Work Package 4:
Establish the reference standards for RPE training

CEA - INSTN
French atomic energy commission and alternative energies
National Institute for Nuclear Science and Technology
France

ENETRAP-II

N° 232620

EUTERP workshop
Radiation Protection training in Europe
Cyprus
27th – 30th March 2011

Paul LIVOLSI*, Philippe MASSIOT

*Presented by

ENETRAP TRAINING SCHEME MODULES

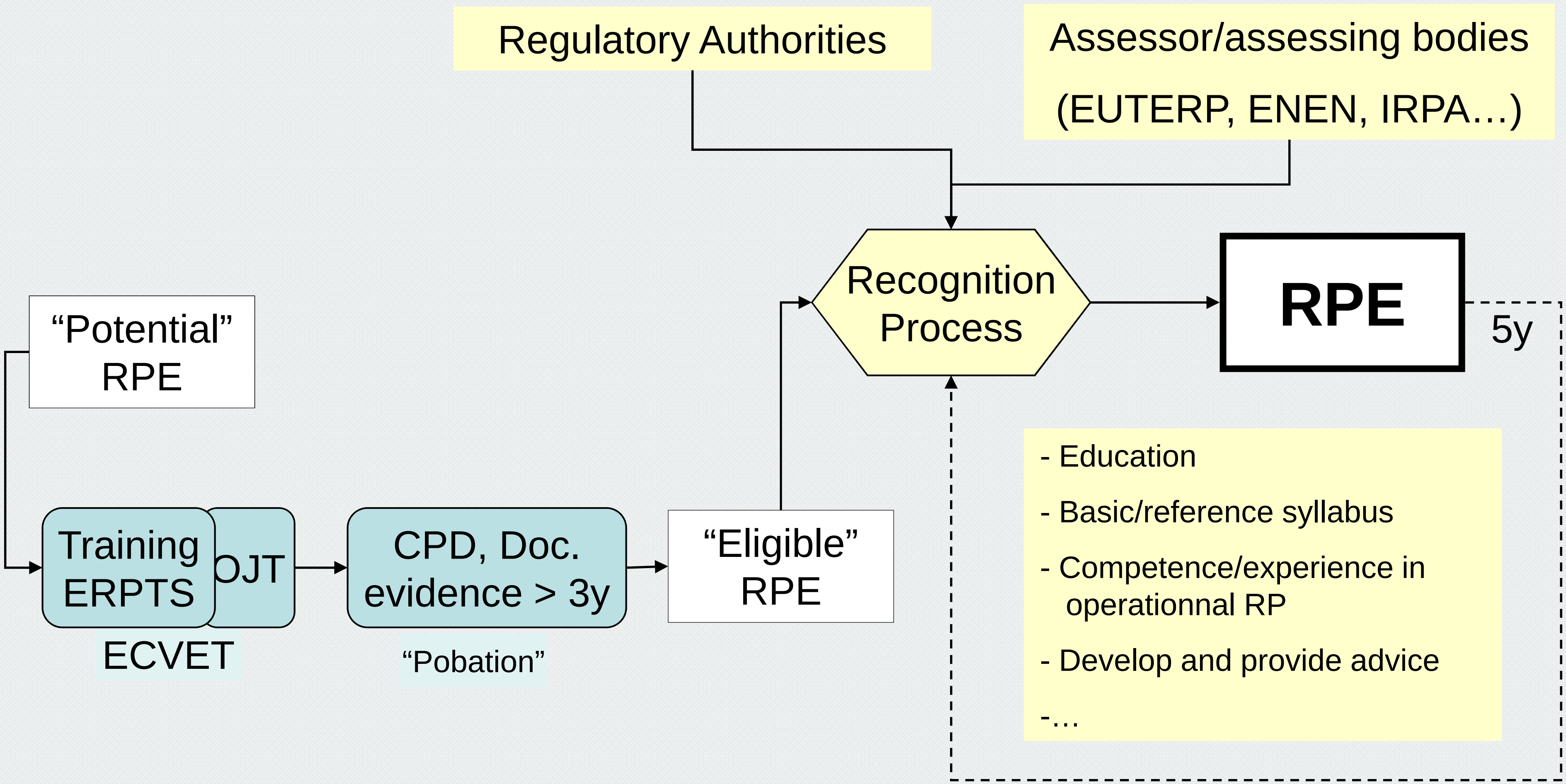
ENETRAP II

Common Basis

Specific Modules

COMMON BASIS									OPTIONAL MODULE									
Module 1 BASICS			**Module 2** FOUNDATION			**Module 3** FOUNDATION + (occupational)			**Module 4** NPP, Research Reactors			**Module 5** WASTE MANAGEMENT DECOMMISSIONING			**Module 6** NON-NUCLEAR, RESEARCH, Oil & Gaz			
	L	E		L	E		L	E		L	E		L	E		L	E	
Radioactivity	6	3	RP and External Dosimetry	3		Transport	3		Reactor types	5		Waste Management	8		Irradiators/generators/Accelerators/Gauges	6	3	Equipm
Interactions	4,5	1,5	Prot. against external Expos.	3	3	Design Issues	3		Fusion	1		Decommissioning	4	2,5	Industrial Radiography	3	3	Occupat
Quantities and Units	4,5		Prot. against internal Expos.	3	3	Accidents & Emergency Issues	3		Fuel Cycle	3		Ventilation, filtration	5	6	Unsealed sources	6	6	Acciden situatior
Basic biology & Bio. Effects	3		Dose monitoring (area + individ)	10,5	3	Safety Culture	3		Dose Monitoring/Regulalory c[illegible]	3		Transport	[illegible]	1,5	Accidental situations	3		
Physical Principles of Detection	7,5	1,5	Regulatory Framework	6	3	ALARA	3		Safety Culture	9								
Applications of Ioni. Radiation (overview)	3		Natural sources	6		Decommission. principles	3		Accidental situations, Criticality	9								
