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SSDL Newsletter

Prepared by the Joint IAEA/WHO Secretariat of the Network of Secondary Standards Dosimetry Laboratories https://ssdl.iaea.org

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Contents

From the Editor

This issue of the SSDL Newsletter (No. 67) is a special issue dedicated to the IAEA/WHO SSDL Network. The SSDL Network was established in 1976 and its main aim is to support Member States to maintain the traceability of their dose measurements. The first article of this newsletter is a historical review of the SSDL Network. It is written by Ahmed Meghzifene, who is the former SSDL officer and DMRP section head with more than 20 years of experience in the Network related issues.

The SSDL Charter explains the privileges, rights and duties of the Network members and it was originally drawn up and published in 1999. The original SSDL Charter has now been reviewed and updated and electronic version of the 2nd edition is available on our website. The second article of this Newsletter is the foreword of the new Charter. It describes the new edition of the Charter and explains how the requirements for the Network members have changed.

One of the requirements of a full SSDL Network member is to fill out and submit the annual report form. This data has been gathered from 2015 and 2016 annual reports and a summary is given in the third article. The article gives a statistical overview of the services provided by the SSDL Network members.

In the future, we would like to share this data with you. We are creating a new database called Dosimetry Laboratory Network i.e. DOLNET. The preliminary version of this database is currently available on our new website. However, we are currently working on revising and upgrading it to be able to provide more information about the services available at the SSDLs of the IAEA/WHO SSDL Network.

Additionally, we would like to welcome both Ms Deborah Van Der Merwe to the DMRP Section as the new Section Head and Mr Sivananthan Sarasanandarajah as the new radiotherapy medical physicist.

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Services provided by the IAEA in 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 Comité International des Poids et Mesures (CIPM), Mutual Recognition Arrangement (MRA).

The IAEA CMCs can be found at the following web site: http://kcdb.bipm.org/AppendixC/search.asp?met=RI

The range of services is listed below.

Services	*Radiation quality*
Calibration of ionization chambers (radiation therapy, diagnostic radiology including mammography, and radiation protection including environmental dose level)*	X rays (10–300kV) and γ rays from ^{137}Cs and ^{60}Co
Comparison of radiation therapy, radiation protection and diagnostic level ionization chamber calibrations coefficients for SSDLs*	γ rays from ^{60}Co and ^{137}Cs and X rays
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 (40–300 kV) and γ rays from ^{137}Cs and ^{60}Co beams

* 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.

The IAEA/WHO Network of Secondary Standards Dosimetry Laboratories

Developments and Achievements

Ahmed Meghzifene[1]

[1]Former IAEA SSDL Officer (1997-2007) and Head of the Dosimetry & Medical Radiation Physics Section and Co-secretary of the IAEA/WHO Network of SSDLs (2007-2017)

1. Introduction

In health care, it is vital that every measurement is conducted according to a predefined and standardized protocol and is traceable to internationally recognized standards. This is because healthcare professionals rely on accurate measurements to diagnose diseases and treat patients in an effective and safe manner. Standardization and traceability are even more important in medical applications where radiation is used for patient care. It was in the early 60's that the IAEA identified a serious problem in the practice of radiation dosimetry in radiotherapy, due mainly to a lack of dosimetry infrastructure and inadequate training of health care professional in many Member States. In fact, the IAEA noted that, even in many industrialized countries, national dosimetry services with a direct link to the international measurement system did not exist. As a result of these findings, the IAEA setup a Network of Secondary Standards Dosimetry Laboratories (SSDLs) in 1986 jointly with the WHO. This article reviews the main historical milestones related to the establishment of the Network and gives a brief overview on its achievements, from the perspective of a former IAEA staff who has contributed to its activities during 20 years.

2. Historical background

It was in the early sixties that the IAEA and WHO became fully aware of the problem of poor dosimetry in radiotherapy in many countries. In 1968, the IAEA convened an experts' meeting in Venezuela on "Dosimetric Requirements of Radiotherapy Centres", attended by IAEA, WHO and PAHO representatives in addition to experts in dosimetry and medical physics. As stated by Dr H. Eisenlohr[1] (IAEA Co-Secretary of the SSDL Network between 1976 and 1987) in his historical paper [1], that meeting can be considered as "the origin of the SSDL programme". Its report included recommendations to the IAEA to (i) develop a manual for radiotherapy dosimetry, (ii) organize regional training courses in radiotherapy physics and (iii) to establish regional dosimetry facilities in the region. Consequently another IAEA/WHO panel was held in Brazil in 1974 and recommended the establishment of an IAEA/WHO Network of SSDLs. It took another two years to finalize the working arrangements between the IAEA and WHO and formally establish the IAEA/WHO Network of SSDLs. The circular letters sent in 1976 to IAEA and WHO Member States announcing the establishment of the Network were accompanied by a technical note outlining the Criteria for the establishment of a Secondary Standards Dosimetry Laboratory. At that time, there were 8 dosimetry laboratories which have been nominated as SSDLs. Within 15 months, the number of laboratories in the Network reached 30 and 11 Primary Standards Dosimetry Laboratories joined the Network, in addition to 5 international organizations (BIPM, ICRU, IEC, IOML, IOMP). Almost 42 years later, the Network has 84 laboratory members in 67 Member States.

