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Contents

Participants of the Regional Workshop on X ray Dosimetry
IAEA Dosimetry Laboratory, Seibersdorf, 27–29 March 2007

From the editor

This issue of the SSDL Newsletter contains a meeting report, a workshop report and two brief notes on recently published IAEA guidance documents.

The first is a summary report of a Task Force Meeting on transition to 3-dimensional (3-D) treatment planning in radiotherapy. The report was prepared during a one week meeting held at the IAEA's Headquarters in June 2007, under the regional project RAF/6/031, and is addressed to African Member States who are considering the transition from 2 to 3-D treatment planning. The self-assessment questionnaire included in the report can be used to assess the readiness of radiotherapy centres intending to implement 3-D treatment planning. It should be noted that an IAEA publication (TECDOC) which deals with this topic is under preparation.

The workshop report highlights the work done by five participants from Secondary Standards Dosimetry Laboratories in Africa in the field of X ray dosimetry for the calibration of radiation protection instruments.

Next, two recently published documents, IAEA-TECDOC-1543 on On-site Visits to Radiotherapy Centres: Medical Physics Procedures and IAEA-TECDOC-1540 on Specification and Acceptance Testing of Radiotherapy Treatment Planning Systems are presented.

Finally, the Dosimetry and Medical Radiation Physics Section welcomes a new staff member: Stig Palm from Sweden, who is a clinical medical physicist in nuclear medicine.

IAEA International Atomic Energy Agency

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

International Atomic Energy Agency, Wagramer Strasse 5, P.O. Box 100, A-1400 Vienna, Austria
Telephone: (+43-1) 2600+extension; Fax: (+43-1) 26007, e-mail:Official.Mail@iaea.org

Name	*Position/tasks*	*E-mail address*	*Extension*
Shortt, Ken	Section Head	k.shortt@iaea.org	21662
Bera, Pranabes	Senior Laboratory Technician, TLD	p.bera@iaea.org	28330
Czap, Ladislav	Senior Laboratory Technician Ionization chamber calibration	l.czap@iaea.org	28332
Girzikowsky, Reinhard	Senior Laboratory Technician High dose and mammography	r.girzikowsky@iaea.org	28328
Izewska, Joanna	TLD Officer, Head, Dosimetry Laboratory Unit	j.izewska@iaea.org	21661
McLean, Ian Donald	Medical Radiation Physicist Diagnostic Radiology	i.mclean@iaea.org	21663
Meghzifene, Ahmed	SSDL Officer Editor, SSDL Newsletter	a.meghzifene@iaea.org	21653
Palm, Stig Harald	Medical Radiation Physicist	s.palm@iaea.org	21659
Vatnitsky, Stanislav	Medical Radiation Physicist Treatment planning systems	s.vatnitsky@iaea.org	21660
Flory, Rosemary	Secretary	r.flory@iaea.org	21662
Danker, Sabine	Secretary/Clerk	s.danker@iaea.org	21665
Barrios, Lucille	Secretary	l.barrios@iaea.org	21634
DMRP Section		Dosimetry.Contact-Point@iaea.org *	21662

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

SERVICES PROVIDED BY THE IAEA IN DOSIMETRY AND MEDICAL RADIATION PHYSICS

The IAEA's Dosimetry and Medical Radiation Physics Section focuses on services provided to Member States through the IAEA/WHO SSDL Network and on a system of dose quality audits. The measurement standards of Member States are calibrated, free of charge, at the IAEA's Dosimetry Laboratory. The audits are performed through the IAEA/WHO TLD postal dose assurance service for SSDLs and radiotherapy centres.

The IAEA Calibration and Measurement Capabilities (CMCs) have been reviewed and published in the CIPM's (Comité International des Poids et Mesures) Appendix C. The Dosimetry Laboratory's Quality Management System has been reviewed and accepted by the Joint Committee of the Regional Metrology Organizations and the BIPM (JCRB). Confidence in the calibration services is strengthened as a result of the Dosimetry Laboratory's participation in international comparisons.

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

The range of services is listed below.

Services	*Radiation quality*
Calibration of ionization chambers (radiotherapy, diagnostic radiology including mammography and radiation protection, including environmental dose level)	X rays (10–300kV) and gamma rays from ^{137}Cs and ^{60}Co
Calibration of well type ionization chambers for low dose rate (LDR) brachytherapy	γ rays from ^{137}Cs
Comparison of therapy level ionization chamber calibrations (for SSDLs)	γ rays from ^{60}Co
TLD dose quality audits for external radiotherapy beams for SSDLs and hospitals	γ rays from ^{60}Co and high energy X ray beams
TLD dose quality audits for radiation protection for SSDLs	γ rays from ^{137}Cs
Reference irradiations to dosimeters for radiation protection	X rays (40–300 kV) and γ rays from ^{137}Cs and ^{60}Co beams

Member States who are interested in these services should contact the IAEA/WHO SSDL Network Secretariat for further details, at the address provided below. Additional information is also available through the Internet at the web site: http://www-naweb.iaea.org/nahu/dmrp/ssdl.asp.

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

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

Guidelines for radiation oncology centres in AFRA Member States intending to make a transition from 2-D to 3-D treatment planning and delivery

A. Meghzifene
Dosimetry and Medical Radiation Physics Section
Division of Human Health, Department of Nuclear Sciences and Applications
IAEA

The IAEA Regional Technical Cooperation Project RAF/6/031 on Medical Physics in Support of Cancer Management aims to strengthen national and regional medical physics capabilities to sustain radiotherapy treatments in the AFRA[1] Member States. In particular, it aims at increasing the number of qualified medical physicists in the region as well as improving the level of medical physics by establishing regional training and continuous development programmes.

Eighteen National Project Coordinators (NPCs) nominated by participating AFRA Member States are engaged in the project.

