWG-guidelines.

Implementation of Results

The insight gained by AG-NGA at the ITWG is shared with the BMU. In the event that concrete knowledge or skills gaps are identified on this topic, AG-NGA will evaluate the necessity for further training, improved written procedures or procurement for the improvement of the defence against nuclear hazards at BfS.

ANCHORS - UAV-Assisted Ad Hoc Networks for Crisis Management and Hostile Environment Sensing

J.T. Eisheh

Objective

The binational Franco-German research project ANCHORS aims at creating a swarm of "Unmanned Aerial Vehicles" (UAV) which can autonomously detect and map a radiation field and establish a communication infrastructure in case of a nuclear incident or a terrorist act.

ANCHORS is jointly financed by the German Federal Ministry of Education and Research (BMBF) and the French Research Agency ANR (Agence Nationale de la Recherche). A time period of three years is scheduled for the completion of the project. A prototype of the system ("early demonstrator") will be presented 18 months after the onset. The research is conducted by a consortium of industrial enterprises, research institutions and end users. While the enterprises and research institutions primarily contribute to the technical development, the end user focus on defining scenarios and requirements to create a system that best suits their needs.

The ANCHORS consortium appointed two coodinators: the fire department of Dortmund (FDDO) looks after the German members and the Commissariat à l'Energie Atomique et aux Energies Alternatives (CEA) looks after the French members. The consortium itself consists of 16 members. The members of the consortium have -among other capabilities- relevant expertise in building and operating remote controlled vehicles in strong radiation fields, building drones and radiation sensors and hardening equipment against radiation.

Four parts have to be developed for the final system: (1) the UAVs and the software for swarm control, (2) the unmanned ground vehicle (UGV) which will be used by the UAVs as starting or landing place, (3) the communication infrastructure, (4) the radiological sensor. Additionally the final report of ANCHORS will contain the legal opinion regarding the use of drones by fire department and other emergency service personnel.

The UAVs will be designed to act autonomously and will be hardened against radiation. The control software of the UAVs will utilize sensor data in real time to adjust flight paths and search patterns. Additionally the drones will have the capability to set up a communication network via WLAN or LTE. The mobile base station (UGV) will be the take-off and landing place for the swarm of UAVs. The recharging and decontamination of the drones will be performed at the UGV as well.

The drones will be equipped with a sensor, especially designed to operate during flight. Weighing less than 800g, it must operate with the power supply of the drone for at least 15 minutes. In addition, the sensor has to be sufficiently shock resistant to survive flying and landing while recording data. It will allow to reliably measure dose-rates from normal ambient rate up to 1 Sv/h and will be capable of nuclide identification of typical radioisotopes for the scenarios considered. In order to link the geo-location data of the drone to the dose rate measurements the sensor has to operate with a fast enough repetition rate.

Impact on the work of the BfS

The motivation for the German Federal Office for Radiation Protection (BfS) to take part in the project is mainly based on the expectation that the sensor equipped drone will deliver a fast and reliable means of reconnaissance in case of (serious) nuclear incidents or terrorist acts. ANCHORS is also considered helpful during accidents with highly radioactive sources and is expected to improve the cooperation within the Federal Unit for the Defence against Nuclear Hazards ("ZUB") in which BfS works together with Federal Police (BPOL) and Federal Criminal Police Office (BKA).

The BfS as an associated partner is involved in scenario development, evaluation of sensor requirements, deployment strategies and quality assurance of measurement data. While working with the project, BfS personnel will offer advice and experience on the use of measurement devices, analyses of data obtained and experience in cooperation of radiation protection with specialists of police, fire department and other emergency service.

WENRA - Western European Nuclear Regulators´ Association

The Western European Nuclear Regulators´ Association (WENRA) is a network of Chief Regulators of EU countries with nuclear power plants (15 members) and Switzerland as well as of other interested European countries which have been granted observer status.

The main objectives of WENRA are to develop a common approach to nuclear safety, to provide an independent capability to examine nuclear safety in applicant countries and to be a network of chief nuclear safety regulators in Europe exchanging experience and discussing significant safety issues. One result of the WENRA activities was the definition of so-called reactor safety reference levels which shall be fulfilled by the EU countries.

WENRA Subgroup T1 „Natural hazards“

M. Krauß

Objective and scope of the WENRA Subgroup T1 „Natural hazards“

WENRA has founded on 31.03.2013 a subgroup T1 with the goal to derive reference levels on natural hazards. The subgroup consists of the members from WENRA countries. Germany is represented by a member from BMU, a member from GRS and a member from BfS. An additional goal is to elaborate a general guidance document for all natural hazards and three separate specific guidance documents for the hazards earthquake, flooding and extreme weather.

Implications and objectives of the BfS Participation

GRS and BMU made the first draft of the reference levels, which served as a basis for discussions in the subgroup meetings. For the elaboration of the three specific guidance documents three small groups were created. Germany has taken the leading part in writing the first draft of the guidance document on extreme weather conditions. BfS, together with BMU, has sent the first draft of this document to all other members for review and comments and this document will be discussed on the next subgroup meeting. Also BfS will review and comment on the other two guidance documents on earthquake and flooding, provided by the other groups.

Once the subgroup has finished all the documents, the final drafts will be sent for discussion to the RHWG (Reactor Safety Harmonization Working Group). Questions and comments will be sent back to our subgroup and after the RHWG is content with the documents, they will be issued as WENRA Reference Levels, which need to be realized in the national body of rules and regulation of each WENRA member country. For Germany and BMU as the responsible institution, BfS can be of great value in providing support due to the expertise and knowledge gained in the process of working on the creation of the reference levels.

WENRA TF SCS - Task Force Safety Critical Software

F. Seidel

Objective and Scope of TF SCS

It is widely accepted that the assessment of software cannot be limited to verification and testing of the end product, i.e. the computer code. Other factors such as the quality of the processes and methods for specifying, designing and coding have an important impact on the implementation. Existing standards provide limited guidance on the regulatory and safety assessment of these factors. An undesirable consequence of this situation is that the licensing approaches taken by nuclear safety authorities and by technical support organisations are determined independently with only limited informal technical co-ordination and information exchange. It was thus felt necessary to compare the respective licensing approaches, to identify where a consensus already exists, and to see how greater consistency and more mutual acceptance could be introduced into current practices.

The reached consensus was formulated within the report “*Common position of nuclear regulators for the licensing of safety critical software for nuclear reactors (EUR 19265)*”; the first revision was published in May 2000 under the umbrella of the European Nuclear Reactor Working Group (NRWG), followed by a revision which was completed at the invitation of the Western European Nuclear Regulators’ Association (WENRA) in 2007. In addition, the 2010 version contains the position on software based smart sensors and actuators. The recent Revision 2013 considers the comments of U.S. NRC experts and contains updated common positions

about e.g. safety demonstration, software development tools, formal methods, software diversity assessment, smart sensors and actuators as well as precautions to perform inspection tasks; see http://nbn-resolving.de/urn:nbn:de:0221-2013022210309.

Implications and objectives of the BfS participation

The major result of the work is the identification of consensus and common technical positions on a set of important licensing issues raised by the design and operation of software based systems used in nuclear power plants for the implementation of safety functions. The Task Force report is intended to be useful also for related German nuclear regulations: – to coordinate regulators' and safety experts' technical viewpoints in licensing practices, or design and revision of guidelines; – as a reference in safety demonstration for software based systems.

Supporting BMU, BfS is obliged to consider state of the art safety principles and safety aspects of new technologies applied in nuclear power plants. Being represented in various national and international regulatory bodies, BfS uses – as an important source of knowledge - - the gained Task Force results to revise and amend the regulatory framework associated to instrumentation and control; e.g. related national KTA rules, technical DKE standards and DIN guidelines as well as the related international IAEA safety guides and IEC standards.

CGC - Czech-German-Commission

A. Lau

Objectives and scope

The "Agreement between the government of the Federal Republic of Germany and the government of the Czech and Slovakian Federal Republic for arrangement of questions of mutual interest regarding nuclear safety and radiation protection" came into force in 1990.

In connection with this agreement an "Exchange of notes between the Federal Republic of Germany and the Czech Republic regarding the extension of validity of the agreements between the government of the Federal Republic of Germany and the government of the Czech and Slovakian Federal Republic" took place in 1992/1993.

Based on these agreements, the Federal Republic of Germany and the Czech Republic decided to establish the Czech-German-Commission with the intention to foster the bilateral contacts in the field of nuclear safety and mutual exchange of information on operation of nuclear facilities in 1990.

The first meeting of the CGC held in March 1995 in Prague and the last (17th) meeting took place in October 2013 in Prague.

Regular topics of the meetings are the following:

- new developments in nuclear legislation and organisational matters of the regulatory body,
- cross-border information exchange related to actual events in Czech/German NPPs,
- operational experience with NPPs: recent events and general trends,
- status of Czech and German energy suppliers ČEZ/EON regarding operational matters,
- upgrade of information on Environmental Impact Assessment (EIA) process for Temelin NPP, and
- developments regarding management of nuclear waste and spent fuel.

Implications and objectives of the BfS participation

The German participants are the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), the Federal Office for Radiation Protection (BfS), the regulatory authority of the neighbouring countries (Bundesländer) Bavaria and Saxony and the Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) mbH as a Technical Safety Organisation (TSO) of the BMU.

The BfS has taken an active part in the meetings since 2007, providing an overview of nuclear regulatory issues and main developments in Germany, information on reportable events of German NPPs on the INES Scale and information on licensing and supervisory issues. A copy of the regularly updated document "Nuclear Regulatory Issues and Main Developments in Germany"

http://www.bfs.de/en/kerntechnik/papiere/Reg_Issues_Developments.html (prepared by BfS) will be delivered to the Czech delegation.

Within this framework the BfS also manages projects to render assistance to the BMU in fostering bilateral contacts in the field of nuclear safety and mutual exchange of information on operation of nuclear facilities and in particular to assess safety aspects of the Czech NPP Temelin.

Risk Communication and Storage of Data and Biological Material (cooperation with NIRS, Japan)

B. Grosche

Background and objective

The BfS and the National Institute for Radiological Sciences (NIRS), Japan have cooperated since the late 1990s . One starting point of this cooperation was the mutual interest in storage of data and biological material, which was reflected by the fact that Dr. Shin Saigusa from NIRS was member of the Advisory Board of the two respective EU-funded projects ERA-PRO and STORE which were coordinated by theBfS.

During the author‘s visits to the NIRS, risk communication was considered as another point of mutual interest.

An additional relevant topic which needs further development in the future is collaboration in the field of biological dosimetry.

Results

Storage

With respect to storage of data and biological material and next to the fact that Dr. Saigusa was member of the Advisory Board to ERA-PRO and STORE, NIRS and BfS organised a joint International Workshop on Research Applications of the Radiobiology Archives which was held in Chiba (Japan) on 24 July 2007.

Within the ERA database, information on animal experiments conducted in Japan could be incorporated.

Risk communication

- The results of the German case-control study on childhood cancer near nuclear installations (KiKK-Study) raised great concern in Japan. Thus, the author was invited to present the results of the KiKK-Study to relevant bodies in Japan.
- After the Fukushima accident, the author cooperated with the German Embassy for two weeks. During this time, the close cooperation with NIRS during the past few years helped getting insights into ongoing activities in Japan which could not be gained otherwise.
- NIRS conducted an International Symposium in collaboration with IAEA entitled “Tackle the Challenges: Low Dose Radiation Effect on Human Body”, Chiba, 22 December 2012. The author was invited to give the opening lecture on possible health effects following the accident. The information he gave was used by NIRS for risk communication.

Biological dosimetry

The Fukushima accident, as well as the establishment of an international network of laboratories involved in biological dosimetry pointed to the necessity to intensify collaboration. Thus, a member of the NIRS will visit the BfS in October 2013 to discuss further progress in cooperation.

Impact to the work of BfS

The close link to NIRS resulted in the draft of a Memorandum of Understanding which was shortly before signature a few days before the Fukushima accident. The accident overruled everything, and the MoU, therefore, has not been signed yet.

The cooperation with NIRS allowed to get better or earlier insights into regulatory developments in Japan following the Fukushima accident. Further, the link to NIRS can often be used as a shortcut when seeking information.

With respect to storage, the link to NIRS helped getting access to other relevant institutions in Japan, e.g. the Institute for Environmental Sciences in Rokkasho, Japan. It is envisaged to include information on animal experiments from this institute into STORE as well as the data from the Japanese Thorotrast Study.

With respect to risk communication, the collaboration should be intensified. The same applies for biological dosimetry. These two topics are of relevance in particular against the background of the Fukushima accident.

NATO Exercise Biological Dosimetry

H. Romm

Objective

Whenever a person may have been exposed to significant levels of ionising radiation, it is important to estimate the dose received to determine any short- or long-term health implications and provide the evidence base for counselling. The cytogenetic laboratory of BfS is appreciated as a reference laboratory by the WHO, as it has long-term biodosimetry experience, practical knowledge in international inter-comparisons, as well as through the establishment of the European network.

In contrast to the typical scenario of a radiation incident that affects only a few individuals, rapid tools are required in the case of large-scale accidental exposure or deliberate radiation exposure to (1) help identify the few severely exposed individuals who may require clinical monitoring and treatment and (2) reassure the many ''worried-well'', to prevent them from overwhelming emergency responders and healthcare infrastructure. Therefore, the focus shifts with increasing number of potential casualties from utmost accuracy, sensitivity and specificity to large capacity and rapid delivery of test results. Consequently, the characteristics of the ideal biodosimeter for rapid triage differ significantly from those for individual dose assessment and pose major challenges for the cytogenetic assays with their slow turn-around times and low throughput.

The NATO exercise of biological dosimetry in 2011 was organised under the umbrella of the NATO Research Task Group RTG-033 ''Radiation Bioeffects and Countermeasures''. It was limited to ex vivo uniformly irradiated blood to simulate acute whole body exposure. Several dimensions were added by (1) comparing established (dicentric chromosome assay,DCA; cytokinesis-block micronucleus assay, CBMN) as well emerging assays (gene expression, γ-H2AX foci) and one assay (H-module) dealing with estimates of haematological damage and not exposure (dose estimate), (2) allowing for both manual and automated scoring, (3) testing how the number of scored cells affects dose estimates and (4) by timing the delivery of dose estimates.

The BfS participated successfully with three assays (DCA, CBMN, γ H2AX foci) and was task leader of the CBMN assay. The participation in an international biodosimetry network is of great importance in order to be prepared for a major radiation accident. One single laboratory would be quickly overwhelmed in a large scale accident and needs therefore the mutual assistance of other service laboratories.

Results

It was the goal of the NATO exercise to compare laboratories performance in dose assessments using established (DCA and CBMN) and emerging assays (gene expression and γ-H2AX) for triage mode biodosimetry. Ten whole blood samples were irradiated within the dose range of 0 to 6.4 Gy and shipped blind coded by overnight courier to the partners. Earliest report times for dose estimations using molecular (gene expression or γ -H2AX foci) assays were 0.3 days, the cytogenetic assays (DCA, CBMN) reported at 2.4 (DCA) or 4 (CBMN) days respectively considering the culture time needed.

Surprisingly, all assays showed a similar 3-fold interlaboratory variation in the accuracy of dose estimates. This finding demonstrates that, in addition to the fixed intrinsic accuracy of an assay, each assay's ''real world'' performance also depends very much on the expertise of the laboratory performing the assay.

The results obtained suggest a significant 2–3-fold higher accuracy of dose estimates generated by the DCA assay in comparison to the other assays including the CBMN assay. Concomitantly, fewer reported dose estimates were observed outside the 0.5 Gy interval for the DCA assay compared to the other assays. Both, manual and automated scoring of DCA and CBMN gave comparable results. All assays showed an upper limit of applicability below the highest blind dose of 6.4 Gy, which was systematically underestimated by all assays.

Binary categories of dose estimates could be discriminated with equal efficiency for all assays, but at doses >1.5 Gy a 10% decrease in efficiency was observed for the foci assay, which was still comparable to the CBMN assay. In conclusion, the DCA was confirmed as the gold standard for biodosimetry methods, but in situations where speed and throughput are more important than ultimate accuracy, the emerging rapid molecular assays have the potential to become useful triage tools.

The results of the NATO exercise are published in 5 manuscripts at Radiation Research (Volume 180, online ahead of print: http://www.rrjournal.org/toc/rare/0/0).

Impact on the work of the BfS

In February 1982 the Cytogenetics Laboratory was assigned by decision of the Federal Committee of Nuclear Energy - Radiation to conduct biological dosimetry for the BRD. The results of the collaboration with NATO consortium complements the work at BfS and supports to get prepared in case of a major radiation accident.

I.9 European and International Networks related to Radiation Protection

There is a wide range of organisations, associations and networks supporting and facilitating the implementation of radiation protection requirements laid down in safety standards and directives. Some of these networks have their origin in European projects and continued their work after funding ended. An example is the European ALARA Network (EAN), dealing with optimisation of radiation protection issues, as well as to facilitate the dissemination of good ALARA practices within the European industry, research and medical sectors. As a result of EAN activities and recommendations, the EC funded the medical ALARA Network (EMAN) and the European ALARA Network for Naturally Occurring Radioactive Materials (EAN-NORM), which are today independent organisations. EURADOS, ESOREX and ISOE are some examples of EAN cooperation partners.

IEC (International Electrotechnical Commission), a network of members of National Committees, provides a platform to companies, industries and governments for meeting, discussing and developing the International Standards they require for all electrical, electronic and related technologies.

ISO (International Organization for Standardization) is a network of national standards bodies developing International Standards providing state of the art specifications for products, services and good practice.

BfS is actively involved in these and other European and international networks. Some of the activities are described in more detail on the following pages.

EAN - European ALARA Network

A. Schmitt-Hannig

Objectives

The objectives of the European ALARA Network (EAN) were progressively expanded and updated. Similarly the scope of EAN, originally limited to improving occupational exposure in industry and research only, was expanded; first to include occupational exposure in the medical sector and in the Naturally Occurring Radioactive Materials (NORM) area, and then to other types of exposures. Finally in 2010, the objectives were simplified at the occasion of the renewal of the EAN Terms and Conditions in 2010:

- Promote a wider and more uniform implementation of the ALARA principle for the management of worker, public and patient exposures in all situations,
- Provide a focus and a mechanism for the exchange and dissemination of information from practical ALARA experiences,
- Identify and investigate topical issues of common interest to further improve the implementation of ALARA.

Currently, organisations from 20 countries are represented in the EAN Steering Group: Austria, Belgium, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, the Netherlands, Norway, Portugal, Slovenia, Spain, Sweden, Switzerland and the UK. The Steering Group decides the work programme and planning of the network activities; in particular it takes decisions on:

- The topics for the ALARA Workshops
- The contents of the ALARA Newsletters and EAN Website

- The selection of topical issues or events relevant to European radiation protection practices,
- The selection of topics for establishing sub-networks or working groups,
- The policy for publication or any other form of dissemination of the results of the work of EAN.

Results

From the beginning in 1996, EAN most important events have been the annual workshops devoted to specific topics where it is thought that significant improvements are still possible and may be expected with the aim of sharing experiences, promoting debates and drawing conclusions and recommendations to be widely diffused and disseminated towards relevant stakeholders. Each workshop gives rise to a set of recommendations to the European Commission, to regulatory bodies and to other stakeholders in order to facilitate the practical implementation of ALARA. The workshops were devoted to:

- ALARA and Decommissioning (1997, Saclay, France)
- Good Radiation Protection Practices in Industry and Research (1998, Chilton, UK)
- Managing Internal Exposure (1999, Munich, Germany)
- Management of occupational radiological and non-radiological risks: lessons to be learned (2000, Antwerp, Belgium)
- Industrial Radiography: Improvements in Radiation Protection (2001, Rome, Italy)
- Occupational Exposure Optimisation in the Medical and Radiopharmaceutical sectors (2002, Madrid, Spain)
- Decommissioning of Installations and Site Remediation (2003, Arnhem, The Netherlands)
- Occupational Radiological Protection Control through Inspection and Self-Assessment (2004, Uppsala, Sweden)
- Occupational Exposure to Natural Radiation (2005, Augsburg, Germany)
- Experience and New Developments in Implementing ALARA in Occupational, Public and Patient Exposures (2006, Prague, Czech Republic)
- ALARA in Radioactive Waste Management (2008, Athens, Greece)
- ALARA Issues Arising for Safety and Security of Radiation Sources and Security Screening Devices (2009, Vienna, Austria)
- ALARA in the Medical Sector (2011, Oscarborg Fortress, Norway)
- "ALARA in Existing Exposure Situations" (2012, Dublin, Ireland).

From the beginning, EAN has also published the ALARA Newsletter twice a year to disseminate practical use of ALARA implementation, examples of good practices, lessons learned, workshop conclusions, ALARA information, etc. Feedback from different sources indicates that the newsletters reach several thousand individuals or institutions, mainly in Europe, and that the lessons learned from incidents are among the most interesting information.

A number of surveys were performed, lessons learned were worked out and various documents were elaborated which can be downloaded from the EAN website: http://www.eu-alara.net.

Finally, working groups and sub-networks are beeing established on topics of particular interest. Sub-networks are meant to be sustainable, whereas working groups are created for a limited period of time. In 2005 the European Radioprotection Authorities Network (ERPAN) was set up to deal with operational exchanges on regulation and control activities such as specific inspections and transcription of EC Directives into national regulations. In 2009, a working group on ALARA culture has been set up.