For the sake of completeness, three additional and

relatively more recent important milestones related to the

IAEA/WHO SSDL Network have to be added to this historical perspective:

(i) 1986: the establishment of a Standing Advisory Group "Scientific Committee of the IAEA/WHO Network of SSDLs". The general purpose of the SSDL Scientific Committee (SSC) is to review and evaluate the work of the Dosimetry and Medical Radiation Physics Section, including those related to the IAEA/WHO Network of SSDLs. The SSC meets every 2 years at the IAEA Headquarters and its report is published in the SSDL Newsletter. The report of the 1st meeting of the SSC Committee was published in the SSDL Newsletter No.25 [3]. The report of the last 17th SSC meeting held in March 2016 was published in the SSDL Newsletter No. 65 [4].

(ii) 1999: the signing by the IAEA, on behalf of the IAEA/WHO SSDL Network, of the International Committee for Weights and Measures (CIPM) Mutual Recognition Arrangement (MRA). The CIPM MRA was established as a formal system whereby the national laboratories of the participating countries could recognize the calibration and measurement capabilities of all signatories as being equivalent [5]. The signature of the MRA by the IAEA places metrology of ionizing radiation in developing countries, having a laboratory member of the SSDL Network, at the level of international recognition with no precedence in the past, allowing for the world wide recognition of their standards and calibration certificates. This, naturally, imposed stricter demands on the performance of the SSDLs, and required tightening the conditions of acceptability of results of the inter-comparisons and quality audits organized by the Agency for the SSDLs [6].

(iii) 2002: the first publication of the IAEA Calibration and Measurement Capabilities (CMCs) in the Appendix C of the CIPM MRA [7]. The IAEA CMCs were approved by the Joint Committee of the Regional Metrology Organisations and the Bureau International des Poids et Mesures (JCRB), following a review by selected members of the CCRI(I) (BIPM, PTB and, NIST) and later by all regional metrology organisations. Approval by the JCRB and publication of IAEA CMCs into Appendix C of the BIPM Key Comparison Data Base (KCDB) was the first step in linking the metrology systems of the SSDL Network members to the international measurement system in the framework of the CIPM MRA.

3. Achievements and challenges

This section will review the main achievements and challenges almost 50 years after the experts' meeting held in Venezuela in 1968 on "Dosimetric Requirements of Radiotherapy Centres". In addition to the important increase in the number of SSDL members (from 8 in 1976, to about 30 in 1978 and 84 in 2017), the scope as well the quality of dosimetry has improved both at the SSDL level and at the end-users' level (hospitals). This is the result of a collaborative effort undertaken by many IAEA Member States and supported by the IAEA, WHO, BIPM, metrology community through the CIPM and its consultative committees, national PSDLs as well as professional societies such as IOMP and international organisations such as the ICRU. The IAEA/WHO Network of SSDLs provided a solid and robust international framework for the development of radiation dosimetry, enabling information exchange between various collaborating organizations and a platform for support and communication between SSDLs.

By large, the main achievement so far is the good level of standardization achieved in radiotherapy for the determination of a reference dose output. This is achieved through the systematic use in almost all radiotherapy clinics of a calibrated reference dosimeter and a code of practice, such as the IAEA TRS-398 [8]. It is a fact that mistakes still occur in radiotherapy dosimetry, but they are mainly due to human errors as identified through the IAEA/WHO postal dosimetry audit service [9]. This high level of standardisation in radiotherapy dosimetry has been achieved partially thanks to work of medical physicists, supported by professional societies as well as international organizations such as the IAEA. There is no doubt that the IAEA dosimetry services coupled with the education and training programmes for medical physicists and SSDL staff as well as IAEA support for setting up and strengthening SSDLs in many countries have played an important role in improving radiotherapy dosimetry worldwide. Unfortunately, the level of standardization of dosimetry in X-ray diagnostic radiology and nuclear medicine continues to face several challenges. Although some progress has been made in the last 10 years in the standardization of dosimetry in X-ray diagnostic radiology, the continuous lack of clinical medical physicists in many radiology and nuclear medicine departments remains the main obstacle for the implementation of appropriate dosimetry protocols, as described in the IAEA guidelines [10, 11]. The lack of adequate calibration services in these areas in many

countries contributes also to poor dosimetry in many radiology and nuclear medicine departments. The IAEA continues to raise awareness on the need of accurate and traceable measurements in X-ray diagnostic radiology and nuclear medicine and support its Member States for the establishment of calibration facilities in these areas.

4. Conclusions

The IAEA/WHO Network of SSDLs was setup in the early sixties as an internationally coordinated action in response to identified gaps in dosimetry practices. It has raised awareness on the need for traceability and standardization in radiation dosimetry among health professionals and provided a platform for sharing information and improving calibration and auditing services for the benefit of patients worldwide. The results achieved so far have had a very positive impact on radiotherapy dosimetry and contributed to improved cancer patient care. However, the level of standardization in dosimetry in X-ray diagnostic radiology and nuclear medicine is still facing several challenges.

5. References

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The Foreword of the Second Edition of the SSDL Network Charter

In 1976, the International Atomic Energy Agency (IAEA) together with the World Health Organization (WHO) established a Network of Secondary Standards Dosimetry Laboratories (SSDLs), known as the IAEA/WHO SSDL Network. This Network, through SSDLs designated by the IAEA Member States, provides a traceability route of national dosimetry standards to the International System of Units (SI). The aim of the Network is to disseminate and encourage correct use of the dosimetry quantities and units through the proper calibration of field instruments by the SSDLs. The Network has proved to be of value in improving national capabilities for instrument calibration and the awareness of the need for better accuracy and traceability.