			Public/Environmental	[illegible]		[illegible] management principles	3											
			Ethical consideralions	3		Communication public, medias	6											
Hours	28,5	6		37,5	12		27	0		30	0		20	10		18	12	
OJT			5 days OJT						10 days OJT + Visits			5 days OJT + Visits			5 days OJT + visits			10 day Vi
Hours	34,5			49,5			27			30			30			30		

RPE - DRAFT PROCESS



RPE definition: “*Persons having the **knowledge**, **training** and **experience** need to **give** radiation protection **advice** in order to **ensure effective protection** of individuals, whose **capacity to act** as a **radiation protection expert** is **recognized** by the competent **authorities***”

STRENGTHENING OF THE 3 PROCESSES

ENETRAP TS)

3. Training Standard
- Based on competences standard
- Training objectives
- Skills and competences evaluation

EUTERP (Workshop 2)
ECVET Workshop

L.O.

2. Competencies Standard
- Technical (dose calculation)
- Transversal (situation analysis, practical guidance, training …)

Δ
Training evaluation

EUTERP (Workshop 2)
ENETRAP Question.
ECVET Workshop

ECVET

Δ
Set of competences

1. Job Standard
- Activities, tasks, roles and duties
- Background (Academic, Work experience)

e.g RPEs advisory & supervisory functions

STRENGTHENING OF THE 3+1 PROCESSES

ENETRAP II

ENETRAP TS

3. Training Standard
- Based on competences standard
- Training objectives
- Skills and competences evaluation

EUTERP Workshop 2-3
ECVET Workshop

L.O.

2. Competencies Standard
- Technical (dose calculation)
- Transversal (situation analysis, practical guidance, training …)

4. RPEs **"Recognition" Standard**
Assessor/ assessing bodies

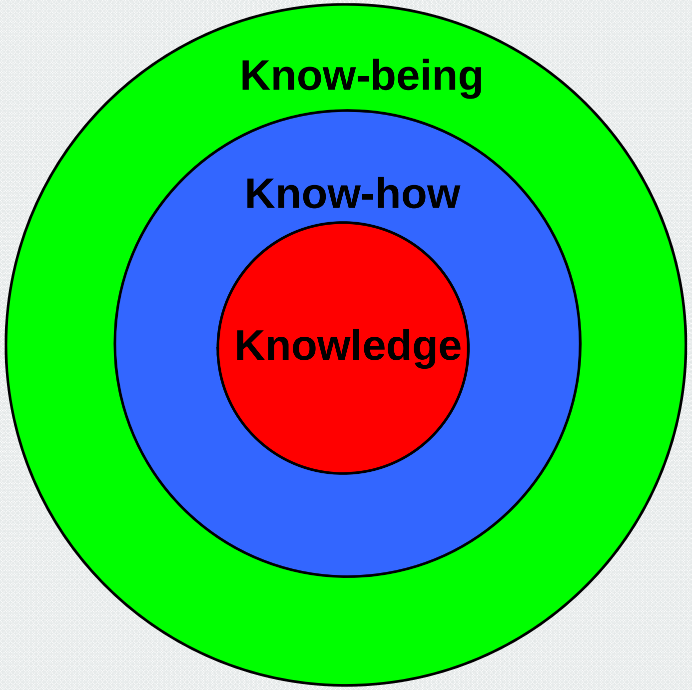
EUTERP Workshop 2
ENETRAP Question.
ECVET Workshop

