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The German Mobile Communications Research Programme

As a consequence of the rapid technical development in the area of modern means of communication, humans are increasingly surrounded by high-frequency electromagnetic fields in their natural surroundings. However, in spite of many national and international efforts research on health risks due to mobile communications is still required.

Against this background, in June 2001 in the Federal Office for Radiation Protection, a workshop was held to prepare a research study on the topic "Effects of electro-magnetic fields in mobile telecommunications".

A research programme with a budget of 17 million Euros in total, being financed at 50 % each by funds from the environmental research plan of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and - in the scope of the so called self-commitment of the operators of mobile telecommunications (www.bmu.de) - by funds from the operators, shall assist to clarify the still open questions.

On the occasion of a second workshop on 25 September 2003 in Berlin, the new projects, the received statements, and the further projects of the German Research Programme on Mobile Telecommunications (www.forschungsprogramm-mobilfunk.de) were put up for discussion together with scientists from federal ministries, environmental associations, research institutions, and environmental agencies of the Länder.

Simone Probst, Parliamentary Undersecretary in the Federal Environmental Ministry, emphasised in her opening address the importance of the research programme.

Wolfgang König, President of the Federal Office for Radiation Protection (BfS), demonstrated in his introductory speech the position of BfS with regard to the content and the marginal conditions for the implementation of the programme by BfS.

The technical discussion included primarily the topics of biology, dosimetry, epidemiology, and risk communication. The projects of the individual subsections were shortly outlined, the comments from the public participation were described, and the controversial points were worked out. The workshop

was concluded with discussions about the whole programme and the focussed topics.

In the scope of discussions in the general public on the German Research Programme on Mobile Telecommunications, very helpful comments and suggestions have been received. A very positive event was the first public participation on the Internet. Most parts of the represented new projects were predominantly judged positive. A clear technical opinion could also be achieved about the discussed projects and the structure of the whole programme.

Based on the results of the second workshop and in co-ordination with the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, BfS establishes the final projects and priorities of the German Research Programme on Mobile Telecommunications.

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Results and Evaluation of a Study on Possible Precautionary Measures in the Field of Mobile Telecommunications

In September 2002, the Federal Office for Radiation Protection commissioned the "ECOLOG-Institut für sozialökologische Forschung und Bildung GmbH" with the study on the "development of a strategy paper for precautionary measures in the field of mobile telecommunications". The results of the study have been published on BfS Internet pages in the form of two partial expert reports "Strategy Paper: Precautionary measures in the field of mobile telecommunications" and "Fulfilment of the voluntary self-commitment of the operators of mobile telecommunications towards the Federal Government of 6 December 2001".

The partial expert report "Strategy Paper: Precautionary measures in the field of mobile telecommunications" is an inventory taken on the multiple proposals and requirements concerning the precautionary measures and recommendations of cellular phones and base stations with an evaluation of their aims and possibilities of implementation. A questioning of the participants in the field of mobile telecommunications has been carried out on this problem. The recommendations of the "Strategy Paper" were thoroughly evaluated by BfS and published on the BfS Internet pages as well. BfS will consider the recommendations in the further development of the precautionary strategy.

Between October and December 2002, in the scope of the partial expert report "Fulfilment of the voluntary self-commitment of the operators of mobile telecommunications towards the Federal Government of 6 December 2001", the ECOLOG Institute sent a questionnaire to 56 towns and communities to determine the experience of the communities and operators with the self-commitment in the first year of its existence. The study provides qualitative results and allows an insight into community projects for precautionary actions in the field of mobile telecommunications.

The results of the BfS partial expert report are, in the essential points, in agreement with the results of the DIFU expertise which the operators of mobile telecommunications commissioned at the German Institute of Urban Affairs (Deutsches Institut für Urbanistik, DIFU) by end of 2002 (www.bmu.de).

The different methodical approach and the sometimes different questioning of the two expert reports complement each other and give valuable information on the progress and the still existing problems in view of establishing mobile telecommunications networks. The two institutes agree on the following statements: the communication between the communities and the network operators has clearly improved one year after the self-commitment was concluded, however, the participation of the citizens at the site selection should be intensified.

Christiane Pözl

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Exposure Measurements of Mobile Phones in Real Operation taken by BfS: Experience on the IFA and the Open Day of BMU

The possibility to measure the SAR values (Specific Absorption Rate) of one's own mobile phone in real operation was welcomed by many visitors on the occasion of both the "Open Day" of BMU in Berlin (16 and 17 Aug. 2003) and the International Consumer Electronics Exhibition (Internationale Funkausstellung, IFA) in Berlin (29 August to 3 September 2003).

