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Contents

From the Editor

In this issue of the SSDL Newsletter (No 74) the focus is on the ISO 4037:2019, the changes and new services at the IAEA Dosimetry Laboratory (DOL) and a report from the Dosimetry Audit Network (DAN) meeting.

Ms Jamema Swamidas, is the new laboratory head (dosimetry laboratory) of the Dosimetry and Medical Radiation Physics (DMRP) section of the International Atomic Energy Agency (IAEA) from June 2021. Previously, she was working as a senior Medical Physicist and Associate Professor in the department of Medical Physics, Tata Memorial Centre, Mumbai, India. She has more than 20 years of experience in radiation oncology medical physics covering all aspects of clinical service, research, and education. She has special research interest in brachytherapy, treatment planning, patient safety and adaptive radiotherapy. She was also the primary physicist responsible for accrediting Tata Memorial centre for various clinical trials, most of them being international-multicentric, testing advanced technologies. She is the author/co-author of more than 50 peer-reviewed scientific publications, as well as 5 book chapters.

Fig.1 Ms Jamema Swamidas

Staff of the Dosimetry and Medical Radiation Physics (DMRP) Section

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Services provided by the IAEA DMRP Section

The IAEA's Dosimetry and Medical Radiation Physics Section focuses on services provided to Member States through the IAEA/WHO SSDL Network and on a system of dose quality audits. The measurement standards of Member States are calibrated, free of charge, at the IAEA's Dosimetry Laboratory. The audits are performed through the IAEA/WHO postal dose assurance service for SSDLs and radiotherapy centres by using radiophotoluminescence and optically stimulated luminescence dosimeters (RPLDs and OSLDs).

The Dosimetry Laboratory's Quality Management System has been reviewed and accepted by the Joint Committee of the Regional Metrology Organizations and the BIPM (JCRB). The IAEA Calibration and Measurement Capabilities (CMCs) have been reviewed and published in Appendix C of the Comité International des Poids et Mesures (CIPM), Mutual Recognition Arrangement (MRA).

The IAEA CMCs can be found at the following web site: https://www.bipm.org/kcdb/

The range of services is listed below.

Services	*Radiation quality*
Calibration of ionization chambers (radiation therapy, brachytherapy*, radiation protection, and diagnostic radiology including mammography) **	X rays and γ rays from ^{137}Cs and ^{60}Co beams ^{137}Cs, ^{60}Co and ^{192}Ir brachytherapy sources
Comparison of ionization chamber calibrations coefficients (radiation therapy, radiation protection, and diagnostic radiology including mammography) for SSDLs**	X rays and γ rays from ^{137}Cs and ^{60}Co beams
Dosimetry audits (RPLD) for external radiation therapy beams for SSDLs and hospitals***	γ rays from ^{60}Co and high energy X ray beams
Dosimetry audits (OSLD) for radiation protection for SSDLs	γ rays from ^{137}Cs
Reference irradiations to dosimeters for radiation protection	X rays and γ rays from ^{137}Cs and ^{60}Co beams

* Brachytherapy calibration services are not included in the IAEA CMCs.

** Technical procedures and protocols for calibrations and comparisons are available on our website https://ssdl.iaea.org/

***Thermoluminescence dosimeters (TLDs) were replaced by RPLDs in 2017.

Member States interested in these services should contact the IAEA/WHO SSDL Network Secretariat, for further details, at the address provided below. Additional information is also available at the web site: https://ssdl.iaea.org

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Note to SSDLs using IAEA calibration and audit services:

1. To ensure continuous improvement in IAEA calibration and audit services, SSDLs are encouraged to submit suggestions for improvements to the Dosimetry Contact Point.

2. Complaints on IAEA services can be addressed to the Dosimetry Contact Point.

3. Feedback can be provided using the form on our website: https://ssdl.iaea.org/

https://iris.iaea.org/public/survey?cdoc=DOL00100

ISO-4037:2019 What is new and why?

Summary from the CCRI webinar

Mr Oliver Hupe, PTB

Reference fields are needed to perform reproduceable and traceable measurements for testing of dosimeters. The test results need to be valid for the field the dosimeters are to be used in. The International Standard (ISO) has published procedures defining the characteristics of the radiation fields and methods that can be used to perform the measurements for photon beams. This standard is the ISO 4037. In 2019, the standard was updated.

Why the changes?

Comparing the HVLs, related to air kerma, of the new and old X ray generators, data show that for lower energies (< 30 keV, N-30) there is a difference of even up to 20 %. The monoenergetic conversion coefficients show a strong energy dependence at these low photon energies and do also depend on tissue depths. The conversion coefficients of the new generation of generators differ almost by a factor of 2 from the values published in ISO 4037:1999. Because of this, a dosimeter that was type tested using the old conversion coefficients calculated for an old type of X ray generator would fail the type test at low energies when using the new type of X ray generators, which are mostly used today.

What has not changed?

- There are still four parts to the ISO 4037 standard and their focus areas are:
  ISO 4037-1:2019— PART 1: Radiation characteristics and production methods;
  ISO 4037-1:2019— PART 2: Dosimetry for radiation protection over the energy ranges from 8 keV to 1,3 MeV and 4 MeV to 9 MeV;
  ISO 4037-1:2019— PART 3: Calibration of area and personal dosemeters and the measurement of their response as a function of energy and angle of incidence; and
  ISO 4037-1:2019— PART 4: Calibration of area and personal dosemeters in low energy X reference radiation fields.

