



**UNIKLINIK  
KÖLN**



# **European Association of Nuclear Medicine (EANM) – Overview of actions and initiatives in radiation protection, with emphasis on ALARA**

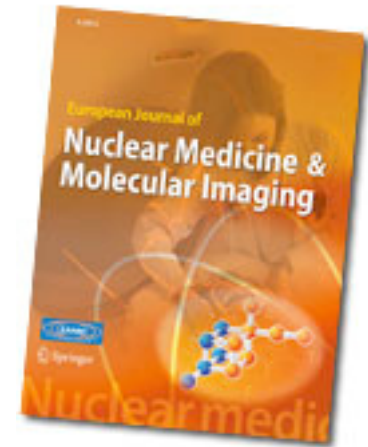
**Wolfgang Eschner**

## About EANM ([www.eanm.org](http://www.eanm.org))

- founded in 1985 in London, HQ situated in Vienna
- umbrella organization of nuclear medicine in Europe
- represents the sector towards European Institutions
- aims at advancing science and education in nuclear medicine for the benefit of public health as well as at
- promoting and coordinating discussion and exchange of ideas and results relating to the diagnosis, treatment, research and prevention of diseases through the use of unsealed radioactive substances ... in medicine
- provide a medium for dissemination and discussion of latest results in the field of nuclear medicine and related subjects

## EANM activities

- Annual Congress, attracting an average of > 4,000 participants
- Continuing Medical Education (CME)  
within the European School of Nuclear Medicine (ESNM):
  - | full programme of CMEs at the annual congress,
  - | courses at the EANM Educational Facility and
  - | seminars in Central & Eastern Europe.
- Scientific Journal  
European Journal of Nuclear Medicine  
and Molecular Imaging (EJNMMI)
- Website, E-Newsletters, Grants, EU/FP7 projects



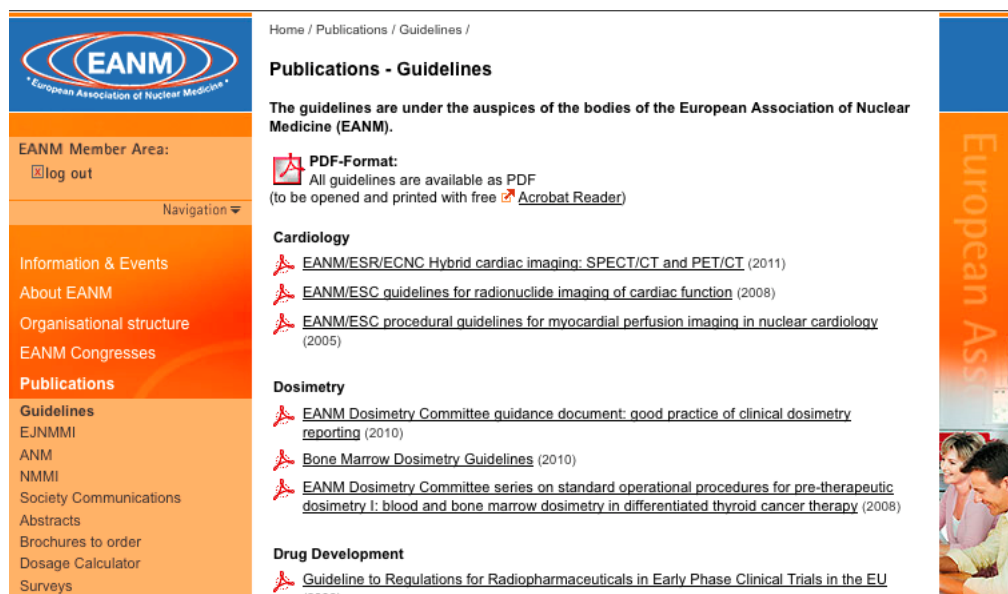
## **EANM structure – Task groups and committees**

- » Cardiovascular Committee
- » **Dosimetry Committee**
- » Drug Development Committee
- » Neuroimaging Committee
- » Oncology Committee
- » Paediatrics Committee
- » **Physics Committee**
- » Radionuclide Therapy Committee
- » Radiopharmacy Committee
- » Technologist Committee
- » Translational Molecular Imaging Committee
- » TG Inflammation and Infection

