IAEA

SSDL Newsletter

No. 59 April 2011

IAEA/WHO Network of Secondary Standards Dosimetry Laboratories

Prepared by the Joint IAEA/WHO Secretariat of the SSDL Network
http://www.naweb.iaea.org/nahu/external/e3/ssdl.asp

Contents

IAEA International Atomic Energy Agency

The International Symposium on Standards, Applications and Quality Assurance in Medical Radiation Dosimetry (IDOS) held at the IAEA Headquarters in November 2010.

From the editor

The first article of this issue of the SSDL Newsletter is a report of the 14th SSDL Scientific Committee (SSC) Meeting held at the IAEA Headquarters in March 2010. The second article is a report of the Coordinated Research Project (CRP E2.10.06) on the Implementation of the International Code of Practice on Dosimetry in Diagnostic Radiology (TRS-457). The third article is a progress report of an international working group jointly established by the IAEA and AAPM on Small and Composite Field Dosimetry. The fourth article briefly describes the purpose and content of a new web site called IAEA Human Health Campus (http://humanhealth.iaea.org). A short note of the IDOS conference held at IAEA Headquarters in Vienna during November 2010 is given in the last article.

The editor would like to welcome a new SSDL that has recently joined our Network: the Kapchagai Calibration Laboratory, Kazakhstan.

The IAEA's Dosimetry and Medical Radiation Physics Section welcomes two new staff members: Deborah van der Merwe from South Africa, who is a clinical medical physicist in radiation therapy and Igor Gomola from Slovakia, who is a medical radiation physicist appointed as SSDL Officer.

Finally, the editor calls for contributions from SSDLs and hospitals for this Newsletter. The contributions should be within the scope of the work of the SSDLs as described in the SSDL Network Charter, including work done in hospitals.

STAFF OF THE DOSIMETRY AND MEDICAL RADIATION PHYSICS (DMRP) SECTION

International Atomic Energy Agency, Vienna International Centre, P.O. Box 100, 1400 Vienna, Austria
Telephone: (+43-1) 2600+extension; Fax: (+43-1) 26007, email: Official.Mail@iaea.org

Name	*Position/tasks*	*Email address*	*Extension*
Meghzifene, Ahmed	Section Head	a.meghzifene@iaea.org	21653
Azangwe, Godfrey	Dosimetrist	g.azangwe@iaea.org	28384
Bera, Pranabes	Senior Laboratory Technician, TLD	p.bera@iaea.org	28330
Czap, Ladislav	Senior Laboratory Technician Radiotherapy and Radiat. Protection	l.czap@iaea.org	28332
Girzikowsky, Reinhard	Senior Laboratory Technician Diagnostic radiology	r.girzikowsky@iaea.org	28328
Gomola, Igor	SSDL Officer Editor, SSDL Newsletter	i.gomola@iaea.org	21660
Gutt Blanco, Federico	Consultant	f.gutt-blanco@iaea.org	21664
Izewska, Joanna	TLD Officer, Head, Dosimetry Laboratory Unit	j.izewska@iaea.org	21661
McLean, Ian Donald	Medical Radiation Physicist Diagnostic Radiology	i.mclean@iaea.org	21663
Palm, Stig Harald	Medical Radiation Physicist Nuclear Medicine	s.palm@iaea.org	21659
Van der Merwe, Deborah	Radiotherapy Medical Physicist	D.Van-Der-Merwe@iaea.org	21655
Van Dyk, Jacob	Medical Radiation Physicist Radiotherapy Consultant	j.van-dyk@iaea.org	24290
Ciortan, Simona	Secretary/Clerk	s.ciortan@iaea.org	21634
Danker, Sabine	Secretary/Clerk	s.danker@iaea.org	21662
Flory, Rosemary	Secretary/Clerk	r.flory@iaea.org	28351
DMRP Section*		Dosimetry.Contact-Point@iaea.org	21662

* This is the e-mail address to which general messages on dosimetry and medical radiation physics should be addressed, i.e. correspondence not related to specific tasks of the staff above. Each incoming general correspondence to the DMRP Section mailbox will be dealt with accordingly.

SERVICES PROVIDED BY THE IAEA IN DOSIMETRY AND MEDICAL RADIATION PHYSICS

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 TLD postal dose assurance service for SSDLs and radiotherapy centres.

The IAEA Calibration and Measurement Capabilities (CMCs) have been reviewed and published in the CIPM's (Comité International des Poids et Mesures) Appendix C. 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).

Additional information 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 (radiotherapy, diagnostic radiology including mammography, and radiation protection including environmental dose level)	X rays (10–300kV) and gamma rays from ^{137}Cs and ^{60}Co
Calibration of well type ionization chambers for low dose rate (LDR) brachytherapy	γ rays from ^{137}Cs
Comparison of therapy level ionization chamber calibrations (for SSDLs)	γ rays from ^{60}Co
TLD dose quality audits for external radiotherapy beams for SSDLs and hospitals	γ rays from ^{60}Co and high energy X ray beams
TLD dose quality audits 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

Member States who are 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 through the Internet at the web site: *http://www-naweb.iaea.org/nahu/dmrp/ssdl.asp.*

IAEA/WHO SSDL Network Secretariat
Dosimetry and Medical Radiation Physics Section
Division of Human Health
Department of Nuclear Sciences and Applications
International Atomic Energy Agency
P.O. Box 100
1400 Vienna
Austria

Telephone: +43 1 2600 21662
Fax: +43 1 26007 21662
Email: Dosimetry.Contact-Point@iaea.org

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.

Scientific Committee of the IAEA/WHO Network of Secondary Standards Dosimetry Laboratories

Report of the Fourteenth Meeting of the SSDL Scientific Committee

IAEA, Vienna
16-19 March 2010

1. FOREWORD

The Scientific Committee (SSC) of the IAEA/WHO network of Secondary Standards Dosimetry Laboratories (SSDLs) is a standing committee within the framework of the International Atomic Energy Agency. It is tasked with conducting periodic reviews and evaluations of the Dosimetry and Medical Radiation Physics (DMRP) Subprogramme and reporting the results of the reviews to the Directors General of the IAEA and the WHO. The report of the thirteenth meeting (held in March 2008) of the SSC (SSC-13) was published in the SSDL Newsletter No. 56 in December 2008.

The fourteenth meeting was held in Vienna at the IAEA Headquarters from 16-19 March 2010. Opening remarks were made by Mr R. Chhem, Director of the Division of Human Health (NAHU); Mr Steffen Groth (Director, Essential Health Technologies, WHO), acting Co-Secretary of the IAEA/WHO SSDL Network; and Mr A. Meghzifene, Head of the Section of Dosimetry and Medical Radiation Physics and Co-Secretary of the IAEA/WHO SSDL Network.

1.1 Introduction

Mr Ahmed Meghzifene opened the meeting with a welcome to the SSC-14. Most members were familiar with the DMRP, having attended the SSC-13. Mr Steffen Groth was warmly welcomed back to the IAEA Headquarters as the WHO Co-Secretary of the SSDL Network.

Mr Rethy Chhem (Director, NAHU) welcomed the committee to Vienna. Mr Chhem mentioned the relationship between the IAEA and WHO and stated that the SSC has had a very positive impact on the DMRP Subprogramme. This meeting was considered to be good timing because the DMRP is currently preparing the programme and budget for the next biennium. Mr Chhem informed the SSC that the IAEA has a new Director General, Mr Yukiya Amano. He also informed the SSC about the realignment of the management of the IAEA Laboratories at Seibersdorf, which led to the transfer of the Dosimetry Unit to DMRP/NAHU. He reminded the SSC that the DMRP is holding an International Symposium on Standards, Applications and Quality Assurance in Medical Radiation Dosimetry in November 2010. He also pointed out that last year was the 40th anniversary of the IAEA/WHO postal TLD audit programme. He wished the SSC a successful meeting and thanked the members for their contributions.

Mr Steffen Groth, Co-Secretary of the SSDL Network then added his welcome. Mr Groth had previously held the position now held by Mr Chhem as Director of NAHU. Mr Groth said that in the past, the DMRP had indeed implemented most of the SSC's recommendations. He remarked that the SSDL network has existed for more than 30 years, during which he felt the contribution of the WHO to the SSDL Network Secretariat had been mostly symbolic. He noted that the audit programme is very successful and described it as the "most comprehensive QA programme that WHO is involved in", a strength of the programme being that it is needs-driven, as he believed an IAEA programme should be. A further strength is its SSC biennial review by experts in dosimetry, which has also helped the DMRP Subprogramme to develop and now engage in imaging, for both nuclear medicine and diagnostic radiology. He listed as a final strength that the programme falls under the regular budget which gives it security and also some freedom because these funds are assured. However, he pointed out that there are also some weaknesses, and in particular, a lack of resource mobilization culture in the IAEA for obtaining external funding. He acknowledged that the Programme of Action for Cancer Therapy (PACT) brought some mobilization culture, but the differences in composition of the IAEA and the WHO budgets have a large influence. He commented that the WHO receives 80% of its budget from external sources which makes it dependent on donors, but also gives it more freedom than the IAEA. He also pointed to a weakness of the SSC in that it cannot work in a vacuum, but must comply with overall IAEA priorities set out by the DG and deputy DG

for Nuclear Sciences and Applications. He also expressed the view that the composition of the SSC was not optimal when issues beyond TLD and the SSDLs arise, specifically, when considering imaging aspects, new partners should be considered such as the International Federation of Biomedical Imaging. In addition he felt that it would be desirable to have more balance on the SSC from developing countries. However, Mr Groth hastened to reiterate that the DMRP's Dosimetry Subprogramme is one of IAEA's most successful activities.

Mr Chhem responded that the new DG has raised the priority and support for radiation medicine. In September, the IAEA will hold a scientific forum on cancer care. Fundraising had not previously been a priority, but it is now. As a clinical radiologist, he sees support for, and involvement of physicists as a high priority. He reminded the SSC that the welfare of the patient is the ultimate goal and said that the focus needs to be on support for innovation in imaging. He is exploring the role of the IAEA in imaging and he is preparing to move forward on this.

Mr Meghzifene, in welcoming Mr Groth back to the IAEA, explained that he had always been a strong supporter of the DMRP when he was with the IAEA. Mr Meghzifene admitted that there are shortcomings in the Subprogramme, but that an objective of the SSC is to identify these, so the DMRP can focus on addressing them. He agreed that there are issues concerning the composition of the SSC and also constraints, and hopes to address these in the future. This SSC will meet once more in 2012, and he will seek advice for future SSC membership. Mr Meghzifene mentioned that the recommendations and prioritization made by the SSC have been helpful and will continue to be so. He concluded by paying tribute to Frantisek Pernicka who passed away in January 2010. Frank Pernicka had developed the X ray imaging activities at the IAEA. He also acknowledged Johann Haider who had passed away in April 2009. Johann Haider had initiated the dosimetry laboratory activities and contributed to the development of about 50 SSDLs worldwide. His contributions were widely acknowledged.

Mr Ahmed Meghzifene, in his role of Head of the DMRP, and as Co-Secretary of the SSDL Network, welcomed the SSC-14 to the meeting and introduced the staff who were in attendance. He explained that the meeting would take place in three segments, the first of which would be the presentation of the activities of the DMRP-run projects in 2008 to 2009. The second part of the meeting would be devoted to the projects for 2010 to 2011, presently being implemented, and an overview of the result of a brainstorming session to feed into the biennium projects for 2012 to 2013. The final part of the meeting would be the deliberations of the SSC resulting in their report on the sub-programme and recommendations for the next biennium. Mr Meghzifene reiterated that the meeting is being held at the right time for the outcome to be considered for the next biennium. He acknowledged that not all of the recommendations of SSC-13 had been implemented but assured the SSC that all recommendations had been carefully considered. Many were implemented fully or partially, while only a few were deferred.

