



**IAEA**

International Atomic Energy Agency

*Atoms for Peace and Development*

# IAEA Activities related to Nuclear Medicine

**Jenia Vassileva**

*Radiation Protection Specialist*

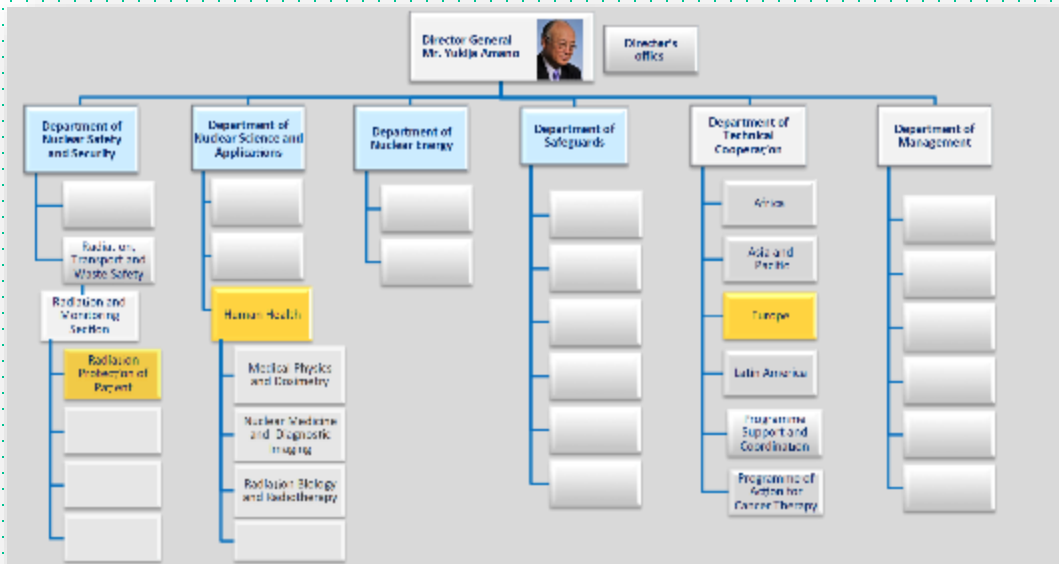
*Radiation Protection of Patients Unit*

*IAEA, Vienna, Austria*

# IAEA statutory role



- The Agency shall seek to **accelerate and enlarge the contribution of atomic energy** to peace, health and prosperity throughout the world
- **Establish or adopt standards of safety** for protection of health and minimization of danger to life and property, and **provide for the application** of these standards

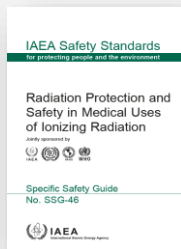


# IAEA activities to support safety



## Providing standards

- Safety standards



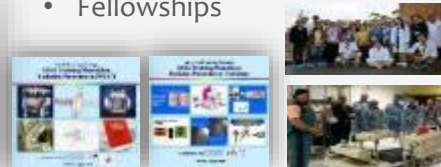
## Providing guidance

- Safety reports
- Technical documents
- Public website



## Providing training

- Training material
- Training courses
- E-learning
- Webinars
- Fellowships



## Giving technical assistance

- Involve in projects
- Providing tools
- Direct advice
- Assessments, missions



## Knowledge exchange

- Meetings, workshops
- Reporting system
- Public website
- Scientific publications



## Building awareness

- Information campaigns
- Press campaigns
- Posters

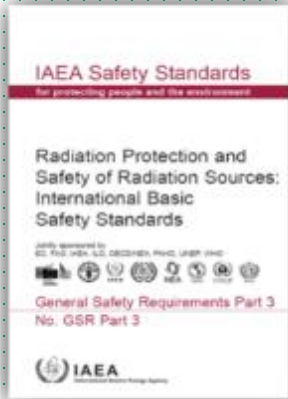


# International Safety Standards



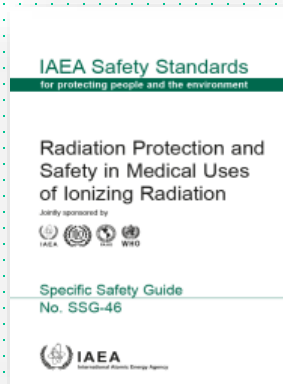
- **International Basic Safety Standards (GSR Part 3)**

- Published 2014
- Co-sponsored by 8 international organizations
- Set basic requirements for protection and safety
- Mandatory for MS receiving technical assistance from the IAEA
- Used as template for many national regulations



- **Safety Guide on Radiation Protection and Safety in Medical Uses of Ionizing Radiation**