RAF/6/031 was approved by the IAEA in 2005 for an initial five year duration. A coordination meeting is held every two years where the NPCs and IAEA Technical and Project Management Officers establish the project's training and development programmes.

During the first coordination meeting at Cape Town in November 2005, it was decided to convene a Task Force Meeting to review the status of treatment planning in radiotherapy in AFRA Member States and prepare a guidance document on the transition from 2-D to 3-D treatment planning. This Task Force Meeting took place at the IAEA's Headquarters in Vienna on 23–26 April 2007.

The resulting guidance document highlights the milestones that have to be achieved by radiotherapy centres routinely implementing 2-D computerized treatment planning before making a transition to 3-D treatment planning and delivery. The implementation of 3-D planning by radiotherapy centres that have not yet met these milestones could lead to serious mistakes in treatments.

A self-assessment questionnaire was also prepared during the Task Force Meeting. Member States that are planning to make a transition to 3-D planning are advised to assess their existing capabilities through this questionnaire. The same questionnaire could also be useful for the IAEA staff and external experts when assessing the readiness of a radiotherapy centre to make a safe and effective transition to 3-D radiotherapy planning.

The members of the Task Force Meeting who drafted the guidance document were: Abdelkader Toutatoui (Algeria), Stefaan Vynckier (Belgium), Kwaku Nani (Ghana), Ahmed Ibn Seddik (Morocco), Hennie Smit (South Africa), Mulugetta Amha (Programme Management Officer, IAEA), and Ahmed Meghzifene (Technical Officer, IAEA).

Stanislav Vatnitsky, Branislav Jeremic and Eduardo Zubizarreta of the Division of Human Health, IAEA, helped in the review of the document and provided valuable suggestions to improve it.

In addition, the IAEA wishes to acknowledge the valuable suggestions and comments provided by Wilhelm Groenewald (South Africa), Debbie van der Merwe (South Africa), Jan Hough (South Africa), Omer Ali (Sudan) and Eugene Ampion (Democratic Republic of the Congo).

[1] African Regional Cooperative Agreement for Research, Development and Training related to Nuclear Science and Technology.

QUESTIONNAIRE FOR RADIATION ONCOLOGY CENTRES INTENDING TO MAKE A TRANSITION FROM COMPUTERIZED 2-D TO 3-D TREATMENT PLANNING

The objective of this questionnaire is to assess the readiness of radiation oncology centres to implement 3-D treatment planning in clinical use. It is assumed that these centres have acquired sufficient experience in computerized 2-D treatment planning and appropriate equipment, and established a comprehensive QA programme as recommended in the IAEA-TECDOC-1040 on Design and Implementation of a Radiotherapy Programme: Clinical, Medical Physics, Radiation Protection and Safety Aspects.

1. GENERAL CENTRE INFORMATION

a. Name of centre:

b. Type of centre (university hospital, general hospital, etc.):

☐ Private	☐ Public	☐ General hospital
☐ University	☐ Cancer centre	☐ Other *(please specify)*

c. Number of new cases seen/treated per year:

d. Ratio — palliative/curative:

e. Most frequent treatment sites:

f. Existing diagnostic and treatment protocols at the level of the hospital:

g. Date of starting radiotherapy:

h. Date of planned transition to 3-D:

2. PERSONNEL

List the experience of the staff working in the centre

Job title	Number	Basic qualifications	Number of years experience in radiotherapy	Experience or training with 3-D radiotherapy	
				Nature	Duration
Radiation oncologist					
Medical physicist					
Dosimetrist					

Therapy radiographer					
Mould room technician					

3. TRAINING

Is there a programme for providing continuous education?

Job title	YES	NO	DETAILS (if yes)
Radiation oncologist	☐	☐	
Medical physicist	☐	☐	
Dosimetrist	☐	☐	
Therapy radiographer	☐	☐	
Mould room technician	☐	☐	

4. EQUIPMENT

List the equipment available in the centre

Equipment	Yes/Qty./Model	No
Cobalt-60		
LINAC		
MLC		
EPID		
Simulator		
Conventional		
CT SIM		
CT scanner		
Diagnostic, adapted for radiotherapy		
Radiotherapy dedicated		
Lasers		
Block cutter		
Access to 3-D water phantom		
TPS, manufacturer, model, version		
Local radiotherapy network		
Positioning and immobilization devices: Are they used? For which treatment sites?		
Beam shaping and modifiers:		

Are they used? For which treatment sites? Coding system used?		

5. TREATMENT PLANNING SYSTEM

a. In your centre, who prepares the treatment plans: ☐ Dosimetrist ☐ Physicist?

b. In your centre, who supervises the treatment planning?.....

c. Was a specification document used for the acquisition of the TPS? ☐ Yes ☐ No
If yes, which document was used for the preparation? ……

d. Who prepared the document? ……..…..

e. Is the present TPS capable of 3-D calculations and display? ☐ Yes ☐ No
If yes, specify the algorithm: ……....…..

f. Patient data acquisition mode available: …….....

g. If patient data is obtained by CT scanner, specify the mode and format of transfer:

h. Does the centre have access to other imaging modalities (MRI, US, PET, etc.)?
☐ Yes ☐ No

i. If yes, specify which one: ……....

j. Is image fusion (registration) available? …….....…..…

k. Is it possible to register contrast and non-contrast CT?.....

l. Is there documented evidence of verification of measured vs. calculated beam data?.....

6. QUALITY ASSURANCE

a. Is there in place an implemented QC programme for the CT scanner? ☐ Yes ☐ No
If yes, following which recommendations? ……..……....

b. Which QC tools for CT Scan are available? …….....

c. Is there a QC programme for data transfer? …….....

d. Is there a QC programme for TPS being implemented? ☐ Yes ☐ No
If yes, which recommendations does it follow? ……...…

e. Are there any available QC tools for the TPS? ☐ Yes ☐ No

f. Is there a preventive maintenance programme in place? ☐ Yes ☐ No

g. Is the TPS under a maintenance contract: ☐ Yes ☐ No
If yes, ☐ Hardware ☐ Software.

h. How is the treatment planning system backed up?.....

