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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/dmrp/SSDL/

Contents

Typical set-up for clinical CT dosimetry, see also Chapter 9.6. of IAEA Human Health Series No. 19. (Courtesy of C. Hourdakis)

From the editor

The first article of this issue of the SSDL Newsletter is a report of the 15th SSDL Scientific Committee (SSC) Meeting held at the IAEA Headquarters in March 2012. An overview of the new IAEA publication on "Quality Assurance Programme for Computed Tomography: Diagnostic and Therapy Applications" is presented in the second article. The third article is a report of a consultants' meeting on the Development of an International Database for Dosimetry Audit Networks for Radiotherapy. The results of an IAEA Survey of Dosimetry Audit Networks for Radiotherapy are presented in the fourth article.

The last article is a short summary from a consultants' meeting on the revision of the SSDL Network Charter. The revision of the SSDL Network Charter has been recommended by the SSC in order to reflect the recent trends and developments in the metrology of ionizing radiation applicable at the level of the SSDL network members.

The IAEA's Dosimetry and Medical Radiation Physics Section welcomes two new staff members: Mr Brendan Healy, from Australia, who is a clinical medical physicist in radiation therapy, and Mr Gian Luca Poli, from Italy, who is a clinical medical physicist in nuclear medicine.

IAEA International Atomic Energy Agency

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

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

The range of services provided is listed below.

Services	*Radiation quality*
Calibration of ionization chambers (radiotherapy, diagnostic radiology including mammography, and radiation protection including environmental dose level)	X rays (10–300 kV) 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 at the web site: *http://www-naweb.iaea.org/nahu/dmrp/SSDL/default.asp*

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Note to SSDLs using IAEA calibration and audit services:

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

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

Report of the Fifteenth Meeting of the SSDL Scientific Committee

IAEA, Vienna
12–16 March 2012

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 fourteenth meeting (held in March 2010) of the SSC-14 was published in the SSDL Newsletter No. 59 in April 2011.

The fifteenth meeting was held in Vienna at the Agency Headquarters from 12–16 March 2012. Opening remarks were made by Mr R. Chhem, Director of the Division of Human Health (NAHU); Ms Renate Czarwinski, Head of the Section Radiation Safety and Monitoring (Department of Nuclear Safety and Security) and Mr A. Meghzifene, Head of the Section of Dosimetry and Medical Radiation Physics and Co-Secretary of the IAEA/WHO SSDL Network. Members of the SSC-15 included: Ms Penelope Allisy-Roberts, Chair, SSC-15, Head, Ionizing Radiation Section, International Bureau of Weights and Measures (BIPM), Sèvres, Ms Lucia Canevaro, National Nuclear Energy Commission, Brazil, Mr Antti Kosunen, Radiation and Nuclear Safety Authority, Finland, Mr Frank Delaunay, Commissariat a l'energie atomique, France, Ms Mary K Martel, MD Anderson Cancer Center, USA, Mr Hans-Georg Menzel, ICRU Bethesda, Ms Adriana Velazquez Berumen, WHO, Geneva.

1.1 Introductions

Mr Ahmed Meghzifene opened the meeting with a welcome to the SSC-15. Most members were familiar with the DMRP, having attended the SSC-13 and SSC-14. Ms Adriana Velazquez Berumen, the WHO Co-Secretary of the SSDL Network, was not able to attend, due to a last minute commitment. However, she indicated her support of the dosimetry and medical radiation physics activities and her willingness to contribute to the work of the SSC-15 through telephone or email communication. Mr Geoffrey Ibbott, the rapporteur of previous SSC meetings, was also not able to attend the meeting for personal reasons, and Ms Mary Martel agreed to act as rapporteur.

Mr Rethy Chhem (Director, NAHU) welcomed the committee to Vienna. Mr Chhem stated that the SSC has had a very positive impact on the DMRP subprogramme. This meeting was considered to be well timed as the DMRP is currently preparing the programme and budget for 2014–2015 budget cycle. Mr Chhem informed the SSC that the Agency has a new Deputy Director General and Head of Department of Nuclear Sciences and Applications, Mr Daud Mohamad. Mr Mohamad was not able to open the meeting due to duty travel but would meet with the Committee later in the week. Mr Chhem informed the SSC members that Member States value the Agency's work in dosimetry and medical physics, as indicated by the increasing number of technical cooperation (TC) projects requiring medical physics support and the increasing number of requests for dosimetry services, particularly as these are now strengthened through participation in the CIPM MRA. In addition to TC, DMRP staff also support the Programme of Action for Cancer Therapy (PACT). Mr Chhem wished the SSC a successful meeting and thanked the members for their contributions to this, their third and last meeting as a Committee.

Ms Renate Czarwinski thanked NAHU for the invitation to attend the meeting and apologized for not being able to attend the whole meeting due to other commitments. She indicated the good collaboration her Section has with DMRP, and acknowledged the support given by DMRP to ensure traceability to the SI units for the IAEA individual monitoring services. She also informed the SSC members about the recent re-accreditation of the individual monitoring services, based on the ISO-17025 standard. Ms Czarwinski

indicated a growing interest of Member States in neutron calibration traceability.

Mr Ahmed Meghzifene, in his role as Head of the DMRP Section, and as Co-secretary of the SSDL Network, welcomed the SSC-15 to the meeting. He explained that the meeting would take place in three parts, the first of which would be the presentation of the activities of the DMRP-run projects in 2010 and 2011. The second part of the meeting would be devoted to the projects for 2012 to 2013 that are presently being implemented, and an overview of the results of a brainstorming session to feed into the biennium projects for 2014 to 2015. The final part of the meeting would consist of 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 was 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-14 had been implemented, but assured the SSC that all recommendations had been carefully considered and were either implemented fully or partially, or were deferred until the next biennium. Mr Meghzifene paid tribute to Hans Svensson, the former Head of the DMRP Section (1987–1994), who passed away in December 2011. Mr Svensson contributed significantly to strengthening of the SSDL network. He worked on the International Code of Practice TRS-277 and strengthened the IAEA dosimetry services (postal TLD audits and calibrations to SSDLs). In addition, he encouraged and supported the education and training of medical physicists and SSDL staff through technical cooperation projects.

Mr Meghzifene then introduced Ms Penelope Allisy of the BIPM as the Chairman of the SSC-15. Ms Allisy expressed the honour and her pleasure to be chair, while looking forward to the SSC deliberations. Ms Allisy thanked all three speakers for their support of the SSC and for their statements illustrating the important issues. Ms Allisy then reviewed the agenda for the meeting and asked if the members or staff wished to propose changes, however none were 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 for the 2010–2011 biennium. Many 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. Late in the afternoon of the second day, and throughout the third day, the SSC-15 met in a closed session, deliberating on the accomplishments and direction of the DMRP's subprogramme, and developing specific recommendations for the programme. Discussion continued on the draft recommendations and their prioritization on the fourth day. The main draft recommendations were discussed with Mr Meghzifene, the DMRP staff and Mr Chhem, and were also presented in outline to Mr Daud Mohamed, the DDG, on the afternoon of the last day. During the feedback session, the SSC-15 thanked the DMRP staff for their comprehensive report and for their exemplary presentations.

In preparation for its report, the SSC-15 reviewed the activities reported by the DMRP for the 2010–2011 biennium, and discussed and made some recommendations concerning the planned subprogramme activities for 2012–2013. In addition, the SSC reviewed the results of the DMRP's "brainstorming" for the biennium 2014–2015 and presented some recommendations for that programme. The scope of the SSC-15 evaluation was similar to that of previous SSCs and addressed the questions of:

- The objectives of the subprogramme 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 Agency activities;
- The distribution of effort between work on the subprogramme projects and support of the laboratory quality management system.

Specific recommendations from the SSC-15 are identified throughout the text, and are also listed in priority categories of high, medium and lower at the end of the report. Comments regarding specific aspects of the DMRP subprogramme are made throughout the text and the more important ones are also given at the end of the report.

2. INTRODUCTION

The SSC-15 thanked the DMRP staff members for preparing a comprehensive report covering the activities of the subprogramme on Dosimetry and Medical Radiation Physics during the biennium 2010–2011. The availability of this report well in advance of the meeting enhanced the Committee's ability to develop thoughtful and appropriate recommendations.

The SSC-15 was pleased to learn that six of the recommendations of SSC-14 have been fully implemented and the remaining seventeen are in progress and due to be completed during the present and next bienniums. Mr Meghzifene noted that the project-specific comments of the SSC-14 had been helpful and that thirteen of these have actually been implemented while a further twelve are in progress or under consideration, as detailed in the written DMRP report.

During the biennium 2010–2011, 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);
- Recurrent Project 2.2.4.3: Quality assurance and guidelines for medical physics in the optimization of clinical radiation imaging;
- Recurrent 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 strengthen and harmonise the quality assurance of radiological imaging, radiation therapy and the 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:

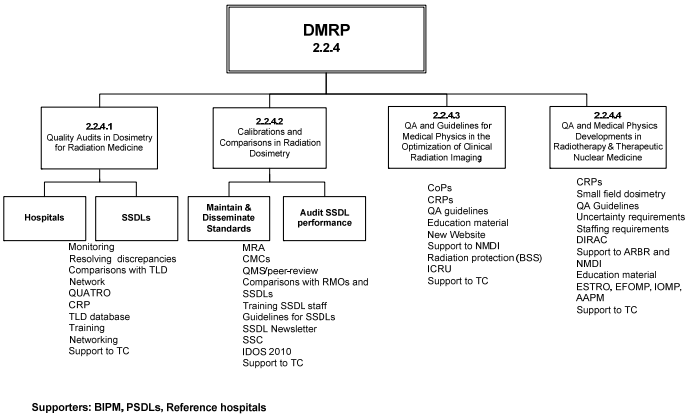


Figure 1: Overview of the major projects of the IAEA DMRP subprogramme, 2010–2011.

The SSC-15 report follows the format established by previous reports and begins with a general discussion of administrative items and collaborative ventures within the Agency. Selected projects are then discussed in turn. In general, the report mentions only those activities of the DMRP Section for which the SSC-15 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-15 with the activity as described in the DMRP report. A list of acronyms is given in the Appendix.

3. REPORT

3.1 General Organizational Items

The SSC-15 was pleased to see that the SSC-14 recommendations made in 2010 are all in hand or have been fully implemented and that the comments made in the previous report have also been acted upon, as evidenced in the written report.

The SSC-15 appreciated very much the presentations made by the DMRP staff that brought the programme highlights to the fore and animated the information provided in the comprehensive written report. Having printed copies of the presentations also greatly facilitated the discussion. However, a comment was made that when written report formats are used in the presentations, it would be helpful if only a portion of the report was shown to highlight the area of particular interest/concern. This would ensure that the contents could be read and understood quickly by the SSC.

The SSC-15 congratulated the DMRP on the success of the IDOS symposium held in 2010 and on the timely publication of the Proceedings, including refereed papers, in 2011.

The SSC-15 was pleased to see the considerable involvement of the DMRP in TC projects and noted that the DMRP has received increased resources to cope with the present dynamic of TC projects. If this dynamic remains at the present level of nearly 30% of the whole programme for projects in Human Health, the SSC-15 considered that the Agency should ensure that appropriate resources should be made available to support the TC projects.