# Publications - Guidelines

54 guidelines available online (open access)

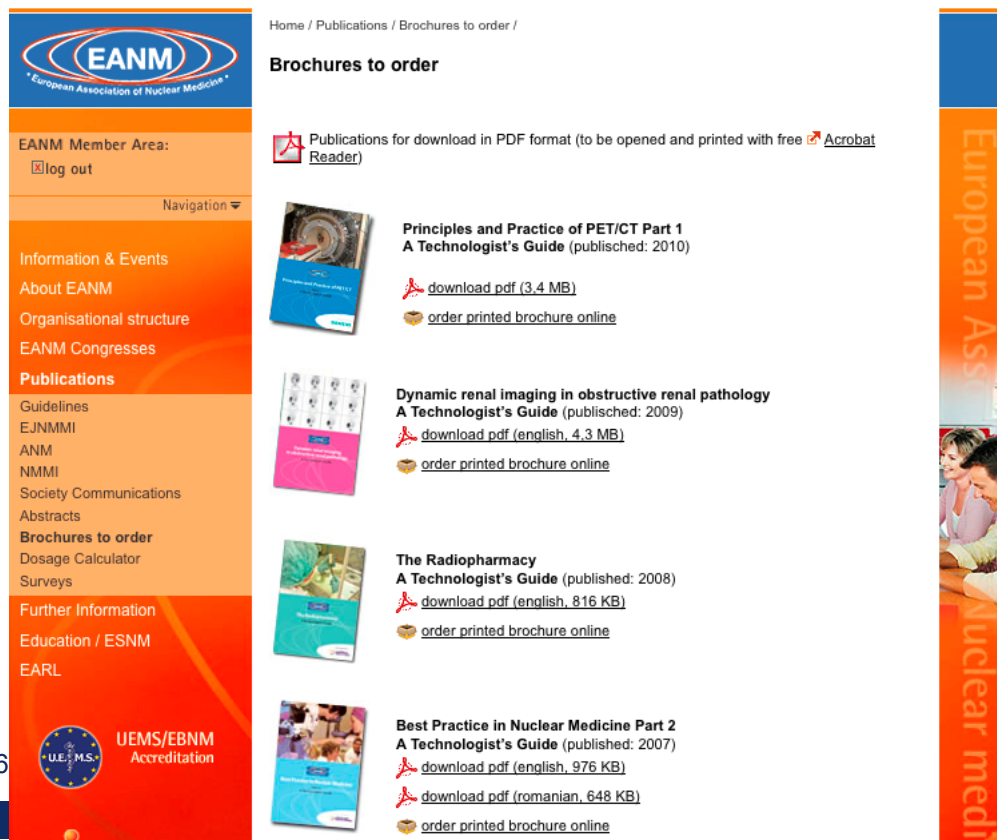
from all areas (dosimetry, physics, pediatric ...), many of them published in EJNMMI



The screenshot shows the EANM website's 'Publications - Guidelines' section. The left sidebar contains navigation links: EANM Member Area (log out), Information & Events, About EANM, Organisational structure, EANM Congresses, Publications (Guidelines, EJNMMI, ANM, NMCI, Society Communications, Abstracts, Brochures to order, Dosage Calculator, Surveys), and a vertical banner for the European Association of Nuclear Medicine. The main content area lists guidelines under three categories: Cardiology (EANM/ESR/ECNC Hybrid cardiac imaging, EANM/ESC guidelines for radionuclide imaging, EANM/ESC procedural guidelines for myocardial perfusion imaging), Dosimetry (EANM Dosimetry Committee guidance document, Bone Marrow Dosimetry Guidelines, EANM Dosimetry Committee series on standard operational procedures), and Drug Development (Guideline to Regulations for Radiopharmaceuticals in Early Phase Clinical Trials in the EU).



