Multidisciplinary European Low Dose Initiative
MELODI Workshop, October 8-10, 2013, Hotel Bedford, Brussels
DoReMi Education & Training Forum

(1) E&T for Life-long-learning and Cross-Border Mobility
(Vocational Education and Training (VET) across the EU)

(2) E&T in Horizon 2020
(EU Policies of Research – Energy – Health - Education)

=> From Knowledge Creation (Research)
To Competence Building (Training) in EURATOM

Georges Van Goethem
EC DG Research and Innovation / Euratom / Unit K4 (Brussels)
(georges.van-goethem@ec.europa.eu)
Research and Training: together since the Euratom Treaty (1957)

Historically

Today

Research & Innovation

Education & Training
TABLE OF CONTENT

1 – Introduction: drivers and enablers for changes in E&T

2 – Analysis of needs of industry and society at EU level

3 – Convergence towards a common vision at EU level

4 – Development of common instruments at EU level

5 - What is “Horizon 2020”? From project to programme

6 - Conclusion: towards a new generation of experts
Lisbon Treaty: distribution of competences between Member States and the Union

(1) exclusive; (2) shared; (3) supporting

“Supporting competence”: "The Union can carry out actions to support, coordinate or supplement Member States' actions"

Education and vocational training = "supporting competences"
(Title XII (Arts 165 and 166) of TFEU)

For example, Art 166(2) states: “Union action shall aim to: — facilitate adaptation to industrial changes, in particular through vocational training and retraining, ..”.

Article 4 of TFEU: research and technological development is a "shared competence" (notably: "3. In the areas of research, technological development and space, the Union shall have competence to carry out activities, in particular to define and implement programmes; however, the exercise of that competence shall not result in Member States being prevented from exercising theirs.’)

Worth noting is that also energy falls under "shared competences".

Definition of education and training

- **Education** is a basic and life-long learning process
  - broader than training, encompassing the need to maintain completeness and continuity of expertise across generations
  - essentially a *knowledge creation* process, involving primarily academic institutions as "suppliers", and students as "customers"
  
  => it deals mainly with *knowledge* (and understanding)

- **Training** involves learning a particular competence required to perform a specific job, usually to an established standard
  - concerned with schooling activities other than regular education programs
  - a *competence building* process, involving experts in continuous professional development as "suppliers", and learners (e.g. professionals) as "customers"

  => mostly about *skills* and *attitudes*, in addition to *knowledge* (= competencies)
Knowledge Triangle - Knowledge cycle management
1 – INTRODUCTION: DRIVERS AND ENABLERS FOR CHANGES IN E&T

WHO ARE THE DRIVERS?

(1) EU POLICIES

"EUROPE 2020 STRATEGY FOR SMART, SUSTAINABLE AND INCLUSIVE GROWTH"

RESEARCH

"Innovation Union"
- Turning ideas into jobs, green growth and social progress
=> "Horizon-2020" under "Smart and inclusive growth" (MFF 2014–2020)

ENERGY

“Resource efficient Europe”
- Towards a resource-efficient, low-carbon economy
=> EU Energy Policy: sustainability, security of supply, competitiveness

EDUCATION

“An agenda for new skills and jobs”
- Towards lifelong learning and borderless mobility
=> improve employability in a global economy at all education levels

(2) END-USER REQUIREMENTS (SCIENTIFIC-TECHNOLOGICAL AND SOCIO-ECONOMIC)

See next Section 2 and 2013 Symposium "Nuclear Fission Research for a low carbon economy"
Of particular interest is the incorporation in the revision of a new chapter (Article 15) specifically covering E&T, namely: "Requirements for radiation Protection Education, Training and Information".

Amongst other things, this chapter will require Member States to have systems in place for the education, training and recognition of

- "Radiation protection experts" (Article 84)
- "Medical physics experts" (Article 85)
- "Radiation protection officers" (Article 86).

More information on the EUTERP website and in the FP7 EFTS projects: RPE and RPO in “ENETRAP II” // MPE in “EUTEMPE RX”.

Follow-up of BSS:

"EUROPEAN GUIDELINES ON MEDICAL PHYSICS EXPERT"

EC - RADIATION PROTECTION N° 174
ANNEX 1 (30 May 2012)
Inventory of Learning Outcomes for the MPE in Europe

"GUIDELINES ON RADIATION PROTECTION EDUCATION AND TRAINING OF MEDICAL PROFESSIONALS IN THE EUROPEAN UNION"

EC - RADIATION PROTECTION N° 175
(DRAFT – 9 Sept 2013)

Excerpt of ToC

4. Learning outcomes for physicians directly involved with the use of ionising radiation
   4.1 Diagnostic radiologists
   4.2 Interventional radiologists
   4.3 Non-radiological specialists employing ionising radiation in interventional techniques
   4.4 Nuclear medicine specialists
   4.5 Radiation oncologists