The SSC-15 congratulated the DMRP on the refurbishment of the dosimetry laboratories and on the recent successful peer review, in accordance with ISO 17025, of its calibration and audit services to Member States. This peer review was conducted this year under the auspices of the EURAMET on behalf of all the regions in the JCRB. This success will maintain the confidence that the SSDL Network and Member States have in the calibration and dissemination capabilities of the Agency, and this is to the credit of the DMRP and of the Agency.

The inclusion of training material and downloadable publications on the Human Health Campus website is welcomed as an efficient method of disseminating information to Member States, particularly when highlighted in the SSDL Newsletter.

The SSC-15 noted the present interest in the assessment of the equivalent dose to the lens of the eye, stemming from the more stringent requirements in the revised BSS in terms of annual dose limits for workers. It suggested that the DMRP collaborates with the NSRW as appropriate provided that the necessary funding is made available.

The SSC-15 noted that the DMRP is presently housing an old neutron source belonging to the NSRW and that it may be advisable to consider recycling this source. If the NSRW wishes to use a neutron dosimetry service, the SSC-15 observed that the DMRP could provide assistance in identifying an appropriate service.

The extension of the SSDL Network to include two new Member States deserves congratulation, and the SSC was pleased to note that the energy and enthusiasm with which the new SSDL Officer is supporting the SSDLs matches that of his predecessor. The update of the SSDL Charter should help to maintain the quality of the SSDL Network and so the confidence invested in it by the Member States.

The quality and volume of work produced by the DMRP is impressive, particularly the support given to the Technical Cooperation Programme. The SSC-15 sincerely thanked the DDG, Mr Daud Mohammed, and the Director of the NAHU, Mr Rethy Chhem, for the support they give to the DMRP programme and budget.

Finally, the SSC-15 expressed the honour it felt in assisting in the evaluation of the DMRP's work for NAHU and the SSDL network, and trusted that its report will be received and judged as useful for the Agency's planning for its programme and budget for 2014 to 2015 and beyond.

3.1.1 Facilities at the Dosimetry Laboratory (DOL)

The SSC-15 was very pleased to see the new management structure of the DOL, as shown in Figure 2.

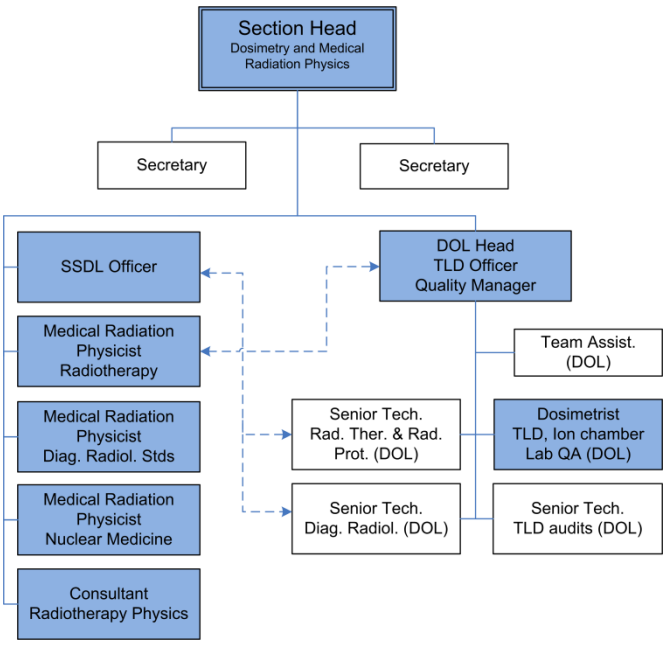


Figure 2: The management structure showing the situation for the DOL.

The maintenance of the DMRP's quality system for the DOL and its calibration and measurement capabilities (CMCs) is essential for continued recognition within the international system supported by the CIPM MRA. The QMS was recently presented to the EURAMET Technical Committee on Quality, having been peer reviewed beforehand, and was approved by the EURAMET on behalf of all the Regional Metrology Organizations. The SSC-15 was delighted with this success, and also congratulated the DMRP on the care with which it ensures that all measuring instruments are traceably calibrated, and on the improvements in the laboratory, including the replacement of a ^{60}Co source and installation of a new remote-controlled bench. With the installation and characterization of the new Mo x-ray tube, the SSC-15 looks forward to seeing the publication of new CMCs in this field.

3.2 Project 2.2.4.1 Quality Audits in Dosimetry for Radiation Medicine

The purpose of this project is to ensure the quality of the dosimetric chain in Member States through an independent means of verification of the calibration of radiation beams used for the treatment of cancer patients and delivered to patients during radiotherapy. The IAEA/WHO TLD audit programme helps hospitals in the Member States, either directly or through national audit networks, to have confidence in the doses they are delivering to their patients.

IAEA/WHO TLD Postal Dose Quality Audit Service for External Radiotherapy

Previous SSCs have been aware of the extensive volume of requests from radiotherapy centres, which exceed the workload capacity of the existing TLD postal service. The SSC-15 was delighted to see that the level of organization and efficiency of the service continues to increase (e.g. with the recent automation of the TLD reporting system) and that additional resources for TLD audit service have been assigned by IAEA. Figure 3 illustrates the level of the present workload.

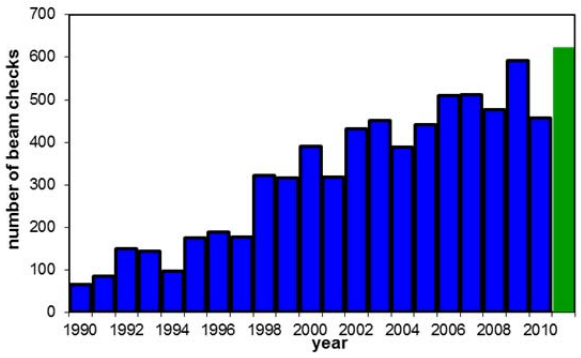


Figure 3: Increase in the IAEA/WHO TLD postal dose audit for radiotherapy hospitals. The number of radiotherapy beam calibrations checked per year has increased significantly since the automatic TLD system was introduced in 1998. The last data bar indicates the number of TLDs distributed in 2011 that are undergoing evaluation by the Dosimetry Laboratory.

[R2.1] In view of the improved level of organization and efficiency of the IAEA/WHO TLD postal dose audit service and its success, the SSC-15 encourages the DMRP to continue the present policy of hospital selection for the dose audit programme and to audit up to 700 hospital beams per year for 2012 and 2013. The SSC-15 recommends that, while the national audit networks are being established, the Agency consider maintaining the resources to handle this level of workload during the 2014–2015 programme.

It is evident from Figure 4 that the present level (10%) of hospital beam calibrations identified as outside the ± 5% acceptance level demonstrates the continuing importance of the IAEA/WHO TLD audit programme. The DMRP is to be congratulated on the standard and effectiveness of their follow-up of these centres, and it must be a disappointment that 5% of the radiotherapy centres fail to respond.

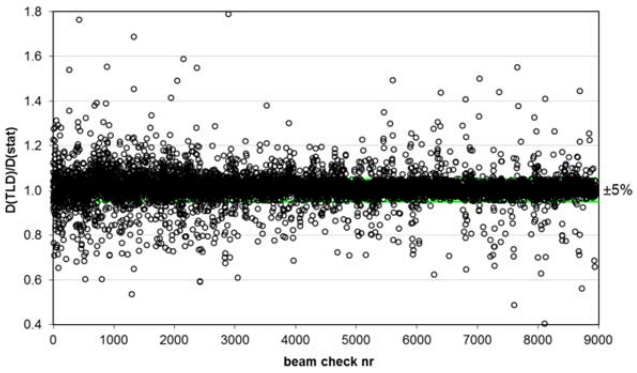


Figure 4: Results of the IAEA/WHO TLD postal dose audits of radiotherapy hospitals for the delivery of absorbed dose to water under reference conditions during 1969–2011 for the TLD batches B1 to B228. Data in the graph correspond to ratios of the Agency's determined dose (DTLD) relative to the dose stated by the hospital (Dstat). Each point corresponds to the average of two dosimeters. A total of 8950 beam calibrations were checked in 1817 hospitals. Approximately 19% of the results were found to be outside the 5% acceptance limit.

Considering the large number of TLD readings made each year, the SSC-15 strongly recommended keeping two TLD readers at an optimum level.

[R1.1] The SSC notes that the DMRP has two TLD readers that are maintained for the TLD service and whose performance is regularly monitored under the quality system. The SSC recommends that this robust approach is continued to ensure that a second reader is always available for the dosimetry audit service.

Although irradiations with electrons are used in a minority of external radiotherapy treatments, such treatments with electrons are more challenging than those with photons. This is due to the strong dose gradients, dosimeter calibration coefficient variation, TPS dose calculations, etc. Consequently, radiotherapy using electrons is more susceptible to mistakes.

[R3.1] Although at a lower level of priority, the SSC-15 is pleased to see that the DMRP will run a pilot audit for electron dosimetry in 2012–13, and recommends that the DMRP use the outcome to define a future audit programme with consideration of the resources needed to support this work.

IAEA Support to National Audit Networks for Radiotherapy Dosimetry

To extend the availability of radiotherapy dosimetry audits to as many hospitals as possible throughout the world, the IAEA has supported the development of methodology and the establishment of national activities in countries where existing resources allow the set-up of national TLD-based QA audit networks for radiotherapy dosimetry. Increasing the number of national audit networks should enlarge the coverage worldwide of reliable and traceable dosimetry in an efficient way.

As the complexity of radiotherapy increases worldwide, there is an increasing need for independent audits of the use of advanced technologies.

[R1.2] In the light of the increasing use of complex treatment techniques, the SSC-15 recommends giving high priority in 2014–15 to the dissemination of the expanded dosimetry audit tools (developed by CRP E2.40.16) and to the national QA networks in participating countries. The SSC-15 believes that this will further the goal to improve the quality of radiation treatment and safety of patients by ensuring that medical physicists have the facility to verify treatment plans.

[R2.2] The SSC-15 recommends that treatment planning system (TPS) audits, implemented under TC programmes, are continued and are extended beyond 3-D-CRT checks to include IMRT.

IAEA Survey of National Dosimetry Audit Networks

The IAEA has undertaken the investigation and review of the coverage and operation of national and international dosimetry audit programmes for radiotherapy and the organization of a global database on this topic. The SSC-15 was concerned to note that one-third of the radiotherapy centres that responded to the initial survey had no external audit of their radiotherapy beams. Consequently, the SSC-15 was pleased to see that progress is being made on the database regarding national audit networks worldwide, and that this will be developed further in the 2012–2013 cycle. It is anticipated that criteria to evaluate performance of national audit networks in radiotherapy will be developed by an international review group that will meet in 2012 and the SSC-15 endorsed this action. The SSC-15 proposed that once the national audit networks database is developed it should be announced through the website and the

SSDL Newsletter so that the information it contains will be as complete and up to date as possible.

IAEA Support to National Audits of Treatment Planning Systems

A new audit modality operated by the IAEA involves audits of treatment planning systems (TPS). The TPS audit reviews the dosimetry, treatment planning and radiotherapy delivery processes in radiotherapy centres using an 'end-to-end' approach.

[R1.4] The results of audits of treatment planning systems (TPS) demonstrate clearly the challenges of implementation and use of TPS in the Member States. For advanced external beam RT techniques the complexity of dose distributions is even more pronounced. The SSC-15 notes also that the TPS database produced by TPS audits provides valuable information to target the comprehensive QUATRO activities. The SSC-15 recommends that the DMRP continue with training and local workshops on TPS audit activities as part of the TC programme to improve radiotherapy delivery for 2014–2015.