7. PROTOCOLS

a. Is there a protocol for volume delineation? ☐ GTV, ☐ CTV, ☐ PTV, ☐ OAR,

b. Dose prescription specifications follow ICRU reports? ☐ Yes ☐ No

c. If yes, which ones? ……

d. Is there a protocol for treatment planning? ☐ Yes ☐ No

e. Is there a protocol for patient identification? ☐ Yes ☐ No

8. TREATMENT DELIVERY AND VERIFICATION

a. Are Portal images used? ☐ Yes ☐ No. If yes, for which cases? ……

b. Is *in vivo* dosimetry implemented ☐ Yes ☐ No. If yes, for which cases? ……..

c. Is an RV network available? ☐ Yes ☐ No. If yes, which model and version? …...…

d. Machines connected to RV: ……....

Regional Workshop on X ray Dosimetry

A. Meghzifene, L. Czap, R. Girzikowsky
Dosimetry and Medical Radiation Physics Section
Division of Human Health, Department of Nuclear Sciences and Applications
IAEA

The use of operational quantities for personnel dosimetry is recommended [1]. In order to verify proper implementation of these operational quantities, the IAEA has been organizing regional intercomparison exercises among dosimetry service providers. In support of these comparisons, reference irradiations are provided by Secondary Standards Dosimetry Laboratories (SSDLs). In Africa, the dosimetry comparison exercise is organized under the Technical Cooperation Regional Project RAF/9/032 under AFRA[2] entitled *Development of Technical Capabilities for the Protection of Health and Safety of Workers Occupationally Exposed to Ionizing Radiation*, which included ^{137}Cs and selected ISO-4037 [2] X ray beam qualities.

Five SSDLs in the Africa Region have been identified as technical back-up for the dosimetry comparison exercise, providing reference irradiations to the countries participating in the Hp (10) comparison exercise. The SSDLs are from Algeria, Ethiopia, Ghana, South Africa and the United Republic of Tanzania.

In order to verify the SSDLs' capability to provide reference irradiations for the comparison exercises, the IAEA organized a TLD audit to check the calibration capabilities of the SSDLs in a ^{137}Cs beam. The results obtained by all five SSDLs were within the 5% acceptance limit.

For X ray beams, two ionization chambers (EXRADIN type) were first calibrated at the IAEA Dosimetry Laboratory and the Austrian Primary Dosimetry Laboratory in the ISO 4037 X ray beams followed by calibration at each SSDL's ISO 4037 radiation qualities. The calibration coefficient for each beam quality was compared with that of the IAEA. One SSDL (Tanzania) could not participate in this exercise due to the breakdown of its X ray equipment. The stability of the ionization chambers was monitored with repeated calibrations in the IAEA ^{137}Cs beam. The IAEA calibration coefficients of the Exradin chamber type were within 0.7% during the period of the comparison (about two years). The IAEA-BEV results agree within 1.5% for both chambers for the ISO-4037 selected beam qualities.

Results from the IAEA SSDLs revealed deviations up to 18% for some beam qualities. One SSDL provided results that deviated from IAEA measurements by one order of magnitude. The reasons for the large deviations are mainly due to lack of traceability, incorrect beam qualities and the probable wrong use of the electrometer calibration factor (for one SSDL).

In consideration of the results obtained during the comparison, it was decided to hold a workshop at the IAEA Dosimetry Laboratory in Seibersdorf on 27–29 March 2007. The contact person at each participating SSDL was invited to attend the workshop and was asked to bring along the reference instrument for calibration or comparison at the IAEA Dosimetry Laboratory. All five SSDLs participated in the workshop and conducted X ray measurements, including half-value layer determinations. A follow-up comparison will be organized next year.

A workshop participant setting up an ionization chamber.

A workshop participant checking the positioning of an ionization chamber.

[2] African Regional Cooperative Agreement for Research, Development and Training related to Nuclear Science and Technology.

References

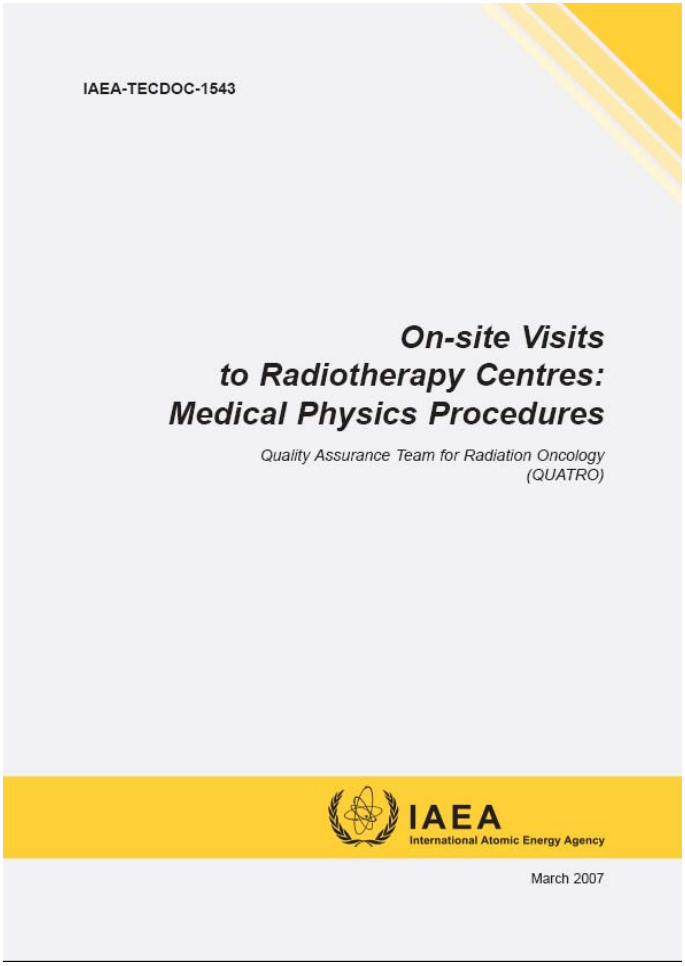
[1] INTERNATIONAL COMMISSION ON RADIATION UNITS AND MEASUREMENTS, Determination of Dose Equivalents resulting from External Radiation Sources" – Part 1, Rep. ICRU-39, Bethesda, MD (1985).