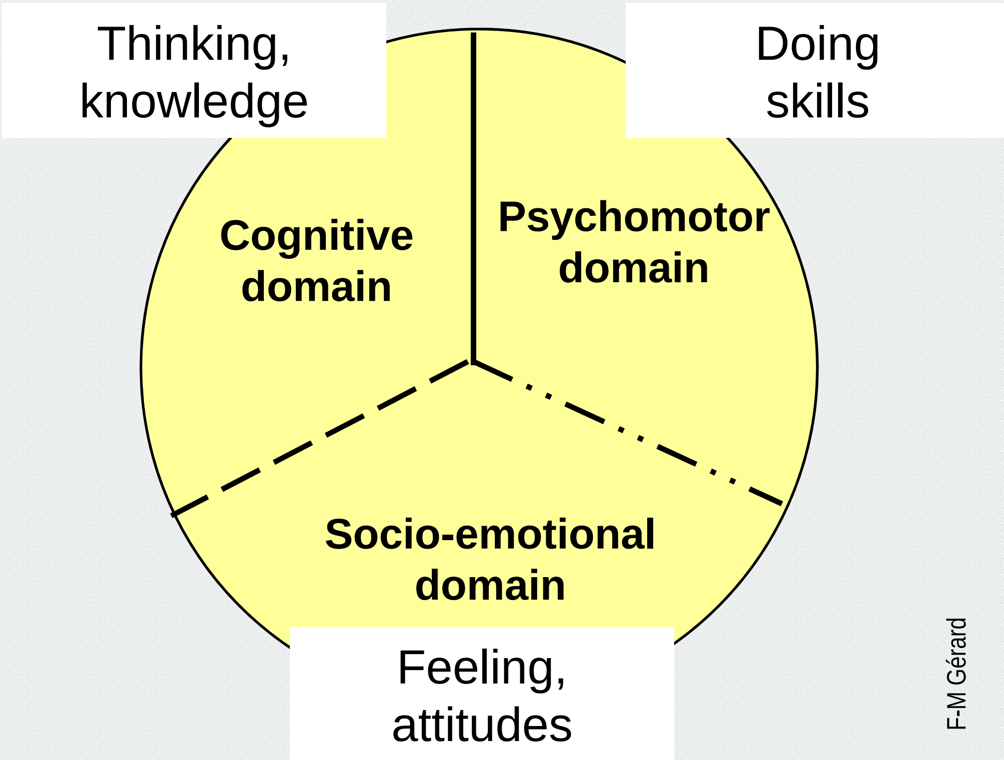
ECVET

1. Job Standard
- Activities, tasks, roles and duties
- Background (Academic, Work experience)

e.g RPEs advisory & supervisory functions

KNOWLEDGE & TRAINING CONSEQUENCES

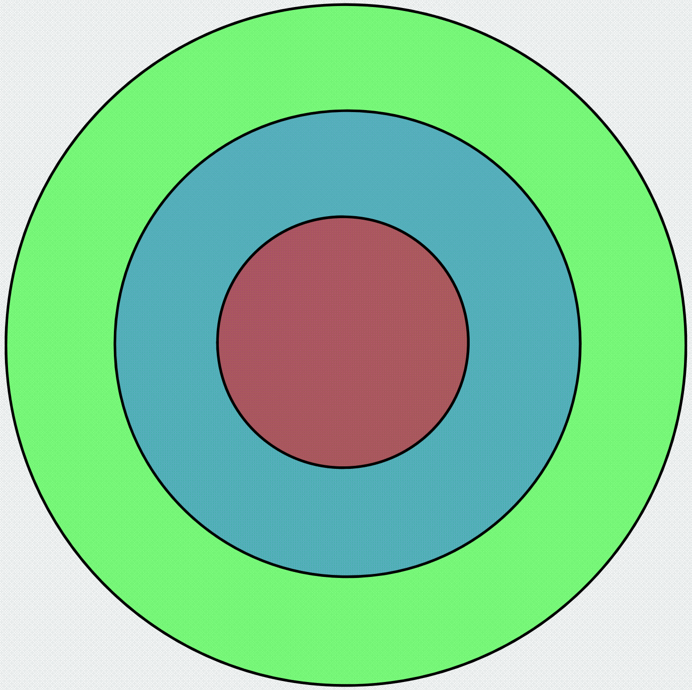


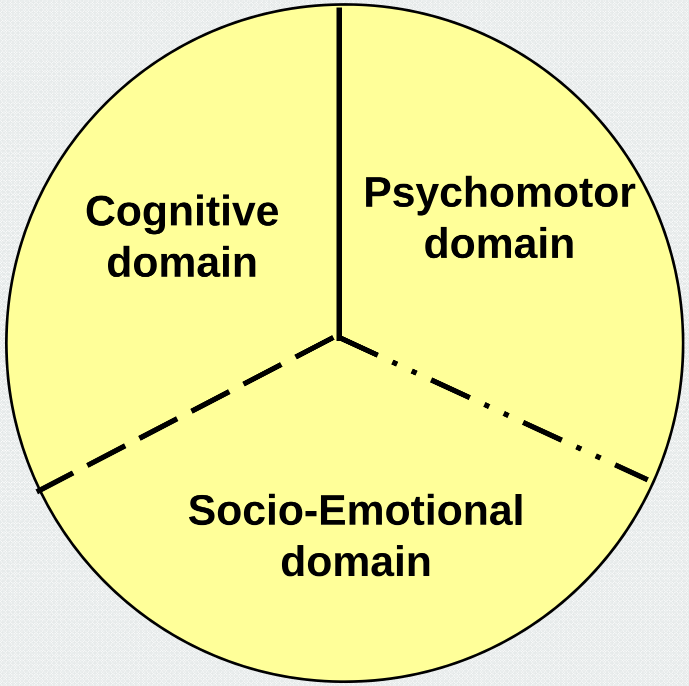


Transdisciplinarity of Radiation Protection

Mathematics, physics, chemistry, medicine, biology, radiobiology, metrology, environment, sociology, psychology, economy, epidemiology, regulation…

CROSSED KNOWLEDGE APPROACH





Because Radiation Protection deals with many topics

CROSSED KNOWLEDGE APPROACH IN RP

	Cognitive domain	Psychomotor domain	Socio-emotional domain
Know-reproduce (knowledge acquisition)	To name the features of different radiations	To withdraw gloves, mask, without contaminating oneself	To speak about radioactivity (to children / collectivity)
Know-how (Practical aspects)	To calculate the adapted shielding to a given source	To detect an alpha contamination with an adapted probe.	To attend and to advice in accidental or post accidental situation
Know-being (integrated behavior)	To achieve an inspection before starting an installation	To behave facing an alpha contamination (surface and/or atmospheric)	To propose a campaign of measurements to inhabitants in contaminated territories (*e.g.* Belarus)

ECVET APPROACH

ECVET: European Credit System for Vocational E&T

- Concerns higher qualifications levels
  - Bologna Framework
  - EQF: European Qualifications Framework
  - ECTS: European Credit Transfer System

- Competences driven
  - Implemented in aircraft, car industries and… in nuclear

- Ongoing process
  - →2012: Create the necessary conditions and adopt measures