# Publications - Brochures


7 brochures available online (open access) and printed mostly aimed at „Best Practice“; also „Dosage Card“





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**Brochures to order**

 Publications for download in PDF format (to be opened and printed with free  Acrobat Reader)

 **Principles and Practice of PET/CT Part 1  
A Technologist's Guide** (published: 2010)  
[download pdf \(3,4 MB\)](#)  
[order printed brochure online](#)

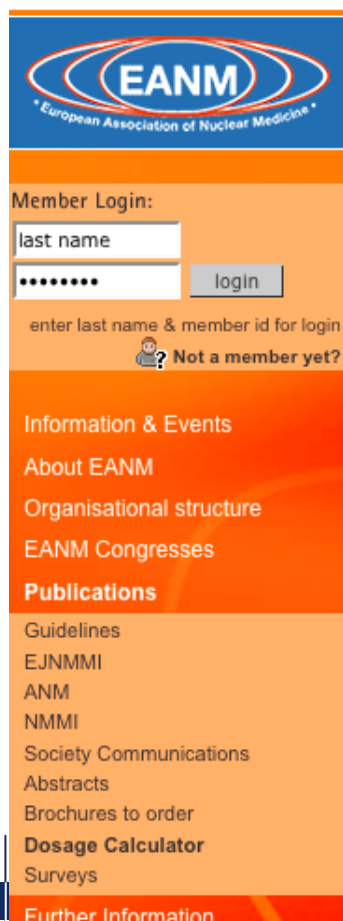
 **Dynamic renal imaging in obstructive renal pathology  
A Technologist's Guide** (published: 2009)  
[download pdf \(english, 4,3 MB\)](#)  
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 **The Radiopharmacy  
A Technologist's Guide** (published: 2008)  
[download pdf \(english, 816 KB\)](#)  
[order printed brochure online](#)

 **Best Practice in Nuclear Medicine Part 2  
A Technologist's Guide** (published: 2007)  
[download pdf \(english, 976 KB\)](#)  
[download pdf \(romanian, 648 KB\)](#)  
[order printed brochure online](#)

# Publications – Dosage Calculator / Dosage Card

online dose calculator; printed version available



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## Dosage Card

### EANM Calculator Dosage Card

Weight  
12 kg

Radiopharmaceutical  
F-18 FDG (3D), Recommended in children

ok

Activity to be administered:  
**= 44 MBq**



### Calculation of the administered activity [MBq]

Selected Radiopharmaceutical:

F-18 FDG (3D), Recommended in children

Selected Weight:

12 kg

$A[\text{MBq}]_{\text{Administered}} = 14.000 \times 3.140 = 44 \text{ MBq}$





## Dosage Card (Version 1.5.2008)

### Multiple of Baseline Activity

Weight kg	Class A	Class B	Class C	Weight kg	Class A	Class B	Class C
3	1	1	1	32	3.77	7.29	14.00
4	1.12	1.14	1.33	34	3.88	7.72	15.00
6	1.47	1.71	2.00	36	4.00	8.00	16.00
8	1.71	2.14	3.00	38	4.18	8.43	17.00
10	1.94	2.71	3.67	40	4.29	8.86	18.00
12	2.18	3.14	4.67	42	4.41	9.14	19.00
14	2.35	3.57	5.67	44	4.53	9.57	20.00
16	2.53	4.00	6.33	46	4.65	10.00	21.00
18	2.71	4.43	7.33	48	4.77	10.29	22.00
20	2.88	4.86	8.33	50	4.88	10.71	23.00
22	3.06	5.29	9.33	52-54	5.00	11.29	24.67
24	3.18	5.71	10.00	56-58	5.24	12.00	26.67
26	3.35	6.14	11.00	60-62	5.47	12.71	28.67
28	3.47	6.43	12.00	64-66	5.65	13.43	31.00
30	3.65	6.86	13.00	68	5.77	14.00	32.33

$$A[\text{MBq}]_{\text{Administered}} = \text{Baseline Activity} \times \text{Multiple}$$

- For a calculation of the administered activity, the *baseline* activity value has to be multiplied by the multiples given above for the recommended radiopharmaceutical class (see reverse).
- If the resulting activity is smaller than the minimum recommended activity, the minimum activity should be administered.
- The national diagnostic reference levels should not be exceeded!