Contents
Curriculum Framework for MPE programmes in Europe
1: Generic Skills
2: KSC for the MPE as Physical Scientist
3: KSC for the MPE as a Healthcare Professional
4: KSC for the MPE as Expert in Clinical Medical Radiological Devices & Radiation Protection
5: KSC Specific for the MPE in Diagnostic & Interventional Radiology
6: KSC Specific for the MPE in Nuclear Medicine
7: KSC Specific for the MPE in Radiation Oncology / Radiotherapy

"Nuclear Safety Directive"
(EU Council, Brussels, 23 June 2009) and 2013 revision

Article 7 is devoted to “Expertise and skills in nuclear safety”:

"Member States shall ensure that the national framework requires all parties to make arrangements for education, training and exercise for their staff having responsibilities relating to the nuclear safety of nuclear installations and to on-site emergency preparedness and response arrangements, in order to build up, maintain and to further develop up-to-date and mutually recognised expertise and skills in nuclear safety."

Two additions as compared to the 2009 version, namely:

• “on-site emergency preparedness and response arrangements”
• “mutual recognition” of “expertise and skills in nuclear safety”

(= two lessons learnt from Fukushima and the subsequent “stress tests”).

=> major step toward achieving a common, legally binding framework and a strong nuclear safety culture


Excerpt:

Whereas (38) .... "Maintenance and further development of competences and skills in the management of spent fuel and radioactive waste, as an essential element to ensure high levels of safety, should be based on learning through operational experience." .......

Article 8 is devoted to "Expertise and skills":

"Member States shall ensure that the national framework requires all parties to make arrangements for education and training for their staff, as well as research and development activities to cover the needs of the national programme for spent fuel and radioactive waste management in order to obtain, maintain and to further develop necessary expertise and skills."

Who are the ENABLERS?

ENSREG = "European Nuclear Safety Regulators Group"
  http://ec.europa.eu/energy/nuclear/ensreg/ensreg_en.htm
- HERCA = "Heads of European Radiological Protection Competent Authorities"
  http://www.herca.org/index.asp
- SNE-TP = "Sustainable Nuclear Energy Technology Platform"
- IGD-TP = "Implementing Geological Disposal of Radioactive waste"
- MELODI = "Multidisciplinary European Low Dose Initiative"
- ENEF = "European Nuclear Energy Forum"
  http://ec.europa.eu/energy/nuclear/forum/forum_en.htm
- http://www.snetp.eu/
- http://www.igdtp.eu/
- http://www.melodi-online.eu/
2 – ANALYSIS OF NEEDS OF INDUSTRY AND SOCIETY

In particular with regard to the nuclear safety culture.

- How to better meet the scientific-technological and socio-economic requirements?
- How to define training schemes in terms of units of "learning outcomes"?
- What kind of knowledge, skills and competences should be taught?
- What are the established standards?
Radiation Protection: Low Dose Risk Extrapolation
(linear no-threshold” /LNT/ model versus “hormesis”) (1/3)

Epidemiological data

LNT: a testable hypothesis

Low Dose Research
The European Council requested on 24/25 March 2011 that the safety of all EU nuclear plants should be reviewed, on the basis of a comprehensive and transparent risk and safety assessment ("stress tests"). These “stress tests” are defined as targeted reassessments of the safety margins of nuclear power plants, developed by ENSREG, including the EC.

WASTE MANAGEMENT:
NO REPROCESSING (SPENT FUEL) VS REPROCESSING (Pu VS ALL ACTINIDES) (3/3)
Another Driver for Changes in E&T:
(2) Socio-economic end-user requirements

- Possible shortage of nuclear skilled professionals and ageing population; high-level decisions needed over long time scales (“from cradle to grave may exceed 100 years”); interdisciplinary scientific approach to support the EU nuclear decision making process

- Need for public debate (understanding and engagement); increasingly complex and international character of the nuclear energy sector; different national policies amongst EU Member States regarding the role of nuclear fission in the energy mix

- Pan-European mobility in science and technology; new sociological characteristics of learners (e.g. "Y" generation); towards a common language between the world of education and the world of work; impact of the new EU tools for E&T (ECTS and ECVET policy).
“Best Available Science” and Good Governance

1. A new way of "making science" : how to select the Best Available Science /BAS/ ? aiming at improving the nuclear safety culture

   => concerted effort needed to describe RTD results in a language that is understandable to a knowledgeable non specialist (e.g. policy maker)

2. Five "principles of good governance" in the EU

   - Participation (of all): either directly or through legitimate intermediate institutions
   - Openness and accountability: vis-à-vis those affected by their decisions or actions.
   - Effectiveness and coherence: meet the needs of society while making the best use of the resources at their disposal (sustainability)

("2001 White Paper on European Governance")
3 – CONVERGENCE TOWARD A COMMON VISION

Putting the above needs in a EU perspective.

