EC PROJECT `GUIDELINES ON MPE´: PROPOSED QUALIFICATION AND CURRICULUM FRAMEWORKS

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MPE Project

- Objective: Improved implementation of the provisions relating to the MPE of:
  - Council Directive 97/43/EURATOM (Medical Exposures Directive, MED)
  - New recast Basic Safety Standards (BSS) Directive.
- Project data:
  - TREN/09/NUCL/SI2.549828
  - website:http://portal.ucm.es/web/medical-physics-expert-project/inicio

Members of Consortium

- Coordinator: Medical Physics Group, Department of Radiology, Complutense University, Madrid
- Partners:
  - EFOMP
  - Institute of Physics and Engineering in Medicine (IPEM), UK
  - Department of Physics, “Enrico Fermi”, University of Pisa
  - German Society of Medical Physics (DGMP)
  - North East Strategic Health Authority, Yorkshire and the Humber Quality Assurance Reference Centre, United Kingdom
- Observer: WHO

Qualification Framework

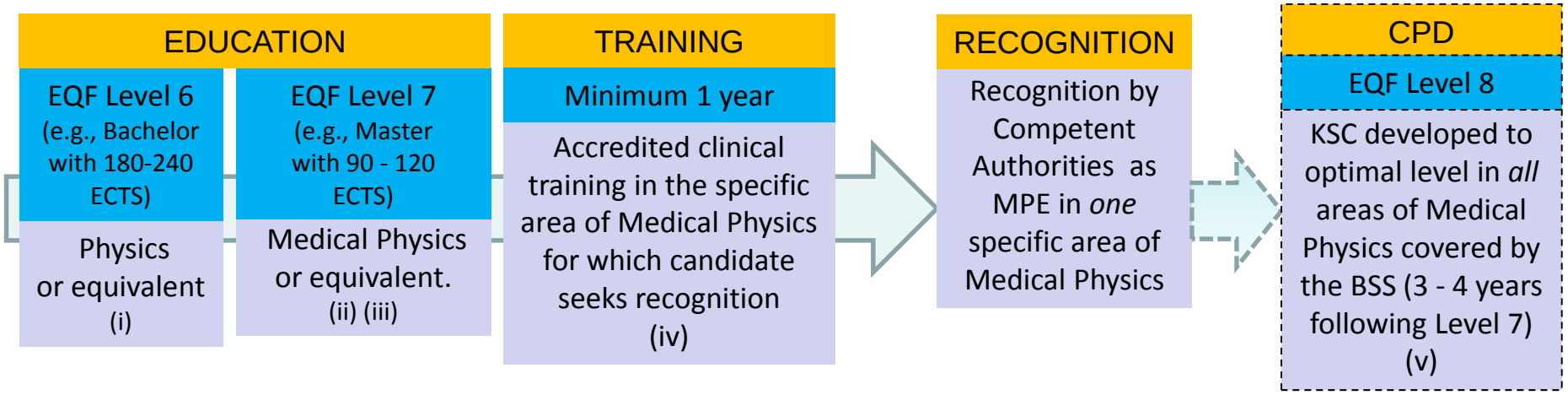
We wanted to design a Qualifications Framework that:

- Is based on the European Qualifications Framework (EQF) which is the most recent EC document on qualification frameworks
- Facilitates the mobility of the MPE in Europe through an agreed set of *minimum criteria* for achievement of MPE status
- Makes it possible for more physical scientists to achieve MPE status through its flexibility, cost-effectiveness and lifelong learning approach

Qualification Framework for the MPE in Europe

Medical Physics Expert: "An individual having the knowledge, training and experience to act or give advice on matters relating to radiation physics applied to medical exposure, whose competence to act is recognized by the Competent Authorities" (Recast BSS)

EQF = European Qualifications Framework KSC = Knowledge, Skills, Competences (EP&C, 2008/C 111/01)



(i) 'Equivalent' here meaning EQF Level 6 with a high level of physics and mathematics content.