#### Examples:

- $^{18}\text{F}$  FDG (WB 3D), 50 kg: activity to be administered  $[\text{MBq}] = 14.0 \times 10.71 [\text{MBq}] \approx 150 \text{ MBq}$
- $^{123}\text{I}$  mIBG, 3 kg: activity to be administered  $[\text{MBq}] = 28.0 \times 1 [\text{MBq}] = 28 \text{ MBq}$   
 $< 80 \text{ MBq}$  (Minimum Recommended Activity)  
**=> activity to be administered: 80 MBq**
- $^{99\text{m}}\text{Tc}$  HMPAO (Brain), 58 kg: activity to be administered  $[\text{MBq}] = 51.8 \times 12 [\text{MBq}] \approx 621 \text{ MBq}$   
 This would e.g. exceed the German diagnostic reference level of 550 MBq  
**=> activity to be administered in Germany: 550 MBq**

## Recommended Amounts in MBq

Radiopharmaceutical	Class	Baseline Activity (for calculation purposes only) MBq	Minimum Recommended Activity <sup>1</sup> MBq
$^{123}\text{I}$ (Thyroid)	C	0.6	3
$^{123}\text{I}$ Amphetamine (Brain)	B	13.0	18
$^{123}\text{I}$ HIPURAN (Abnormal renal function)	B	5.3	10
$^{123}\text{I}$ HIPURAN (Normal renal function)	A	12.8	10
$^{123}\text{I}$ mIBG	B	28.0	80
$^{131}\text{I}$ mIBG	B	5.6	35
$^{18}\text{F}$ FDG (2D) <sup>4</sup>	B	25.9	26
$^{18}\text{F}$ FDG (3D), Recommended in children <sup>4</sup>	B	14.0	14
$^{18}\text{F}$ Fluorine (2D)	B	25.9	26
$^{18}\text{F}$ Fluorine (3D), Recommended in children	B	14.0	14
$^{67}\text{Ga}$ Citrate	B	5.6	10
$^{99\text{m}}\text{Tc}$ ALBUMIN (Cardiac)	B	56.0	80
$^{99\text{m}}\text{Tc}$ COLLOID (Gastric Reflux)	B	2.8	10
$^{99\text{m}}\text{Tc}$ COLLOID (Liver/Spleen)	B	5.6	15
$^{99\text{m}}\text{Tc}$ COLLOID (Marrow)	B	21.0	20
$^{99\text{m}}\text{Tc}$ DMSA	A	17.0	15
$^{99\text{m}}\text{Tc}$ DTPA (Abnormal renal function)	B	14.0	20
$^{99\text{m}}\text{Tc}$ DTPA (Normal renal function)	A	34.0	20
$^{99\text{m}}\text{Tc}$ ECD (Brain perfusion)	B	32.0	110
$^{99\text{m}}\text{Tc}$ HMPAO (Brain)	B	51.8	100
$^{99\text{m}}\text{Tc}$ HMPAO (WBC)	B	35.0	40
$^{99\text{m}}\text{Tc}$ IDA (Biliary)	B	10.5	20
$^{99\text{m}}\text{Tc}$ MAA / Microspheres	B	5.6	10
$^{99\text{m}}\text{Tc}$ MAG3	A	11.9	15
$^{99\text{m}}\text{Tc}$ MDP	B	35.0	40
$^{99\text{m}}\text{Tc}$ Pertechetate (Cystography)	B	1.4	20
$^{99\text{m}}\text{Tc}$ Pertechetate (Ectopic Gastric Mucosa)	B	10.5	20
$^{99\text{m}}\text{Tc}$ Pertechetate (Cardiac First Pass)	B	35.0	80
$^{99\text{m}}\text{Tc}$ Pertechetate (Thyroid)	B	5.6	10
$^{99\text{m}}\text{Tc}$ RBC (Blood Pool)	B	56.0	80
$^{99\text{m}}\text{Tc}$ SestaMIBI/Tetrofosmin	B	63.0	80



## CME Sessions at EANM congress 2010

### CME Topics:

- CME I – Cardiovascular – October 10, 08:00-09:30  
Practical Aspects of PET Imaging in Patients with Ischemic Heart Disease
- CME II – Physics – October 10, 11:30–13:00  
Radiation Exposure in Nuclear Medicine and Multimodality Imaging
- ...

most lectures available online

# COURSES 2011



## CME at the Educational Facility

○ **FEBRUARY 05–06**  
EANM/ESTRO Educational Seminar on  
PET in Radiation Oncology  
In Brussels