- "Vision Reports" of the European Technology Platforms (e.g. SNE-TP, IGD-TP) and of authoritative expert associations (e.g. MELODI)

- Towards a new way of "making / teaching science" in order to better support decision making processes (aiming at robust, equitable and socially acceptable systems)

- Towards a new governance for Euratom programmes based on improved participation, openness, accountability, effectiveness and coherence.
Excerpt:

"Better quantification of risks at low dose and how they vary between individuals will impact policy in many areas, for example:

- the management of spent fuel or high level waste where the concern is potential exposure of populations to very small doses over extremely long time periods;
- decisions on screening programmes (e.g., mammography) where a balance must be sought between the benefits and the potential harm;
- the identification of those who are more "radiosensitive", through genetic screening."

MELODI - website http://www.melodi-online.eu/ (originated from “High Level Group” - http://www.hleg.de/)
Excerpt:

"This vision report .... proposes a vision for the short-, medium- and long-term development of nuclear fission energy technologies, with the aim of

- achieving a sustainable production of nuclear energy,
- a significant progress in economic performance, and
- a continuous improvement of safety levels as well as resistance to proliferation.

In particular, this document proposes ...... actions to harmonise Europe’s training and education, whilst renewing its research infrastructures.“

Excerpt:

"Our vision is that by 2025, the first geological disposal facilities for spent fuel, high-level waste, and other long-lived radioactive waste will be operating safely in Europe".

Our commitment is to:

(1) **Build confidence in the safety of geological disposal solutions** ……;

(2) **Encourage the establishment of waste management programmes that integrate geological disposal as the accepted option for the safe long-term management of long-lived and/or high-level waste**;

(3) **Facilitate access to expertise and technology** ……“

"EUROPEAN HUMAN RESOURCE OBSERVATORY IN THE NUCLEAR ENERGY SECTOR"

1ST SITUATION REPORT ON EDUCATION AND TRAINING IN THE NUCLEAR ENERGY FIELD IN THE EU (COM(2011) 563, BRUSSELS, 16.9.2011)


"EHRO-N is therefore the initiative to fill this gap, especially as it can provide a continuous monitoring and scanning of future challenges. EHRO-N will be the central information source for all stakeholders in the EU interested in the optimisation and rounding up of the initiatives taken. Member States are therefore invited to fully support the Commission in developing this promising tool."

(follow-up: 2-nd Situation Report due to be issued by end of 2013)

=> First EHRO-N report on the supply and demand for nuclear experts for the present and future nuclear projects in the EU by 2020 (analysis done on data received from spring 2010 to spring 2011).

Hypothetical graphical representation of the nuclear energy sector in the EU-27 by type of employees
4 – DEVELOPMENT OF COMMON INSTRUMENTS

Responding to the above needs and vision.

- ECVET partnerships aiming at mutual recognition of learners’ qualifications and freedom of establishment for experts;
- Funding from “Erasmus +” programme (e.g. Sector Skills Alliances);
- Co-funding of nuclear E&T programmes (e.g. Euratom Horizon-2020, ERC, EIT / KIC, P2P, PPP).
ECTS / European Credit Transfer System
(Mutual Recognition of Academic Grades)

European System: 1 year = 60 ECTS
1 ECTS ~ 10 Hours

Other reference for international accreditation: e.g. Accreditation of CPD in the USA - excerpt of their IACET website:
"The International Association for Continuing Education and Training is a non-profit association dedicated to quality continuing education and training programs. IACET accredits education providers that meet strict continuing education guidelines originally created in 1968 and recently updated by the IACET Council on Standards Development (ICSD). IACET accreditation is the standard learners seek for quality when they choose a provider.
The ANSI/IACET 1-2007 Standard is the core of thousands of educational programs worldwide."
THE ENEN ASSOCIATION
(EUROPEAN NUCLEAR EDUCATION NETWORK)

A non-profit international organization established on September 22, 2003 under the French law of 1901 and located at CEA-INSTN (Saclay) Paris.

Mission
The preservation and further development of higher nuclear education and expertise in all areas of nuclear fission and radiation protection (education and training)

Composition (as of March 2013)

⇒ 64 members (universities, research institutions and industry) from 17 EU Member States, plus Switzerland, Russian Federation, Ukraine, Japan and South Africa

⇒ further international collaboration: partnership agreements with ENS, IAEA / ANENT (Asia), Canada and WNU

Website = http://www.enen-assoc.org/

ECVET / European Credit System for Vocational Education and Training (lifelong learning and cross-border mobility)

- European mobility
- Permeability
- Recognition, validation
- Quality and standards
- Lifelong learning
- Integration in working and social life
- European identity
- Transparency of qualifications
- Improve VET cooperation
- Flexibility
ECVET: WHERE DO WE COME FROM?

European Reference tools: EQF, ECVET, EQARF, etc.