Other results from ALARA workshop recommendations were the initiation of the

- ALARA Network for NORM (EAN_{NORM}) which interconnects groups of experts and provides experiences for the implementation of the ALARA principle in non-nuclear industries (see website: http://www.ean-norm.net) and the
- European Medical ALARA Network (http://www.eman-network.eu).

Impact on the work of BfS

The commitment of BfS in the EAN Network offers the potential

- to identify important activities, approaches and initiatives related to the practical implementation of optimisation in radiation protection in Europe which may need harmonisation and/or further development;
- to exchange ideas and experiences and learning from approaches to best practices already developed by others;
- to develop a common approach to the practical implementation of optimisation in radiation protection in Europe and means to harmonise efforts, where necessary.

Thus, the commitment in EAN has a strong impact on conceptual and practical work of BfS with regard to optimisation in radiation protection.

EMAN - European Medical ALARA Network

A. Schmitt-Hannig

Objectives

The main objective of the EMAN Project was to establish a sustainable network where different stakeholders within the medical sector had the opportunity to discuss and to exchange information relating to the implementation of the ALARA principle in the medical field.

Three specific topics were selected as focus areas for the project:

- computed tomography (CT);
- interventional radiology and
- activities using X-ray equipment outside X-ray departments

In addition, EMAN aims to:

- Disseminate up-to-date information about literature, studies, research, and good practices relating to the ALARA principle in the medical sector,
- Identify and communicate to the EC needs for development and update of European Union (EU) guidance,
- In particular cover the areas of education and training as well as continuous quality improvement as requested in the Directive 97/43 EURATOM,
- Formulate proposals to the EC on harmonisation issues,
- Propose to the EC solutions of identified issues at the European level,
- Establish cooperation with appropriate international organisations and associations.

To fulfil these objectives, EMAN particularly relied on:

- Three working groups, where the three selected topics listed above, were extensively discussed by professionals in the specific medical fields,
- A website to disseminate the information gathered, and the work carried out, by the working groups and to facilitate the exchange of information between the network members,
- A final workshop as a platform to present and discuss the work performed by the network and by the three working groups and to propose recommendations to the EC for improving the optimisation of radiation protection in the medical sector.

Results

The main objective of the EMAN project, i.e. to establish a sustainable network where different stakeholders within the medical sector would have the opportunity to discuss and to exchange information relating to the implementation of the ALARA principle in the medical field, has been successfully achieved. The European Society of Radiology (ESR), the European Federation of Medical Physics Organisations (EFOMP) and the European Federation of Radiographer Societies (EFRS), representing altogether more than 150.000 professionals in the medical sector, have agreed to continue collaboration in medical radiation protection optimisation

within the European Medical ALARA Network in order to sustain and improve the network established under the EC tender project.

The three working groups elaborated reports on the major issues in their area of work, providing recommendations to the European Commission and identifying gaps where further work is needed. These reports can be downloaded from the EMAN website: http://www.eman-network.eu/ as well as the presentations given at the final EMAN Workshop 2012 in Vienna.

Impact on the work of BfS

The commitment of BfS in the EMAN project offers the potential

- to identify important activities, approaches and initiatives related to optimisation in medical radiation protection in Europe which may need harmonisation and/or further development;
- to exchange ideas and experiences and learning from approaches to best practices already developed by others;
- to develop a common approach in optimisation in medical radiation protection in Europe and means to harmonise efforts, where necessary.

Thus, the commitment in the EMAN Project has a strong impact on conceptual and practical work of BfS with regard to optimisation in medial radiation protection.

EAN-NORM - European ALARA Network - Naturally Occurring Radioactive Material

K. Wichterey, B. Hoffmann

The European ALARA Network - NORM (EAN-NORM) was established in 2007 by a German consortium led by the company IAF Radioökologie GmbH and was funded for two years by the European Commission. The aim of this network is the implementation of the ALARA principles in the non-nuclear industry, which is mainly the industry dealing with enhanced concentrations of **n**aturally **o**ccurring **r**adioactive **m**aterial (NORM). Examples are the phosphate and zirconium industry, as well as the oil and gas industry, metal melting etc. The network helps exchange information on regulations, administrative procedures and radiation protection measures, as well as experience between experts from different branches or countries. Therefore, a database and a network of contact points was established at the website www.ean-norm.net.
This internet portal provides online support, including information on contacts, authorities, organisations, events and documents like recommendations and directives, national legislation, decision support and scientific information concerning NORM related topics. Alltogether, the EAN-NORM network consists of more than 200 registered members of authorities, industries and research, and is organised into 44 contact points from 23 countries within Europe.

NORM and its legislation to ensure adequate radiation protection for workers and members of the public are directly connected to the tasks of BfS. The contact and exchange of experience with relevant industries is extremely important as BfS gives advice for responsible persons of authorities and the industry concerning the implementation of legislation and development provisions for dose calculations in specific NORM fields. From the beginning, BfS has contributed to the network by being one of the contact points in Germany and by actively participating in, and giving presentations at the yearly workshops organised to exchange experiences and discuss relevant questions. In order to benefit from the knowledge of the network members, BMU/BfS promoted EAN-NORM through a contract with IAF Radioökologie GmbH from 2009 – 2011.

During that time the international scientific state of the art was analysed and two leaflets were developed for the zirconium industry and the oil and gas industry. These leaflets give support and practical advice for all relevant people dealing with radiation protection of workers in these industries, as well as members of the public from deposition of industrial residues. The cooperation between international partners within EAN-NORM was very helpful for the future work of BfS concerning many practical questions and for those downloading the information from the website. Useful discussions and fruitful contacts are provided by the workshops dealing with current problems in the NORM field organised by IAF Radioökologie or other network partners.

BfS will continue to cooperate with, and actively contribute to the EAN-NORM network and participate in current discussions and future workshops. This is especially important in view of the coming new Basic Safety Standards for radiation protection and its implementation into national law. Following the example of leaflets

for certain NORM industries, BfS is developing similar advice including provisions for dose calculations for other branches.

EURADOS - European Radiation Dosimetry Group

It is the aim of EURADOS to support the scientific understanding and the technical development of methods of dosimetry of ionising radiation in the fields of radiation protection, radio-biology, radio-therapy, and medical diagnostics. This is achieved by cooperation between European institutions, especially from EU countries. BfS is involved in several EURADOS working groups.

EURADOS Working Group 7 „International Dosimetry“

A. Giussani, D. Noßke

The working group "Internal Dosimetry" is subdivided into several subgroups:

- Implementation of new biokinetic models
- Improvement of the DTPA therapy model and the MADOR Code
- Application of Monte Carlo methods for In-vivo monitoring
- Uncertainty studies on internal dose assessments
- Training actions on internal dosimetry
- Microdosimetry of internal emitters

A member of the BfS is the secretary of this working group and another one is head of the subgroup "Implementation of new biokinetic models". The aim of this group is to implement the new biokinetic ICRP OIR models with a quality assurance of the implementation as well as the model formulation by ICRP. Another very important aim of this subgroup is to give guidance how to use these more complex models for individual dose assessment. BfS is also involved in the improvement of the DTPA therapy model, in uncertainty studies, training, and was involved in the development of the IDEAS Guidelines for incorporation monitoring.

EURADOS Working Group 10 “Retrospective Dosimetry”

H. Romm

Objective

The European Radiation Dosimetry Group (EURADOS) is a network of more than 50 European institutions and 200 scientists. As a non-profit organisation, EURADOS promotes research and development and European cooperation in the field of the dosimetry of ionising radiation. A network is maintained, which includes experts, reference and research laboratories, and dosimetry services. This enables appropriate specialist groups to be formed in a timely manner to solve problems or promote research identified within EURADOS or upon request from external bodies.

The BfS participates in several subgroups. The WG 10 “Retrospective Dosimetry” will be described in below, which started in 2008. The activity of working group 10 is focused on retrospective dosimetry following acute and prolonged exposure. The working group is open to all groups operating in biological, physical and clinical retrospective dosimetry.

Motivation

To establish a network of contacts and collaborations throughout European laboratories with expertise in the area of physical and biological retrospective dosimetry

Aims of the WG are :

- To establish a multiparameter approach to dose assessment in retrospective dosimetry (including emergency response)

- To disseminate the knowledge about retrospective dosimetry among authorities, scientific institutions and stakeholders
- To evaluate newly developed physical dosimetry methods
- To establish a common approach for uncertainty estimation throughout biological and physical methods of dosimetry
- To elaborate an approach to dosimetry after partial body or internal exposure

Results

A review about biological indicators is published (E. A. Ainsbury et al., Review of retrospective dosimetry techniques for external ionising radiation exposures. Radiation Protection Dosimetry 12/2010; 147(4):573-92).

A survey about current European retrospective dosimetry resources and needs in physical labs in Europe is conducted (Results were presented at EPR-Biodose Conference, Oct. 2010, Mandelieu, France).

An inter-laboratory comparison exercise of physically based methods was organised.

A survey was performed regarding the different methods used to assess uncertainties in retrospective techniques, to identify training needs and to encourage standardisation and harmonisation.

A cooperation with WG 7 “Internal Dosimetry” was started to examine the usefulness and limitations of cytogenetic dosimetry in cases of internal and mixed internal /external exposures.

In Oct. 2012, the BfS and HelmholtzZentrum München organized successfully an international EURADOS Training School on Retrospective Dosimetry - Practical exercises in solid state & cytogenetic dose reconstruction.

Implementation of the results

The WG 10 addresses open questions in biological dosimetry after a radiation exposure. The results obtained by this group so far and the efforts to maintain expert knowledge are highly relevant for the dose assessment of ionising radiation.

The BfS has an interest to address and to improve assays for dose assessment to be prepared in case of a large scale radiation accident. Of ultimate concern is the protection of the general population against ionising radiation.

EURADOS - Working Group 3: Measurement results of gamma ray probes from European monitoring networks in comparison

U. Stöhlker, M. Bleher

As a consequence of the reactor accident in Chernobyl in 1986, most countries in the European Union (EU) installed and are continuously operating environmental radiation monitoring networks. Since more than one decade, the common European data exchange platform (EURDEP) has been established, to which all EU member states are reporting their measurement results on a daily basis under routine conditions. In case of emergency the agreed reporting interval is one hour allowing to follow-up national and trans-boundary effects in almost real-time.

Different types of detectors (Geiger-Mueller counters, proportional counters, scintillating detectors and semi-conductor based detectors with spectroscopic capabilities) are used in European countries. The characteristics of different detector types show large variations even with respect to the most important criteria like for example sensitivity, linearity, energy dependence, self-effect and response to secondary cosmic radiation.

The harmonisation of ambient dose rate measurements in Europe is an important contribution to the quality of the EURDEP data exchange. Therefore, the EURADOS working group on environmental radiation monitoring (WG3) invited the operators of national early warning dosimetry networks in Europe to participate in intercomparison programmes in 1999, 2002, 2006 2008, 2009 and 2012. These intercomparison experiments form the metrological basis to characterise and compare properties of different probe types.

In Summer 2007, the BfS intercalibration facility (INTERCAL) on mount Schauinsland (altitude 1200 m) was established with the aim to perform long-term comparison experiments for up to 20 dose rate probes from dif-

ferent European monitoring networks. INTERCAL was designed to perform exposure experiments with artificial sources and to compare readings from different detector systems taking into account the natural variability of dose rate under real environmental conditions. Exposure experiments were performed In April 2009 and May 2012. The impact of soil moisture was investigated and published in 2010 and currently the impact of increased radon levels on observed dose rate data is under investigation.

Due to recent progress in the development of affordable room-temperature detector materials with medium energy resolution, operators of national ambient gamma dose rate networks in Europe tend to introduce spectrometric detector systems. These types of detectors inherently provide nuclide specific information which is an asset to discriminate natural from anthropogenic radiation and thus leads to increased detection sensitivity of artificial radiation. In addition, nuclide-specific information enables to calculate ground contamination maps in almost real-time which is an important input for decision making, allowing to react faster in cases of nuclear emergencies, thus leading to minimisation of the radiological impact for the population.

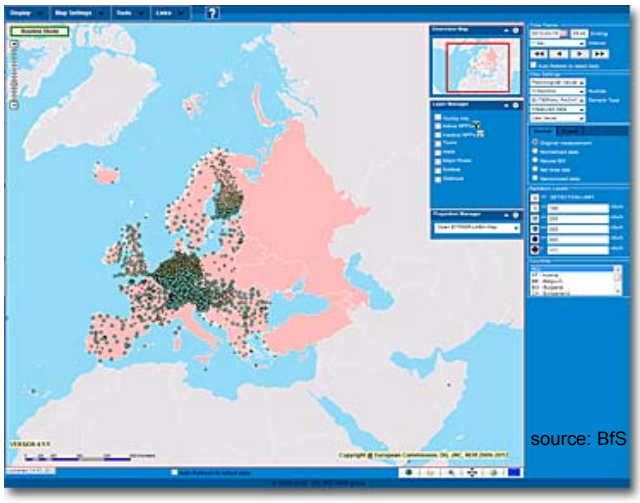
Spectrometric detector systems include different hardware components, i.e. detector, data acquisition system and detector control and stabilization units. Additional challenges are software related: dedicated system internal analysis procedures, data communication techniques, data exchange format and finally procedures for spectrum storage and analysis on central servers of national networks.

Different approaches to design and combine the above mentioned hardware and software components have been reported by manufacturers and network operators in the past. In 2011 the subgroup “spectrometry systems” of the EURADOS working group 3 (WG 3) “environmental dosimetry” was established aimed at exchanging experience in the design and the operation of these systems. In addition one of the goals of this EURADOS subgroup is to formulate mutually agreed standards on the design, calibration and operation of spectrometry systems.

The cooperation between BfS and EURADOS WG3 partners is well established. BfS chairs the subgroup “spectrometry systems” of EURADOS WG3 and contributes with INTERCAL facility reports on a yearly basis to this community.

EURDEP / AIRDOS

P. Bieringer, P. Bossew


source: BfS

EURDEP, or European Radiological Data Exchange Platform, is a system aimed to provide and to share European radiation monitoring data in almost real time, based on fixed monitoring stations. Participation is compulsory for EU Member States (Council Decision 87/600 and Recommendation 2000/473/Euratom) and voluntary for non-EU states. The primary objective is alerting against, and informing about levels of environmental radioactivity in case of nuclear emergencies and events associated with major releases of radioactive substances. Currently (March 2013), non-EU countries participating are CH, HR, IS, NO, RS, RU and TR, while participations of BA, BY, MK and UA are under negotiation. More than 4500 automatic dose rate monitors and almost 200 air monitors (some automatic) are currently connected to the system. The readings are accessible to the public through a web site, https://eurdep.jrc.ec.europa.eu/Basic/Pages/Public/Home/Default.aspx#1 . More information and additional tools are available on a restricted site. Administratively and technically, EURDEP is located at the Joint Research Centre (ITU / REM, Ispra, Italy).

The system is technically challenging in particular on the joint level. Data have to be transmitted and collected in defined formats and protocols, and to be displayed in a useable and interpretable, and user friendly manner. But apart from this, being composed of technically different national, and even regional networks, the joint systems require additional steps of data integration and harmonisation in order that the data be comparable and interpretable on that joint level.

EURDEP workshops are organised by the JRC every year or every two years (the last one in March 2013) where new developments and new features are being discussed, relating to all levels of the system: from in-

novation in monitoring technology (recently e.g. the increased use of spectrometric devices for dose rate monitors) to concepts and methods of data harmonization, and features and tools provided in the joint system, such as data display, download and – currently under development – semi-automatic mapping options. Also organisational and legal questions are addressed at these meetings, relating for example to competences and data copyrights.

Data harmonisation has been acknowledged a demanding task. The AIRDOS project (Evaluation of existing standards of measurement of ambient dose rate; and of sampling, sample preparation and measurement for estimating radioactivity levels in air) has been initiated by the EC in 2004 for this purpose. It resulted in collecting technical information about the different networks and monitors and their statistical evaluation a condition to understanding the system as a whole, and to achieving generation of a harmonised data realm. The process is ongoing, and given continuous progress, is unlikely to be ever completed; for dose rate monitoring it is quite advanced and first harmonisation steps have been implemented. Knowledge and understanding on the joint level and harmonising is still lagging behind for air monitoring, on the other hand. First discussions only started for sampling further types of environmental media. The mentioned recent EURDEP workshop was partly aimed at accelerating progress in these fields, motivated importantly by the experiences after the Fukushima accident, when exchange of relevant monitoring data in Europe turned out sub-optimal.

For technical development EURDEP / AIRDOS has been closely linked to EURADOS (see there), in charge mainly with technical questions of QA and calibration of dose rate monitoring.

German contribution to EURDEP / AIRDOS is vital for a number of reasons. Germany has one of the densest monitoring networks of all participants and given the size of the country therefore contributes to almost half of stations. Technical development is comparatively advanced as to both monitors and data interpretation capacities. Members of the BfS are involved in all fields of developing EURDEP / AIRDOS and one of the mirror servers for the data exchange is operated by BfS.

Given its own large network, Germany depends less on joint monitoring information than smaller countries obviously do. On the other hand, access to joint data certainly improves assessing and possibly predicting the radiological situation also on a national level, and exchanging technical expertise and experience provides chances to optimize one's own capacities. Among the BfS' contributions are workshops on special subjects (e.g. one on advances in off-site gamma dose rate and ground contamination measurements, May 2013, Freiburg) as well as – together with the PTB – organisation of facilities and meetings (INTERCAL) specifically aimed at calibration and QA of dose rate monitoring by different systems.

EURANOS - European approach to nuclear and radiological emergency management and rehabilitation strategies

F. Gering

The EU research project EURANOS was finished in 2009 after more than five years of work. More than 50 organisations in Europe working in the field of radiological emergency management contributed to this project, the Federal Office for Radiation Protection (BfS) was one of the main partners in the project (for example member of the management committee).

Main achievements of this project are:

- comprehensive handbooks and compendia about measures to reduce the exposure after a radiological emergency in inhabited and agricultural areas,
- essential improvement of the operational applicability of the RODOS system (for example a completely redesigned version, which will replace the version currently being in use in the RODOS centre at BfS),
- new and tested concept for stakeholder involvement in planning and management of radiological and nuclear emergencies.

As a follow-up of the project the international cooperation in the field of emergency management is being continued:

- within the international RODOS Users Group (which is being chaired by the BfS)
- within the "European Platform on Preparedness for Nuclear and Radiological Emergency Response and Recovery" NERIS.

ESOREX Platform Project
European Studies of Occupational Radiation Exposure

G. Frasch

On behalf or the European Commission, the French Institute de Radioprotection et de Sûreté nucléaire (IRSN) executes the ESOREX Platform Project. The 3-years project starts in 2013 and is guided by an international steering group in which the BfS is member.

In 1997, the BfS initiated ESOREX (European Studies of Occupational Radiation Exposure) and since then has executed four ESOREX projects for the European Commission, three of them as project leader, the fourth under the auspices of the Czech Office for Nuclear Safety (SUJB). The studies involved 30 European countries with the objective

- to survey how individual occupational radiation monitoring is organised;
- to collect reliable and comparable data on the annual radiation exposure in the various work sectors and occupational categories over a period of ten years,
- to establish a platform for the contact and the exchange of information between national dose registries in Europe and international organisations

The aim of the current ESOREX Platform Project is to establish on a European level a self-sustainable legal, organisational and technical platform in order to collect regularly aggregated official dose data on occupational radiation exposure from the member states and to facilitate comparative statistical analyses and information exchange between central dose registers and equivalent regulatory institutions.

Annual international data collection and analyses about occupational radiation exposure as well as the exchange of information within the ESOREX network make an important contribution to the comparative evaluation of the development of occupational radiation exposures and optimisation. Due to the comparatively high data quality of the previous ESOREX surveys, UNSCEAR participates as an observer in the steering group. The participation of the BfS in the steering group guaranties influence on the project. This is of importance in the context of the new EU Basic Safety Standards which will have a significant impact on the German system of occupational radiation protection monitoring.

ISOE - Information System on Occupational Exposure

G. Frasch

The Information System on Occupational Exposure (ISOE) provides a worldwide forum for radiation protection professionals from nuclear electricity utilities and national regulatory authorities to share dose reduction information, operational experience and information to improve the optimisation of radiological protection at nuclear power plants. ISOE collects information on individual and collective radiation doses of the personnel in nuclear installations. The ISOE surveys cover more than 90 % of all nuclear power plants in the OECD. The annual ISOE data analyses about the exposures of employees and contractors as well as benchmarks and information exchanges on dose-reduction techniques are essential to implement effective dose-control programmes and to apply the ALARA principle. ISOE is jointly sponsored by IAEA and OECD/NEA. The BMU contributes to the ISOE surveys by contract. The BfS participates as anobserver in order to have access to detailed information about international radiation protection developments.

EN-TRAP - European Network of Testing Facilities for the Quality Checking of Radioactive Waste Packages

S. Steyer

The European Network of Testing Facilities for the Quality Checking of Radioactive Waste Packages, in the following abbreviated to the Network or “EN-TRAP”, was created in 1992 on the initiative of the European Commission. Its objectives are to promote and facilitate collaboration in the development, application and

standardization of quality checking for waste packages. The Network involves laboratories of the European Union Member States that are performing checks related to regulatory issues on waste packages.