○ **FEBRUARY 19–20**  
Cardiovascular Course

○ **MARCH 10–12**  
Course on PET/CT in Oncology, basic

○ **MARCH 19–20**  
Technologist PET/CT Course, basic

○ **MAY 05–07**  
Course on PET/CT in Oncology, advanced

○ **MAY 14–15**  
Neuroimaging Course

○ **MAY 21–22**

○ **SEPTEMBER 01–03**  
Course on PET/CT in Oncology, basic

○ **SEPTEMBER 10–11**  
Technologist PET/CT Course, basic

○ **SEPTEMBER 17–18**  
Cardiovascular Course  
In German

○ **SEPTEMBER 22–23**  
Dosimetry Course, advanced

○ **NOVEMBER 05–06**  
Paediatric Course

○ **NOVEMBER 19–20**  
EANM/ESTRO Educational Seminar  
on PET in Radiation Oncology

○ **NOVEMBER 26–27**  
Technologist PET/CT Course, advanced

**radiation protection topics covered in each course**

# ALARA topics in nuclear medicine

## Protection of workers

- No urgent topics, level of awareness high
- incorporation risk generally low
- external exposure from beta emitters: technical (see session 3)
- cataract induction?

## Protection of the public

- public exposure (e.g. to excreted iodine-131) not being discussed from ALARA point of view

# ALARA topics in nuclear medicine

Protection of patients

- **focus on children and adolescents**
- multidimodality imaging: PET-CT, SPECT-CT
- (harmonization of) diagnostic reference levels
- critical review of dosimetric data for licensed / used /investigated radiopharmaceuticals
- reappraisal of the „R“ in ALARA: investigate **risk**
  - | Epidemiological risk analysis, e.g. thyroid cancer caused by radioiodine treatment
  - | Prognosis-based lifetime attributable risk approximation (PROLARA)



## Home



### Introduction

Welcome to the website of the project **PEDDOSE.NET**:

Dosimetry and Health Effects of Diagnostic Applications of Radiopharmaceuticals with particular emphasis on the use in children and adolescents.

Nuclear medicine contributes significantly to the health, healthcare and quality of life of European citizens, particularly in major clinical areas such as cancer and cardiovascular disease. Every year, over 6 million patients benefit from a nuclear medicine procedure in Europe, 95% of which are diagnostic and 5% therapeutic. The evaluation of the impact on patients' health of small and non-repetitive or less repetitive doses of radioactive substances, as currently used in diagnostic imaging procedures, has up to now not been addressed systematically in a European context. This is where the project Peddose.net steps in.

This Support Action started in April 2010 and is partially funded by the European Commission under the FP 7 call: *HEALTH-2009-1.2-6: Evaluation of the potential health impact of diagnostic imaging agents doses.*



## (WP1) review of frequently used radiopharmaceuticals

In many biokinetic and dosimetric studies the number of subjects included is  $< 10$ . In the scope of the new ICRP recommendations (ICRP 103) also gender-specific differences might need to be considered in the future.

Dosimetric raw data (residence times, %ID) not compatible with ICRP 103 organ weighting factors.

The quality of the experimental data as a base for assessments of the absorbed dose is highly variable.

For some more frequently used PET-pharmaceuticals such as F-18-fluoride or Ga-68-DOTATATE no published data on dosimetry are available.

For some substances such as Tl-201-chloride recalculations of the absorbed doses in ICRP 106 lead to a substantial decreased effective dose (14 mSv vs. 20 mSv) due to a re-evaluation of the available data on testes uptake.

