



European Conference on Individual Monitoring of Ionizing Radiation Athens, 8-12 March 2010

The European Conference on Individual Monitoring of Ionizing Radiation (IM2010), organized by the Greek Atomic Energy Commission (GAEC) under the auspices of the European Commission, in co-operation with the International Atomic Energy Agency (IAEA) and the European Radiation Dosimetry Group (EURADOS), was held in Athens from 8 to 12 March 2010.

IM2010 was the fourth of a series of conferences dealing with individual monitoring. Its programme was focused on the relevant regulatory aspects, the technical developments achieved and the present trends in the field of individual monitoring. The conference brought together scientists from regulatory authorities, individual monitoring services, research bodies, European networks and companies, for the purpose of facilitating the dissemination of knowledge, exchanging experiences and promoting new ideas in the field of individual monitoring. Therefore, it was a unique opportunity to keep up to date with the scientific and technological knowledge gained at European level by experts on individual monitoring.

The main goal of the conference was to assist progress towards the harmonization of practices in individual monitoring across Europe, with the aim of the mutual recognition of the results of dose assessments. Among the main thematic topics were the recommendations of the EU-Trimer project, as well as the results of the intercomparison exercises. The programme consisted of oral and poster sessions of contributed papers. Invited lectures were given by eminent speakers. Individual Monitoring Services have been invited to present their activities in posters.

Key figures

Participation:

- 277 participants
- 34 accompanying persons
- 8 companies as exhibitors
- 9 sponsors
- 17 one-day visitors

Scientific programme:

- 15 invited lectures
- 73 oral presentations
- 172 poster presentations
- 29 Individual Monitoring Services poster presentations
- 3 satellite meetings

Main conclusions

Session I: New developments in international recommendations and requirements

The basic lines of new international and European radiation protection standards that will be issued by IAEA and the European Council were presented first. The natural continuation was the presentation of the New Technical Recommendations on Individual Monitoring. A complete and solid document, this conference best seller free of charge, addressed to all people involved in Individual Monitoring. During the conference, a lot of discussion took place, on how this document will be followed and applied, aiming to an enhanced level of harmonization of Individual Monitoring Services and to their mutual recognition throughout Europe. International standards on Radiation Protection and Individual Monitoring are issued from different organisations with different levels of acknowledgement and legal binding. And, the better the experts in working groups, the better the standards are: experts and scientists are invited to contribute, by joining the international committees through their national ones.

Session II: Practical implementation of standards and regulations – Quality management systems

The substantial interest on the newly developed standards and other guidance was obvious during the second session. It included the application of new views on the analysis of measurement uncertainties and quality assurance.

In particular:

The application of internationally agreed standards and especially, the accreditation of services are essential for an efficient quality management. Three speakers reported on their experience. Emphasis was given on the fact that accreditation can be facilitated and achieved also, with the application of a flexible scope.

In line with developments recently published in international standards and guidance on uncertainty analysis, much attention was paid on Monte Carlo methods and Bayesian statistics. The well-known law of propagation of uncertainties (LPU) is one of the options to use for uncertainty calculation as recommended by the Joint Committee for Guides in Metrology (JCGM). Practical examples were presented, both for film and TLD systems. However, for application in individual monitoring the LPU approach could require a more in-depth analysis, because usually the relevant model functions are non-linear and uncertainties are relatively large. Numerical solutions using statistical sampling (normally referred to as Monte Carlo methods) appear to offer the best alternative. The invited lecture and two other contributions in this session strongly supported the choice for Monte Carlo methods for uncertainty calculations in individual monitoring. It was emphasized that uncertainty analysis is an essential part of quality management. This also means that the results must be made accessible to the users of individual monitoring in such a way that it adds to the understanding of the dose data reported.

The current status, procedures to reform, and the introduction of new features to national dose registers were presented and discussed. Registries from Finland, Belgium and Switzerland were presented. One speaker shared the experience with the set-up of a national dose assessment system and a national dose registry involving 23000 category A workers. Possible extension of national activities to a European level was discussed too. IAEA

activities by carrying out missions, appraisals and training courses in Latin America were presented. The evaluation on the achievements was referenced to the requirements defined in the relevant IAEA documents. Special monitoring issues for pregnant women (or fetus) were given particular consideration.

Session III: Development in external dosimetry systems

An overview on the state of the art of APDs, their evolution since the last conference (IM2005) and the present challenges of its application, were presented. Other communications described the detectors, methodologies and simulation methods, for passive and active devices. New dosimeters, dosimetry systems based on various techniques and the respective improvements were presented. In particular, a new dosimetry system for large scale individual monitoring based on RPL was presented. Detector and dosimeter simulations, as well as algorithms for improving dose assessment and quality assurance were shown.

Session IV: Intercomparison exercises

In the intercomparisons session, it was proved that the previous challenge for EURADOS, became an established and successful procedure, promising very interesting conclusions. Intercomparisons of whole body dosimeters are more demanded, however, intercomparisons of extremities dosimeters are more critical. We observed a systematic under response, depending on the energy, that needs special attention.