In the early 1980s the European Commission (EC) recognised the importance of soundly based Quality Assurance (QA) for providing confidence in the safe management of radioactive waste. To be successful this QA based approach requires application by responsible operators within an effective regulatory regime implemented by national authorities. The International Atomic Energy Authority (IAEA) specified the key elements in its publication Safety Standard III-s-1: "Establishing a National System for Radioactive Waste Management". This standard includes broad guidance on the responsibilities of IAEA Member States for

- establishing and implementing a legal framework,
- establishing a regulatory body,
- enforcing compliance with legal requirements and
- implementing the licensing process

A key element of exercising effective regulatory control is the quality checking of radioactive waste packages by an organisation independent of the waste disposer. An ad-hoc group of European experts, convened in 1989 under the EC Plan of Action for Radioactive Waste, concluded that national regulators, licensing authorities and laboratories performing such quality checks would benefit from European collaboration. In October 1992, following an initiative by the EC, the "European Network of Testing Facilities for the Quality Checking of Radioactive Waste Packages" (formerly the ‘Network’ but now known as ‘ENTRAP’) was founded to promote European collaboration in this field.

ENTRAP is devoted to joint activities related to the verification of conformity of conditioned radioactive waste with regulatory specifications and criteria. Its objectives are to promote and facilitate collaboration in the development, application and standardization of quality checking for waste packages:

- exchange of information via specialist meetings and circulation of statistical data,
- identification of R&D requirements and collaboration in the development of new test methods,
- joint evaluation of test methods and (Round Robin) proficiency testing,
- coordination in the field of national and international standardization of test methods,
- provision of training services for laboratory staff, and
- promotion of the availability of testing/analytical services.

ENTRAP members can propose further fields of collaboration at both the steering committee (SC) and in the working groups (WGs).

IEC, ISO and CEN: BfS involvement in international standardisation

CEN TC351 WG3

B. Hoffmann

In November 2005, the European Committee for Standardization (CEN, www.cen.eu) based on a mandate of the European Commission established a Technical Committee (CEN/TC) number 351 entitled "Construction products: Assessment of release of dangerous substances"(www.centc351.eu).The scope of this TC covers the development of horizontal[1] standardised assessment methods for harmonised approaches relating to the release (and/or the content when this is the only practicable or legally required solution) of regulated dangerous substances under the Construction Products Directive (CPD), taking into account the intended conditions of use of the product. It addresses emission into indoor air and release into soil, surface water and ground water. This TC adopts assessment methods by which information may be given in the CE marking of construction products on the release of dangerous substances in the use phase.

[1] In this context „horizontal standardisation“ means a standardisation process in which the use of common test methods is made possible for a large a number of products as possible.

The CPD and the CPR, which repealed the CPD in 2013, demand as a basic requirement that building products shall not threaten the health of the occupants as a result of (inter alia) the emission of “dangerous radiation” as well as “dangerous particles” and “substances” into indoor air. Whereas the first is generally interpreted as gamma radiation, the latter can additionally – besides e.g. volatile organic compounds (VOC) – cover the exhalation of radon and thoron. Therefore, a special Working Group (WG3 “Radiation”) was established with two basic working items: the development of a standardised measurement method for activity concentrations of radionuclides (specified later as stemming from natural sources) and composing a state of the art report regarding radon exhalation measurement and dose assessment methods. WG3 consists of members of national radiation protection authorities as well as representatives of European umbrella organisations of the building product industry, the European Commission and the European Organisation for Technical Approvals (EOTA).

BfS was nominated 2010 by the German mirror committee (wtww.nabau.din.de) to represent the national interests, based on the longstanding experiences in the measuring of NORM (as coordinating office for questions of radioactivity monitoring in case of enhanced natural radioactivity) and building products, and the subsequent dose assessment.

Up to now, the WG has developed a horizontal testing procedure for determining the activity concentrations of the radionuclides radium-226, thorium-232 and potassium-40 using gamma spectrometry. The draft is based on existing international regulations and standards, and also describes sampling and sample preparation. Before coming into effect, tests for robustness (intralaboratory) as well as for repeatability and reproducibility (interlaboratory) have to be carried out.

Currently, WG3 is preparing a Technical Report discussing existing approaches on gamma dose assessment in the EU and in Member States. This report will also present methods for calculating the external gamma dose that could be a basis for a harmonised European approach. As part of the work, BfS has developed a simple formula to assess the dose inside a standard room in a realistic, but sufficiently conservative way.

Experiences and results of the WG will also be used within the context of the national implementation of the upcoming European Basic Safety Standards Directive, wherein a reference level of 1 mSv/a for the use of building products (in addition to the natural background) is specified.

IEC SC 45A WG A9 „Instrumentation Systems“

F. Seidel

Objective and scope of IEC SC 45A WG A9

The Subcommittee SC 45 A of the International Electrotechnical Commission (IEC) prepares standards applicable to the electronic and electrical functions and associated equipment used in the instrumentation and control systems (I&C) of nuclear energy generation facilities (Nuclear Power Plants, fuel handling and processing plants, interim and final repositories for spent fuel and nuclear waste) to improve the efficiency and safety of nuclear energy generation.

The standards cover the entire lifecycle of these I&C systems, from conception, through design, manufacture, test, installation, commissioning, operation, maintenance, aging management, modernisation and decommissioning.

The core domain is I&C systems important to safety in nuclear energy generation facilities.

The nuclear sector has its own well-developed safety philosophy and methodology, hence the safety publications address the differences from the generic approach and provide directives specific to nuclear energy related facilities with an all-encompassing approach to safety. According to an agreement the IEC nuclear sector safety standards implement principles and terminology of the IAEA safety guides.

The IEC SC 45 A’s Working Group WGA9 “Instrumentation Systems” produces and maintains standards and reports on all aspects of instrumentation systems at the system or channel level including: electronic aspects, processing aspects, safety aspects. The WGA9 scope currently includes set-points, critical safety and performance monitoring functions as well as electromagnetic and radiofrequency interference (EMI/RFI).

As a new working area, Cyber Security was allocated to WG A9 with two ongoing projects:

The standard “Nuclear power plants – Instrumentation and control systems – Requirements for security programmes for computer-based systems” (IEC 62645) is in the Final Draft of International Standard (FDIS) state shortly before becoming issued.

The new standard project "Nuclear power plants – Instrumentation and control systems – Requirements for coordinating safety and cybersecurity" (IEC 62859) was launched early in 2013.

Implications and Objectives of the BfS Participation

The major result of the participation is the identification of international consensus on a set of important safety and security requirements to be met for instrumentation systems at nuclear facilities.

Supporting BMU, BfS is obliged to consider state of the art safety and security requirements on nuclear instrumentation, particularly with respect on new I&C technology applications. Actually there is a worldwide demand for further development of the nuclear regulatory framework on cyber security. As an important source of knowledge, BfS considers and assesses the intensively discussed requirements of IEC standards on cyber security to contribute in developing associated national regulations, as well as to comment on related international draft standards and guidelines.

ISO TC /SC / Working Group 18 “Biological Dosimetry”

The International Organization for Standardization

H. Romm

Aim

The International Standards of the International Organization for Standardization (= ISO) ensure that products and services are safe, reliable and of good quality. For business, they are strategic tools that reduce costs by minimising waste and errors and increasing productivity. They help companies access new markets, level the playing field for developing countries and facilitate free and fair global trade.

The Working Group 18 “Biological Dosimetry” has the aim to develop standards for dose assessment in biological dosimetry. The consortium consists of experts from biodosimetry service labs all over the world.

Results

The Working Group 18 “Biological Dosimetry” established 3 ISO Standards :

ISO 21243:2008 Radiation protection -- Performance criteria for laboratories performing cytogenetic triage for assessment of mass casualties in radiological or nuclear emergencies -- General principles and application to dicentric assay

ISO 19238:2004 Radiation protection -- Performance criteria for service laboratories performing biological dosimetry by cytogenetics

Submitted 2012: Cytokinesis-block micronucleus (CBMN) assay in peripheral blood lymphocytes for biological dosimetry.

The next standard will cover stable translocations detected by the FISH method.

Implementation of the results

The ISO Standards are essential tools to harmonise the assays used in biological dosimetry and very important to receive comparable results in international networks.

The BfS is an expert in the field of biological dosimetry and the participation in the ISO WG is of great importance for the daily work, as the ISO standards describe the state of the art for quality assurance and quality maintenance, how the dose assessment has to be performed in a biodosimetry service laboratory.

II Programmes, networks and platforms for planning and funding of radiation research projects

II.1 BfS as a partner in projects of the Seventh Framework Programme of the European Atomic Energy Community (Euratom) for nuclear research and training activities

The Seventh Framework Programme of the European Atomic Energy Community (Euratom) for nuclear research and training activities (2007 to 2011)

C. Bernhard-Ströl

The European Research Framework Programme (http://ec.europa.eu/research/fp7) is the main instrument at EU level aimed specifically at supporting research and development. It has two major strategic objectives: strengthening the scientific and technological base of European industry and encouraging its international competitiveness, through research that supports EU policies.

The procedure of awarding research funds out of the EU budget is clearly defined in terms of content and time, this procedure is being referred to as Research Framework Programme (RFP). Since the first framework programm for research, technology and development was introduced in 1984, the European Union has played a leading role in the planning and implementation of multidisciplinary research and cooperation measures in Europe. Currently, already the Seventh Research Framework Programme (http://cordis.europa.eu/fp7) (FP7 2007 - 2013) is running.

FP7 consists of the specific programmes: The progamme on Cooperation, on Ideas, on People, on Capacities, on Euratom and Activities of the Joint Research Centre (JRC).

Euratom energy research activities are carried out under the treaty with the same name, which in 1957 established the **European Atomic Energy Community (Euratom)**. Euratom is legally separated from the European Community (EC) and has its own Framework Research Programme, the so called 'Euratom Programme' but is managed by the common Community institutions.

Euratom Programme

The Euratom Programme (http://cordis.europa.eu/fp7/euratom/) (2007 - 2011) includes important subject areas, such as

- **nuclear fusion,**
- **nuclear fission,**
- **radiation protection**,
- and **research activities by the Joint Research Centre (JRC)**.

In these subject areas the programm aims to develop and assemble knowledge and to improve scientific and technical competences and know-how in support of safety, security, reliability and sustainability.

The safe use of radiation in medicine and industry relies on a sound radiation protection policy and its effective implementation. Research under the Euratom Programme plays a key role in maintaining and improving the standards of protection and is therefore of special importance to the Federal Office for Radiation Protection (BfS).

Radiation protection research areas

- Quantification of risks for low and protracted exposures
- Medical uses of radiation
- Emergency management and rehabilitation
- Malevolent uses of radiation or radioactive material

The BfS participates in many research projects of the Euratom Research Programme. Some of them are described in this chapter.

Horizon 2020

source: ec.europa.eu

The eighth Research Framework Programme will be the so called 'Horizon 2020 (http://ec.europa.eu/research/horizon2020) – the framework Programme of Research and Innovation' (2014 – 2020).

The name reflects the ambition to deliver ideas, growth and jobs for the future.

Horizon 2020 brings together all existing Union research and innovation funding, including the Framework Programme for Research, the innovation related activities of the Competitiveness and Innovation Framework Programme (CIP) and the European Institute of Innovation and Technology (EIT).

Horizon 2020 will focus resources on three distinct priorities, where there is clear Union added value. These priorities correspond to those of Europe 2020 and the Innovation Union:

- Excellent Science
- Industrial Leadership
- Societal Challenges

As in the European Framework Programmes before, a Euratom Programme (2014 – 2018) will complement Horizon 2020.

Network of National Contact Points (NCPs)

The network of National Contact Points (http://cordis.europa.eu/fp7/get-support_en.html) is the main structure to provide, practical information, guidance and assistance concerning the participation in European Framework Programmes.

NCPs are national structures established and financed by governments of the 27 EU member states and the states associated to the the framework programm. NCPs give personalised support on the spot and in proposers' own languages.
The central task of the National Contact Points (NCP) is to provide advice to applicants in the fields of the respective framework programm and subject area they are in charge for.

NKS EURATOM

The National Contact Point for the field of **EURATOM / Radiation Protection** is the Federal Office for Radiation Protection (BfS).

ANDANTE - Multidisciplinary evaluation of the cancer risk from neutrons relative to photons using stem cells and the induction of second malignant neoplasms following paediatric radiation therapy

L. Walsh

Objective

The aim of the ANDANTE project (Multidisciplinary evaluation of the cancer risk from neutrons relative to photons using stem cells and the analysis of second malignant neoplasms following paediatric radiation therapy www.andanteproject.eu) is to investigate the relative risk of cancer induction of from exposure to neutrons compared to photons by integrating the disciplines of radiation physics, molecular biology, systems biology modelling, and epidemiology. The overarching objective of the project is to determine values of RBE (relative biological effectiveness) for neutrons, for specific tissues and neutron energies, which can then be validated using paediatric proton therapy data. ANDANTE is an integrated project funded by the European Commission in the 7th Framework Programme and started on 1 January 2012 with a duration of 4 years.

The BfS, which is represented by two staff members, is a sub-task leader in the task 4 (“Relative carcinogenesis of neutrons on humans using paediatric data”). This task will develop a methodology for the reconstruction of neutron dose and energy, develop a predictive neutron dose-risk model for the validation of neutron RBE values and provide the ground work for a future prospective multi-centre epidemiological study to validate neutron RBE models and to investigate more general tumorigenesis risk from neutrons. Two annual meetings were held in Pavia and Brussels in the last two years so far. The next meeting is planned for January 2014. The current work focuses on reviewing studies on the risk of second malignant neoplasms in children occurring after radiotherapy in childhood, and also on many studies on cell, animal and epidemiological assessments on the RBE of neutrons. These reviews form an important part of the ground work for designing and initiating a prospective epidemiological study using paediatric proton therapy data collected from multiple proton centres world-wide. Additionally, visits to both proton therapy facilities, the Loma Linda Medical Centre, United States, and the Paul Scherer Institute, Switzerland, are planned in the next time to take part in the set up of a patient database and the subsequent statistical analyses of this data.

Results

The detailed review of the most directly relevant and best documented epidemiological cohorts of paediatric cancer survivors as well as the expected result from the epidemiological model validation will be confirmation that the RBE model appropriate to second cancer risk from neurons is valid for humans, at least for children.

Implementation of the results

The results of the ANDANTE project will be of relevance to the BfS in two ways, by increasing the specialist knowledge of BfS staff and increasing the ability of staff members to disseminate of epidemiological information concerning the radiation related risks of neutrons with regard to the development of second malignant neoplasms after radiotherapy in childhood.

ANDANTE Partners

UNIVERSITA DEGLI STUDI DI PAVIA - ITALY
CHALMERS TKNISKA HOEGSKOLA AB - SWEDEN
BUNDESAMT FÜR STRAHLENSCHUTZ - GERMANY
UNIVERSITAET ROSTOCK - GERMANY
PAUL SCHERRER INSTITUT - SWITZERLAND
EUROPEAN SOCIETY FOR THERAPEUTIC RADIOLOGY AND ONCOLOGY - BELGIUM
ACADEMISCH ZIEKENHUIS GRONINGEN - NETHERLANDS
LOMA LINDA UIVERSITY - UNITED STATES

CO-CHER - Cooperation on Chernobyl Health Research

B. Grosche

Background and objective

The 1986 Chernobyl accident has led to the most serious exposure of a human population to ionising radiation, apart from the atomic bombings in Japan. Many millions of the general population were exposed to radiation from fallout and over half a million liquidators (clean-up workers) were exposed to a variable mixture of external and internal radiation. While a number of reviews of the health consequences of the accident have been made, there are disagreements as to its consequences to date, and considerable variability in the assessment of the potential consequences in the future.

There is general agrement that risk of thyroid carcinoma has been increased by exposure to radiation in childhood subsequent to the Chernobyl accident. The fact that no other radiation-related health effect has been clearly demonstrated by now does not mean that no increase has occurred or will occur in the future. Many of the studies conducted to date provide little information about radiation risks because of a number of methodological limitations. Further, based on the experience of other populations exposed to ionising radiation, a measurable increase in the relative risk of cancer is expected, even at the low to moderate doses received. In addition, because radiation-related diseases continue to occur decades after exposure, it is certainly too early to evaluate the full radiological impact of the accident.

From 2008 to 2010, an international group of experts and advisors carried out the EU funded project “ARCH: Agenda for Research on Chernobyl Health” (www.arch.iarc.fr) under the leadership of the International Agency for Research on Cancer (IARC - www.iarc.fr). The Multidisciplinary European Low Dose Initiative (MELODI www.melodi-online.eu) endorsed the two main recommendations of the ARCH: to set up a coordinating mechanism for research on Chernobyl health effects and to ensure long-term financial commitment for Chernobyl studies. MELODI also recognised that it is recommendable to focus on a limited number of studies in order to allow for a sufficient financial endowment of these studies; the major priorities are the lifespan follow-up of liquidators and exposed children cohorts.

The aim of CO-CHER therefore is to bring together both key scientific players and funding partners to decide on the highest research priorities following the Chernobyl accident and to seek sustainable funding for those priority areas. Thus, the main objective of the project is to set up an international collaboration enabeling long-term research on the health effects of the Chernobyl accident. Agreements on collaboration will be sought with the relevant authorities from the three European countries mainly affected (Belarus, the Russian Federation and Ukraine), as well as research bodies and authorities from Europe, Japan and the USA.

The specific objectives are:

- Identifying key institutions worldwide (authorities and research bodies) willing to commit to future collaboration on the Chernobyl research,
- Thorough assessment of existing infrastructures (cohorts of affected populations, dosimetry data bases, biobanks) in terms of their suitability and needs for improvement for setting up future life-span cohorts,
- Evaluating accessibility to the infrastructures (data bases, biobanks, etc.) and rules for data access rights,
- Identifying the nature and structure of an international coordinating mechanism for future Chernobyl research, including preliminary agreements, when achievable, with stakeholders to support the proposed mechanism ,
- Development of a long-term research plan with agreed research priorities.

Results

The project will start in 2013. Thus, there are no results yet.

Impact on the work of BfS

The above mentioned Chernobyl studies are of high relevance to radiation protection issues, and their features provide a real opportunity to overcome some of the classical limitations (existing individual dosimetric data and possibilities of improvement, possibility of specifically nested study design to collect additional information, possibility of combined analyses to increase power…). The results will help better estimate the risk of low to medium exposures to ionising radiation, and thus improving radiation protection standards.

CO-CHER Partners

INTERNATIONAL AGENCY FOR RESEARCH ON CANCER - FRANCE
ASSOCIATION MELODI - FRANCE
SÄTEILYTURVAKESKUS - FINLAND
BUNDESAMT FÜR STRAHLENSCHUTZ - GERMANY
RESEARCH CINTER FOR RADIATION MEDICINE, ACADEMY OF MEDICAL SCIENC3S OF UKRAINE - UKRAINE
THE REPUBLICAN RESEARCH CENTRE FOR RADIATION MEDICINE AND HUMAN ECOLOGY, GOMEL - BELARUS
FEDERAL STATE INSTITUTION MEDICAL RADIOLOGICAL RESEARCH CENTER OF THE MINISTRY OF HEALTH OF THE RUSSIAN FEDERATION - RUSSIAN FEDERATION
NATIONAL CANCER INSTIUTUTE - USA

COMET – Coordination and Implementation of a Pan-European Instrument for Radioecology

M. Steiner

COordination and iMplementation of a pan European instrumenT for Radioecology

The EU project COMET (Coordination and Implementation of a Pan-European Instrument for Radioecology, www.comet-radioecology.org) started in June 2013. The project is coordinated by the Belgian Nuclear Research Centre (SCK•CEN). The COMET consortium has 13 partners from 10 European countries and Japan.

Objective

COMET will build upon and complement the foundations laid by the European Radioecology Alliance and the ongoing Network of Excellence STAR (Strategy for Allied Radioecology). The overall objective of this project is to strengthen the pan-European research initiative in radioecology. This will be achieved by meeting the following specific objectives:

- Develop innovative mechanisms for joint programming and implementation (JPI) for radioecological research.
- Initiate highly innovative research on the key needs jointly identified by the radioecology community and the (post) emergency management (NERIS, www.eu-neris.net), low-dose research (MELODI, www.melodi-online.eu) and dosimetry communities (EURADOS).
- Under an enlarged consortium and facilitated by the flex funds further conduct priority research identified following the joint programming mechanisms developed under COMET.
- Develop strong mechanisms for knowledge exchange and dissemination to enhance and maintain European capacity, competence and skills in radioecology.

By collaborating with the European platforms on nuclear and radiological emergency response and low-dose risk research, COMET will significantly aid preparation for the implementation of the Horizon 2020 umbrella structure for radiation protection. In close association with STAR and the European Radioecology Alliance, COMET will take forward the development of a Strategic Research Agenda as the basis for developing innovative mechanisms for joint programming and implementation of radioecological research.

Impact on the work of BfS

The major benefits for BfS that are expected to arise from participating in COMET can be summarised as follows:

- COMET allows BfS to directly influence the international long-term research strategy in radioecology.
- COMET strengthens the link of radioecology to other areas of radiation protection such as radiation risks of low doses and emergency preparedness.
- COMET will develop strong mechanisms for knowledge exchange, dissemination and training to enhance and maintain European capacity, competence and skills in radioecology.

COMET provides the opportunity to develop and validate advanced radioecological models in an efficient way by pooling efforts and sharing data and resources.