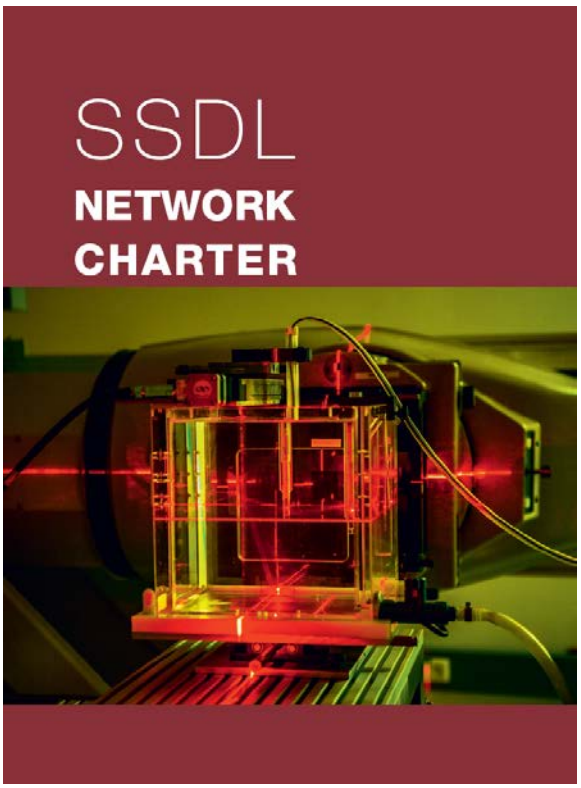
The SSDL Charter was originally drawn up and published in 1999, explaining the privileges, rights and duties of members in the Network. This second edition of the SSDL Network Charter has been modified to accommodate the changes and the developments in the field. It has become clear that in some instances the obligations and the benefits of the Network membership have not been clear. Consequently, the Scientific Committee which advises the Network Secretariat has recommended that the Charter should be updated to incorporate more guidance and recent developments with a view to strengthening the links of the SSDL Network to the SI.

This updated version of the SSDL Charter aims to clarify the duties and responsibilities as well as the benefits related to the SSDL Network membership. In addition, the Charter describes how the SSDLs can be designated, how the Network functions and the scope of the work of the SSDLs. In updating this Charter the principles and commitments of the original Charter have been maintained. However, the updates take into account (i) the IAEA experience in coordinating the activities of the SSDL Network for more than 40 years, (ii) the mutual recognition arrangement for the national measurement standards and recognition of the validity of calibration and measurement certificates established by the International Committee for Weights and Measures in 1999 (CIPM MRA), and (iii) the requirement for SSDLs to have a quality management system according to the ISO/IEC 17025 standard.

The IAEA wishes to express its gratitude to all authors and reviewers of this publication, as listed at the end of the document. The final editorial contribution of P. Allisy-Roberts from Bureau International des Poids et Mesures (BIPM), France is gratefully acknowledged.

The IAEA officers responsible for this publication were A. Meghzifene, I. Gomola and P. Toroi of the Division of Human Health.

The electronic version of the 2nd edition of the SSDL Charter is available now on the SSDL website.



The IAEA/WHO SSDL Network in Numbers

Statistics and visualizations based on the 2015 and 2016 Annual Reports

Paula Toroi[1], Yaroslav Pynda[2], and Mirja Kemppi[1]
[1]Dosimetry and Medical Radiation Physics Section, IAEA
[2]Division of Human Health, IAEA

1. The SSDL Network

At the end of 2016, the IAEA/WHO Network of SSDLs included 83 full members, two provisional members, 16 primary standards dosimetry laboratories (PSDLs) and 5 other affiliated members in the Network (Fig. 1). The up-to-date list of the Network members is included in every issue of the SSDL Newsletter (see p. 16) and it is also available on the SSDL Network website. One of the requirements of a full SSDL Network member is to fill out and submit the annual report form. The data from 2015 and 2016 annual reports has been gathered and a summary is given in this article.

