ORAMED TRAINING MATERIALS, NEW TOOLS TO OPTIMIZE OCCUPATIONAL RADIATION PROTECTION IN INTERVENTIONAL RADIOLOGY AND NUCLEAR MEDICINE

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1. Introduction
1.1 Objectives of the ORAMED training materials

- To provide guidelines and recommendations to optimise radiation protection of medical staff involved in interventional radiology and cardiology and in nuclear medicine.
- To ensure appropriate education and the development of an effective radiation protection programme in the fields of interventional radiology, interventional cardiology and nuclear medicine.
- To disseminate the lessons learned from the analysis of ORAMED project results

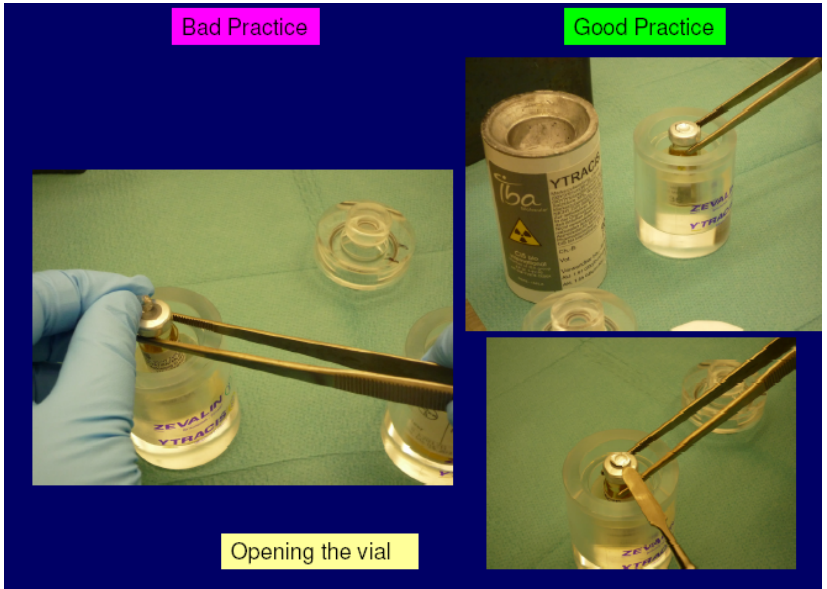
1.2 Scope

New developments

Eye lens dosemeter

Optimization in interventional radiology and cardiology

and in Nuclear medicine



1. Introduction
1.3 Main stakeholders

The training material can be useful for:

- Radiation exposed medical staff and more specifically: interventional radiologists, cardiologists, nuclear medicine technologists, nuclear medicine therapists, but also radiation protection officers, regulators.
- Medical staff trainers: radiation protection officers and medical physicists in hospitals and medical facilities.
- Dosimetry and metrology technicians and experts.

A short summary of the contents and methodology for the 2 first points is illustrated in this presentation.

2. ORAMED Training materials

2.1 **ORAMED training material for medical staff 2.1.1 Contents of ORAMED specific modules**

1.- Introduction

Aims of the medical speciality, a general introduction on occupational radiation protection.

2.- Radiological risks

Main critical procedures from the radiation protection point of view and the corresponding organs at risk,.

3.- Available dosemeter types

Technical characteristics, advantages and limitations, new developments.

4.- Radiation protection means

Description of available RP means, shielding, type of syringe, position of the tube, distance, time.

5.- Guidelines, recommendations to optimize radiation protection (summary lessons learned in ORAMED)

2.1 ORAMED training material for medical staff
2.1.2 Particularities and format of ORAMED specific modules

- Practical approach by using, as support, real images of good and bad practices as well as experimental and computational results obtained in the development of the 7th FP project ORAMED.
- Questions on the main topics are proposed and collectively answered using interactive systems.
- After reviewing the participants' answers, solutions based on the ORAMED project results are shown.