Emphasis on collaboration between EU member states, as a basis for mobility and LLL

<table>
<thead>
<tr>
<th>Year</th>
<th>City</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>Copenhagen</td>
</tr>
<tr>
<td>2004</td>
<td>Maastricht</td>
</tr>
<tr>
<td>2006</td>
<td>Helsinki</td>
</tr>
<tr>
<td>2008</td>
<td>Bordeaux</td>
</tr>
<tr>
<td>2010</td>
<td>Bruges</td>
</tr>
<tr>
<td>2012</td>
<td>Strasbourg</td>
</tr>
</tbody>
</table>

2008: EQF Recommendation

2009: ECVET/ EQAVET Recommendation

- ET 2020
- Youth on the Move
- New skills for new jobs
EURATOM CO-FUNDING OF E&T ACTIONS FOR LIFELONG LEARNING AND CROSS-BORDER MOBILITY IN NUCLEAR FISSION AND RADIATION PROTECTION

List of 11 “Euratom Fission Training Schemes” /EFTS/ (as of August 2013)

- **ENEN-RU** - Cooperation with Russia in Nuclear Education, Training and Knowledge Management (2010-2012)
- **ENETRAP II** - European Network on E&T in Radiological Protection (2009-2012)
- **ECNET** - EU-CHINA Nuclear Education and Training Cooperation (2011-2013)
- **ENEN III** Training schemes - Generation III and IV engineering (2009-2013)
- **TRASNUSAFe** - Nuclear Safety Culture (2010-2014)
- **CORONA** - Regional Center of Competence for VVER Technology and Nuclear Applications (2011–2014)
- **CINCH-II** - Cooperation in education and training In Nuclear Chemistry (2013–2016)
- **PETRUS III** - Implementing sustainable E&T programmes in the field of Radioactive Waste Disposal (2013-2016)
- **EUTEMPE-RX** - EUropean Training and Education for Medical Physics Experts in Radiology (2013 –2016)
- **NUSHARE** – Project for sharing and growing nuclear safety competence (2013 –2016)
- **GENTLE** - Graduate and Executive Nuclear Training and Lifelong Education (2013 –2017)
5 - WHAT IS “HORIZON 2020” ? FROM PROJECT TO PROGRAMME FOLLOW-UP OF FP-7 (2007 – 2013)

- Commission proposal (2011) for a €80 billion funding programme for research, innovation and technological development (2014-2020), including Euratom programme
  - Compromise (Council, EP, EC) in June 2013 = provisional budget of €70 billion, now pending on EP's approval of the proposed overall €960 billion EU budget for 2014-2020

- A core part of Europe 2020, Innovation Union and European Research Area

WHAT IS NEW?
- Coupling research to innovation – from research to retail, all forms of innovation
- Focus on societal challenges facing EU society, e.g. health, clean energy and transport

THREE PRIORITIES
- excellence in the science base
- tackling societal challenges
- creating industrial leadership and boosting competitiveness.
"The budget will invest in Europe's brains by increasing the amounts allocated to education, training, research and innovation. These areas are so crucial for Europe's global competitiveness so that we can create the jobs and ideas of tomorrow." A Budget for Europe 2020, Brussels, 29.6.2011 COM(2011) 500

(= Multiannual Financial Framework 2014 – 2020), Jose Manuel Durão Barroso, President of the European Commission
Euratom (2014-2018) within Horizon 2020

Budget TOTAL: € 1788 million, including Fission €355m; Fusion €709m; JRC €724m. Funding for ITER inside MFF but outside Horizon 2020 in a separate programme: € 2573 million for 2014-2018

Specific objectives for Research & Innovation indirect actions

- support **safe operation** of nuclear systems;
- contribute to efficient solutions for the **management of ultimate waste**;
- Support development and maintain **nuclear competences**;
- foster **radiation protection**;
- ensure availability of **research infrastructures**


**Perfect link with FP7**
### Descriptors Defining Levels in the European Qualifications Framework (EQF)

<table>
<thead>
<tr>
<th>Level</th>
<th>The learning outcomes relevant to Level are</th>
<th>Descriptors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>basic general knowledge</td>
<td></td>
</tr>
<tr>
<td>Level 2</td>
<td>basic factual knowledge of a field of work or study</td>
<td></td>
</tr>
<tr>
<td>Level 3</td>
<td>knowledge of facts, principles, processes and general concepts, in a field of work or study</td>
<td></td>
</tr>
<tr>
<td>Level 4</td>
<td>factual and theoretical knowledge in broad contexts within a field of work or study</td>
<td></td>
</tr>
<tr>
<td>Level 5*</td>
<td>comprehensive, specialised, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge</td>
<td></td>
</tr>
<tr>
<td>Level 6**</td>
<td>advanced knowledge of a field of work or study, involving a critical understanding of theories and principles</td>
<td></td>
</tr>
<tr>
<td>Level 7***</td>
<td>highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research and critical awareness of knowledge issues in a field and at the interface between different fields</td>
<td></td>
</tr>
<tr>
<td>Level 8****</td>
<td>knowledge at the most advanced frontier of a field of work or study and at the interface between fields</td>
<td></td>
</tr>
</tbody>
</table>

Transfer and accumulation Mobility

1. Learning agreement

2. The individual acquires KSC

3. The learning outcomes are assessed

4. Credit is awarded for the individual learning outcomes achieved

5. Learner’s credit in a individual transcript of record

6. Credit is validated

7. Learning outcomes are recognised and accumulated as part of the intended qualification, corresponding ECVET points are included.
6 - CONCLUSION
TOWARDS A NEW GENERATION OF HIGHLY QUALIFIED NUCLEAR EXPERTS IN A GLOBAL WORLD