  - 2012 →2014: Step by step introduction
  - 2014 →: « Possible revision of the European Recommendation »…

ECVET tools: LEARNING OUTCOMES

- What are they?
  - Learning outcomes specify what <u>learners' new behaviours</u> will be after a learning experience.
  - They state the <u>knowledge, skills and attitudes</u> that the learner will gain through training
  - Using an action verb (Bloom taxonomy) and describe something <u>observable or measurable and evaluable</u>

- Why are they important?
  - Tool for learning assessment
  - clearly communicate expectations to learners
  - clearly communicate graduates' skills to prospective employers
  - guide and organize the instructor and the learner.

BLOOM TAXONOMY→ LEARNING OUTCOMES

ENETRAP II

› › Increasing level of cognitive complexity › ›

‹ *knowledge & understanding* | *intellectual skills* ›

Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Recalling important information	*Explaining important information*	*Solving closed-ended problems*	*Solving open-ended problems*	*Creating 'unique' answers to problems*	*Making critical judgments based on a sound knowledge base*
define	translate	interpret	distinguish	compose	judge
repeat	restate	apply	analyse	plan	appraise
record	discuss	employ	differentiate	propose	evaluate
list	describe	use	appraise	design	rate
recall	recognize	demonstrate	calculate	formulate	compare
name	explain	dramatize	experiment	arrange	revise
relate	express	practise	test	assemble	assess
underline	identify	illustrate	compare	collect	estimate
	locate	operate	contrast	construct	
	report	schedule	criticize	create	
	review	sketch	diagram	set up	
	tell		inspect	organize	
			debate	manage	
			question	prepare	
			relate		
			solve		
			examine		
			categorize		