(ii) 'Equivalent' here meaning EQF Level 7 with a high level of physics and mathematics content, *plus further additional education* in the Core KSC of Medical Physics (as specified in this document) and the KSC specific to the area of Medical Physics for which the candidate would be seeking recognition (as specified in this document).

(iii) The educational level for the MPE has been set at EQF Level 7 because to provide effective, safe and economical practice based on current best evidence, the MPE requires highly specialized knowledge, critical awareness of knowledge issues in the field, specialized problem-solving skills, ability to manage work contexts that are complex and ability to review the performance of teams (2008/C 111/01).

(iv) Accredited credentialing training programme for further on-the-job development of the Core KSC of Medical Physics (as specified in this document) and the KSC specific to the area of Medical Physics for which the candidate would be seeking recognition (as specified in this document). This training should ideally take the form of a Residency.

(v) This Qualification Framework concerns the minimum qualification level for the MPE. This level is therefore not

Curriculum Framework

We wanted a detailed inventory of learning outcomes (LO) that is:

- Expressed in terms of Knowledge, Skills and Competences (KSC) as required by the EQF:
  - Knowledge: facts, principles, theories, practices
  - Skills: use knowledge and know-how to complete tasks and solve problems (both cognitive skills and practical skills involving manual dexterity and the use of methods, materials, tools and instruments)
  - Competence: responsibility and autonomy (EQF definitions)
- Guided by an updated mission statement for Medical Physics Services.
- Structured in a way that promotes the unity of the profession whilst at the same time making it easier for an MPE to move easily from one area of medical physics practice to another, according to national and personal needs, with a minimum amount of additional education and training.