- Contribute to the creation and transfer not only of knowledge but also of skills and competences, taking advantage of instruments developed by EU policies and Member States
- Ensure scientific and technological excellence in all parts of the EU through shared programmes of research and training (international world-wide collaboration is welcome)
- Develop a new governance for Euratom (i.e. rules, processes and behaviour) based on improvements in participation, openness, accountability, effectiveness and coherence.
  ⇒ a new way of “making / teaching science” aiming at improving and disseminating the nuclear safety culture

MELODI Discussion: How Can we Make the Best Advantage of What the EC Will Be Able to Offer? / Does LDR Benefit from CPD courses? Do other Professions Benefit?
EU / EURATOM - NUCLEAR EVENTS

FISA 2013
8th European conference on Euratom research and training in reactor systems
14-17 October 2013
Vilnius, Lithuania

EURADWASTE ’13
8th EC Conference on the Management of Radioactive Waste
Community Policy and Research on Disposal 14-16 October 2013
Vilnius, Lithuania
Available links

- EU Energy research: [http://ec.europa.eu/research/energy/index_en.htm](http://ec.europa.eu/research/energy/index_en.htm)
- CORDIS publications
- Euratom FP6 Research Projects and Training Activities, Volumes I, II and III (PDF)
- Euratom FP7 Research Projects and Training Activities, Volumes I, II and III (PDF)
ANNEX 1 - ECVET
"European Credit System for Vocational Education and Training"

"The ECVET is a technical framework for the transfer, recognition and where appropriate, accumulation of individuals’ learning outcomes with a view to achieving a qualification. ECVET tools and methodology comprise the description of qualifications in terms of units of learning outcomes with associated points, a transfer and accumulation process and complementary documents such as Learning Agreements, transcripts of records and ECVET users’ guides."

Source: Recommendation of the European Parliament and the Council,

"ECVET support teams" produced a "USERS' GUIDE" in three parts:
- Part 1 : "Questions & Answers about ECVET" (April 2011);
- Part 2 : "Using ECVET for Geographical Mobility" (October 2012);
- Part 3 : "Using ECVET to Support Lifelong Learning" (November 2011)

“Learning Outcomes” (Copenhagen Process 2002 - ECVET): Knowledge, Skills and Competences (KSC)

1. Knowledge (Learning to know: for example in the nuclear domain, knowledge needed to support operational and technical decisions in NPPs) – "cognitive domain" ECVET definition: Knowledge is the outcome of the assimilation of information through learning (= the body of facts, principles, theories and practices that is related to a field of work or study)

2. Skills (Learning to do: for example in the nuclear domain, translation of nuclear safety culture into practical terms) – "psychomotor domain" ECVET definition: Skills are the ability to apply knowledge and use know-how to complete tasks and solve problems

3. Competences or attitudes (Learning to live together: e.g. communicating efficiently / Learning to lead a team: e.g. nuclear safety values and beliefs) – "affective domain" ECVET definition: Competence is the proven ability to use knowledge, skills and personal, social and/or methodological abilities in work or study situations and in professional and personal development.
**Anderson and Bloom Taxonomy Adapted for RPE (including taxonomy action verbs)**

**Cognitive Domain** (Thinking, Knowledge)

<table>
<thead>
<tr>
<th>Definition</th>
<th>Knowledge</th>
<th>Comprehension</th>
<th>Application</th>
<th>Analysis</th>
<th>Synthesis</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remember previously learned material</td>
<td>Grasps the meaning of material (lowest level of understanding)</td>
<td>Uses learning in new and concrete situations (higher level of understanding)</td>
<td>Understands both the content and structure of material</td>
<td>Formulates new structures from existing knowledge and skills</td>
<td>Judges the value of material for a given purpose</td>
<td></td>
</tr>
</tbody>
</table>

**Example Verbs**

<table>
<thead>
<tr>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>text form</td>
</tr>
<tr>
<td>apply</td>
</tr>
<tr>
<td>carry out</td>
</tr>
<tr>
<td>demonstrate</td>
</tr>
<tr>
<td>compare</td>
</tr>
<tr>
<td>contrast</td>
</tr>
<tr>
<td>differentiate</td>
</tr>
<tr>
<td>discriminate</td>
</tr>
<tr>
<td>outline</td>
</tr>
</tbody>
</table>

**RPE = Radiation Protection Expert**

*(job qualifications described in Euratom legislation “Basic Safety Standards”)*

*Source = FP7 Euratom project ENETRAP II (ENEN website)*
**Psychomotor Domain** (doing, skills)