- Realization and characterization of the reference radiation fields is further done in terms of spectral fluence and total air kerma (free in air).
  - Mean photon energy, E_f, with respect to the spectral photon fluence
  - Spectral resolution, R_E, with respect to the spectral photon fluence
  - Half value layer thickness (HVL)
  - Homogeneity coefficient, $h = 1^{st}$ HVL/2^{nd} HVL
  - Characterisation of the fields is still in air kerma.

What has changed?

- Every value and every requirement are traceable to a publication.
- The requirements were chosen to ensure an overall uncertainty ($k = 2$) of about 6 % to 10 % for the dose rate of the phantom related operational quantities instead of the earlier requirement which was focusing on K_a.
- The lowest air kerma rate for which this standard is applicable is 1 µGy h^{-1}. Below this air kerma rate the (natural) background radiation needs special consideration, and this is not included in this document.
- Introduction of matched reference fields and characterised reference fields.
  - A matched reference field has properties that are sufficiently well-characterized so as to allow the use of the recommended conversion coefficients.
  - A characterised reference field is defined as a field whose properties are not sufficiently well-characterized so as to allow the use of recommended conversion coefficients but the mean energy of which is close enough to the nominal value to be used as a reference radiation field with the given designation [ISO 4037-1].

Whether a laboratory is realizing a characterised or matched field, within the stated uncertainty of 6 % to 10 % ($k = 2$), the same result should be achieved, e.g., when used to determine the response of a dosemeter.

- Consideration of ISO 29661:2012 Reference radiation fields for radiation protection — Definitions and fundamental concepts.
- W- and H- series have been extended to lower energies; N- and H series have been extended up to 400 kV.
- High voltage has to be measured with a high voltage divider rather than determined by spectrometry.
- Omission of HV adjustment.
- Consideration of the high voltage by the voltage drop across the short circuit protection resistor in the tube.
- Build up plate used during the irradiation of dosimeters has to be 3 mm for S-Cs and S-Co. Also, it has to be positioned as closely as possible to the dosimeter.
- Conversion coefficients are given for all quantities, given in 15° steps instead of 10° steps.

- For the gamma radiation emitted by radionuclides, the standard includes use of lead attenuators for dose rate variation and excludes uncollimated geometry installations, they are no longer reference fields.
- The Am-241 source is deleted from the main text but retained in informative Appendices A and B, where it is no longer a reference field since there is insufficient spectrometry data to define it as a reference field.
- The first edition of ISO 4037-1, issued in 1996, included some additional radiation qualities for which there is insufficient spectrometry data to define them as reference field. These have been removed from the main part of this document and are:
  - fluorescent radiations,
  - gamma radiation of the radionuclide Am-241, S-Am, and
  - the high energy photon radiations R-Ti and R-Ni. which.
  - The most widely used radiations, the fluorescent radiations and the gamma radiation of the radionuclide Am-241, S-Am, are included nearly unchanged in the informative Annexes A and B.
  - The informative Annex C gives new additional X radiation fields, which are specified by the quality index.

What to do when setting up an SSDL?

X ray beam qualities

a) Purchase of a high voltage generator and X ray tube according to 4.2.1 of ISO 4037-1:2019 (low ripple, high stability).
b) Purchase of the necessary filters for the desired series, material requirements according to 4.2.3.5 of ISO 4037-1:2019.
c) Construction of the X ray irradiation equipment.
d) Determination of the self-filtering according to 4.2.3.3 of ISO 4037-1:2019.
e) Purchase of the necessary additional filters to adjust the inherent filtering, material requirements (purity, thickness) according to 4.2.3.5 of ISO 4037-1:2019.
f) Purchase of traceable calibrated K_a and $H_p(10)$ or H*(10) chamber in line with the SSDL need.
g) Validation of any radiation quality with these chambers, according to 5.10.3 of ISO 4037-2:2019.
h) Perform irradiations with/without phantom and
   - measuring K_a at each irradiation with K_a secondary standard chamber and applying the recommended conversion coefficient (or using an appropriately calibrated monitor chamber) or
   - directly measure the correct value of the measurand at each irradiation using a suitable traceable calibrated standard, e.g. with $H_p(10)$ or $H^*(10)$ chamber (or use of a calibrated monitor chamber)

Gamma radiation emitted by radionuclides

The ISO 4037:2019 stipulates that:

a) S-Cs and S-Co shall be used (see Table 16 of ISO 4037:2019).
b) The encapsulation shall comply to ISO 2919 and be thick enough to absorb the beta radiation from the sources (5.3.2).
c) The air kerma rate due to the principal impurities in the source shall be < 1 % of the air kerma rate due to the radiation of the isotope to be used (5.4.1).
d) A collimator shall be employed to define the shape and size of the primary photon beam (5.4.2).
e) The air kerma rate outside the collimated beam shall not exceed 5 % of that inside the collimated beam.
f) The distance from the final aperture to the detector shall be ≥ 30 cm.
g) The air kerma rates shall be measured on the axis of the beam at the various points of test. After correcting for air attenuation, the air kerma rates shall be proportional within 5 % to the inverse square of the distance from the source centre to the detector centre.
h) Lead attenuators may be used for dose rate variation.
i) Uncollimated geometry installations are no longer reference fields.