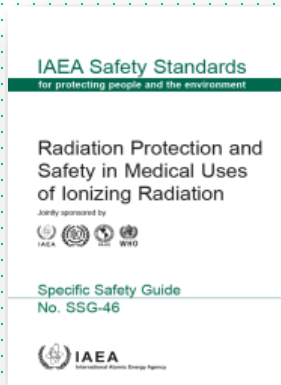
- Provides guidance on fulfilling the BSS requirements in medical settings
- Published October 2018



# Safety Guide on Medical Uses SSG-46



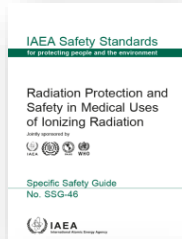

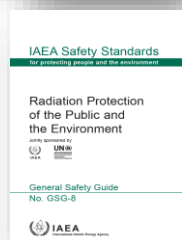
- Jointly sponsored by IAEA, WHO, PAHO, ILO
- Cooperation in developing from IOMP, ISR, ISRRT, WFNMB, ESTRO
- Provides recommendations on fulfilling the requirements of GSR Part 3 with respect to the safe use of ionizing radiation in:
  - Diagnostic radiology and image guided interventional procedures;
  - Nuclear medicine;
  - Radiation therapy.



- Aimed primarily at end-users in medical radiation facilities;
- Applicable to regulatory bodies, health authorities, government agencies and professional bodies.

# Safety Guide on Medical Uses SSG-46



Safety guide	Medical exposure	Occupational exposure	Public exposure
	<p style="color: red; text-align: center;">General and specific guidance</p>	<p style="color: red; text-align: center;">Specific to medical uses of radiation</p>	<p style="color: red; text-align: center;">Specific to medical uses of radiation</p>
	<p style="text-align: center;">NA</p>	<p style="text-align: center;">General and comprehensive guidance</p>	<p style="text-align: center;">NA</p>
	<p style="text-align: center;">NA</p>	<p style="text-align: center;">NA</p>	<p style="text-align: center;">General and comprehensive guidance</p>

# Structure of the Safety Guide SSG-46



1. Introduction
2. General recommendations for radiation protection and safety in medical uses of ionizing radiation
3. Specific recommendations for radiation protection and safety in diagnostic radiology and image guided interventional procedures
4. Specific recommendations for radiation protection and safety in nuclear medicine
5. Specific recommendations for radiation protection and safety in radiation therapy

**Appendix I.** Summary of typical causes of and contributing factors to accidental exposures in medical uses of ionizing radiation (DR, NM, RT)

**Appendix II.** Avoidance of pregnancy following radiopharmaceutical therapy

**Appendix III.** Cessation of breast feeding following administration of various radiopharmaceuticals

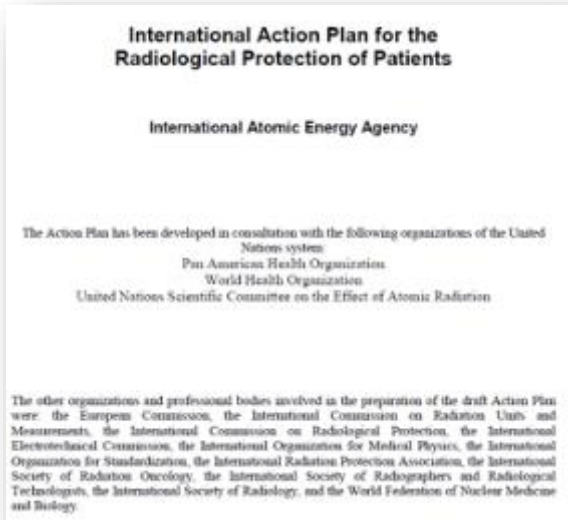
**417 references**

# Implementation of Safety Standards



## The International Action Plan (2002)

- Born in the Málaga Conference (2001)



## Bonn Call to Action (2012)

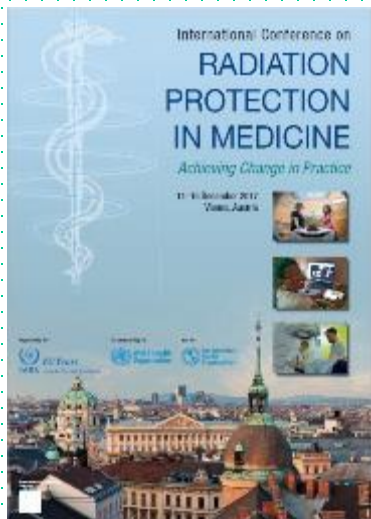
- Issued by IAEA and WHO in the International conference in Bonn (2002)
- 10 actions to improve radiation protection in medicine in the next decade
- Implementation reviewed in the **Radiation Protection in Medicine conference in Vienna** (December 2017)



