



ANNUAL REPORT 2018

Objective

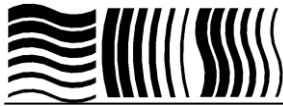
The Nederlandse Commissie voor Stralingsdosimetrie (NCS, Netherlands Commission on Radiation Dosimetry) was established on the 3rd of September 1982 with the main objective of promoting the appropriate use of radiation dosimetry, both for radiation research and for practical applications. The NCS is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

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

expanded with a representative from the Dutch Metrology Institute VSL.

To achieve its aims, the NCS carries out the following tasks: participation in dosimetry standardisation, promotion of mutual comparisons of dosimetry, drafting of dosimetry protocols and the collection and evaluation of physical data related to dosimetry. Furthermore, the commission shall establish or maintain links with national and international organisations concerned with ionising radiation and promulgate information on new developments in the field of radiation dosimetry.

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



Board

On December 31, 2018 the members of the board of the NCS were:

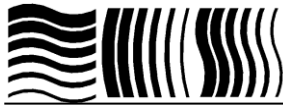
Dr. J.B. van de Kamer	chairman	(NVRO)
T.W.M. Grimbergen	vice chairman	(NVS)
Dr. J.A. de Pooter	secretary	(VSL)
Dr. A. Rijnders		(SBPH/BVZF)
J.M.J. Hermans	treasurer	(NVKFM)
Dr. J. R. de Jong		(NVNG)
N. de Graaf		(NVvR)
Dr. P. Sminia/ Dr. K. Franken		(NVRB)
Dr. Ir. F.W. Wittkämper		(NVKF)
M.K. Zeeman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

The board of the NCS met three times in 2018 on 29 January, 24 May and 11 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 2018 four NCS reports have been published:

- NCS28 - National Audit of Quality Assurance for IMRT and VMAT (<https://doi.org/10.25030/ncs-028>)
- NCS29 - An on-site dosimetry audit for high-energy electron beams (<https://doi.org/10.25030/ncs-029>)
- NCS30 - Code of Practice for Quality Assurance of Brachytherapy with Ir-192 Afterloaders (<https://doi.org/10.25030/ncs-030>)
- NCS31 - Radiation Protection and Dosimetry of the Eye Lens (<https://doi.org/10.25030/ncs-031>)



Subcommittees

1. 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 tumour 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.

In 2018 the report has been finished and is ready for review.

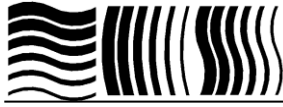
Members of the subcommittee

Peter Remeijer (NKI/AVL, Amsterdam, chairman)
Kirsten Deurloo (MCA, Alkmaar, secretary)
Heleen van Herpt (UMCG, Groningen)
Martijn Hol (LUMC, Leiden)
Martijn Kusters (UMC St Radboud, Nijmegen)
Greet d'OlieSlager (BVI, Tilburg)
Marianna Sijtsema (UMCG, Groningen)
Niek van Wieringen (AMC, Amsterdam)
Koos Geleijns (LUMC, Leiden, advisor CT dosimetry)
Joep Hermans (MAASTRO, Maastricht, representative of the NCS board)

2. 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.

In 2018 a paper was published (Seravalli, E, *et al.*, Auditing local methods for quality assurance in radiotherapy using the same set of predefined treatment plans, Physics and Imaging in Radiation Oncology, p19, 5, 2018.) Based on the comments on the paper, some minor modifications have been made to the report before it was published.



Members of the subcommittee are:

Enrica Seravalli (UMCU, Utrecht, chair)
Anette Houweling (AMC, Amsterdam, secretary)
Marion van Gellekom (ARTI, Arnhem)
Leo van Battum (VUmc, Amsterdam)
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 (UMCU, Utrecht)

3. Subcommittee on QA of brachytherapy with Ir-192 afterloaders

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. The code of practice will update and partially replace three previous reports of the NCS on Brachytherapy with Ir-192. In 2018 the committee had 5 meetings, 4 of which were teleconferences. The committee prepared the final version of the report, which was sent to the NCS board for final approval. Final approval was given on the 25th of May. The report was published on the NCS website in June 2018.