[2] INTERNATIONAL ORGANIZATION FOR STANDARDIZATION, X and Gamma Reference Radiation for Calibrating Dose Meters and Dose Rate Meters and for Determining their Response as a function of Photon Energy – Characteristics of the Radiations and their Methods of Production, ISO Standard 4037-1, Geneva (1995).

A new IAEA publication

IAEA-TECDOC-1543, On-Site Visits to Radiotherapy Centres: Medical Physics Procedures

Quality Assurance Team for Radiation Oncology (QUATRO)



The IAEA has a long standing history of providing support and assistance for radiotherapy dosimetry audits in Member States, for educating and training radiotherapy professionals, and for reviewing the radiotherapy process in a variety of situations.

The IAEA/WHO TLD service aims at improving the accuracy and consistency of clinical radiotherapy dosimetry worldwide. Detailed follow-up procedures have been implemented for rectifying incorrect beam calibrations. When necessary, on-site visits by IAEA experts in radiotherapy physics are organized to identify and resolve dosimetry problems in hospitals. The IAEA has also been requested to organize expert missions in response to problems found during the radiation treatment planning process. Assessment of the doses received by affected patients, including medical assessment, was undertaken when appropriate.

Although vital to the radiotherapy process, accurate beam dosimetry and treatment planning alone cannot guarantee the successful treatment of a patient. Quality assurance (QA) of the entire radiotherapy process has to be taken into account. Hence, a new approach has been developed and named Quality Assurance Team for Radiation Oncology (QUATRO). The principal aim of QUATRO is to review the radiotherapy process, including the organization, infrastructure, clinical and medical physics aspects of the radiotherapy services. It also includes reviewing the hospital's professional competence, with a view to quality improvement. The QUATRO methodology is described in the IAEA publication entitled *Comprehensive Audits of Radiotherapy Practices: A Tool for Quality Improvement*.

QUATRO, in addition, offers assistance in the resolution of suspected or actual dose misadministrations in radiotherapy (over and under-exposures). It includes the follow-up of inconsistent results detected with the IAEA/WHO TLD postal service and helps Member States at a very early stage in the problem-solving process, focusing on prevention of incidents or accidents in radiotherapy. The structure and systematic approach of QUATRO, combined with its low key problem-solving mode, provide a complement to the operations of the IAEA Response and Assistance Network which deals with nuclear and radiological accidents and emergencies through the 'Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency'.

QUATRO involves audits — both *proactive*, i.e. comprehensive reviews of the radiotherapy practice, and *reactive*, i.e. focused investigations in response to suspected or actual incidents during radiotherapy.

This IAEA-TECDOC describes the audit technique for medical physics aspects of the operation of radiotherapy hospitals. The audit methodology was developed by a group of international experts through a series of IAEA consultants meetings conducted from 1999 to 2005, with Scientific Secretaries: a) Joanna Izewska – for

standardized procedures for resolving discrepancies in radiotherapy dosimetry, and b) Stanislav Vatnitsky – for the methodology for auditing of clinical treatment planning. The IAEA Officer responsible for the publication is Joanna Izewska of the Division of Human Health.

The document is available in hardcopy as well as on-line at the IAEA website:

http://www-pub.iaea.org/MTCD/publications/PDF/te_1543_web.pdf.

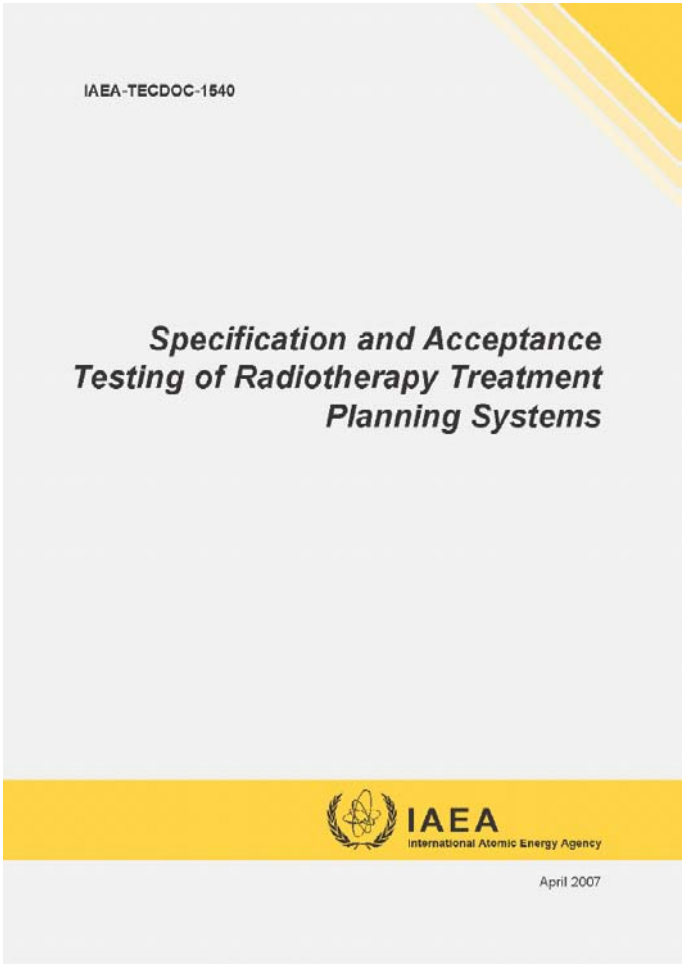
A new IAEA publication

IAEA-TECDOC-1540, Specification and Acceptance Testing of Radiotherapy Treatment Planning Systems: New IAEA Guidelines for Manufacturers and Users

