

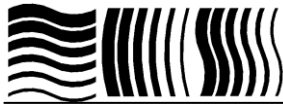


ANNUAL REPORT 2015

Objective

The Nederlandse Commissie voor Stralingsdosimetrie (NCS, Netherlands Commission on Radiation Dosimetry) was established on the 3rd of September 1982 with the main objective of promoting the appropriate use of radiation dosimetry, both for radiation research and for practical applications. The NCS is chaired by a board of scientists, installed in consultation with the supporting societies:

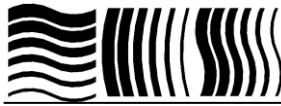
- Nederlandse Vereniging voor Radiotherapie en Oncologie (NVRO, Dutch Society for Radiotherapy and Oncology);
- Nederlandse Vereniging voor Nucleaire Geneeskunde (NVNG, Dutch Society for Nuclear Medicine);
- Nederlandse Vereniging voor Klinische Fysica (NVKF, Dutch Society for Medical Physics)
- Nederlandse Vereniging voor Radiobiologie (NVRB, Dutch Radiobiological Society);
- Nederlandse Vereniging voor Stralingshygiëne (NVS, Society for Radiological Protection of the Netherlands);
- Nederlandse Vereniging Medische Beeldvorming en Radiotherapie (NVMBR, Dutch Society for Medical Imaging and Radiotherapy);
- Nederlandse Vereniging voor Radiologie (NVvR, Radiological Society of the Netherlands);
- Société Belge des Physiciens des Hôpitaux/Belgische Vereniging voor Ziekenhuisfysici (SBPH/BVZF, Belgian Hospital Physicists Association);
- Nederlandse Vereniging van Klinisch Fysisch Medewerkers (NVKFM, Dutch society of Medical Physics Engineers)



To pursue its aims, the NCS has the following tasks:

- Participation in dosimetry standardization and promotion of dosimetry inter-comparisons;
- Drafting of dosimetry protocols;
- Collection and evaluation of physical data related to radiation dosimetry;
- Maintain or establish links with national and international organizations concerned with ionizing radiation;
- Promulgate information on new developments in the field of radiation dosimetry.

Website: <http://www.radiationdosimetry.org>



Board

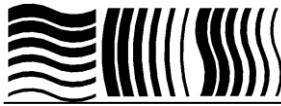
On December 31, 2015 the members of the board of the NCS were:

Dr. J.B. van de Kamer	chairman	(NVRO)
T.W.M. Grimbergen	vice chairman	(NVS)
Dr. J.A. de Pooter	secretary	(VSL)
Dr. A. Rijnders		(SBPH/BVZF)
J.M.J. Hermans	treasurer	(NVKFM)
Dr. J. R. de Jong		(NVNG)
Dr. P. Sminia / Dr. K. Franken		(NVRB)
Dr. A. Spilt		(NVvR)
Dr. Ir. F.W. Wittkämper		(NVKF)
M.K. Zeeman		(NVMBR)

The board of the NCS met four times in 2015, on 13 January, 9 April, 7 July, and 22 October. The main subjects raised at the board meetings were:

- Monitoring the progress of activities by the subcommittees and the platform;
- Initiate the publication of NCS-reports;
- Development of new activities.

In 2015 NCS report 24, Code of Practice for the Quality Assurance and Control for Volumetric Modulated Arc Therapy, and NCS report 25, Process Management and Quality Assurance for Intracranial Stereotactic Treatment and have been published, 1 new subcommittee has been installed; Audit for high-energy electron beams.



Subcommittees

1. *Subcommittee on Quality Assurance and Quality Control for Intracranial Stereotactic Treatment; Process Management & Treatment Technique*

The aim of the subcommittee is to compose a report that provides recommendations for Belgian and Dutch medical physicists on dosimetry procedures and quality assurance for add-on stereotactic equipment, dedicated fully integrated systems and the treatment process. The subcommittee was started in January 2006.