Members of the subcommittee are:

Jacco Steenhuijsen (Catharina ziekenhuis, Eindhoven, chairman)
Marja Harbers (Medisch Spectrum Twente, Enschede)
Aswin Hoffmann (University Hospital Carl Gustav Carus, Technische Universität Dresden)
Astrid de Leeuw (UMCU, Utrecht)
Mirko Unipan (MAASTRO, Maastricht)
Alex Rijnders (Europa Ziekenhuizen, Brussel, representative of the NCS board)

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

The goals 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 workgroup had a turbulent year in which some members unfortunately had to leave the subcommittee due to other occupations. But in the second half of the year, a small part of the group had two fruitful meetings (July, August) to restart with the TBI/TSI questionnaire.



Members:

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

5. *Subcommittee on Audit for high-energy Electron beams*

In February 2015, the NCS installed a new subcommittee to devise a practical audit for electron beam dosimetry, based on the NCS-18 Code of Practice (CoP). 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 centres. In 2018 the draft of the report was finalized. Based on this report a publication was issued to the journal *Physics and Imaging in Radiation Oncology: An on-site dosimetry audit for high-energy electron beams* L.A. de Prez, *et al.*, *Physics and Imaging in Radiation Oncology* 5 (2018) 44–51. <https://doi.org/10.1016/j.phro.2018.02.001>

Finally, some textual changes to the draft report have been made to get it in line with the publication. The report was published on the website in October 2018 as NCS report 29.

Members of this NCS subcommittee:

Frits Wittkämper (NKI/AvL, Amsterdam, chairman and representative of the NCS board)
Thijs Perik (NKI/AvL, Amsterdam)
Stan Heukelom (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)

6. *Subcommittee on Radiation Protection and Dosimetry of the Eye Lens*

Evaluation of the eye lens dose is of increasing importance due to the growing insight in the sensitivity of the organ. The European BSS directive of 2013 has implemented the recommendations of the ICRP and limited the annual eye lens dose to 20 mSv. This directive will be implemented in the national legislation by February 2018.

The goals of the subcommittee are to:

- 1) Provide guidance for reducing the exposure of the eye lens
- 2) Provide guidance for determination of the eye lens dose
- 3) Provide decision rules when to use eye lens dosimetry

The committee finalized its work in 2018 and gathered 3 times. The draft report was submitted for consultation to several stakeholders in December 2017. Experts from the following stakeholder groups have been consulted: Vascular surgery, trauma surgery, radiology, cardiology, nuclear medicine, NCS board, the Dutch and Belgian societies for radiation



protection (NVS and BVS), KINT (society for non-destructive testing), the veterinary society, the Dutch medical physics society and a number of people on a personal title. Based on the input the draft report was updated and submitted to the NCS board in May 2018, after which it was published just before the IRPA conference in The Hague in June 2018.

Publications:

- NCS Report 31 Guidelines for Radiation Protection and Dosimetry of the Eye Lens, Netherlands Commission on Radiation Dosimetry, <https://doi.org/10.25030/ncs-031>, May 2018.
- Kollaard, Robert; Carinou, Eleftheria; Ginjaume, Merce; Struelens, Lara, How to establish an adequate system for eye lens dose monitoring: a proposal for typical workplaces, RPD-18-0494.R1, [10.1093/rpd/ncz009](https://doi.org/10.1093/rpd/ncz009), accepted for publication in Radiation Protection Dosimetry, 15 January 2019.

Symposium contributions:

- Robert Kollaard, Guidelines for Radiation Protection and Dosimetry of the Eye Lens in the Netherlands, oral presentation, 5th European IRPA congress, 4-8 June 2018.
- Bart Goessens, Medical Surveillance of radiological workers, Refresher for radiation doctors, 5th European IRPA congress, 4-8 June 2018.
- Mariska Damen, Guidelines for Radiation Protection and Dosimetry of the Eye Lens in the Netherlands and Belgium, NVKF refresher Algemene Klinische Fysica, 13 September 2018.