<table>
<thead>
<tr>
<th>Definition</th>
<th>Perception</th>
<th>Set</th>
<th>Guided Response</th>
<th>Mechanism</th>
<th>Compete overt response</th>
<th>Adaption</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Senses cues that guide motor activity</td>
<td>Is mentally, emotionally, and physically ready to act.</td>
<td>Imitates and practices skills, often in discrete steps.</td>
<td>Performs acts with increasing efficiency, confidence, and proficiency.</td>
<td>Performs automatically.</td>
<td>Adapts skills sets to meet a problem situation.</td>
<td>Creates new patterns for specific situations.</td>
</tr>
<tr>
<td>Example Verbs</td>
<td>• detect</td>
<td>• achieve a posture</td>
<td>• copy</td>
<td>• complete with confidence</td>
<td>• act habitually</td>
<td>• adapts</td>
<td>• designs</td>
</tr>
<tr>
<td></td>
<td>• hear</td>
<td>• assume a body stance</td>
<td>• duplicate</td>
<td>• conduct</td>
<td>• advance with assurance</td>
<td>• reorganizes</td>
<td>• originates</td>
</tr>
<tr>
<td></td>
<td>• listen</td>
<td>• establish</td>
<td>• imitate</td>
<td>• demonstrate</td>
<td>• control</td>
<td>• alters</td>
<td>• combines</td>
</tr>
<tr>
<td></td>
<td>• observe</td>
<td>• a body position</td>
<td>• manipulate with guidance</td>
<td>• execute</td>
<td>• direct</td>
<td>• revises</td>
<td>• composes</td>
</tr>
<tr>
<td></td>
<td>• perceive</td>
<td>• place hands, arms, etc</td>
<td>• operate under supervision</td>
<td>• improve efficiency</td>
<td>• excel</td>
<td>• changes</td>
<td>• composes</td>
</tr>
<tr>
<td></td>
<td>• recognize</td>
<td>• position the body</td>
<td>• practice</td>
<td>• increase speed</td>
<td>• guide</td>
<td>• changes</td>
<td>• constructs</td>
</tr>
<tr>
<td></td>
<td>• see</td>
<td>• sit</td>
<td>• repeat</td>
<td>• make</td>
<td>• maintain efficiency</td>
<td>• designs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• sense</td>
<td>• station</td>
<td>• try</td>
<td>• pace</td>
<td>• manage</td>
<td>• originates</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• smell</td>
<td></td>
<td></td>
<td>• produce</td>
<td>• master</td>
<td>• combines</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• taste</td>
<td></td>
<td></td>
<td>• show dexterity</td>
<td>• organize</td>
<td>• composes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• view</td>
<td></td>
<td></td>
<td></td>
<td>• perfect</td>
<td>• changes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• watch</td>
<td></td>
<td></td>
<td></td>
<td>• perform</td>
<td>• designs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• automatically</td>
<td>• originates</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• proceed</td>
<td>• combines</td>
<td></td>
</tr>
</tbody>
</table>
**AFFECTIVE DOMAIN** (Feeling, attitudes)

<table>
<thead>
<tr>
<th>Definition</th>
<th>Receiving</th>
<th>Responding</th>
<th>Valuing</th>
<th>Organisation</th>
<th>Internalizing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selectively attends to stimuli.</td>
<td>Responds to stimuli.</td>
<td>Attaches value or worth to something.</td>
<td>Conceptualizes the value and resolves conflict between fend other values.</td>
<td>Integrates the value into a value system that controls behavior</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Example Verbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>- accept</td>
</tr>
<tr>
<td>- acknowledge</td>
</tr>
<tr>
<td>- be aware</td>
</tr>
<tr>
<td>- listen</td>
</tr>
<tr>
<td>- notice</td>
</tr>
<tr>
<td>- pay attention</td>
</tr>
<tr>
<td>- tolerate</td>
</tr>
<tr>
<td>- agree to</td>
</tr>
<tr>
<td>- answer freely</td>
</tr>
<tr>
<td>- assist</td>
</tr>
<tr>
<td>- care for</td>
</tr>
<tr>
<td>- communicate</td>
</tr>
<tr>
<td>- comply</td>
</tr>
<tr>
<td>- conform</td>
</tr>
<tr>
<td>- consent</td>
</tr>
<tr>
<td>- contribute</td>
</tr>
<tr>
<td>- cooperate</td>
</tr>
<tr>
<td>- follow</td>
</tr>
<tr>
<td>- obey</td>
</tr>
<tr>
<td>- participate willingly</td>
</tr>
<tr>
<td>- read voluntarily</td>
</tr>
<tr>
<td>- respond</td>
</tr>
<tr>
<td>- visit</td>
</tr>
<tr>
<td>- volunteer</td>
</tr>
<tr>
<td>- adopt</td>
</tr>
<tr>
<td>- assume responsibility</td>
</tr>
<tr>
<td>- behave according to</td>
</tr>
<tr>
<td>- choose</td>
</tr>
<tr>
<td>- commit</td>
</tr>
<tr>
<td>- desire</td>
</tr>
<tr>
<td>- exhibit loyalty</td>
</tr>
<tr>
<td>- express</td>
</tr>
<tr>
<td>- initiate</td>
</tr>
<tr>
<td>- prefer</td>
</tr>
<tr>
<td>- seek</td>
</tr>
<tr>
<td>- show concern</td>
</tr>
<tr>
<td>- show continual</td>
</tr>
<tr>
<td>- desire to</td>
</tr>
<tr>
<td>- use resources to</td>
</tr>
<tr>
<td>- adapt</td>
</tr>
<tr>
<td>- adjust</td>
</tr>
<tr>
<td>- arrange</td>
</tr>
<tr>
<td>- balance</td>
</tr>
<tr>
<td>- classify</td>
</tr>
<tr>
<td>- conceptualize</td>
</tr>
<tr>
<td>- formulate</td>
</tr>
<tr>
<td>- group</td>
</tr>
<tr>
<td>- organize</td>
</tr>
<tr>
<td>- rank</td>
</tr>
<tr>
<td>- theorize</td>
</tr>
<tr>
<td>- al upon</td>
</tr>
<tr>
<td>- advocate</td>
</tr>
<tr>
<td>- defend</td>
</tr>
<tr>
<td>- exemplify</td>
</tr>
<tr>
<td>- influence</td>
</tr>
<tr>
<td>- justify behavior</td>
</tr>
<tr>
<td>- maintain</td>
</tr>
<tr>
<td>- serve</td>
</tr>
<tr>
<td>- support</td>
</tr>
</tbody>
</table>
EU Council (meeting of 28 June 2011) requested to "organise a symposium in 2013 on the benefits and limitations of nuclear fission for a low carbon economy. The symposium will be prepared by an interdisciplinary study involving, inter alia, experts from the fields of energy, economics and social sciences".