**BONN CALL FOR ACTION**  
10 Actions to Improve Radiation Protection  
in Medicine in the Next Decade



# International Conference 2017



- 11-17 December 2017 in Vienna
- 534 participants from 97 countries
- 16 international organizations
- 25,000 people viewed the live streaming
- 8 topical sessions; 4 Roundtables; 3 breakout sessions; 6 ESPACE presentations
- Speakers presentations and Contributed papers available at the Bonn Call for Action Platform



<https://www.iaea.org/resources/rpop/resources/bonn-call-for-action-platform>

# RPOP website



A screenshot of the RPOP website homepage. The header includes the IAEA logo and navigation links for OFFICES, SERVICES, RESOURCES, NEWS &amp; EVENTS, and ABOUT US. A search bar is located on the right. The main banner features a blue-tinted image of a medical professional and a patient, with the text "Radiation Protection of Patients (RPOP)". Below the banner, there is a paragraph describing RPOP as the leading resource for health professionals, patients, and the public. The page is divided into two columns: "For health professionals" and "For patients and public". The "For health professionals" section includes an image of a person looking at a medical scan and a list of specialties: Radiology, Radiotherapy, Nuclear medicine, Interventional procedures, Dentistry, and Other specialties and imaging modalities. The "For patients and public" section includes an image of a medical professional talking to a child and a list of topics: X-rays, Computer tomography (CT), Interventional procedures, Nuclear medicine, Radiotherapy, and Brachytherapy. On the right side, there is a "Bonn Call for Action Platform" button, a "Resources" section with buttons for Training, Webinars, Safety in Radiation Oncology (SARCON), Safety in Radiological Procedures (SARFAD), Posters and leaflets, and Publications, and a "RPOP Newsletter" button.

<http://rpop.iaea.org>


- The leading resource for health professionals, patients and public on the safe and effective use of radiation in medicine
- Almost 900 000 views
- Annual increase of 40% in audience in last 3 years

# Education and training

## 1) Free training material

<https://www.iaea.org/resources/rpop/resources/training-material>

### Nuclear medicine



Lectures →  
Exercises →  
Notes →

Lectures (in Spanish) →  
Lectures (in Russian) →  
Exercises (in Russian) →  
Notes (in Russian) →

Lectures:

- 00. Introduction to nuclear medicine
- 01. Biological effects
- 02. Radioactive physics
- 03. Principles of radiation protection
- 04. Safety of sources and design of facilities
- 05. Occupational protection
- 06. Medical exposure
- 07. Organisation of medical exposure diagnosis
- 08. Organisation of medical exposure therapy
- 09. Quality assurance
- 10. Radioactive waste
- 11. Personal exposure
- 12. Protection of the general public
- 13. Organisation of radiation protection in nuclear medicine

## 2) E-learning

Launched end 2016

4000 users

> 1500 certificates of completion

Next step: Spanish and Russian versions



*Radiation Dose Management in Computed Tomography*



*Safety and Quality in Radiotherapy*

## 3) Free webinars



Since February → 2016

23 webinars covering various topics

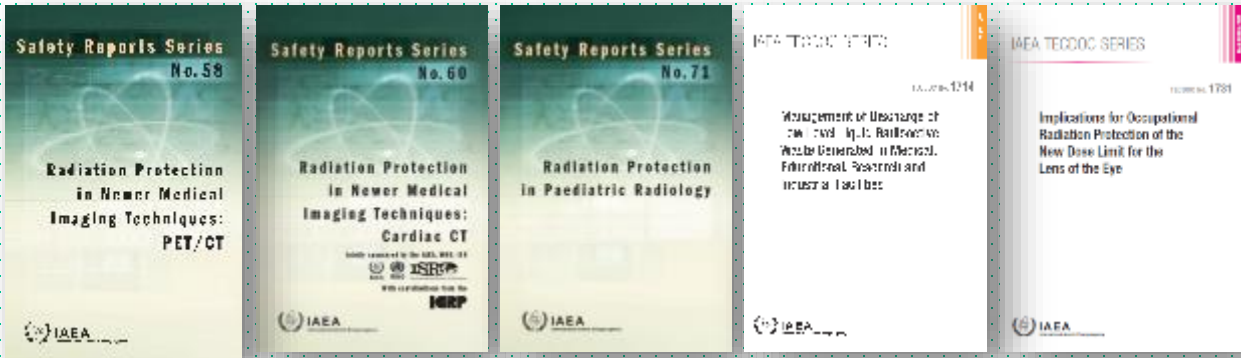
→ over 4300 participants attended from 100 Member States