Quality Assurance Team for Radiation Oncology (QUATRO)

The principal aim of comprehensive audits using the QUATRO proactive approach is to review and evaluate the quality of all components of the practice of radiotherapy, including the organization, infrastructure, clinical and medical physics aspects of the radiotherapy services, with a view to improving quality.

[R1.3] The SSC-15 is impressed by the large number of QUATRO radiotherapy audit missions in Member States as 65 audits and three re-audits have been organized to date. Based on the results from the re-audits, three centres have now been recognized as centres of competence. The SSC-15 recommends that to improve the implementation of advanced radiation treatment techniques in the Member States, the DMRP continue its collaboration on training workshops for local auditors for QUATRO in all regions, and seek feedback on its training methods.

The QUATRO audits and the revelations identified have been particularly enlightening and SSC-15 would be pleased to support a formal report on QUATRO to the General Conference to raise awareness of this facility among Member States. This could also identify the usefulness of regional or national QUATRO facilities, which could then be supported efficiently by NAHU.

The information collected by QUATRO audits illustrates that the range of radiotherapy resources available in different countries is very wide. The SSC-15 recognized the importance of the Agency published recommendations for minimum staffing and machines for radiotherapy clinics, and encouraged the Agency to include these figures in the QUATRO report to the General Conference. The SSC-15 understands that an updated document on staffing levels in radiation medicine is in progress.

3.3 Project 2.2.4.2 Calibration and comparison of national dosimetry standards

This project serves to enhance the capability of Member States to achieve and maintain a high level of quality and consistency in the radiation measurements and dosimetry standards used in radiotherapy, diagnostic radiology and radiation protection that are linked to the international measurement system in accordance with the CIPM MRA.

The SSC-15 was pleased to note that two more countries have joined the IAEA/WHO SSDL network, as Kazakhstan and Kenya have now become members. The DMRP has also sent a reminder to the few SSDLs that have not submitted annual reports since 2010 to encourage these laboratories to remain as members. Further action concerning follow-up needs to be identified by the DMRP in case of any non-response.

The SSC-15 noted that the dissemination of calibrations is accelerated and enlarged through the establishment of Regional Designated SSDLs, which can also support IAEA training and calibration activities in the region. This is seen as an effective way to increase the coverage for traceability.

[R2.4] The SCC-15 notes that there are presently two regionally designated SSDL centres in Africa that assist others in their region by providing local training and reference irradiations to accelerate and broaden the dissemination of dosimetry calibrations. The SSC-15 recommends that the DMRP encourages the establishment of further such centres, for example in Latin America and Asia. This would also enable some other prioritizations for the DMRP programme.

A one week regional training course was organized at the SSDL Algiers in 2011. The SSC-15 noted that the course achieved a large participation as, in addition to the local and regional participants, fellows from outside the African region also participated in the course

[R1.5] The SSC-15 recommends that the DMRP continue to support the SSDLs, in particular by providing standardized training packages for SSDL staff. Such packages should include guidance on calibration of dosimetry equipment (using IAEA protocols), participation in comparisons, operating a quality system in accordance with ISO 17025 and dissemination of appropriate calibrations to hospitals. The SSC-15 recommends that once finalized, the framework for this package should be publicized in the SSDL Newsletter.

Depending on the success of the Technical Meeting that includes dosimetry comparisons, which was scheduled for November 2012, the SSC-15 encouraged the DMRP

to hold similar Technical Meetings at regular, for example biennial, intervals to ensure that dosimetry is being properly disseminated in the Member States. In view of the Member States' requests for TC projects to support dosimetry comparisons, the SSC-15 believed that this mechanism would benefit from promotion through the SSDL Newsletter.

The activities for TLD monitoring of SSDLs, both at therapy and at radiation protection level form, the solid basis of SSDL audits. Results of TLD monitoring for radiotherapy dosimetry show the continuum of acceptable performance of the SSDLs in this field, and for radiation protection dosimetry the results of the last two TLD runs were all within the acceptable limits of ± 7%, which shows the improvement in the performance of SSDLs also in this field, as shown in Figure 5.

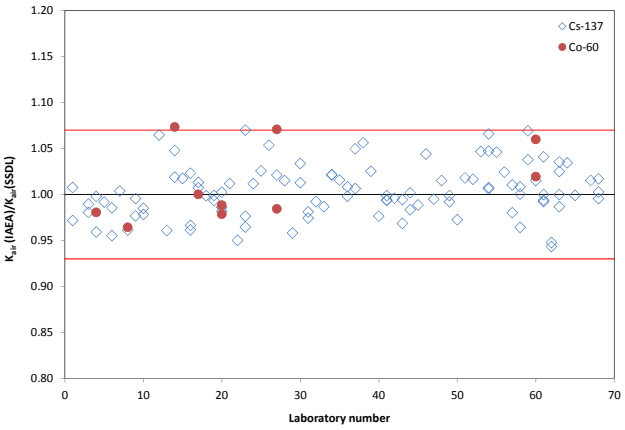


Figure 5: TLD monitoring of SSDL measurements for radiation protection dosimetry.

The SSC-15 was pleased to note that while the valuable comparison programme for calibrations of ionization chambers for therapy level ionization chambers is aimed to be extended to other areas, some consideration should be given to priorities.

[R2.3] The SSC-15 recommends that the comparison of calibration coefficients for ionization chambers used by the SSDLs for diagnostic radiology beams is undertaken as a higher priority than for radiation protection beams as the latter are already audited using TLD.

The SSC-15 was pleased to notice that the SSDL database has been redesigned to help SSDLs in the request for and follow-up of calibrations for their reference instruments.

The SSC-15 congratulated the DMRP on the refurbishment of the IAEA SSDL facilities as X ray equipment has been upgraded for calibration of standards for mammography and diagnostic radiology, and as the new Co-60 source for calibration of radiation protection standards and new calibration benches have been commissioned.

The SSC-15 was pleased to note that the DMRP has taken part in several RMO and bilateral dosimetry comparisons and congratulated the DMRP for the successful peer review, in accordance with ISO 17025. These activities will enable the IAEA to continue to offer reliable calibration and measurement services to Member States and to support the SSDLs' calibration and measurement capabilities through reliable calibrations that are linked to comparisons.

The volume of calibrations for diagnostic radiology has increased significantly in the last two years. This is considered to be due to increased number of available X ray radiation qualities for diagnostic radiology including mammography and the availability of the DMRP X ray calibration service after renovation. The distribution of IAEA calibrations in the various fields since 2000 is illustrated in Figure 6, where it can be seen that brachytherapy calibrations are also being requested.

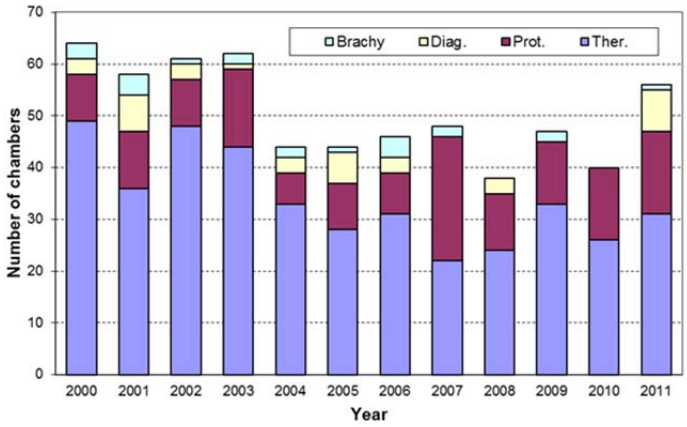


Figure 6: Distribution of IAEA calibration in the various dosimetry fields during 2000–2011.

[R1.6] The SSC-15 notes that now Co-60 high dose-rate sources are being recommended and used with after-loading systems, especially for cervical cancer treatments, the DMRP should consider a pilot study to investigate a calibration protocol for these sources to assist the SSDLs that should be providing traceability. The SSC-15 recommends that the IAEA collaborate with the PSDLs through the CCRI over this study.

[R1.7] The SSC-15 recommends that the DMRP investigate whether SSDLs are making use of the Cs-137 well-chamber calibrations that are being provided, and if not, the SSC-15 recommends that the DMRP cease to provide this service and that it concentrate future efforts on the potential Co-60 calibrations that are likely to be needed.

The SSC-15 noted the DMRP suggestion to implement absorbed dose to water calibrations for Ir-192 sources of brachytherapy. Although new absorbed dose to water standards have been developed in the PSDLs, e.g. under the European Metrology Research Programme (EMRP) project JRP6 for brachytherapy dosimetry, consistency has not yet been reached for these standards.

[R2.5] The SSC-15 recommends that the DMRP continue to support the use of reference air kerma

rate for Ir-192 sources until the PSDLs reach agreement on absorbed dose to water standards for these sources.

[R3.2] The SSC-15 recommends that the DMRP investigate the need for well-type ionization chamber calibrations of ^{192}Ir and ^{125}I brachytherapy sources and, if considered necessary, studies an appropriate way to establish such a service for the SSDL network, and for hospitals without access to an SSDL.

In view of the previous work developed by DMRP on KAP meters, including calibration and participation in the EURAMET comparison, the SSC-15 was pleased to note that comparisons of KAP meter calibrations are being extended to the SSDLs of Member States through a CRP for the development of advanced dosimetry techniques for diagnostic and interventional radiology.

The publication of the report on the implementation of TRS357 (Human Health Series No. 4) also supports SSDLs in their work on establishing and improving their calibration facilities for dosimetry of diagnostic radiology beams.

The SSC-15 considered that 2014–2015 is probably too early for the DMRP to be considering absorbed dose to water calibrations for medium and low energy X ray beams and that this should wait until new robust standards are disseminated by the PSDLs.

The SSC-15 considered that it would be appropriate to start a new CRP in about 2015 to support SSDLs in the planning and introduction of new calibration services in terms of absorbed dose to water for brachytherapy sources, and for medium energy and low energy X ray beams.

3.4 Project 2.2.4.3 Quality assurance and guidelines for medical physics in the optimization of clinical radiation imaging

This project aims to establish and maintain high quality medical imaging capabilities for diagnosis and related treatment in Member States that follow appropriate standards in hospital quality assurance and safety by producing educational publications that guide and train.

This ongoing project demonstrates the positive contribution of imaging science to the field of radiation medicine. The SSC-15 was pleased that several new documents have been published, e.g. Comprehensive Clinical Audits of Diagnostic Radiology Practices (Human Health Series # 4), and that others are to be published shortly.

The SSC-15 noted the publication of Human Health Series #4, and recognized that it should be very useful for improving performance in the measurement and accuracy of the specific quantities used in diagnostic radiology.

[R1.9] The SSC-15 congratulates the DMRP on the guidance document produced jointly with the WHO on digital imaging in radiology and looks forward to its imminent publication. The SSC-15 recommends that the DMRP support the Member States in implementing the guidance through involvement with TC projects on training materials and courses.

Following the recommendations of SSC-14, guidance material for dosimetry in diagnostic radiology for pediatric patients has been prepared.

[R2.7] The SSC-15 notes the importance of ensuring that paediatric radiology is of a high standard and recommends that the DMRP continue developing work in this field.

[R2.6] The SSC-15 is encouraged to see the success of the QA publications for SPECT and PET/CT and recommends that a similar publication on the QA of hybrid systems such as SPECT/CT is produced; this would also provide continued support to the NMDI, particularly in conjunction with a Technical Meeting on hybrid imaging.

