Overview of TG 117 Report. Radiological Protection in PET and PET/CT

Josep M Martí-Climent
Clínica Univesidad de Navarra, Pamplona, Spain
ICRP Committee 3 on Protection in Medicine

TG 117 WORKSHOP

RADIOLOGICAL PROTECTION IN PET AND PET/CT

18 SEPTEMBER 2023

Positron Emission Tomography (PET)

- **Nuclear medicine imaging procedure**
- **Multimodal imaging particularly with**
  - computed tomography (CT)
  - magnetic resonance (MR)

PET/CT importance

- **Scans make up about 10% of all nuclear medicine examinations**
- **About 20% of the patient effective dose delivered in nuclear medicine**

Radiation doses

- Administered activity
- CT utilization

Positron Emission Tomography (PET)

PET radionuclides

- **Short half-lives**
- **High energies of annihilation photons (511 keV)**

→ **Particular challenges for staff radiological protection**

The publication provides guidance on

- occupational
- patient
- public

radiological protection in PET and PET/CT

PET and PET/CT principles

Knowledge of the technology

- Patient preparation
- Performance of the PET/CT scanner
- Acquisition and reconstruction parameters

➢ Image quality
➢ Dose received by the patient

New PET equipment

✓ Improved resolution
✓ Extended field of view
✓ Increased sensitivity
✓ Extended acquisition modalities
✓ Improved reconstruction techniques

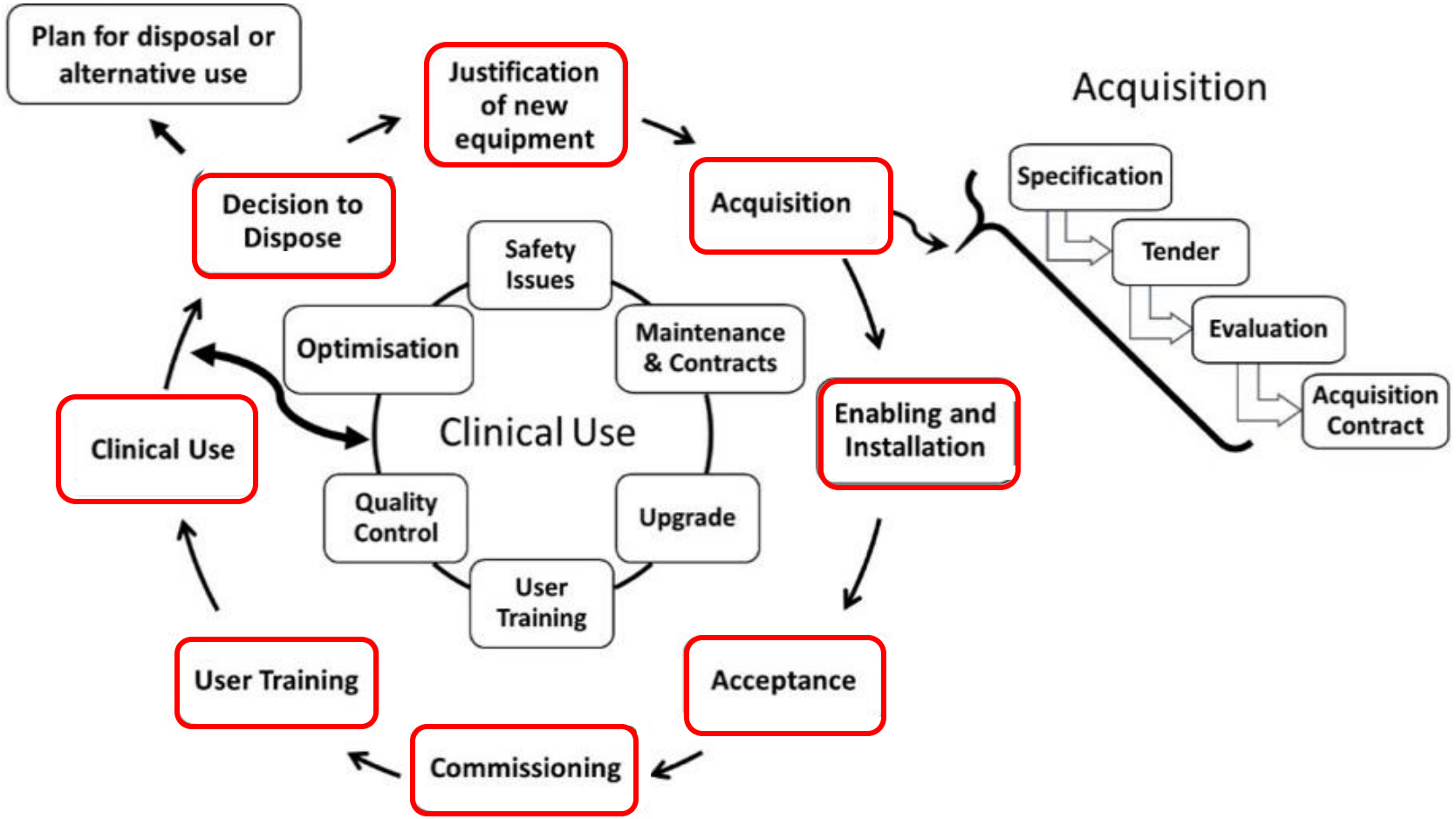
➢ Reduce image noise
➢ Without increasing administered activity