ISO 4037:2019 Part 2

- This part of the standard specifies the procedures for the dosimetry of X and gamma reference radiation for the calibration of radiation protection instruments over the energy range from approximately 8 keV to 1,3 MeV and from 4 MeV to 9 MeV.
- This document can also be used for the radiation qualities specified in ISO 4037-1:2019, Annexes A, B and C, but this does not mean that a calibration certificate for radiation qualities described in these annexes is in conformity with the requirements of ISO 4037.
- The first method is to produce “matched reference fields”, which follow the requirements so closely that recommended conversion coefficients can be used. The existence of only a small difference in the spectral distribution of the “matched reference

field" compared to the nominal reference field is validated by procedures, which are given and described in detail in this document. For matched reference radiation fields, recommended conversion coefficients are given in ISO 4037-3 only for specified distances between source and dosemeter, e.g., 1,0 m and 2,5 m. For other distances, the user has to decide if these conversion coefficients can be used.

- The second method is to produce "characterized reference fields". Either this is done by determining the conversion coefficients using spectrometry, or the required value is measured directly using secondary standard dosimeters. This method applies to any radiation quality, for any measuring quantity and, if applicable, for any phantom and angle of radiation incidence. The conversion coefficients can be determined for any distance, provided the air kerma rate is not below 1 µGy/h.
- Both methods require charged particle equilibrium for the reference field.

ISO 4037:2019 Part 3

- This document specifies additional procedures and data for the calibration of dosemeters and doserate meters used for individual and area monitoring in radiation protection. The general procedure for the calibration and the determination of the response of radiation protection dose(rate)meters is described in ISO 29661 and is followed as far as possible.
- In Annex D additional information on reference conditions, required standard test conditions and effects associated with electron ranges are given.
- For individual monitoring, both whole body and extremity dosemeters are covered and for area monitoring, both portable and installed dose(rate)meters are covered.
- Charged particle equilibrium is needed for the reference fields although this is not always established in the workplace fields for which the dosemeter should be calibrated.
- The procedures to be followed for the different types of dosemeters are described. Recommendations are given on the phantom to be used and on the conversion coefficients to be applied.
- Recommended conversion coefficients are only given for matched reference radiation fields, which are specified in ISO 4037-1:2019, Clauses 4 to 6.
- ISO 4037-1:2019, informative Annexes A, B and C: conversion coefficients are given in Annexes A to C, but only as a rough estimate as the overall uncertainty of these conversion coefficients in practical reference radiation fields is not known.
- Recommended conversion coefficients from air kerma to the operational quantities
  - **Note**: For S-Cs the h^*_K value changed from 1.20 to 1.21.
  - ISO 4037-3 gives conversion coefficients only up to 90°

ISO 4037:2019 Part 4

- This document gives guidelines on additional aspects of the characterization of low energy photon radiations and on the procedures for calibration and determination of the response of area and personal dose(rate)meters as a function of photon energy and angle of incidence.
- This document concentrates on the accurate determination of conversion coefficients from air kerma to $H_p(10)$, $H^*(10)$, $H_p(3)$ and $H'(3)$ and for the spectra of low energy photon radiations.
- As an alternative to the use of conversion coefficients the direct calibration in terms of these quantities by means of appropriate reference instruments is described.
- Evaluation of the effect of angle of radiation incidence: Table 3 states values – some are not achievable in practice.
- At low energies, the air density-dependent absorption changes
  - the dose rate and it changes
  - the shape of the spectra and therefore
  - the conversion coefficient as well.

Annex A (normative) states a method for correction.

Challenges and future research topics

- HVL determined by: spectrometry vs. dosimetry
- Influence of filter thickness: theory vs. experiment
- What is the (realistic) uncertainty by using the alternative approach using appropriate reference instruments?
- The newly founded European Metrology Network for Radiation Protection under the roof of EURAMET is currently discussing a proposal for a founded support action in the upcoming call 2022 (https://www.euramet.org/european-metrology-networks/radiation-protection/?L=0). If you are interested in the EMN, please subscribe to the newsletter.

Implementation of ISO 4037:2019 at IAEA DOL

Mr Ladislav Czap and Ms Zakithi Msimang

The IAEA DOL offers calibrations in ^{60}Co, ^{137}Cs and X ray beam qualities in terms of air kerma following the ISO 4037:2019. With the release of the 2019 standard, DOL had to ensure that the set up was still fulfilling the standard requirements. The beam qualities established using an X ray system are N-40 to N-300. The tube potential of the X ray system is measured using a high voltage divider connected to the tube during all calibrations and adjustments are made if there is any deviation of the tube potential at the start of the calibration. Once this is done the tube potential remains stable on the set value. The thickness of X ray tube window is 3 mmBe. The inherent filtration was verified to be 4 mmAl. The filters used are of 99.99 % purity. Measurements were performed following the method described in paragraph 4.2.2 of the ISO 4037:2019 that confirmed that there is no protective resistor in the tube housing. The calibration distance in all beam qualities for radiation protection applications was changed from 2 m to 2.5 m. The field uniformity is ≥ 98 % for all the beam qualities.