The SSC-15 was pleased to see the collaboration with the NMDI as shown by the DMRP's support of the CRP on the early detection of breast cancer by mammography, and encouraged the continuation of such collaborations designed to ensure that both medical physics and dosimetry are addressed in such radiation medicine projects.

The SSC-15 supported the DMRP in the implementation of the CRP on advanced dosimetry techniques for diagnostic and interventional radiology, noting the relevance of testing different dosimetry approaches and emerging diagnostic radiology modalities.

The SSC-15 noted that the IAEA/WHO collaboration towards a common platform is focusing on medical imaging for mammography and digital imaging in general and encouraged this continued collaboration, which will be well supported by representation of the WHO at future SSC meetings. This collaboration can be strengthened by joint activities on capacity building and by provision of technical support at regional/national level.

The SSC-15 was pleased to see that the doctoral CRP on imaging physics has been initiated, and supports its approval and continuation through the next programme.

As the technology for quantitative molecular imaging has become more mature, the techniques have migrated from research institutions into clinical practice. In order to ensure the best health care for people served by these sites, it is timely to investigate the implementation of quantitative imaging at such sites to ensure the adoption of safe and sustainable healthcare at the highest level achievable.

[R1.10] The SSC-15 recommends the DMRP continue its work on completing the CRP on patient specific dosimetry through standardized quantitative nuclear medicine imaging protocols. This work may

have to continue through the following work programmes.

The SSC-15 encouraged the DMRP to continue with its support for the QUAADRIL reviews, particularly through the training of auditors for this work, noting that three reviews have been held to date.

The SSC-15 was pleased to note the success of the QUANUM audits and to note that a medical physicist is always included in the audit team for nuclear medicine. The launch of QUAADRIL audits should have a similar success and, again, the SSC-15 believed that the presence of a medical physicist will enhance the efficacy of the audit team.

The SSC-15 suggested that the DMRP collaborations in radiation medicine over the IAEA-ICTP courses be continued while there is still the need for formal training in Member States. This should ensure that a maximum number of participants is reached by training the trainers, the SSC-15 noted that there are nearly 9000 medical physicists working in radiotherapy alone, as indicated in the DIRAC database. A useful follow-up to the DIRAC would be to identify, together with the IOMP, what training the medical physicists have received to enable them to practise.

The SSC-15 was also pleased to see the involvement of the DMRP in the IAEA-lead revision of the International Basic Safety Standards.

[R1.8] The SSC-15 notes the growing importance of diagnostic radiology doses from high technology equipment and the general lack of quality control programmes. The SCC-15 recommends giving high priority to the dissemination of dosimetry methodologies and quality assurance programmes in the Member States, backed up by the need to have medical physicists for this work to ensure the safety of patients.

3.5 Project 2.2.4.4 Quality assurance and developments in radiotherapy and therapeutic nuclear medicine

The objective of this project is to enhance the capability of Member States to develop new techniques, methodologies and training materials for dose auditing and quality assurance in medical physics for radiation treatment, including nuclear medicine therapy.

Development of guidelines for improving quality in radiotherapy

In view of the importance given by Member States to having Agency guidelines, the SSC-15 made some recommendations and comments regarding this project.

[R2.8] As a continuation of the series of guidelines in radiotherapy technology QA, the SSC-15 recommends development of procedures for acceptance testing, commissioning and QA for advanced technology, such as MLC, IMRT and EPIDS.

[R2.9] The SSC-15 recommends that a guidance document be developed for quality control of imaging devices used for image guided radiation therapy, followed by a CRP on the characterization and dosimetry of image-guided procedures.

The SSC-15 recognizes the important collaborations between the DMRP and the ARBR, particularly in finalizing the staffing guidelines in radiation medicine, and encourages further collaborative work in the development of guidelines for adaptive radiotherapy.

Directory of radiotherapy centres (DIRAC)

Considerable work has gone into researching data sources for the DIRAC, and this now covers 7609 radiotherapy centres in 141 countries. The SSC-15 applauded the DMRP for the excellent work in further updating of the IAEA/WHO DIRAC database and encouraged the continuation of this work to keep the DIRAC up to date as it becomes increasingly widely known and used. Indeed, the Global Health Observatory is using this data to complete Member States' information for the World Health Statistics.

The SSC-15 was pleased to note that the DMRP is planning to collaborate with the NSRW to identify a risk/benefit analysis of the age (from the IAEA/WHO DIRAC) and quality (from audits) of radiotherapy equipment installed worldwide, and encouraged WHO involvement in this work.

Small field dosimetry

[R1.11] The SSC-15 recommends that the IAEA report on static small field dosimetry should be tested and the results from these tests should be used as input to any future revision of the Dosimetry Code of Practice, TRS 398. Furthermore, the SSC-15 recommends that the DMRP start a CRP to develop methodology for non-static small field delivery in radiotherapy.

Medical physics support for nuclear medicine

[R1.12] The SSC-15 endorses the programme of work on internal dosimetry for therapeutic nuclear medicine and recommends the harmonization of protocols internationally, with the emphasis on uncertainty analysis and the dissemination of methodology through education and training materials. The gamma-camera facility at Seibersdorf should continue to be used for such training purposes. Collaboration with the EANM and the MIRD Committee on this topic would obviously be beneficial.

The SSC-15 considered that the DMRP needs to monitor new technical developments in radiation dosimetry as applied to radiation medicine so as to be prepared for future needs of Member States.

4. SSC-15 RECOMMENDATIONS AND SUGGESTIONS (sorted by priority category)

Recommendations

High Priority

4.1. The SSC-15 notes that the DMRP has two TLD readers that are maintained for the TLD service and whose performance is regularly monitored under the quality system. The SSC recommends that this robust approach is continued to ensure that a second reader is always available for the dosimetry audit service. [R1.1]

4.2. In the light of the increasing use of complex treatment techniques, the SSC-15 recommends giving high priority in 2014–15 to the dissemination of the expanded dosimetry audit tools (developed by CRP E2.40.16) and to the national QA networks in participating countries. The SSC-15 believes that this will further the goal to improve the quality of radiation treatment and safety of patients by ensuring that medical physicists have the facility to verify treatment plans. [R1.2]

4.3. The SSC-15 is impressed by the large number of QUATRO radiotherapy audit missions in Member States as 65 audits and three re-audits have been organized to date. Based on the results from the re-audits, three centres have now been recognized as centres of competence. The SSC-15 recommends that to improve the implementation of advanced radiation treatment techniques in the Member States, the DMRP continue its collaboration on training workshops for local auditors for QUATRO in all regions, and seek feedback on its training methods. [R1.3]

4.4. The results of audits of treatment planning systems (TPS) demonstrate clearly the challenges of implementation and use of TPS in the Member States. For advanced external beam RT techniques the complexity of dose distributions is even more pronounced. The SSC-15 notes also that the TPS database produced by TPS audits provides valuable information to target the comprehensive QUATRO activities. The SSC-15 recommends that the DMRP continue with training and local workshops on TPS audit activities as part of the TC programme to improve radiotherapy delivery for 2014–2015. [R1.4]

4.5. The SSC-15 recommends that the DMRP continue to support the SSDLs, in particular by providing standardized training packages for SSDL staff. Such packages should include guidance on calibration of dosimetry equipment (using IAEA protocols), participation in comparisons, operating a quality system in accordance with ISO 17025 and dissemination of appropriate calibrations to hospitals. The SSC-15 recommends that once finalized, the framework for this package should be publicized in the SSDL Newsletter. [R1.5]

4.6. The SSC-15 notes that now Co-60 high dose-rate sources are being recommended and used with after-loading systems, especially for cervical cancer treatments, the DMRP should consider a pilot study to investigate a calibration protocol for these sources to assist the SSDLs that should be providing traceability. The SSC-15 recommends that the IAEA collaborate with the PSDLs through the CCRI over this study. [R1.6]

4.7. The SSC-15 recommends that the DMRP investigate whether SSDLs are making use of the Cs-137 well-chamber calibrations that are being provided, and if not, the SSC-15 recommends that the DMRP cease to provide this service and that it concentrate future efforts on the potential Co-60 calibrations that are likely to be needed. [R1.7]

4.8. The SSC-15 notes the growing importance of diagnostic radiology doses from high technology equipment and the general lack of quality control programmes. The SCC-15 recommends giving high priority to the dissemination of dosimetry methodologies and quality assurance programmes in the Member States, backed up by the need to have medical physicists for this work to ensure the safety of patients [R1.8].

4.9. The SSC-15 congratulates the DMRP on the guidance document produced jointly with the WHO on digital imaging in radiology and looks forward to its imminent publication. The SSC-15 recommends that the DMRP supports the Member States in implementing the guidance through involvement with TC projects on training materials and courses.[1.9]

4.10. The SSC-15 recommends the DMRP continue its work on completing the CRP on patient specific dosimetry through standardized quantitative nuclear medicine imaging protocols. This work will probably have to continue through the following work programmes. [R1.10]

4.11. The SSC-15 recommends that the IAEA report on static small field dosimetry should be tested and the results from these tests should be used as input to any future revision of the Dosimetry Code of Practice, TRS 398. Furthermore, the SSC-15 recommends that the DMRP start a CRP

to develop methodology for non-static small field delivery in radiotherapy. [R1.11]

4.12. The SSC-15 endorses the programme of work on internal dosimetry for therapeutic nuclear medicine and recommends the harmonization of protocols internationally, with the emphasis on uncertainty analysis and the dissemination of methodology through education and training materials. The gamma-camera facility at Seibersdorf should continue to be used for such training purposes. Collaboration with the EANM and the MIRD Committee on this topic would obviously be beneficial. [R1.12]

Medium Priority

4.13. In view of the improved level of organization and efficiency of the IAEA/WHO TLD postal dose audit service and its success, the SSC-15 encourages the DMRP to continue the present policy of hospital selection for the dose audit programme and to audit up to 700 hospital beams per year for 2012 and 2013. The SSC-15 recommends that, while the national audit networks are being established, the Agency consider maintaining the resources to handle this level of workload during the 2014–2015 programme. [R2.1]

4.14. The SSC-15 further recommends that treatment planning system (TPS) audits, implemented under TC programmes, are continued and are extended beyond 3-D-CRT checks to include IMRT. [R2.2]

4.15. The SSC-15 recommends that the comparison of calibration coefficients for ionization chambers used by the SSDLs for diagnostic radiology beams is undertaken as a higher priority than for radiation protection beams as the latter are already audited using TLD. [R2.3]

4.16. The SCC-15 notes that there are presently two regionally designated SSDL centres in Africa that assist others in their region by providing local training and reference irradiations to accelerate and broaden the dissemination of dosimetry calibrations. The SSC-15 recommends that the DMRP encourages the establishment of further such centres, for example in Latin America and Asia. This would also enable some other prioritizations for the DMRP programme.[R2.4]

4.17. The SSC-15 recommends that the DMRP continue to support the use of reference air kerma rate for Ir-192 sources until the PSDLs reach agreement on absorbed dose to water standards for these sources. [R2.5]

4.18. The SSC-15 is encouraged to see the success of the QA publications for SPECT and PET/CT and recommends that a similar publication on the QA of hybrid systems such as SPECT/CT is produced; this would also provide continued support to the NMDI, particularly in conjunction with a Technical Meeting on hybrid imaging. [R2.6]

4.19. The SSC-15 notes the importance of ensuring that paediatric radiology is of a high standard and recommends that the DMRP continue developing work in this field. [R2.7]

4.20. As a continuation of the series of guidelines in radiotherapy technology QA, the SSC-15 recommends development of procedures for acceptance testing, commissioning and QA for advanced technology, such as MLC, IMRT and EPIDS. [R2.8]

4.21. The SSC-15 recommends that a guidance document be developed for quality control of imaging devices used for image guided radiation therapy, followed by a CRP on the characterization and dosimetry of image-guided procedures. [R2.9]

Lower Priority

4.22. The SSC-15 is pleased to see that the DMRP will run a pilot audit for electron dosimetry in 2012–13, and recommends that the DMRP use the outcome to define a future audit programme with consideration of the resources needed to support this work. [R3.1]

4.23. The SSC-15 recommends that the DMRP investigate the need for well-type ionization chamber calibrations of ^{192}Ir and ^{125}I brachytherapy sources and, if considered necessary, studies an appropriate way to establish such a service for the SSDL network, and for hospitals without access to an SSDL. [R3.2]

5. SCC-15 COMMENTS

5.1 General

- The SSC-15 is pleased to see the considerable involvement of the DMRP in TC projects, and notes that the DMRP has received increased resources to cope with the present dynamic of TC projects. If this dynamic remains at the present level of nearly 30% of the whole programme for projects in Human Health, the SSC-15 feels that the Agency should ensure that appropriate resources be made available to support the TC projects.
- The SSC-15 notes the present interest in the assessment of the equivalent dose to the lens of the eye, stemming from the more stringent requirements in the revised BSS in terms of annual dose limits for workers, and suggests that the DMRP collaborate with the NSRW as appropriate,

presuming that the necessary funding is made available.