ENETRAP II - RPE training scheme

ENETRAP II

Optional modules

8. NORM 30h
NORM activities - Dose of workers - Dose of population - Protective measure - corrective actions

ALARA
Additional module could be organized with European ALARA Network - EAN

DOSIMETRY
Additional module could be organized with European Radiation Dosimetry Group - EURADOS

Additional Module
Accidental situations – RP simulation codes and tools –Emergency Response - Communication – Train the trainers… or during refresher courses

Add-on modules

4. NPP Research 30h
Reactor types – Fusion - Fuel Cycle - Dose Monitoring - Regulatory control - Safety Culture - Accidental situations - Criticality

5. Waste, Dec. 30h
Waste Management - Decommissioning – Ventilation and filtration - Transport

6. Non nuclear 30h
Irradiators / generators – Accelerators / Gauges - Industrial Radiography - Unsealed sources - Accidental situations

7. Medical 30h
Equipment - Occupational Radiation Protection - Classification of areas - Accidental situations

Common Basis @

1. Basics 35h
Radioactivity - Interactions - Quantities and Units - Basic biology & Bio. Effects - Physical principles of detection - Applications of Ionis. Radiation (overview)

→

2. Foundation 50h
RP and External Dosi.- Prot. against external - Prot. against internal - Dose monitoring - Regulatory Framework - Natural sources - Public / Environmental - Ethical considerations

→

3. Occupational 30h
Transport - Design issues - Accidents & Emergency issues - Safety Culture – ALARA - Decommissioning Principles – Waste Management principles

▲OJT=5d

@ b-learning possibility

RPE in NPPs or Research reactors

ENETRAP II

Common Basis: 115h + OJT: 30h = 145h

Optional module: 30h + OJT: 60h = 90h

Training: 4 weeks

Training + OJT: 235h ~ 30days ~ 6 weeks

Optional modules

4. NPP, Research 30h

Reactor types – Fusion - Fuel Cycle - Dose Monitoring - Regulatory control - Safety Culture - Accidental situations - Criticality

Common Basis

1. Basics 35h

Radioactivity - Interactions - Quantities and Units - Basic biology & Bio. Effects - Physical principles of detection - Applications of Ionis. Radiation (overview)

2. Foundation 50h

RP and External Dosi.- Prot. against external - Prot. against internal - Dose monitoring - Regulatory Framework - Natural sources - Public / Environmental - Ethical considerations

3. Occupational 30h

Transport - Design issues - Accidents & Emergency issues - Safety Culture – ALARA - Decommissioning Principles – Waste Management principles

▲OJT=5d

RPE in other domains (except NPPs)

1 of Optional modules

8. NORM 30h

NORM activities - Dose of workers - Dose of population - Protective measure - corrective actions

Common Basis: 115h + OJT: 30h = 145h

Optional module: 30h + OJT: 30h = 60h

Training: 4 weeks

Training + OJT: 205h ~ 25 days ~ 5 weeks

5. Waste, Dec. 30h

Waste Management - Decommissioning - Ventilation, filtration - Transport

6. Non nuclear 30h

Irradiators/generators - Accelerators/Gauges - Industrial Radiography - Unsealed sources - Accidental situations

7. Medical 30h

Equipment - Occupational Radiation Protection - Classification of areas - Accidental situations

Common Basis

1. Basics 35h

Radioactivity - Interactions - Quantities and Units - Basic biology & Bio. Effects - Physical principles of detection - Applications of Ionis. Radiation (overview)

2. Foundation 50h

RP and External Dosi.- Prot. against external - Prot. against internal - Dose monitoring - Regulatory Framework - Natural sources - Public / Environmental - Ethical considerations

3. Occupational 30h

Transport - Design issues - Accidents & Emergency issues - Safety Culture – ALARA - Decommissioning Principles – Waste Management principles

▲OJT=5d

COURSE DESCRIPTION Part 1

RPE - Course Description Form

March 2010 _v2

ENETRAP-II

COMMOM BASIS	
Module name:	***Basics***
Subject title:	***Radioactivity and nuclear physics***

N° course	***Lecture***	***Tutorial/EW***	***Prerequisite***	***Lecturer***
1.2.	*6*	*3*		

COMMON BASIS module deals with physics related to ionising radiation, e.g. radioactivity and nuclear physics, interaction of radiations with matter, quantities and units, biological effects of radiation and detection.

	Courses objectives
	Making learners familiar with the basic properties of atomic nuclei, quantities characterising nuclei, acting forces, and principal ideas of basic nuclear models, which will serve as a background for explanation of dynamic processes in nuclear and radiation physics.