He then introduced Ms Penelope Allisy of the BIPM as the Chairman of the SSC-14. Ms Allisy expressed the honour and pleasure to be chair, while looking forward to the SSC deliberations. She said she believed that there are good reasons that not all the recommendations were implemented. She agreed that the IAEA should consider the breadth of the SSC membership for the future.

Ms Allisy thanked all three speakers for their support of the SSC and for their statements illustrating important issues regarding the relationships among the DMRP, the NAHU, the IAEA as a whole, and the WHO. She assured Mr Groth that the composition of the SSC would be reviewed during the meeting and changes would be recommended as necessary. Ms Allisy then reviewed the agenda for the meeting and asked if the members or staff wished to propose changes. None was suggested.

1.2 General discussion

1.2.1 Programme of the Meeting

Mr Meghzifene began the meeting programme by presenting an overview of the DMRP subprogramme. Several DMRP staff members then presented reports on the activities of the Section during the remainder of the first day of the meeting. These reports continued into the morning of the second day. In the afternoon of the second day, and throughout the third day, the SSC-14 met in closed session, deliberating on the accomplishments and direction of the DMRP's subprogramme, and developing specific recommendations. Discussion continued on the draft recommendations on the morning of the fourth day. The main draft recommendations were discussed with Mr Meghzifene, the DMRP staff, Mr Groth and Mr Burkart on the afternoon of the last day. During the feedback, the SSC-14 thanked the DMRP staff for their report and for their clear presentations.

In preparation for its report, the SSC-14 reviewed the activities reported by the DMRP for the 2008–2009 biennium and discussed the planned subprogramme activities for 2010–2011. In addition, the SSC reviewed the results of the DMRP's brainstorming for the biennium 2012–2013. The scope of the SSC-14 evaluation was similar to that of previous SSCs and addressed the questions of:

- The objectives of the sub-programme areas
- The impact (benefit to the Member States)

- Opportunities to reduce costs by eliminating projects or transferring them to other laboratories
- The continuing relevance of IAEA activities
- The distribution of effort between work on the sub-programme projects and support of the laboratory quality management system.

Specific recommendations from the SSC-14 are listed in order of priority at the end of the report. Comments regarding specific aspects of the DMRP programme are also reiterated at the end of the report.

2. INTRODUCTION

The SSC-14 wishes to thank the DMRP staff members for preparing a comprehensive report covering the activities of the sub-programme on Dosimetry and Medical Radiation Physics during the biennium 2008-2009. The availability of this report well in advance of the meeting enhanced the Committee's ability to develop thoughtful and appropriate recommendations.

The SSC-14 was pleased to learn that ten of the recommendations of SSC-13 have been fully implemented and thirteen were in progress. Three recommendations had been deferred until a later date. The SSC notes that the DMRP intends, in the current biennium, to complete implementation of the SSC-13 recommendations that are currently in progress. Several of the SSC-13 recommendations were discussed in detail, together with the DMRP's plans. The comments made by SSC-13 were also discussed. Fourteen of the 15 comments have been implemented fully, are in progress, or are under consideration.

Considerable discussion followed regarding recommendation #7 of SSC-13. This recommendation called for the DMRP to develop a method of systematic reporting on the number of beams audited by the national TLD networks. Mr Meghzifene reported that efforts to address the recommendation were in progress, but that staffing limitations inhibited the DMRP's progress. Ms Izewska explained that resources in Member States also limited their ability to implement some activities.

During the biennium 2008–2009, the DMRP Section's projects and their titles were:

- Recurrent Project 2.2.4.1: Quality audits in dosimetry for radiation medicine
- Recurrent Project 2.2.4.2: Radiation metrology supporting the network of Secondary Standards Dosimetry Laboratories (SSDLs)
- Project 2.2.4.3: Quality assurance and guidelines for medical physics in the optimization of clinical radiation imaging
- Project 2.2.4.4: Quality assurance and medical physics developments in radiotherapy and therapeutic nuclear medicine

This arrangement allows projects 2.2.4.1 and 2.2.4.2 to ensure the quality of the dosimetric chain and to enhance the capabilities of Member States to achieve and maintain high quality and consistency in their radiation measurements and dosimetry standards. Projects 2.2.4.3 and 2.2.4.4 have been restructured to strengthen and harmonise the quality assurance of radiological imaging, radiation therapy and therapeutic use of radionuclides in Member States. An illustration of the arrangement of these major projects appears in Figure 1, reproduced here from the DMRP report.

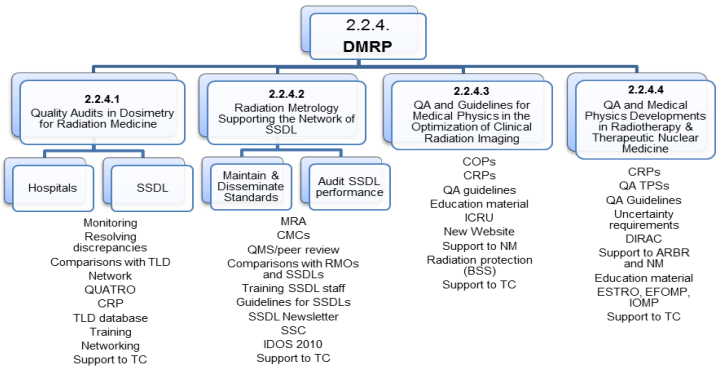


Figure 1: Overview of the major projects of the IAEA DMRP Sub-programme, 2008-2009.

The SSC-14 report follows the format established by previous reports and begins with a general discussion of administrative items and collaborative efforts within the IAEA. Selected projects are then discussed in turn. For the most part, the report mentions only those activities of the DMRP Section for which the SSC-14 has comments or recommendations at this time. *The absence of mention of a particular DMRP activity should be interpreted positively and as an indication of concurrence by the SSC-14 with the activity as described in the DMRP Report.*

3. REPORT

3.1 General Organizational Items

As noted earlier, SSC-14 congratulates the DMRP on their comprehensive report and presentations. The SSC-14 appreciated having the DMRP report in advance, and was grateful to have printed copies of the slides, which greatly facilitated the discussion. The SSC hopes that the DMRP can find a way in the future to simplify the correlation between the presentations (and slides) with the report, perhaps by changing the page numbering to a system that uniquely identifies each slide page (e.g., A-1).

The SSC-14 appreciated the balance of information and suggests that the same balance should be retained for the next SSC for the report, the presentations and the agenda.

The SSC-14 was pleased to hear about the progress made on implementing the recommendations made by the SSC-13 and is confident that the remaining recommendations will be implemented as indicated during the 2012-2013 biennium.

As previously, the SSC-14 has observed that the success of the DMRP encourages both Member States and other sections of the IAEA to demand more assistance from the DMRP. However, the SSC-14 is concerned that a continuation in this trend could overload the DMRP resources and jeopardize the quality of the services, and consequently has made several recommendations that address the section's workload.

The SSC-14 notes the difficulty in recruiting for the open positions and commends DMRP on appointing temporary workers to fill these vacant positions to avoid undue delays in the programme.

The SSC-14 encourages the IAEA to help its Member States to find information on the IAEA web site perhaps through an improved search engine.

The SSC-14 believes that the next external peer review audit of the DOL should be in advance of the SSC, not at the same time as had occurred during SSC-13. The audit should span 2 days, to allow a full day for a visit to Seibersdorf and a second day for report preparation and discussion.

The SSC-12 had recommended that a dosimetry symposium be held in 2008, to follow the 2002 symposium. The SSC-14 was pleased to note that the International Conference on Advances in Radiation Oncology was held in April 2009 and the dosimetry symposium is scheduled to be held in November 2010.

Finally, the SSC-14 congratulates the DMRP on the quality of the report and presentations and noted that the information in the appendices is 'overwhelming'.

3.1.1 Facilities at the Dosimetry Laboratory (DOL)

In response to a recommendation made by SSC-13, the structure of the DOL was changed in early 2010, to optimise and streamline the management at the Seibersdorf laboratory. The Dosimetry Unit was renamed the Dosimetry Laboratory and fully incorporated in the DMRP Subprogramme, shown in Figure 2.

The SSC-14 was very pleased to see the reorganization of the reporting structure of the DOL and trusts that the unit head will be appointed at the appropriate level.

In 2008, the SSC-13 has identified that dosimetry audit mechanisms in Member States would be of benefit in ensuring the safe delivery of radiotherapy doses. A recommendation (#1) was made to encourage the DDG to urge Member States to develop audit mechanisms similar to the QUATRO methodology. The SSC14 feels that the time is opportune to press this recommendation as follows:

> **[R 1.1]** The SSC-14, acknowledging that the IAEA overall programme for 2010 has an emphasis on cancer, recommends to the Secretariat that the timing is appropriate to prepare a draft resolution on quality assurance in cancer treatment for the IAEA's governing bodies to consider. This resolution should urge as one of its objectives for Member States, the establishment of national audit mechanisms for radiation therapy using the QUATRO methodology, and as a further objective, the updating of their national data in the DIRAC database.

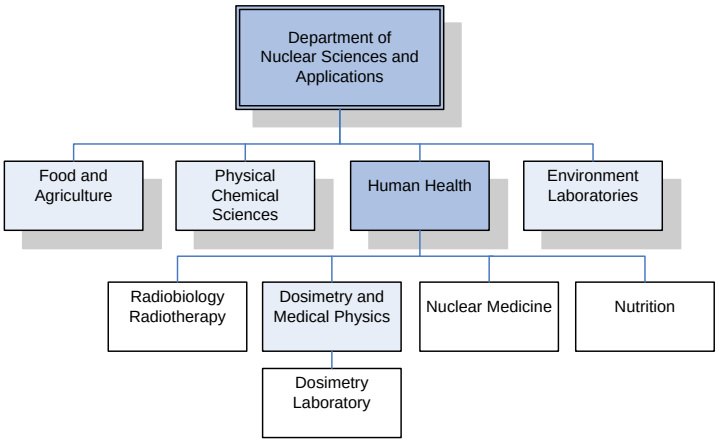


Figure 2: The placement of the Dosimetry Unit within the IAEA administrative structure[1].

The SSC-13 had also prepared a recommendation (#21) that advised the DMRP to collaborate with the WHO in updating existing dosimetry and basic imaging QA procedures, and corresponding training materials for use in member countries. The SSC-14 feels that the collaboration could be strengthened to the benefit of both sets of Member States and makes the following recommendation:

> **[R 2.1]** The SSC-14 understands that the WHO is in the process of moving towards a common platform for its various units working in radiation and imaging. Consequently, the SSC-14 recommends that regular meetings take place between the WHO platform and the IAEA to facilitate collaboration and reduce potential duplication.

The SSC-14 heard presentations regarding the workload at the DMRP and at the DOL and recognizes that the staff is under a great deal of pressure to manage an increasingly demanding workload. The demands for DMRP staff could be reduced by transferring some of its

[1] As of January 2010, the Dosimetry Unit was renamed 'Dosimetry Laboratory' and is directly attached to DMRP.

activities (training, calibrations and audits) to regional SSDLs.

> **[R 2.2]** In view of the heavy demand on the DMRP staff, SSC-14 recommends that the DMRP consider posting educational material for medical physicists on dosimetry and QA for imaging and radiotherapy on the new NAHU website. Any direct training provided should be preferentially for designated trainers in the regions.

3.2 Project 2.2.4.1: Quality Audits in Dosimetry for Radiation Medicine

The requests for the DMRP's calibration and audit services continue to grow. As an example, Figure 3 shows the increase in the number of TLD audits conducted at radiotherapy facilities each year since 1990.