- The SSC-15 notes that the DMRP is presently housing an old neutron source belonging to the NSRW and that it may be advisable to consider recycling this source. If the NSRW wishes to use a neutron dosimetry service, the SSC-15 considers that the DMRP could provide assistance in identifying an appropriate service.

5.2 Project 2.2.4.1 Quality audits in Radiation Medicine

- The information collected by QUATRO audits illustrates that the range of radiotherapy resources available in different countries is very wide. The SSC-15 recognizes the importance of the Agency-published recommendations for minimum staffing and machines for radiotherapy clinics and encourages the Agency to include these figures in the QUATRO report to the General Conference. The SSC-15 understands that an updated document on staffing levels in radiation medicine is in progress.
- The SSC-15 proposes that, once the national audit networks database is developed, this be announced through the website and the SSDL Newsletter so that the information the database contains will be as complete and up to date as possible.

5.3 Project 2.2.4.2 Calibration and comparison of national dosimetry standards

- The SSC-15 considers that 2014–2015 is probably too early for the DMRP to be considering absorbed dose to water calibrations for medium and low-energy X ray beams and that this should wait until new robust standards are disseminated by the PSDLs.
- The SSC-15 considers that it would be appropriate to start a new CRP in about 2015 to support SSDLs in the planning and introduction of new calibration services in terms of absorbed dose to water for brachytherapy sources, and for medium-energy and low-energy X ray beams.
- Depending on the success of the Technical Meeting that includes dosimetry comparisons, scheduled for November 2012, the SSC-15 encourages the DMRP to hold similar Technical Meetings at regular, for example biennial, intervals to ensure that dosimetry is being properly disseminated in the Member States.
- In view of the Member States' requests for TC projects to support dosimetry comparisons, the SSC-15 believes that this mechanism would benefit from promotion through the SSDL Newsletter.

5.4 Project 2.2.4.3 Quality assurance and guidelines for Medical Physics in the optimization of clinical radiation imaging

- The SSC-15 notes that the IAEA/WHO collaboration towards a common platform is focusing on medical imaging for mammography and digital imaging in general and encourages this continued collaboration, which will be well supported by representation of the WHO at future SSC meetings. This collaboration can be strengthened through joint activities on capacity building and provision of technical support at regional/national level.
- The SSC-15 encourages the DMRP to continue with its support for the QUAADRIL reviews, particularly through the training of auditors for this work,
noting that three reviews have been held to date.
- The SSC-15 is pleased to see the collaboration with the NMDI as shown by the support of the DMRP for the CRP on the early detection of breast cancer by mammography, and encourages the continuation of such collaboration to ensure that both medical physics and dosimetry are addressed in such radiation medicine projects.
- The SSC-15 encourages the continuation of the close collaboration of the DMRP with the Radiation Safety and Monitoring Section, particularly for the support of the International Action Plan for the Radiological Protection of Patients.
- The SSC-15 suggests that the DMRP collaborations in radiation medicine over the IAEA-ICTP courses be continued while there is still need for formal training in Member States. This should ensure that a maximum number of participants is reached by training the trainers, noting that there are nearly 9000 medical physicists working in radiotherapy alone, as indicated in the DIRAC database. A useful follow-up to the DIRAC would be to identify, in collaboration with the IOMP, what training the medical physicists have received to enable them to practise.
- The SSC-15 is pleased to note the success of the QUANUM audits in nuclear medicine and that a medical physicist is always included in the audit team. The QUAADRIL audits should have a similar success, and again, the SSC-15 believes that the presence of a medical physicist will enhance the efficacy of the audit team.

5.5 Project 2.2.4.4 Quality assurance and developments in radiotherapy and therapeutic nuclear medicine

- The SSC-15 applauds the DMRP for the excellent work in further updating the IAEA/WHO DIRAC database and encourages the continuation of this

work to keep the DIRAC up to date as it is becoming more widely known and used. Indeed, the Global Health Observatory is using this data to complete Member States' information for the World Health Statistics.

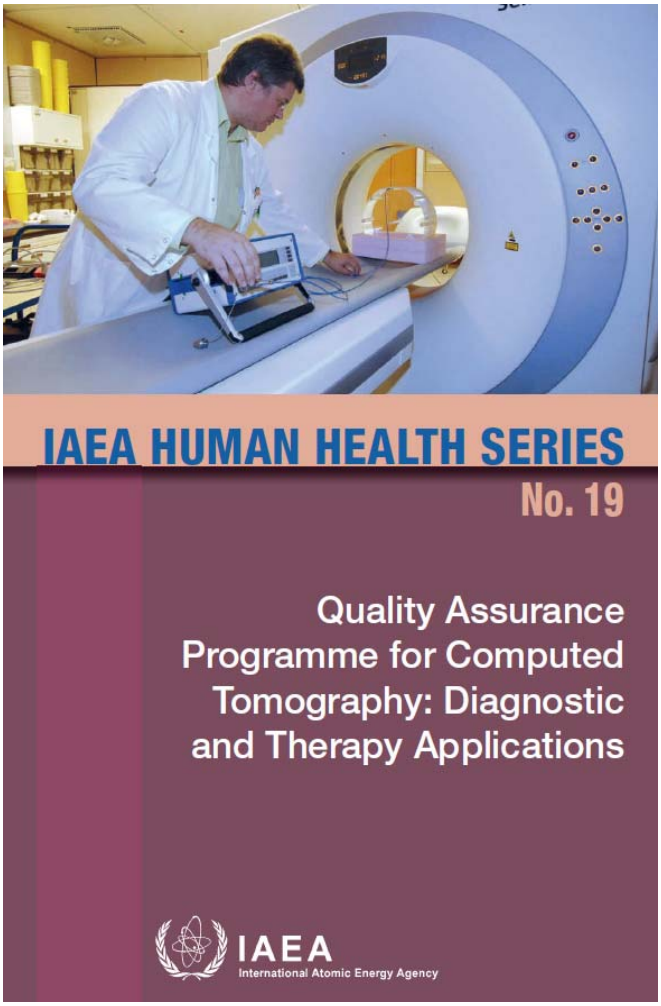
- The SSC-15 recognizes the important collaborations between the DMRP and the ARBR, particularly in finalizing the staffing guidelines in radiation medicine, and encourages further collaborative work in the development of guidelines for adaptive radiotherapy.
- The SSC-15 feels that the DMRP needs to monitor new technical developments in radiation dosimetry as applied to radiation medicine so as to be prepared for future needs of Member States.
- The SSC-15 is pleased to note that the DMRP is planning to collaborate with the NSRW to identify a risk/benefit analysis of the age (from the IAEA/WHO DIRAC) and quality (from audits) of radiotherapy equipment installed worldwide, and encourages WHO involvement in this work.

Acronyms used in the SSC-15 Report

3-D	3-dimensional
ARBR	Applied Radiation Biology and Radiotherapy Section of the Agency
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", Agency publication No. 115 in the Safety Series)
CIPM	International Committee of Weights and Measures (BIPM)
CM	Consultants' meeting of the Agency
CMC	Calibration and Measurement Capability
CoP	Code of Practice
CRP	Coordinated Research Project of the Agency
CT	Computed tomography
DG	Director General (of the Agency)
DIRAC	Directory of Radiotherapy Centres
DMRP	Dosimetry and Medical Radiation Physics Section of the Agency
DOL	Agency's Dosimetry Laboratory
ESR	Electron spin resonance
ESTRO	European Society for Therapeutic Radiology and Oncology
EURAMET	European Association of National Metrology Institutes
HDR	High dose rate
IAEA	International Atomic Energy Agency
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 Agency
MRA	Mutual Recognition Arrangement of the CIPM (CIPM MRA)
MRI	Magnetic resonance imaging
NAAL	Agency's Laboratories Division, Vienna and Seibersdorf
NAHU	Division of Human Health of the Agency
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 Agency
PACT	Programme of Action for Cancer Therapy of the Agency
PET/CT	Positron Emission Tomography/Computed Tomography
PSDL	Primary Standards Dosimetry Laboratory
QA	Quality assurance
QMS	Quality management system
QS	Quality system
QUADDRIL	Quality Assurance Audit for Diagnostic Radiology Improvement and Learning
QUANUM	Quality Management Audits in Nuclear Medicine Practice
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 Agency
TL	Thermoluminescent, or thermoluminescence
TLD	Thermoluminescent dosimeter, or thermoluminescence dosimetry
TPS	Treatment Planning System
TRS	Technical Reports Series (an Agency publication series)
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
WHO	World Health Organization

Quality Assurance Programme for Computed Tomography: Diagnostic and Therapy Applications



The new publication on "Quality Assurance Programme for Computed Tomography: Diagnostic and Therapy Applications" (IAEA Human Health Series 19) is now available.

The application of radiation in the diagnosis and treatment of disease is an important component of the work of the IAEA. In the area of diagnostic radiology, this work is currently focused on quality assurance (QA) methods to promote the effective use of radiation for a diagnostic outcome through achieving and maintaining appropriate image quality, and on dose determination to allow the monitoring and reduction of dose to the patient.

The role of computed tomography (CT) in modern medicine is well established as a means of diagnosis and also as an essential precursor to radiation therapy treatment. The clinical relevance of the technology and the recent rapid technological developments have brought about extensive increases in the use of this diagnostic tool generally, and in an increasing number of Member States. The complexity of this technology continues to increase, as does its potential to deliver substantial doses to patients. Consequently, the need for QA to acquire the maximum clinical information at acceptable radiation dose levels is critical. The current publication is unique in that it contains advice applicable to both diagnostic and therapeutic applications of CT, in recognition of the fact that the use of a CT scanner for both diagnostic and therapeutic applications may be common in many facilities.

