

Recommendations for monitoring individuals occupationally exposed to external radiation

The new European Technical Recommendations for monitoring individuals occupationally exposed to external radiation constitute the basis for harmonisation as well as for mutual recognition of individual monitoring services

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European Commission Technical Recommendations for Monitoring Individuals Occupationally Exposed to External Radiation provide guidance on those aspects of the implementation of the European Union Parliament and Council Directives directly related to individual monitoring of external radiation, and encourage harmonisation thereof. They are mainly aimed at the management and staff of individual monitoring services but also at manufacturers, laboratories supplying type testing services and national approval authorities trying to harmonise approval procedures, and even Government bodies to harmonise regulations and guidance. The Technical Recommendations, main topics are: objectives and aims of individual monitoring for external radiation; dosimetry concepts; accuracy requirements; calibration, type-testing and performance testing; approval procedures; quality assurance and quality control; dose record keeping. Attention is paid to particular aspects, such as: wide energy ranges for the use of personal dosimeters, pulsed fields, and non-charged particle equilibrium; use of active personal dosimeters. The Technical Recommendations give proposals towards achieving harmonisation in individual monitoring and the eventual mutual recognition of dose results.

European Commission (EC) Directives introduce principles for the operational radiation protection of workers including requirements for the monitoring of individuals occupationally exposed to external radiation. With the objective to harmonise the technical implementation of these requirements, EC provided already in 1975 guidance on individual monitoring of external radiation and in 1994 published RP73¹ a second issue of Technical Recommendations.

RP73 was issued at a time when final drafts of the 1990 Recommendations of the ICRP were circulating, and a few years before the publication

of the European Basic Safety Standards Directive (BSS), which generalised within the European Union (EU) the use of the operational quantities, personal dose equivalents $H_p(10)$, $H_p(3)$ and $H_p(0.07)$, ambient dose equivalent, $H^*(10)$ and directional dose equivalent $H'(0.07)$. The BSS also emphasised the importance of quality assurance (QA) and quality control (QC) issues. Revised and new international standards in the field of metrology and dosimetry with specific requirements regarding accuracy, performance and the assessment of the uncertainty in measurement have been published since that time. The previous technical recommendations were written mainly with passive dosimeters in mind, in particular whole body TLDs. Specific aspects of the use of passive dosimeters based on other techniques, extremity dosimeters and dosimeters for measuring in neutron and beta fields were not addressed in detail, and APDs were not addressed at all. All the above constitute the reasons for considering the revision of the European technical recommendations.

In 2007 EC awarded a contract (no 211361. TREN/07/NUCL/S07.70121, Project EU-Trimer) to a consortium composed of Greek Atomic Energy Commission (GAEC) and the European Radiation Dosimetry Group (EURADOS) to update the 1994 recommendations and to prepare the new draft of Technical Recommendations. The submitted document was endorsed in June 2009 by the Euratom Article 31 Group of Experts, and published as an EC document (RP160).² An extended summary of the document entitled 'The new European Commission Technical Recommendations for Monitoring Individuals Occupationally Exposed to External Radiation' is going to be published soon in a special volume of *Radiat Prot Dosim Journal* dedicated to the European Conference on Individual Monitoring (IM2010).