PET radionuclides requires (short half-life)

- on-site cyclotron
- fast distribution system
- generator systems

➢ Require specific radiological protection for the staff

Imaging equipment life cycle



PET/CT facility design

Planning and layout of the PET facility

Direct impact on radiological protection for

- patients
- staff
- public

Protection against

✓ Irradiation

✓ Contamination

Radionuclide production

- Cyclotron vaults
- Radionuclide transfer systems

Pharmaceutical preparation

- Laboratory facilities

Imaging part of the facility

- Administration and resting rooms
- Scanner room

shielding and automation

movement of the patient

Justification and optimisation of PET

- **Justification of radiological practices**
  - Proper use of radiation in medicine is accepted (more good than harm)
  - Procedure with a specified objective is defined and justified
  - Procedure to each individual patient should be justified

- **Optimisation in relation to medical imaging requires:**
  1. Clinical images for individual patients are of sufficient quality to ensure accurate and reliable diagnoses
  2. Doses used in acquiring such clinical images should be adjusted so that, while being adequate to produce the images, they are minimised to the level appropriate to the applied imaging technology

- **Optimisation applied at two levels:**
  - the design, appropriate selection, and construction of equipment and installations
  - the day-to-day working procedures

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Optimisation related to the medical exposure

- **Diagnostic Reference Levels (DRLs)**
  - Are applied for a particular procedure and used as an optimisation tool
  - Nuclear medicine: administered activity [in becquerels (Bq)]
    - ➢ to indicate the magnitude of a patient's internal irradiation
  - PET/CT
    - two imaging modalities
    - set for each modality independently

- **Scenarios**
  - Paediatric patients
  - Breast feeding from mothers who have been submitted to a PET
  - Fetal dose
  - Carers and comforters of the patient
  - Research volunteers

Radiological protection of the public

- Patients undergoing diagnostic PET radiopharmaceutical studies generally do not pose a significant radiation risk to the public

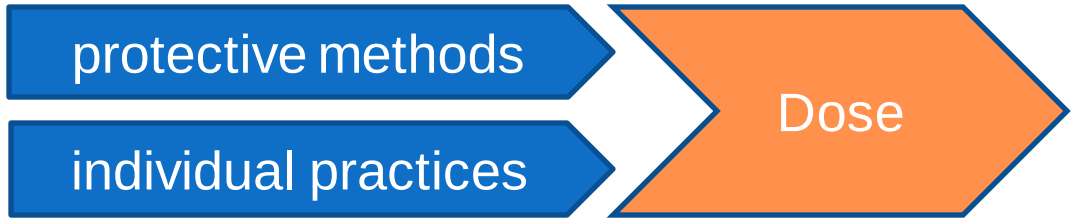
- Radiological protection measures for

✓ Administered activity ✓ Distance ✓ Time ✓ Shielding ✓ Facility design ✓ Restricted access	➢ other patients ➢ non-radiation workers ➢ general public

during the PET radiopharmaceutical uptake period and during PET/CT imaging

Optimisation for staff

- **Occupational doses in PET**
  - can be of few mSv per year
  - Skin doses to the fingers from manipulating PET radiopharmaceuticals can exceed the annual skin dose limit of 500 mSv if proper protection measures are not followed