The reasons behind is the rapidly growing number of radiotherapy centers in The Netherlands and Belgium being equipped for intra- and extra-cranial stereotactic radiotherapy, i.e. stereotactic surgery (SRS) and stereotactic radiotherapy (SRT) The focus is on imaged guided “frameless” high-dose high precision techniques with standard and dedicated treatment devices, e.g. Novalis, Cyberknife and Gamma Knife. “Frameless” here is related to intra-cranial stereotactic treatment, meaning “without an invasive or relocatable localizer and treatment frame fixed on the skull of the patient with the aim to fix the patient on the treatment couch”.

Stereotactic treatment is related to very high fraction doses combined with a high accuracy in (re)positioning of the tumor with respect to the isocenter. Higher accuracy levels in equipment and processes are required with more attention to the quality assurance of both treatment devices and treatment process. Often overlooked: manpower trained at expert-level, working as a team, all embedded in a well-structured organization.

From scratch extra-cranial stereotactic treatment was excluded, as explained in the report. Over the years the focus became the treatment process itself rather the technology. As the latter is well-developed while the first is still sensitive for a lot of human aspects.

In 2015 the committee finished its job with the publication of its report: “Process Management and Quality Assurance for Intracranial Stereotactic Treatment” (NCS Report 25, October 2015)

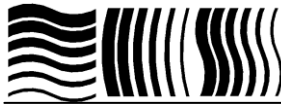
With this report the subcommittee is closed.

Members of this NCS subcommittee:

- Stan Heukelom (VUmc, Amsterdam, chairman)
- Hans Marijnissen (Erasmus MC, Rotterdam),
- An Nulens (UZ Gasthuisberg, Leuven)
- Geert Pittomvils (UZ, Gent)
- Esther Raaijmakers (Instituut Verbeeten, Tilburg)
- Dirk Verellen (UZ-Brussel, Brussel)
- Thierry Gevaert (UZ-Brussel, Brussel)
- Sandra Vieira (Champalimaud Centre for the Unknown, Lisboa, Portugal),
- Nienke Holtzer (NKI/AvL, Amsterdam)
- Joep Hermans (Maastricht Clinic, Maastricht, representative from the NCS-board).

2. *Subcommittee on Guidelines for Quality Assurance of Helical Tomotherapy*

Helical Tomotherapy is a modality for radiation therapy treatment with integrated systems for treatment planning, imaging, image registration and dose delivery. It has several differences compared to conventional linear accelerators, which imply that general Quality Assurance guidelines are not always applicable or sufficient. For example, current dosimetric protocols, based on the absorbed dose (NCS 18, AAPM TG-51), require calibration measurements under reference conditions. These reference conditions can not



be met. New methodologies are proposed in literature and are currently under discussion. Other specific QA issues concern the acceptance testing and commissioning of the integrated system, verification of dose planning and delivery, mechanical QA and patient safety.

Since the publication of TG148 on Tomotherapy Quality Assurance (Langen et al, Med.Phys. 2010) new functionality has been added to the system, like the dose control system, a new type of linac and target, the VoLO optimization and dose calculation using GPU architecture, calibration of the MVCT HU units to density, TomoDirect (treatment with fixed gantry angles), TomoEdge (treatment with dynamic collimation in cranio caudal direction) and TQA (integrated and automated tool for QA using the build in detector array). The goal of this report is to provide an updated guideline for QA and dosimetric calibration of the Helical Tomotherapy system.

In 2015 the subcommittee was in the process of editing the drafts and to produce the final version. Koen Tournel has left the subcommittee. The resulting vacancy has been filled in by Kai Schubert, medical physicist from DKFZ, Heidelberg.