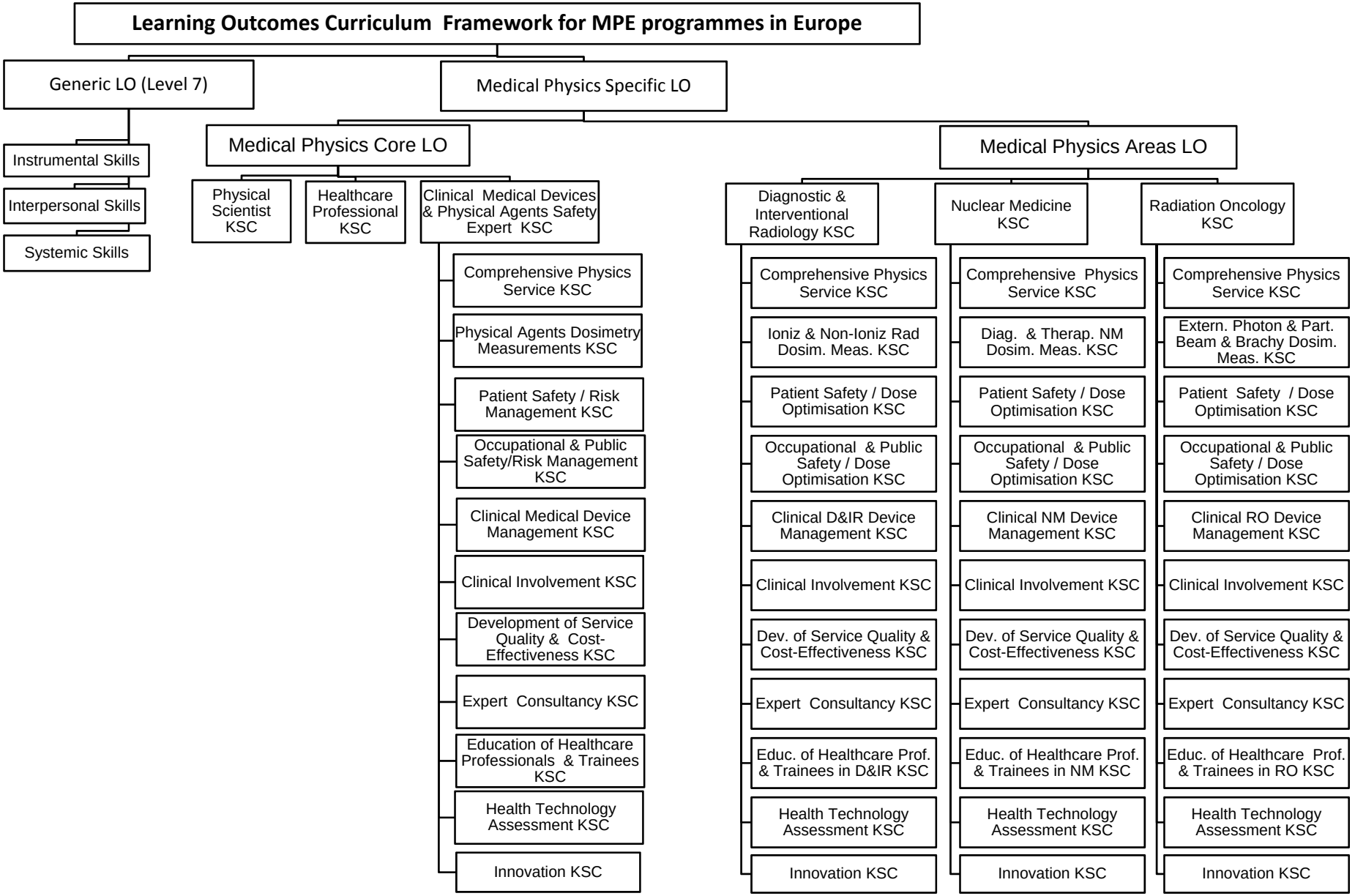
Mission Statement for MPE Services

"Medical Physics Services will contribute to maintaining and improving the quality, safety and cost-effectiveness of healthcare services through patient-oriented activities requiring expert action, involvement or advice regarding the selection, acceptance testing, commissioning, quality assurance including quality control, and optimised clinical use of the medical devices used in Diagnostic and Interventional Radiology, Nuclear Medicine and Radiation Oncology and regarding risks from associated physical agents* (particularly though not exclusively ionising radiation); all activities will be based on current best evidence or own scientific research when the available evidence is not sufficient"

*The term 'physical agents' has been used to include both ionising and non-ionising radiations. The use of non-ionising radiation imaging modalities as alternatives to ionising radiation is mandated by Article 3 of 97/43/Euratom and Article 80 of the new BSS. The term 'physical agents' refers to not only ionising radiation but also static magnetic fields, radiofrequency radiation, ultrasound and any other physical agent associated with these imaging modalities.

11 Key Activities for the MPE

- Comprehensive Physics Service,
- Physical Agents Dosimetry Measurements,
- Patient Safety and Risk Management,
- Occupational / Public Safety and Risk Management (when associated with medical exposures),
- Clinical Medical Device Management (particularly selection, acceptance testing, commissioning and quality assurance including quality control),
- Clinical Involvement,
- Development of Service Quality and Cost-Effectiveness,
- Expert Consultancy,
- Education of Healthcare Professionals and Trainees,
- Health Technology Assessment,
- Innovation.