10 December 2018: on Hybrid Imaging 11

# Specific guidance



## Specific guidance on implementation of standards (Safety Reports, TechDocs)



- **New under development:**
  - Patient Radiation Exposure Monitoring in Medical Imaging | (with ICRP, WHO, UNSCEAR, IOMP, DICOM WG28)
  - Radiation Protection in Dental Radiology (with WHO, FDI, IADMR, IOMP, Image Gently)

# Education and training



## Training courses and workshops

- National, Regional, Inter-regional
- Main target audience: health professionals in hospitals, but also regulators

### Joint ICTP–IAEA Advanced School on Quality Assurance and Dose Management in Hybrid Imaging (SPECT–CT and PET–CT)

Trieste, Italy, 17 - 28 September 2018

- Support of AAMP, EFOMP and EANM
- 75 attendees from 47 countries



6 November 2018, HERCA Workshop

### Regional Training Course on Radiation Protection in X-ray imaging and Nuclear Medicine for Regulatory Bodies

19-23 November 2018

Tirana, Albania

under the Regional project RER/g147 on Enhancing Member States' Capabilities for Ensuring Radiation Protection of Individuals Undergoing Medical Exposure

30 participants from TC Europe region



## Technical meetings 2018

- Experiences in the Implementation of the Bonn Call for Action (5-7 March)
- Preventing Unintended and Accidental Exposures in Nuclear Medicine (16-18 May)
- Safety Culture Learning in Medical Uses of Radiation (1-3 October)

### Technical Meeting on Preventing Unintended and Accidental Exposures in Nuclear Medicine, 16-18 May 2018 in Vienna

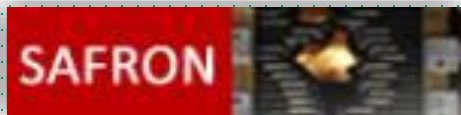
- Attended by 45 delegates from 33 Member States and 11 international bodies.
- Reviewed the causes of unintended and accidental exposure during the different steps of the nuclear medicine process, and defined actions for preventing such incidents and strengthening safety.
- Report available from <https://www.iaea.org/sites/default/files/18/06/2018-report-tm-on-preventing-accidental-exposure.pdf>
- Scientific paper with guidance on prevention of incidents under preparation



# Safety Reporting Systems



## SAFRON: Safety in Radiation Oncology



**New project:** Upgrade of SAFRON to include NM therapy:  
Consultancy meeting in November



## SAFRAD: Safety in Radiological Procedures



# Poster and leaflets



Available in over 20 languages at  
<https://www.iaea.org/resources/rpop/resources/posters-and-leaflets>



## Resources

- ☛ RPOP Home
- ☛ International Safety Standards
- ☛ Publications
- ☛ Posters and leaflets
- ☛ Bonn Call for Action platform
- ☛ Smart Card
- ☛ RELID Study

## Materials for download

- Poster - Building awareness in pregnancy →
- Trifold - Delivering Safe Radiotherapy is in your Hands →
- Poster - 10 Pearls: Radiation protection of patients in CT →
- Poster - 10 Pearls: Appropriate referral for CT examinations →
- Poster - 10 Pearls: Radiation protection for children in interventional procedures →
- Poster - 10 Pearls: Radiation protection of patients in fluoroscopy →
- Poster - 10 Pearls: Radiation protection of staff in fluoroscopy →

## New posters under development:

- 10 pearls: Radiation protection of patients in nuclear medicine
- 10 pearls: Radiation protection of patients in nuclear medicine

**Pregnant?**  
or think you could be?  
Please tell the staff before an X ray or nuclear medicine procedure

**What you need to know**  
Unborn babies are more sensitive to radiation.  
Risk depends on stage of pregnancy, type of procedure and the amount of radiation used.  
Diagnostic radiological procedures are safe under most circumstances even during pregnancy.

**DO's and DON'Ts**  
Don't avoid the procedure if it's important for your health.  
Do ask the medical staff what measures will be taken to reduce any risks.  
Do seek advice before the procedure if you are concerned.  
Do ask if a pregnancy test is needed.

IAEA  
International Atomic Energy Agency  
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# Activities of NAHU



NAHU: Division of Human Health  
Department of  
Nuclear Science and Applications