The SAR indicates the transmission power absorbed in the tissues in Watt per kilogramme (W/kg) body weight. In Germany, the values recommended by the International Commission on Non-ionizing Radiation Protection (ICNIRP) are the basis for the limit values of the 26th BImSchV (Federal Immission Control Act) for fixed high-frequency stations and amount to 0.08 W/kg for the whole body exposure and 2 W/kg for the partial body exposure, respectively. The standard measurement of the maximum SAR values of mobile phones according to EN 50361 is carried out with special measuring instruments. These measurements are extremely laborious and not appropriate for the determination of SAR values under real exposure conditions.

By means of the mobile SAR measuring head ESM-120 of the Maschek Company Ltd., it is now possible to determine the SAR values generated by mobile phones off-site of laboratories under normal conditions. Although the measurements do not completely correspond to the requirements of the CENELEC standard EN 50361, they still allow a quite reliable evaluation of the real absorption levels at different sites.

The measuring head is a spherical-symmetrical phantom model of the human head, consisting of a plastic dish filled with a tissue-simulating liquid. Directly under the marked point at the surface is a fixed built-in isotropic high frequency sensor which measures the SAR value averaged over 1 g body mass. According to the manufacturer's specifications

the measuring accuracy is about +/- 30% and the measuring range reaches from 0.001 W/kg to 20 W/kg. The measuring head allows measurements of frequencies of the GSM 900- and GSM 1800-networks. The measuring head can be adapted to UMTS.

The SAR values can directly be read at the display in the body/trunk of the measuring head or by means of a graphic PC display. The computer display allows also the visualisation of the power control behaviour between base station and mobile phone.

For the visitors of both the "Open Day" of BMU and of the IFA it was particularly impressing to be able to see on the screen how the power level, following the phase of dial-up, is reduced to the level actually required for making the call under the given conditions. Also the differences between the various types of mobile phones became clear and drew the attention of some visitors to the topic of "mobile phones with low radiation exposure". On the "Open Day" of BMU in Berlin the SAR values measured were mainly below 0.01 W/kg under the prevailing good receiving conditions, frequently even at the lower response limit of the measuring head, i. e. more than factor 100 below the limit values. In single mobile phones, however, SAR values of about 0.1 W/kg were observed.

At the IFA the extremely good receiving conditions prevailing proved to be a "problem" insofar as the mobile phones reduced their transmission power to such an extent that differences could hardly be detected during an established connection. The maximum SAR values during dial-up were between 0.1 and 1.8 W/kg, depending on device type and age.

For consumer information about the possibilities to make phone calls with low radiation levels the mobile measuring head is very suitable. Various influences on the SAR, such as receiving conditions, how to hold the mobile phone, time elapsed, etc. can be represented and conveyed quickly and safely.

Monika Asmuss, Blanka Pophof

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Exercise "Airborne Detection of Radiation" with French Participation in Saxony

The Federal Office for Radiation Protection (BfS) provides measuring systems for helicopters allowing a quick determination of soil contamination and of the dose rate over a large area following an incident-caused release of radioactive substances from a nuclear facility. Another important task for the use of helicopters for airborne radiation measurements is the detection of radioactive sources, such as e. g. radioactive satellite fragments or radioactive gamma radiation sources lost during transports.

For the measuring flights helicopters of the Federal Border Police (BGS) are used. They are pre-equipped with quick installing devices, connectors, and cableforms as well as with a radio-altimeter for taking up the measuring systems.

In their joint BfS and BGS exercise "Airborne radiation measurements 2003" nuclide-specific measurements of soil contamination and the detection of radiation anomalies should be carried out with helicopter-aided measuring systems. In accordance with the competent State Ministry for the Environment and Agriculture of the State of Saxony six areas suspected to contain relics with enhanced contents of natural radionuclides were selected.

Altogether 26 Federal Border Police members with four helicopters, various field vehicles including mobile tower were involved. The exercise was managed by the Federal Border Police "Fliegerstaffel Ost". The Federal Office for Radiation Protection attended the exercise with 12 members and four measuring systems.

The partial areas were assigned short-term on site by the head of operations. As far as this was possible, flights were carried out in a height of 100 m above ground at a velocity of about 100 km/h and at a distance of 250 m. The four helicopters of BGS and the one of the French team were used simultaneously.

On two days all selected areas were flown over. For quality assurance purposes one measuring area was flown over by all teams (also by the French team). Altogether more than 500 km² were covered with the help of gamma spectrometry in detail in a grid of 250 m.

First results could already be presented on the press conference on the second day of flight. After a detailed analysis of the measured data the results are made available to the Saxonian Environmental Ministry for the evaluation of remediation measures. Co-operation between the German teams and the French team was extremely good thanks to the flight organisation by the German Boarder Police.