COMET Partners

STUDIECENTRUM VOOR KERNENERGIE - BELGIUM
NATURAL ENVIRONMENT RESEARCH COUNCIL - UNITED KINGDOM
BUNDESAMT FUER STRAHLENSCHUTZ - GERMANY
GLOWNY INSTYTUT GORNICTWA ÜPÖÖAMD - POLAND
SATSTOCKHOLMS UNIVERSITETEILYTURVAKESKUS - FINLAND
NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE - UKRAINE
CENTRO DE INVESTIGACIONES ENERGETICAS, MEDIOAMBIENTALES Y TECNOLOGICAS-CIEMAT - SPAIN
UNIVERSITETET FOR MILJO OG BIOVITENSKAP - NORWAY
INSTITUT DE RADIOPROTECTION ET DE SÛRETÉ NUCLÉAIRE - FRANCE
NATIONAL UNIVERSITY CORPORATION FUKUSHIMA UNIVERSITY - JAPAN
NORWEGIAN RADIATION PROTECTION AUTHORITY - NORWAY
STATE SCIENTIFIC AND RESEARCH INSTITUTION CHERNOBYL CENTER FOR NUCLEAR SAFETY RADIOACTIVE WASTE AND RADIOECOLOGY - UKRAINE

DoReMi-NoE - Low Dose research towards Multidisciplinary Integration

U. Kulka

Objective

DoReMi (Low Dose research towards Multidisciplinary Integration) (www.dore-mi-noe.net) is a network of excellence, funded within FP7 of EURATOM. The project was launched in **January 2010** with **12 original partners including the BfS** and a run time of six years. Due to competitive calls within DoReMi the consortium has now a total of 32 partners.

The aim of DoReMi is to promote the sustainable integration of low dose risk research in Europe in order to address the key policy questions identified by the High Level Expert Group (HLEG) on low dose risk research (www.hleg.de). Chairman of HLEG was Wolfgang Weiss, the former head of BfS department Radiation and Health (SG). The open questions address 1) the shape of the dose response curve for cancer, 2) the individual radiation sensitivity for cancer, and 3) the risk for non-cancer effects. Additional to these scientific topics, the NoE focuses on the recording of radiation-related infrastructure in Europe and education and training activities for future radiation scientists.

DoReMi also provides an operational tool for the further development of the MELODI platform (Multidisciplinary European Low Dose Initiative) (www.melodi-online.eu), and thus influences the research programmes in low dose risk research on European and national level.

BfS and BMU have a special interest in a long-term, interdisciplinary and integrative research strategy. This will be the best approach to clarify existing uncertainties in the risk assessment of low dose radiation exposure.

Results

BfS contributed to all work packages (WP) of DoReMi except for WP1 “network coordination”. Contributions came from the department „Radiation Protection and Health“.

BfS contribution to the three scientific work packages WP5, WP6, and WP7:

In **WP5 “shape of the dose response curve for cancer”** BfS took part in Task 5.1 Phase – shifts in responses and processes at high/low doses and dose rates. Alterations in the profile of the proteome of primary human fibroblast cells after low-dose gamma irradiation at different doses and dose rates were explored and single proteins involved in these biological responses were identified. The results were presented as posters and oral presentations at several European meetings (e.g. 2nd proteomics workshop, Munich 2013). A paper summarising the results was submitted. Additional funding for consumables was achieved from the DoReMi flexibility fund to further investigate stem cells.

In Task 5.5 the cross-cutting molecular epidemiological group of the BfS participates in the discussions on the possibility of multidisciplinary approaches to assessing risk from internal exposures. This was possible because BfS participated in the review of cohorts (within WP4) and in the think tank meeting of WP 6.1. Results were published.

In **WP6 “individual radiation sensitivity”** BfS took part in Task 6.1 Molecular epidemiological studies to address the role of individual genetic variation in determining susceptibility to low doses. BfS took part in a meeting of epidemiologists and biologists held in November 2010 to discuss how mechanistic research could be better integrated with epidemiology in molecular epidemiological studies. A report on the meeting was delivered and a review paper on biomarkers and bioassays for molecular radiation epidemiology was published.

In **WP7 “non-cancer effects”** BfS is leader of Task 7.2 – Preparation of a pilot study to conduct molecular epidemiology studies in vascular radiation damage. A meeting was held in Munich in October 2011 at the BfS with the specific objectives to determine strategies to conduct molecular epidemiology studies in vascular damage and to finalise recommendations for internal/external DoReMi calls. A meeting report was published on the public DoReMi website and a publication is under consideration.

BfS contributed to Task 7.4 – Pilot epidemiological study of lens opacities among a cohort of interventional radiologists and cardiologists. BfS participated in 3 meetings, one was organised by the BfS. A report on essential aspects of an epidemiological study protocol and the questionnaire on risk factors were written under the aegis of the BfS.

BfS contribution to the work packages WP 2, WP3, and WP4:

WP2 “structuring MELODI” is divided into a Research and Technological Development (RTD) part and a dissemination part.

In Task 2.2 (RTD) “Establishing and updating the Transition Research Agenda and Joint Programme of Research” BfS took part in identifying priority research needs and assisted in the further development of the transitional research agenda (TRA). The TRA and a TRA statement is available on the DoReMi website.

BfS take care of Task 2.3.2 “to maintain and to update the public MELODI website”. The public MELODI website was maintained and updated on a regular basis. This included the easy access to MELODI documents and related information that are open to the public, the announcement of upcoming MELODI-workshops, access to the MELODI-workshop presentations, access to the updated draft of the Strategie Research Agenda, and information about DoReMi, e.g. E&T courses. A members log-in was installed on the public homepage, so registered members can directly connect to the internal MELODI website operated by SCK-CEN.

In **WP3 “education and training”** BfS contributed to Task 3.5 Funding training activities.
BfS took part in all internal DoReMi calls for education and training activities. Thus, between 2011 and 2013 three 2 week training courses (Interdisciplinary Radiation Research) for 3x12 participants were developed, organised and evaluated at the BfS. There was no course fee and accommodation was free for all participants. The courses were intended to promote and stimulate interdisciplinary cooperation by introducing the basic principles in radiation physics, biology and epidemiology. All courses were fully booked. The last course had been overbooked already 3 months before start. An application for a 4th course was submitted in 2013. The course was advertised via poster presentation at relevant congresses and workshops.

In **WP4 “infrastructures”** large infrastuctures such as irradiation facilities, databases & biobanks, analysis platforms and cohorts are recorded.
The BfS contributed to Task 4.1 Survey of existing facilities for low dose risk research. BfS contributed to the review of existing epidemiological cohorts and the evaluation of their potential to address key issues in

low-dose radiation research. Detailed questionnaires were prepared and information on study design, dose estimation and existence of, or potential for biological samples on existing and planned radiation epidemiological cohorts in Europe were collected. A critical review included 59 cohorts of persons with occupational, environmental and medical exposure to ionising radiation and key cohorts to answer the key policy questions were identified. A manuscript is under preparation by the cross-cutting epidemiology group detailing the different cohorts and their potential use to address specific research questions in WP5, 6 and 7 via a molecular epidemiological approach.

BfS is task leader of Task 4.8 Integrating STORE into DoReMi. BfS was coordinator of the EU Project STORE. A memorandum of understanding was signed between DoReMi and STORE and a new task (4.8) was funded by the DoReMi flexibility fund to integrate STORE into DoReMi as a trustable and viable database and/or pointer to biobanks and ascertain sustainability.

Implementation of the results

DoReMi RTD projects address open questions in radiation research. The results obtained by DoReMi and the efforts to maintain research infrastructure and expert knowledge are highly relevant for the risk assessment of ionising radiation and thus will have sustainable impact on radiation protection on European as well as on national level.

The BfS has an interest to address and clarify open questions in radiation research including radiation biology and epidemiology topics. Of ultimate concern is the protection of the general population, patients and job holders against ionising radiation. The better understanding of low dose effects in individuals and the population will directly influence radiation protection concepts and regulatory statutes.

DoReMi Partners

SATEILYTURVAKESKUS - FINLAND
COMMISSARIAT A L' ENERGIE ATOMIQUE - FRANCE
ISTITUTO SUPERIORE DI SANITA - ITALY
INSTITUT CURIE - FRANCE
OXFORD BROOKES UNIVERSITY - UNITED KINGDOM
DUBLIN INSTITUTE OF TECHNOLOGY - IRELAND
UNIVERSITA DEGLI STUDI DI PAVIA - ITALY
LUDWIG-MAXIMILIANS-UNIVERSITAET MUENCHEN - GERMANY
BRUNEL UNIVERSITY - UNITED KINGDOM
BUNDESAMT FUER STRAHLENSCHUTZ - GERMANY
STATNI USTAV RADIACNI OCHRANY V.V.I. - CZECH REPUBLIC
FUNDACIO CENTRE DE RECERCA EN EPIDEMIOLOGIA AMBIENTAL - CREAL - SPAIN
ERASMUS UNIVERSITAIR MEDISCH CENTRUM ROTTERDAM - THE NETHERLANDS
STOCKHOLMS UNIVERSITET - SWEDEN
HEALTH PROTECTION AGENCY HPA - UNITED KINGDOM
INSTITUTE FOR ENVIRONMENTAL SCIENCES KOUEKI ZAIDAN HOUJIN - JAPAN
JOHANN WOLFGANG GOETHE UNIVERSITAET FRANKFURT AM MAIN - GERMANY
UNIVERSITAETSKLINIKUM ERLANGEN - GERMANY
NUVIA LIMITED - UNITED KINGDOM
UNIVERSITAET DES SAARLANDES - GERMANY
HELMHOLTZ ZENTRUM MUENCHEN DEUTSCHES FORSCHUNGSZENTRUM FUER GESUNDHEIT UND UMWELT GMBH - GERMANY
AWE PLC - UNITED KINGDOM
STUDIECENTRUM VOOR KERNENERGIE - BELGIUM
UNIVERSITETET FOR MILJO OG BIOVITENSKAP - NORWAY
ORSZAGOS FREDERIC JOLIOT-CURIE SUGARBIOLOGIAI ES SUGAREGESZSEGUGYI KUTATO INTEZET - HUNGARY
NORWEGIAN RADIATION PROTECTION AUTHORITY - NORWAY
NASJONALT FOLKEHELSEINSTITUTT - NORWAY
UNIVERSITAET ROSTOCK - GERMANY
ACADEMISCH ZIEKENHUIS LEIDEN - LEIDS UNIVERSITAIR MEDISCH CENTRUM - THE NETHERLANDS
INSTITUT DE RADIOPROTECTION ET DE SÛRETÉ NUCLÉAIRE - FRANCE
AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE,L'ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE - ITALY
UNIVERSITAET DER BUNDESWEHR MUENCHEN - GERMANY
SATEILYTURVAKESKUS - FINLAND

Dose Datamed 2

E. Nekolla

Article 12 of the Medical Exposure Directive
(MED) requires Member States to determine data on the population radiation dose from medical exposures. The BfS has been collecting and evaluating data for medical radiation exposure in Germany from the beginning of the 1990's. With the amended “Röntgenverordnung” (X-ray Ordinance) coming into force in 2002, the BfS has been assigned the official task to regularly assess medical radiation exposures of the general population.

At the end of 2004, an EU-funded project called DOSE DATAMED (DDM 1) was set up with regard to the implementation of Art. 12 of the MED. DDM 1 covered ten European countries (Belgium, Denmark, France, Germany represented by BfS, Luxembourg, Netherlands, Norway, Sweden, Switzerland, and the United Kingdom) with national experiences in conducting surveys on medical radiodiagnostic procedures. In 2011, a follow-up project was launched addressing also EU countries with less or no experiences concerning this matter: Dose Datamed 2 (http://www.ddmed.eu/ DDM 2; duration: January 2011 - March 2013).

The aim of DDM 1 was to gather methods of data acquisition and analysis of the participating countries, to compare results, and to develop methods and guidance for future surveys of population exposure from radiodiagnostic procedures. The guidance developed by the DDM 1 working group, together with best available survey data from the ten participating countries was published by the European Commission as Radiation Protection 154: European Guidance on Estimating Population Dose from Medical X-ray Procedures (RP154).

Objective

The objectives of the DDM 2 project were:

- to collect latest data on population radiation exposure from medical X-ray and diagnostic nuclear medicine procedures in those European countries with experiences in conducting surveys,
- and to support European countries with less or no experiences in estimating medical exposures.

To achieve the above objectives, the study aimed at:

- providing advice and collecting feedback from the application of the guidance RP 154;
- providing estimates of medical population doses in EU Member States and the population dose in European Union as a whole;
- providing a database for European data and information on frequency and doses of radiodiagnostic imaging procedures which will enable continuous collection and follow-up.

DDM 2 was coordinated by the Finnish Radiation and Nuclear Safety Authority STUK. The project team (from Finland, Greece, Bulgaria, Norway, and Luxembourg) was supported by a Panel of Scientific Experts, with participants from the former DDM 1 project and relevant international bodies, and by observers representing WHO and UNSCEAR. A BfS representative was member of the Panel of Scientific Experts.

Data were collected using electronic questionnaires and Excel sheets that were sent to national contact persons recognised for the project. BfS was the national contact for Germany.

Results

The DDM 2 project estimated European population doses from radiodiagnostic procedures based on data collections from 36 European countries. The mean effective dose from X-ray procedures in all 27 EU-countries and three EFTA countries (Norway, Iceland and Switzerland) was on average *1.07 mSv per caput of population*. The mean effective dose from Nuclear medicine (NM) procedures was on average *0.06 mSv per caput*, i.e. the contribution of NM procedures to the total population dose was about 5 %. Computed tomography (CT) yields by far the highest contribution, on average 57 %, to the total collective dose from all X-ray procedures. The overall per caput effective dose for all medical imaging (X-rays + NM) is therefore 1.1 mSv. These values are about half of the recent value of the per caput effective dose estimated in Australia and about one third of the corresponding value in the USA.

Impact on the work of the BfS

With the amended “Röntgenverordnung” (X-ray Ordinance) coming into force in 2002, the BfS has been assigned the official task to regularly estimate and to assess medical radiation exposures of the general popu-

lation. In this context, the comparison of national results with other countries is an important aspect. As to that, the Dose Datamed projects provided essential information.

There are in fact substantial differences in population dose estimates from diagnostic procedures between the various European countries where Germany is in the upper range with approx. 1.7 mSv arising from X-ray procedures and appr. 0.1 mSv caused by NM diagnostic procedures (2010). It is important to understand these differences, and to grade the own national estimate as compared to estimates from other countries. The considerable differences in examination frequencies as well as in population doses are assumed to be primarily due to the different healthcare, reimbursement and payment systems operating in each country, which resulted in considerable variations in the amount of equipment and manpower devoted to medical radiology and in the financial incentives for carrying it out.

Dose Datamed 2 Partners

- RADIATION AND NUCLEAR SAFETY AUTHORITY - FINLAND
- PUBLIC RESEARCH CENTRE - LUXEMBOURG
- NORWEGIAN RADIATION PROTECTION AUTHORITY - NORWAY
- NATIONAL CENTRE OF RADIOBIOLOGY AND RADIATION PROTECTION - BULGARIA
- GREEK ATOMIC ENERGY COMMISSION - GREECE
- INSTITUT DE RADIOPHYSIQUE - SWITZERLAND
- EUROPEAN FEDERATION OF ORGANISATIONS FOR MEDICAL PHYSICS - UNITED KINGDOM
- SWEDISH RADIATION SAFETY AUTHORITY - SWEDEN
- INSTITUT DE RADIOPROTECTION ET DE SÛRETÉ NUCLÉAIRE - FRANCE
- HEALTH PROTECTION AGENCY - UNITED KINGDOM
- BUNDESAMT FÜR STRAHLENSCHUTZ - GERMANY
- NETHERLANDS NATIONAL INSTITUTE FOR PUBLIC HEALTH AND THE ENVIRONMENT - THE NETHERLANDS
- INTERNATIOANAL ATOMIC ENGERGY AGENCY- AUSTRIA

EPI-CT - European cohort study of cancer risk after paediatric computed tomography

M. Gomolka

Objective

The worldwide increasing use of paediatric computed tomography (CT) raises the question of possible late effects, caused by exposure to ionising radiation.

The long-term risk of radiation induced cancer or other health effects following computed tomography (CT) scanning has never been directly assessed. There is scientific evidence that radiation exposures down to about 100 mSv in adults and down to about 10 mSv in children can cause cancer. However, increased cancer risks due to radiation exposure have to be assumed even below these levels of proven effects. The European collaborative EPI-CT (http://epi-ct.iarc.fr) project is the first large-scale cohort study to investigate cancer risks and the underlying biological effects induced by medical CT exposure.

The project is coordinated by the Section of Environment and Radiation at the International Agency for Research on Cancer (IARC, www.iarc.fr). Eighteen centres from Belgium, Denmark, Germany, Finland, France, Luxemburg, the Netherlands, Norway, Spain, Sweden and the United Kingdom will cooperate in this project to enrol approximately one million patients.

The cohort populations will be assembled both, retrospectively and prospectively until 2013. For each child in the cohort, organ specific dose estimates will be derived based on Monte Carlo computer simulation of radiation exposure in the human body by using hybrid mathematical phantoms of children of various ages. Linkage with national cancer registries will allow to calculate cancer incidence in the pooled cohort and to perform external comparisons (SIR-analysis). Association between estimated organ dose and cancer incidence will be

evaluated. In parallel, biomarkers of CT exposure and age dependent sensitivity to radiation will be tested in blood and saliva.

EPI-CT will provide direct epidemiological evidence on the potential cancer risk due to low doses of ionising radiation exposure in a large multinational European cohort. It will be the largest, and the statistically most powerful study of paediatric CT scans undertaken until to date.

In this project the BfS organises a feasibility study to investigate age dependent radiosensitivity. Together with clinical partners in Munich (LMU, TUM) and the BfS partner organisation in Finland (STUK), blood samples from three age groups ranging from newborns (umberical cord blood), young children (2 – 5 years) to adolescents were collected in 2011 and 2012 and investigated for different DNA damage parameters. Blood samples were irradiated in a CT scanner in vitro and chromosome aberrations as well as the induction and repair of DNA double strand breaks using γ H2AX foci were analysed.

Results

First results show increased radiosensitivity of children (0 – 5 years).

Implementation of the results

The results of EPI-CT will contribute to

- radiation protection especially for children,
- dose optimisation of CT scans, and
- low dose radiation research.

The results of the feasibility study within EPI-CT will be used to access the feasibility of conducting a larger study with enough power to estimate age and sex dependent radiosensitivity.

.

EPI-CT Partners

CENTRE INTERNATIONAL DE RECHERCHE SUR LE CANCER - FRANCE
INSTITUT CURIE - FRANCE
INSTITUT NATIONAL DE LA SANTE ET DE LA RECHERCHE MEDICALE (INSERM) - FRANCE
KAROLINSKA INSTITUTET - SWEDEN
UNIVERSITY OF NEWCASTLE UPON TYNE - UNITED KINGDOM
UNIVERSITEIT GENT - BELGIUM
BUNDESAMT FUER STRAHLENSCHUTZ - GERMANY
OSLO UNIVERSITETSSYKEHUS HF - NORWAY
FUNDACIO CENTRE DE RECERCA EN EPIDEMIOLOGIA AMBIENTAL - CREAL - SPAIN
SATEILYTURVAKESKUS - FINLAND
CENTRE DE RECHERCHE PUBLIC HENRI TUDOR - LUXEMBOURG
KRAEFTENS BEKAEMPELSE - DENMARK
STUDIECENTRUM VOOR KERNENERGIE - BELGIUM
UNIVERSITAETSMEDIZIN DER JOHANNES GUTENBERG UNIVERSITAET MAINZ - GERMANY
STICHTING HET NEDERLANDS KANKER INSTITUUT - THE NETHERLANDS
CENTRE D'ASSURANCE DE QUALITE DES APPLICATIONS TECHNOLOGIQUES DANS LE DOMAINE DE LA SANTE - FRANCE
NORWEGIAN RADIATION PROTECTION AUTHORITY - NORWAY
INSTITUT DE RADIOPROTECTION ET DE SURETE NUCLEAIRE - FRANCE

ERA - European Radiobiological Archives

B. Grosche

Background and objective

Past radiobiological animal studies are, to a large extend, unrepeatable experiments. Still, the information from these experiments is important to reanalyse these in the light of new knowledge in radiation biology. Subsequently, there is a strong need to keep this data available for the research community. The European Radiobiological Archives (ERA) was developed to fulfil this task.

Results

In the frame of the EU-funded project ERA-PRO, a legacy database was updated and made accessible on the internet, while the legacy database was kept in a manner that it could not be used online. Standardisation of terminology and histopathology is a prerequisite for meaningful comparison of data across studies and analysis of potential carcinogenic effects. A harmonised pathology nomenclature with today's standard pathology terms was introduced. As far as possible references for the various studies were directly linked to the studies themselves. Further, a direct link to the JANUS database was established. ERA can be accessed at no costs at https://era.bfs.de. Only a password is required which can be obtained from the curators at era@bfs.de .

Impact on the work of BfS

ERA has become a unique archive, including information from almost all former European long-term studies carried out between the 1960s and the 1990s. Further, it includes information on studies from the USA and from Japan. ERA is well accepted by the scientific community. To date, there are more than 70 registered users working with ERA.

Based on the good experience made with ERA, a follow-up project named STORE was conducted allowing a more flexible information handling.

With ERA and with STORE, BfS has become renowned as a relevant partner within the scientific community for archiving data and further information.

ERA Partners

BUNDESAMT FÜR STRAHLENSCHUTZ - GERMANY
UNIVERSITY OF CAMBRIDGE - ENGLAND

MULTIBIODOSE - Multi-disciplinary biodosimetric tools to manage high-scale radiological casualties

H. Romm

Objective

The aim of this multi-disciplinary collaborative project is to analyse a variety of biodosimetric tools and adapt them to different mass casualty scenarios. It is envisaged that the MULTIBIODOSE (www.multibiodose.eu) project will result in the establishment of a biodosimetric network that is fully functional and ready to respond in case of a mass radiological casualty.