The report will cover the following topics:

- Treatment delivery – mechanics - TQA
- Dosimetry
- Treatment planning
- Imaging and set up verification
- Miscellaneous (adaptive, patient transfer and DQA)

Members of this NCS subcommittee:

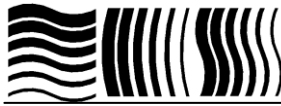
Vincent Althof (Radiotherapiegroep, Deventer, chairman)
Bie De Ost (UZA/ZNA, Antwerpen, secretary)
Nick Reynaert (Centre Oscar Lambret, Lille)
Kay Schubert (DKFZ, Heidelberg)
Jeroen van de Kamer (NKI/AvL, Amsterdam, representative from the NCS-board)
Edmond Sterpin (UCL, Brussel)

3. Subcommittee on QA for rotational IMRT

The aim of our subcommittee is to produce a report with guidelines for introduction and maintenance of safe and high quality rotational IMRT (or VMAT) techniques in clinical practice. The report will be based on the experience present in Belgian and Dutch institutes as well as on available literature.

One subcommittee meeting was organized in 2015. In this meeting, the final version of the report, including the comments from external reviewers was discussed. In February 2015, the report was published. The final activity of the subcommittee was a joint diner.

On September 16, 2015, Jeroen van de Kamer presented the contents of the report on the annual meeting of the Dutch linac technicians. An invitation was received to present the report at an IPEM workshop on VMAT QA in Oxford (UK) on April 20, 2016. Jochem Wolthaus will represent the subcommittee there



Members of this NCS subcommittee:

Anton Mans (NKI/AvL, Amsterdam, chairman)
Mark Arends (RIF, Leeuwarden, secretary)
Jochem Wolthaus (UMC-U, Utrecht)
Marjan Admiraal (VUmc, Amsterdam)
Danny Schuring (CZE, Eindhoven)
Rob Louwe (Wellington & Wairarapa, New Zealand)
Heidi Lotz (UMCG, Groningen)
Lia Vugts (Instituut Verbeeten, Tilburg)
Michel Öllers (Maastric Clinic, Maastricht)
Jeroen van de Kamer (NKI/AvL, Amsterdam, representative from the NCS board)

4. Subcommittee on quality assurance of cone-beam CT

Cone-beam CT scanners integrated with linear accelerators have become increasingly important tools for image guidance of radiotherapy treatments. The application of cone-beam CT based image guidance is very diverse, ranging from bony anatomy based offline correction protocols to online stereotactic tumor based correction strategies. Although most institutions have presently implemented QA procedures for CBCT, the frequency and methods vary widely.

The aim of the subcommittee is to develop uniform guidelines for the commissioning and quality assurance of cone x-ray based image guidance systems on conventional linacs, i.e. cone-beam CT (XVI, OBI), and portal imagers. The guidelines will be based on current literature as well as clinical experience from the participating members of this subcommittee.

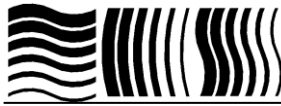
Two meetings of the committee have been held in 2015, the first in Maastricht (Maastric), and the second in Amsterdam (NKI). The meetings were focused on creating draft versions of all chapters. This has been accomplished, and the drafts are currently being reviewed by subcommittee members that were not involved in writing them. Martijn Eenink needed to resign the committee due to other obligations, and Martijn Hol has re-joined the committee. For the coming year, the goal will be to finalize the report.

Members of the subcommittee

Peter Remeijer (NKI/AvL, Amsterdam, chairman)
Martijn Eenink (LUMC, past-member, Secretary)
Martijn Hol (LUMC)
Willy de Kruijf (Instituut Verbeeten, Tilburg)
Kirsten Deurloo (MCA, Alkmaar)
Niek van Wieringen (AMC, Amsterdam)
Heleen van Herpt (UMCG, Groningen)
Marianna Sijtsema (UMCG, Groningen)
Martijn Kusters (RadboudUMC, Nijmegen)
Koos Geleijns (LUMC, Leiden, advisor CT dosimetry)
Joep Hermans (Maastric Clinic, representative of the NCS board)

5. Subcommittee on IMRT & VMAT Audit

The subcommittee conducts a voluntary audit of IMRT and VMAT/RapidArc delivery modalities in the radiotherapy institutes in the Netherlands. The goal of the audit is to independently validate patient-specific quality assurance (QA) methods, clinically used in the Netherlands, for IMRT and VMAT plans using the same set of treatment plans for all institutes.