	Learning Outcomes
	On successful completion of this subject, learners are expected to be able to:
1	*Explain the different modes of disintegration and desexcitation*
2	*Describe the different type of radiations emitted and their features*
3	*Define the notions of activity, intensity of radiation, half-life.*
4	*Calculate the activity of a source at any time...*

Key words

Nuclear decay - natural radioactivity - artificial radioactivity - mechanisms of nuclear reactions - types of nuclear reactions - atomic nucleus - nuclear models

Teaching and Learning Approach

Lectures which aim to enrich the knowledge and concepts of nuclear physics. In addition, tutorial sessions are also included for further consolidating the knowledge discussed in lectures.

Assessment method

(to be defined) Learners will be assessed by written assignments, quizzes and written examination.

Bibliography

Text book:

Other recommended readings:

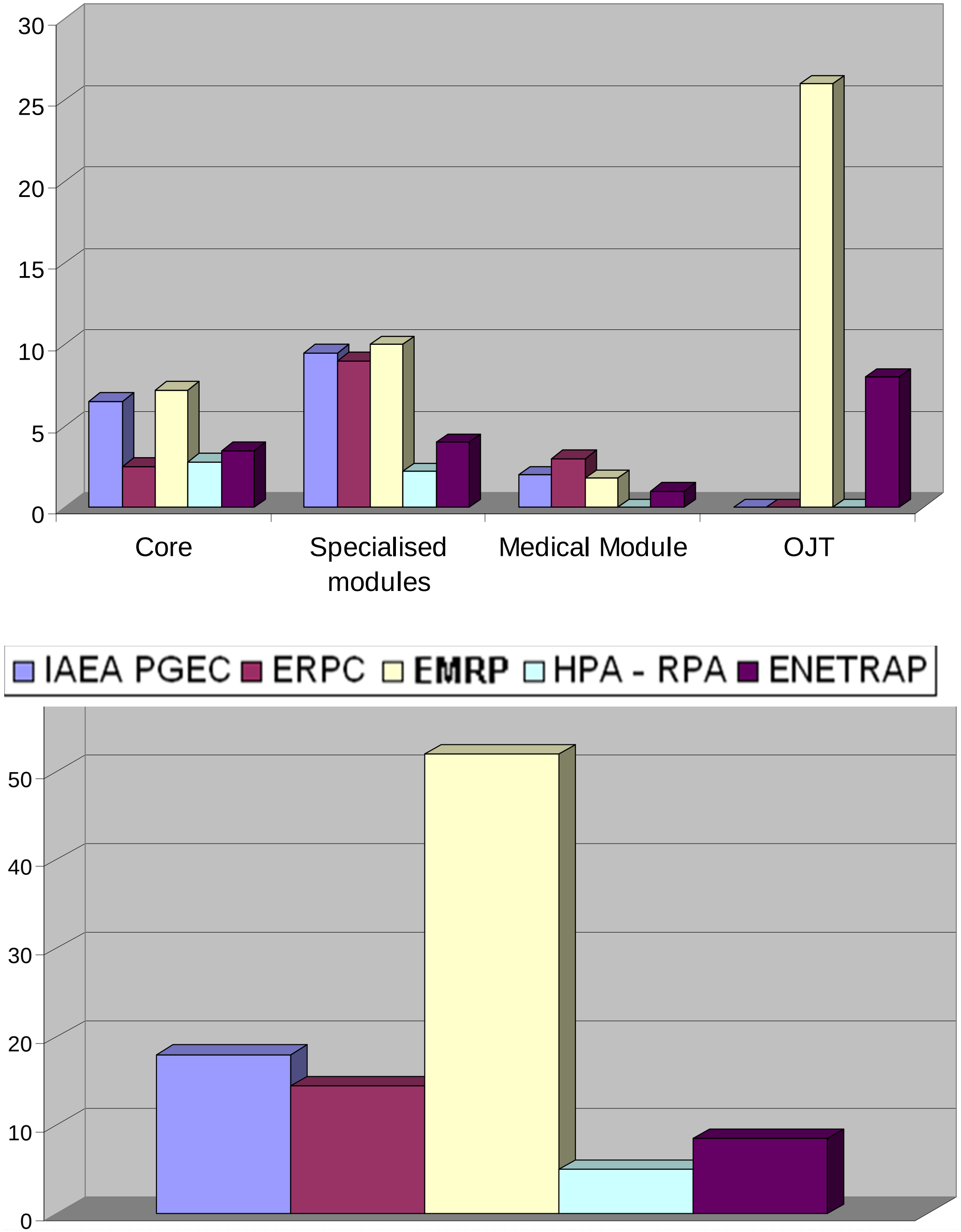
Lapp, R.E. - Andrews, H.L.: Nuclear Radiation Physics. Engelwood Cliffs (N.J.), Prentice Hall 1972.
Turner, J.E.: Atoms, Radiation and Radiation Protection. New York, Pergamon Press 1986.
Liley, J.: Nuclear Physics. Principles and Applications. Chichester, Wiley 2001.
G.F.Knoll Radiation detection and measurement, Hardcover 1979
Povh, B. - Rith, K. - Scholz, Ch. - Zetschke, F.: Particles and Nuclei. Springer, Berlin 1999.
Magill, J. - Gally, J.: Radioactivity, Radionuclides, Radiation. Springer, Berlin 2005.
Martin, B.R.: Nuclear and Particle Physics. Wiley, Chichester (U.K.) 2006.
Podgorsak, E.B.: Radiation Physics for Medical Physicists. Springer, Berlin 2006.
Loveland, W.D. - Morrissey, D.J. - Seaborg, G.T.: Modern Nuclear Chemistry. Wiley, Hoboken (New Jersey) 2006.
Hussein, E.M.A.: Radiation Mechanics - Principles and Practice. Elsevier, Oxford 2007.
B Firestone, Table of isotopes, Jul 19, 1999
K.S. Krane, Introductory Nuclear Physics Wiley; 3rd edition (October 22, 1987.
P.E Hodgson, Introductory Nuclear Physics, Oxford University Press, 1997).
G.G Eichholz, Principle of nuclear radiation protection.
D.Blanc, Physique nucléaire, Masson, 1980.
V.V.Balashov Interaction of particles and radiation with matter, Springer 1997.