Brachytherapy comparison

Mr Ladislav Czap and Ms Zakithi Msimang

The IAEA Dosimetry Laboratory (DOL) provides calibrations for well-type ionization chambers and electrometers in terms of reference air kerma rate. Calibrations are performed using the reference air kerma rates that are measured using an appropriate IAEA reference standard chamber. Starting in Q1 of 2022, DOL will launch a service for comparison of well type chambers in ^{60}Co and ^{192}Ir HDR sources. SSDL's that need to participate in this comparison will have to book in advance as the participation is limited by the number of reference chambers available.

Fig.2 Brachytherapy calibration set up at DOL.

New tube for diagnostic radiology calibrations

Changes in the beam qualities used for diagnostic calibrations at the IAEA DOL

Mr Joao Cardoso and Ms Zakithi Msimang

A new high voltage generator (Isovolt Titan E GE) and a new tungsten anode X ray tube (MXR 160) was installed at the IAEA dosimetry laboratory (DOL) after the previous system failure. The opportunity was taken to adjust the air kerma rates to 40 mGy/min for all the beam qualities, except for RQA and Mo+Mo+Al which were kept at 3 mGy/min.

The changes resulted in some changes in the HVLs of our system. The details of the previous and current HVL's are indicated in tables 1 to 5 for all the beam qualities. The SSDLs obtaining traceability from DOL needs to take these changes into consideration especially when comparing their new calibration coefficients from those previously obtained.

Table 1. RQR Beam qualities

Beam quality	Tube voltage (kV)	Old First HVLL (mmAl)	**New First HVL (mmAl)**	**New Homogeneity coefficient (h)**
RQR-2	40	1.42	**1.42**	**0.81**
RQR-3	50	1.77	**1.78**	**0.76**
RQR-4	60	2.18	**2.18**	**0.7**
RQR-5	70	2.59	**2.57**	**0.68**
RQR-6	80	3.07	**3.00**	**0.67**
RQR-7	90	3.57	**3.58**	**0.67**
RQR-8	100	4.03	**4.02**	**0.67**
RQR-9	120	5.10	**5.04**	**0.67**
RQR-10	150	6.74	**6.71**	**0.72**

Table 2. RQA Beam qualities

Beam quality	Tube voltage (kV)	Old First HVLL (mmAl)	**New First HVL (mmAl)**
RQR-2	40	2.25	**2.21**
RQR-3	50	3.82	**3.77**
RQR-4	60	5.45	**5.38**
RQR-5	70	6.87	**6.89**
RQR-6	80	8.16	**8.24**
RQR-7	90	9.19	**9.26**
RQR-8	100	10.18	**10.24**
RQR-9	120	11.75	**11.64**
RQR-10	150	6.74	**6.71**

Table 3. RQT Beam qualities

Beam quality	Tube voltage (kV)	Old First HVLL (mmAl)	**New First HVL (mmAl)**
RQT-8	100	7.03	**7.02**
RQT-9	120	8.49	**8.47**
RQT-10	150	10.20	**10.26**

Table 4. Mammography beam qualities from a Mo tube

Beam quality	Tube voltage (kV)	Old First HVLL (mmAl)	**New First HVL (mmAl)**
Mo+Mo 25	25	0.289	0.293
Mo+Mo 28	28	0.324	0.327
Mo+Mo 30	30	0.344	0.345
Mo+Mo 35	35	0.381	0.380
Mo+Rh 25	25	0.352	0.352
Mo+Rh 28	28	0.393	0.391
Mo+Rh 30	30	0.411	0.407
Mo+Rh 35	35	0.446	0.442
Mo+Mo+Al 25	25	0.582	0.577
Mo+Mo+Al 28	28	0.625	0.620
Mo+Mo+Al 30	30	0.653	0.652
Mo+Mo+Al 35	35	0.730	0.729

Table 5. Mammography beam qualities from a W tube

Beam quality	Tube voltage (kV)	Old First HVLL (mmAl)	**New First HVL (mmAl)**
W+Al 25	25	0.312	0.322
W+Al 28	28	0.354	0.359
W+Al 30	30	0.380	0.39
W+Al 35	35	0.435	0.445
W+Ag 25	25	0.478	0.466
W+Ag 28	28	0.534	0.518
W+Ag 30	30	0.559	0.544
W+Ag 35	35	0.605	0.593
W+Mo 25	25	0.340	0.341

Electrometer calibration at DOL

Mr Ladislav Czap and Ms Zakithi Msimang

Reference dosimeters (ionization chambers) are calibrated at the IAEA Dosimetry Laboratory (DOL) either as a system, i.e. chamber and electrometer (in terms of Gy/scale division), or individually, i.e. (in terms of Gy/C) using the IAEA electrometer. However, the user electrometers can be calibrated also separately to determine the correction factor k_{elec} for charge /current measurements. The IAEA DOL has introduced a service to calibrate the electrometers for charge/current measurements and thus provide a Calibration Certificate with the correction factors k_{elec} to the SSDL's. This calibration service is performed by comparing the output of the calibrated Keithley 6430 current source to the response of electrometer under calibration. The IAEA current source used for the calibration is traceable to the BEV, Austria. Calibrating the electrometer independently will allow SSDLs to use their calibrated electrometer with any other calibrated ionisation chamber in their system. Note: These electrometers are only calibrated for charge/current measurements.