- **Staff dose monitoring**
  - Whole-body monitoring
  - Extremities and the skin monitoring
    - ➢ Guidance on the use of extremity dosimeters

Dose management and quality assurance-program

- **Quality Assurance and Quality Control program in PET or PET/CT**
  - must address and ensure radiological protection and safety related to
    - medical
    - occupational
    - public

    } exposures

- **Each member** of the medical imaging team has a crucial and defined role and must obtain proficiency in radiological protection

- **The QA program must include metrics**
  - to demonstrate that the goals and objectives of the program are being met

- Each facility should have **a system for reporting and reviewing undesired events**

(accidents, misadministration, near misses)

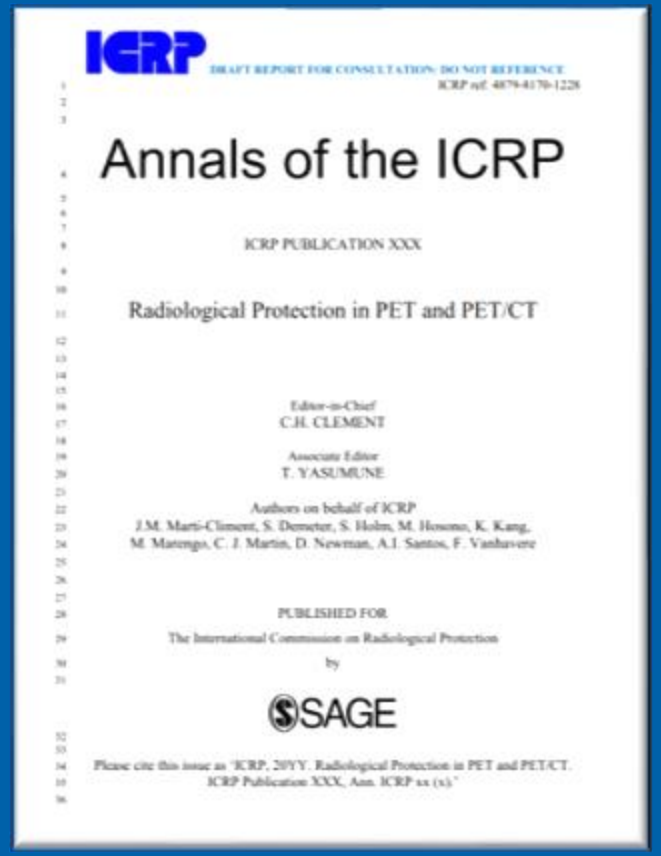
Education and training in radiological protection

- **It is a key issue**
- **Responsibilities and needs**
  - Detailed by international stakeholders
  - For all groups of health professionals in a PET or PET/CT facility

- **The health professional** performing the procedures in the facility **must obtain proficiency in radiological protection and safety through**
  - formal education
  - training
  - continuous professional development

- **Educational programmes**
  - ➢ Based on educational documents and tools
  - ➢ Developed by stakeholders and some Scientific Societies and Councils

Summary TG117 publication



- PET and PET/CT principles
- Imaging equipment life cycle
- PET/CT facility design
- Justification and optimisation of PET
- Optimisation related to the medical exposure
- Radiological protection of the public
- Optimisation for staff
- Dose management and quality assurance-program
- Education and training in radiological protection

I acknowledge contributions from other members of

ICRP Task Group 117

S. Demeter
S. Holm
M. Hosono
K. Kang
M. Marengo
C. J. Martin
D. Newman
A.I. Santos
F. Vanhavere

Thank you for your attention

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