Quality assurance (QA) in the radiation therapy treatment planning process is essential to ensure accurate dose delivery to the patient and to minimize the possibility of accidental exposure. The computerized radiotherapy treatment planning systems (RTPSs) are now widely available in industrialized and developing countries and it is of special importance to support hospitals in Member States in developing procedures for acceptance testing, commissioning and QA of their RTPSs. Responding to these needs, a group of experts developed an IAEA document that was published in 2004 as IAEA Technical Reports Series No. 430. This document provides a general framework and describes a large number of tests and procedures that should be considered by the users of new RTPSs. However, small hospitals with limited resources or large hospitals with high patient load and limited staff are not always able to perform complete characterization, validation and software testing of the algorithms used in RTPSs.

The IAEA-TECDOC-1540 on Specification and Acceptance Testing of Radiotherapy Treatment Planning Systems was developed under the framework of the IAEA coordinated research project on Development of procedures for quality assurance for dosimetry calculations in radiotherapy to provide a step-by-step recommendation for users at hospitals or cancer centres on how to implement acceptance procedures for newly purchased RTPSs. The IAEA-TECDOC used as its basis the International Electrotechnical Commission (IEC) standard IEC 62083, "Requirements for the safety of radiotherapy treatment planning systems".

Acceptance testing relates to the evaluation by the purchaser of a new RTPS — that the RTPS meets the specifications as defined by the user and/or the manufacturer. While acceptance testing is a well defined and standardized process for the purchase of other radiation therapy equipment, it is not nearly as clear cut for RTPSs. For example, with the purchase of a linear accelerator, the purchaser and manufacturer agree on a set of specifications (frequently defined by the manufacturer), and then the manufacturer installs the linear accelerator. Prior to the machine being signed off and handed over to the purchaser, a detailed set of tests is performed to demonstrate to the purchaser that the machine complies with all the specifications agreed to prior to the purchase.



However, in the case of RTPSs, a true assessment of the capabilities and limitations of the dose calculation algorithm cannot be performed until the user has performed measurements and entered the measured data into the RTPS. Because of the length of time it takes to commission a specific photon or electron beam, proper acceptance cannot be performed until long after the vendor has installed the RTPS and left the user's facility.

Consequently, the process of acceptance of an RTPS had evolved into a simple process of cataloguing that the hardware and software components of the treatment planning system were delivered and installed at the user's site and testing of the system to demonstrate that the various components of the software are operational. Unfortunately, this process would not provide evidence that the software meets the specifications that have been defined by the manufacturer or the user at the hospital or by both.

IAEA-TECDOC-1540 serves as a protocol to be used by both manufacturers and users for the specification and acceptance testing of RTPSs. Recommendations are provided in this report for specific tests to be performed at the manufacturing facility and acceptance tests to be performed at the user's site. The IAEA-TECDOC refers heavily to IEC 62083 since it is a specific standard for manufacturers of RTPSs. It uses the description of the tests directly from the IEC 62083 standard and the terms 'type test' and 'site test':

Type test: *"For a particular design of device or EQUIPMENT, a TEST by the MANUFACTURER to establish compliance with specified criteria."*

Site test: *"After installation, TEST of an individual device or EQUIPMENT to establish compliance with specified criteria." "Note: The recommended replacement is ACCEPTANCE TEST."*

Section 5 of the IAEA-TECDOC includes the type tests that are summarized by IEC 62083 and are to be performed by the manufacturer prior to the delivery of the RTPS to the purchaser's institution. During the process of acceptance testing at the user's site, the manufacturer must
demonstrate, as outlined in Section 5, that these tests have been performed and must include the corresponding results of these tests where relevant. As part of acceptance testing the user should inspect the completed Section 5 and the accompanying documentation provided by the manufacturer.

Section 6 contains a subset of tests from Section 5, which need to be repeated with the user's specific RTPS at the time of its acceptance testing in the user's department. These tests serve two important purposes. Firstly, the tests will demonstrate to the user that the results using the hardware and software as installed at the user's site are consistent with the type tests performed by the manufacturer at the factory. Section 6 represents a set of tests that must be performed by the installer and the user together at the hospital to ensure acceptability of the RTPS. Secondly the tests will provide an educational opportunity for the user to participate in the operation of the RTPS.

Section 7 provides an additional/optional set of tests that may be performed at the user's site. However, the specific optional tests that the user wishes to have done should be defined in advance of the acceptance testing process, ideally as part of the purchase process, to avoid debate about the number of tests to be performed.

Although sections 5, 6, and 7 list multiple dose calculation tests, the IAEA-TECDOC is limited to photon beam treatment considerations only, i.e. electron beam acceptance testing procedures are not provided in this document but might become an independent document in the future. The dose calculation tests are based on a set of test
configurations originally developed by the AAPM TG23 for purposes of testing RTPS photon dose calculation algorithms. In the IAEA document, new sets of data for 6 MV, 10 MV, and 18 MV X ray beams from Elekta linear accelerators are used as the input data and test case results are attached to the document on a separate CD-ROM. Recognizing that cancer centres in the developing world make significant use of cobalt-60 gamma ray beams, an additional similar data set for cobalt-60 radiation as the input data and test case results is also attached to this document on the CD-ROM. Prior to publication, the IAEA protocol was distributed to RTPS manufacturers and their comments and suggestions were included in the final version.