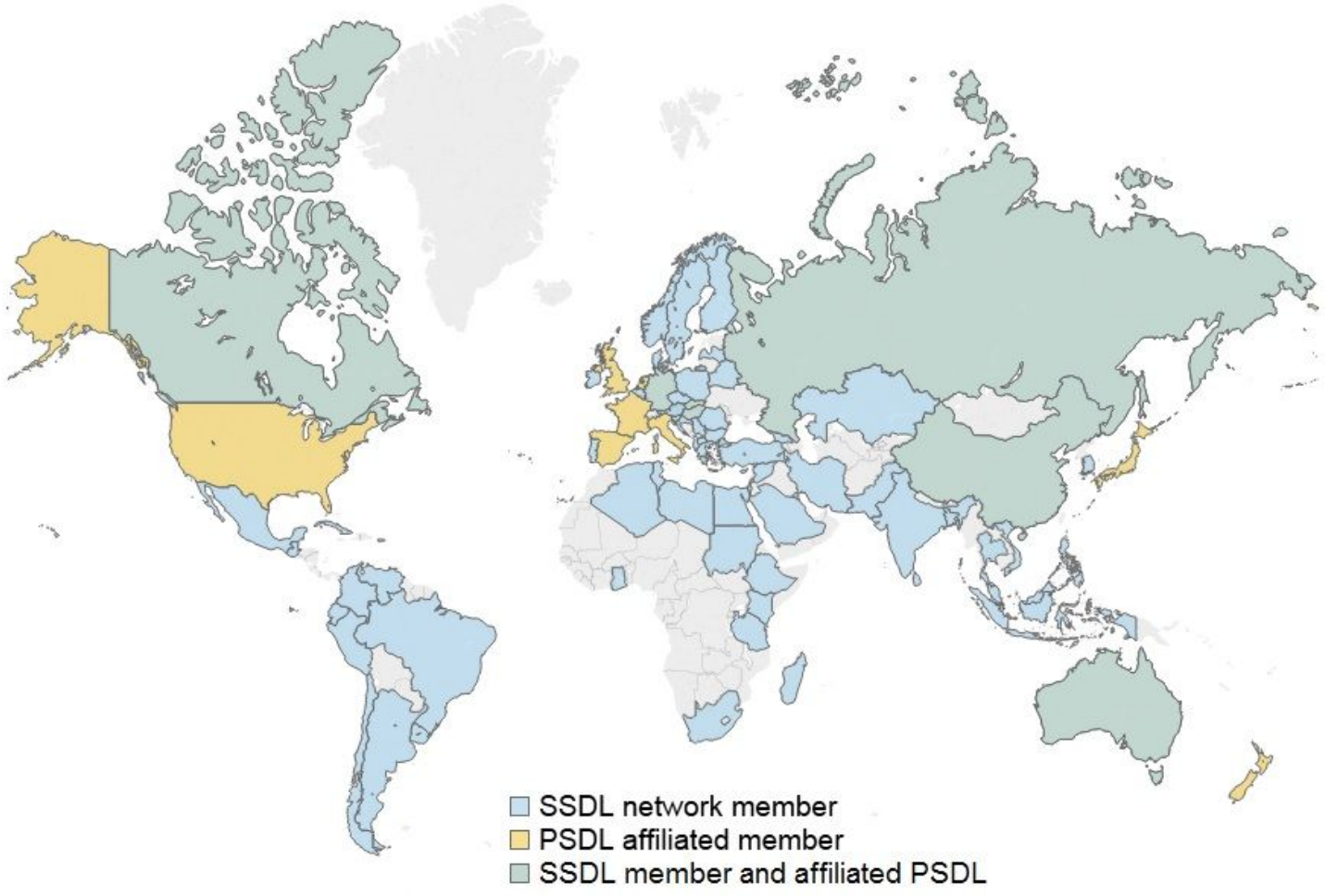


Fig. 1 The members of the IAEA/WHO SSDL Network.

2. Annual report data

The Figures 2 - 8 and tables 1 - 2 in this article are based on the data from the SSDL Network Annual Reports of 2015 and 2016. By filling out the Annual Report form, the member SSDLs report on their activities and review and/or update their contact information as well as the information about the laboratory equipment. In 2015, a total of 71 member laboratories of the SSDL Network submitted their annual report, whereas in 2016 all full members of the Network, i.e. 81 active SSDLs submitted their annual report forms.

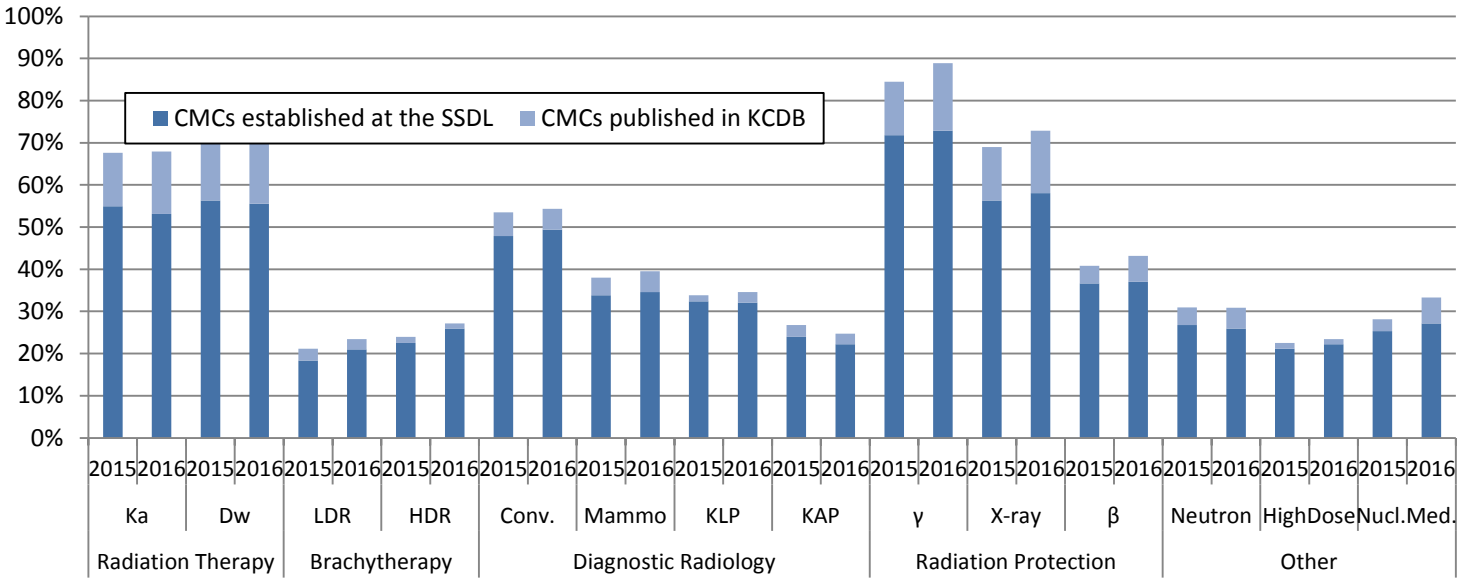


Fig. 2 The percentage of SSDLs providing specific calibration and measurement services in 2015 and 2016: Dark blue represents the percentage of SSDLs which have a particular calibration services established at their laboratory and the light blue marks the percentage of those SSDL whose calibration and measurement capabilities (CMCs) have been published in the BIPM Key Comparison Database (KCDB). The services listed in the graph are based on the Annual Report form.