Members of the subcommittee are:

Robert Kollaard (NRG, Arnhem, chairman)
Doreth Valk (RIVM, Bilthoven, secretary)
Mariska Damen (LUMC, Leiden)
Bart Goessens (Radboud University Medical Center, Nijmegen)
Tom Grimbergen (NRG, Arnhem, representative from the NCS board)
Kirsten Henken (St. Antonius Hospital, Nieuwegein)
Kitty Hoornstra (UMCU, Utrecht)
Wim Idema (AMC, Amsterdam)
Pierre Kicken (Astra Consultancy, Eindhoven)
Martine Lagerweij (Isala Hospital, Zwolle)
Alexander Maass (University of Groningen, University Medical Center Groningen)
Leo Schultze Kool (UMC St Radboud, Nijmegen)
Lara Struelens (SCK•CEN, Mol, Belgium)
Ischa de Waard (RIVM, Bilthoven)

7. Subcommittee on "Dosimetry for Scanned Pencil Beam Proton Therapy"

International codes of practice for reference dosimetry and recommendations for measurement of beam characteristics in proton therapy (TRS-398, ICRU 78) are mainly focused on passive scattering delivery technology. These reports do not address specific issues of pencil beam scanning. The aim of the subcommittee on "Dosimetry for Scanned Pencil Beam Proton Therapy" is therefore to develop uniform guidelines for the absolute and relative dosimetry of the pencil beam scanning modality with continuous and pulsed proton beams. The subcommittee focuses on the new proton therapy facilities that are currently being developed in the Netherlands and Belgium. The goal is to deliver a report that can be used as a code of practice in proton therapy not only in the Netherlands, but internationally as well. The report will be based on the current literature as well as clinical experience of the



participating members of this subcommittee. Moreover, members of the subcommittee are in close contact with international committees working on the similar reports to be sure that NCS report will agree with future international recommendations.

There was one meeting in person in 2018 – 12th April and one Skype meeting on the 4th of June. During this meeting a detailed content of each chapter was discussed. Due to the heavy commissioning activities at proton therapy centres in Groningen and Delft, it was difficult to organize other meetings. Arturs Meijers, Carles Gomà and Severine Rossumme have left the subcommittee

Members of the committee are:

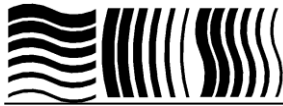
Petra Trnková (HPTC, chair)
Marco Schippers (PSI/UMCG, advisor)
Jacco de Pooter (VSL, representative of the NCS board)
Marc-Jan van Goethem (UMCG, Groningen)
Frank Verhaegen (MAASTRO, Maastricht)
Enrica Seravalli (UMCU, Utrecht)
Steven Habraken (Erasmus MC, Rotterdam)
Paul van Beers (HPTC, Delft)
Gloria Vilches (MAASTRO, Maastricht)

8. Subcommittee on Quality Assurance of Treatment Planning Systems

Treatment planning has considerably evolved over the last decades. We see, for example, a growing use of automated tools to generate treatment plans and adaptive planning strategies. On the other hand, ancient techniques such as virtual simulation and the use of wedges have become obsolete. This leads to new questions regarding the quality assurance and commissioning of treatment planning systems.

The aim of the subcommittee is to develop guidelines for the commissioning and quality assurance of treatment planning systems focused on current practices. The subcommittee will specifically focus on new treatment planning related items like scripting and optimization techniques. Old techniques such as virtual simulation and the use of wedges are not within the scope of the report.

In June 2018 the subcommittee had its initial meeting. During this meeting and the following meeting, the scope of the report was set, and members were assigned for specific chapters. In the final meeting of 2018, the committee has performed a prospective risk analysis and decided on subtopics for each chapter.