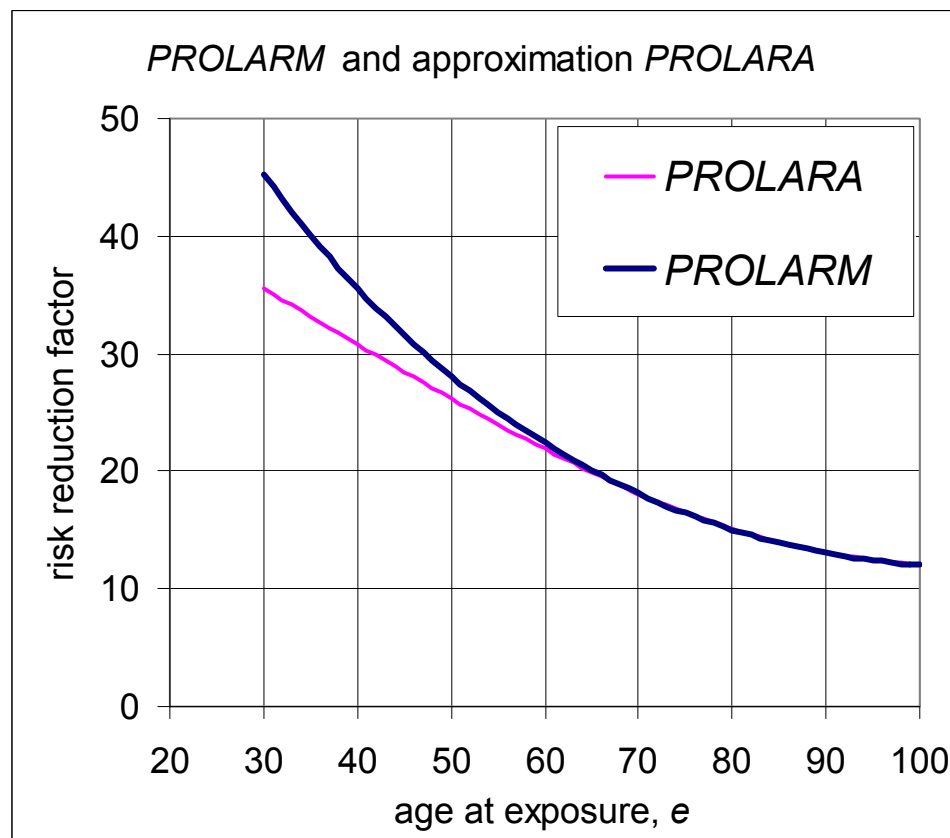
For I-131-iodide used for pre-treatment dose estimates in differentiated thyroid cancer patients the absorbed doses given by ICRP reports need to be modified e.g. because of medication-related changes in the patients' biokinetics.

## (WP1) Report on Epidemiologic Data

### „R reappraisal“

Standard risk calculations applied to a group of  $n=4285$  patients with metastatic breast cancer

- An effective dose of 10 mSv at age  $e=50$  years yields LAR values of  $1.2 \times 10^{-3}$  for nonpatients and  $4.3 \times 10^{-5}$  for a patient in the above cohort.
- That is a reduction in risk by a factor of 29 (PROLARM). From an approximation using only survival data, that ratio is 27 (PROLARA).



Eschner W et al. Eur J Nucl Med Mol Imag 2010, 37, 131.





## 2011.04.28 — PEDDOSE.NET Final Workshop

### SAVE THE DATE!

**PEDDOSE.NET Final Workshop: Peddose.net - Do we apply too much radiation in diagnostic nuclear medicine?**

**15 October 2011, 9:30 - 12:30 hrs**

**Part of a pre-congress dosimetry symposium to the 2011 EANM congress in Birmingham**

### **Venue:**

The ICC & the NIA Birmingham

Broad Street

Birmingham, B1 2EA, United Kingdom



## MEDRAPET

Medical Radiation Protection  
EDUCATION AND TRAINING

**April 21-23, 2012**  
European Workshop on education  
and training in medical radiation protection  
in Athens/Greece



CONTACT

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- PROJECT ORGANISATION
- CONSORTIUM

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PARTNERS' AREA

**ABOUT**

The main aim of the MEDRAPET project is the identification of needs in radiation protection training. An integrated approach to education and training with high-standard training programmes harmonised at EU level is a key prerequisite to ensure excellence in radiation protection and to implement programmes for dose optimization in medicine.

It is essential that all stakeholders in radiation protection ensure that proper education and training are in place, in particular with regard to new technologies and complex medical exposure procedures that have been developed in the past years and that are introduced into clinical practice at a rapid pace.

The results of the MEDRAPET project will be the basis for the revision of the Radiation Protection 116 Guidelines on Education and Training in Radiation Protection for Medical Exposures.

*MEDRAPET is financially supported by the European Commission.*





**Thank you!**