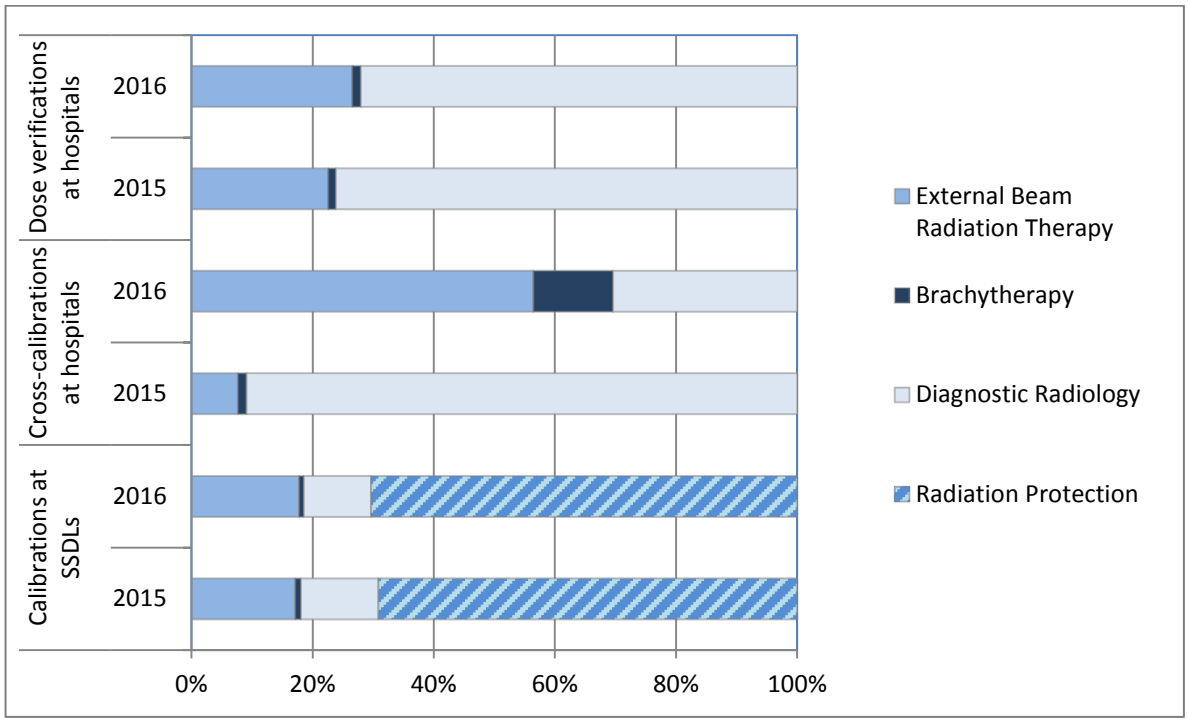


Fig. 3. The relation between the numbers of calibrations and checks conducted for each service scope listed in Table 1.

Table 1. The reported total numbers of calibrations conducted in 2015 and 2016 at the SSDLs, and the total numbers of cross-calibrations of dosimeters and beam/source verifications conducted at hospitals; the percentages represent the ratio between the numbers of calibrations conducted for each service and the total number of conducted calibrations.

Scope	Dosimetry type	Services	Calibrations at SSDLs		Cross-calibrations at hospitals		Verifications at hospitals	
			2015	2016	2015	2016	2015	2016
External Beam Radiation Therapy	kV X-rays	Low energy	1.1 %	1.2 %	0.2 %	0.0 %	0.6 %	0.3 %
		Medium energy	0.9 %	1.0 %	0.1 %	0.0 %	1.3 %	0.6 %
	High energy photons	Co-60 Ka	2.0 %	2.1 %	0.0 %	0.0 %	0.0 %	0.0 %
		Co-60 Dw	12.2 %	12.8 %	0.4 %	6.3 %	1.3 %	1.4 %
		X-rays (linac)	—	—	2.0 %	26.6 %	10.1 %	12.1 %
	High energy electrons	High energy electrons	—	—	5.1 %	23.5 %	9.2 %	12.2 %
	Other	Other	0.7%	0.6 %	—	—	—	—
	TOTAL		**16.9 %**	**17.7 %**	**7.7 %**	**56.4 %**	**22.6 %**	**26.5 %**
Radiation Protection	Ionization chambers and/or survey meters	Photons	61.6 %	63.6 %	—	—	—	—
		Beta rays	4.9 %	5.0 %	—	—	—	—
		Neutrons	1.6 %	1.6 %	—	—	—	—
	TOTAL		**68.1 %**	**70.2 %**	**—**	**—**	**—**	**—**
Brachytherapy	Ionization chambers / sources	Co-60	0.2 %	0.2 %	0.2 %	0.3 %	0.1 %	0.2 %
		Cs-137	0.0 %	0.0 %	0.1 %	5.0 %	0.0 %	0.4 %
		Ir-192	0.6 %	0.5 %	1.2 %	7.8 %	1.2 %	0.8 %
		Other	0.1 %	0.1 %	0.0 %	0.0 %	0.0 %	0.0 %
	TOTAL		**0.9 %**	**0.8 %**	**1.4 %**	**13.2 %**	**1.3 %**	**1.4 %**
Diagnostic Radiology	Conventional DR dosimeters	RQR, RQT, RQA, Other	5.3 %	5.0 %	90.9 %	30.4 %	35.1 %	36.3 %
	Mammography dosimeters	Mo-anode	0.9 %	0.7 %	0.0 %	0.0 %	0.9 %	1.5 %
		W-anode	0.8 %	0.7 %				
	KAP dosimeters	RQR, RQT	4.8 %	3.9 %	—	—	—	—
	CT dosimeters	RQR, RQT, Other	0.8 %	0.8 %	—	—	3.2 %	4.5 %
	Interventional Radiology	Clinical beam	—	—	—	—	1.8 %	3.1 %
	Dental radiography	Clinical beam	—	—	—	—	35.2 %	26.6 %
	TOTAL		**12.6 %**	**11.1 %**	**90.9 %**	**30.4 %**	**76.2 %**	**72.1%**
Other	X-ray tube voltage meters		1.5 %	0.3 %	—	—	—	—
TOTAL NUMBER OF CALIBRATIONS			**48,546**	**54,831**	**1,980**	**319**	**5,137**	**5,424**