In the event of a large scale radiological emergency, biological dosimetry is an essential tool that can provide timely assessment of radiation exposure of the general population and enable the identification of those exposed who should receive medical treatment. A number of biodosimetric tools are potentially available, but they must be adapted and tested for a large-scale emergency scenario. These methods differ in their specificity and sensitivity to radiation, the stability of signal and speed of performance. A large-scale radiological emergency can take different forms. Based on the emergency scenario, different biodosimetric tools should be applied so that the dosimetric information can be made available with optimal speed and precision.

The following biodosimetric tools will be validated and established:

- the dicentric assay (WP Leader: BfS),
- the micronucleus assay,
- the gamma-H2AX assay,
- the skin speckle assay,
- the blood serum protein expression assay, and
- electron paramagnetic resonance (EPR)/optically stimulated luminescence (OSL) dosimetry in components of pocket electronic devices.

These assays were chosen because they complement each other with respect to sensitivity, specificity to radiation and the exposure scenario, as well as speed of performance. Future training programmes will be developed for all the assays validated and established in the project, and automation and commercialisation will be pursued. An operational guidance that will address the multi-parametric approach for large-scale human exposures will be developed and disseminated among emergency preparedness and radiation protection organisations.

Results

The BfS was leading the improvement of the dicentric assay in eight European labs and participated at the CBMN assay in a consortium of five labs.

To increase the thoughput of the time-consuming dicentric assay, new scoring strategies in triage mode were investigated, the automated dicentric scoring was established and validated, and a gallery with over 23,000 Metaphases was established in the cloud for web-based scoring.

The automated CBMN assay was investigated and dose effect curves for acute whole body, partial body and protracted exposure were established. Furthermore a control group of 200 healthy subjects were analysed.

Implementation of the results

The MULTIBIODOSE project improved established assays for dose assessment to increase the throughput of samples. The results obtained are very promising and enable the participants to give mutual assistance and to work as a network. Furthermore it was possible to demonstrate the efficiency of the automated assays during the NATO exercise 2011.

The BfS has an interest to improve assays for dose assessment to be prepared in case of a large-scale radiation accident. Of ultimate concern is the protection of the general population against ionising radiation.

.

MULTIBIODOSE Partners

STOCKHOLM UNIVERSITY - SWEDEN
BUNDESAMT FÜR STRAHLENSCHUTZ - GERMANY
UNIVERSITEIT GENT - BELGIUM
PUBLIC HEALTH ENGLAND - UNITED KINGDOM
INSTITUT DE RADIOPROTECTION ET DE SÛRETÉ NUCLÉAIRE (IRSN) - FRANCE
INSTITUTO SUPERIORE DI SANITÀ -ITALY
NORWEGIAN RADIATION PROTECTION AUTHORITY - NORWAY
RADIATION AND NUCLEAR SAFETY PROTECTION - FINLAND
UNIVERSITAT AUTONOMA DE BARCELONA - SPAIN
INSTITUTE OF NUCLEAR CHEMISTRY AND TECHNOLOGY - POLAND
HELMHOLTZ ZENTRUM MÜNCHEN - GERMANY
BUNDESWEHR INSTITUT FÜR RADIOLOGIE IN VERBINDUNG MIT DER UNIVERSITÄT ULM - GERMANY
GRAY INSTITUTE FOR RADIATION ONCOLOGY AND BIOLOGY, UNIVERSITY OF OXFORD - UNITED KINGDOM
EUROPEAN RADIATION DOSIMETRY GROUP - GERMANY

NERIS-TP -

Towards a self-sustaining European Technology Platform on Preparedness for Nuclear and Radiological Emergency Response and Recovery

F. Gering

Objective

The EU project NERIS-TP (February 2011 – January 2014, http://resy5.fzk.de/NERIS-TP/) aims, on the one hand, at keeping the momentum gained through the European Project EURANOS in establishing a platform (NERIS) where the operational and research community can meet and discuss with all the relevant stakeholders the topics related to emergency response and recovery preparedness and, on the other hand, at tackling urgent research topics in the area of nuclear emergency response and recovery preparedness.

Based on collaboration of industry, research and governmental organisations in Europe, methodological aspects and computational models will be developed to be consistent with recent recommendations from international bodies such as the ICRP (International Commission of Radiation Protection) and improve Europe's response by coupling decision support systems with an emergency information system such as the European wide information system ECURIE.

Results

Within this project, the self-supporting platform NERIS has been established, i.e. a unique place for combined meeting of the research and the operational community. Prototypes of improved computational models have already been provided, which e.g. allow to provide decision support in emergency management for any nuclear power plant in the world.

Impact on the work of the BfS:

Currently (June 2013) 46 organisations are members of the NERIS platform. BfS is supporting member of NERIS, and a BfS representative acts as a vice-chair of NERIS. The results of NERIS and the NERIS-TP project will allow BfS to cooperate more closely with other nuclear emergency management organisations in Europe and to influence the future European research in this area.

.

NERIS-TP Partners

KARLSRUHER INSTITUT FUER TECHNOLOGIE - GERMANY
CENTRO DE INVESTIGACIONES ENERGETICAS, MEDIOAMBIENTALES Y TECNOLOGICAS - SPAIN
NATIONAL CENTER FOR SCIENTIFIC RESEARCH "DEMOKRITOS" - GREECE
BEREDSKABSSTYRELSEN - DENMARK
NORWEGIAN RADIATION PROTECTION AUTHORITY - NORWAY
CENTRE D'ETUDE SUR L'EVALUATION DE LA PROTECTION DANS LE DOMAINE NUCLEAIRE - FRANCE
VUJE AS - SLOVAKIA
DANMARKS TEKNISKE UNIVERSITET - DENMARK
STUDIECENTRUM VOOR KERNENERGIE - BELGIUM
MUTADIS CONSULTANTS SARL - FRANCE
INSTITUTUL NATIONAL DE CERCETARE -DEZVOLTARE PENTRU FIZICA SI INGINERIE NUCLEARA "HORIA HULUBEI" - ROMANIA
PROLOG DEVELOPMENT CENTER A/S - DENMARK
HEALTH PROTECTION AGENCY HPA - UNITED KINGDOM
SATEILYTURVAKESKUS - FINLAND
UKRAINIAN CENTER OF ENVIRONMENTAL AND WATER PROJECTS OF ACADEMY OF TECHNOLOGICAL SCIENCES OF UKRAINE LLC - UKRAINE
UNIVERSIDAD POLITECNICA DE MADRID - SPAIN
BUNDESAMT FUER STRAHLENSCHUTZ - GERMANY
PANEPISTIMIO DYTIKIS MAKEDONIAS (UNIVERSITY OF WESTERN MACEDONIA) - GREECE
UNIVERSITETET FOR MILJO OG BIOVITENSKAP - NORWAY

OPERRA - Open Project for the European Radiation Research Area

B. Grosche

Background and objective

Within the OPERRA (www.melodi-online.eu/operra.html) project, it is proposed that the MELODI Association, as a well-advanced network, takes the lead in establishing the necessary structures able to manage the long-term European research programms in radiation protection, also taking advantage of the valuable experience gathered through the DoReMi network of excellence. Whilst in fields adjacent to low-dose risk research (radioecology, nuclear emergency management) scientific issues would continue to be hosted by the sister associations, Alliance and NERIS, these associations are encouraged to join MELODI to establish an umbrella structure as equal partners.

OPERRA will exploit the synergies of EURATOM and other EC programmes considering the most relevant joint programm areas and mechanisms for funding joint activities. The project will also strengthen the links with national funding programmes as well as the European education and training structures. Also, it will take steps towards a greater involvement of those new Member States who could benefit from increased participation in the radiation research programmes. Finally, OPERRA will take steps to further integrate the joint use of infrastructures in European countries, and to develop and facilitate an easier access to research infrastructures.

The final objective of this project is to build up an umbrella coordination structure that has the capacity to administer in a legal and logistical sense future calls for research in radiation protection as a whole (including low-dose risk, radioecology, nuclear emergency management, and also research activities related to the medical uses of ionising radiation) on behalf of the European Commission. OPERRA will prepare the organisation for a first competitive call by the end of 2013 for projects in low-dose risk research and a second competitive call in 2014 for broader projects in radiation protection research, subject to the approval of EC services, with the support of an outsourced company.

Because of its strong involvement in both radiation protection research and training, BfS will be involved in many different tasks in OPERRA. BfS will lead WP2 (Integration of national & EU research & training programmes covering research in radiation protection) and within this WP, it will head Task 2.1 (Determining joint funding mechanisms of national & EU Fission R&D programmes). Further, it will contribute to the other tasks of WP2, WP3 (Preparing to operate an integrated platform & organising competitive calls) and to some tasks of WP4 (Reaching out to new Member States, academic & professional partners, as well as to major stakeholders & authorities).

Results

The project will start in 2013. Thus, there are no results yet.

Impact on the work of BfS

The following points illustrate the benefits for BfS when participating in this important project which will lay the tracks for future radiation related research in Europe, at the long run not only for radiation protection but also for radiation ecology and emergency preparedness:

1. BfS has a direct influence on the research goals of the EU and a possibility to contribute to the Horizon 2020 perspective;

2. BfS leads the Work Package responsible for developing models for joint funding from different sources, which is of particular importance against the background of smaller resources on the one hand and the need for integrated research on the other.

3. it becomes more and more importantto maintain competence in all areas of radiation research and radiation protection education and training ; BfS can extend its activities in this field which are already ongoing in radiation protection (through DoReMi), in radioecology (through STAR), and for radiation protection officers or NPP operators.

4. last but not least, BfS will have direct access to latest developments in all areas of radiation research; this will help achieve most effective collaborations within national and international organisations as well as in giving scientific based advise to the Federal Ministry for the Environment.

OPERRA Partners

INSTITUT DE RADIOPROTECTION ET DE SÛRETÉ NUCLÉAIRE -- FRANCE
STUDIECENTRUM VOOR KERNENERGIE - BELGIUM
BUNDESAMT FUER STRAHLENSCHUTZ - GERMANY
SATEILYTURVAKESKUS - FINLAND
ASSOCIATION MELODI - FRANCE
JIHOCESKA UNIVERZITA V CESKYCH BUDEJOVICICH - CZECH REPUBLIC
ORSZAGOS FREDERIC JOLIOT-CURIE SUGARBIOLOGIAI ES SUGAREGESZSEGUGYI KUTATO INTEZET - HUNGARY
HEALTH PROTECTION AGENCY HPA - UNITED KINGDOM
COMMISARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES - FRANCE
FUNDACIO CENTRE DE RECERCA EN EPIDEMIOLOGIA AMBIENTAL - SPAIN
INSTITUTO SUPERIORE DI SANITA - ITALY
HELMHOLTZ ZENTRUM MÜNCHEN DEUTSCHES FORSCHUNGSZENTRUM FÜR GESUNDHEIT UND UMWELT GMBH - GERMANY
UNIVERSITA DEGLI STUDI DI PAVIA - ITALY
STOCKHOLMS UNIVERSITET - SWEDEN

ORAMED - Optimization of Radiation Protection for Medical Staff

A. Rimpler

Objective

ORAMED (www.oramed-fp7.eu) was a research project under the 7th Framework Programme “Euratom programm for Nuclear Research and Training”. It was launched in 2008 and ran for three years. The main goal of the project was to improve radiation protection standards for medical staff for procedures resulting in potentially high exposures, for example in interventional radiology and nuclear medical therapy. This general objective was approached in five working packages (WP):

WP 1 Measurement and calculation of extremity and eye lens doses in interventional radiology;

WP 2 Development of practical eye lens dosimeters for interventional radiology;

WP 3 Optimization of active personal dosimeters in interventional radiology;

WP 4 Extremity exposure and improvement of individual dosimetry in nuclear medicine;

WP 5 Knowledge dissemination and training.

A consortium of twelve partners from nine European countries dealt with these tasks. BfS was mainly involved in WP4 and WP5, due to its long standing expertise in this area.

Results

Comprehensive measurements were performed involving 32 hospitals in 7 European countries and 139 workers, to get an overview on hand exposure and the skin dose distributions across the hands of nuclear medical staff. The study included the most frequently used radionuclides, i.e. ^{99m}Tc- and ^{18}F-labelled radiopharmaceuticals for diagnostics and ^{90}Y-labelled radiopharmaceuticals for nuclide therapy. It was revealed that the exposure can exceed the annual skin dose limit of 500 mSv if radiation protection standards are inadequate.

The measurements revealed that individual exposures cover a very wide range. The study also demonstrated that doses can be reduced to an acceptable level when appropriate training is given and suitable radiation protection measures are used. The utilisation of shielding for vials and syringes and of tools for enlarging the distance are the most important instruments to limit skin exposures.

However, the level of skin doses observed during nuclide therapies and handling of PET-nuclides also give reason to demand a compulsory skin dose monitoring for personnel in nuclear medicine facilities in general. When following this recommendation, rules for an optimal positioning of official ring dosemeters have to be considered. Nevertheless, a systematic underestimation of skin exposures in routine monitoring is inevitable.

A highlight of the whole project and the main task within WP5 was the final workshop ORAMED 2011 (Barcelona, 20.-22.01.2011).

Implementation of the results

The results of the ORAMED project referring to the exposure situation of staff in nuclear medicine in the European scale confirmed the findings of selected surveys in Germany made at BfS during the last decade. Related to the legal dose limits of occupationally exposed persons, extremity exposure, mainly of the skin on the hands, are more crucial than whole body exposures. It has to be assumed that (even in Germany) the skin dose limit is exceeded in a considerable percentage of staff in nuclear medicine. This remains undetected because of principal and generally unavoidable deficiencies of finger ring dosimeters. Therefore, precautionary measures to increase protection standards and decrease exposures should have first priority.

The outcome of the project was evaluated in an expert discussion (Bonn, 11.01.2012) with stakeholders of the German nuclear medical community, dosimetry services and competent authorities to improve both radiation protection standards and individual extremity dose monitoring. As a consequence, BfS proposed changes within the procedure of official individual monitoring of extremity exposures. First of all, nuclear medicine staff should be obliged to wear adequate ring dosimeters. Moreover, it is intended to inform the responsible persons in case of abnormal dosimeter readings as early as possible aimed at taking adequate measures to reduce exposures. This can be solved by setting a reduced dose constraint (‘reporting level’) in routine monitoring. The implementation of these proposals into practice requires decisions by the responsible German committee Fachausschuss Strahlenschutz (FAS)

The ORAMED results and its practical consequences for safety standards in nuclear medicine also gave reason to publish dedicated radiation protection recommendations (to be published soon on the BfS website).

Finally, BfS collaborators in the project presented the ORAMED findings at several scientific committees and events (AKD, SSK/A4, FAS, TÜV-Meeting, Annual Meeting of DGN 2011, 1st Ga-68/PRRNT World Congress 2011).

ORAMED Partners

STUDIECENTRUM VOOR KERNENERGIE - CENTRE D'ETUDE DE L'ENERGIENUCLEAIRE - BELGIUM
ENTE PER LE NUOVE TECNOLOGIE, L'ENERGIA E L'AMBIENTE - ITALY
COMMISSARIAT A L'ENERGIE ATOMIQUE - FRANCE
UNIVERSITAT POLITECNICA DE CATALUNYA - SPAIN
BUNDESAMT FUER STRAHLENSCHUTZ - GERMANY
HOSPICES CANTONAUX CHUV - SWITZERLAND
MGP INSTRUMENTS SA - FRANCE
GREEK ATOMIC ENERGY COMMISSION - GREECE
INSTITUTE OF OCCUPATIONAL MEDICINE - POLAND
RADCARD SC*PAWEL BILSKI MACIEJ BUDZ ANOWSKI JOZEF DYBEL IRENA LIPENSKA PAWEL OLKO ELZBIETA RYBA - POLAND
SLOVAK MEDICAL UNIVERSITY FACULTY - SLOVAKIA
INSTITUT DE RADIOPROTECTION ET DE SÛRETÉ NUCLÉAIRE - FRANCE

PEDDOSE.NET

D. Noßke

PEDDOSE.NET ("Dosimetry and Health Effects of Diagnostic Applications of Radiopharmaceuticals with particular emphasis on the use in children and adolescents", www.peddose.net) was a 22-months-project that started in April 2010 and was partially funded by the European Commission under the FP 7 call "HEALTH-2009-1.2-6: Evaluation of the potential health impact of diagnostic imaging agents doses".

Objective

PEDDOSE.NET addressed the following objectives:

- Summary and evaluation of current knowledge on the impact on patients' health of small and non- or little-repetitive amounts of radioactive substances, as currently used in diagnostic imaging procedures;
- Development of recommendations and guidelines to drive scientific and technologic innovation to improve patient healthcare in medical imaging;
- Identification, if clinical studies are needed, and corresponding detailing of the studies;
- Involvement of people in legislative approval of these agents for human use.

Results

The project provided data on dosimetry and corresponding dose related risks when administering radiopharmaceuticals for diagnostic purposes in children and adults.

It focused on assessing how absorbed doses were derived, and how new developments within that field can possibly improve the level of confidence associated with dosimetric findings within the next few years. The pharmacological risk associated with the use of radiopharmaceuticals can be neglected in most cases as the amount of substance injected is lower than the lowest amount of impurity accepted in conventional pharmacological uses. Therefore, this project addressed primarily the risks associated with the use of ionising radiation on patients.

Impact on the work of the BfS

The main tasks of BfS within this project were to compile the most recent data on dosimetry for nuclear medicine diagnostics and to contact national and international bodies to provide an overview of new developments in dosimetry by international expert groups. The results are used by BfS for the establishment of diagnostic reference values in nuclear medicine [published at Bundesanzeiger] and for the dosimetric approval of applications for medical research involving humans [Bekanntmachung der aktualisierten diagnostischen Referenzwerte für diagnostische und interventionelle Röntgenuntersuchungen: www.bfs.de/de/ion/medizin/diagnostik/drw_roentgen.pdf] according to § 23 of the German Radiation Protection Ordinance (StrlSchV).

PEDDOSE-NET Partners

EUROPEAN INSTITUTE FOR BIOMEDICAL IMAGING RESEARCH - AUSTRIA
UNIVERSITAET WÜRZBURG - GERMANY
INSERM - FRANCE
UNIVERSITEIT GENT - BELGIUM
BUNDESAMT FUER STRAHLENSCHUTZ - GERMANY

PREPARE - Innovative integrated tools and platforms for radiological emergency preparedness and post-accident response in Europe

F. Gering

Objective

The EU research project PREPARE (February 2013 – January 2015) aims to close gaps that have been identified in nuclear and radiological preparedness following the first evaluation of the Fukushima disaster. The consortium intends to review existing operational procedures in dealing with long lasting releases, address the cross border problematic in monitoring and safety of goods and will further develop still missing functionalities in decision support system, ranging from improved source term estimation and dispersion modelling to the inclusion of hydrological pathways for European water bodies. As the management of the Fukushima event in Europe was far from being optimal, we propose to develop on a scientific and operational basis, means to improve information collection, information exchange and the evaluation for such types of accidents. This will be achieved through a collaboration of industry, research and governmental organisations in Europe, taking into account the networking activities carried out under the NERIS-TP project. Furthermore, the NERIS Platform member organisations will be actively involved in the development.

Impact on the work of BfS

BfS leads the working package in which emergency preparedness and response arrangements in various European countries are reviewed for accident scenarios with long lasting releases. Additionally, BfS is represented in the management board of the project. The results of the PREPARE project will be an important step towards harmonising the nuclear emergency management concepts among European countries, which is one of the major goals of the emergency management division of BfS.