2.1 ORAMED training material for medical staff
2.1.3 Example of transparencies (1/2)

Radiological risks

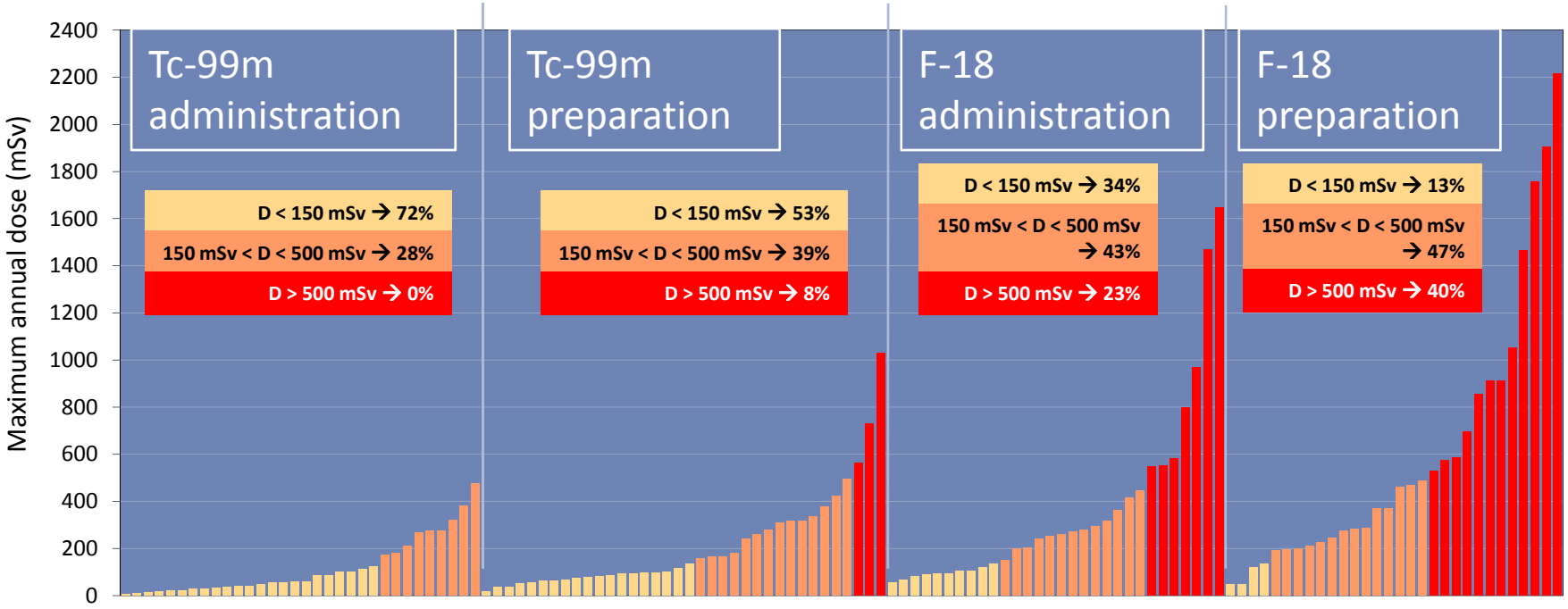
Q12 What are the procedures at risk for nuclear medicine technologists in diagnostic nuclear medicine, regarding the doses to the extremities?

For the same activity, the maximum skin dose,

A. is usually higher for the preparation of Tc-99m than for the administration of F-18.
B. is usually higher for the preparation of F-18 than for the administration of F-18.
C. Can be higher for the preparation of Tc-99m than for the preparation of F-18.
D. A, B and C are correct.
E. B and C are correct.

Voting system to select the answer.

2.1 ORAMED training material for medical staff
2.1.3 Example of transparencies (2/2)



a.- First the participants vote the correct answer.
b.- The screen shows the number of votes for each options
c.- The correct answer is highlighted. (E)
d.- The justification is shown with a graph of ORAMED measurements.
e.- The wrong answers are discussed, if needed.

2.2 ORAMED training guidelines for Medical staff trainers:

- Overview of training materials of particular interest for the topic of radiation protection of medical staff in interventional radiology and nuclear medicine, respectively.
- The selected materials can be freely downloaded from the IAEA website : http://rpop.iaea.org/RPOP/RPoP/Content/AdditionalResources/Training/1_TrainingMaterial/index.htm.
- Example: "RADIATION PROTECTION OF MEDICAL STAFF IN INTERVENTIONAL RADIOLOGY: RECOMMENDATIONS ON MATERIAL FOR TRAINERS"

Version: 9 November 2010

RADIATION PROTECTION OF MEDICAL STAFF IN INTERVENTIONAL RADIOLOGY: RECOMMENDATIONS ON MATERIAL FOR TRAINERS

These guidelines give an overview of training materials of particular interest for the topic of radiation protection of medical staff in interventional radiology.

These materials can be freely downloaded from the IAEA website :
http://rpop.iaea.org/RPOP/RPoP/Content/AdditionalResources/Training/1_TrainingMaterial/index.htm

GENERALITIES

L 0. Principles of Radiation Protection Basics: definitions of radiation, radiation protection, natural radiation, radiation effects, dose limits, radiation protection in radiology

L 4: International system of radiation protection
Concept and aims of Radiation Protection (RP)
The framework of RP
Relevant organizations in RP (ICRP, IAEA and UNSCEAR)
System of RP
- Justification of practices
- Limitation of doses
- Optimization of protection

Occupational, medical and public exposures
Dose limits

L 9: Medical Exposure - BSS (Potential exposure and investigation of accidental medical exposures)
Institutions Involved
Regulatory aspects - General
Medical Exposure Responsibilities
Radiation Protection Requirements - Justification
Optimization of Protection for Medical Exposure
Guidance Levels Investigation of Accidental Medical Exposures

L 1: Overview of Radiation Protection in Diagnostic Radiology
Definition of medical exposure: medical exposure versus occupational exposure
Justification
Optimization: ALARA principle
Guidance (or reference) levels - practical aspects, dose constraints for medical exposure
Guidance levels and effective doses