This publication has been compiled in the light of existing publications on Quality Assurance, Acceptance Testing and Quality Control for CT. It has incorporated the principal components of the existing programmes in a harmonized manner to create a useful handbook for the broad range of Member States. It has been developed with the philosophy that CT imaging must be of the highest quality in order to fulfil the diagnostic tasks expected of it. This publication addresses topics such as the special requirements for scanners used for radiotherapy treatment planning and how to ensure adequate performance in shared diagnostic and radiotherapy scanner utilization and in radiotherapy-only use. In some areas, resources, both technological and human, are limited, and therefore this publication was developed with the concept of practical application in mind.

Measurement of dose in standard CTDI PMMA body phantom.

The following chapters are included in the document, along with appendices that describe the required equipment, special tests for radiotherapy applications,

as well as a Visual Inspection and Programme Review Check List.

1. Introduction
2. CT Technology
3. Performance Requirements in CT
4. Considerations for the Selection of a CT Unit
5. Basic Principles of Quality Assurance in CT
6. Optimization of Clinical Practice
7. Outline of Performance Tests
8. Radiographer's Tests
9. Medical Physicist's Tests
10. Additional Tests for Radiotherapy

The publication is available in the official IAEA website, at:

http://www-pub.iaea.org/books/IAEABooks/8751/Quality-Assurance-Programme-for-Computed-Tomography-Diagnostic-and-Therapy-Applications

Development of an International Database for Dosimetry Audit Networks for Radiotherapy

Report of a consultants' meeting

IAEA, Vienna
23–27 April 2012

Consultants: David Followill (Radiological Physics Center, Houston, USA), Coen Hurkmans (Catharina Hospital, Eindhoven, The Netherlands), Tomas Kron (Peter McCallum Cancer Centre, Melbourne, Australia), Tommy Knoos (Lund University Hospital, Lund, Sweden)

Scientific Secretary: Joanna Izewska, DMRP, IAEA

In 2009, the IAEA undertook a task to collect information on the access of radiation therapy centres in the various countries in the world to an independent dosimetry audit of their clinical beams used for cancer treatment. To this end, the IAEA conducted two surveys of various national dosimetry audit networks in 2010 and 2011 using a "Dosimetry Audit Network for Radiotherapy Questionnaire" that was designed in an IAEA consultants' meeting in 2009. Responses were received from 53 different audit networks in 45 countries, from which data regarding their scope of activities, methodologies and range of audit coverage were compiled. As a next step, the development of a comprehensive international database for dosimetry audit networks for radiotherapy is underway. This database can be used to provide information to international medical physics community on the availability of dosimetry audits in radiotherapy and on the status of audit activities in the different countries and world regions. At the same time, the information on the participation in audits will be available to clinical trial organizations so that radiotherapy centres that are audited nationally and pass the national criteria are recognized as being competent to participate in international clinical trials as part of a global harmonization of clinical trial QA activities.

From 23 to 27 April 2012, a consultants' meeting was held at the IAEA Headquarters that defined the framework for organizing the Dosimetry Audit Networks (DAN) database. Furthermore, a system for international recognition of operations of dosimetry audit networks for radiation therapy was discussed.

The consultants proposed the structure, content and operation of the DAN database that will be used to store data gathered from dosimetry audit networks. The DAN database will be located and maintained at the IAEA. The data from the IAEA 2010 and 2011 surveys will be used to initially populate the database. The IAEA will also be responsible for ensuring the integrity and accuracy of data. Information from the audit networks will be obtained on a periodic basis by means of the "Dosimetry Audit Networks for Radiotherapy Questionnaire" to update the database.

The structure of the database will be such that it is based on key dosimetry auditing network data tables. For each unique DAN identified, four primary data tables will be included. These are: DAN general information data set, scope of activities, institutions/machines/beams audited, and the details of the DAN Quality Management System (QMS). The general information data set will include the dosimetry audit network administrative data and operations, scope of work, geographical area of the audit coverage and rationale for establishing the auditing programme, as well as other relevant points. Within the scope of DAN activities there will exist data tables that distinguish between remote and on-site audits. Within each of these types of audits, data tables will exist for reference and non-reference conditions including the levels of audit, for example, the check of a few beam parameters or the 'end-to-end' audit using anthropomorphic and semi-anthropomorphic phantoms. Lists of radiotherapy centres, machines and beams audited including the audit type and date will be added, but no audit results will be included in the DAN database due to their confidential nature. Transfers of dosimetry audit results to third parties are normally made by the audit participants or upon the request of the participants to the auditing organization. The DAN database will also contain information on the DAN QMS, including accreditations, certifications, peer reviews, records of inter-laboratory comparisons, traceability and uncertainty of audit results.

Access to the DAN database general information will be publicly available, whereas detailed information can be accessed by authorized users only. User groups will be defined and user rights and passwords will be determined to ensure the secure access and use of the database.

In addition to the DAN database, the introduction of a system for international recognition of operations of dosimetry audit networks was discussed and considered to be advantageous for comparing the auditing work between the various countries and regions, and to ensure that the national networks consistently operate at internationally accepted standards and levels. To this end, guidelines were drafted for the review of DAN activities as a prerequisite for recognition as being able to perform audits and report results at an internationally acceptable level. An international committee called the DAN International Recognition Group (DAN IRG) will be established and hosted by the IAEA. This group will define a specific set of criteria to evaluate the performance of national audit networks in radiotherapy. DAN IRG will be comprised of five international experts in quality audit methodology, radiation therapy dosimetry, medical physics and clinical trials QA supported by the IAEA Scientific Secretary.

The DAN IRG will review the documentation provided by individual DANs aspiring to be acknowledged as internationally recognized auditing organizations. The reviewed results of the DAN IRG will be recorded in the DAN database. If considered necessary, the DAN IRG may suggest that review visits by 'peers' be undertaken, in order that the DAN may demonstrate confidence and capability in their claimed audit activities. DAN IRG will provide feedback to the DAN with respect to the review results and any recommendations arising from it.

The DAN IRG will ensure that the DAN database will be used to provide information to international trial organizations in order to facilitate the participation in clinical trials of those radiotherapy centres that passed a national audit by an internationally recognized DAN.

In addition, DAN IRG will assess the regional coverage of DAN services and will provide feedback to the radiation therapy community regarding the activities of DANs. It will also review feedback from clinical trial organizations, professional organizations, DANs and SSDLs, and will promote the recognition of DANs as a tool for quality improvement in radiation therapy.

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An IAEA Survey of Dosimetry Audit Networks for Radiotherapy

Paulina Grochowska, Joanna Izewska, IAEA

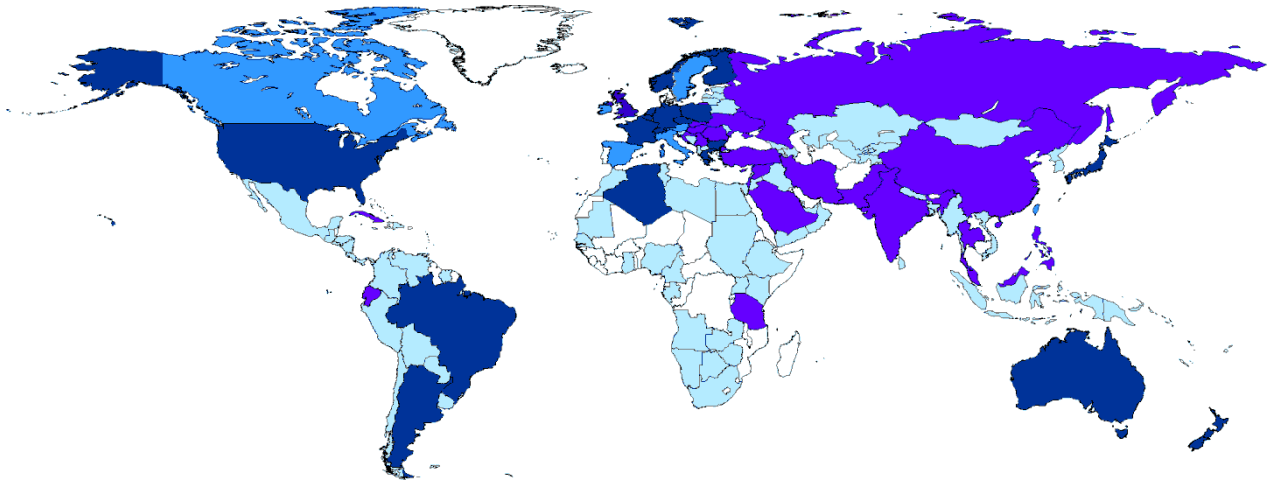
A survey

In 2010, the IAEA undertook a task to investigate and review the coverage and operations of national and international dosimetry audit programmes for radiotherapy. The aim was to organize the global database describing the activities of dosimetry audit networks in radiotherapy.

A dosimetry audit questionnaire has been designed at an IAEA consultants' meeting held in 2010 for organizations conducting various levels of dosimetry audits for radiotherapy. Using this questionnaire, a survey was conducted for the first time in 2010 and repeated in 2011. Request for information on different aspects of the dosimetry audit was included, such as the audit framework and resources, its coverage and scope, the dosimetry system used and the modes of audit operation, i.e. remotely and through on-site visits. The IAEA questionnaire was sent to over 80 organizations, members of the IAEA/WHO Network of Secondary Standards Dosimetry Laboratories (SSDLs) and other organizations known for having operated dosimetry audits for radiotherapy in their countries or internationally.

Survey results and discussion

In response to the IAEA survey, 53 organizations in 45 countries confirmed that they operate dosimetry audit services for radiotherapy. Mostly, audits are conducted nationally, however there are five organizations offering audits abroad, with two of them operating in various parts of the world and three of them at the regional level, auditing radiotherapy centres in neighbouring countries. Figure 1 presents the distribution of dosimetry audit services in the world.



Participants in the National Dosimetry Workshop, ISP/INC, Santiago de Chile, Chile September 28th-October 2nd, 2011.

Country operating national audit

Country operating national audit and participating in the IAEA/WHO TLD postal dose audit service

Country not participating in audits or no radiotherapy

Country participating in the IAEA/WHO TLD postal dose audit service

Country with access to an international audit programme other than IAEA/WHO

Figure 1: Dosimetry audit services in the world.

The audit coverage varied from a few radiotherapy centres audited per year to almost 2000 centres, with eight organizations auditing more than 100 different radiotherapy centres each. The two largest audits coverages, auditing almost 2000 centres each, are by the IAEA/WHO [1] and the Radiological Physics Center in Houston, USA [2]. Audits are mostly operated within the framework of national quality assurance (QA) programmes, yet they often serve other purposes such as licensing, credentialing, accreditation or state inspection (Figure 2).

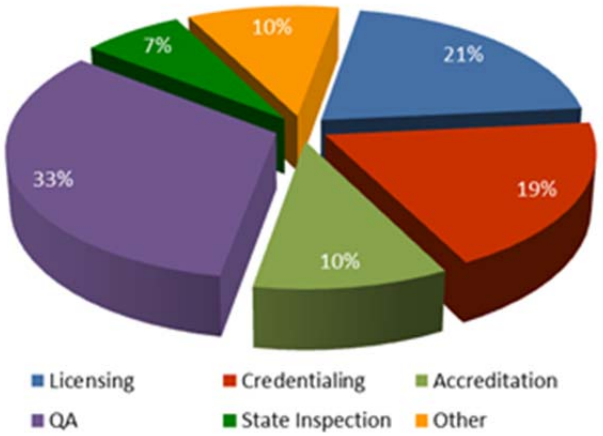


Figure 2: Purpose of organizing a dosimetry audit in radiotherapy

The framework of operation of an auditing network differs by country. Several auditing organizations operate under the auspices of the ministry of health (19 of 53), the regulatory body (18 of 53) or professional societies (12 of 53), but most are linked to the dosimetry standards laboratories in their countries (33 of 53). Some organizations operate under the umbrella of more than one governmental agency, for example the ministry of health and the regulatory body, and are also supported by professional societies. Others operate within the framework of regulatory systems and are linked to or located in SSDLs. In some cases, audits are organized as part of clinical trial programmes and the auditing organizations are associated with the relevant clinical trial groups. There are 5 audit networks that provide services for institutions involved in clinical trials.