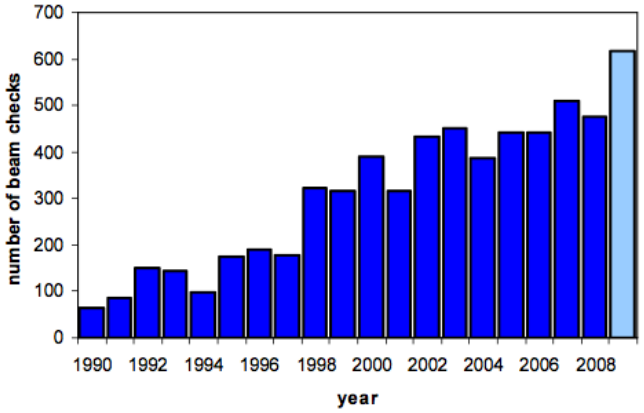


Figure 3: Increase in the IAEA/WHO TLD postal dose audit for radiotherapy hospitals. The number of radiotherapy beam calibration checks per year increased significantly since the automatic TLD system was introduced in 1998. The last data bar indicates the number of TLDs distributed in 2009 that are undergoing evaluation by the Dosimetry Laboratory

The SSC-13 had recognized that the DMRP is eager to provide a variety of services to Member States and that there is presently a demand for increased support, particularly in regard to advanced technologies in imaging and therapy. However, the DMRP was advised to avoid diluting its activities in assuring basic dosimetry practices while responding to requests for new services. The SSC14 maintains this view and makes the following recommendation:

> **[R 1.2]** The SSC-14 supports the establishment of acceptance criteria by the DMRP for the provision of radiation beam audits in response to rapidly growing demands by radiotherapy centres in Member States, given the limited resources of the Dosimetry Laboratory and in the interest of quality. In the event of an excess demand, SSC-14 recommends the DMRP to provide the information to the WHO to enable the WHO to identify any need for local infrastructure to support national audit networks for this purpose.

The benefit of the TLD audits of SSDLs and of the hospitals is well understood. An additional benefit is the participation of the BIPM and six PSDLs to give an independent verification of the IAEA TLD calibration. Figure 4 illustrates the improvement in the IAEA measurements from 1996 to 2009 and consequently the robustness of the TLD audit system.

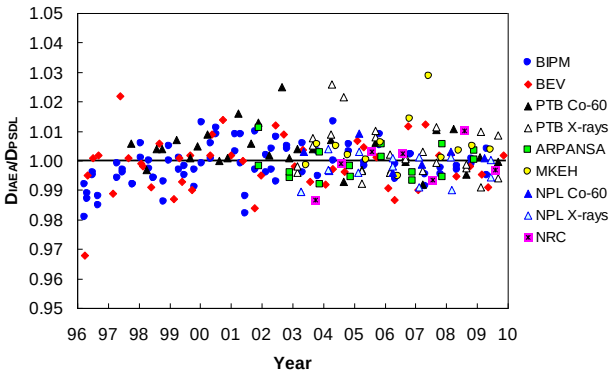


Figure 4: The results of 232 reference irradiations of IAEA TLDs provided by the BIPM and PSDLs during 1996-2009. Data in the graph correspond to ratios of the IAEA's TLD determined dose (DIAEA) relative to the absorbed dose delivered by the BIPM or PSDL (DPSDL). Each point corresponds to the average of three dosimeters.

The importance of independent radiotherapy audits was discussed at length. The SSC-14 noted that a number of reports of significant calibration errors had appeared in publications recently, and that the attention of the public and governments had been drawn to the risk of incorrect radiation doses to patients. The SSC-13 had recommended that a method of systematic reporting on the number of beams audited by the national TLD networks be identified to determine the extent of dissemination of radiotherapy audits.

> **[R 1.3]** The SSC-14 recommends that the DMRP provide each SSC with the number of the beams audited by the national TLD networks. The reasons for the low levels of activity of some networks should be investigated by the DMRP and discussed with the WHO Secretariat with a view to enabling these networks to provide a more complete service to their hospitals.

In the 2012–2013 programme the IAEA should be aware that, having established audits for complex techniques and encouraged the development of additional SSDLs, they can expect an increase in demand for the TLD audit service. The IAEA should be prepared to meet this need in support of radiotherapy in the Member States. The SSC-14 observed that with the anticipated increasing demand for audits as complexity of RT increases, and in response to publication of the TECDOC on 2D/3D/IMRT, a request for additional resources should be made for the next programme cycle. If the dynamic in audit programmes demonstrates significant increase, this should be reflected in the human resource plan.

It was noted that the complexity of radiotherapy is increasing worldwide, and there is an increasing need for independent audits of the use of advanced technologies.

However the DMRP cannot meet this need alone and the QUATRO methods should be disseminated more widely for implementation at national level.

> **[R 1.5]** In view of the importance of safe implementation of advanced radiation treatment technologies, the SSC-14 recommends that the QUATRO methodology developed for advanced technologies be adopted and widely disseminated. The SSC-14 recommends that this dissemination includes holding another series of workshops to train more auditors.

The SSC-14 was impressed with the number of TC projects that come to the DMRP for technical review and support, and recognizes that the demand for human resources must be significant.

> **[R 1.6]** In view of the dynamic of the TC projects moving from 12% in human health to nearly 30% in the last few years, that the DMRP has had to provide technical advice on 228 TC projects in the programme 2008-2009 and that this is likely to continue, the SSC-14 recommends that the IAEA consider an adjustment of the human resource complement in favour of the Section.

During the ICARO meeting held in April 2009, the IAEA received a request from several clinical trials QA offices to act as an umbrella organization for the international harmonization of QA for clinical trials and to provide an information exchange platform regarding the activities of national networks operating dosimetry audits for radiotherapy centres participating in international clinical trials.

> **[R 2.4]** The SSC-14 recommends that the DMRP identify ways to organize a database of national quality audit networks and to assess the quality of their work.

The SSC-14 took note of the fact that, among the advanced treatment techniques that are becoming ubiquitous in radiotherapy departments, volumetric modulated arc therapy (VMAT) is becoming particularly widespread. This technique is challenging conventional dosimetry techniques, as it combines arc therapy and IMRT. Consequently, point measurements with ion chambers, and possibly even planar measurements with film or detector array systems, are inadequate.

The SSC-14 encourages the DMRP to develop a CRP on dosimetry audits for modern dynamic dose delivery techniques, which are now becoming more common in hospitals.

The DMRP's audit techniques have, to date, been limited to photon beams. However, many patients are treated with electron beams, also. The SSC-14 encourages the DMRP to identify the additional resources that would be needed to audit radiotherapy electron beams in the future.

3.3 Recurrent Project 2.2.4.2: Radiation Metrology supporting the Network of Secondary Standards Dosimetry Laboratories (SSDLs)

The DMRP has conducted a number of TC projects in the current biennium that have facilitated comparisons between measurements at the SSDLs and at the IAEA's DOL. In view of the success of the TC projects to support SSDL staff and to facilitate comparisons with the IAEA, the SSC-14 believes that this mechanism should be continued.

In its recommendation #15, the SSC-13 recommended that the DMRP investigate sources of uncertainty in the calibration of CT chambers and KAP meters under modern beam configurations. The SSC-14 was pleased to learn that this work is in progress, and an IAEA-TECDOC on the implementation of TRS-457 is in preparation. In particular, the SSC-14 was pleased to learn that a CRP on advanced dosimetry techniques for diagnostic and interventional radiology, including paediatric KAP measurements is in progress. The CRP includes testing TRS 457, the importance of defining the beam qualities for the calibration of CT chambers, and KAP meters, and notes that different qualities are required for panoramic dental units. The SSC-14 proposed that an explanation about these points should be included in a future SSDL Newsletter.

A previous recommendation advised the IAEA to update its guidance on the calibration of radiation protection monitoring instruments. The SSC-14 is pleased to see that a first draft has been completed and looks forward to the publication of this valuable report.

The SSC-14 observed that the IAEA's web-based reporting form restricts an SSDL to report the results of participation in either a regional dosimetry comparison or an IAEA comparison, but not both. The SSC-14 suggests that this be corrected.

The SSC-13 had taken note of the changes that had occurred over the previous 10 years in international metrology and recommended that the IAEA/WHO SSDL charter be reviewed to take into account the developments resulting from the CIPM MRA, new radiation medicine technologies and associated developments in ionizing radiation metrology. The SSC-14 is pleased to see that this review is planned for 2010-2011 and again encourages the DMRP to make this review.

> **[R 3.1]** The SSC-14 is pleased to note that the DMRP plans to revise the SSDL charter in 2010-2011 and recommends that the SSDL members be advised of the new requirements and be given a reasonable opportunity to comply.

The SSC-14 understands that a comprehensive survey of the SSDLs is conducted periodically via the SSDL Newsletter. The next survey was originally planned for 2011 but was actually conducted in early 2010 because an article in the Newsletter was on a similar topic. The

SSC-14 was encouraged to see that the 2010 survey has gone ahead as planned and hopes that the DMRP will take action on the results as appropriate. The SSC thought it would be of interest that the DMRP determine the return rate from the Newsletter survey.

The SSC-14 was delighted to see that the refurbishment of the X ray facilities at Seibersdorf is almost complete. The SSC looks forward to the calibration services being restarted in the autumn of 2010 to support the SSDLs in X ray calibrations and comparisons.

Figure 5: New x-ray calibration and measuring bench for radiotherapy and radiation protection dosimetry

A discussion then took place regarding the status of the SSDLs and their traceability to the SI for dosimetry through the IAEA and their regional metrology organizations (RMOs). The RMOs have the ability to run key comparisons linked into the reference values of the key comparison database (KCDB) to provide support for the SSDLs, and the DMRP can help in this role.

> **[R 2.5]** To facilitate the recognition of SSDL calibration capabilities, the SSC-14 recommends that whenever the DMRP takes part in a regional metrology organization (RMO) dosimetry comparison it should take the opportunity to register bilateral comparisons with the other SSDLs through the RMO to enable them to be linked to the international system via the IAEA comparisons.

The performance of audits at the SSDLs is a valuable service provided by the DMRP. These audits show that over the years, the performance of the SSDLs has improved markedly. Figure 6 illustrates the results of TLD audits in both ^{60}Co and high energy X[2] ray beams in recent years. With one significant exception, the results are all within 3.5%.

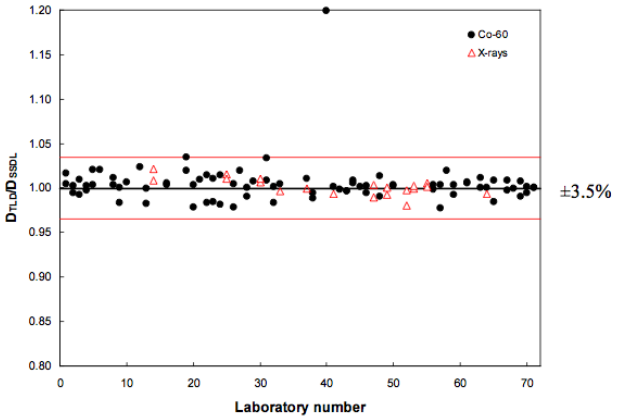


Figure 6: Results of the IAEA/WHO TLD batches 2008 and 2009. Data in the graph correspond to the ratio of the IAEA's determined dose from the TL-response (DTLD) to that stated by the SSDL (DSSDL). Each point corresponds to the average of three dosimeters. A total of 103 beam calibrations were checked in 58 laboratories, which include 83 60Co (circles) and 20 high energy X ray beams (triangles for 12 SSDLs who irradiated TLDs in hospitals). The number of therapy beams checked in different TLD runs was 51 in batch 2008 and 52 in 2009. One deviation was found outside the acceptance limit of 3.5% in the 2009 TLD run

The SSC-14 also noted that re-starting the audits of protection-level calibrations would be a valuable service to Member States. The SSC supports the DMRP in organizing a TLD audit for radiation protection dosimetry for the SSDLs.

Maintaining a number of reference-quality radiation (RQR) X ray beams is a common problem for every SSDL as well as for the DMRP. The international Consultative Committee for Ionizing Radiation (CCRI) will be making recommendations about the minimum necessary selection of qualities and so the SSC-14 makes the following recommendation:

> **[R 2.6]** The SSC-14 recommends that the DMRP take note of the CCRI recommendations for RQR x-ray beams and prepare for future comparisons with SSDLs in these selected RQR beams.