PREPARE Partners

KARLSRUHER INSTITUT FUER TECHNOLOGIE - GERMANY
NUCLEAR RESEARCH AND CONSULTANCY GROUP - THE NETHERLANDS
INSTITUT JOZEF STEFAN - SLOVENIA
NATIONAL CENTER FOR SCIENTIFIC RESEARCH"DEMOKRITOS" - GREECE
DANMARKS TEKNISKE UNIVERSITET - DENMARK
UNIVERSITA DEGLI STUDI DI MILANO - ITALY
UNIVERZA V LJUBLJANI - SLOVENIAN
UNIVERSIDAD POLITECNICA DE MADRID - SPAIN
KONINKLIJK NEDERLANDS METEOROLOGISCH INSTITUUT(KNMI) - THE NETHERLANDS
BEREDSKABSSTYRELSEN - DENMARK
BUNDESAMT FUER STRAHLENSCHUTZ - GERMANY
HEALTH PROTECTION AGENCY HPA - UNITED KINGDOM
AUTORITE DE SÛRETÉ NUCLÉAIRE - FRANCE
SATEILYTURVAKESKUS - FINLAND
RADIOLOGICAL PROTECTION INSTITUTE OF IRELAND - IRELAND
AGENCIA PORTUGUESA DO AMBIENTE - PORTUGAL
UKRAINIAN CENTER OF ENVIRONMENTAL AND WATER
PROJECTS OF ACADEMY OF TECHNOLOGICAL SCIENCES OF UKRAINE LLC - UKRAINE
ASSOCIATION POUR LE CONTROLE DE LA RADIOACTIVITE DANS L'OUEST - FRANCE
STATE SCIENTIFIC AND TECHNICAL CENTRE ON NUCLEAR AND RADIATION SAFETY - UKRAINE
PAPUSH LIANA - SWEDEN
COOPANAME - FRANCE
STICHTING DIENST LANDBOUWKUNDIG ONDERZOEK - THE NETHERLANDS
RIJKSINSTITUUT VOOR VOLKSGEZONDHEIDEN
MILIEU*NATIONAL INSTITUTEFOR PUBLIC HEALTH AND THE ENVIRONMENTEN - THE NETHERLANDS
SLOVENIAN NUCLEAR SAFETY ADMINISTRATION - SLOVENIAN
GREEK ATOMIC ENERGY COMMISSION - GREECE
MUTADIS CONSULTANTS SARL - FRANCE
INSTITUTUL NATIONAL DE CERCETARE -DEZVOLTARE PENTRU FIZICA SI INGINERIE NUCLEARA "HORIA HULUBEI" - ROMANIA
STUDIECENTRUM VOOR KERNENERGIE - BELGIAN
KWR WATER B.V. - THE NETHERLANDS
EIDGENOESSISCHES DEPARTEMENT DES INNERN - SWITZERLAND
VUJE AS - SLOVAKIA
CENTRO DE INVESTIGACIONES ENERGETICAS, MEDIOAMBIENTALES Y TECNOLOGICAS-CIEMAT - SPAIN

PREPARE Partners

UNIVERSITETET FOR MILJO OG BIOVITENSKAP - NORWAY
TN INTERNATIONAL - FRANCE
UNIVERSIDAD DE SEVILLA - SPAIN
NORWEGIAN RADIATION PROTECTION AUTHORITY - NORWAY
PANEPISTIMIO DYTIKIS MAKEDONIAS (UNIVERSITY OF WESTERN MACEDONIA) - GREECE
PROLOG DEVELOPMENT CENTER A/S - DENMARK
UNIVERSITAET WIEN - AUSTRIA
CENTRE D'ETUDE SUR L'EVALUATION DE LA PROTECTION DANS LE DOMAINE NUCLEAIRE - FRANCE
HEALTH AND SAFETY EXECUTIVE - UNITED KINGDOM
ASSOCIACAO DO INSTITUTO SUPERIOR TECNICO PARA A INVESTIGACAO E DESENVOLVIMENTO - PORTUGAL
FEDERAL AGENCY FOR NUCLEAR CONTROL - BELGIUM
INSTITUT DE RADIOPROTECTION ET DE SURETE NUCLEAIRE - FRANCE
AGENZIA NAZIONALE PER LE NUOVE ECNOLOGIE, L'ENERGIA E LO SVILUP-PO ECONOMICO SOSTENIBILE - ITALY

RADPAR - Radon Prevention and Remediation

M. Kreuzer

The EU-project „Radon Prevention and Remediation" (http://web.jrc.ec.europa.eu/radpar, May 2009 – May 2012) was funded by EU DG SANCO. It was coordinated by Dr. Bartzis from Greece and included 10 partners from different European countries.

Objective

The general objective of this project was to assist in the reduction of the public health burden of lung cancers due to exposure to radon in EU Member States.

The main objectives of the RADPAR project were:

- assessment of the health burden to the general population from exposure to residential radon;
- improvement of radon prevention and remediation strategies;
- development of radon risk communication strategies;
- standardisation of measurement procedures for radon sources and control technologies;
- assessment of the cost-effectiveness of existing and potential radon prevention and remediation strategies in the EU;
- improvement of the effectiveness of radon control strategies through the design and use of training courses for radon measurement, prevention, remediation and cost-effectiveness analysis;
- assessment of the potential conflicts between energy conservation in buildings, and reduction in radon exposure.

The BfS has long-term experience in the field of radon epidemiology, risk communication, cost effectiveness (SG), and radon prevention and measurement (SW). It was part of the editorial board of the WHO Radon Handbook (www.who.int/ionising-radiation/env/radon/en/), it is member of many international committees dealing with residential radon (e.g. ICRP, UNSCEAR, etc.) and contributes to the development of national and international radon reduction strategies (e.g. Basic Safety Standards, etc.). The experts of the BfS were thus involved in all working packages of the RADPAR project.

Results

Within the RADPAR project, comprehensive questionnaires were distributed within 27 EU member states to get information on the current and planned activities to address the above mentioned topics. In addition, the BfS and few other partners conducted a survey on risk awareness in the respective countries. Based on this information as well as current recommendations of international committees, a total of specific 66 recommendations on radon policies and strategy was prepared and submitted to national authorities for comment and possible incorporation into national radon control strategies.

Implementation of results

The results of the RADPAR project contributed to the Radon Action Plan of the BfS, particularly with respect to risk communication. Moreover, the recommendations on radon prevention and remediation will contribute to the BfS Radon Handbook. Next to that, the results will be used within the activities of the BfS as a WHO Collaborating Centre. Here the constructural technical possibilities are in the focus, because WHO together with the BfS and other experts develops a radon handbook for construction experts.

RADPAR Partners

UNIVERSITY OF WESTERN MACEDONIA - GREECE
BUNDESAMT FUER STRAHLENSCHUTZ - GERMANY
UNIVERSITAET BREMEN - GERMANY
THE CHANCELLOR, MASTERS AND SCHOLARS OF THE UNIVERSITY OF OXFORD - UNITED KINGDOM
CENTRE SCIENTIFIQUE ET TECHNIQUE DU BÂTIMENT - FRANCE
INSTITUTE SUPERIORE DI SANITA - ITALY
AUSTRIAN AGENCY FOR HEALTH AND FOOD SAFETY - AUSTRIA
NORWEGIAN RADIATION PROTECTION AUTHORITY - NORWAY
RADIATION AND NUCLEAR SAFETY AUTHORITY - FINLAND
INTERNATIONAL BUREAU FOR ENVIRONMENTAL STUDIES - BELGIUM
NATIONAL RADIATION PROTECTION INSTITUTE - CZECH REPUBLIC
JOINT RESEARCH CENTRE - ITALY

RENEB - Realizing the European Network of Biodosimetry

U. Kulka

Objective

Realizing the European Network of Biodosimetry (RENEB - www.reneb.eu) is a Coordination Action (CSA-CA) project funded within the 7th EU framework EURATOM Fission Programme. The RENEB project was launched in January 2012, and is planned to be carried out until the end of the year 2015. The project is coordinated by the BfS and involves 23 partners from 16 European countries, amongst them radiation protection authorities, universities, research centres and hospitals. The goal of RENEB is to establish a sustainable European network of biological dosimetry that will guarantee maximum efficiency in processing and scoring of biological samples for fast and reliable dose estimations implemented in the EU emergency management structures. In case of a large scale radiological incidence, biological dosimetry will help distinguish people needing extensive medical care due to violent injuries plus severe irradiation from those with injuries who have not received high doses of ionising radiation. However, identification and assurance of the huge number of 'worried well' individuals, i.e. persons who are extremely distressed but have not actually received radiation doses likely to cause acute health effects, will be most important in order to prevent the healthcare infrastructure being overwhelmed and to avoid socio-economic harm. In such large-scale radiological incidents, the number of people that may need to be screened, therefore, could easily exceed the capacity of a single or even a number of laboratories. As a consequence, biodosimetry networking has been recognised as a sensible and important emergency response strategy.

It is a superior purpose of BMU to care for a high level standard in radiation protection in Germany and to give input to the international, particularly European discussion. In this regard, international cooperation and assistance to international committees is of high priority for the BMU. Also of central concern is emergency management and preparatory work like the establishment of an European network of biodosimetry is an important contribution to this.

Results

The project is composed of 6 Workpackages (WPs). Since the start of the project, the following progress has been achieved.

WP1 Operational Basis: an operational basis of the network, based on coordination of the existing reliable and proven methods in biological dosimetry is on the way to be set up. six different methods were chosen and a first intercomparison was planned and performed to assess the quality capabilities of laboratories involved. BfS is the task-leader of the “dicentric assay” and is involved in two other tasks (FISH assay and micronucleus assay). During the intercomparison, blood probes for two different assays were irradiated and sent to partners. Dose estimations were performed for dicentric assay, FISH assay and micronucleus assay at the BfS laboratory.

WP2 Development: a strategy for horizon scanning of new techniques and new partners was developed. On this basis the network will be able to expand and improve by implementing appropriate new, molecular biology methods and integrating new partners. BfS was involved in the development of reporting sheets for new partners and new techniques.

WP3 Education &Training and QA&QM: High quality standards of education and training activities of members are of utmost importance. Hence, quality assurance and management (QA&QM) regarding the assays performed and laboratories involved were emphasised. A picture gallery for dicentric scoring-training was installed by BfS and images for FISH-training were provided. A first laboratory quality check for dicentrics was performed by BfS.

WP4 Sustainability: it is essential to set up an operational structure of the network, including contacts to national first responders, a well organised trans-national infrastructure, e.g. to facilitate cross-border transport of human biological samples, a long-term funding strategy, and an agenda to transform RENEB into a legal organisation. BfS is the leader of this WP and of a task, responsible for the legal affairs. BfS was significantly involved in developing questionnaires regarding practical aspects like shipment and research activities of the partners. BfS prepared a list of possible legal organisation forms of the future network, including the pros and cons of the forms.

WP5 Dissemination: dissemination of knowledge and the awareness of RENEB is ensured by providing access to internal and external communication platforms and databases and by implementing the network in the European and global emergency preparedness systems. Here the BfS contributed with its contacts to IAEA and WHO (BioDoseNet) and by giving input to the RENEB website as well as by presenting RENEB at international conferences.

WP6 Coordination: BfS is coordinating the project, in this regard all organisational aspects of the performance of the project are addressed by the BfS. This includes the presentation of the project as a whole, manage and coordinate the meetings, report to the commission, monitor the overall progress in the project and disseminate the results. BfS is in charge of the link to the Advisory Board, and supports the organisation of workshops and meetings of the consortium WPs.

Implementation of the results

The laboratory for biological dosimetry at the BfS has been officially assigned by the decision of the “Länder” since 1982 to perform chromosome analysis for Germany (www.bfs.de/de/ion/wirkungen/biologische_dosimetrie).

With regard to applied radiation protection there is need to prepare for a high-scale radiological event. Therefore, a network of biological dosimetry under the leadership of BfS is on its way to be established for fast and reliable dose estimations implemented in the EU emergency management structures. Thus, existing European biodosimetry infrastructure will be available with highest efficiency, the implemented E&T programmes will sustainably keep high level knowledge in the laboratories and new information will be implemented systematically. The sustainability of the network will be assured by interaction with national, European and international organisations (NGA, IAEA, WHO).

RENEB Partners

BUNDESAMT FUER STRAHLENSCHUTZ - GERMANY
ISTITUTO SUPERIORE DI SANITA - ITALY
NORWEGIAN RADIATION PROTECTION AUTHORITY - NORWAY
HELMHOLTZ ZENTRUM MUENCHEN DEUTSCHES FORSCHUNGSZENTRUM FUER GESUNDHEIT UND UMWELT GMBH - GERMANY
UNIVERSITA DEGLI STUDI DELLA TUSCIA - ITALY
UNIVERSITAT AUTONOMA DE BARCELONA - SPAIN
INSTITUTONTECHNOLOGICO E NUCLEAR, INSTITUTO SUPERIORE TECHNICO, UNIVERSIDADE TECHNICA DE LISBOA - PORTUGAL
UNIVERSITAET ULM - GERMANY
HEALTH PROTECTION AGENCY (NOW: PUBLIC HEALTH ENGLAND) - UNITED KINGDOM
INSTYTUT CHEMII I TECHNIKI JADROWEJ - POLAND
COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES - FRANCE
NATIONAL CENTRE OF RADIOBIOLOGY AND RADIATION PROTECTION - BULGARIA
SATEILYTURVAKESKUS - FINLAND
STOCKHOLMS UNIVERSITET - SWEDEN
ACADEMISCH ZIEKENHUIS LEIDEN - LEIDS UNIVERSITAIR MEDISCH CENTRUM - THE NETHERLANDS
ORSZAGOS FREDERIC JOLIOT-CURIE SUGARBIOLOGIAI ES SUGAREGESZSEGUGYI KUTATO INTEZET - HUNGARY
NATIONAL CENTER FOR SCIENTIFIC RESEARCH "DEMOKRITOS" - GREECE
FUNDACION PARA LA INVESTIGACION DEL HOSPITAL UNIVERSITARIO LA FE DE LA COMUNIDAD VALENCIANA - SPAIN
SERVICIO MADRILENO DE SALUD - HOSPITAL GENERAL UNIVERSITARIO GREGORIO MARANON - SPAIN
AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE,L'ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE - ITALY
INSTITUT DE RADIOPROTECTION ET DE SURETE NUCLEAIRE - FRANCE
INSTITUTUL NATIONAL DE SANATATE PUBLICA - ROMANIA
UNIVERSITEIT GENT - BELGIUM

SEMI-NUC - Prospective cohort study of residents near the Semipalatinsk nuclear test site – feasibility assessment

B. Grosche

Background and aim

From 1998 – 2001, BfS was the coordinator of a cohort study among persons affected by the atomic bomb testing in Kazakhstan. In the meantime dosimetry for the population living near the test site has been improved, and a Japanese-Kazakh group were able to set up a new cohort study. Past activities have therefore been resumed.

This goes together with the Strategic Research Agenda of the Multidisciplinary European Low Dose Initiative (MELODI - http://melodi-online.eu) platform, where it is noted that the overall aim of MELODI is “consolidating European initiatives on researching and better understanding the health effects of exposure to low dose ionising radiation”. The MELODI platform has already integrated nearly twenty national research organisations in Europe with significant programmes in low-dose risk research and now needs to extend its approach beyond the European boundaries.

The SEMI-NUC project, which is coordinated by IARC (www.iarc.fr), Lyon, therefore focuses on assessing the feasibility of developing a new international collaboration to study health effects from low-dose to moderate-dose radiation. The support action brings together a multidisciplinary group of scientists from Europe, Kaza-

khstan, Japan and the United States to evaluate access to existing research infrastructures in Kazakhstan and to assess the future feasibility of conducting in the future an integrated prospective study of the dose-effect relationship for both cancer and non-cancer effects from low to moderate chronic doses (external and internal) in the cohort of residents near the Semipalatinsk nuclear test site exposed to radioactive fallout from nuclear testing and nuclear accidents.

Results

The official start date of the project was the 1st April 2013, the kick-off meeting was held in May 2013 in Lyon, France.

Impact on the work of BfS

The analysis of the Kazakh cohort contributes to risk assessment in the range of low to medium doses (< 600 mSv). In particular, recent analyses of the risk for deaths from cardio-vascular diseases indicate that such a risk can be seen only many decades after exposure (Grosche *et al.*, 2011). An extended follow-up will help in estimating such a risk.

.

SEMI-NUC Partners

CENTRE INTERNATIONAL DE RECHERCHE SUR LECANCER - FRANCE
BUNDESAMT FUER STRAHLENSCHUTZ - GERMANY
SCIENTIFIC RESEARCH INSTITUTE OF RADIATION MEDICINE AND ECOLOGY NIIRME - SUBSTANTIVE - KAZAKHSTAN
NATIONAL INSTITUTE OF RADIOLOGICAL SCIENCES - JAPAN
INSTITUTE OF RADIATION SAFETY AND ECOLOGY OF THE NATIONAL NUCLEAR CENTER OF KAZAKHSTAN - KAZAKHSTAN
NORWEGIAN RADIATION PROTECTION AUTHORITY - NORWAY

STAR - European Network of Excellence

M. Steiner

The Federal Office for Radiation Protection joined eight renowned European partners – national radiation protection authorities, major research centers and universities – to form a network of excellence in radioecology. Within the project STAR (Strategy for Allied Radioecology, https://wiki.ceh.ac.uk/display/star/The+Radioecology+Exchange the EU financially supports this network for a period of 4.5 years. The project started in February 2011 and is coordinated by the French Institute for Radiation Protection and Nuclear Safety (IRSN).

Objective

The primary aim of STAR is to cross-link European top level research in radioecology and to create synergistic effects, thus counteracting the decrease of experts and compensating the declining financial and personel resources. Key areas are therefore the development of a common long-term research strategy on the European level, the shared use of research infrastructure, a modern knowledge management using web-based techniques and the mutual exchange of scientists. STAR is expected to initiate a sustainable, efficient, long-term integration of radioecology within Europe. The joint programme of activities concentrates on collaborative research in three key areas:

- Integrating human and non-human radiological risk assessments.
- Radiation protection in a multi-contaminant context.
- Ecologically relevant low-dose effects.

Results

The list of technical and scientific results obtained so far includes, among others,

- a web-based compilation of research infrastructure, models, expertise and archived samples held by the STAR member organisations,
- the development of a web portal http://www.star-radioecology.org) that openly provides radioecological

information (publications, data, EURATOM reports, training materials, news items, methods),

- the first Strategic Research Agenda (SRA) in radioecology, a document providing a long-term vision of radioecological research needed within the European Community,
- a critical evaluation of the applicability of ecotoxicological methods for radioecological research and assessments and
- the first steps towards the creation of Observatories for Radioecological Research, contaminated field sites that provide a focus for international collaboration and shared field work.

Examples of key results are described in more detail below.

The **Observatories for Radioecological Research** are being established under the leadership of the Federal Office for Radiation Protection. Based on a list of criteria, two European areas with complementary characteristics were selected by combining multi-criteria decision analysis, group discussions and recommendations provided by invited external experts. These are the Upper Silesian Coal Basin in Poland and the Chernobyl Exclusion Zone. Both areas will be characterised ecologically, ecotoxicologically and radiologically and then jointly used for radioecological research by the project partners.

The **Strategic Research Agenda** (SRA) is both a long-term vision of radioecological research needed within the European Community and a suggested prioritisation of research topics. The STAR consortium produced a SRA for radioecology for the first time. The SRA is a living document that will be regularly updated in order to reflect new ideas and scientific progress. A web consultation conducted in autumn 2012 and an open meeting in November 2012 gave all stakeholders the opportunity to make suggestions and recommendations on the first draft and to highlight the contribution of the SRA relative to the research agendas of other platforms, such as NERIS, MELODI and IGD-TP.

For **process-oriented modelling**, which is an essential step towards more robust radioecological model predictions, first results are expected in the near future. The Federal Office for Radiation Protection focuses on elucidating key processes governing the dynamic behaviour of radionuclides in the biosphere, improving the knowledge of the relevant mechanisms and explicitly modelling these key processes. The aim is to replace empirical radioecological parameters which may be subject to considerable uncertainties, by robust radioecological sub-models. Feasibility studies are expected to reveal whether this concept allows to predict the radioactive contamination of environmental media and eventually radiation exposure of man and nature more accurately and reliably.

Impact on the work of BfS

Altogether, the network of excellence STAR establishes the basis to sustainably cross-link European top-level research in radioecology and to create synergistic effects by pooling efforts, sharing data and resources and developing modern methods of knowledge management. It provides the opportunity for the Federal Office for Radiation Protection to efficiently improve the predictive capabilities of radioecological models. The project is a milestone to effectively counteract the impending loss of competence in radioecology on the European level.

.

STAR Partners

INSTITUT DE RADIOPROTECTION ET DE SÛRETÉ NUCLÉAIRE - FRANCE
NATURAL ENVIRONMENT RESEARCH COUNCIL- UNITED KINGDOM
CENTRO DE INVESTIGACIONES ENERGETICAS, MEDIOAMBIENTALES Y TECNOLOGICAS-CIEMAT - SPAIN
NORWEGIAN RADIATION PROTECTION AUTHORITY - NORWAY
SATEILYTURVAKESKUS - FINLAND
STOCKHOLMS UNIVERSITET - SWEDEN
STUDIECENTRUM VOOR KERNENERGIE - BELGIUM
BUNDESAMT FUER STRAHLENSCHUTZ - GERMANY
UNIVERSITETET FOR MILJO OG BIOVITENSKAP - NORWAY

STORE - Sustaining access to data and material from radiobiological experiments

B. Grosche

Background and objective

The original EU-funded STORE project (www.fpstore.eu) was coordinated by BfS and ran from 2009 to 2012. The work on STORE is now continued as a Task within the Infrastructure WP of the DoReMi project.

The sharing of data and biomaterials from publicly-funded experimental radiation science adds enormous value to the original investment. Sharing will yield substantial scientific added value through re-analysis and new investigations. This does not only account for new technologies in data analysis. Moreover, the rapid progress in radiation biology allows analysis of old material with new techniques. The emergence of high throughput 'omics' technologies has led to an explosion in the rate and volume of data generation, and data sharing through the scientific literature alone has become impossible. It is well recognised in the community that potential benefits will accrue from a widespread culture of sharing research data and bioresources by making data available immediately after publication, and resources, within a defined period. Additionally, the use of legacy data is particularly important for radiation biology because a large number of studies conducted between the 1950s and '90s are unrepeatable due to ethical and financial restrictions. Still, such legacy data can be usefully reanalysed in the light of new paradigms.

Thus, it is not only important to rescue endangered primary data; even more crucial is to archive it at the time it is generated. This lesson has been learned by the radiobiology community, who took on that challenge 25 years ago when developing the International Radiobiological Archives, which was further developed to become the internet-based data repository ERA, jointly developed by BfS and the University of Cambridge and now held by BfS.

For the purpose of rescuing endangered data from past experiments and saving data from modern studies, the STORE infrastructure has been developed.

Results

STORE allows the storage and retrieval of data from past, current and future radiobiological studies. Securely accessible software allows full data control to its originator: information can be stored without a public access; it can be made available to selected coworkers only; it can be released to the whole scientific community. STORE can also act as a directory to collections of tissue samples, FFPE blocks, and slides etc. or to other relevant data bases, e.g. the one of the German Uranium Miners Cohort Study. STORE offers the possibility of hosting whole histopathology slide scans as a virtual archive. It has to be emphasised that STORE is suitable for both information from radiobiological experiments and for studies amongst human populations. As an example, STORE hosts the data of the German Thorotrast study – a cohort study amongst Thorotrast patients –, as well as the data of the respective animal experiments and a pointer to biomaterial from these experiments.