Michael Thomas

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Determination and Publication of Diagnostic Reference Values by BfS

Through publication in the Federal Gazette no. 143 of 5th August 2003 diagnostic reference values (DRV) were introduced into diagnostic radiology and nuclear medicine. With this a recommendation of the International Commission on Radiological Protection (ICRP) of 1996 on "Radiation Protection and Safety in Medicine" and a requirement of the Directive 97/43/EURATOM on "Health Protection of Persons Against the Hazards of Ionising Radiation in Case of Medical Exposure" (in short: Patient Protection Directive) were implemented in national law. According to the provisions of the amended X-ray Ordinance (RöV) or the Radiation Protection Ordinance (StrlSchV), respectively, DRVs are determined and published by BfS and "have to be taken as a basis in the examination of human beings".

The DRVs serve physicians as upper guidance levels in frequent and/or dose-intensive X-ray examinations which must not be exceeded permanently and unjustifiably. Unlike X-ray

diagnostics the DRVs are no upper guidance levels in nuclear-medical diagnostics but they are optimum levels. They give thus the activity necessary for a good image quality and should be accepted in standard procedures and patients.

The DRVs do not represent dose limit values for patients and do not apply to single individual examinations, but they refer to examinations in groups of patients. One assumes that individual differences between the patients (such as e. g. height, weight) are averaged through this procedure. It is essential that the mean values of the patient doses or the applied activities, respectively, do not exceed the DRVs and that they comply with them, respectively.

Through the establishment of DRVs the operators are obliged to regularly determine within the scope of quality assurance mean values of patient exposure of the corresponding examinations. The physicians responsible for quality assurance according to X-ray Ordinance and/or Radiation Protection Ordinance have the task to control compliance with the DRVs and, if required, to recommend measures to reduce radiation exposure. For doing this they compare the dose values of the patients determined by the operators or the applied activities, respectively, with the DRVs and check by random tests if the image quality corresponds to the requirements. Details are regulated in the directive "Goals and Requirements on Physicians and Dentists" being in preparation. Operators who do unjustifiably not comply with the DRVs must modify their procedures or their devices in such a way that they also comply with the DRVs. The physicians are obliged to report each permanent, unjustifiable exceeding of the DRVs to the competent state authority. The authority can then initiate a inspection in place.

On the basis of the data on dose and activity being compiled by the physicians within the scope of reviewing the DRVs, BfS determines updated DRVs in regular intervals. It is expected that through this measure both the patient doses and the DRVs will decrease in the long term and that a reduction in radiation exposure of the general public due to medical measures will be achieved.

Jürgen Griebel

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Measures for Danger Prevention According to Mining Law in the Central Part of the ERAM – A Progress Report

BfS as the operator and the Landesamt für Geologie und Bergwesen (LAGB, Federal State Office for Geology and Mining) of the Federal State of Saxony-Anhalt as the competent mining supervisory authority are commonly of the opinion that an acute danger exists for the permanent stability in a limited area in parts of the so-called central part of the Morsleben Repository for Radioactive Waste (ERAM), where no radioactive waste has been disposed of. The LAGB has given orders to BfS to begin with suitable backfill measures in the central part as soon as possible.

The measures were initiated in March 2003 immediately after the decision of BMU that the implementation of the measures for danger prevention approved according to Mining Law is permissible without licensing procedure according to nuclear law. The mining and facility-related preparation work has been concluded, so that on 8th October 2003 in the presence of the Federal Minister for the Environment, Nature Conservation and Nuclear Safety, Jürgen Trittin, and the BfS President, Wolfram König, backfill operations could begin.

After extensive geotechnical calculations 20 mining rooms in a depth between –253 m sea level and –305 m sea level and with a cavity volume of about 670,000 m³ were chosen. The mining rooms are backfilled with salt concrete consisting of salt, coal filter ash and cement which has been used for the first time. The mining cavities, which have no longer been used for mining purposes for the last 60 to 70 years, must be made accessible again. One reason for this is that dams have to be erected which avoid that the backfill material flows into neighbouring areas. Another reason is that it must be possible to make drillings through which the concrete will be pumped. Thus, mining security work, extensions and new driving of mine openings are required. Altogether drillings with a total length of more than 2 km are planned for backfilling.

The salt concrete is mixed outside the ERAM and delivered from there. On the ERAM premises there is a rented mobile diesel-driven high-pressure pump which is able to pump daily up to 300 m³ of salt concrete in a 1000-m long pipeline through the shaft into the mining cavities. The entire pump installation is extended and replaced by a more efficient stationary installation, with which then up to 580 m³ of salt concrete will be pumped underground daily, probably starting in spring 2004.

The approved operation extends in a first phase until mid 2005 and comprises a backfill volume of 214,000 m³. The residual backfill work in the affected mining rooms in the central part of the ERAM will probably be concluded by 2008. Costs will amount until then to about 100 million Euro.

The behaviour of the rock in the central part is monitored by means of geotechnical measurements. The measurements focus on areas where changes in the load and stress states are to be expected as a result of backfilling. In particular geomechanically exposed load-bearing elements are monitored, in order to be able to initiate differentiated precautions, depending on the measurement results. Furthermore the effectiveness of the backfill measures is examined by geotechnical measures.

Gerald Laumert

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