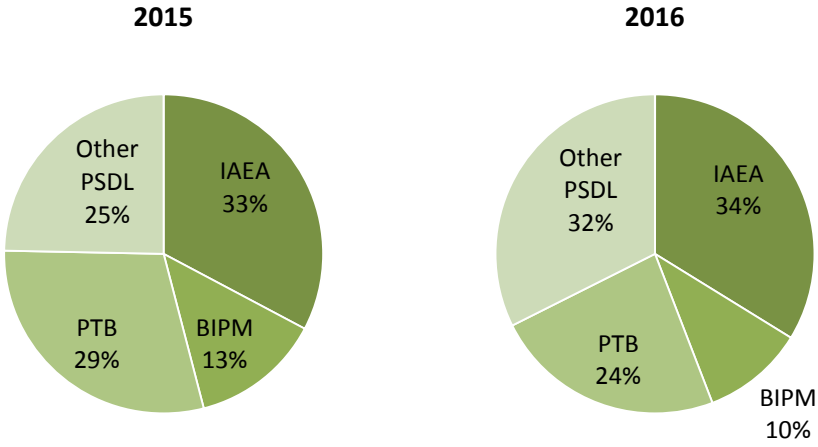


Fig. 4. The traceability of the services listed in Table 1: From the radiation protection services only the traceability of the service of calibrating ionization chambers for photons is included in these percentages.

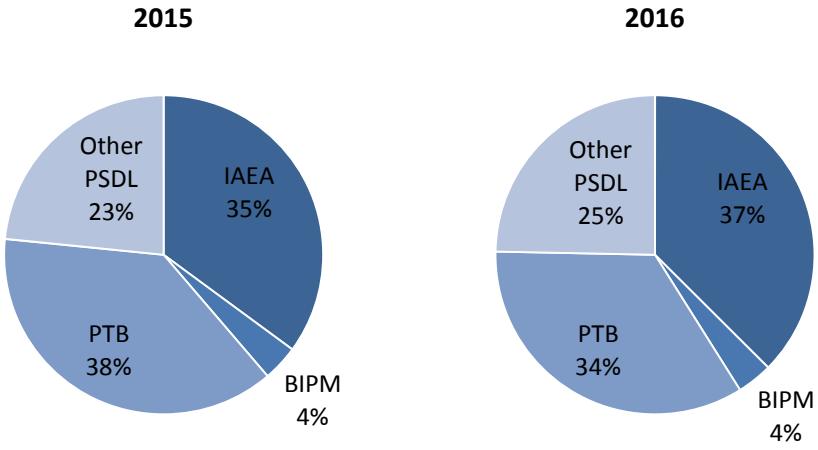


Fig. 5. The traceability of calibrations at SSDLs listed in Table 1: From the radiation protection services only the traceability of ionization chamber calibrations for photons is included in these percentages.

Table 2. The numbers of calibrated personal dosimeters and other passive targets in 2015 and 2016

Scope	Dosimetry type	Services	Calibrations at SSDLs	
			2015	2016
Radiation Protection	Personal dosimeters and other passive targets	TLDs	32.2 %	15.0 %
		Films	1.9 %	6.9 %
		Other	65.9 %	78.1 %
Total number of calibrated personal dosimeters and other passive targets			**866,645**	**276,894**

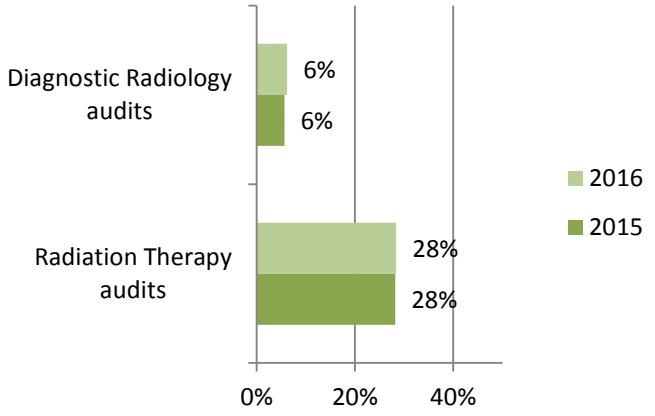


Fig. 6. The percentage of SSDLs that have provided audit services to hospitals

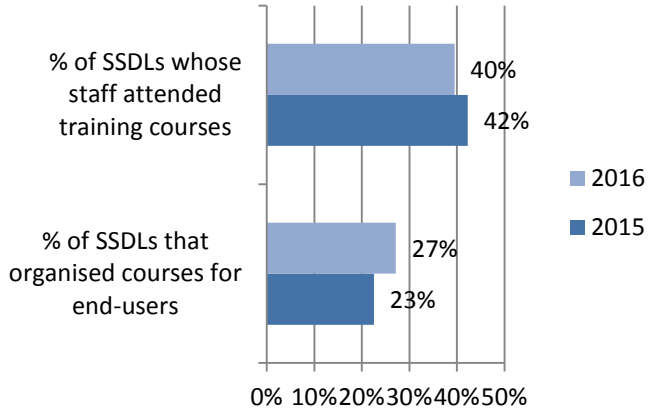


Fig. 7. The percentages of SSDLs whose staff has participated in training courses (above) and SSDLs that have organized training courses for end-users (below)