The new Technical Recommendations are

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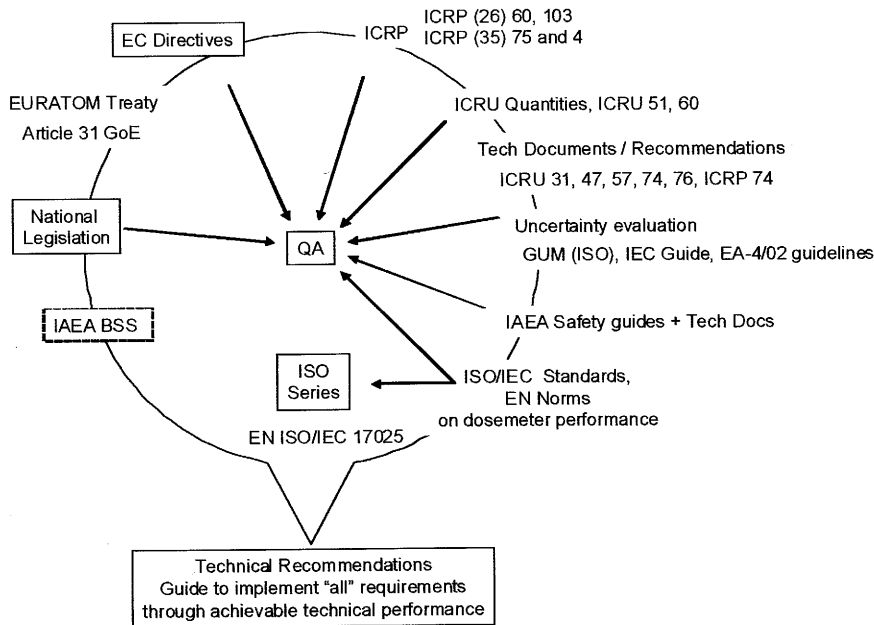


Figure 1. Context of the new European Technical Recommendations for monitoring individuals occupationally exposed to external radiation

derived from the requirements of EU Council Directives, the ICRP recommendations on radiation protection, relevant reports of the ICRU, various standards and guides on metrology and quality assurance, reports and technical documents or safety guides of the IAEA. The opinion of all stakeholders involved in radiation protection, eg, European dosimetry services, calibration laboratories and international organisations, has been taken into account, by means of the widespread distribution of draft documents for comments and suggestions, and discussion at EURADOS meetings, in particular those of Working Group on 'Harmonisation of Individual Monitoring' attended by representatives of stakeholder organisations from all EU Member States.

The EURADOS WG has published significant reports on the status of individual monitoring and new developments in individual monitoring in the recent years.^{3,4}

Purpose of the new Technical Recommendations

The purpose of the new European Technical

Recommendations for monitoring individuals occupationally exposed to radiation is to provide guidance on those aspects of the implementation of the EU Parliament and Council Directives that are directly related to individual monitoring of external radiation, and to encourage harmonisation thereof. Technical Recommendations are primarily aimed at the management and staff of European individual monitoring services. It is considered that the text will also be useful for manufacturers, laboratories supplying type testing services and for national approval authorities trying to harmonise approval procedures, and Government bodies to harmonise regulations and guidance. Finally, other partners in the radiation protection dosimetry framework may find useful information and guidance in these recommendations.

The Technical Recommendations bring together requirements and guidance given in:

- EU Council Directive 96/29/Euratom BSS and EU Council Directive 90/641/Euratom Outside Workers Directive (OWD).
- Publications on radiation protection of the International Commission on Radiological Protection (ICRP); (ICRP 103,⁵ ICRP 75⁶).

- The relevant reports of the International Commission on Radiation Units and Measurements (ICRU).
- Various standards and guides on metrology and quality assurance.
- Reports, technical documents and safety guides of the International Atomic Energy Agency (IAEA).

The Technical Recommendations aim to present good practice for individual monitoring that follows from these "top-level" documents as a comprehensive and consistent text including guidance and recommendations that will contribute to the harmonisation of individual monitoring procedures in Member States. Figure 1 illustrates the position of the documents and the source organisations within the content of the Technical Recommendations.

Scope of the new European Technical Recommendations

The new European Technical Recommendations cover the following topics:

- Objectives and aims of individual monitoring for external radiation.
- Dosimetry concepts.
- Assessment of uncertainty.
- Accuracy requirements.
- Calibration, type-testing and performance testing.
- Approval procedures.
- Quality assurance and quality control.
- Dose record keeping.

In addition, attention is paid to particular aspects, such as:

- Wider energy ranges for the use of personal dosimeters, pulsed fields and non-charged particle equilibrium.
- The use of active personal dosimeters.
- Data protection.
- The basis for procedures and criteria for mutual recognition within the EU of approved dosimetry services.