Participation in audits is voluntary for a radiotherapy centre in 29 countries and is mandatory in 16 countries. Usually, the cost of audit is covered by the auditing organization or by a governmental agency; however, in 12 countries radiotherapy centres must cover the costs themselves.

Most auditing organizations report that they have a quality management system, half of them following ISO/IEC 17025 or 9001 standards [3]. Almost all organizations take part in inter-laboratory comparisons between the various audit programmes to verify the quality of the operation of the dosimetry systems used in audits. Such comparisons are typically performed on an annual basis. Some organizations, however, participate in inter-laboratory comparisons with a frequency of 2–3 years.

On most occasions, radiotherapy centres are offered an audit regularly, every 1–2 years, with the frequency depending on the local arrangements. For various reasons, some auditing organizations run audits less frequently, and a few by request only.

As shown in Figure 3, most auditing organizations focus their audit on the dose delivery using high energy photon and electron beams, i.e. 34 of 53 organizations offer the audit for Co-60 beams and 44 organizations for X rays; of these 23 also perform audits of electron beams. Some organizations extend the audit scope to orthovoltage X rays (15 institutions), brachytherapy (13 institutions) and radiosurgery (7 institutions). Eight organizations offer the audit of tomotherapy beams, and there is one organization that audits the beam dosimetry of proton facilities and one that operates audits for dosimetry of boron neutron capture therapy.

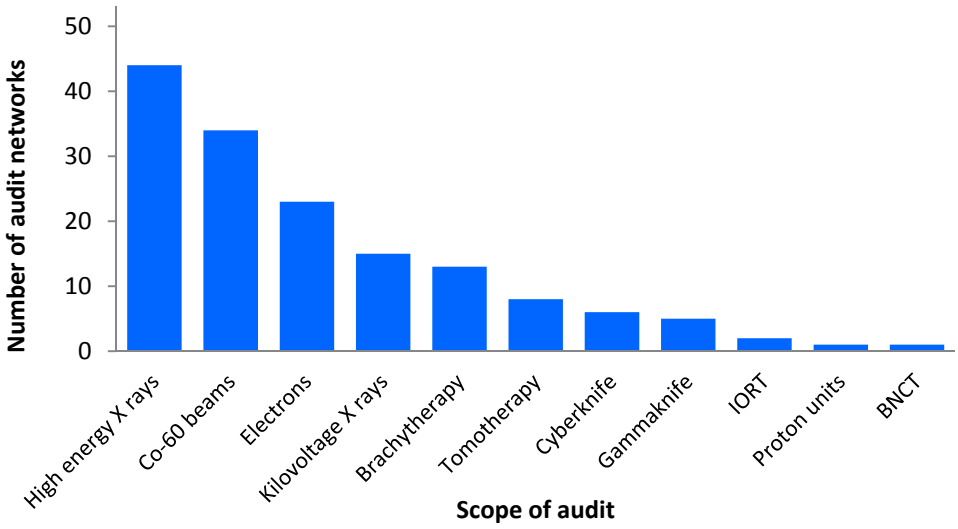


Figure 3: Scope of audit networks.

All organizations offer the basic dosimetry audit in the reference conditions. Audits are also conducted for non-reference conditions; many organizations check the output for the asymmetrical, wedged, oblique, multileaf collimator (MLC) shaped and large open fields. Profiles for open and wedged fields as well as percent depth doses are a part of the audit. There are also tests including the MLC transmission and leaf gap dosimetry. Dosimeter irradiations are typically done in water phantoms but solid phantoms are also in use. Some audits are focused on Treatment Planning System (TPS) calculations for complex beam geometries as 3-D conformal techniques or intensity modulated radiotherapy (IMRT). Such audits are performed using semi-anthropomorphic and anthropomorphic phantoms. For electron beams the audits include: dose measurement at d_{max} and R_{50}, beam output factors for different applicators, extended distance factors, profile measurements (flatness and symmetry) and percentage depth doses.

For remote audits, passive detectors are used, i.e. the most common dosimetry system is based on thermoluminescent dosimeters (TLD), but also films, optically stimulated luminescence dosimeters (OSLD), alanine and radiophotoluminescence dosimeters (RPLD) are used. On-site audits typically use ionization chambers, but passive detectors are also included in such programmes and are irradiated on-site. Occasionally, ionization chambers are sent to audited centres. Overall, most clinical beams (85%) are checked through remote audits.

The summary of information received from 53 auditing organizations helped the IAEA to estimate the number of radiotherapy centres with access to dosimetry audits globally. Figure 4 shows the percentage of radiation therapy centres participating in dosimetry audits operated by the national audit networks and the IAEA/WHO TLD postal dose audit service in the different world regions. Globally, approximately 2/3 (67%) of radiotherapy centres registered in the IAEA Directory of Radiotherapy Centres (DIRAC) [4] have received some level of the dosimetry audit.

The South East Asia region represents the highest level of audit coverage with 96% centres participating in dosimetry audits, which exceeds the world average of 67% significantly. There are over 350 audit participants out of 360 centres operating in the region. They are located in the following countries: Bangladesh, India, Indonesia, Mongolia, Myanmar, Nepal, Sri Lanka and Thailand. There are two audit networks active in South East Asia, one in India and one in Thailand. The Bhabha Atomic Research Centre (BARC) provides audits to 278 centres throughout India and also to 10 centres in neighbouring countries. BARC plays an important role in the provision of audits to the region, as 80% of radiotherapy centres in South East Asia are located in India. The IAEA/WHO supports the national audits in India by providing additional TLDs to BARC for the Indian centres; in the last 10 years more than 100 centres received TLDs from the IAEA Dosimetry Laboratory. The IAEA/WHO also provides audits to other countries in the region, to 50 of 76 centres in total.

In South America and the Caribbean, 94% centres (578 out of 615) have participated in dosimetry audits, which is also substantially higher than the world average. There are four national organizations in this region, located in Argentina, Brazil, Cuba and Ecuador, performing audits for the majority of centres within their countries. In total, they provide audit coverage for more than 50% of centres in South America. The Brazilian National Cancer Institute, INCA [5], offers their services not only in Brazil, but also in neighboring countries. The audits for the remaining centres in the South America region (250 centres) are available mostly through the IAEA in co-operation with the Pan-American Health Organization (PAHO).

In the Eastern Mediterranean region, the percentage of audited centres is also higher (88%) than the world average. There are approximately 160 centres located in Cyprus, Egypt, Islamic Republic of Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Pakistan, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, United Arab Emirates and Yemen. Around half of the centres in the Eastern Mediterranean region have been audited by the IAEA/WHO. There are also six national organizations performing audits for around 70 centers. Two of them (the Pakistan Institute of Nuclear Science and Technology, and the Atomic Energy Organization of Islamic Republic of Iran) are particularly active in the area of dosimetry audits for radiotherapy.

In Africa[1], the percentage of radiotherapy centres participating in the dosimetry audits is 74%, with most audits performed by the IAEA/WHO TLD postal dose audit service. In total, 46 out of 74 centres have participated in the audits. Two national audit networks exist in Algeria [6] and Tanzania, but the scope of their activities is very limited and their effect on the overall auditing statistics is minor. They provide dosimetry audits to less than 10 centres in total. In general, Africa has a low number of radiotherapy facilities per country, in particular in its central part, therefore the infrastructure for establishing national auditing organizations is generally not adequate and the motivation for setting up national auditing systems is low. Efforts are being made to initiate a national audit network for radiotherapy in South Africa, where both the national expertise exists and infrastructure is available. So far, however, South African radiotherapy centres have been using the services of the IAEA/WHO.

In Europe, almost 1100 out of over 1500 centres (73%) have participated in dosimetry audits for radiotherapy. There are twice as many centres in Western Europe as in Eastern Europe. The majority of audits in Western Europe are done by the national organizations of Belgium, Finland, Germany, the Netherlands, Norway, Portugal, Switzerland and United Kingdom, for around 640 centres in total. These are complemented by the Equal-ESTRO laboratory which performs audits for approximately 200 centres including those for French centers and for some centres outside France. In Eastern Europe, a comparable number of audits are carried out by the IAEA/WHO and national audit networks which are located in Bulgaria, Croatia, the Czech Republic [7], Greece, Hungary, Poland [8], Romania, Russia, Serbia, Slovakia, Turkey and Ukraine.

There are two regions with the audit coverage below the world average: North America and the Western Pacific. 65% of all radiotherapy centres in the world are located in these two regions. In North America, a total of 61% of centres have participated in dosimetry audits, whereas in the Western Pacific, only 57% participated.

In North America, there are over 3000 radiotherapy centres, which constitute approximately 40% of the world's centres, and new centres open every year. The RPC, Houston, USA, audits over 60% of the centres in the region. This is one of the organizations, which performs the largest number of audits in the world, together with the IAEA/WHO. The RPC provides audits to about 2000 centres; 87% of which are done nationally and 13% abroad. It should be noted, however, that the information reported here covers the activities of the RPC only. As data on activities of other auditing organizations in the USA have not been made available through the survey, there is reason to believe that the actual percentage (number of centres) audited in North America is higher than reported here.

In the Western Pacific region, only 57% of centres have undergone any type of dosimetry audit. In almost every country with radiotherapy centres in this region, national organizations provide an audit service (Australia, China, Japan [9], Malaysia, New Zealand, Philippines, Republic of Korea, Singapore and Vietnam). The Western Pacific is the region with the second highest number of radiotherapy centres in the world (approximately 2300); most of them are located in China and in Japan. The IAEA/WHO complements national efforts by performing audits for around 400 centres in this region, mostly in of China, Malaysia, Papua New Guinea, Philippines, and Vietnam.

[1] *In accordance with the WHO definition of the world regions some North African countries are included in the Eastern Mediterranean region. These are Egypt, Libya, Morocco, Sudan and Tunisia.*

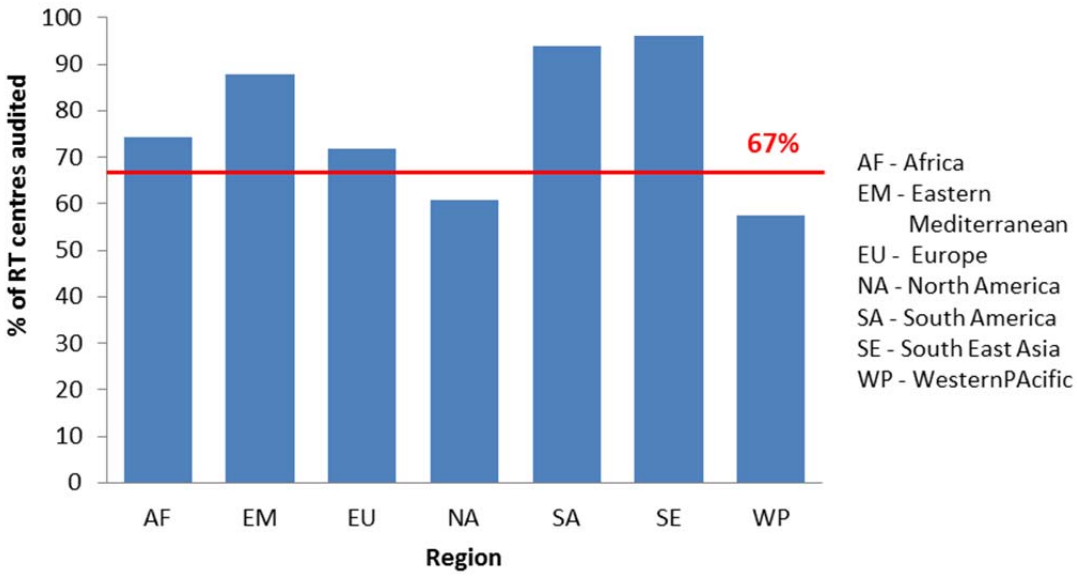


Figure 4: Percentage of radiotherapy centres having participated in a dosimetry audit in the various world regions.