> **[R 2.7]** The SSC-14 recommends that DMRP continue providing international group training for diagnostic calibrations and continue conducting comparisons at the IAEA's Seibersdorf laboratories. The training could be conducted as group training under regional TC projects to promote regional cooperation.

The SSC-13 had noted that the incorrect implementation of IAEA-TECDOC-1274 may lead to incorrect calibrations for energy-dependent well-type ionization chambers used for brachytherapy source calibrations. A recommendation was made in 2008 that the DMRP revise the brachytherapy guidance document and develop a code of practice for Member States to use for the consistency of calibrations for HDR brachytherapy. Indeed, the SSC-14 was pleased to note that a joint consultants' meeting with the ARBR was conducted in 2008 and a draft of a document on HDR brachytherapy that will replace the existing IAEA-TECDOC is under preparation.

[2] Measurements in high energy X ray beams are conducted by SSDLs at hospitals.

[R 1.4] The SSC-14 recommends that the DMRP review existing protocols for brachytherapy dosimetry and assess the need for the development of an international protocol for the calibration of brachytherapy sources (after consultation with relevant institutions such as AAPM, ESTRO, etc).

3.4 Project 2.2.4.3: Quality Assurance and Guidelines for Medical Physics in the Optimization of Clinical Radiation Imaging

The SSC-14 is pleased that several new documents have been published recently, and trusts that the new NAHU web site will have links to these publications.

The SSC-14 looks forward to the completion of the two companion documents on digital mammography and CT.

[R 2.8] In view of the fact that a guidance document on teleradiology and digital imaging incorporating a complete PACS system will be prepared by the DMRP jointly with the WHO, the SSC-14 recommends the development of appropriate CRPs to test this guidance document.

The SSC-14 endorses the upcoming publication of two new handbooks in diagnostic radiology and nuclear medicine and the production of clinical training guides in all three discipline areas, and recommends that they be disseminated widely.

The SSC-14 endorses the CRP on quantitative nuclear medicine imaging, and the CRP on advanced dosimetry techniques. Both of these CRPs will extend through 2013.

The SSC notes that many physicists in NM are faced with acceptance testing NM gamma cameras before they have received any training in acceptance testing. The DMRP course is expensive, but two more courses have been approved. No more than 4 or 5 physicists can be included in each offering of the course.

[R 2.9] In relation to the gamma camera facility that was transferred from the NAPC to the DMRP with the aim to train physicists on acceptance testing procedures in nuclear medicine, the SSC-14 recommends that DMRP analyse the use of this facility for training, incorporating feedback from the trainees, and as appropriate, maintain the facility for additional training programs.

The SSC-14 is in strong support of the close collaboration between the DMRP and the Nuclear Medicine section, but notes that any actions at the DMRP as a result of the Nuclear Medicine advisory meeting could have consequences on the DMRP work program and some additional resources or prioritization might be needed.

The SSC-14 suggests that the DMRP build on the success of the doctoral CRP programs in radiotherapy and develop a doctoral CRP in imaging physics.

[R 1.8] The SSC-14 is pleased to note that the IAEA has signed on to the "Image Gently" alliance and recommends the IAEA review existing guidelines or protocols for paediatric imaging with a view to producing international guidance for the safe imaging of children in both diagnostic radiology and nuclear medicine, if needed.

3.5 Project 2.2.4.4: Quality Assurance and Medical Physics Developments in Radiotherapy and Therapeutic Nuclear Medicine

In the report of SSC-13, a recommendation #18 was made in regard to promoting the harmonization of training programs in Low and Middle Income (LMI) countries. This project appears to be well under way and handbooks are expected to be completed at the end of this year. The DMRP showed the SSC-14 some statistics describing how many handbooks have been purchased or downloaded, and how many requests have been made for the slides. The data indicate that over 50 countries have asked for slide sets to use in teaching.

The SSC-14 encourages the DMRP to produce further slide sets based on the two new handbooks (in preparation) on Nuclear Medicine Physics and Diagnostic Radiology Physics, and to facilitate their dissemination for training purposes.

The SSC applauds the DMRP for the continuation of the work on DIRAC. A cooperation with UNSCEAR in collecting and using DIRAC data is strongly encouraged.

The SSC-14 was pleased to note that the WHO had already written to ministries of health regarding medical devices in general. The SSC-14 encourages the DMRP to find opportunities to encourage member countries to update their data in DIRAC.

[R 1.10] In the event that the IAEA co-sponsors the WHO Forum on Medical Devices to be held in Thailand in September 2010, the SSC-14 recommends that the opportunity is taken to present the DIRAC and other IAEA information on medical devices for diagnostic and therapeutic radiology.

The SSC-14 is pleased to see that the DMRP has implemented the SSC-13 recommendation #17 to support ARBR and NM in their training programme development to address imaging for radiotherapy, for radiation oncology professionals in Member States, as recommended by the consultant's report.

[R 2.3] In view of the success of the course, SSC-14 recommends that the DMRP repeat the IAEA/ICTP course with as large a number of participants as possible.

Recognizing the prevalence of electronic portal imaging systems in radiotherapy, the SSC-14 was pleased to learn of a consultants meeting focused on the development of a guidance document on the QA of portal imaging systems. The SSC-14 strongly encourages the full development of the document on QA of portal imaging.

The SSC-14 believes that the work on quantitative nuclear medicine imaging is very important for therapy applications and is pleased to see this work is making progress.

The SSC is pleased that the DMRP continues to support the postal TLD audit. Results of the CRP for complex techniques should be published. The QUATRO methodology for new technologies should be adopted for national audits.

The SSC-14 is very supportive of the IAEA's PACT and suggests that external resources be identified to help support DMRP's involvement in the PACT.

The SSC-14 advises that the DMRP prepare a strategy together with TC for the QUATRO missions to be run at regional level. [See also R 1.5].

The SSC-14 advised that the DMRP prepare a plan to start clinical audits for diagnostic and nuclear medicine. It was suggested that the greatest need existed in nuclear medicine.

The SSC-14 is delighted that the DMRP is organizing a dosimetry symposium, and that they will publish the proceedings in 2011. The SSC-14 endorses the IAEA's plan to solicit recommendations from the symposium for future planning. Although the previous dosimetry symposium resulted in an action list of recommendations, the SSC-14 does not advocate such an action list on this occasion.

> **[R 2.10]** The SSC-14 recommends that during the dosimetry symposium to be held in November 2010, the DMRP investigate the present usage of TRS-398. The need for updating the TRS-398 protocol should thus be identified.

The SSC-14 was very pleased to see that the guidelines on QA of record and verify (R&V) systems will be finalized soon and published. The SSC looks forward to the dissemination of this report.

The SSC-14 was pleased to see the publication of the report on moving from 2D to 3D radiation therapy, and onwards to IMRT. The SSC-14 looks forward to completion of the associated training package followed by testing and dissemination.

The SSC-14 was very pleased to see that the guideline document on accuracy requirements and uncertainties is to be finalized in the near future.

In light of the increased visibility given recently to radiation therapy accidents, the SSC-14 encourages the DMRP to continue work with the ARBR to identify staffing requirements in radiation oncology, with emphasis on medical physics staffing, to assure protection of the patient.

See SSC-13 recommendation 26.

> **[R 1.9]** In support of the road map for IAEA involvement in the development of guidance documents and training in internal dosimetry for nuclear medicine, the SSC-14 recommends that the DMRP develop methodology during 2010-2011 and 2012-2013 for quantitative imaging that can be used in patient-specific internal dose calculations for therapeutic applications. The SSC-14 recommends the development and implementation of practical training materials for internal dosimetry noting that the gamma camera facility in the laboratory is particularly useful for this training.
>
> **[R 2.11]** The SSC-14 recommends that the TECDOC on small field dosimetry be completed during the 2012-2013 biennium and testing be initiated with a CRP.
>
> **[R 1.7]** In view of the rapid growth of intensity-modulated radiotherapy (IMRT) used in cancer treatments, the SSC-14 recommends that the DMRP develop and provide education and training activities to support the implementation of TECDOC 1588.

In view of the analysis of radiotherapy beam audits, the SSC-14 suggests that the DMRP proceed with plans for a consultancy that advises on QA protocols with a risk/benefit analysis that incorporates age and quality of treatment equipment.

> **[R 2.12]** The SSC-14 recommends that a CRP be planned jointly with ARBR for testing the forthcoming joint publication on uncertainties and accuracy requirements in radiotherapy. The initial focus could usefully be on the investigation of patient positioning uncertainties.

4. SSC-14 RECOMMENDATIONS AND SUGGESTIONS (sorted by priority category)

Recommendations

High Priority

4.1. The SSC-14, acknowledging that the IAEA overall programme for 2010 has an emphasis on cancer, recommends to the Secretariat that the timing is appropriate to prepare a draft resolution on quality assurance in cancer treatment for the IAEA's governing bodies to consider. This resolution should urge as one of its objectives for Member States, the establishment of national audit mechanisms for radiation therapy using the QUATRO methodology, and as a further objective, the updating of their national data in the DIRAC database. [R 1.1]

4.2. The SSC-14 supports the establishment of acceptance criteria by the DMRP for the provision of radiation beam audits in response to rapidly

growing demands by radiotherapy centres in Member States, given the limited resources of the Dosimetry Laboratory and in the interest of quality. In the event of an excess demand, SSC-14 recommends the DMRP to provide the information to the WHO to enable the WHO to identify any need for local infrastructure to support national audit networks for this purpose. [R 1.2]

4.3. The SSC-14 recommends that the DMRP provide each SSC with the number of the beams audited by the national TLD networks. The reasons for the low levels of activity of some networks should be investigated by the DMRP and discussed with the WHO Secretariat with a view to enabling these networks to provide a more complete service to their hospitals. [R 1.3]

4.4. The SSC-14 recommends that the DMRP review existing protocols for brachytherapy dosimetry and assess the need for the development of an international protocol for the calibration of brachytherapy sources (after consultation with relevant institutions such as AAPM, ESTRO, etc.) [R 1.4]

4.5. In view of the importance of safe implementation of advanced radiation treatment technologies, the SSC-14 recommends that the QUATRO methodology developed for advanced technologies be adopted and widely disseminated. The SSC-14 recommends that this dissemination includes holding another series of workshops to train more auditors. [R 1.5]

4.6. In view of the dynamic of the TC projects moving from 12% in human health to nearly 30% in the last few years, that the DMRP has had to provide technical advice on 228 TC projects in the programme 2008-2009 and that this is likely to continue, the SSC-14 recommends that the IAEA consider an adjustment of the human resource complement in favour of the Section. [R 1.6]

4.7. In view of the rapid growth of intensity-modulated radiotherapy (IMRT) used in cancer treatments, the SSC-14 recommends that the DMRP develop and provide education and training activities to support the implementation of TECDOC 1588. [R 1.7]

4.8. The SSC-14 is pleased to note that the IAEA has signed on to the 'Image Gently' alliance and recommends the IAEA review existing guidelines or protocols for paediatric imaging with a view to producing international guidance for the safe imaging of children in both diagnostic radiology and nuclear medicine, if needed. [R 1.8]

4.9. In support of the road map for IAEA involvement in the development of guidance documents and training in internal dosimetry for nuclear medicine, the SSC-14 recommends that the DMRP develop methodology during 2010-2011 and 2012-2013 for quantitative imaging that can be used in patient-specific internal dose calculations for therapeutic applications. The SSC-14 recommends the development and implementation of practical training materials for internal dosimetry noting that the gamma camera facility in the laboratory is particularly useful for this training. [R 1.9]

4.10. In the event that the IAEA co-sponsors the WHO Forum on Medical Devices to be held in Thailand in September 2010, the SSC-14 recommends that the opportunity is taken to present the DIRAC and other IAEA information on medical devices for diagnostic and therapeutic radiology. [R 1.10]