L11: Quality Assurance General lecture Quality Assurance definition.
QA Management and responsibilities
Outline of a Quality Assurance and Radiation Protection program for diagnostic radiology

L 23: Organizing a QA in Diagnostic Radiology
Standards of acceptable image quality
Retake analysis
Image quality and patient dose
Effect of poor-quality images

L 3: Biological effects of ionizing radiation
Classification of radiation health effects (deterministic/stochastic effects)
Factors affecting the radiosensitivity
Dose-effect response curve
Whole body response: acute radiation syndrome
Effects of antenatal exposure and delayed effect
Epidemiology

PHYSICS - INSTRUMENTATION

L 5: Interaction of radiation with matter
Introduction to the atomic basic structure
Quantities and units
Bremsstrahlung production
Characteristic X Rays
Primary and secondary ionization
Photo-electric effect and Compton scattering
Beam attenuation and half value thickness
Principle of radiological image formation

L 8: Factors affecting image quality
Image quality evaluators
Image contrast
Blur or lack of sharpness
Distortion and Artifacts
Image noise

DOSIMETRY

L 2: Radiation units and dose quantities
Exposure and exposure rate
Absorbed dose and KERMA
Mean Absorbed Dose in a tissue
Equivalent dose H
Effective Dose
Related dosimetry quantities (surface and depth dose, dose area product…..)

L10: Patient dose assessment
Parameters influencing patient exposure
Dosimetry methods
Instrument calibration
Dose measurements

L14: Radiation exposure in pregnancy (patient and staff)
Introduction to the problem
Example of dose per examination
Fetal radiation risk

L 6: X Ray production
Basic elements of an X Ray source assembly
Cathode structure
Anode structure
Rating chart
X Ray generator
Automatic exposure control

L 7: X Ray beam
Bremsstrahlung production
Characteristic X Rays
Beam filtration
Scattered radiation
Factors affecting X Ray spectrum, Quantity and Quality

L13.1: Occupational exposure - Regulatory aspects
Organization, responsibilities and training
Conditions of service
Classification of areas
Local rules and supervision

L12: Shielding and X Ray room design
Equipment design and acceptable safety standards
Use of dose constraints in X Ray room design
Barriers and protective devices

L 21: Optimization of Protection in Pediatric Radiology
General recommendations
Quality criteria for radiographic images (EUR-16261 document)
Recommendations for X Ray equipment and rooms for pediatric radiology
References

L13.2: Occupational exposure - Radioprotection measures
Personal protective equipment
Individual monitoring and exposure assessment
Investigation and follow up
Health surveillance
Records

OPTIMIZATION OF PROTECTION IN INTERVENTIONAL RADIOLOGY

L17.1: Optimization of Protection in Interventional Radiology
Principles of Interventional radiology
Design requirement and international recommendations: WHO/FDA/ACR
Purchase specifications
Operational modalities
Risk level (staff and patients)
Factors affecting staff and patient doses
Examples of dose values

L17.2: Optimization of Protection in Interventional Radiology
Deterministic effects in Interventional Radiology
The ICRP 85 recommendations
Dose reduction measures

OPTIMIZATION OF PROTECTION – PRACTICAL EXERCICES

Part 12.1 : Shielding and X-ray room design
Subject matter : design and shielding calculation of a diagnostic radiology department
Step by step procedure to be followed
Interpretation of results

Part 16: Optimization of protection in fluoroscopy
16.1: Measurement of standard entrance dose rate
16.2: Maximum dose rate
16.3: High contrast spatial resolution
16.4: Low contrast resolution and noise
16.5: Image Distortion
16.6: Video Monitor performance

2.3 Videos to be used as training support:

- *ORAMED project, interventional radiology measurement campaign protocol, prepared* by **SMU** (available in Slovak and English).
- *- Good practice for the labeling of Y-90 Dotatoc,* prepared by BfS (available in German and English).

Topic: NM therapy for Y-90 peptide labelling and administration).

(Available at ORAMED website, shown during coffee breaks)

3. Distribution, dissemination

- The FP7 ORAMED training materials have been presented during ORAMED 2011
- They will be available at the ORAMED project website www.oramed-fp7.eu (end of March 2011, introduce feedback from the workshop) – the website will be maintained at least 2-3 years.
- Its dissemination is foreseen through the participation in scientific conferences (EURADOS winter school 2011, February, Prague) and meetings.
- Contacts with professional societies are foreseen to improve its dissemination to specific stakeholders. In particular, dissemination trough the participation in the European Medical Alara Network (EMAN).

4. Summary

- Recommendations and guidelines are provided to improve radiation protection practice in interventional radiology, cardiology and nuclear medicine.
- Special emphasis is given to specific problems not included in most available training courses.
- New technologies are used to promote participants to be more active and to give immediate feed-back to trainers.
- A selection of available training material is presented.
- Pilot training sessions have been organised during ORAMED 2011, feedback from interested parties and regular up-date are foreseen.

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Thank you for you attention!

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