Members of the subcommittee are:

Rik Westendorp (Radiotherapiegroep, Deventer, chairman)
Danny Schuring (Catharina Ziekenhuis, Eindhoven, secretary)
Jorrit Visser (AUMC/AMC, Amsterdam)
Kimmie de Bruin (AUMC/VUMC, Amsterdam)
Wilko Verbakel (AUMC/VUMC, Amsterdam)
Erik van der Bijl (NKI/AVL, Amsterdam)
Younes Jourani (Jules Bordet, Brussel)
Antoine Delor (UC-Louvain, Brussel)
Roel Kierkels (UMCG, Groningen)
Chin Loon Ong (HagaZiekenhuis, Den Haag)
Tara van de Water (RIF, Leeuwarden)
Wouter Crijns (UZ, Leuven)
Joan Penninkhof (ErasmusMC, Rotterdam)
Gijsbert Bol (UMCU, Utrecht)
Jeroen van de Kamer (NKI/AVL, Amsterdam, representative from the NCS board)

9. Annual Report of the NCS Subcommittee on MRI QA for RT

Magnetic Resonance Imaging (MRI) is increasingly used in the process of radiation therapy (RT). In the workflow of MRI-guided RT-planning the superior soft-tissue contrast of MRI is utilized for high-precision delineation of the target volume and organs at risk. In most cases, the MR images are co-registered to the planning CT scan, but MR-only based workflows are now also making their way into the clinic for specific indications. Furthermore, targeting uncertainties at the dose delivery phase can be reduced in an MR-integrated workflow, in the form of MRI-integrated brachytherapy and external beam RT.

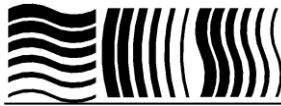
A concern of integrating MRI into RT-planning is the spatial accuracy of these images, as they are affected by magnetic field inhomogeneities, magnetic susceptibility artefacts, chemical shifts and non-linearities in the gradient fields. Since these effects are system and patient dependent, dedicated procedures for quality assurance (QA) and quality control (QC) of MRI for RT are mandatory.

The subcommittee has been established in 2017. The goal of this subcommittee is to develop a code of practice for MRI QA/QC which is dedicated to RT purposes. In 2018, the subcommittee had three meetings: January, April and July. The group has made good progress.

Members of the subcommittee are:

Zdenko van Kesteren (AMC, Amsterdam, chairman)
Marloes Frantzen-Steneker (NKI/AVL, Amsterdam, secretary)
Ellen Brunenberg (UMC St Radboud, Nijmegen)
Aswin Hoffmann (University Hospital Carl Gustav Carus, Technische Universität Dresden)
Joost Kuijjer (VUmc, Amsterdam)
Steven Petit (Erasmus MC, Rotterdam)
Mariska de Smet (BVI, Tilburg)
Rob Tijssen (UMCU, Utrecht)
Pieter van der Tol (HollandPTC, Delft)
Arjan Verduijn (UMCU, Utrecht)
Jeroen van der Kamer (NKI/AVL, Amsterdam, representative from the NCS board)

10. Subcommittee on "Code of Practice and Recommendations for Stereotactic Body



Radiotherapy "

The purpose of the committee is to provide the basic requirements and guidelines for providing safe and high-quality SBRT treatments according to state-of-the-art international standards.

In 2018 the committee has organized 5 meetings (in summer one meeting was skipped). The aim is to make a practical report that can readily be used with clear recommendations. Group members have started writing draft versions of the chapters and these were discussed during the meetings. Also, some relevant topics and literature were discussed during the meetings.