Intercomparison exercises are an important tool and element not only for external but also for internal dosimetry. The fact that in France they are imposed by law, justifies it. It is not a European need or novelty. Latin America follows the example.

In a **Special Session**, the results of the EURADOS intercomparison for extremity dosimeters (2009) were presented. In addition, details about specific irradiations were discussed. The need for further intercomparisons on a regular basis for IMSs to help to maintain and improve their quality of dose assessment was confirmed.

Session V: Developments in internal dosimetry systems

The invited lecture on on-going internal dosimetry models of ICRP and NCRP provided also information of the forthcoming ICRP document to deal with Occupational Intakes of Radionuclides (OIR Report). A review of the EURADOS WG7 related to internal dosimetry was presented: the fields of activities are mainly connected to revision of harmonized procedure for dose assessment, to quality assurance of biokinetic modeling and to applications of Monte Carlo methods and voxel phantoms for in vivo measurements of incorporated radionuclides.

Improvements on in-vivo monitoring of internal exposures were considered. Numerical, voxel and deformable phantoms were shown as a very useful tool to be applied; for example in a variability study of radioiodine measurements in the thyroid or in an uncertainty assessment of whole body counting systems depending on size and sex of the subject, or in the comparison of efficiency values for head measurements between physical and voxelized numerical phantoms. Special interest was put on the application of 3D adjustable phantoms on the lung monitoring of female nuclear workers and on the application of walking posture phantoms.

With reference to the application of in-vitro techniques for measurements of radionuclides in excreta, a rapid method for the determination of ^{226}Ra and ^{228}Ra in biological samples by liquid scintillation technique was presented, as well as the extraction of thorium by calix[6]arene columns in the aim of urinary analysis.

As different approaches, the interesting experience of Health Canada on using people to test emergency response equipment was shown as well as the developments on modeling of the particle clearance due to alveolar-interstitial transfer inside the lung for long-term retention carried out by HPA.

Reviews of methods to perform internal dosimetry monitoring programs were presented both by French and Ukrainian representatives, with description of methodologies for the choice of the monitoring period and modalities and with the presentation of results in working on the Shelter Object construction.

Finally a new software tool aimed at calculating the reduction on effective dose associated with DTPA administration and the planning of decorporation activities was introduced by CEA.

Session VI: Individual monitoring in medical applications

Many authors reported on measurements of extremity doses both in nuclear medicine and in interventional cardiology and radiology sectors. The importance of the proper practices was underlined, since extremity doses can be very high. Two of the most important topics presented were the eye lens dosimetry and the use of active personal dosimeters in pulsed fields. The first results of the ORAMED project that deals with many of these issues were presented in the conference. We are looking forward to the ORAMED workshop to be held in Barcelona in January 2011. Finally, different methodologies for the measurement of internal contamination of nuclear medicine staff were presented.

Session VII: Dosimetry in emergency situation

Individual monitoring is not needed only in routine. Dosimetry in emergency situations is still an open issue. Various techniques used for retrospective dosimetry or dose reconstruction in case of overexposures due to contamination and irradiation, as well as different methodological approaches to manage an emergency situation were presented. Innovative dosimetry techniques using ESR, TL and OSL or new material as electronic devices were presented and new methodological approaches to assess the dose in the case of overexposure were proposed. Interesting real cases were reported showing the importance of the dose assessment to manage the medical aspects after an overexposure.

Session VIII: Education and training

Education and training, an essential element of any radiation protection programme, is a requirement explicitly stated in the Basic Safety Standards. Appropriate programmes shall cover the needs of the staff of the individual monitoring services as well as of those to be monitored. The activities of IAEA and of two training courses and their outcome, carried out in Europe and Argentina were presented.

Session IX: Workplace monitoring

All aspects of workplace monitoring from external exposure to internal exposure and from space at about 200 km above ground to flight altitudes at about 10 km above ground to the ground itself and further to the underground, were covered. The invited lecture was on the current status of monitoring of mixed neutron-photon radiation. Concerning external exposure, this type of radiation is the most complicated to measure and requires a lot of experience. A lot of activities seem to go into dosimetry at flight altitudes. Here systems are developed to measure continuously on aircrafts the dose and even the spectral distribution. One hope is to measure during a solar particle event. At ground level the environmental background radiation was covered by several presentations, either with the aim to monitor the environmental radiation for the purpose of warning against radiological events or to get information on the geographical variation to subtract the local background when performing individual monitoring. One interesting idea is to determine the geographical variation by measuring during a train ride.

Concerning internal exposure the measurement of radon concentration is still the focus of workplace monitoring. Some new instruments were presented and a lot of measurements concerning internal exposure due to Technically Enhanced Naturally Occurring Radioactive Material (TENORM). Other workplaces considered are caves for tourists' activities in the UK and ancient tombs in Luxor, Egypt. Even chromosomal aberration analysis is used and could demonstrate effects on underground water well workers.