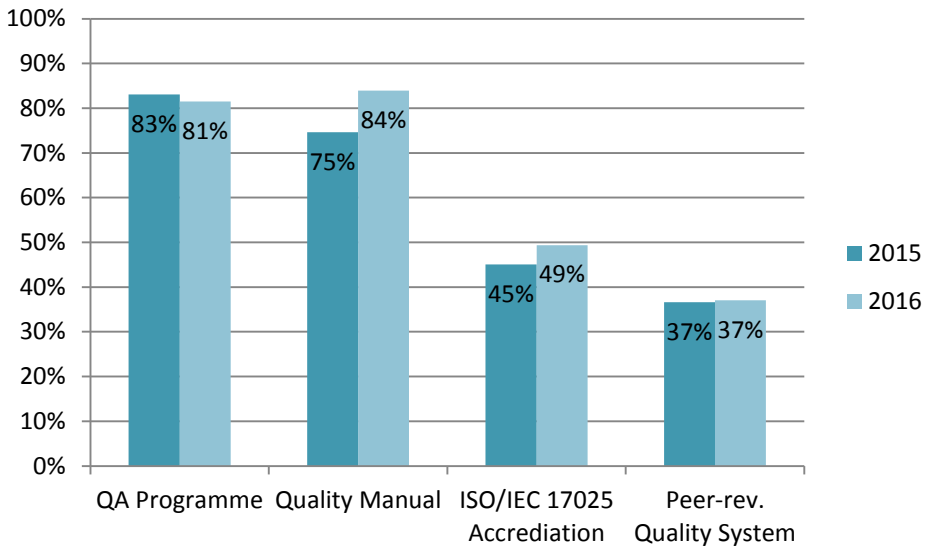


Fig. 8. Percentages of SSDLs that have a quality assurance programme (left), a quality manual (2nd from the left), that have been accredited according to the ISO/IEC 17025 (3rd from the left), and of SSDLs that have a peer-reviewed quality system (right)

3. Future steps

Since 1976, the IAEA has maintained a register of dosimetry laboratories in the IAEA/WHO SSDL Network. The list of Network members has been available and published by IAEA but information about their calibration and measurement services has not been available for public. In 2016, the Scientific Committee of the IAEA/WHO Network of SSDLs recommended that this information should be made available on our website. Therefore, we are in the process of creating a new database called DOsimetry Laboratory NETwork i.e. DOLNET, which will contain up-to-date information about calibration services provided around the world. The preliminary version of this database was created based on the most recent annual report data and it is available on our new website. However, as DOLNET is still in development, the information available online may be incomplete. In the near future we plan to collect some new and more detailed data from the SSDLs so that we can provide more accurate information about the services available at the SSDLs of the IAEA/WHO SSDL Network and make this information available for anyone who wants to have their dosimeters calibrated.

Intern's Corner

Internship at the DMRP Section

December 2016 – November 2017

Before my internship at the IAEA, my experience in radiation and particle physics was limited to a few general courses at the University of Helsinki. I also had some knowledge about clinical terminology having worked at a hospital in Finland, but no words can describe the amount of new information, both practical and theoretical, I received and tried my best to absorb during the past 12 months.

My main responsibilities revolved around dosimetry and the SSDL Network, although in the beginning of my internship I was also responsible for the administrational issues related to the Directory for Radiotherapy Centres (DIRAC) and the extensive email correspondence related to the updating process. Throughout my internship, I continued to be a member of the DIRAC team by participating in the weekly meetings and performing DIRAC-related tasks.

My duties as the unofficial SSDL intern have been very diverse. They have included organizational work and email correspondence related to various meetings, courses and workshops as well as collecting and analyzing the 2016 annual reports. In addition I have had many opportunities to apply the skills I acquired during my second studies: I have been allowed to contribute to the SSDL Newsletters by writing reports and acting as one of the editors. Additionally, I have proofread and edited several reports and documents during my internship. I have also been strongly involved in developing both the new SSDL website and the new SSDL database, DOLNET, especially during the second half of my internship. The website was launched in the summer and the goal towards which we have been working on is to integrate DOLNET to the new website and to provide the Member SSDLs a web-interface similar to DIRAC. Through this online interface, the SSDLs will be able to review and update all information related to their own laboratories and to submit the annual report.