Medium Priority

4.11. The SSC-14 understands that the WHO is in the process of moving towards a common platform for its various units working in radiation and imaging. Consequently, the SSC-14 recommends that regular meetings take place between the WHO platform and the IAEA to facilitate collaboration and reduce potential duplication. [R 2.1]

4.12. In view of the heavy demand on the DMRP staff, SSC-14 recommends that the DMRP consider posting educational material for medical physicists on dosimetry and QA for imaging and radiotherapy on the new NAHU website; any direct training provided should be preferentially for designated trainers in the regions. [R 2.2]

4.13. The SSC-14 is pleased to see that the DMRP implemented the SSC-13 recommendation #17 to support ARBR and NMS in their training program development to address imaging for radiotherapy for radiation oncology professionals in member states, as recommended by the consultant's report. In view of the success of the course, SSC-14 recommends that the DMRP repeat the IAEA/ICTP course with as large a number of participants as possible. [R 2.3]

4.14. During the ICARO meeting held in April, 2009, the IAEA received a request from several clinical trials QA offices to act as an umbrella organization for international harmonization of QA for clinical trials and provide an information exchange platform regarding the activities of national networks operating dosimetry audits for radiotherapy centers participating in international clinical trials. The SSC-14 recommends that DMRP identify ways to organize a database of

national quality audit networks and to assess the quality of their work. [R 2.4]

4.15. To facilitate the recognition of SSDL calibrations, the SSC-14 recommends that whenever the DMRP takes part in a regional metrology organization (RMO) dosimetry comparison it should take the opportunity to register bilateral comparisons with the other SSDLs through the RMO to enable them to be linked to the international system via the IAEA comparisons. [R 2.5]

4.16. Maintaining a number of RQR x-ray beams is a common problem for every SSDL. The CCRI will be making recommendations about the minimum necessary selection of qualities and the SSC-14 recommends that the DMRP take note of these recommendations and prepare for future comparisons with SSDLs in these selected RQR beams. [R 2.6]

4.17. The SSC-14 recommends that DMRP continue providing international group training for diagnostic calibrations and continue conducting comparisons at the IAEA's Seibersdorf laboratories. The training could be conducted as group training under regional TC projects to promote regional cooperation. [R 2.7]

4.18. In view of the fact that a guidance document on teleradiology and digital imaging incorporating a complete PACS system will be prepared by the DMRP jointly with the WHO, the SSC-14 recommends the development of appropriate CRPs to test this guidance document. [R 2.8]

4.19. In relation to the gamma camera facility that was transferred from the NAPC to the DMRP with the aim to train physicists on acceptance testing procedures in nuclear medicine, the SSC-14 recommends that DMRP analyse the use of this facility for training, incorporating feedback from the trainees, and as appropriate, maintain the facility for additional training programs. [R 2.9]

4.20. The SSC-14 recommends that during the dosimetry symposium to be held in November, 2010, the DMRP investigate the present usage of TRS-398. The need for updating the Technical Report Series No. 398 protocol should thus be identified. [R 2.10]

4.21. The SSC-14 recommends that the IAEA-TECDOC on small field dosimetry be completed during the 2012-2013 biennium and testing be initiated with a CRP. [R 2.11]

4.22. The SSC-14 recommends that a CRP be planned jointly with ARBR for testing the forthcoming joint publication on uncertainties and accuracy requirements in radiotherapy. The initial focus should be on the investigation of patient positioning uncertainties. [R 2.12]

Lower Priority

4.23. The SSC-14 is pleased to note that the DMRP plans to revise the SSDL charter in 2010-2011 and recommends that the SSDL members be advised of the new requirements and be given a reasonable opportunity to comply. [R 3.1]

5. SSC-14 COMMENTS

5.1 General

- The SSC-14 congratulates the DMRP on their comprehensive report and clear presentations. The SSC-14 appreciated having the DMRP report in advance of the meeting, and was particularly grateful to have copies of the presentations at the meeting.

- The SSC-14 agrees that the same structure should be retained for the next SSC for both the report and for the presentations. The overall agenda timing also should be retained.

- The SSC-14 was pleased to hear about progress made on implementing the recommendations made by SSC-13 and is confident that the remaining recommendations will be implemented during the 2012-2013 biennium.

- The SSC-14 encourages the IAEA to facilitate the locating of information on their web site through an improved search engine.

- The SSC-14 believes that the next audit of the DOL scheduled for 2012 should be in advance of the SSC, not at same time as had occurred during the SSC-13. The audit should span 2 days, to allow a full day for a visit to Seibersdorf and a second day for report preparation and discussion.

- The SSC-14 was very pleased to note the reorganization of the reporting structure of the DOL and presumes that the unit head post grade will be revised to the appropriate level.

- The SSC-14 notes the difficulty in recruiting for the open positions and commends DMRP on appointing temporary workers to cover these vacant positions.

5.2 Project 2.2.4.1: Quality Audits in Radiation Medicine

- The SSC-14 is encouraged to see that the DMRP will conduct a survey of the SSDL activities in 2010 as planned and will take action on the results as appropriate.

- The SSC-14 believes the success achieved with the QUATRO audits of radiotherapy facilities should be extended to diagnostic radiology and nuclear medicine facilities. The SSC-14 believes that the most pressing need exists in nuclear medicine.

- The SSC-14 encourages the DMRP to develop a CRP on dosimetry audits for modern dynamic dose delivery techniques which are now becoming more common in hospitals.

5.3 Project 2.2.4.2: Radiation metrology supporting SSDLs

- In view of the success of the TC projects to support SSDL staff and to facilitate comparisons with the IAEA, the SSC-14 believes that this mechanism should be continued.

- The SSC-14 was pleased to learn that a CRP on the development of advanced dosimetry techniques for diagnostic and interventional radiology is in progress. The IAEA should include in the forthcoming CRP , the importance of defining the beam qualities for the calibration of CT chambers, and KAP meters, and note that different qualities are required for panoramic dental units. The SSC-14 proposed that an explanation about this should be included in a future SSDL Newsletter.

- The SSC-13 had recommended that the IAEA consider updating its guidance on recommendations for the calibration of radiation protection monitoring instruments. The SSC-14 is pleased to see that a first draft has been completed and looks forward to its publication.

- The SSC-14 observed that the IAEA's web-based reporting form restricts an SSDL to report the results of either a regional comparison or an IAEA comparison, but not both. The SSC-14 suggests that this be corrected.

- The SSC-14 was delighted to see that the refurbishment of the X ray facilities at Seibersdorf is almost complete. The SSC looks forward to calibration services being restarted in the autumn of 2010 to support the SSDLs in X ray calibrations and comparisons.

- The SSC-14 supports the DMRP in organizing a TLD audit for radiation protection dosimetry.

- The SSC-14 notes an increase in requests for protection level calibrations using caesium. The DMRP should consider investigating additional support for this project, perhaps from Nuclear Safety.

5.4 Project 2.2.4.3: Quality Assurance and Guidelines for Medical Physics in the Optimization of Clinical Radiation Imaging

- In view of general concern about x-ray doses to children, the SSC-14 strongly supports the development of a CRP on advanced dosimetric techniques that focuses on paediatric dosimetry including the use of KAP meters for paediatric imaging.

- The SSC-14 believes that the work on quantitative nuclear medicine imaging is very important for therapy applications and is pleased to see this work is making progress.

- The SSC-14 is pleased that several new documents have been published recently, and trusts that the new NAHU web site will have links to these publications.

- The SSC-14 looks forward to the completion of the two companion documents on digital mammography and CT.

- The SSC-14 endorses the upcoming publication of two new handbooks in diagnostic radiology and nuclear medicine and the production of clinical training guides in all three discipline areas, and recommends that they be disseminated widely.

- The SSC-14 endorses the CRP on quantitative nuclear medicine imaging, and the CRP on advanced dosimetry techniques. Both of these CRPs will extend through 2013.

- The SSC-14 is in strong support of the close collaboration between the DMRP and the Nuclear Medicine section, but notes that any actions at the DMRP as a result of the Nuclear Medicine advisory meeting could have consequences on the DMRP work program and some additional resources or prioritization might be needed.

- The SSC-14 suggests that the DMRP build on the success of the doctoral CRP programs in radiotherapy and develop a doctoral CRP in imaging physics.

5.5 Project 2.2.4.4: Quality Assurance and Medical Physics Developments in Radiotherapy and Therapeutic Nuclear Medicine

- The SSC-14 encourages the DMRP to produce slide sets based on the two new handbooks (in preparation) on Nuclear Medicine Physics and Diagnostic Radiology Physics, and facilitates their dissemination for training purposes.

- The SSC-14 supports the Division's efforts to support a database similar to DIRAC to include nuclear medicine facilities (NUMDAB). The SSC-14 appreciates the difficulties experienced in collecting data and suggests that it may be practical to collaborate with the UNSCEAR.

- The SSC-14 is delighted that the DMRP is organizing a dosimetry symposium, and that they will publish the proceedings in 2011. The SSC-14 endorses the IAEA's plan to solicit recommendations from the symposium for future planning.

- The SSC-14 was very pleased to see that the guidelines on QA of record and verify (R&V) systems will be finalized soon and published. The SSC looks forward to the dissemination of this report.

- The SSC-14 was pleased to see the publication of the report on moving from 2D to 3D radiation therapy, and onwards to IMRT. The SSC-14 looks forward to completion of the associated training package followed by testing and dissemination.

- The SSC-14 is very supportive of the IAEA's PACT and suggests that external resources be identified to help support DMRP's involvement in the PACT.

- In light of the increased visibility given recently to radiation therapy accidents, the SSC-14 encourages the DMRP to continue work with the ARBR on staffing requirements in radiation oncology, with emphasis on medical physics staffing, to assure protection of the patient.

- The SSC-14 suggests that the DMRP assess the need for development of a guidance document for adaptive radiotherapy, in collaboration with the ARBR.

- In view of the analysis of radiotherapy beam audits, the SSC-14 suggests that the DMRP proceed with plans for a consultancy that advises on QA protocols with a risk/benefit analysis that incorporates age and quality of treatment equipment.

- The SSC-14 was very pleased to see that the guideline document on accuracy requirements and uncertainties is to be finalized in the near future.

Acronyms used in the SSC-14 Report

3-D	3-dimensional
ARBR	Applied Radiation Biology and Radiotherapy Section of the IAEA
BIPM	Bureau International des Poids et Mesures
BSS	Basic Safety Standards (refers to « International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources », IAEA publication No. 115 in the Safety Series)
CIPM	International Committee of Weights and Measures (BIPM)
CM	Consultants' meeting of the IAEA
CMC	Calibration and Measurement Capability
CoP	Code of Practice
CRP	Coordinated Research Project of the IAEA
CT	Computed tomography
DG	Director General (of the IAEA)
DIRAC	Directory of Radiotherapy Centres
DMRP	Dosimetry and Medical Radiation Physics Section of the IAEA
DOL	IAEA's Dosimetry Laboratory
ESR	Electron spin resonance
ESTRO	European Society for Therapeutic Radiology and Oncology
EUROMET	European Collaboration in Measurement Standards
HDR	High dose rate
ICRU	International Commission on Radiation Units and Measurements
IDAS	International Dose Assurance Service
IEC	International Electrotechnical Commission
ILO	International Labour Office
IGRT	Image-guided radiation therapy
IMRT	Intensity modulated radiation therapy
IOMP	International Organization for Medical Physics
ISO	International Organization for Standardization
JCRB	Joint Committee of Regional Metrology Organizations and the BIPM
KAP	Kerma-area-product
MPIT	Medical Physics Investigation Team of the IAEA
MRA	Mutual Recognition Arrangement
MRI	Magnetic resonance imaging
NAAL	IAEA's Laboratories Division, Vienna and Seibersdorf
NAHU	Division of Human Health of the IAEA
NIST	National Institute of Standards and Technology (USA)
NMS	Nuclear Medicine Subprogramme
OECD	Organisation for Economic Cooperation and Development
OIOS	Office of Internal Oversight Services of the IAEA
PACT	Programme of Action for Cancer Therapy of the IAEA
PET/CT	Positron Emission Tomography/Computed Tomography
PSDL	Primary Standards Dosimetry Laboratory
QA	Quality assurance
QANTRM	The IAEA's International Conference on Quality Assurance and New Techniques in Radiation Medicine, to be held 13-15 November 2006

QMS	Quality management system
QS	Quality system
QUATRO	Quality Assurance Team for Radiation Oncology
RMO	Regional Metrology Organization
SSC	SSDL Scientific Committee
SSDL	Secondary Standards Dosimetry Laboratory
TC	Department of Technical Cooperation of the IAEA
TL	Thermoluminescent, or thermoluminescence
TLD	Thermoluminescent dosimeter, or thermoluminescence dosimetry
TPS	Treatment Planning System
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
WHO	World Health Organization

Summary report on the Coordinated Research Project (CRP) on Implementation of the International Code of Practice on Dosimetry in Diagnostic Radiology Technical Reports Series No. 457 at Secondary Standard Dosimetry Laboratories and Hospitals

Introduction

The CRP to review the effectiveness of the implementation of the Technical Reports Series No. 457 (TRS 457) both in the SSDL and clinical environment ran from 2005 – 2008, with 11 participants; 7 being primarily from SSDLs and 4 from clinical centres. The specific objectives of the CRP were (i) to test the establishment of calibration facilities for diagnostic X rays and the calibration of selected instruments; (ii) to test measurement procedures with phantoms and on patients in hospitals; and (iii) the publication of the results of experiments as well as suggestions for the practical implementation of the procedures described in the Technical Reports Series No. 457. Seven activities were undertaken to achieve the above objectives as seen below.