For a limited set of RT plans, defined by the committee, the dose distribution computed by an institution's treatment planning system is compared with the dose measurements performed by the audit team at the institution's linear accelerators. This is done independently from the treatment planning optimization process. Each plan is measured by an ionization chamber (pinpoint), Gafchromic film and a 2D ionization chamber array (Octavius, PTW).

Additionally, the results are compared to the QA measurements done by each institute according to their local protocol.

In 2015 the subcommittee met 5 times. The remaining 11 institutes were audited. The data is being analysed and the writing of the final report has started.

The (preliminary) results of the audit were presented at the following congresses:

- 3rd ESTRO forum, 24-28 April 2015, Barcelona, Spain
- AAPM, 12-16 July 2015, Anaheim, California

In 2016 the final results will be presented the 35th ESTRO forum in Torino, Italy.

Members of the subcommittee are:

- Enrica Seravalli (UMC-U, Utrecht)
- Anette Houweling (AMC, Amsterdam)
- Marion van Gellekom (ARTI, Arnhem)
- Jochem Kaas (NKI/AvL, Amsterdam)
- Erik Loeff (Erasmus MC, Rotterdam)
- Thom Raaben (MST, Enschede)
- Marc Kuik (MCA, Alkmaar)
- Jacco de Pooter (VSL, Delft, representative from the NCS board)
- Wilfred de Vries (UMC-U, Utrecht)

6. Subcommittee on QA of Afterloaders for Brachytherapy

The subcommittee has been set up in 2014. Goal of the subcommittee is to prepare a code of practice for Quality Assurance of Ir-192 afterloaders for HDR and PDR brachytherapy, as used in The Netherlands and Belgium.

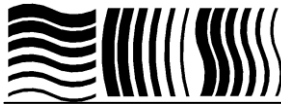
In 2015 the subcommittee had 6 meetings in which we discussed the content of the several chapters of the report. Chapters will among others be dedicated to QA of afterloader and source; QA of applicators and transfer tubes; safety and security; organizational aspects. Discussions were very fruitful.

Aswin Hoffmann moved to Dresden, Germany. Mirko Unipan from Maastric Clinic then joined the subcommittee; Aswin Hoffmann remains member of the subcommittee from a distance.

Driven by actual discussions in the Netherlands concerning the QA of applicators and transfer tubes the subcommittee published a preliminary report on this topic in June 2015. A second version of this preliminary report was published in November 2015.

Members of the subcommittee are:

- Jacco Steenhuijsen (CZE, Eindhoven, chairman)
- Marja Harbers (MST, Enschede)
- Aswin Hoffmann (Maastric clinic, Maastricht)
- Astrid de Leeuw (UMC-U, Utrecht)
- Rita Reymen (GZA-Sint Augustinus Wilrijk/Antwerpen)
- Mirko Unipan (Maastric Clinic, Maastricht)
- Alex Rijnders (Europa Ziekenhuizen, Brussel, representative from the NCS board)



7. *Subcommittee on Code of Practice and recommendations for Total Body Irradiation and Total Skin Irradiation*

The goal of this NCS subcommittee is to investigate the status of treatment protocols and quality control for total body and total skin irradiation in the Netherlands and Belgium. Most centres use AAPM reports 17 and 23 as a starting point, but deviate from this after a few decades. Recent technological evolution allows new treatment and treatment planning techniques, creating a need for a guidance report for individual centres in order to compare their current way of practice to the state of the art practice.

The questionnaire was finalised and submitted in 2015. All participants replied on the extensive questionnaire and in 2016 the results will be analysed. The working group was divided in subgroups and each subgroup was asked to make an overview of the topics on their chapter. Most chapters were submitted on the dropbox. When this is finished the final drafting of the report can start.