- 9 scientific-technological + 16 socio-economic experts + ethics report

泽连 2013 Symposium "Nuclear Fission Research for a low carbon economy", EC and EESC Brussels, 26-27 February 2013

=> fair balance between four criteria - access rights, security of supply, safety, and sustainability - in light of social, environmental and economic concerns.
2012 INTERDISCIPLINARY STUDY

BENEFITS AND LIMITATIONS OF NUCLEAR FISSION FOR A LOW CARBON ECONOMY: DEFINING PRIORITIES FOR EURATOM FISSION RESEARCH & TRAINING (HORIZON 2020)

EU Council (meeting of 28 June 2011) requested to "organise a symposium in 2013 on the benefits and limitations of nuclear fission for a low carbon economy. The symposium will be prepared by an interdisciplinary study involving, inter alia, experts from the fields of energy, economics and social sciences".

- 9 scientific-technological experts
- 16 socio-economic experts

=> 2013 Symposium "Nuclear Fission Research for a low carbon economy"
EC and EESC Brussels, 26-27 February 2013
9 SCIENTIFIC-TECHNOLOGICAL EXPERTS

- **TOPIC 1** EU Energy Policy – William D’HAESSELEER, Professor in the College of Engineering of the University of Leuven (K.U.Leuven), Belgium

- **TOPIC 2** SET Plan – Maria Teresa DOMINGUEZ BAUTISTA, Advanced Projects Directorate, Empresarios Agrupados, Spain

- **TOPIC 3** Research and Development (ERA) – Gustaf LOWENHIELM, CGL Consulting, Märsta, Sweden

- **TOPIC 4** Education and Training (E&T) and skills – François WEISS, senior scientist at the CNRS, Grenoble Institute of Technology and KIC InnoEnergy, France

- **TOPIC 5** EU Nuclear Safety and Security Aspects – Victor TESCHENDORFF, Private Consultant (formerly with Gesellschaft für Anlagen- und Reaktorsicherheit - GRS), Munich

- **TOPIC 6** People, quality of life and environment – William J. NUTTALL, Professor of Energy at The Open University, based in Milton Keynes, UK

- **TOPIC 7** Safety and Security culture beyond EU borders – Olivia COMSA, CITON (Center of Technology and Engineering for Nuclear Projects), Bucharest-Magurele

- **TOPIC 8** Science based policies and nuclear safety and security legislation – Jozef MISAK vice-president of engineering and research organization UJV Rez a.s., Czech Rep.

- **TOPIC 9** Ethics – EGE Ethics Group (EC Bureau of Policy Advisors)

- **TOPIC 10** SYNTHESIS report – John WOOD, Professor, PhD, Secretary-General, Association of Commonwealth Universities
ANNEX 3 - EURATOM CO-FUNDING OF E&T ACTIONS FOR LIFELONG LEARNING AND CROSS-BORDER MOBILITY IN NUCLEAR FISSION AND RADIATION PROTECTION

1) Many FP7 Euratom projects with embedded Education & Training (E&T) actions, in particular, in FP7 Collaborative projects, such as PELGRIMM

2) FP7 Euratom projects dedicated to nuclear education and training (11 in total)
   (i.e. “Euratom Fission Training Schemes” /EFTS/ = Euratom FP7 “coordination actions”, duration of 3 years, total budget of circa 500 000 Euros each)