The last point is very important. At present there is a growing need for strengthening harmonisation of practices in individual monitoring in Europe, moving in the direction of the mutual recognition of dose assessments performed by approved dosimetry services. As a consequence of the free

movement of workers, different dosimetry services from different Member States may enter dose data into radiation passbooks. This is of concern with regard to entries in the national dose registers of a Member State, because the measured and possibly evaluated dose values may have been submitted by services which are not approved by the authority in that Member State. Different conditions imposed by the authorities for a number of procedures, for example background subtraction, recording levels and notional doses can have an impact on occupational exposure studies, such as the European Study on Occupational Radiation Exposure (ESOREX). The present Technical Recommendations will contribute to more consistent presentation of data.

Following the publication in 2007 of the ICRP recommendations, the EC has prepared the draft of the new BSS; advice concerning these changes is included. The new BSS will combine the content of the current BSS and with that of the OWD, and that of the directives on medical exposure, high activity sealed sources and information to the public.

It is of particular concern that the recommended procedures for the assessment of measurement uncertainty have proved confusing for many users. Therefore, care has been taken so that this is addressed in a clear way. The procedures to derive estimates of the measurement uncertainty, overall accuracy criteria, and the basis for acceptable uncertainties and characteristic limits will be addressed in detail. The methods recommended follow the guidance of the Joint Committee for Guides in Metrology (JCGM), which has produced the Guide to the Expression of Uncertainty in Measurement (GUM)⁷ and the International Vocabulary of Basic and General Terms in Metrology (VIM).⁸ The new Technical Recommendations use the overall accuracy criteria of ICRP and ICRU as the basis, and take into account the guidance of the European cooperation for Accreditation (EA), the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). The accuracy criteria are applied to the range of doses and radiation fields in which a dosimetry system is to be used. There is guidance on type testing requirements and on routine calibrations and in-house performance tests, with recommendations on participating in periodic international inter-com-

parisons. Details are given of approval procedures and of quality management systems.

Although the objectives and fundamental principles of dose record keeping have not changed much over the years, huge developments in information technology, such as easy access to storage media and wider Internet use, have had an impact on dose record, dose data transfer and dose record keeping. The application of EN ISO/IEC 17025:2005⁹ on dose registration (for example, archiving of measurement results and traceability) as well as the implications of the EU Directive 95/46/EC on data protection, is addressed.

Other specific changes/updates include state of the art knowledge on the application of dosimetry, protection and operational quantities in agreement with ICRU and ICRP recommendations and with international standards, and guidance on the following: (i) monitoring procedures in line with the recommendations of ICRP, on the use of workplace monitoring information in order to better estimate E from the measured $H_p(10)$ value; (ii) the use of extremity dosimeters and whole body dosimeters when protective equipment is worn; (iii) assessment of dose to the lens of the eye.

The authorities in the Member States set criteria on the technical performance of approved dosimetry systems. These criteria will in general be derived from those recommended by the ICRP and ICRU, and thus result in a reasonable degree of harmonisation throughout the EU. However, their details, in particular when it comes down to exact values, might not always be the same and may vary in relevance from the radiation protection point of view.

Conformity with international standards may not be mandatory but is recommended as being desirable in general, whilst noting that technical standards are more likely to change than radiation protection criteria and guidance. Therefore the Technical Recommendations do not state precise numbers for technical requirements in some cases but refer to the appropriate standards.

Last, but not least, there is a growing need for improving the harmonisation of practices in individual monitoring across Europe. Given that there is no specific guidance on harmonised approval requirements of dosimetry services at the present time, the Technical Recommendations give proposals towards

achieving this harmonisation and the eventual mutual recognition of dose results.

Conclusion

The new European Technical Recommendations for monitoring individuals occupationally exposed to external radiation, are based on the relevant legislation and accepted standards, and are the product of the compilation of relevant documents. They provide basic knowledge for the individual monitoring and metrology community, specific and clear technical advices and guidelines. Additionally, they fill the gap between the previous recommendations RP73 and the recent ICRP publications. Moreover, they constitute the basis for harmonisation as well as for mutual recognition of individual monitoring services. Since the opinions of all stakeholders involved in radiation protection were requested and their comments taken into consideration during the drafting process, these technical recommendations will have achieved, before being issued, the broad consensus and acceptance from the scientific community. ■

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