The calibration factors supplied may be used with any ionisation chamber when measuring charge. Ionization current measured with an electrometer can be determined as

$$I = k_{TB} \times k_{elec,i} \times \left(\frac{Q}{t} - \frac{Q_0}{t_0}\right)$$

where:

- $k_{elec,i}$ is calibration coefficient of the electrometer for a given range.
    - Q is the charge integrated over time period t.
    - Q_0 is the leakage charge integrated over time period t_0.
    - k_{TB} is the timebase correction.

Modern electrometers use built-in timebase for triggering the readings and measurement of integration time period t. However, not all electrometers supply individual readings together with a timestamp, i.e. with exact time when the reading was performed. For those electrometers the timebase correction k_{TB} is not determined as it is intrinsically included in k_{elec}. For electrometers (e.g. Keithley, Keysight) supplying the timestamp together with the readings, the timebase correction k_{TB} is reported in the certificate

Figure 3.Electrometers at DOL

New IAEA/WHO dosimetry audit services using Linac beams

Mr. Krzysztof Chelminski, Mr. Alexis Dimitriadis and Mr. Pavel Kazantsev

Since the IAEA Dosimetry Laboratory (DOL) in Seibersdorf has been equipped with a medical linear accelerator (Linac) in 2019, new radiation beam qualities for external radiotherapy became available in providing the support for dosimetry audits. In addition to the Cobalt-60 beam, high energy photon beams up to an energy of 18 MV and electron beams up to 22 MeV can be used in DOL now which allowed to offer new services to hospitals and dosimetry audit networks (DANs) worldwide.

The number of linacs that can deliver both photon and electron beams is constantly growing according to data from the IAEA DIrectory of RAdiotherapy Centres (DIRAC). Electron beams are not as commonly used as compared to photon beams in contemporary radiation therapy of cancer, but due to their finite depth range in tissue, they are suitable for the treatment of superficial lesions like skin cancer. The audit service provided by the IAEA-WHO since 1969 was limited to checking high energy photon beams only but now it has been extended to electron beams too. Lack of the direct dosimetry audit service for electron beams potentially makes the use of the electron therapy less safe and effective, as too high dose delivered to a tumour may result in higher probability of side effects to normal tissues surrounding a tumour. On the other hand, if the dose is too low it may compromise the tumour control. Hence the IAEA external audit service can support locally developed quality assurance programmes for radiotherapy to guarantee the proper dose delivered to treated patients.

The availability of the linac enabled the development and testing of a new auditing methodology for electron beams utilizing radiophotoluminescence dosimeters (RPLDs). The methodology employs a specialised RPLD holder, designed by the DOL staff and manufactured at the IAEA mechanical workshop in Seibersdorf, that can be positioned in a water phantom. The characterization of the dosimeters for various electron beams was carried out, which included correction factors to determine the delivered dose. After the initial tests, the dosimeters along with the holders and irradiation instructions were dispatched to a group of 11 reference institutions in 10 Member States for a pilot audit. After irradiation to a specified dose, the auditees were asked to send back the dosimeters to the IAEA for evaluation of the delivered dose. The results of the characterisation of the RPLD system for electron audits, as well as the multicentre pilot study will be published soon. A relevant instructing video with the irradiation procedure will also be recorded in the linac bunker in Seibersdorf and will be published for common use by auditees. Another advantage of the linac at the IAEA Dosimetry Laboratory is the capability of reference and blind test irradiations for national Dosimetry Audit Networks (DAN) providing services to hospitals in Member States.

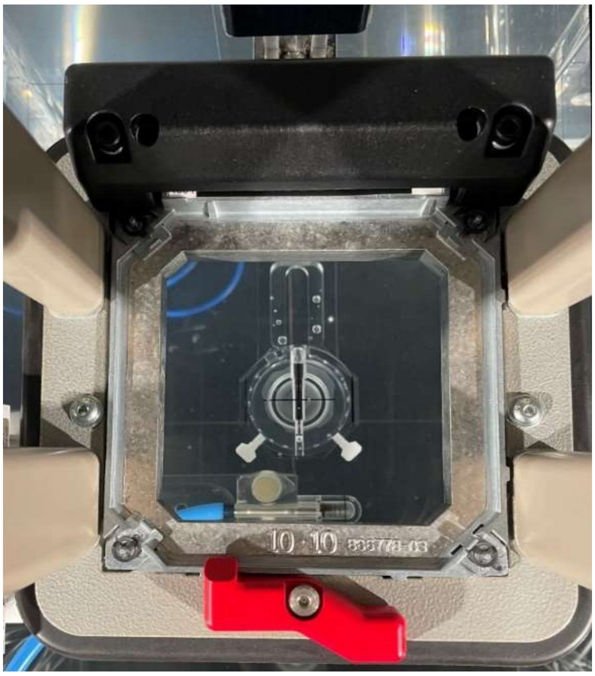

Figure 4. Beam's eye view of RPLD irradiation in an electron beam.