A screenshot of the IAEA Human Health Campus website. The header includes the IAEA logo and the text "IAEA Human Health Campus". Below the header is a navigation menu with categories: Home, Nuclear Medicine, Radiotherapy, Radiation Biology, Medical Physics, Technologists, and Radiation. The main content area features a large banner titled "Resources and Learning for Health Professionals" with a sub-headline: "The IAEA offers information resources for health professionals working in nuclear medicine, radiation oncology, medical physics, and radiation protection, insight into the different aspects of modern clinical practice." Below the banner are three columns: "Shortcuts" with links like "Home", "About", "News", "Media", "Workshops &amp; Information", "Publications &amp; Products", and "IPAN Publications"; "The Human Health Portfolio" with a link to "Nuclear Applications in Human Health: Publications"; and "What's New" with several news items including "PAINLESS: New Radiation Detector", "Users receive use of stable isotopes to live safer", "Publication - 2016 Annual Scientific Sessions Live Coverage", "Fights Bone Cancer in Children with 3D Models", "Innovative use of water resources in Radiotherapy for Breast Cancer: From Research to Practice", "Users receive a multidisciplinary suite of small field output factors calculated on treatment planning systems used in radiotherapy", and "Open Access: Improving the quality of the order or receipt of patient's acceptance of radiation therapy in the Latin America Region". At the bottom, there is a "In the Spotlight" section with a video thumbnail titled "Cancer is one of the main causes of mortality worldwide".

- Publications
- Webinars
- E-learning
- Tools
- Coordinated Research Projects (CRP)
- Trainings
- Meetings

<https://humanhealth.iaea.org/HHW/index.html>

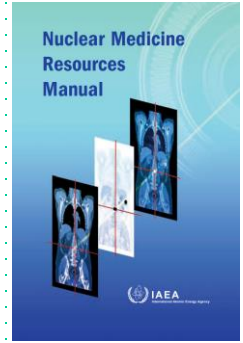
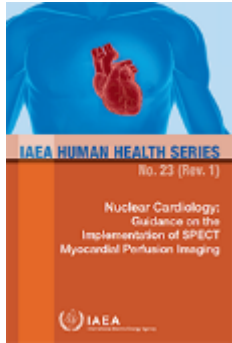
# Activities of NAHU



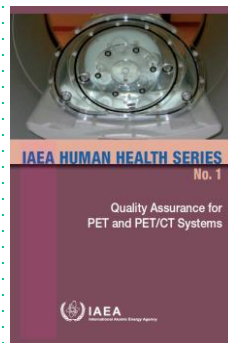
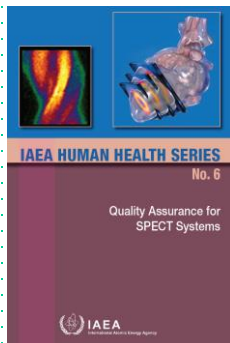
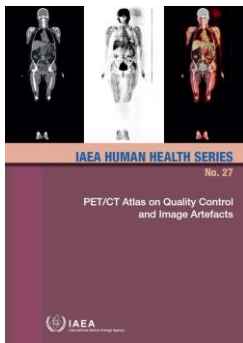
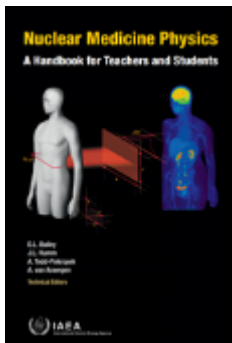
A screenshot of the IAEA Human Health Campus website. The page features a navigation bar with links for Home, Nuclear Medicine, Radiobiology, Radiation Dosimetry, Medical Physics, Technological, and Solidors. The main content area is titled "Nuclear Medicine" and includes a search bar, a "Clinical Applications" section, and several featured articles or resources with images and titles such as "Theology and PET/CT Imaging", "Continuum in the and Parameters", "Radiobiology", "Radiological and Technicians", "Medical and Technicians", "Healthcare and Technicians", "Quality of Practice", "Educational Resources", "Webinars", "E-learning modules", "SAGA Conferences", "Nuclear Medicine Links", "DATOL", "SAGA Nuclear Medicine Publications", "Mobile Apps", "Advanced Case Event", and "Towards 2017: Theoretical and Molecular Radiotherapy".

- Publications
- Webinars
- E-learning
- Tools
- Coordinated Research Projects (CRP)
- Trainings
- Meetings