Knowledge management does not only imply making data and biomaterial available. Information will only turn into knowledge if it is linked together in biologically meaningful ways; however, having the information is the necessary first step. To allow the extraction of all possible information from a platform such as STORE, experience from other similar platforms has been made available.

STORE is capable of including annotations to the information, give references to scientific publications or incorporate grey literature such as internal laboratory reports. This was done successfully in the former EU FP6-funded project ERA-PRO, within which the electronic form of ERA was created (http://era.bfs.de).

In the STORE project, knowledge management also included the development of Standard Operating Procedures (SOP) to evaluate the quality of radiobiological archive tissue and define test systems describing the usefulness of such material. The resulting data were quantified and the procedures performing best in terms of the call rates of data points and experimental noise, compared to those from the fresh-frozen or freshly-made formalin-fixed paraffin-embedded (FFPE) control, were validated. The SOPs were made available on the STORE web page (http://www.rbstore.eu). Last but not least, new methods applicable for archival material (e.g. XFM) were successfully tested during the course of the project.

Impact on the work of BfS

BfS has become known as a trustworthy archive for data from studies in the field of radiation protection, both for epidemiological and animal studies. Making such data available for future scientific questions adds enormous value to the original investigation, and BfS as a national body is an adequate organisation for hosting such an archive.

.

STORE Partners

BUNDESAMT FÜR STRAHLENSCHUTZ - GERMANY
IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE - UNITED KINGDOM
THE UNIVERSITY OF EDINBURGH - UNITED KINGDOM
CENTRE HOSPITALIER UNIVERSITAIRE D' AMIENS - FRANCE
HELMHOLTZ ZENTRUM MUENCHEN DEUTSCHES FORSCHUNGSZENTRUM FUER GESUNDHEIT UND UMWELT GMBH - GERMANY
RIJKSINSTITUUT VOOR VOLKSGEZONDHEID EN MILIEU - THE NETHERLANDS
INTEGRATED BIOBANK OF LUXEMBOURG FOUNDATION - LUXEMBOURG
THE CHANCELLOR, MASTERS AND SCHOLARS OF THE UNIVERSITY OF CAMBRIDGE - UNITED KIKNGDOM
SOUTHERN URALS BIOPHYSICS INSTITUTE - RUSSIAN FEDERATION

TENEB - Towards a European Network of Excellence in Biological Dosimetry

H. Romm

Objective

An important question is how well European Union (EU) Member States are prepared to cope with mass radiological casualties. The present note addresses one aspect of this as follows: the capacity of EU biodosimetric laboratories to perform dosimetric triage of irradiated victims. The European Commission funded the feasibility studyTENEB (February to Juli 2009) to assess the viability of a European Network of Excellence (NoE) for biological dosimetry (cytogenetic and related assays) to assess mass radiation casualties.

Results

A survey to establish the current status of biological dosimetry across the EU was carried out. 18 of the 27 EU member states confirmed the need for the provision of biological dosimetry; 15 states have already established operational laboratories for biological dosimetry. In total 24 European laboratories have the capability to perform biological dosimetry; they have expressed their interest in creating a network of excellence. This kind of network is also favoured by 18 leading European radiation protection organisations, which signed corresponding letters of intent for a sustainable integration of research in the field of biological dosimetry. These statements, together with the long-term expertise and the integration of the laboratories in their national structures, makes it highly probable that a network will be sustained beyond the period.

Implementation of the results

The results of TENEB were the basis for a EU Call in frame of FP7, which resulted in the EU project RENEB organised and running under the leadership of BfS in 2012.

.

TENEB Partners

STOCKHOLM UNIVERSITY - SWEDEN
BUNDESAMT FUER STRAHLENSCHUTZ - GERMANY
PUBLIC HEALTH ENGLAND - UNITED KINGDOM
INSTITUT DE RADIOPROTECTION ET DE SÛRETÉ NUCLÉAIRE - FRANCE

II.2 Euratom Collaborative Platforms

Technological Platforms to support Euratom research and training programmes

A. Schmitt-Hannig

The European Technological Platforms (ETP) and other authoritative expert bodies play an increasingly important advisory and implementation role in the Euratom research and training programmes based on a consensus on common needs, vision and instruments[1)]. Their respective "Vision Reports" are particularly important to understand the objectives fixed to the scientific communities associated (reactor safety, waste management, radiation protection).

The ETPs bring together the main stakeholders of nuclear fission and radiation protection research, namely:

- research organisations,
- systems suppliers (e.g. vendors, engineering companies, medical equipment manufacturers),
- energy providers,
- regulatory authorities and associated technical organisations
- higher education and training institutions, in particular universities,
- society (e.g. policy makers and opinion leaders), interest groups and NGOs.

Nuclear fission in the EU is discussed most notably in the *Sustainable Nuclear Energy Technology Platform* (SNE-TP), launched in September 2007. The SNE-TP aims at promoting research, development and demonstration that will maintain excellence in fission technology and provide long-term waste management solutions.

The *Implementing Geological Disposal Technology Platform* (IGD-TP) was launched in November 2009. It provides the necessary focus in the lead up to the operation of geological repositories for high-level nuclear waste in Europe.

The EU research strategy for radiation protection is in the hands of the *Multidisciplinary European Low Dose Initiative*. MELODI is a non-profit association focussing on research related to the impact of low dose radiation. A number of short training courses are offered in the framework of related FP7 research projects (DoReMi) and EFTS.

With regard to safety enforcement, an important role is played by the *European Nuclear Safety Regulators Group* (ENSREG), launched in October 2007, which is composed of senior officials from national nuclear safety authorities. This Group focuses on nuclear safety (they were also in charge of the specification of the EU "stress tests"), waste management and spent fuel, in synergy with the "*Western European Nuclear Regulators Association*" (WENRA).

Another important association is the "*Heads of European Radiological protection Competent Authorities Association*" (HERCA), created in 2007. Their fields of competence cover radiological protection during the design, construction, operation and decommissioning of nuclear installations, the transport, as well as the storage and use of radioactive materials and ionising radiation for industrial, medical, veterinary and research purposes.

---

1) List of *European Technological Platforms* (reactor safety, radiation protection, geological disposal, etc.)

MELODI = "*Multidisciplinary European Low Dose Initiative*" - http://www.melodi-online.eu/

IGD-TP = "*Implementing Geological Disposal of Radwaste TP*" -http://www.igdtp.eu/

SNE-TP = "*Sustainable Nuclear Energy Technology Platform*" - http://www.snetp.eu/

MELODI - Multidisciplinary European Low Dose Initiative

U. Kulka

Objective

MELODI (www.melodi-online.eu) is a European Platform dedicated to low-dose radiation risk research. In April 2009 five partners (BfS, CEA, IRSN, ISS and STUK) previously involved in the High Level Expert Group (HLEG) (www.hleg.de) signed a Letter of Intent, in which they jointly marked their intention to progressively integrate their Research and Technology programmes in low-dose radiation risk research with similar R&T programmes funded by the European commission. MELODI has thus constituted a platform for radiation protection research in EUROPE to promote the idea of joint programmeming and integrated funding for R&T. A key point of the evolving platform is the openness of MELODI to all national R&T organisations and regulatory bodies as well as stakeholders in Europe who are interested in, willing to and capable of sustainably engaging in such an integration process. 2010 MELODI was founded as a registered association with 15 members and has total of 22 members to the end of 2012.

The purpose of MELODI is:

- to develop a strategic research agenda (SRA) and to propose R&T priorities for Europe in its field of competence,
- to seek the views of stakeholders on the priorities for research, keep them informed on progress made, and to contribute to the dissemination of knowledge,
- to interface with international partners like WHO and IAEA,
- to organise open MELODI scientific workshops.

BfS and BMU have a special interest in a long-term, interdisciplinary and integrative strategy which will address open questions in the low-dose area on the European level as well as in the maintenance of expert knowledge and research infrastructures.

Results

BfS as a member of the HLEG (with the former head of BfS department Radiation and Health (SG) as chairman) was a driving expert force to establish and structure the MELODI platform. In September 2009 the BfS (department SG) organised the first open MELODI workshop in Stuttgart. 156 scientists, representatives of regulatory bodies and interested stakeholders from 23 European countries, the USA and Japan took an active part in the workshop and discussed the future development of low-dose radiation research in Europe. Up to now the yearly MELODI workshops are a driving force for MELODI to review the state of knowledge on low-dose radiation effects at the international level. Also in 2009 the BfS installed and since then has updated on a regular basis the open accessible MELODI website (www.melodi-online.eu) where e.g. background information, official MELODI documents, workshop presentations, and information about the SRA are available to the public. Since MELODI became a registered association in 2010, the head of BfS department “radiation and health” (SG) has held the position of the vice president of MELODI. Several sections of the department are actively involved in identifying and defining of research priorities as well as in developing strategies to maintain and facilitate multilateral initiatives leading to better use and development of research infrastructures such as radiation facilities, cohorts or biobanks and to promote knowledge management, training and mobility of students and scientists in the field of radiation research. To practically implement these activities in the development of MELODI, the department is involved in the EU-project “DoReMi-NoE (runtime 2010 – 2015), that was set-up to provide an operational tool for the development of the MELODI platform. Key questions in radiation research, highly relevant for radiation protection as there are:

a) the shape of dose effect curve for cancer,

b) differences in the individual radiation sensitivity and

c) risk for non cancer effects will have direct influence.

These key questions are directly processed by the BfS department Radiation and Health (SG) within several EU-projects. Additionally to its contribution to the low dose research on the European level, SG stimulated and promoted projects on national level. This was done by identifying, advertising and attending UFOPLAN projects and by actively participating in several BMBF projects.

In February 2012 following a BfS interview given in Rome during the 3rd MELODI workshop an editorial about "The low-level nuclear threat" was published in Nature and MELODI was introduced to be the right approach.

Implementation of the results

MELODI outlines the most effective approach to efficiently address open questions in radiation research. The results are highly relevant for the risk assessment of ionising radiation and thus will have major impact on radiation protection on European as well as on national level.

The BfS has an interest to address and clarify open questions in radiation research including radiation biology and epidemiology topics. Of ultimate concern is the protection of the general population, patients and job holders against ionising radiation. The better understanding of low dose effects in individuals and the population will directly influence radiation protection concepts and regulatory statutes.

IGD-TP - Implementing Geological Disposal - Technology Platform

M. Beushausen

In its decision 2006/976/EURATOM the European council outlined that the emphasis in the Euratom research should be placed on implementation-oriented Research and Development (R&D) activities on all remaining key aspects of deep geological disposal of spent fuel and long-lived radioactive waste. As appropriate, demonstration of technologies and safety, and to support the development of a common European view on the main issues related to the management and disposal of waste are pointed out. For this reason the instrument of European Technology Platforms (ETPs) has been introduced by EC.

Objective

The IGD-TP (Implementing Geological Disposal - Technology Platform - www.igdtp.eu) is supposed to provide a framework for stakeholders, led by implementors, to define R&D priorities, timeframes and action plans on a number of strategically important issues regarding the commitment to build confidence in the safety of geological safety solutions among European citizens and decision-makers. It is also supposed to encourage the establishment of waste management programmes that integrate geological disposal and to facilitate the access to expertise and technology in the relevant field.

Results

The Implementing Geological Disposal - Technology Platform (IGD-TP) was launched on November 12, 2009 and at the same time its Vision Report was published (www.igdtp.eu/index.php/key-documents). The Vision Report, outlining the objectives, challenges, benefits, organisation and participation of the IGD-TP had been prepared by an Interim Executive Group (IEG) with members from Sweden, Finland, France and Germany.

A Strategic Research Agenda (SRA) provides the basis for priorities regarding RD&D, in particular the Key Topics to be dealt with, in order to achieve the goals. This document therefore communicates the remaining research needs, but will also be an instrument for creating synergies, cooperation and coordination both internally between the IGD-TP participants and externally with activities taking place in other technology platforms and international forums. The next step for the IGD-TP was providing a Deployment Plan, detailing how the participants can work together and start actual joint work on some of the Key Topics. During January 2011 an open public consultation on the draft SRA document has been conducted.

The aim of the SRA activities is to support the IGD-TP Executive Group members and participants in achieving the vision and the desired results by joint RD&D activities during the next few years.

Each SRA Topic was classified according to this scheme and linked with the overall timeline in the SRA report this permitted development of a Master Deployment Plan for the period 2011-2016. The guidance of the Executive Group was also considered in the identification of Topics that should be pursued first. The first Master Deployment Plan is presented in the actual SRA document.

The implementation of Joint Activities among the platform members and participants focuses on the topics identified in the SRA and which are not yet addressed on any other existing platforms. The Joint Activities may be based on project specific or framework agreements. The joint activities already now takes place in various forms like multilateral projects including at least three parties, within an Euratom Framework project consortium, or in bilateral projects.

Impact on the work of the BfS

The waste management organisations in Europe share the opinion that it is time to proceed to licence the construction and operation of deep geological repositories for spent fuel, high-level waste, and other long-lived radioactive waste. They also agree that the technology platform is the appropriate tool to facilitate the implementation process. The IGD-TP will provide opportunities to take part in the planning of research, development and demonstration (RD&D) activities, to participate in focused implementation work efficiently, and to take part in important information exchange and knowledge transfer. By continued and strengthened cooperation in the field of scientific, technical, and societal challenges related to deep geological disposal, the participation in the IGD-TP is beneficial for the safe and timely implementation of geological disposal facilities. With Finland, Sweden and France planning to start the operation of a deep geological repository for high-level waste and spent fuel within the 2020's, it is time to put the plans for implementing deep geological disposal facilities into action. Target date for commencing operation of a repository for spent nuclear fuel and high-level waste in Germany is 2035. Demonstrating a feasible management of high active waste could help enhance stakeholder confidence in Germany.

The technology platform is implementer-driven. For BfS being responsible for implementing a waste management programm it is essential to be a member of the IGD-TP.

The platform offers access to expertise and technology, allows interaction with the stakeholders, and communicates the results to the benefit of all members.

WWW.IGDTP.EU/INDEX.PHP/PARTICIPANTS **IGD-TP Partners**

SNETP - Sustainable Nuclear Energy Technology Platform

A. Schmitt-Hannig

The SNETP published a vision for the development of nuclear fission energy technologies, aimed at:

- achieving a sustainable production of energy,
- achieving significant progress in economic performance,
- improving the efficiency in the utilisation of natural resources,
- cogenerating electricity and process heat,
- continuously improving safety levels,
- minimising waste and resistance to proliferation.

The SNETP underlines the importance of the research dimension of the nuclear sector, the need to maintain high levels of safety, the importance of retaining competences and know-how, and the increasingly competitive nature of this global industry.

The SNETP also ensures enhanced coordination between national programmes while guaranteeing the most effective use of programme funding. The success depends on a strong, bottom-up stakeholder involvement supported through a transparent and inclusive approach to membership of the platform itself.

The SNETP is an instrument for attaining the above goals, leading to the long-term establishment of sustainable energy production towards the transition to a low-carbon energy mix. BfS is not involved in the work of this platform.

WWW.SNETP.EU/WWW/SNETP/INDEX.PHP?OPTION=COM_CONTENT&VIEW=ARTICLE&ID=34&ITEMID=17 **SNETP Partners**

III European and international activities on education and training in radiation protection

European and international activities on education and training in radiation protection

Education and training are fundamental to safety in the workplace. Those working with radiation sources in industry, medicine and research will have a wide range of responsibilities and training needs depending on the radiation practice, but will all need:

- A basic education as well as specific training providing the required level of understanding of radiation risk and its management,
- Standards for the recognition of skills and experience,
- An opportunity to refresh, update and test acquired knowledge and competence on a regular basis.

International meetings, publications and recommendations covering safety culture in the field of radiological protection increasingly stress the need for education and training. In addition, compliance with the requirements of specific European directives and the international basic safety standards is crucial in a world of dynamic markets and increasing workers' mobility, and common approaches to training facilitate the understanding of these requirements.

Education and training in nuclear, radiation, transport safety, and waste management is one of the mechanisms and primary strategies for assisting Member States in the application of the IAEA Standards. Several General Conference Resolutions were emphasising the importance of education and training in establishing and maintaining an adequate radiation protection and nuclear safety infrastructure and requesting, inter alia, to intensify postgraduate educational and specialised training courses in appropriate official languages of the Agency, and to develop, in a systematic manner, syllabuses and training material for specific target groups. For more details see:

http://www-ns.iaea.org/downloads/rw/training/strategic-approach2011-2020.pdf

http://www-ns.iaea.org/downloads/ni/training/strategy2013-2020.pdf

BfS is actively involved in networks, such as ENETRAP, EUTERP and EUSECTRA as well as in the activities consolidated under the IAEA strategies on education and training. Some of the activities are described in more detail on the following pages.

ENETRAP II - European Network on Education and Training in Radiation Protection II

A. Schmitt-Hannig

Objective

The overall objective of this 7th Framework Programme project is to develop European high-quality "reference standards" and good practices for education and training in radiation protection (RP), specifically with respect to the radiation protection expert (RPE) and the radiation protection officer (RPO). These "standards" will reflect the needs of the RPE and the RPO in all sectors where ionising radiation is applied.

The outcome of this project is instrumental for the cooperation between regulators, training providers and customers (nuclear and non-nuclear industry, research, etc.) in reaching harmonisation of the requirements for, and the education and training of RPE and RPO within Europe, and will stimulate building competence and career development in radiation protection to meet the demands of the future.

Results

The main results of the project which ended in December 2012 are

- Development of European reference standards for RPE training, and based on that development of training schemes (European Radiation Protection Training Scheme - ERPTS), with specific attention to topics, including non-technical skills/soft skills, On-the-Job Training/Work Experience, etc.;
- Development of requirements for RPO competencies and guidance for appropriate RPO training
- Development of mechanisms for the evaluation of training material, courses (and providers);
- Creation of a database of training events and training providers;
- Initiatives to attract early-stage research in radiation protection on a European level;
- Development of some course material examples (including e-learning/cyber book);
- Organisation of pilot sessions of specific modules of the ERPTS and monitoring of the effectiveness;
- Development of a European passport for continuous professional development (CPD) in radiation protection.

Impact on the work of BfS

The commitment of BfS as a consortium partner in the ENETRAP and in the ENETRAPII project offers the potential

- to identify activities related to education and training in radiation protection which may be useful for European approaches and initiatives, for harmonisation and/or further development in this important area,
- to develop reference standards for education and training in radiation protection of RPE, taking into account the European Qualification Framework (EQF) and European Credit System for Vocational Education and Training (ECVET),
- requirements for RPO competencies and guidance for appropriate RPO training, taking into account EQF and ECVET developments,
- to exchange ideas and experiences and learning from approaches to education and training in other European countries,
- to disseminate information on the German regulatory requirements with regard to education and training in radiation protection.

Thus, achievements and experiences in other countries can be integrated in the BfS conceptual work on education and training supporting national and European approaches.

EUTERP - European Platform on Training and Education in Radiation Protection

A. Schmitt-Hannig

Objective

The EUTERP-Foundation is an independent legal entity set-up to provide a centralised European source of information on radiation protection education and training matters. Main objectives of the Foundation are

- to encourage and support harmonisation of education and training requirements for radiation protection experts, radiation workers and other radiation protection professionals,
- to better integrate radiation protection education and training systems into general vocational training and education infrastructures, and
- to act as a focus for the sharing of information on training events, standards, developments etc.

Results

The main output of the EUTERP Foundation consists of the exchange of information through website (www.euterp.eu/), publication of regular newsletters and organisation of workshops. Workshop presentations can be downloaded from the EUTERP homepage

A system of National Contact points (NCP), - an EUTERP NCP is the prime reference point on information regarding radiation protection education and training, law and regulation, accreditation and mutual recognition -, will assist all those looking for specific information on education and training in radiation protection.

The EUTERP website hosts national pages which contain country by country information on the regulatory requirements with regard to education and training of Radiation Protection Experts (RPE), Radiation Protection Officers (RPO) or Radiation Worker (RW). The National Pages may also give a (general) description about the different courses and radiation protection education systems, a list of education and training providers and information about national accreditation bodies and (mutual) recognition, if available.

Impact on the work of BfS

The commitment of BfS as EUTERP National Contact Point for Germany offers the potential

- to identify activities related to education and training in radiation protection which may be useful for European approaches and initiatives, for harmonisation and/or further development in this important area;
- to exchange ideas and experiences and learning from approaches to education and training in other European countries;
- to disseminate information on the German regulatory requirements with regard to education and training in radiation protection.

Thus, achievements and experiences in other countries can be integrated in the BfS conceptual work on education and training supporting national and European approaches.

IAEA - International Atomic Energy Agency

A. Schmitt-Hannig

Objectives

The International Atomic Energy Agency (IAEA) has developed a strategy on education and training in radiation, transport and waste safety. To successfully implement the strategy, an adaptable and flexible response is required as training needs develop and change. Consequently, there is a need for ongoing observation and review to ensure that implementation of the strategy continues to be on course to meet the objectives. The IAEA therefore established a Steering Committee for Education and Training in Radiation, Transport; and Waste Safety which is aimed at advising the IAEA on the implementation of the strategic approach. Its terms of reference include:

- Reviewing progress of, and providing advice with respect to the implementation of the strategy;
- Identifying appropriate performance indicators;
- Advising on the priorities for the development of standardised training material and training activities;
- Providing advice with respect to how Member States may monitor effectiveness of their own E&T programmes.

It comprises representatives from regional and collaborating centres, BfS being one of them, international organisations and IAEA staff with responsibilities for education and training in radiation, transport and waste safety.