The passive dosimeters used by the local DAN can be delivered to the IAEA DOL for irradiation in beams of different energies. After irradiation the dosimeters are sent back to the DAN for the determination of the delivered dose. A wide range of energies accessible on the linac installed at the IAEA DOL allows the local DAN to test their correction factors for the dosimeters irradiated to a known dose or to test the whole procedure of dose determination using the dosimeters irradiated to an unknown dose (blind test). The doses delivered to the dosimeters in the IAEA DOL during the blind test irradiation are disclosed to the national DAN laboratories after reporting results of their dose determination.

The IAEA encourages hospitals and DAN members to apply for participation in the newly launched dosimetry audit services either during the commissioning of new electron beams or for cross-checking their auditing capabilities.

Publication and educational material announcements

Ms Giorgia Loreti

New publications and educational material have been made available in different areas of dosimetry and medical radiation physics. The relevant links to freely access the material are listed below.

Publications

- Training Course Series No. 71 Guidelines for the Certification of Clinically Qualified Medical Physicists: https://www.iaea.org/publications/14746/guidelines-for-the-certification-of-clinically-qualified-medical-physicists.
- Technical specifications of radiotherapy equipment for cancer treatment: https://www.who.int/publications/i/item/9789240019980.
- Implementation of a Remote and Automated Quality Control Programme for Radiography and Mammography Equipment: https://www-pub.iaea.org/MTCD/Publications/PDF/PUB1936_web.pdf.
- Technical specifications for imaging devices: https://www.who.int/medical_devices/priority/Chapter_8_20167_WHO_Priority_medical_devices_list_for_COVID_19_response_8.pdf?ua= 1
- Portable digital radiography system: technical specifications: https://www.who.int/publications/i/item/9789240033818

e-learning courses

Home page:
https://elearning.iaea.org/m2/course/index.php?categoryid=127

- Uncertainty Estimations for Radiation Measurements in SSDLs and Hospitals: https://elearning.iaea.org/m2/course/view.php?id=708
- Quality Control and Dosimetry in Digital Radiology: https://elearning.iaea.org/m2/enrol/index.php?id=642

Tutorial videos

- Human Health Campus - Tutorial Videos on Quality Control for CT: https://humanhealth.iaea.org/HHW/MedicalPhysics/e-learning/ctqualitycontrol/index.html

Web pages

- Human Health Campus - Proton therapy: https://humanhealth.iaea.org/HHW/MedicalPhysics/Radiotherapy/Dosimetry/Proton_therapy/index.html
- IDOS 2019 conference material Human Health Campus - International Symposium on Standards, Applications and Quality Assurance in Medical Radiation Dosimetry (IDOS 2019): https://humanhealth.iaea.org/HHW/MedicalPhysics/e-learning/IDOS2019/index.html.
- Webpage on remote and automated QC in radiography and mammography: https://humanhealth.iaea.org/HHW/MedicalPhysics/DiagnosticRadiology/PerformanceTesting/AutomatedQAinRadiology/index.html.
  For more information and material, please visit the Human Health Campus – Home: https://humanhealth.iaea.org/HHW/index.html and International Atomic Energy Agency / Atoms for Peace and Development: https://www.iaea.org/.

Figure 5. Picture from the tutorial videos on quality control for CT. Portrayed Mr Eleftherios Tzanis at the Department of Medical Physics, University of Crete, University Hospital of Iraklion, Greece)

On the occasion of the International Day of Medical Physics (IDMP) 2021 the IAEA released a dedicated webpage on the Human Health Campus website: https://humanhealth.iaea.org/HHW/MedicalPhysics/TheMedicalPhysicist/IDMP/2021/index.html, from which the users could download the eflyer; https://humanhealth.iaea.org/HHW/MedicalPhysics/TheMedicalPhysicist/IDMP/2021/ePoster_Intl_Day_Med_Physics.jpg of the event.

Also, the IAEA released new documents:

- An infographic summarizing the role of IAEA guidelines on Education and Training in medical physics (MP).
- The adaptation of IAEA guidelines on academic education and clinical training (3 specialties) of MPs to the Latin American region, in Spanish language: https://humanhealth.iaea.org/HHW/MedicalPhysics/TheMedicalPhysicist/IDMP/2021/Guias_LA_Region_E&T_MedicalPhysics_ARCAL_ALFIM.pdf.
- A web story on the pioneering work of Marie Sklodowska-Curie and Irène Joliot-Curie: https://www.iaea.org/newscenter/news/mother-and-daughter-science-pioneers-sklodowska-curie-and-joliot-curie-remembered-on-international-day-of-medical-physics.

Technical Meeting of Dosimetry Audit Networks 9-13 August 2021

Mr Pavel Kazantsev

The IAEA Dosimetry laboratory organized a hybrid on-site and virtual meeting to discuss the current status and common challenges in the area of dosimetry audits in radiotherapy (RT). The participants representing different dosimetry audit networks (DANs) included clinical radiotherapy medical physicists, dosimetry specialists and radiation metrologists from hospitals, clinical trial quality assurance groups, international and national dosimetry audit centres, and dosimetry laboratories. Altogether, 56 experts from 36 countries participated in the meeting, 14 of which were onsite participants and 42 joined virtually. For the convenience of the international participants across various time-zones, all meeting sessions were recorded for viewing at a convenient time and deleted after the end of the meeting.