COURSE DESCRIPTION Part 3

Detailed content

Contents of teaching	Lecturer	Lect.	Ec/PW	OJT	Visit
Total =		6	3	0	0
1. Basics					
1.2. Radioactivity and nuclear physics					
1.2.1. Alpha decay		3			
- Description - characteristics of the daughter nucleus. Decay scheme, Ground or excited state of the daughter nucleus. Examples of decay schemes					
1.2.2. Beta minus decay					
- Description, characteristics of the daughter nucleus. Repartition of the available energy between the electron and the neutrino, energy spectrum of the electron, examples of decay schemes					
1.2.3. Beta plus decay and electron capture					
- Beta plus decay: Description, characteristics of the daughter nucleus. Repartition of the available energy between the positron and the neutrino. Energy spectrum of the positron, examples of decay scheme					
- Electron capture: Description, characteristics of the daughter nucleus, examples of decay scheme , competition between beta plus decay and electron capture					
1.2.4. Electronic shell rearrangement			1.5		
- Consequences of a vacancy on a shell.					
- Amount of energy available from the electronic shell rearrangement					
- consequence of the electron capture: X-ray or Auger emission					
1.2.5. Gamma emission and internal conversion					
- Gamma emission: Description, examples of decay schemes					
- internal conversion: description, consequences: X-ray or Auger emission					
1.2.6. Evolution of the activity		1.5	1.5		
- Exponential law: decay constant, half-life					
- Decay chain with two isotopes. Special cases: T1 >> T2 and T1 << T2					
- Decay chain with n isotopes.					

COMPARATE DURATION with existing syllabi

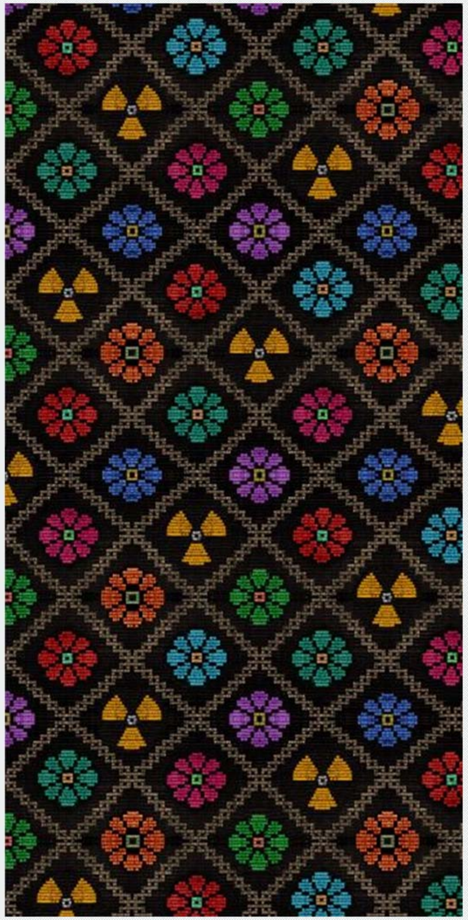


"Compare what is comparable"