Learning Outcomes Curriculum Framework for MPE programmes in Europe
Generic LO (Level 7)
Instrumental Skills
Interpersonal Skills
Systemic Skills
Medical Physics Specific LO
Medical Physics Core LO
Physical Scientist KSC
Healthcare Professional KSC
Clinical Medical Devices & Physical Agents Safety Expert KSC
Comprehensive Physics Service KSC
Physical Agents Dosimetry Measurements KSC
Patient Safety / Risk Management KSC
Occupational & Public Safety/Risk Management KSC
Clinical Medical Device Management KSC
Clinical Involvement KSC
Development of Service Quality & Cost-Effectiveness KSC
Expert Consultancy KSC
Education of Healthcare Professionals & Trainees KSC
Health Technology Assessment KSC
Innovation KSC
Medical Physics Areas LO
Diagnostic & Interventional Radiology KSC
Comprehensive Physics Service KSC
Ioniz & Non-Ioniz Rad Dosim. Meas. KSC
Patient Safety / Dose Optimisation KSC
Occupational & Public Safety / Dose Optimisation KSC
Clinical D&IR Device Management KSC
Clinical Involvement KSC
Dev. of Service Quality & Cost-Effectiveness KSC
Expert Consultancy KSC
Educ. of Healthcare Prof. & Trainees in D&IR KSC
Health Technology Assessment KSC
Innovation KSC
Nuclear Medicine KSC
Comprehensive Physics Service KSC
Diag. & Therap. NM Dosim. Meas. KSC
Patient Safety / Dose Optimisation KSC
Occupational & Public Safety / Dose Optimisation KSC
Clinical NM Device Management KSC
Clinical Involvement KSC
Dev. of Service Quality & Cost-Effectiveness KSC
Expert Consultancy KSC
Educ. of Healthcare Prof. & Trainees in NM KSC
Health Technology Assessment KSC
Innovation KSC
Radiation Oncology KSC
Comprehensive Physics Service KSC
Extern. Photon & Part. Beam & Brachy Dosim. Meas. KSC
Patient Safety / Dose Optimisation KSC
Occupational & Public Safety / Dose Optimisation KSC
Clinical RO Device Management KSC
Clinical Involvement KSC
Dev. of Service Quality & Cost-Effectiveness KSC
Expert Consultancy KSC
Educ. of Healthcare Prof. & Trainees in RO KSC
Health Technology Assessment KSC
Innovation KSC

Generic LO

Instrumental	1.Retrieve information from different sources. 2.Analyze and synthesize. 3.Solve problems. 4.Use general productivity software. 5.Organize, plan and manage one's workload. 6.Communicate effectively (orally and in writing) in two European languages one of which should preferably be English. 7.Take decisions in a timely manner.
Interpersonal	1.Communicate orally and in writing with both experts in the field and non-experts. 2.Respect diversity and multiculturalism. 3.Exhibit aptitude to work in an international context. 4.Demonstrate ongoing ethical commitment. 5.Work productively in both mono-disciplinary and multi-disciplinary teams. 6.Criticise constructively and accept constructive criticism.
Systemic	1.Generate new ideas (creativity). 2.Design and manage projects. 3.Adapt to new situations. 4.Learn autonomously and take responsibility for one's own learning. 5.Reflect and evaluate one's own practice and learning. 6.Apply research skills and use published evidence to develop and improve the quality of one's own practice. 7.Work within the scope of one's practice and abilities. 8.Seek advice when a task is outside one's ability. 9.Be entrepreneurial. etc

LO for the MPE as Physical Scientist

Knowledge	Skills	Competence
1. List the fundamental quantities and dimensions of physics, including use in checking consistency of equations. 2. List the common fundamental physical constants. 3. List the base and derived SI units. 4. List and describe the properties of the common fundamental particles, including mass, charge and spin. Particle-antiparticle annihilation. 5. List the various forms of energy and types of forces in nature and the properties of their carrier particles. 6. Explain the basic principles of quantum theory (sufficient for medical physics). 7. Describe the structure of the atom and nucleus and define the terms 'isotope' and 'isobar'. 8. Explain nuclear and electron energy levels, ionization, nuclear isomers and the auger effect. 9. Describe and explain the structure of the periodic table and chart of the nuclides. 10. List and describe the various forms of chemical bonding. 11. Explain energy transitions, spectra and the various forms of spectroscopy / spectrometry (including magnetic resonance spectroscopy) 12. Describe the band theory of solids with particular emphasis on semiconductors. 13. Discuss nuclear stability, list and describe the various modes of radioactive decay, explain decay schemes, and use decay and secular / transient equilibrium equations. 14. etc	1. Manage the acquisition, editing, analysis, interpretation, presentation, and reporting of measurement data. 2. Communicate clearly results to peers (in the form of notes, resumes, reports, poster, article, oral presentation) at local and international meetings and for research journals. 3. Use statistical techniques / tests and software to analyse measurement data and manage associated uncertainties. 4. Use modelling and simulation software (e.g. Matlab, SimuLink) to solve physics problems including signal and image processing. 5. etc	1. Assume responsibility to carry out experimental work autonomously and in a safe manner. 2. Assume responsibility to autonomously: – List a set of research objectives worthy of attention which are realizable given the available resources. – Write a literature review article concerning the area of interest. – Realize the research objectives by integrating and applying knowledge and skills. – Communicate clearly results to peers (in the form of notes, resumes, reports, poster, article, oral presentation) at local and international meetings and for research journals. – Defend results in front of peers 3. etc