The meeting was organized with the aim of achieving greater harmonization, cooperation, and collaboration among DANs and it provided a platform for all DANs to share their experiences and discuss key issues faced by the dosimetry auditing community. The agenda was structured in a way that every first and last session of the day was a discussion on one of the topics of interest for the community such as IAEA support to DANs, Establishment and operation of a DAN, Harmonization of auditing practices, Limitations of auditing methodologies and Following up results out of tolerance. The middle of each day was dedicated to presentations, and every DAN was given an opportunity to present its current status and activities. The IAEA, on the other hand, had presented its work in the area of radiation medicine, technical cooperation programme, past and present activities for support of DANs. Database support for dosimetry audits, quality management issues and the IAEA/WHO SSDL network were discussed in separate presentations. A dedicated session on the advances in dosimetry audits included talks on auditing new technologies, New types of dosimetry audits, Treatment plan complexity as an auditing tool and Research in the field of dosimetry audits. Both onsite and virtual participants were given an opportunity to get a tour of the IAEA Dosimetry laboratory, including the new linear accelerator facility.

Figure 6. Some of the DAN meeting virtual participants. (Photo: G. Hinterleitner/IAEA)

The key challenges identified included the need for technical guidelines, training material and harmonized reporting templates. One of the main recommendations of the meeting was the establishment of an international recognition scheme for DANs that would help quality improvements and gain credibility within the radiotherapy community.

Meeting participants supported the idea of organizing such meetings on a regular basis given the possibility of cost-free participation through virtual platforms.

Figure 7. DAN meeting on-site participants having a tour of the linear accelerator facility at the Dosimetry Laboratory in Seibersdorf. (Photo: L. Czap/IAEA)

The Consultative Committee for Ionizing Radiation (CCRI)

Mr Vincent GRESSIER

The BIPM is the international organization established by the Metre Convention, through which Member States act together on matters related to measurement science and measurement standards. It is the home of the International System of Units (SI) and the international reference time scale (UTC). The International Committee for Weights and Measures (CIPM) oversees the work of the BIPM. The CIPM has set up a number of Consultative Committees that bring international experts from various fields as advisers on scientific and technical matters. The mission of the Consultative Committee for Ionizing Radiation (CCRI) are to discuss, foster, enable and co-ordinate the development, comparison and promulgation of national measurement standards for ionizing radiation. The aim is to enable all users of ionizing radiation to make measurements with confidence at an accuracy that is fit for purpose.

The CCRI and its associated sections meet every two years, with the last meetings taking place in June 2021. The 3 sections deal respectively with dosimetry (Section 1), radioactivity (Section 2) and neutron (Section 3) metrology. The minutes of each meeting are publicly available on the BIPM website, as is the CCRI strategy document 2018-2028.

Figure 8 CCRI participants in 2019 (Photo provided by the BIPM)

In addition, monthly CCRI webinars are held to promote ionizing radiation metrology to all interested persons worldwide.

Main CCRI website page :
https://www.bipm.org/en/committees/cc/ccri.

Peter Ambrosi obituary

(1949 - 2021)

Dr. Peter Ambrosi, former head of the Department Radiation Protection Dosimetry at Physikalisch-Technische Bundesanstalt (PTB), passed away on March 06, 2021 at the age of 71.

He was born on 20.09.1949 in Osnabrück and studied experimental physics at the Technical University of Braunschweig where he received his doctorate in 1980 in the field of strain hardening and strain softening during plastic tensile deformation of copper single crystals. In 1981, he joined the PTB in Braunschweig. His field of work was the dosimetry of photon and beta radiation. From August 2002 until his retirement at the end of 2014, he was head of the department 6.3 "Radiation Protection Dosimetry".

Peter Ambrosi was an internationally recognized expert in the field of radiation protection dosimetry with a large number of publications and invited lectures. Major scientific developments include the development of the current German legal gliding-shadow film dosemeter, the establishment of the department's reference radiation fields and the development of suitable secondary standards for photon dosimetry. Additionally, he was involved in the development of two secondary standards for beta dosimetry, for radiation protection and therapy. He shared his extensive experience at several national and international training events. Peter Ambrosi was for many years a consultant in the Dosimetry Working Group (AKD) of the German Radiation Protection Association and active member in EURADOS WG2. He was involved in the revision of the European Commission technical recommendation RP160. Likewise, he used his expertise competently and purposefully in policy consultations.

His in-depth expertise was in demand at the International Atomic Energy Agency (IAEA). He was involved in several intercomparisons for individual monitoring and contributed to writing publications e.g. IAEA TECDOC

No. 704 and 1126. He was used by the IAEA as an expert in workshops e.g. Workshop on Uncertainty Estimations for Radiation Measurements in 2017.

He was a consultant of the Report Committee 26 of the International Commission on Radiation Units and Measurements (ICRU), involved in the redefinition of radiation protection measurement quantities of the ICRU. He was particularly committed to keeping the calibration procedures as simple and practical as possible.