Conclusion

Although several national dosimetry audit networks exist, the current access of world radiotherapy centres to the audit is still insufficient. About 1/3 of world centres operate radiotherapy services without their beams having been checked by an independent body, which may constitute potential risks for safety and effectiveness of cancer treatments. Many new facilities come into existence every year, and the demand for a dosimetry audit significantly exceeds the current capabilities of the dosimetry audit networks operating in the various regions. Despite the large number of audits conducted in the regions, the audit provision is still insufficient. In several countries, the national regulations do not obligate radiotherapy centres to participate in a dosimetry audit, neither to licence new facilities nor to renew such licences. Participation in the audit is voluntary for centres in these countries and the motivation to participate is mostly driven by the need to execute good dosimetry practices in accordance with the principles of quality assurance in radiotherapy. Where national regulations do not exist, the setting up of a national audit network may be difficult due to the lack of or insufficient support from the relevant governmental agencies. Better availability of dosimetry auditing is necessary for improving dosimetry practices in radiotherapy and also in order to increase the safety of patients undergoing radiation treatments.

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Revision and Update of the SSDL Network Charter

Report of a consultants' meeting

IAEA, Vienna
19–23 November 2012

Consultants: Penelope Allisy-Roberts (former Director of the BIPM's Ionizing Radiation Department, France), Ralf-Peter Kapsch (Physikalisch-Technische Bundesanstalt, Braunschweig, Germany), Antti Kosunen (Radiation and Nuclear Safety Authority, Finland), Ken R Shortt (former Head of IAEA DMRP section, Canada), Zakithi Msimang (National Metrology Institute of South Africa, South Africa)

Scientific Secretary: Igor Gomola, DMRP, IAEA

In 1976, the International Atomic Energy Agency (IAEA), together with the World Health Organization (WHO), established a network of Secondary Standard Dosimetry Laboratories (SSDLs), known as the IAEA/WHO SSDL network. This network, through SSDLs designated by Member States, provides the link between users and primary standards, mainly for countries that are not members of the Metre Convention. The network presently consists of 84 laboratories in 68 Member States, more than half of which are developing countries. The SSDL network also includes 20 affiliated members, mainly the Bureau International des Poids et Measures (BIPM), several national Primary Standards Dosimetry Laboratories (PSDLs), the International Commission for Radiation Units (ICRU) and other international organizations.

The main function of an SSDL is to provide calibration services, including the dissemination of information on calibration procedures, and practical help to users on instruments used in their particular application. SSDLs with appropriate facilities and expertise can provide a range of additional services, such as: (i) Dosimetry comparisons for medical institutions within a country or region (using TLD, ion chambers or on-site visits), (ii) Reference irradiations for personal radiation dosimeter services, (iii) Advise users on quality assurance matters, (iv) National training courses in radiation measurement and calibration techniques and use and maintenance of the instrumentation.

Membership of the IAEA/WHO SSDL network is open to laboratories designated by their national competent authority. The privileges, rights and duties of members in the network, the network functions, and the scope of the work of the SSDLs are specified in the SSDL Network Charter, published in 1999 [1].

The worldwide globalization of research, development and trade required to apply new metrological approaches among National Metrology Institutes (NMIs). In 1999, the directors of NMIs of 38 Member States of the Metre Convention and representatives of international organizations, including the IAEA, signed the Mutual Recognition Arrangements (MRA) under the auspices of the International Committee for Weights and Measures (CIPM) [2]. The IAEA, although not holding primary standards, is an active participant in CIPM MRA related activities through Regional Metrology Organization (RMO) key comparisons and CCRI supplementary comparisons. The IAEA Calibration and Measurement Capabilities (CMCs) in the field of dosimetry were published in the BIPM key comparison database (KCDB) in 2001 and revised in 2007. One of the duties of IAEA regarding the SSDL network is the organization of laboratory comparisons between the IAEA and the SSDL network members. During the 2009 CCRI meeting, the IAEA asked the BIPM to look for a way to connect the SSDL network comparisons with the CIPM MRA comparisons and if possible to register these in the KCDB.

At the time of the publishing of the SSDL Network Charter there was no internationally accepted standard for laboratory quality systems that could provide a globally accepted basis for accreditation. The demonstration of the competence of calibration laboratories is achieved through comparisons and through the establishment of a quality system that meets the requirements of the ISO 17025, published in 2005 [3]. Most SSDLs have some system in place for assuring quality, although it might not be formally documented, or compliant with the ISO17025. The Scientific Committee which advises the Network Secretariat recommended revising and updating the SSDL Network Charter to reflect the recent trends and developments in the me-

trology of ionizing radiation applicable at the level of the SSDL network members [4].

From 19 to 23 November, a consultants' meeting was held at the IAEA Headquarters with the purpose of reviewing and updating the SSDL Network Charter in the following areas: (i) Relation between the IAEA/WHO network of SSDLs and the MRA, (ii) Quality management systems at SSDLs, (iii) IAEA/WHO SSDL network programme ,(iv) Guidelines to Member States on the designation of SSDLs, (v) Criteria for establishing an SSDL for the IAEA/WHO network of SSDLs, (vi) Roles and Duties of the SSDLs, (vii) Conditions of membership (viii) Role of affiliated members and collaborating organizations.

The updated version of the SSDL Network Charter contains five sections: 1) The Secondary Standards Dosimetry Laboratory Network and its measurement traceability, 2) Membership in the IAEA/WHO SSDL network and its benefits, 3) Scope of the work of SSDLs, 4) Duties of the SSDLs in the IAEA/WHO SSDL network, 5) Conclusions. The consultants proposed reducing the appendices from 11 to 2 and updating the IAEA website with pages on the (i) History of the SSDL network, (ii) Short history on radiation metrology, (iii) Composition and role of the SSDL scientific committee.

The updated version of the SSDL Network Charter has taken into account the lessons learned since the first Charter was established, the CIPM MRA that has reinforced the international measurement system, and the ISO/IEC Standard 17025 related to quality management systems. By clearly explaining the duties and responsibilities of the SSDLs in order to obtain the privileges of being a network member, the updated Charter should assist the Member States in obtaining and maintaining membership status for their secondary standards dosimetry laboratories. In working together, all the parties of the network gain confidence in the international measurement system for dosimetry, ensure traceability of their standards, and properly disseminate dosimetric quantities and practices to the end users. This should enable dosimetry in the use of radiation medicine and industrial applications to be consistent throughout the world. This will also assure each Member State's population that the man-made contribution to their radiation dose is measured appropriately for the particular application, whether therapeutic, diagnostic, occupational or public safety.

The draft of the document will be sent to the SSDL network members in order to seek their feedback. The comments received from the SSDLs will be consolidated and implemented into the final version of the SSDL Network Charter.

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Courses, Meetings and Consultancies in 2013

Courses and workshops

Regional Training Course on Quality Assurance of Physical and Technical Aspects in Radiotherapy, Argonne National Laboratory, United States of America, 18 February–1 March 2013

IAEA/ ESTRO Training Course on Dose Modelling and Verification for External Beam Radiotherapy (RER/6/023), Florence, Italy, 10–14 March 2013

Regional Training Course on Quality Assurance of Radiotherapy Treatment Planning (RER/6/025, course for Russian-speaking participants), Moscow, Russia, 18–29 March 2013

Regional Training Course on Dosimetry and Quality Assurance of External Beam Radiotherapy (RER6/025, course for Russian-speaking participants) Moscow, Russia, 1–12 April 2013

RAS6/053 Regional Training Course on Image Based Radiotherapy and QA for Lung and Gastrointestinal Cancer, Thailand, 6–10 May 2013

RAF6/044: Development of a Harmonised Regional Clinical Training Model for Medical Physics, Algeria, 3–7 June 2013

RAS6/068 Regional Training Course on HDR Brachytherapy, Qatar, 13–17 June, 2013

IAEA/ESTRO Training Course on Advanced Imaging for Physicists (RER/6/023), Vienna, Austria, 8–12 September 2013

RAS6/062 Regional Training Course on 3-D Image Guided Brachytherapy, Thailand, 7–11 October 2013

RAF6045/6044 Regional (AFRA) Training Course on Transitioning from 2-D to 3-D CRT, South Africa, 21–25 October 2013

IAEA/ICTP Course on Accuracy Requirements and Uncertainty in Radiotherapy for Medical Physicists, Italy, 9–13 December 2013

Meetings and consultancies

RAF6/038 Task Force meeting to review and finalise requirements for academic programme and clinical training in nuclear medicine and radiology, Vienna, Austria, 4–6 February 2013

RAF6/044 Development of a harmonised regional academic syllabus for medical physics, Vienna, Austria, 8–12 April 2013

Consultants' Meeting to review the status of brachytherapy dosimetry, Vienna, Austria, 27–31 May 2013

RAF6/044 Development of a harmonised regional clinical training model for medical physics, Algeria, 3-7 June 2013

1st RCM on the CRP in treatment related uncertainties in radiotherapy, Vienna, Austria, 26-30 August 2013 (tentative)

Consultants' Meeting to develop training material on the transition from 3-D to 3-D brachytherapy, Vienna, Austria, 2–6 September 2013 (tentative)

RAF6/044: Development of logbooks to support medical physics clinical training programmes in the region, Ethiopia, 30 September–4 October 2013

Technical Meeting on harmonizing quality audit in radiotherapy and promoting the concept of audits in Member States, Vienna, Austria, 16–18 December 2013

Research Coordination Meeting (RCM) for the Coordinated Research Project (CRP) on the development of quality audits for advanced technology in radiotherapy dose delivery, Vienna, Austria, 16–20 December 2013

International Recognition Group for evaluation of national dosimetry audit activities and recommendations on the dosimetry audit programmes, Vienna, Austria (dates to be decided)

Research Coordination Meeting (RCM) for the Coordinated Research Project (CRP) on “Enhancing capacity for early detection and diagnosis of breast cancer through imaging”, (place and dates to be decided)

Research Coordination Meeting (RCM) for the Coordinated Research Project (CRP) on the “Development of quantitative nuclear medicine imaging for patient specific dosimetry”, Vienna, Austria (dates to be decided)

Research Coordination Meeting (RCM) for the Doctoral Coordinated Research Project (Doctoral CRP) on “Advances in medical imaging techniques”, Vienna, Austria (dates to be decided)

Consultancy on the IAEA/WHO computerized Directory of Radiotherapy Centres (DIRAC), Vienna, Austria (dates to be decided)

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