LO for the MPE as a Healthcare Professional

Knowledge	Skills	Competence
1. List and explain the functions of healthcare organizations, describe the way healthcare is organized (internationally, nationally and locally) and discuss principles of clinical governance. 2. Describe the position of own institution and its function within the local healthcare organization 3. Utilize accurate medical terminology in communication with other healthcare professionals. 4. Explain those sections of the human biological sciences (anatomy, physiology, pathology, cellular and biomolecular science, radiological anatomy) to a level appropriate to the profession and own future area/s of medical physics. 5. etc	1. Communicate effectively clinical information, advice, instruction and professional opinion to colleagues, other healthcare professionals within own future area/s of medical physics, support staff, service users, their relatives and carers using appropriate terminology. 2. Establish the necessary communication links and relations with other disciplines within the hospital both connected to own future area/s of medical physics. 3. Recognize and respond appropriately to own, patients' and their relatives' emotional responses present within own future area/s of medical physics. 4. etc	1. Practise responsibly within the legal, regulatory and ethical boundaries of the profession. 2. Maintain fitness to practise in an autonomous manner. 3. Collaborate with other healthcare professionals, support staff and service users, their relatives and carers within own future area/s of medical physics. 4. Take responsibility for the management of own workload to ensure effective and efficient input to the work of the healthcare team within own future area/s of medical physics. 5. Organise the various aspects of the routine service within own future area/s of medical physics. 6. Work responsibly within national / local professional codes of practice. 7. etc

LO for the MPE as Clinical Medical Device / Physical Agents Safety Expert

	Knowledge	Skills	Competence
Comprehensive Scientific Service	1. List statutory and institutional requirements for Medical Physics Services in own area/s of medical physics practice with respect to the provision of a Comprehensive Scientific Service. 2. Use physics, concepts, principles and theories to describe in detail and quantitatively, the structure, functioning, characteristics and use of the medical devices used in own area/s of medical physics. 3. Describe in detail and quantitatively the physical properties of the physical agents (e.g., electrical energy, heat energy, static electric / magnetic fields, ionising and non-ionising electromagnetic radiation, ionising particles (electrons, ions, neutrons), vibration, sound and ultrasound and laser) to be found in the healthcare environment. 4. Explain the difference between deterministic/stochastic, early/late and teratogenic/genetic effects in relation to each physical agent. 5. etc	1. Apply the general concepts, principles, theories and practices of physics to the solution of clinical problems concerning the optimised use of medical devices and safety / management of risk with respect to associated physical agents. 2. Use the general concepts, principles, theories and practices of physics to analyze the research literature concerning the optimised use of medical devices and safety / management of risk with respect to associated physical agents. 3. etc	1. Take responsibility for statutory and institutional requirements for Medical Physics Services in own area/s of medical physics practice with respect to the provision of a Comprehensive Scientific Service. 2. Take responsibility for applying the general concepts, principles, theories and practices of physics to the solution of clinical problems concerning the optimal use of medical devices and management of risk from associated physical agents in own area/s of medical physics practice. 3. Take responsibility analyzing the research literature concerning the optimal use of medical devices and management of risk from associated physical agents and to transfer relevant published research results to the clinical environment in own area/s of medical physics practice. 4. etc