In spite of its specific scope, IAEA-TECDOC-1540 is useful to the purchasers of RTPSs in any country. However, performing tests beyond those described in this report may be required to meet the needs of specialized techniques that have not been addressed here. The manufacturers are expected to prepare the set of type test results and submit them to the user at the hospital prior to the installation. By following the IAEA-TECDOC-1540 guidelines, the user will acquire the initial knowledge of the algorithms used in the system and be able to check their accuracy. This will be done through inspection of the type tests results and confirmed with the vendor during the demonstration of the RTPS performance for specific site tests. Using pre-installed beam data, the vendor will show the user that similar results can be obtained on-site, compared to the factory type tests results. Possible limitations of the algorithms could be also demonstrated and discussed.

The document is available in hardcopy as well as on-line at the IAEA website:

http://www-pub.iaea.org/MTCD/publications/PDF/te_1540_web.pdf.

IAEA COURSES, MEETINGS AND CONSULTANCIES IN 2007

Courses and workshops

IAEA/ESTRO Teaching Course on Radiotherapy Treatment Planning Principles and Practice (RER/6/015), Dublin, Ireland, 25–29 March

IAEA/ESTRO Teaching Course on Dose Calculation and Verification for External Beam Therapy (RER/6/015), Budapest, Hungary, 29 April–3 May

IAEA/ESTRO Teaching Course on 3-D Planning and Imaging – Russian edition (RER/6/015 and RER/6/0/16), St. Petersburg, Russian Federation, 22–25 August

IAEA Training Course on the Implementation of TRS-430, Commissioning and Quality Assurance of Computerized Treatment Planning Systems for Radiotherapy (RLA/6/051), Cartagena, Colombia, 2–6 October

IAEA Regional (AFRA) Training Workshop on Dosimetry, QA/QC, Patient and Personnel Safety in Brachytherapy (RAF/6/031), Johannesburg, South Africa, 22–26 October

IAEA Regional (AFRA) Training Workshop on Medical Internal Dosimetry Relevant to Nuclear Medicine, Tunis, Tunisia, 29 October–2 November

IAEA/Ben-Gurion University of the Negev Seminar on Medical Physics in Israel — Present and Future, Beer-Sheva, Israel, 7–8 November

IAEA/ESTRO Teaching Course on Evidenced based Radiation Oncology: Methodological Basis and Clinical Application (RER/6/016), Athens, Greece, 11–16 November

IAEA Training Course on the Implementation of TRS-430, Commissioning and Quality Assurance of Computerized Treatment Planning Systems for Radiation Treatment of Cancer (RER/6/015), Glivice, Poland, 13–17 November

IAEA Regional (AFRA) Training Workshop on Commissioning of Linear Accelerators (RAF/6/031), Algiers, Algeria, 24–28 November

IAEA Regional (RAS) Training Workshop on the Implementation of International Code of Practice for External Radiotherapy Dosimetry based on Standards of Absorbed Dose to Water, TRS-398 (RAS/6/038), Singapore, 5–8 December

Meetings and consultancies

Consultants Meeting on Potential Doctoral Coordinated Research Project (CRP) on Advanced Technologies in Radiotherapy, IAEA Headquarters, Vienna, Austria, 15–17 January

Consultants Meeting on Transition from Conventional to Conformal Radiotherapy, IAEA HQ, 12–16 March

Consultants Meeting on Development of Procedures to conduct Comprehensive Audits in the Physical and Clinical Aspects of Diagnostic Radiology, IAEA HQ, Vienna, 23–27 April

Consultants Meeting to revise and update TRS-374: Calibration of Dosimeters used in Radiotherapy, IAEA HQ, Vienna, 25–29 June

Consultants Meeting on Harmonization of Quality Control in Digital Mammography, IAEA HQ, 2–5 July

Research Coordination Meeting of the CRP on Testing of the Implementation of the Code of Practice for Dosimetry in X rays Diagnostic Radiology, IAEA HQ, Vienna, 9–13 July

Consultants Meeting to prepare the final report for the CRP on Development of TLD based Quality Audits for Radiotherapy Dosimetry in Non-reference Conditions, IAEA HQ, Vienna, 30 July–3 August

Final Research Coordination Meeting of the CRP on Development of Procedures for Quality Assurance for

Dosimetry Calculations in Radiotherapy, IAEA HQ, Vienna, 6–10 August

Consultants Meeting to prepare a Handbook for Diagnostic Radiology, IAEA HQ, Vienna, 27–31 August

Consultants Meeting on Computer Tomography Quality Assurance, IAEA HQ, Vienna, 3–7 September

Research Coordination Meeting of the CRP on Harmonization of Quality Assurance Practices for Nuclear Medicine Radioactivity Measurements, IAEA HQ, Vienna, 24–28 September[1]

Consultants Meeting to establish a new CRP on Quality Assurance for Imaging in Radiotherapy, IAEA HQ, Vienna, 15–19 October

Research Coordination Meeting of the CRP on Development of Procedures for *In Vivo* Dosimetry in Radiotherapy, IAEA HQ, Vienna, 15–19 October

Consultants Meeting on Physics Issues from QUATRO Asian Mission, IAEA HQ, Vienna, 28–30 November

Consultants Meeting to continue development of a Guideline Document on Comprehensive Audits of Diagnostic Radiology Practices, IAEA HQ, Vienna, 10–14 December

MEMBER LABORATORIES OF THE IAEA/WHO NETWORK OF SSDLs[1]