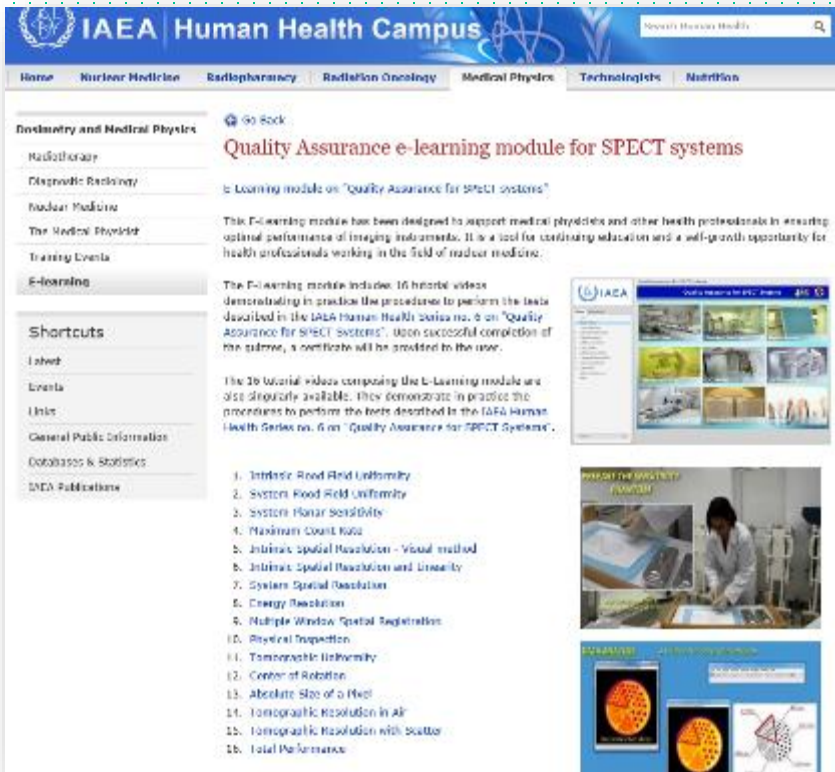
# Publications



Updated version  
to be published







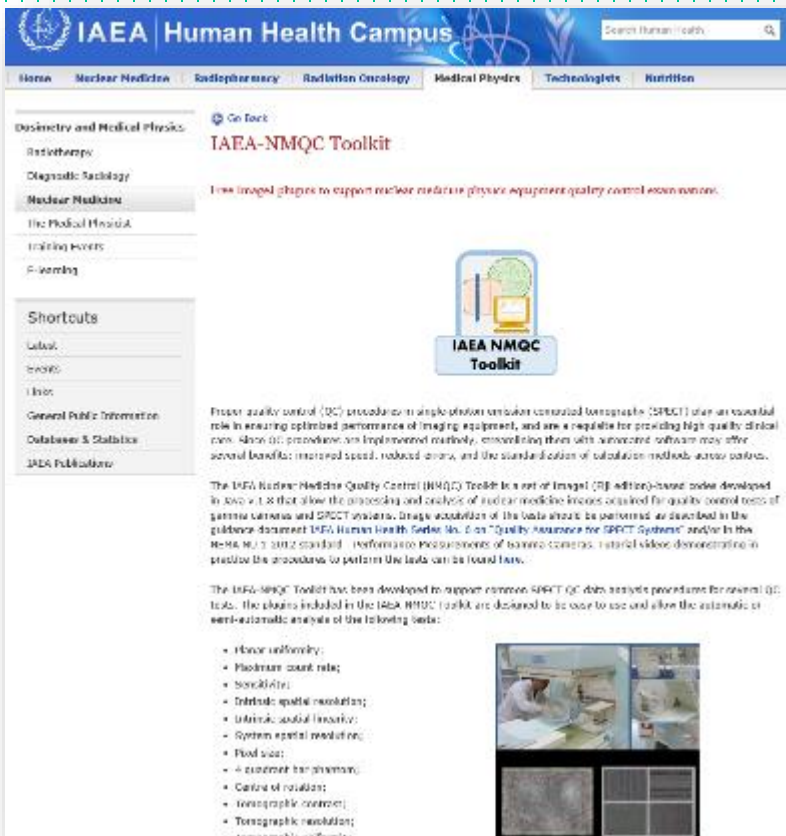
The screenshot shows the IAEA Human Health Campus website. The main navigation bar includes: Home, Nuclear Medicine, Radiopharmacy, Radiation Oncology, Medical Physics, Technologists, and Nutrition. The left sidebar contains: Radiometry and Medical Physics, Radiobiology, Diagnostic Radiology, Nuclear Medicine, The Medical Physicist, Training Events, E-learning, Shortcuts, Jobs, Events, Links, General Public Information, Databases & Statistics, and IAEA Publications.

The main content area is titled "Quality Assurance e-learning module for SPECT systems". It includes a "Go Back" link and a "Learning module on 'Quality Assurance for SPECT systems'" section. Below this, there is a paragraph describing the module's purpose and a list of 16 topics to be covered:

1. Intrinsic Flood Field Uniformity
2. System Flood Field Uniformity
3. System Planar sensitivity
4. Maximum Count Rate
5. Intrinsic Spatial Resolution - Visual method
6. Intrinsic Spatial Resolution and Linearity
7. System Spatial Resolution
8. Energy Resolution
9. Multiple Window Spatial Registration
10. Physical Inspection
11. Tomographic Uniformity
12. Center of Rotation
13. Absolute Size of a Pixel
14. Tomographic Resolution in Air
15. Tomographic Resolution with Scatter
16. Total Performance

There are also two small images: one showing a person in a lab coat working with a SPECT system, and another showing a computer screen displaying a SPECT image with a resolution diagram.