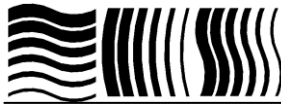
Members of the subcommittee are:

- Geert Pittomvils (UZ Gent, Gent, chairman)
- Wim Jansen (LUMC, Leiden, secretary)
- Maxime Coevoet (Saint Luc UCL, Brussels)
- Nicolas Hermand (UZ Leuven, Leuven)
- Phil Koken (VUmc, Amsterdam)
- Heleen van Herpt (UMCG, Groningen)
- Daan Martens (NKI/AvL, Amsterdam)
- Lars Murrer (Maastrro Clinic, Maastricht)
- Peter van der Hulst (UMCG, Groningen)
- Ruud van Leeuwen (RadboudUMC, Nijmegen)
- Francoise Vanneste (Saint Luc UCL, Brussels)
- Jeroen Van de Kamer (NKI/AvL, Amsterdam, representative of the NCS Board)

8. *Subcommittee on Radiation Dose & Risk Estimation of Medical Diagnostic and Research Procedures*

The aims of this NCS subcommittee are (1) to define threshold radiation doses regarding the risk of deterministic effects and to estimate stochastic effects in humans exposed to ionizing radiation, (2) to provide guidelines for diagnostic and interventional procedures in patients and healthy volunteers participating in scientific medical research, and (3) to define additional measures for those cases where the threshold values are exceeded. Threshold radiation doses (mSv/mGy) will be derived from the literature, mainly the ICRP reports. Based on these threshold values and taking into account several variables like radiation dose, age at exposure, gender and life expectancy, risk estimations will be presented. The subcommittee will also propose guidelines for interventional procedures that inevitably exceed the threshold values, both for clinical practice and for healthy subjects or patients participating in medical research. A follow-up working group will define those interventions for which additional measures, e.g. specific training or protocols, are required.

In 2015, subcommittee meetings were held on February 11, April 1 and April 29. Further communication was via e-mail and phone. Early September, the concept report was published on the NCS website and spread among supporting societies with a request for review and recommendations. Eleven appreciated comments were received, which were answered in detail and used for adaption of the report. November 18, the concept report was presented and discussed in a meeting of the Centrale Commissie Mensgebonden Onderzoek (CCMO) for the chairs of all Medical Ethical Committees in the Netherlands. Written comments and suggestions were received by the end of 2015.



In 2015, the concept of the report has been finalized and was reviewed by all relevant national societies and Medical Ethical Committees represented in the CCMO.

Subcommittee aims and activities, as well as the concept report were announced on the NCS website. Presentation of the concept report during a meeting of the Centrale Commissie Mensgeboden Onderzoek on November 18.

Members of this NCS subcommittee:

Peter Sminia (VUmc, Amsterdam, Chairman, representative of the NCS board)
Marloes Zeeman (NVMBR, Utrecht, representative of the NCS board)
Klaas Franken (AMC, Amsterdam, representative of the NCS board)
Marcel Greuter (UMCG, Groningen)
Arno van de Wiel (Ministerie van VWS, Den Haag)
Frank de Lange (RadboudUMC, Nijmegen)
Ali Vegter (NVMBR, Utrecht, representative of the NCS Platform)
Adriaan Lammertsma (VUmc, Amsterdam, representative of NVNG)
Aart Spilt (Kennemer Gasthuis, Haarlem, representative of the NCS board)
Marcel Wiegman (RadboudUMC, Nijmegen)

9. Subcommittee on Audit for high-energy electron beams

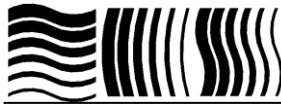
Based on the results of a survey about the use of electron beams in the Radiotherapy departments in The Netherlands and the wish of a number of Radiotherapy departments for an electron dosimetry audit, the NCS board established in 2015 the NCS subcommittee on Electron Audits.

The kick-off meeting was in June 2015. During this meeting the scope, plan of action and tasks were discussed and drafted. An audit for all radiotherapy departments would be too time consuming and would take a number of years. In addition, short before the VSL has launched an Audit service for photon beams. Therefore the subcommittee decided to establish an audit method for electron beams and apply this audit method at the 4 participating institutes. Thereafter the VSL will adopt the audit method and will make it available to all Radiotherapy centers.