Activities

SSDLs

(i) *Establishment of calibration facility following guidelines in the TRS 457. This includes calibration beams and procedures*: All seven participants in the project from SSDLs, successfully established beam qualities and procedures for the calibration of diagnostic radiology dosimeters. This demonstrated that TRS 457 gave a clear guidance for calibration laboratories.

(ii) *Establishment of uncertainty budget for SSDLs calibrations*. Uncertainty budgets were established for 6 of the participants.

(iii) *Comparison of calibration of diagnostic dosimeters and kVp meters*. A comparison of calibration coefficients through exchange of ionization chambers was made by all seven SSDLs. The derived N_K coefficients at certain RQR beam qualities from different SSDLs (except in one case) were within the relevant uncertainties. This comparison confirms the ability of the participants to setup the calibration infrastructure in diagnostic X rays. No comparison of kVp meters was made – see section on effectiveness.

Hospitals

(i) *Implementation of measurements procedures for dosimetry in general radiography, fluoroscopy, mammography, computed tomography and dental radiography. This includes measurements with phantoms as well as on patients*. This was achieved for all modalities. It was found that the procedures in TRS 457 were effective for all modalities, with the note that the variety of CT scanner types requires additional worksheets to be prepared and tested for this modality.

(ii) *Establishment of an uncertainty budget for clinical measurements*. Uncertainty budgets were established for all modalities except mammography.

(iii) *Calibration of KAP meters in the hospital*. This activity was conducted in both SSDLs and hospitals. The area of KAP calibration was substantially clarified and new knowledge on the topic was produced as seen by the publications on the subject listed under 'impact' below.

(iv) *TLD audit of diagnostic dosimetry measurements*. This activity was carried out and reported, however no satisfactory conclusion was reached – see effectiveness.

A major outcome of the project was the realization there is great benefit in SSDL personnel understanding more of the clinical applications of the dosimeters they calibrate and similarly that clinical physicists also benefit from a more rigorous understanding of instrument calibration.

Effectiveness of CRP

The project demonstrated that the advice on the establishment of calibration facilities for diagnostic X rays, as found in TRS 457, is effective, through the establishment of beam qualities, procedures and uncertainty budgets by the participants. Further knowledge was gained in some areas of calibration, notably in mammography and for

KAP meters, where the interface with clinical centres highlighted the need for consideration of extended beam qualities to cover the required newer applications of dosimetry in the clinical environment.

The project demonstrated that the advice on the measurement procedures for phantoms and the procedures for the collection of data for the estimation of patient dose required in the clinical environment, as found in TRS 457, are effective through the response of the participants in being able to determine clinical doses with the use of phantoms or through the collection and analysis of patient data, for 5 central modalities. The concept of uncertainty budget was expanded by the participants to give a more full treatment for clinical scenarios and was identified as an area where future work should focus, especially in the area where the dose of a collection of patients is required. A number of advanced areas in dosimetry were identified where future work could continue, including the area of paediatrics.

The area of calibration of diagnostic radiology instruments is new for the IAEA and also for the SSDL network. International guidance in this field was published only a few years ago. The project therefore confirmed that the developed documentation is suitable for the implementation of this calibration at SSDLs. In some areas some notes have been made in the final publication of results that may further assist Member States in the practical implementation of calibration for diagnostic radiology at SSDLs. Further the project has demonstrated the advantages of SSDL facilities becoming familiar with clinical needs and tailoring their services to meet these needs.

TRS 457 was also demonstrated to give a unified international approach to the area of clinical dosimetry in diagnostic radiology. This was demonstrated for 5 central modalities. It was further observed that the rapid change in technology of diagnostic radiology equipment requires continuing monitoring of dosimetric methods. This is especially true in the high dose area of computed tomography where accuracy in the methodologies of dose estimation will have a significant contribution to the control of high doses for patients. The project also demonstrated that clinical medical physicists would benefit from an improved understanding of calibration and calculation of uncertainty as outlined in TRS 457.

Factors, if any, which adversely affected the effectiveness of the CRP

A number of factors had an adverse effect on the project.

- It was not fully appreciated the amount of time necessary to fully establish a calibration facility for diagnostic X rays (as recommended in TRS 457), and so the SSDLs found it challenging to complete all activities within the scope of the project.
- The area of kVp meter evaluation and the use of the measurement quantity peak practical voltage (PPV) was not completed, due in part to the factors mentioned above, but also to the lack of experience, published or otherwise, with the concept of PPV. At the end there was no participant with the capacity to fulfil this activity, however it was discussed extensively. As a final analysis, while it may be interesting to investigate this area further, it has been recognized that the influence of kVp evaluation on dosimetry for either SSDLs or clinical facilities may not warrant a large allocation of resources.

The use of TLDs as a method of dosimetry for diagnostic radiology application was an activity undertaken by 10 participants. However, only one participant conducted all measurements. Unexplained inconsistencies in the results were identified and this required that the activity be re focused and sections repeated. At the second attempt some inconsistencies remained and it was not possible to verify the usefulness of TLD measurement as a practical tool for dosimetry audits in diagnostic radiology. It was observed that TLD work in dosimetry requires specialized facilities and that it can be particularly challenging at the beam energies used in diagnostic radiology. Consequently most practical dosimetry, outside of specialized facilities, does not include TLD. At this stage it is not planned to investigate this form of dosimetry further for diagnostic radiology application.

Recommendations for further actions

In general the recommendations are to extend the work of the IAEA into advanced areas of dosimetry for diagnostic radiology, not presently fully covered by TRS 457. Whilst this is more noticeable for the clinical areas, there are still areas of calibration at the SSDL where future action is applicable. These areas are itemized below.

1. Work sheets for clinical dosimetry should be put into Excel format with the use of macro functions where possible (completed).

2. The implementation of calibration procedures for CT chambers and KAP meters should be carefully reviewed and related to the clinical tasks performed by these detectors.

3. Future work in paediatric dosimetry, the use of relevant phantoms and consequent uncertainty budgets is required

4. Further work is needed to extend the CT procedures to accommodate the new developments in CT technology.

5. Manufacturers should be encouraged to comply with IEC requirements to include KAP meters (or calculation) in equipment used for fluoroscopy, especially high dose rate equipment.

6. Attention should be given in the future to the determination of organ doses and associated uncertainties. Some examples include skin, eye, and foetus.

Resulting Publications:

The document 'Implementation of the International Code of Practice on Dosimetry in Diagnostic Radiology (TRS 457): Review of Test Results' is now in preparation and will be available soon on: (http://www.pub.iaea.org/MTCD/publications/publications.asp)

.

Publications and presentations by project members on some outcomes of the project:

HOURDAKIS, C.J., BOZIARI, A., KOUMBOULI, E., The effect of a compression paddle on energy response, calibration and measurement with mammographic dosimeters using ionization chambers and solid-state detectors, Phys Med Biol 54 4 (2009) 1047-59.

TOROI, P., KOSUNEN, A., The energy dependence of the response of a patient dose calibrator, Phys. Med. Biol. 54 (2009) 151-156.

TOROI, P., KOMPPA, T., KOSUNEN, A., TAPIOVAARA, M., Effects of radiation quality on the calibration of kerma-area product meters in x-ray beams, Phys. Med. Biol. 53 (2008) 5207–5221.

Progress report of an international (IAEA/AAPM) working group on Small and Composite Field Dosimetry

Hugo Palmans[1], National Physics Laboratory, UK

Reference dosimetry for external beam radiotherapy is at present performed in broad beam reference conditions according to Codes of Practice like IAEA TRS-398 and AAPM TG-51. With the increased complexity of radiotherapy treatments, however, the reference conditions prescribed in those Codes of Practice are far away from the way such complex treatments are actually delivered. Think for example of IMRT, tomotherapy, stereotactic radiosurgery and scanned proton beam therapy. Each of those modalities is characterized by a distinct way of delivering a dose distribution, different from broad beam deliveries and also very different from each other. For most of them there is at present a large step from the broad beam reference dosimetry to the dosimetry of a clinical delivery sequence involving large amounts of relative dose data and complex dose calculation algorithms. An additional issue is that numerous modalities are not able to create the broad beam reference conditions prescribed either because the maximum field size is too small or because square field shapes cannot be set. Also, dosimeters can be part of the problem since most are not suitable for the entire range of field sizes required.

While several particular solutions have been reported for absolute dosimetry or QA of these complex clinical deliveries and non-standard field sizes, there is no comprehensive approach available ensuring the consistency of dosimetry across treatment modalities. This obviously raises the need for extending the scope of reference dosimetry towards reference conditions that are more closely related to the way these radiotherapy treatments are delivered to the patient as well as to smaller and intermediate reference fields.

An international working group was formed by the IAEA in collaboration with the AAPM, with the aim of publishing an extension of existing Codes of Practice to provide recommendations on reference conditions and reference dosimetry procedures for small fields and composite fields. A first step in this direction was the publication of a proposed formalism allowing for such an extension [1]. The aim of this publication was to get the ideas of extended reference conditions out and to invite medical physicists and scientists worldwide to contribute to improved knowledge and understanding in this area by discussion and research. This has thus far led to a number of papers and conference presentations being published by members of the working group [2-5]. An AAPM Task Group report on quality assurance for tomotherapy has provided recommendations for dosimetry based on the formalism [6] and numerous other papers and presentations have appeared on this subject [7].

There is a long way to go before publication of a Code of Practice will be possible and in particular on reference conditions for composite field dosimetry there is much to be investigated. Many groups are involved in this among which, at present and to our knowledge, research groups from the University of Wisconsin (WI, USA), University of Pittsburgh (PA, USA), MD Anderson (TX, USA), McGill University (Montreal, Canada), Royal Marsden Hospital (London, UK), Stockholm University (Sweden), University of Vienna (Austria), University of Santiago de Compostela (Spain) and the University of Athens (Greece) are investigating ways to define relevant reference conditions for head-and-neck and prostate treatments with high-energy photons, as well as determining correction factors for the use of ion chambers in such composite reference fields by experiments and Monte Carlo simulations. Some of these groups are in particular involved with reference dosimetry for GammaKnife and CyberKnife radiosurgery systems. Both are systems that cannot achieve 10 cm × 10 cm reference fields and in particular for the GammaKnife the maximum field size is way below that (18 mm for the classic type and 16 mm for the newer Perfexion type). Research groups who are performing research in this area or who feel that they can contribute to the research in this new area of reference dosimetry are welcome to contact members of the working group and if possible to establish a formal link with the IAEA working group.