He was particularly committed to harmonization and national and international standardization. For many years he was chairman of several national and international standardisation bodies, e.g., convenor of the IEC/SC 45B/WG B8 "Pocket active electronic dose equivalent and dose equivalent rate monitors", chairperson of CENELEC CLC/TC 45B "Radiation protection instrumentation" and convenor of ISO/TC85/SC2/WG2 "Reference Radiation Fields".

Peter Ambrosi made significant contributions to the redesign and harmonization of the most important standards for radiation protection dosimetry. His achievements include the preparation and revision of IEC standards fundamental to the type testing of area and personal dosemeters, the systematic consideration of measurement uncertainties and the preparation of a corresponding Technical Report. Of particular note is the simultaneous revision of the four parts of the basic reference radiation field standard ISO 4037, which he completed after his retirement. For his great merits, he was awarded the IEC 1906 Award in 2007 and the DKE pin in 2011 by the VDE/DKE for his personal commitment to electrotechnical standardization.

Peter Ambrosi was always a competent advisor who excelled in providing comprehensive detailed laboratory knowledge. He was held in high esteem by all his colleagues especially because of his calm and very reliable manner.

Our deepest sympathy goes to his family and friends.

Courses, Meetings and Consultancies in 2022

Please note that due to COVID-19 crisis many events have been postponed and the dates are still to be decided (TBD). In some cases, new dates have been proposed but there might still be some further changes.

TC Courses and Workshops related to DMRP activities

- TC Regional (AFRA) Training Course on Dosimetry Audits for English-speaking countries, Vienna, Austria, 14 – 18 February 2022
- TC Regional (AFRA) Training Course on Dosimetry Audits for French-speaking countries, Vienna, Austria, 7 – 11 March 2022
- E2-TR-1904408 Joint ICTP – IAEA Workshop on Medical Physics Aspects of Stereotactic Radiotherapy Techniques, Vienna, Austria, 21 – 25 March 2022
- Joint ICTP – IAEA Advanced School on Radiotherapy Dosimetry Audits, Seibersdorf, Austria, 2 November – 2 December 2022
- Joint IAEA – ICTP Workshop on Quality Assurance and Dosimetry in Brachytherapy, Trieste, Italy, December 2022

Training courses and ESTRO Courses

- RER6036 IAEA/ESTRO Training Course on Target Volume Determination - From imaging to margins, 21 – 24 February 2022 (online)
- RER6036 IAEA/ESTRO Training Course on Best Practice in Radiation Oncology – A Workshop to Train the RTT (Radiation Therapist) Trainers – Part I, Brussels, Belgium, 28 March – 1 April 2022
- RER6036 IAEA/ESTRO Training Course on Advanced treatment planning, Prague, Czech Republic, 3 – 7 April 2022 (postponed from September 2021)
- RER6036 IAEA/ESTRO Advanced Skills in Modern Radiotherapy, Seville, Spain, 3 – 7 April 2022
- RER6036 IAEA/ESTRO Training Course on Dose Modelling and Verification for External Beam Radiotherapy, Budapest, Hungary, 4 – 8 April 2022 (postponed from June 2021)
- E2-TR-1805156 Joint IAEA and Argonne National Laboratory Training Activity on Comprehensive Clinical Audits in Diagnostic Radiology under the Quality Assurance Audit for Diagnostic Radiology Improvement and Learning (QUAADRIL) Tool, Argonne, United States of America, 12 – 16 September 2022 (postponed from November 2021)
- RER6036 IAEA/ESTRO Training Course on Image guided radiotherapy and chemotherapy in gynaecological cancer: focus on MRI based adaptive brachytherapy for Cervical Cancer, Lisbon, Portugal, 19 – 22 September 2022
- RER6036 IAEA/ESTRO Training Course on Image-Guided and Adaptive Radiotherapy, Ljubljana, Slovenia, 2 – 6 October 2022

DMRP Meetings and Consultancies

- Consultancy Meeting on review and drafting the guidance document for calibration in radiation protection, Vienna, Austria, 6 – 10 December 2021
- 20th Biennial Meeting of the Scientific Committee of the IAEA/WHO Network of Secondary Standards Dosimetry Laboratories for the Evaluation of and Recommendations on the IAEA's Dosimetry Programme and the IAEA/WHO Network of SSDLs, Vienna, Austria, 14 – 18 March 2022

- Consultancy Meeting on the Preparation of a Guidance document on QC/QA and optimization of equipment and procedures used in fluoroscopically-guided interventional radiology, Vienna, Austria, 9 – 13 May 2022
- Consultancy Meeting on the Preparation of guidelines for medical physicists on the content, analysis, and evaluation of dose management systems for radiology, Vienna, Austria, 30 May – 3 June 2022
- Second Research Coordination Meeting on Development of Methodology for Dosimetry Audits in Brachytherapy, Vienna, Austria, 7 – 11 November 2022
- Second Research Coordination Meeting on Advanced Tools for Quality and Dosimetry of Digital Imaging in Radiology, Vienna, Austria, 14 – 11 November 2022
- Third Research Coordination Meeting for the Doctoral CRP on Advances in Radiotherapy Techniques, Vienna, Austria, 21 – 25 November 2022

Other events

- International Conference on Radiation Medicine (ICRM2022), organized in cooperation with the International Atomic Energy Agency, Riyadh, Saudi Arabia, 13 – 17 February 2022

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