Members of the subcommittee are:

- Johan Cuijpers (VUmc, Amsterdam, chairman)
- Anke van Mourik (NKI-AvL, Amsterdam)
- Marloes Steneker (NK-/AvL, Amsterdam)
- Anna Pethoukova (HMC, Den Haag)
- Richard Canters (MAASTRO, Maastricht)
- Marcus Wendling (UMC St Radboud, Nijmegen)
- Siete Koch (MST, Enschede)
- Rens Vingerhoets (NWZ, Alkmaar)
- Chrysi Papalazarou (Erasmus MC, Rotterdam)
- Petra Kroon (UMCU, Utrecht)
- Jeroen van de Kamer (NKI-AvL, representative of the NCS board)

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

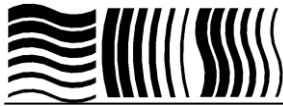
1. Advisory platform on Radiation Protection in Hospitals

In 2010 the NCS platforms was reinitiated with the aim to provide practical advice regarding legal aspects concerning the use of radiation in the clinical environment. For this, the platform is represented by the participating societies, expanded with the Dutch Society on Pharmacy in Hospitals. To achieve this goal, the platform has frequent contact with the Dutch Government.

The Platform advises on radiation safety laws and regulations. It establishes practical guidelines for existing and new laws and regulations. The Platform maintains close contacts with the Dutch ministries of VWS (Ministry of Health, Welfare and Sport) and SZW (Ministry of Social Affairs and Employment) and the ANVS (Authority for Nuclear Safety and Radiation Protection). The Platform plays a key role in effective and efficient implementation of European directives into national law.

The Platform had three meetings in 2018 and several consultations by mail. Other activities in 2018 include:

- Reporting dose in patient files according to the Bbs
- Revision of the General Risk Analysis and calculation sheets for Radiology, Nuclear Medicine and Radiotherapy (collaboration with iSZW)
- Clearance of nuclear waste



- DRLs in Nuclear Medicine
- Cremation after I-125 therapy
- Guideline for organizing radiation protection in hospitals (committee of VWS and ANVS)

The platform published an advice and template safety certificates which can be provided to by hospitals to patients that have undergone treatment with radioactive isotopes and who pass a customs check.

An up-to-date overview of the activities of the platform can be found at: <https://radiationdosimetry.org/platform/activities>

Members of the NCS platform are:

- Peter Brands (NVKF, chair)
- Kitty Hoornstra (NVS, secretary)
- Herman Pieterman (NVvR)
- Niels Veltman (NVNG)
- Alie Vegter (NVMBR)
- Jan Habraken (NVNG)
- Bradley Pieters (NVRO)
- Marja Harbers (NVKFM)
- Kirsten Schimmel (NVZA)
- Jeroen van de Kamer (NVRO, representative from the NCS board)



NCS FINANCIAL OVERVIEW 2018

	Income (€)	Costs (€)
Savings-account on January 1, 2018	38129.38	
Current-account on January 1, 2018	11302.12	
Project-account on January 1, 2018	14252.18	
Contribution Netherlands Society for Radiology (NVvR)	600.00	
Contribution Netherlands Society for Medical Physics (NVKF)	400.00	
Contribution Netherlands Society for Radiotherapy and Oncology (NVRO)	800.00	
Contribution Netherlands Society for Nuclear Medicine (NVNG)	200.00	
Contribution Netherlands Society for Radiological Protection (NVS)	400.00	
Contribution Netherlands Radiobiological Society (NVRB)	100.00	
Contribution Dutch society of Medical Physics Engineers (NVKFM)	100.00	
Contribution Netherlands Society for Medical Imaging (NVMBR)	300.00	
Contribution Belgian Hospital Physicists Association (BHPA)	200.00	
Banking costs project account		108.00
Interest savings-account	18.30	
Banking costs current account		66.00
Costs web site		544.50
Costs meetings NCS board		919.04
Costs NCS subcommittees		1671.15
Savings-account on December 31, 2018		38147.68
Current-account on December 31, 2018		11201.43
Project account on December 31, 2018		14144.18
Total	<u>66801.98</u>	<u>66801.98</u>



NCS BUDGET 2019

	<i>Income (€)</i>	<i>Costs (€)</i>
Contributions scientific societies	3100.00	
Interest savings-account	20.00	
Banking costs		200.00
Costs of board and subcommittees meetings		3000.00
Website maintenance etc		600.00
Total	3120.00	3800.00