Between June and December the 4 participating institutes were visited and the audit measurements were performed. In the first half of 2016 the results will be finalized and the report will be written.

Members of this NCS subcommittee:

Frits Wittkamper (NKI/AvL, Amsterdam, Chairman and representative of the NCS board)
Thijs Perik (NKI/AvL, Amsterdam)
Stan Heukelom (VUmc, Amsterdam)
Wenze van Klink (VUmc, Amsterdam)
Wim Jansen (LUMC, Leiden)
Elfried Kok (RdGG, Delft)
Leon de Prez, (VSL, Delft, secretary)
Bartel Jansen (VSL, Delft)
Jacco de Pooter, (VSL, Delft, advisor)



Advisory platforms

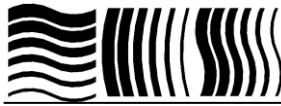
The Netherlands Commission on Radiation Dosimetry covers a wide range of expertise through the participating scientific societies. In 1999 NCS platforms were established on dosimetry for radiology and nuclear medicine and dosimetry for radiotherapy. The tasks of these platforms are to give advice on specific research projects initiated by the Government. In case of future needs the NCS can be approached for consultation through its secretary under the condition of modest coverage of NCS experts in terms of attendance fee and travel costs for meetings.

1. Advisory platform on Radiation Protection in Hospitals

No report on activities.

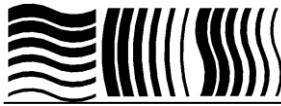
Members of the advisory platform are:

- Christiaan van Swol (representative of the NVKF, chairman)
- Paul Jonkergouw (representative of the NVS, secretary)
- Jan Habraken (representative of the NVNG)
- Marja Harbers (representative of the NVKFM)
- Jeroen van de Kamer (representative of the NCS board)
- Bradley Pieters (representative of the NVRO)
- Kirsten Schimmel (representative of the NVZA)
- Alie Vegter (representative of the NVMBR)
- Niels Veltman (representative of the NVNG)



NCS FINANCIAL OVERVIEW 2015

	Income (€)	Costs (€)
Savings-account on Januari 1, 2015	37410.33	
Current-account on Januari 1, 2015	6234.57	
Project-account on Januari 1, 2015	21374.66	
Contribution Netherlands Society for Radiology (NVvR) 2015	600.00	
Contribution Netherlands Society for Medical Physics (NVKF) 2015	400.00	
Contribution Netherlands Society for Radiotherapy and Oncology (NVRO) 2015	800.00	
Contribution Netherlands Society for Nuclear Medicine (NVNG) 2015	200.00	
Contribution Netherlands Society for Radiological Protection (NVS) 2015	400.00	
Contribution Netherlands Radiobiological Society (NVRB) 2015	100.00	
Contribution Dutch society of Medical Physics Engineers (NVKFM) 2015	100.00	
Contribution Netherlands Society for Medical Imaging (NVMBR) 2015	300.00	
Contribution Belgian Hospital Physicists Association (BHPA) 2015	200.00	
Income Vmat/Rapidarc audit	0.00	
costs Vmat/Rapidarc audit		2882.98
Banking costs project account		70.50
Interest savings-account	389.75	
Banking costs current account		16.80
Costs web site		562.59
Costs meetings NCS board		1355.86
Costs NCS subcommittees		312.01
Divers	2.89	88.54
Savings-account on December 31, 2015		37800.08
Current-account on December 31, 2015		7001.66
Project account on December 31, 2015		18421.18
Total	68512.20	68512.20



NCS BUDGET 2016

	Income (€)	Costs (€)
Contributions scientific societies	3100.00	
Contributions scientific societies	3100.00	
Interest savings-account	400.00	
Banking costs		150.00
Costs of board and subcommittees meetings		1500.00
Website maintenance etc		600.00
Total	3500.00	2250.00