LO for the MPE as Clinical Medical Device / Physical Agents Safety Expert

	Knowledge	Skills	Competence
Physical Agents Dosimetry Measurements	1. List and explain statutory and institutional role of Medical Physics Services with respect to Physical Agents Dosimetry Measurements (including ionising and non-ionising radiations). 2. Define and explain the physical quantities used to assess beneficial or adverse biological effects for the various types of physical agents and methods for their measurement. 3. List, define and measure or calculate the quantities (incl uding units and inter-relationships) used in patient dosimetry for the various types of ionising (including radionuclides) and non-ionising radiations for each medical application (e.g.,for projection radiography these would include photon / energy fluence and fluence rate, absorbed dose, terma, kerma, KAP, IAK, ESAK, ESD, effective dose; for CT these are $CTDI_{air}$, $CTDI_{w}$, $CTDI_{vol}$, KLP, effective dose). 4. Explain the relationship between the various dosimetric quantities used (e.g., between energy fluence, kerma and absorbed dose for photon beams including the concept of charged particle equilibrium). 5. etc	1. Select and perform measurements with instrumentation for the measurement of the physical quantities used to assess beneficial or adverse biological effects for the various types of physical agents for patients, workers and public in own area/s of medical physics practice. 2. Select and perform measurements with ionizing radiation dosimetry systems appropriate to own area/s of medical physics practice. 3. Interpret the results of dosimetry measurements. 4. Develop rigorous dosimetry protocols in own area/s of medical physics practice. 5. Use specialized dosimetry software / conversion coefficients to calculate effective doses and organ absorbed doses from dosimetry measurements. 6. etc	1. Take responsibility for statutory and institutional requirements for Medical Physics Services in own area/s of medical physics practice with respect to Physical Agents Dosimetry Measurements. 2. Equip a laboratory for the measurement of quantities used to assess beneficial or adverse biological effects for the various types of physical agents for the patients, workers and public in own area/s of medical physics practice. 3. Take responsibility for the selection and operation of instruments for the measurement of the physical quantities used to assess beneficial or adverse biological effects for physical agents in own area/s of medical physics practice. 4. Take responsibility for the handling, management and maintenance of dosimetry instruments in own area/s of medical physics practice. 5. Take responsibility for dosimetric investigations and the supervision of dosimetry measurements. 6. etc

Areas of MP - Nuclear Medicine

	Knowledge	Skills	Competences
Clinical involvement	1. List statutory and institutional requirements for Medical Physics Services in Nuclear Medicine with respect to Clinical Involvement. 2. Describe the principles of anatomy, physiology, biology, radiobiology and pathology as related to the main clinical applications of Nuclear Medicine diagnostic and therapeutic techniques. 3. Describe the general role of Nuclear Medicine procedures in diagnosis, therapy and treatment response evaluation. 4. Explain how Nuclear Medicine devices are used for the solution of a clinical problem. 5. Describe the principle of radiopharmaceutical preparation and associated quality control. 6. Describe the principles of radiopharmaceutical biodistribution in normal organ and target tissues. 7. Describe the fundamentals of molecular radiotherapy. 8. Explain the fundamentals of the use of Nuclear Medicine procedures in EBRT planning. 9. etc	10. Optimize imaging and therapeutic protocols. 11. Design a treatment plan. 12. Advise on the use of Nuclear Medicine data for radiotherapy planning. 13. Analyze how molecular radiotherapy could impact on other treatment modalities. 14. etc	15. Take responsibility for statutory and institutional requirements for Medical Physics Services in Nuclear Medicine with respect to Clinical Involvement. 16. Advise Nuclear Medicine physicians in imaging interpretation and quantification. 17. Take responsibility for deriving semi-quantitative and quantitative data for clinical application. 18. Advise on different treatment schedule options. 19. Participate in justification as appropriate. 20. Advise on and take responsibility for optimization of clinical acquisition protocols in both standard and non-standard situations. 21. etc

Seville Workshop

- Objectives of Workshop:
  - Discuss the status, education and training, recognition and cross-border mobility of the MPE
  - Discuss the final draft of the ‘Guidelines on MPE’ document

Thank you for your attention

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