- E-learning:
  - Quality Assurance for SPECT systems
  - Quality Assurance for PET and PET/CT Systems
  - Nuclear Medicine Handbook slides
  - Many on NM medical topics




**IAEA Human Health Campus**

Home Nuclear Medicine Radiopharmacy Radiation Oncology Medical Physics Technology Nutrition

Go Back

## IAEA-NMQC Toolkit

Five integral phases to support nuclear medicine physics equipment quality control examinations.



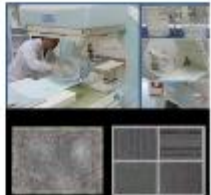
**IAEA NMQC Toolkit**

Proper quality control (QC) procedures in single-photon emission computed tomography (SPECT) play an essential role in ensuring optimized performance of imaging equipment, and are a requisite for providing high-quality clinical care. When QC procedures are implemented routinely, controlling them with automatic software may offer several benefits: improved speed, reduced errors, and the standardization of calculation methods across centers.

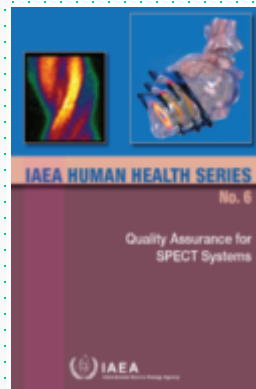
The IAEA Nuclear Medicine Quality Control (NMQC) Toolkit is a set of integral (IE) software-based tools developed in 2010 to allow the processing and analysis of nuclear medicine images acquired for quality control tests of gamma cameras and SPECT systems. Single acquisition of the data allows its processing as described in the guidance document IAEA Human Health Series No. 6 on "Quality Assurance for SPECT Systems" and/or in the IAEA HU-1302 standard. A reference implementation of software controls, tutorial videos demonstrating in practice the procedures to perform the tests can be found here.

The IAEA-NMQC Toolkit has been developed to support common SPECT QC data analysis procedures for several QC tests. The phases included in the IAEA-NMQC Toolkit are designed to be easy to use and allow the automatic or semi-automatic analysis of the following tests:

- Image uniformity;
- Maximum count rate;
- Sensitivity;
- Intrinsic spatial resolution;
- Intrinsic spatial resolution;
- System spatial resolution;
- Flood tests;
- 4 quadrant test phantom;
- Centre of rotation;
- Tomographic contrast;
- Tomographic resolution;
- Tomographic contrast.



## • Nuclear Medicine QC Toolkit

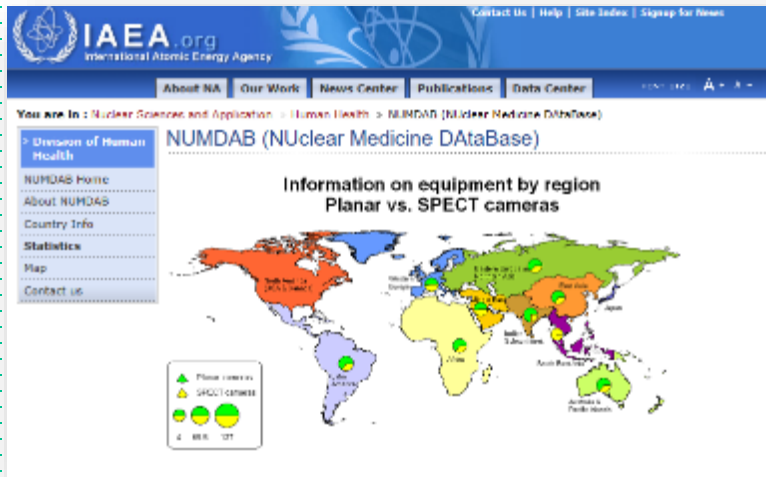




# NUMDAB: Nuclear Medicine DataBase



- IAEA's Nuclear Medicine DataBase
- The aim of NUMDAB is to gather and maintain updated information regarding the status of nuclear medicine practice around the world
- Focused at collecting data on individual nuclear medicine facilities: information on manpower and equipment, isotopes and radiopharmaceuticals employed.
- Other relevant data such as SPECT procedures performed and educational needs are expected to be registered as well.