The Steering Committee meets annually. During the meeting it discusses and evaluates the status report provided by the Secretariat and the results of the performance indicators, determines recommendations and future actions, and prepares a report of the meeting to be submitted to the IAEA.

Results

The implementation of the 2001–2010 strategy was considered to be a success in as much as the objectives were achieved at the regional level. While there has been significant progress with respect to the development

of specific activities, the process needs to be continued to facilitate further development of the education and training infrastructure at the national level.

The strategy for 2011–2020 recognises the importance of Member States taking ownership of the tasks through developing and implementing national strategies to strengthen education and training in radiation, transport and waste safety to achieve the desired level of competence.

More details can be found on the IAEA website*:* www-ns.iaea.org/training/ and in the Newsletter (http://www-pub.iaa.org/MTCD/Publications/PDF/Newsletters/ET-NSRW-01.pdf).

Impact on the work of BfS

The commitment of BfS as a Collaborating Centre of the IAEA „Strategic Approach to Education and Training in Radiation Protection and Waste Safety" offers the potential

- to identify important international activities related to education and training in radiation, transport and waste safety which may be useful for European approaches and initiatives, for harmonisation and/or further development in this important area;
- to exchange ideas and experiences and learning from approaches to education and training in other parts of the world;
- to develop a joint approach to education and training in radiation protection and waste safety to make sure that the high level of competence in radiation protection in Europe is the same as in other parts of the world;
- to support both IAEA efforts in education and training in general and regional training centres by providing assistance and lecturers in particular.

Thus, international achievements and experiences can be integrated in the BfS conceptual work on education and training supporting national and European approaches.

EUSECTRA - European Nuclear Security Training Centre at the Institute for Transuranium Elements (JRC-ITU)

E. Kröger

Objective

The BfS Working Group „Defence Against Nuclear Hazards" (AG-NGA) cooperates with the European Nuclear Security Training Centre (EUSECTRA), which is being currently set up at the Institute for Transuranium Elements (JRC-ITU) (ec.europa.eu/dgs/jrc/index.cfm?id=1410&dt_code=NWS&obj_id=15490&ori=RSS).

The objective of the training centre is to encourage knowledge transfer for capacity building in nuclear security. The BfS supports the training programm by providing expert input at training courses and working groups in the form of presentations and drafting written procedures.

Results

The expert input of the BfS has been well received in the past, resulting in intensified information exchange.

The participation of the BfS at two workshops organised by EUSECTRA on the topic "Border Monitoring Working Group (BMWG): Nuclear Security Applications of Mobile Radiation Detection Technologies" in 2012 resulted in the inclusion of the BfS in the drafting process for a technical document on this subject.

Implementation of the results

Through EUSECTRA, AG-NGA is able to share with the international community presentation methods that are also used in our work with the German police authorities on the subject of radiation protection. As a result, these presentation methods are improved. In addition, German best practice methods can be directly compared to best practice within the European Union and discussed with technical experts.

The experience gained by AG-NGA within EUSECTRA is used to improve and expand our technical and practical training, both in-house and with our partners in other German authorities.

Organisation and Subject Index

E

F

G

H

I

J

M

N

W

Bisher erschienene BfS-Schriften

BfS-SCHR-1/90
Warnecke, E.; Odoj, R.; Simon, R. (Editors)
Requirements for Waste Acceptance and Quality Control.
Proceedings of the 2nd International Seminar on Radioactive Waste Products.
28 May - 1 June 1990, Research Centre Jülich, Federal Republic of Germany.
Salzgitter 1990

BfS-SCHR-2/91
Sicherheitsreihe Nr. 6.
IAEO-Empfehlungen für die sichere Beförderung radioaktiver Stoffe. Ausgabe 1985.
(Diese Übersetzung enthält auch die von der IAEO im Nachtrag 1988 zu den Empfehlungen vorgenommenen Ergänzungen).
Salzgitter 1991

BfS-SCHR-3/91
Schüttmann, W.; Aurand, K.
Die Geschichte der Außenstelle Oberschlema des Kaiser-Wilhelm-Instituts für Biophysik Frankfurt am Main.
Salzgitter 1991

BfS-SCHR-4/91
Bornemann, O. (mit einem Beitrag von *R. Fischbeck*)
Zur Geologie des Salzstocks Gorleben nach den Bohrergebnissen.
Salzgitter 1991

BfS-SCHR-5/92
Herrmann, *A.G.*
Endlager für radioaktive Abfälle Morsleben (ERAM).
Lösungszuflüsse in den Grubenfeldern Marie und Bartensleben: Stoffbestand, Herkunft, Entstehung. Eine Dokumentation.
Zweiter Bericht. Abschlußbericht für den Zeitabschnitt 1. Januar bis 31. Dezember 1991. Clausthal-Zellerfeld, den 29. Februar 1992.
Salzgitter 1992

BfS-SCHR-6/92
Bestandsaufnahme IMIS-IT.
Seminar zum Projektstand IMIS am 3. Mai 1991.
Salzgitter 1992

BfS-SCHR-7/92
Empfehlungen der Reaktor-Sicherheitskommission (RSK) 1987 - 1991 (Band 7).
Zusammengestellt von der RSK-Geschäftsstelle.
Salzgitter 1992

BfS-SCHR-8/92
Radiologische Erfassung, Untersuchung und Bewertung bergbaulicher Altlasten.
Abschlußbericht zum ersten Teilprojekt.
Salzgitter 1992

BfS-SCHR-9/93
Grosche, B.; Burkart, W. (Editors)
Radiation epidemiology after the Chernobyl accident.
Proceedings of a workshop held at the Institute for Radiation Hygiene, Federal Office of Radiation Protection, Neuherberg, October 23-25, 1991

Bisher erschienene BfS-Schriften

BfS-SCHR-10/93
von Borstel, L.E.
Lösungen in marinen Evaporiten.
Salzgitter 1993

BfS-SCHR-11/93
Herrmann, *A.G.*
Endlager für radioaktive Abfälle Morsleben (ERAM).
Lösungsvorkommen in den Grubenfeldern Marie und Bartensleben: Stoffbestand, Herkunft, Entstehung.
Eine Dokumentation.
Abschlußbericht für den Zeitabschnitt 1. Januar bis 31. Dezember 1992. Clausthal-Zellerfeld, den 29. Februar 1992.
Salzgitter 1993

BfS-SCHR-12/93
IMIS-Statusgespräch.
Seminar zum Projektstand IMIS am 1. Februar 1993.
Salzgitter 1993

BfS-SCHR-13/94
Przyborowski, S.; Röhnsch, W.
ICRP-Publikation 65
über den Schutz gegenüber Radon-222 in Wohnung und an Arbeitsplätzen und die Situation in der Bundesrepublik Deutschland.
Salzgitter, 1994

BfS-SCHR-14/95
Kammerer, L.; Peter, J.; Burkhardt, J.; Trugenberger-Schnabel, A.; Bergler, I.
Umweltradioaktivität in der Bundesrepublik Deutschland 1992 und 1993. Daten und Bewertung.
Bericht der Leitstellen des Bundes und des Bundesamtes für Strahlenschutz.
Salzgitter, Dezember 1995

BfS-SCHR-15/96
Solare terrestrische UV-Strahlung in Deutschland.
Meßergebnisse und strahlenhygienische Bewertung der Daten aus dem UV-Meßnetz des BFS/UBA für den Zeitraum Januar bis Dezember 1994.
Salzgitter, März 1996

BfS-SCHR-16/98
Kammerer, L.
Umweltradioaktivität in der Bundesrepublik Deutschland 1994 bis 1995. Daten und Bewertung.
Bericht der Leitstellen des Bundes und des Bundesamtes für Strahlenschutz.
Salzgitter, März 1998

BfS-SCHR-17/98
Radiologische Erfassung, Untersuchung und Bewertung bergbaulicher Altlasten.
Abschlußbericht zum zweiten Teilprojekt.
Salzgitter, März 1998

BfS-SCHR-18/98
Sonnek, C.
Die Euratom-Grundnormen für den Strahlenschutz 1996 und 1997.
Ausblick auf zukünftiges Strahlenschutzrecht in Deutschland.
Salzgitter, Juli 1998

Bisher erschienene BfS-Schriften

BfS-SCHR-19/99
Strahlenschutz und Sicherheit in der Medizin.
ICRP-Veröffentlichung 73.
Ein Bericht einer Arbeitsgruppe des Komitees 3 der Internationalen Strahlenschutzkommission.
Von der Kommission angenommen im März 1996.
Salzgitter, Mai 1999

BfS-SCHR-20/99
WORKSHOP
Strahlenüberwachung von Arbeitsplätzen mit erhöhten Konzentrationen von Radon und Radonzerfallsprodukten und Qualitätssicherung der Überwachungsmessungen.
22. bis 24. Juni 1998, Berlin.
Salzgitter, November 1999

BfS-SCHR-21/00
Kammerer, L.
Umweltradioaktivität in der Bundesrepublik Deutschland 1996 und 1997. Daten und Bewertung.
Bericht der Leitstellen des Bundes und des Bundesamtes für Strahlenschutz.
Salzgitter, Oktober 2000

BfS-SCHR-22/01
Ettenhuber, E.; Gehrcke, K.
Radiologische Erfassung, Untersuchung und Bewertung bergbaulicher Altlasten.
Abschlussbericht.
Salzgitter, März 2001

BfS-SCHR-23/01 (ist nicht als Druck erschienen, nur im Internet)
Steinmetz, M.
UV-Index in practical use
Proceedings of an International Workshop
Institute of radiation hygiene, Munich, Germany, December 4-7, 2000
Salzgitter, 2001

BfS-SCHR-24/02
Peter J.; Schneider G.; Bayer A.; Trugenberger-Schnabel A.
High Levels of Natural Radiation and Radon Areas:
Radiation Dose and Health Effects
Proceedings of the 5th International Conference on High Levels of Natural Radiation and Radon Areas held in Munich, Germany on September 4 to 7 2000
Neuherberg, März 2002

BfS-SCHR-25/02
Brix, J.; Matthes, R.; Schulz, O.; Weiss, W.
Forschungsprojekte zur Wirkung elektromagnetischer Felder des Mobilfunks.
Bundesamt für Strahlenschutz
21. und 22. Juni 2001
Salzgitter, Juni 2002

BfS-SCHR-26/02
Bruchertseifer, F.; Pohl, H.
Fachgespräch
Begrenzung der Strahlenexposition als Folge von Störfällen bei kerntechnischen Anlagen und Einrichtungen.
1. und 2. März 2001
Salzgitter, Juni 2002

Bisher erschienene BfS-Schriften

BfS-SCHR-27/03
Trugenberger-Schnabel, A.; Peter J.;
Kanzliwius, R.; Bernhard, C.; Bergler, I.
Umweltradioaktivität in der Bundesrepublik Deutschland 1998 bis 2001
Daten und Bewertung
Bericht der Leitstellen des Bundes und des Bundesamtes für Strahlenschutz
Salzgitter, Januar 2003

BfS-SCHR-28/03
Walter, H.
2.Fachgespräch SODAR
19. u. 20. März 2003
Im Auftrag des Bundesministeriums für Umwelt,
Naturschutz und Reaktorsicherheit
Zusammenfassung der Vorträge
Salzgitter, Juni 2003

BfS-SCHR-29/03
Bergler, I.; Bernhard, C.; Gödde, R.; Schmitt-Hannig, A.
Strahlenschutzforschung
- Programmreport 2001 -
Bericht über das vom Bundesamt für Strahlenschutz fachlich und verwaltungsgemäß begleitete Ressortforschungsprogramm Strahlenschutz des Bundesumweltministeriums
Salzgitter, Juni 2003

BfS-SCHR-30/04
Lennartz, H.-A.; Mussel, Ch.; Thieme, M.
Beteiligung der Öffentlichkeit bei der Standortauswahl für die Endlagerung radioaktiver Abfälle
Abschlussbericht
Salzgitter, April 2004

BfS-SCHR-31/04
Weiß, D.; Bönigke, G.; Spoden, E.; Warnecke, E.
Übersicht zu stillgelegten kerntechnischen Anlagen in Deutschland und in Europa – Januar 2004
Salzgitter, September 2004

BfS-SCHR-32/04
Bergler, I.; Bernhard, C.; Gödde, R.; Löbke-Reinl, A.; Schmitt-Hannig, A.
Strahlenschutzforschung
Programmreport 2003
Bericht über das vom Bundesamt für Strahlenschutz fachlich und administrativ begleitete Ressortforschungsprogramm Strahlenschutz des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit
Salzgitter, Dezember 2004

BfS-SCHR-33/05
Hartmann, M.; Beyer, D.; Dalheimer, A.; Hänisch, K.
Ergebnisse der In-vitro-Ringversuche: S-35 in Urin sowie Am-241 und Pu-Isotope in Urin
Workshop zu den In-vitro-Ringversuchen 2001 und 2002 der Leitstelle Inkorporationsüberwachung des BfS am 1. Juli 2003 im Bayerischen Landesamt für Umweltschutz, Kulmbach
Salzgitter, Januar 2005

BfS-SCHR-34/05 (nur als CD vorhanden)
Trugenberger-Schnabel, A.; Peter, J.; Kanzliwius, R.; Bernhard, C.; Bergler, I.
Umweltradioaktivität in der Bundesrepublik Deutschland
Bericht der Leitstellen des Bundes und des Bundesamtes für Strahlenschutz
Daten und Bewertung für 2002 und 2003
Salzgitter, Juni 2005

Bisher erschienene BfS-Schriften

BfS-SCHR-35/05 (nur als CD vorhanden)
Bergler, I.; Bernhard, C.; Gödde, R.; Löbke-Reinl, A.; Schmitt-Hannig, A.
Strahlenschutzforschung
Programmreport 2004
Bericht über das vom Bundesamt für Strahlenschutz fachlich und administrativ begleitete Ressortforschungsprogramm Strahlenschutz des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit
Salzgitter, August 2005

BfS-SCHR-36/05 (nur als CD vorhanden)
Steinmetz, M.
200 Jahre solare UV-Strahlung
Geschichte und Perspektiven
Wissenschaftliches Kolloquium
Salzgitter, Oktober 2005

BfS-SCHR-37/05
Facharbeitskreis Probabilistische Sicherheitsanalyse für Kernkraftwerke
Methoden zur probabilistischen Sicherheitsanalyse für Kernkraftwerke
Stand: August 2005
Salzgitter, Oktober 2005

BfS-SCHR-38/05
Facharbeitskreis Probabilistische Sicherheitsanalyse für Kernkraftwerke
Daten zur probabilistischen Sicherheitsanalyse für Kernkraftwerke
Stand: August 2005
Salzgitter, Oktober 2005

BfS-SCHR-39/06
Borrmann, F.; Brennecke, P.; Koch, W.; Kugel, K.; Rehs, B.; Steyer. S.; Warnecke. E.
Management of Decommissioning Waste in Germany
Contribution to the IAEA CRP on „Disposal Aspects of Low and Intermediate level Decommissioning Waste“! (T2.40.06)
Stand: August 2006
Salzgitter, Dezember 2006

BfS-SCHR-40/06
Bergler, I.; Bernhard, C.; Gödde, R.; Löbke-Reinl, A.; Schmitt-Hannig, A.
Strahlenschutzforschung
Programmreport 2005
Bericht über das vom Bundesamt für Strahlenschutz fachlich und administrative begleitete Forschungsprogramm Strahlenschutz des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit
Salzgitter, Dezember 2006

BfS-SCHR-41/07
Schkade, U.-K.; Arnold, D. [*)]*; Döring, J.; Hartmann, M.; Wershofen, H.* [*)]
[*)] *Physikalisch-Technische Bundesanstalt*
Gammaspektrometrische Bestimmung der spezifischen Aktivitäten natürlicher Radionuklide in Umweltproben
7. Vergleichsanalyse „Boden 2006“
Leitstelle für Fragen der Radioaktivitätsüberwachung bei erhöhter natürlicher Radioaktivität
Berlin, Dezember 2006
Salzgitter, Januar 2007

BfS-SCHR-42/07
Dushe, C.; Ettenhuber, E.; Gehrcke, K.; Kümmel, M.; Schulz, H. [*)]
[*)] *IAF-Radioökologie GmbH Dresden*
Ein neues Verfahren zur Ermittlung der Radonexhalation großer Flächen
Salzgitter, Februar 2007

Bisher erschienene BfS-Schriften

BfS-SCHR-43/07
Richtlinie für die physikalische Strahlenschutzkontrolle zur Ermittlung der Körperdosis
Teil 2: Ermittlung der Körperdosis bei innerer Strahlenexposition; Inkorporationsüberwachung
(§§ 40, 41 und 42 Strahlenschutzverordnung)
Rundschreiben vom 12.01.2007 RS II 3 – 15530/1 (GMBl 2007 S. 623)
Salzgitter, September 2007

BfS-SCHR-44/07
Bernhard, C.; Gödde, R.; Löbke-Reinl, A.; Schmitt-Hannig, A.; Trugenberger-Schnabel, A.
Strahlenschutzforschung
Programmreport 2006
Bericht über das vom Bundesamt für Strahlenschutz fachlich und administrativ begleitete Forschungsprogramm Strahlenschutz des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit
Salzgitter, Dezember 2007

BfS-SCHR-45/09
urn:nbn:de:0221-2009011200
Bernhard-Ströl, C.; Gödde, R.; Hachenberger, Claudia, Löbke-Reinl, A.; Schmitt-Hannig, A.
Strahlenschutzforschung
Programmreport 2007
Bericht über das vom Bundesamt für Strahlenschutz fachlich begleitete und administrativ umgesetzte Forschungsprogramm Strahlenschutz des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit
Salzgitter, Januar 2009

BfS-SCHR-46/09
urn:nbn:de:0221-2009082120
Bernhard-Ströl, C.; Gödde, R.; Hachenberger, Claudia, Löbke-Reinl, A.; Schmitt-Hannig, A.
Strahlenschutzforschung
Programmreport 2008
Bericht über das vom Bundesamt für Strahlenschutz fachlich begleitete und administrativ umgesetzte Forschungsprogramm Strahlenschutz des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit
Salzgitter, November 2009

BfS-SCHR-47/09
urn:nbn:de:0221-2009082154
Die Empfehlungen der Internationalen Strahlenschutzkommission (ICRP) von 2007
ICRP-Veröffentlichung 103, verabschiedet im März 2007
Deutsche Ausgabe
Salzgitter, November 2009

BfS-SCHR-48/10
urn:nbn:de:0221-201009153217
Bernhard-Ströl, C.; Gödde, R.; Hachenberger, Claudia, Löbke-Reinl, A.; Schmitt-Hannig, A.
Strahlenschutzforschung
Programmreport 2009
Bericht über das vom Bundesamt für Strahlenschutz fachlich begleitete und administrativ umgesetzte Forschungsprogramm Strahlenschutz des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit
Salzgitter, November 2010

Bisher erschienene BfS-Schriften

BfS-SCHR-49/11
urn:nbn:de:0221-201111236640
Bernhard-Ströl, C.; Gödde, R.; Hachenberger, Claudia, Löbke-Reinl, A.; Schmitt-Hannig, A.
Strahlenschutzforschung
Programmreport 2010
Bericht über das vom Bundesamt für Strahlenschutz fachlich begleitete und administrativ umgesetzte Forschungsprogramm Strahlenschutz des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit
Salzgitter, November 2011

BfS-SCHR-50/12
urn:nbn:de:0221-2012120510259
Beyermann, M.; Bünger, T.; Guttmann, A.; Schmidt, K.; Wershofen, H.; Winterfeldt, I.; Labahn, A.
Ringversuch zur Bestimmung von Radon-222, Radium-226, Radium-228, Uran-238, Uran-234 und der Gesamt-□-Aktivität in Trinkwasser – Ringversuch 4/2012
Salzgitter, Dezember 2012

BfS-SCHR-51/13
urn:nbn:de:0221-2013012210275
Bernhard-Ströl, C.; Gödde, R.; Hachenberger, Claudia, Löbke-Reinl, A.; Schmitt-Hannig, A.
Strahlenschutzforschung
Programmreport 2011
Bericht über das vom Bundesamt für Strahlenschutz fachlich begleitete und administrativ umgesetzte Forschungsprogramm Strahlenschutz des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit
Salzgitter, Dezember 2012

BfS-SCHR-52/13
urn:nbn:de:0221-2013110811124
Bernhard-Ströl, C.; Gödde, R.; Hachenberger, Claudia, Löbke-Reinl, A.; Schmitt-Hannig, A.; Trugenberger-Schnabel, A.
Strahlenschutzforschung
Programmreport 2012
Bericht über das vom Bundesamt für Strahlenschutz fachlich begleitete und administrativ umgesetzte Forschungsprogramm Strahlenschutz des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit
Salzgitter, Dezember 2013

BfS-SCHR-53/14
urn:nbn:de:0221-2014010911155
Schmitt-Hannig, A.; Peter, J.; Bernhard-Ströl, C.; Trugenberger-Schnabel, A.; Hachenberger, C, Löbke-Reinl, A.; Schulte-Büttner, B.
International Cooperation and Research
Report on International Cooperation and Research Activities at the Federal Office for Radiation Protection
Status 2013
Salzgitter, Januar 2014

| Verantwortung für Mensch und Umwelt |

Kontakt:
Bundesamt für Strahlenschutz
Postfach 10 01 49
38201 Salzgitter
Telefon: + 49 (0)3018 333 0
Telefax: + 49 (0)3018 333 1885
Internet: www.bfs.de
E-Mail: ePost@bfs.de
Gedruckt auf Recyclingpapier aus 100 % Altpapier.

Bundesamt für Strahlenschutz