Country	City	Contact person	Fax	E-mail
ALBANIA	Tirana	Mr. Kostandin Dollani	+35 5 4362596	kdollani@albmail.com
ALGERIA	Algiers	Mr. Mehenna Arib	+21 3 2143 4280	mehenna.arib@ifrance.com
ARGENTINA	Buenos Aires	Ms. Margarita Saraví	+54 1 167798228	saravi@cae.cnea.gov.ar
AUSTRALIA	Menai	Mr. Dimitri Alexiev	+61 2 97173257	jbd@ansto.gov.au
AUSTRIA	Seibersdorf	Mr. Hannes Stadtmann	+43 2 2547802502	hannes.stadtmann@arcs.ac.at
BANGLADESH	Dhaka	Mr. Md. Shakilur Rahman	+88 0 28613051	shakilurssdl@yahoo.com
BELARUS	Minsk	Mr. Valery Milevsky	+37 5 172130938	ion@belgim.belpak.minsk.by
BELGIUM	Ghent	Mr. Hubert Thierens	+32 9 2646699	hubert.thierens@rug.ac.be
BOLIVIA **	La Paz	Mr. Ismael Villca	+59 1 2433063	ibten@caoba.entelnet.bo
BRAZIL	Rio de Janeiro	Mr. Carlos J. da Silva	+55 2 124421605	carlos@ird.gov.br
BULGARIA	Sofia	Ms. Katya Sergieva	+35 9 29432 144	sergievakm@abv.bg
CANADA	Ottawa	Mr. Brian R. Gaulke	+16 1 39578698	brian_gaulke@hc-sc.gc.ca
CHILE	Santiago	Mr. Carlos Oyarzún Cortes	+56 2 27318723	coyarzun@gopher.cchen.cl
CHINA *	Beijing	Mr. Gan Zeuguei	+86 10 444304	
CHINA	TaiYuan, Shanxi	Mr. Zhang Qingli		zhangqing_li@hotmail.com
CHINA	Shanghai	Mr. Liu Shu-lin	+86 2 164701810	simtt@stn.sh.cn
CHINA	Beijing	Mr. Li Kaibao	+86 1 062012501	kaibaoli@hotmail.com
CHINA	Hong Kong	Mr. C.L. Chan	+85 2 29586654	cchan@ha.org.hk
CHINA	Beijing	Mr. Guo Wen	+86 1 69357178	rmcssdl@iris.ciae.ac.cn
COLOMBIA	Bogotá	Mr. Héctor Manuel Enciso Prieto	+57 1 3153059	henciso@ingeominas.gov.co
CROATIA	Zagreb	Mr. Branko Vekić	+38 5 14680084 or +38 5 14680098	bvekic@irb.hr
CUBA	Havana	Mr. Gonzalo Walwyn Salas	+53 7 579573	gonzalo@cphr.edu.cu
CYPRUS	Nicosia	Mr. Stelios Christofides	+35 7 2 801 773	cstelios@cytanet.com.cy
CZECH REP. *	Prague	Ms. I. Horakova	+42 0 2738330	ihorak@suro.cz
CZECH REP.	Prague	Mr. Pavel Dryák	+42 0 266020466	pdryak@cmi.cz
CZECH REP.	Prague	Mr. D. Olejár	+42 0 267313119	dolejar@suro.cz
DENMARK	Herlev	Mr. Klaus Ennow	+45 4 4543450	kln@sis.dk
ECUADOR	Quito	Mr. Marcos M. Frías Sánchez	+59 3 22563336	comecen1@comecenat.gov.ec
EGYPT	El-Giza	Mr. Mokhtar Sharaf	+20 2 3867451	mokhtar_sharaf@yahoo.com
ETHIOPIA	Addis Ababa	Mr. Worku Wodaje	+25 1 162 04 95	nrpa@telecom.net.et
FINLAND	Helsinki	Mr. Antti Kosunen	+35 8 975988450	antti.kosunen@stuk.fi
FRANCE	Fontenay-aux-Roses	Ms. Isabelle Clairand	+33 1 4746 97 77	isabelle.clairand@irsn.fr
GEORGIA	Tibilisi	Mr. Simon Sukhishvili	+99 5 32613500 or +99 5 32613301	simoniko@list.ru
GERMANY	Neuherberg	Mr. Dieter F. Regulla	+49 8 93187192224	regulla@gsf.de
GERMANY	Freiburg	Mr. Christian Pychlau	+49 7 614905570	pychlau@ptw.de
GERMANY	Schwarzenbruck	Mr. Igor Gomola	+49 9 12860710	igor.gomola@wellhofer.com
GHANA	Legon-Accra	Mr. Joseph Kwabena Amoako	+23 3 21 400807	rpbgaec@ghana.com; joekamoako@yahoo.com.uk
GREECE	Paraskevi-Attiki	Mr. Costas J. Hourdakis	+30 2 106506748	khour@eeae.gr
GUATEMALA	Guatemala C. A.	Mr. Angel Osorio	+50 2 2762007	arot23@yahoo.com
HUNGARY *	Budapest	Mr. István Csete	+36 1 458 5945	i.csete@omh.hu
HUNGARY	Budapest	Mr. Gabor Kontra	+36 1 2248620	kontra@oncol.hu
HUNGARY	Paks	Mr. Mihaly Orbán	+36 1 3551332	orbanmi@npp.hu
INDIA	Mumbay	Mr. Shri Suresh Rao	+91 2 225505151	suresh@barc.gov.in
INDONESIA	Jakarta Selatan	Mr. Susetyo Trijoko	+62 1 217657950	strijoko@batan.go.id