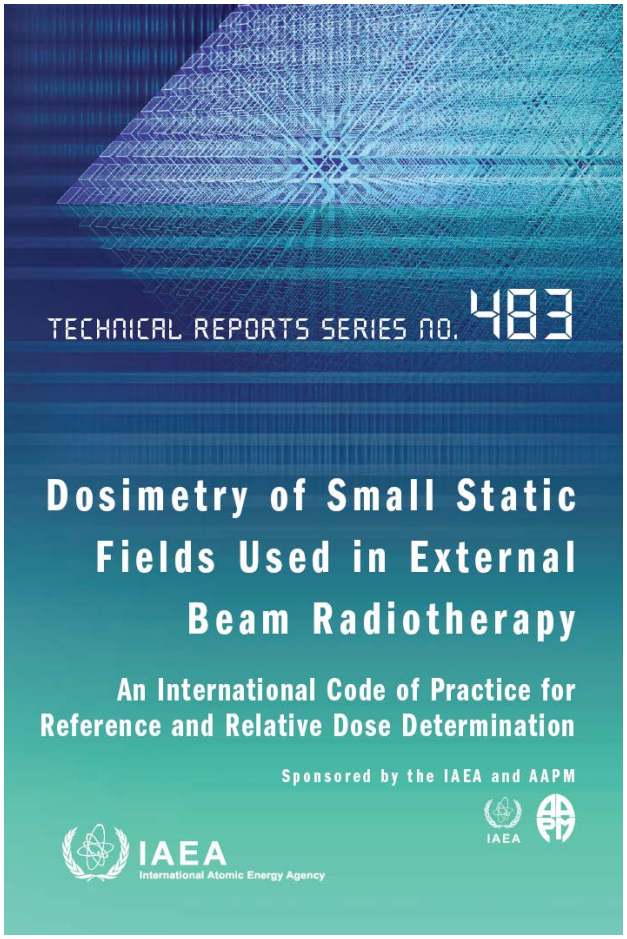
This internship has not only been a very educational experience but also a unique opportunity to work in an international organization and to meet and work with many brilliant and nice people from all over the world. To conclude, I would like to thank all colleagues with whom I had the privilege to work and especially both of my supervisors for supporting me and ensuring I never ran out of challenges.

Mirja Kemppi

New IAEA Publications

Dosimetry of Small Static Fields Used in External Beam Radiotherapy

This is the first international code of practice dedicated to the dosimetry of small static fields used in radiotherapy. It provides consistent reference dosimetry, traceable to metrological primary standards, and enables common procedures within a country to be followed. The publication presents an overview of the physics, followed by a general formalism for reference dosimetry in small fields. Guidelines for its practical implementation using suitable detectors and methods for the determination of field output factors are given for specific clinical machines that use small static fields. The development of this code of practice has been done through an international working group, established jointly with the American Association of Physicists in Medicine. Internationally harmonized guidelines in this field will ensure worldwide consistency in dose delivery to radiotherapy patients and will contribute to dose standardization in international clinical trial studies, comparing outcomes of various radiotherapy treatment modalities using small fields.



(*Information taken from* www.pub-iaea.org)

Kindly find a story online:

https://www.iaea.org/newscenter/news/new-guideline-for-radiotherapy-treatment-with-small-fields

Upcoming Courses, Meetings and Consultancies in 2018

TC Courses and Workshops related to DMRP activities

- RER6038: Implementation of Quality Management Systems in Diagnostic Radiology, Banja Luka, Bosnia and Herzegovina, 19—23 March 2018
- RER6036: Joint ICTP-IAEA Advanced School on IAEA/AAPM Code of Practice for the Dosimetry of Static and Small Photon Fields, Trieste, Italy, 12—16 April 2018
- Joint ICTP-IAEA School on Quality Assurance and Dose Management in Hybrid Imaging (SPECT/CT and PET/CT), Trieste, Italy, 17—28 September 2018
- Joint ICTP-IAEA Advanced School on Quality Assurance and Dosimetry in Mammography, Trieste, Italy, 22—26 October 2018
- RER6036: In-Holland/VMAT Treatment Planning Hands-on course for MPs, Haarlem, The Netherlands, 29 October—2 November 2018
- RAF6048: QA for Non-imaging Equipment and Radiation monitoring instrumentation in Nuclear Medicine, Cape Town, South Africa, 2018

ESTRO Courses

- RER6036: ESTRO/Image Guided and Adaptive Radiotherapy in Clinical Practice (MPs and ROs), Budapest, Hungary, 11—15 February 2018
- RER6036: ESTRO/Evidence based radiation oncology, Athens, Greece, 27 May—1 June 2018
- RER6036: ESTRO/IMRT and other conformal techniques in practice (MPs and ROs / a team from institution can attend), Tallin, Estonia, 3—7 June 2018
- RER6036: ESTRO/Dose modelling and verification for external beam radiotherapy, Dublin, Ireland, 10—14 June 2018
- RER6036: ESTRO/Target volume determination - From imaging to margins, Moscow, Russia, 15—30 September 2018
- RER6036: ESTRO/Best practice in radiation oncology - Train the RTT (Radiation Therapists) Trainers - Part I, Vienna, Austria, 22—26 October 2018

DMRP Meetings and Consultancies

- Consultancy Meeting on Revisions and Updates of QUATRO Procedures, Vienna, Austria, 8—12 January 2018
- 18th Biennial Meeting of the SSDL Scientific Committee (SSC-18) for the Evaluation of and Recommendations on the Dosimetry Programme and the IAEA/WHO Network of SSDLs, Vienna, Austria, 12—16 March 2018
- Technical Meeting of the Programme Committee of the Second International Symposium on Standards, Applications and Quality Assurance in Medical Radiation Dosimetry, Vienna, Austria, 2nd Quarter 2018
- Technical Meeting of the Programme Committee of the Second International Symposium on Standards, Applications and Quality Assurance in Medical Radiation Dosimetry, Vienna, Austria, 11 – 15 June 2018
- Consultancy Meeting on Update of TRS398, Vienna, Austria, 25—28 September 2018

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