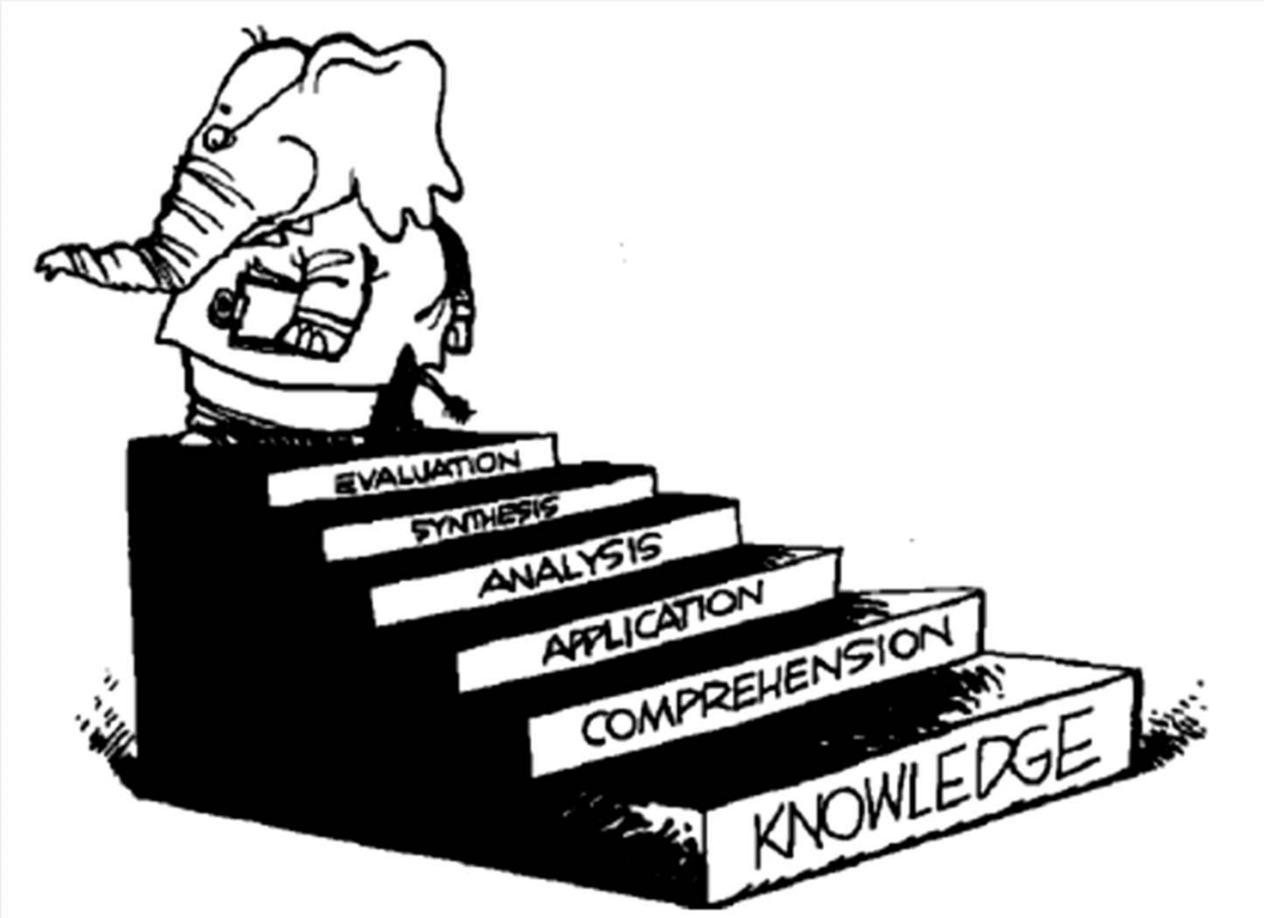
- IAEA program proposed a module on training the Trainers (1 week).
- EMRP program integrate a module on conventional safety (1,5 week) but EMR is a full academic year.

- Minimum duration
  - ERPC 5,5 weeks
  - HPA-RPA <3 weeks
  - ENETRAP II 5 or 6 weeks

- Maximum duration (all modules)
  - IAEA – PGEC 18 weeks
  - ERPC 14,5 weeks
  - EMRP 52 weeks
  - HPA-RPA 5+ weeks
  - ENETRAP II 12 weeks



T. SCHNEIDER CEPN Traditional Belarus scarf material



http://brebru.com/education/invent.html

Thank you for your attention!!

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