Country	City	Contact person	Fax	E-mail
IRAN, ISLAMIC REPUBLIC OF	Karaj	Mr. Mostafa Ghafoori	+98 2 614411106	mghafoori@nrcam.org
IRELAND	Dublin	Ms. Lorraine Currivan	+35 3 12697437	rpii@rpii.ie
ISRAEL	Yavne	Mr. Ben Shlomo	+97 2 89434696	abenshlomo@hotmail.com
KOREA, REP. OF	Seoul	Mr. Heon-Jin Oh	+82 2 3801352	radjin@kfda.go.kr
KUWAIT	Kuwait City	Ms. Ilham Elfares	+96 5 4862537	ssyyy12@yahoo.com
LATVIA	Salaspils	Mr. Antons Lapenas	+37 1 7901210	alap@latnet.lv
LIBYAN ARAB JAMAHIRIYA	Tripoli	Mr. Saleh A. Ben Giaber	+21 8 213614143	BenGiaber@yahoo.com
MADAGASCAR	Antananarivo	Mr. Raoelina Andriabololona	+26 1 202235583	instn@dts.mg
MALAYSIA	Kajang	Mr. Taiman Bin Kadni	+60 3 89250575	taiman@nuclearmalaysia.gov.my
MEXICO	Mexico City	Mr. Victor M. Tovar Munoz	+52 5 53297302	vmtm@nuclear.inin.mx
NORWAY	Osteras	Mr. Hans Bjerke	+47 6 7147407	Hans.Bjerke@nrpa.no
PAKISTAN	Islamabad	Mr. Waheed Arshed	+92 5 19290275	warshed@pinstech.org.pk
PERU	Lima	Mr. Tony Benavente A.	+51 1 488 5101	tbenavente@ipen.gob.pe
PHILIPPINES *	Diliman, Quezon	Ms. Estrella S. Caseria	+63 2 9201646	escaseria@pnri.dost.gov.ph
PHILIPPINES	Sta. Cruz, Manila	Ms. Nieva O. Lingatong	+63 2 711 6016	nolingatong@doh.gov.ph
POLAND	Warsaw	Mr. Wojciech Bulski	+48 2 26449182	w.bulski@rth.coi.waw.pl
PORTUGAL	Sacavém	Mr. J.A. Ferro de Carvalho	+35 1 219941995	aferroc@itn.pt
PORTUGAL	Lisbon	Mr. Paulo Ferreira	+35 1 217229877	radfisica@ipolisboa.min-saude.pt
ROMANIA	Bucharest	Mr. Constantin Milu	+40 2 13183635	cmilu@ispb.ro
RUSSIAN FED.	St. Petersburg	Mr. V.I. Fominykh	+78 1 23239617	info2101@vniim.ru
RUSSIAN FED.	St. Petersburg	Ms. Galina Lutina	+78 1 25966705	cherviakov.a@cards.lanck.net; crirr@peterlink.ru
SAUDI ARABIA	Riyadh	Mr. Abdalla N. Al-Haj	+96 614424777	abdal@kfshrc.edu.sa
SERBIA	Belgrade	Mr. Milojko Kovačević	+38 1112455943	milojko@vin.bg.ac.yu
SINGAPORE *	Singapore	Mr. Eng Wee Hua	+65 7 384468	
SINGAPORE	Singapore	Mr. Stephen Chong	+65 2 262353	sckmipil@pacific.net.sg
SINGAPORE	Singapore	Mr V.K. Sethi	+65 2 228675	trdwac@nccs.com.sg
SLOVAKIA	Bratislava	Ms. Viera Laginová	+42 1 252923711	vlaginov@ousa.sk
SLOVENIA	Ljubljana	Matjaz Stuhec	+38 6 14773841	matjaz.stuhec@ijs.si
SOUTH AFRICA	Pretoria	Ms. Zakithi Msimang	+27 128412131/ 4458	zmsimang@@nmisa.org
SUDAN **	Khartoum	Mr. Ibrahim Idris Suliman	+24 9 122347305	i.i.suliman@gamil.com
SWEDEN	Stockholm	Mr. Jan-Erik Grindborg	+46 8 7297108	ssi@ssi.se
SYRIAN ARAB REPUBLIC	Damascus	Mr. M. Takeyeddin	+96 3 116112289	atomic@aec.org.sy
TANZANIA, UNITED REP. OF	Arusha	Mr. Wilbroad E. Muhogora	+25 5 272509709	taec@habari.co.tz; wmuhogora@yahoo.com
THAILAND *	Bangkok	Mr. Kriengsak Bhadrakom	+66 2 5806013	
THAILAND	Nonthaburi	Mr. Siri Srimanoroth	+66 2 2239595	siri@dmsc.moph.go.th
THAILAND	Bangkok	Mr. Thongchai Soodprasert	+66 2 5620093	thongcha@oaep.go.th
THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA	Skopje	Mr. Velko Velev	+00389 2 3215044 220	velkovelev@yahoo.com
TUNISIA	Tunis	Ms. Latifa Ben Omrane	+21 6 7171697	sadok.mtimet@rns.tn
TURKEY	Istanbul	Mr. Ata Türer	+90 2125482234	dogan.yasar@taek.gov.tr
URUGUAY	Montevideo	Mr. Alejandro San Pedro	+59 8 29021619	calibraciones@dinaten.miem.gub.uy
VENEZUELA	Caracas	Ms. Lila Carrizales	+58 2 125041577	lcarriza@ivic.ve
VIETNAM	Hanoi	Mr. Vu Manh Khoi	+84 4 8363295	dung-khoi@hn.vnn.vn; vmkhoi@mail.vaec.g

** Provisional Network members; * SSDL Organization

[1] Kindly notify the Dosimetry and Medical Radiation Physics Section of any change or correction.

COLLABORATING ORGANIZATIONS ASSOCIATED WITH THE IAEA/WHO NETWORK OF SSDLs

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AFFILIATED MEMBERS OF THE IAEA/WHO NETWORK OF SSDLs

Bundesamt für Eich und Vermessungswesen (BEV)	Vienna, AUSTRIA
Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)	Yallambie, AUSTRALIA
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A-1400 Vienna, Austria

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