In the coming year(s), there will be continued research activity by the working group members and the groups mentioned above to generate the necessary knowledge and data for developing a Code of Practice. The IAEA has organized an international dosimetry symposium dur-

[1] *On behalf of the IAEA/AAPM working group on Small and Composite Field Dosimetry, consisting of Rodolfo Alfonso, Pedro Andreo, Roberto Capote, M. Saiful Huq, Joanna Izewska, Jonas Johansson, Warren Kilby, Rock Mackie, Ahmed Meghzifene, Hugo Palmans, Karen Rosser, Jan Seuntjens and Wolfgang Ullrich.*

ing 9-11 November 2010 [8] at which about 20 oral and poster presentations were related to small and composite field dosimetry. A Consultants Meeting was held with most members of the working group from 31 January to 4 February 2011 and the group aims at producing a document by the end of 2011 that will present a comprehensive treatment of static small fields according to the formalism and that will highlight areas of missing data.

References

[1] Alfonso et al., A new formalism for reference dosimetry of small and non-standard fields, Med. Phys. 35:5179-86 (2008).

[2] Bouchard et al., Ionization chamber gradient effects in nonstandard beam configurations, Med. Phys. 36:4654-63 (2009).

[3] Rosser and Bedford, Application of a new dosimetry formalism to volumetric modulated arc therapy (VMAT), Phys. Med. Biol. 54:7045-61 (2009).

[4] Sterpin et al., Full Monte Carlo computation of k correction factors calculated in tomotherapy static and helical deliveries for future ion chamber reference dosimetry protocols of non standard beams, Med. Phys. 36:2615-6 (2009).

[5] Chung et al., Investigation of three radiation detectors for accurate measurement of absorbed dose in nonstandard fields, Med. Phys. 37:2404-13 (2010).

[6] Langen, QA for helical tomotherapy: Report of the AAPM Task Group 148, Med. Phys. 37:4817-4853 (2010).

[7] International Symposium on Standards, Applications and QA in Medical Radiation Dosimetry, IAEA, Vienna, 9-12 November 2010 (http://nucleus.iaea.org/HHW/MedicalPhysics/TheMedicalPhysicist/Continuedprofessionaldevelopment/IDOS2010/index.html).

A new Website for Resources and Learning for Health Professionals

The division of Human Health has recently launched a new web site – *Human Health Campus* (http://humanhealth.iaea.org) for radiation health professionals. This web site is designed to serve as an informative resource for health professionals working in Nuclear Medicine, Radiology, Radiation Oncology, and Nutrition, and provides insight into different aspects of modern clinical practice. The website both offers IAEA created resources (case studies, spread sheets, etc.) as well as directs users to existing quality material with an emphasis on freely available resources. This website will help promote a global academic community, and evolve over time in response to the needs of the community. The main homepage with various links is shown in Figure.1. Figure 2 shows the link to Medical Radiation Physics section. Figure 3 and 4 show Radiotherapy and Diagnostic Radiology pages with various topics covered in these areas.

Figure 1: Human Health Campus – main page

Figure 3: Medical Physics / Radiotherapy / subtopics

Figure 2: Medical Radiation Physics section

Figure 4: Medical Physics / Diagnostic Radiology / subtopics

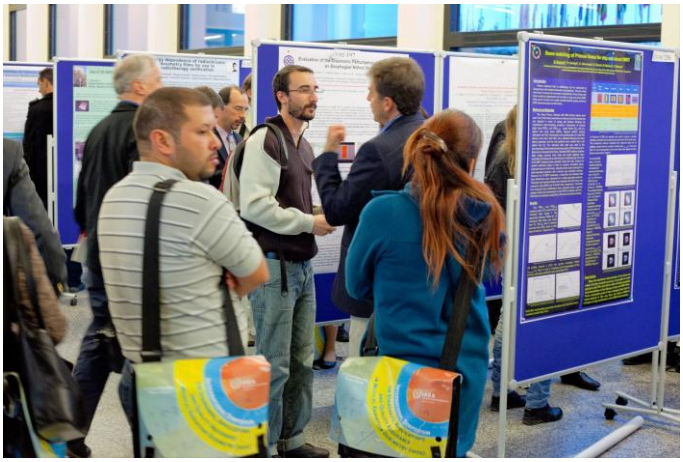
The International Symposium on Standards, Applications and Quality Assurance in Medical Radiation Dosimetry (IDOS)

IAEA, Vienna
9-12 November 2010

The International Symposium on Standards, Applications and Quality Assurance in Medical Radiation Dosimetry (IDOS) was organized by the IAEA and held in Vienna form 9 to 12 November 2010 to foster the exchange of information along the whole dosimetry chain and highlight recent developments in this field. 372 delegates representing 66 Member States, 45 observers and 12 international and professional organizations attended the meeting, at which 75 oral presentations were delivered, 4 round table discussions were held and 187 posters were presented covering a broad range of topics in medical radiation dosimetry.

A refereed selection of papers presented at the symposium forms the core of these Proceedings, which will be published in 2011. The presentations are available for download (PDF files) through the IAEA Human Health website:
http://nucleus.iaea.org/HHW/MedicalPhysics/TheMedicalPhysicist/Continuedprofessionaldevelopment/IDOS2010/index.html

IDOS,Plennary Session



IDOS, Poster Session

IDOS, Poster Session

IDOS, Session on Internal Dosimetry for Nuclear Medicine

Courses, Meetings and Consultancies in 2011

Courses and workshops

RAS6054 Regional Training course on medical physics for nuclear medicine, Dubai, United Arab Emirates, 6-10 February 2011

RAS6053 RCA Training Course on Introduction to Image Based Radiotherapy (For Radiation Oncologists and Medical Physicists), Quezon City, Philippines, 22-26 February 2011

IAEA/ESTRO Training Course on Advanced Treatment Planning (under RER/6/018), Genoa Italy, 6-10 March 2011

IAEA/ICTP School on Advanced Radiotherapy Techniques with Emphasis on Imaging and Treatment Planning (SMR-2231), Trieste, Italy 4-8 April 2011

IAEA Regional Training Course (RTC) on Dosimetry of Co-60 Beams and Quality Assurance in Radiotherapy (under RER/6/018), Kharkiv, Ukraine, 6-10 April 2011

RLA0039 Regional Training Course on Internal Dosimetry Applied to Nuclear Medicine, Havana, Cuba, 2-6 May 2011

RAF0027 Regional Training Course on Uncertainty in Measurements performed at SSDLs and Dosimetry Service Laboratories, Algiers, Algeria, 8-12 May 2011

RLA6061 Regional Training Course on Transitioning from 2D to 3D Conformal Radiotherapy, Cordoba, Argentina, 7-11 May 2011

RLA0039 Gamma cameras: Quality control and preventive maintenance, Seibersdorf, Austria, 25-29 July 2011

RAF6038 Regional (AFRA) Training Course on Internal Dosimetry, Alger, Algeria, 2-6 October 2011

Joint ICTP-IAEA Advanced Course on Mammography (SMS 2266), Trieste, Italy, 3-7 October 2011

RLA6061 Regional (ARCAL) Training course for Medical physicists on nuclear medicine physics, Mendoza, Argentina, 10-14 October 2011

IAEA/ESTRO Training Course on Physics for Clinical Radiotherapy (under RER/6/018), Porto, Portugal, 16-20 October 2011

RAF 6038 Regional (AFRA) Training Course on Acceptance Test of Gama Cameras, Seibersdorf, Austria, 17-21 October 2011

Meetings and consultancies

Consultants Meeting on development of guidelines for dosimetry measurements for small and irregular fields, IAEA, Vienna, Austria, 31 January-4 February 2011

Consultants Meeting on staffing requirements in Radiation Medicine, IAEA, Vienna, Austria, 31 January-2 February 2011

Consultants Meeting on the production of the final version of an IAEA Handbook on Nuclear Medicine Physics, IAEA, Vienna, Austria, 7-11 March 2011

Consultants Meeting to draft a guidance document for paediatric diagnostic X ray Dosimetry associated with CRP in advanced Dosimetry and QA procedures, Vienna, Austria, 29 March-1 April 2011

2nd RCM on the Development of Quantitative Nuclear Medicine Imaging for Patient Specific Dosimetry, 9-13 May 2011

Consultants Meeting to complete the QA atlas for PET/CT systems, 12-16 September 2011

Consultants Meeting on establishing a guidance document on internal dosimetry for therapeutic nuclear medi-

cine, 26-30 September 2011

Second Research Coordination Meeting (RCM) for the Coordinated Research Project (CRP) on Development of Quality Audits for Radiotherapy Dosimetry for Complex Treatment Techniques, IAEA, Vienna, Austria, 5-9 December 2011

Consultants Meeting to produce a manual for hands-on exercises for internal dosimetry, 5-9 December 2011

QUATRO "Lessons Learned", Consultants' Meeting to be organized jointly by DMRP and ARBR Sections; IAEA, Vienna, Austria, dates to be decided