<http://nucmedicine.iaea.org>

# Medical Physics Training and Staffing needs



**IAEA Human Health Campus**

Home | Nuclear Medicine | Radiobiology | Radiation Therapy | **Medical Physics** | Biotechnology | Statistics

**Dosimetry and Medical Physics**

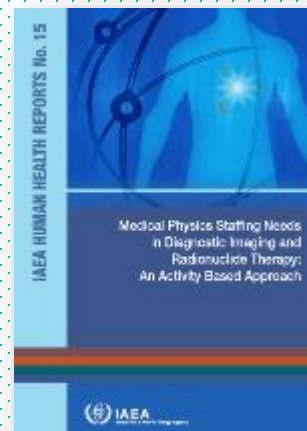
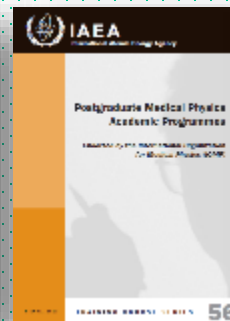
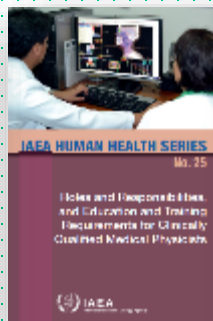
[Radiobiology](#)  
[Diagnostic Radiology](#)  
[Nuclear Medicine](#)  
[The Medical Physicist](#)  
[Training Course](#)  
[Workshop](#)

**Shortcuts**

[Lancet](#)  
[Oncop](#)  
[Lancet Oncology](#)  
[The Medical Physicist](#)  
[IAEA Publications](#)

[Reference](#)  
[Diagnostic radiology](#)  
[Nuclear Medicine](#)  
[The Medical Physicist](#)  
[Training Course](#)  
[IAEA Publications](#)

**Medical Physics** is the application of physics to medicine. It includes physics research and practice in the provision of accurate measurement of dose in Medical Physics, the use of radiation, radiobiology, radiological and medical research, and in the optimisation of certain health related activities. Medical Physics includes areas such as radiophysics, clinical diagnostic radiology, nuclear medicine physics, cancer medicine physics, and radiation protection, diagnostic radiology and nuclear health as well other areas in which a medical physicist's specialisation through their own therapeutic aspects of Medical Physics associated with radiation therapy. Other areas of interest to Medical Physicists include the measurement of ionising radiation, usage of contrast agents, and the application of heavy charged particles in the treatment of all of the previously mentioned areas of medicine. The development of several of these fields is a continuous process, to include new fields which are constantly being developed. As part of a team of health professionals, medical physicists play a central role in ensuring the safe and effective use of radiation in medicine. Their skills of quality are achieved through the use of GANUC protocols in the context of medicine-related occupational radiation protection planning and methods, diagnostic image optimisation and dose reduction, and data management and analysis, all of which are based on an in-depth understanding of both the physics principles and medical technology. The international community has a central role in providing the guidance, advice, physical and technical infrastructure, as well as support for the working to these standards. The IAEA is one of the leading international organisations in the support of training programs.



Published  
2018



# IDOS-2019 Conference

A screenshot of the IAEA website's event page for IDOS 2019. The page features a blue header with the IAEA logo and navigation menus. A large banner for "IDOS 2019" includes a video stream icon, a "50 YEARS" anniversary badge, and a photograph of a laboratory setting. Below the banner, the event title "International Symposium on Standards, Applications and Quality Assurance in Medical Radiation Dosimetry (IDOS 2019)" is displayed, along with the dates "18-21 June 2019, Vienna, Austria". The main content area is divided into sections for "Medical Radiation Dosimetry Symposium (IDOS-2019)", "Objectives", "Live Video Stream", and "Related resources".

English العربية ايدو Français Português Español

Press centre Employment Contact

TOPICS SERVICES RESOURCES NEWS & EVENTS ABOUT US

Home / Events

## IDOS 2019

50 YEARS OF IAEA

### International Symposium on Standards, Applications and Quality Assurance in Medical Radiation Dosimetry (IDOS 2019)

18-21 June 2019, Vienna, Austria

#### Medical Radiation Dosimetry Symposium (IDOS-2019)

- Home
- News

#### Objectives

The major goal of the symposium is to provide a forum at which advances in radiation dosimetry, radiation medicine, radiation protection and associated standards made over the last decade can be disseminated and scientific knowledge exchanged. It will cover all specialties in radiation medicine and radiation protection, with a specific focus on those areas where the standardization of dosimetry has improved in recent years (advanced radiotherapy, diagnostic radiology, nuclear medicine and audit). It will also summarize the present status of, and outline future trends in, medical radiation dosimetry and identify possible areas for improvement. The conclusions and summaries from the symposium should lead to the formulation of recommendations for the scientific

Live Video Stream

#### Related resources

- Online Pre-registration
- Announcement and call for Papers
- List of invited organizations
- Participation Form A (Form A) - no deadline
- Form for submission of a Paper (Form B) - Submit by 15 December

<https://www.iaea.org/events/idos2019>

*Thank YOU!*

Visit us at  
<https://www.iaea.org/resources/rpop>