Member Laboratories of the IAEA/WHO Network of SSDLs

Country	City	Contact person	Fax	E-mail
ALBANIA	Tirana	Mr Kostantin Dollani	+35 5 42362596	kdollani@albmail.com
ALGERIA	Algiers	Mr Mehenna Arib	+213 21 43 4280	mehenna.arib@yahoo.fr
ARGENTINA	Buenos Aires	Ms Margarita Saraví	+54 11 6779 8228	saravi@cae.cnea.gov.ar
AUSTRALIA	Menai	Mr Justin Davies	+612 97179325	ssdl@ansto.gov.au
AUSTRIA	Seibersdorf	Mr Hannes Stadtmann	+43/50550-3011	hannes.stadtmann@arcs.ac.at
BANGLADESH	Dhaka	Mr Md. Shakilur Rahman	+880 2 8613051	shakilurssdl@yahoo.com
BELARUS	Minsk	Mr Valeri Milevski	+375172880938	milevski@belgim.by
BELGIUM	Gent	Mr Hubert Thierens	+32 92 646699	hubert.thierens@UGent.be
BOLIVIA **	La Paz	Mr Lucio R. Berdeja Amatller	+591 2 2433063	ibten@entelnet.bo
BRAZIL	Rio de Janeiro	Mr Carlos J. da Silva	+55 21 3411 8163	carlos@ird.gov.br
BULGARIA	Sofia	Mr Ivailo Petkov	+35 9 28621059	ipetkoff@abv.bg
CANADA	Ottawa	Mr Manisch Kumar	+1 613 941-3497	manish_kumar@hc-sc.gc.ca
CHILE	Santiago	Mr Carlos Oyarzún Cortes	+56 2 3646 277	coyarzun@cchen.cl
CHINA	Beijing	Mr Gan Zeuguei	+86 10 444304	sshen@sbts.sh.cn
CHINA	Beijing	Mr Jinsheng Cheng	+86 10 6201 2501	cjs3393@sina.com
CHINA	Beijing	Mr Guo Wen	+86 1 69357178	rmcssdl@iris.ciae.ac.cn
CHINA	Hong Kong Sar	Mr C.L. Chan	+85 2 29586654	cchan@ha.org.hk
CHINA	Shanghai	Mr Tang Fangdong	+86(21)50798270	hxdl@simt.com.cn
CHINA	TaiYuan, Shanxi	Mr Zhang Qingli	+86 351 7020407	zhangqing_li@hotmail.com
COLOMBIA	Bogotá	Mr Edgar Guillermo Florez Sañudo	+57 1 50 220 3425	egflorez@ingeominas.gov.co
CROATIA	Zagreb	Mr Branko Vekić	+385 1 4680098	bvekic@irb.hr
CUBA	Havana	Mr Gonzalo Walwyn Salas	+53 7 682 9573	gonzalo@cphr.edu.cu
CYPRUS	Nicosia	Mr Stelios Christofides	+357 22 603137	cstelios@cytanet.com.cy
CZECH REP.	Prague	Mr Pavel Dryák	+42 0 266 020 466	pdryak@cmi.cz
CZECH REP.	Prague	Mr Libor Judas	+42 0 241 410 215	Libor.judas@suro.cz
DENMARK	Herlev	Mr Kurt Meier Pedersen	+45 72 227417	sis@sis.dk
ECUADOR	Quito	Mr Marcos M. Frías Sánchez	+59 3 22563336	comecen1@comecenat.gov.ec
EGYPT	El-Giza	Ms Noha Emad M. Khaled	+20 2 3867451	nemadnis@netscape.net
ETHIOPIA	Addis Ababa	Mr Melaku Minwuylet Anteneh	+251 1 62 0495	melie_oneday@yahoo.com
FINLAND	Helsinki	Mr Antti Kosunen	+358 9 759 884 50	antti.kosunen@stuk.fi
FRANCE	Cedex	Ms Isabelle Clairand	+33 1 474 697 77	isabelle.clairand@irsn.fr
GEORGIA	Tbilisi	Mr Simon Sukhishvili	+99 5 32 613500	simoniko@list.ru
GERMANY	Neuherberg	Mr Dieter F. Regulla	+49 8 93187192224	regulla@helmholtz-muenchen.de
GERMANY	Freiburg	Mr Christian Pychlau	+49 761 49055 70	pychlau@ptw.de
GERMANY	Schwarzenbruck	Mr Frantisek Gabris	+49 9128 607 10	frantisek.gabris@iba-group.com
GHANA	Legon-Accra	Mr Joseph Kwabena Amoako	+23 3 21 400807	rpbgaec@ghana.com
GREECE	Paraskevi-Attiki	Mr Costas J. Hourdakis	+30 2 106506748	khour@eeae.gr
GUATEMALA	Guatemala C. A.	Mr José Diego Gòmez Vargas	+50 2 2762007	jdagadj@yahoo.es
HUNGARY	Budapest	Mr István Csete	+36 1 458 5945	cseteis@mkeh.hu
HUNGARY	Budapest	Mr Gabor Kontra	+36 1 2248620	kontra@oncol.hu
HUNGARY	Paks	Mr Mihaly Orbán	+36 1 3551332	orbanmi@npp.hu
INDIA	Mumbay	Mr Shri A.K. Mahant	+91 2 225505151	amahant@barc.gov.in
INDONESIA	Jakarta Selatan	Mrs C. Tuti Budiantari	+62 1 217657950	ssdl.jakarta@batan.go.id
IRAN, ISLAMIC REPUBLIC OF	Karaj	Mr Mostafa Ghafoori	+98 261 4424058	mghafoori@nrcam.org
IRELAND	Dublin	Ms Veronica Smith	+35 3 12697437	vsmith@rpii.ie
ISRAEL	Yavne	Mr Ben Shlomo	+97 2 89434696	abenshlomo@hotmail.com
KAZAKHSTAN	Kapchagai	Mr Baurzhan Korshiyev		ssdlkz@gmail.com
KOREA, REP. OF	Seoul	Mr Hyeong Ju Kim	+82-43-719-5000	khjtree@kfda.go.kr
KUWAIT	Kuwait City	Ms Elham Kh. Al Fares	+96 5 4862537	ekalfares@hotmail.com
LATVIA	Salaspils	Mr Viesturs Silamikelis	+371 67901210	lvgma@lvgma.gov.lv
LIBYAN ARAB JAMAHIRIYA	Tripoli	Mr Saleh A. Ben Giaber	+21 8 213614143	BenGiaber@yahoo.com

Country	City	Contact person	Fax	E-mail
TFYR MACEDONIA	Skopje	Ms Lidija Nikolovska	+389 2 3125044 220	nikolovska@gmail.com
MADAGASCAR	Antananarivo	Mr Raoelina Andriabololona	+26 1 202235583	instn@moov.mg
MALAYSIA	Kajang	Mr Taiman Bin Kadni	+60 3 89250575	taiman@nuclearmalaysia.gov.my
MEXICO	Mexico City	Mr Victor M. Tovar Munoz	+52 5 53297302	victor.tovar@inin.gob.mx
NORWAY	Osteras	Mr Hans Bjerke	+47 6 7147407	Hans.Bjerke@nrpa.no
PAKISTAN	Islamabad	Mr Waheed Arshed	+92 5 19290275	warshed@pinstech.org.pk
PERU	Lima	Mr Tony Benavente A.	+51 1 488 5101	tbenavente@ipen.gob.pe
PHILIPPINES *	Quezon City	Ms Estrella S. Caseria	+63 2 9201646	escaseria@pnri.dost.gov.ph
PHILIPPINES	Manila	Ms Nieva O. Lingatong	+63 2 711 6016	n_lingatong@hotmail.com
POLAND	Warsaw	Mr Wojciech Bulski	+48 2 26449182	w.bulski@rth.coi.waw.pl
PORTUGAL	Sacavém	Mr Carlos Oliveira	+35 1 219941995	coli@itn.pt
PORTUGAL	Lisbon	Ms Maria Esmeralda Ramos Poli	+35 1 217229877	radfisica@ipolisboa.min-saude.pt
ROMANIA	Bucharest	Ms Alina Dumitrescu	+40 21 3183635	alina.dumitrescu@insp.gov.ro
RUSSIAN FED.	St. Petersburg	Mr Vladimir I. Fominykh	+7 812 3239617	info2101@vniim.ru
RUSSIAN FED.	St. Petersburg	Ms Galina Lutina	+78 1 25966705	crirr@peterlink.ru
SAUDI ARABIA	Riyadh	Mr Abdalla N. Al-Haj	+96 614424777	abdal@kfshrc.edu.sa
SERBIA	Belgrade	Mr Milojko Kovačević	+38 1112455943	milojko@vinca.rs
SINGAPORE *	Singapore	Mr Phua Tan Tee	+65 67319585	phua_tan_tee@nea.gov.sg
SINGAPORE	Singapore	Mr Stephen Chong	+65 2 262353	sckmipil@pacific.net.sg
SINGAPORE	Singapore	Mr James Lee	+65 62 228675	trdjas@nccs.com.sg
SLOVAKIA	Bratislava	Mr Gabriel Kralik	+42 1 252923711	gkralik@ousa.sk
SLOVENIA	Ljubljana	Mr. Matjaz Stuhec	+386 1 477 3151	matjaz.stuhec@ijs.si
SOUTH AFRICA	Pretoria	Ms Zakithi Msimang	+27 128412131	zmsimang@@nmisa.org
SRI LANKA	Orugodawatta	Mr Cyril Kasige	+9411 2533448	ckasige@aea.ac.lk
SUDAN **	Khartoum	Mr Ibrahim Idris Suliman	+249 (0)183774179	i.i.suliman@gmail.com
SWEDEN	Stockholm	Mr Torsten Cederlund	+46 8 799 40 10	torsten.cederlund@ssm.se
SYRIAN ARAB REPUBLIC	Damascus	Mr Mamdouh Bero	+96 3 116112289	atomic@aec.org.sy
TANZANIA, UNITED REP. OF	Arusha	Mr Wilbroad E. Muhogora	+25 5 272509709	taec@habari.co.tz
THAILAND *	Bangkok	Mr Kriengsak Bhadrakom	+66 2 5806013	thongchai@oaep.go.th
THAILAND	Nonthaburi	Mr Siri Srimanoroth	+66 2 2239595	siri.s@dmsc.mail.go.th
THAILAND	Bangkok	Mr Thongchai Soodprasert	+66 2 5620093	thongchai@oaep.go.th
TUNISIA	Tunis	Ms Latifa Ben Omrane	+21 6 7171697	sadok.mtimet@rns.tn
TURKEY	Istanbul	Mr Dogan Yasar	+90 212 4732634	dogan.yasar@taek.gov.tr
URUGUAY	Montevideo	Mr Alejandro San Pedro	+59 8 29021619	calibraciones@dinaten.miem.gub.uy
VENEZUELA	Caracas	Ms Lila Inés Carrizales	+58 2 125041577	lcarriza@ivic.gob.ve
VIETNAM	Hanoi	Mr. Vu Manh Khoi	+84 4 8363295	dung-khoi@hn.vnn.vn

** Provisional Network members; * SSDL Organization

COLLABORATING ORGANIZATIONS ASSOCIATED WITH THE IAEA/WHO NETWORK OF SSDLs

Bureau International des Poids et Mesures (BIPM)
International Commission on Radiation Units and Measurements (ICRU)
International Electrotechnical Commission (IEC)
Organisation Internationale de Métrologie Légale (OIML)
International Organization of Medical Physics (IOMP)

AFFILIATED MEMBERS OF THE IAEA/WHO NETWORK OF SSDLs

Bundesamt für Eich und Vermessungswesen (BEV)	Vienna, AUSTRIA
Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)	Yallambie, AUSTRALIA
National Research Council of Canada (NRC-CNRC)	Ottawa, CANADA
Bureau National de Métrologie (BNM)	Gif-sur-Yvette, FRANCE
Physikalisch-Technische Bundesanstalt (PTB)	Braunschweig, GERMANY
Hungarian Trade Licensing Office (MKEH)	Budapest, HUNGARY
Ente per le Nuove Tecnologie L'Energia e L'Ambiente (ENEA)	Rome, ITALY
National Metrology Institute of Japan, AIST (NMIJ/AIST)	Ibaraki, JAPAN
NMi Van Swinden Laboratorium	Delft, NETHERLANDS
National Radiation Laboratory (NRL)	Christchurch, NEW ZEALAND
Scientific Research Institute for Physical-Technical and Radiotechnical Measurements (VNIIFTRI)	Moscow, RUSSIAN FEDERATION
Laboratory of Ionizing Radiation, Slovak Institute of Metrology (SMU)	Bratislava, SLOVAKIA
Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT)	Madrid, SPAIN
National Physical Laboratory (NPL)	Teddington, UNITED KINGDOM
National Institute of Standards and Technology (NIST)	Gaithersburg, UNITED STATES OF AMERICA

INTERNATIONAL ATOMIC ENERGY AGENCY

Dosimetry and Medical Radiation Physics Section
Division of Human Health

THE IAEA/WHO NETWORK OF SSDLs
CUSTOMER SATISFACTION SURVEY FORM

Please help us in our continuous improvement process by completing this form and returning it to us* as soon as possible.

How do you rate the following:	Excellent	Very Good	Good	Average	Poor	N/A
The quality of our calibration services?	☐	☐	☐	☐	☐	☐
The appropriateness to your questions and concerns?	☐	☐	☐	☐	☐	☐
The timeliness of IAEA response?	☐	☐	☐	☐	☐	☐
The communication with IAEA staff in charge of calibration services?	☐	☐	☐	☐	☐	☐
The quality of our auditing services?	☐	☐	☐	☐	☐	☐
The communication with IAEA staff in charge of auditing services?	☐	☐	☐	☐	☐	☐
Your overall level of satisfaction with our services?	☐	☐	☐	☐	☐	☐

Additional comments:

To ensure anonymity of response, please do not provide any details on the respondent. If you would like us to follow up with you on a pending matter, please send us a separate e-mail to dosimetry@iaea.org.

**Please send the form (by e-mail, fax or post) to:*

Dosimetry and Medical Radiation Physics Section
International Atomic Energy Agency
Vienna International Centre
P.O. Box 100
A-1400 Vienna, Austria

Tel: +43 1 2600 21662
Fax: +43 1 26007 21662
E mail: dosimetry@iaea.org

Impressum

SSDL Newsletter No. 59, April 2011

The SSDL Newsletter is prepared by the Dosimetry and Medical Radiation Physics Section,
Division of Human Health, Department of Nuclear Sciences and Applications.

International Atomic Energy Agency
Vienna International Centre, PO Box 100, 1400 Vienna, Austria
Printed by the IAEA in Austria, April 2011.

11-09321