Euratom WP 2014-2016 / "5.1 Education and Training (BOLOGNA AND COPENHAGEN PROCESSES)"
Specific Challenge: ............ Moreover a special effort should be devoted to a better dissemination of the key findings from Euratom and national RTD projects, whenever possible: therefore summer schools and training workshops for the continuous professional development of research workers and private / public stakeholders should be organised. This action should be undertaken under the umbrella of the Technology Platforms concerned.
PELGRIMM - "PELLETS versus GRANULATES: IRRADIATION, MANUFACTURING & MODELLING"

Focus of this Collaborative project: research and innovation in Minor-Actinide (MA) bearing fuel developments for Generation IV Fast Reactor Systems

Embedded E&T action = Task 6.1: Education and training (task leader = ENEN)

In accordance with EURATOM recommendations to embed Education & Training (E&T) within Collaborative projects, PELGRIMM promotes the implication of European students and young researchers through:

- The placement of trainees in organisations involved in PELGRIMM;
- The development and delivery of training courses and workshops in the subject matter in the project;
- A contribution to research actions of the project by researchers preparing a doctoral thesis or employed at a post-doctoral position.

Two training courses on “closed nuclear fuel cycle”: students and young researchers (trainees, PhD and/or post-doctoral researchers) are called for presenting and discussing the results of their work, with feedback from Work Package Leaders. Each workshop would last 2-3 days, 1 day devoted to lectures and 1-2 days to student presentations.

12 participants : CEA FR as coordinator

- AREVA NP SAS FR; ELECTRICITE DE FRANCE S.A. FR; AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE,L’ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE ENEA Italy; ENEN FR; JRC -JOINT RESEARCH CENTRE- ITU Karlsruhe and IE Petten; Karlsruher Institut fuer Technologie KIT Germany; KUNGLIGA TEKNISKA HOEGSKOLAN KTH SE; LAGRANGE SARL LGI FR; NUCLEAR RESEARCH AND CONSULTANCY GROUP NRG Netherlands; PAUL SCHERRER INSTITUT PSI Switzerland; Studiecentrum voor Kernenergie SCK-CEN BE
Euratom co-funding of E&T actions for lifelong learning and cross-border mobility in nuclear fission and radiation protection

List of 11 “Euratom Fission Training Schemes” /EFTS/ (as of August 2013)

- ENEN-RU - *Cooperation with Russia in Nuclear Education, Training and Knowledge Management*: focus on the mobility of teachers and students (GA 249684, November 2010 – October 2012)
- ENETRAP II - *European Network on E&T in Radiological Protection*: addressing mainly the nuclear safety authorities (GA 232620 / March 2009 - December 2012)
- ECNET - *EU-CHINA Nuclear Education and Training Cooperation*: mirror project financed by the Chinese Atomic Energy Authority (under the coordination of the Tsinghua University in Beijing) (GA 269883 / March 2011 – February 2013)
- ENEN III Training schemes - *Generation III and IV engineering*: addressing mainly the nuclear systems suppliers (GA 232629 / May 2009 – April 2013)
- TRASNUSAFE - *Nuclear Safety Culture*: addressing mainly the health physics sector (e.g., ALARA principle) (GA 249674 / November 2010 - October 2014)
- CORONA - *Regional Center of Competence for VVER Technology and Nuclear Applications*: focus on VVER (GA 295999 / 1 December 2011 – 30 November 2014)
- CINCH-II - *Cooperation in education and training In Nuclear Chemistry*: focus on the European master's degree in nuclear and radiochemistry (NRC) (GA 605173, June 2013 – May 2016)
- PETRUS III - *Implementing sustainable E&T programmes in the field of Radioactive Waste Disposal*: focus on a “Competency-Based Curriculum” (GA 605265, August 2013 – July 2016)
- NUSHARE – *Project for sharing and growing nuclear safety competence*: focus on 3 target groups (policy makers; nuclear regulatory authorities; industry) /GA 335530, January 2013 – December 2016/
- GENTLE - *Graduate and Executive Nuclear Training and Lifelong Education*: focus on synergy industry – academia (GA 323304 / January 2013 – December 2017)
(1) "ENEN-RU" - Cooperation with Russia in Nuclear Education, Training and Knowledge Management

Focus on a common basis to allow effective cooperation between the European and Russian networks for nuclear E&T

- To define the needs of cooperation in the long-term;
- To establish a framework for mobility of teachers and students (including some pilot sessions for Education and Training);
- To list up and promote further use of E&T facilities, laboratories and equipments.

Three organizations involved in the mirror project on the Russian side:

1. ROSATOM as the coordinator in the Euratom-Rosatom cooperation
2. For Education, Ministry of Education & Science, Russian Federation
   - "National Research Nuclear University (NRNU)" led by the Moscow Engineering Physics Institutes (MEPhI), Moscow
   - Obninsk State Technical University for Nuclear Power Engineering, Obninsk
3. For Training, State Corporation for Atomic Energy “ROSATOM”
   - Central Institute for Continuing Education and Training (CICET), Obninsk
   - SSC – Research Institute for Atomic Reactors, Dimitrovgrad

Organizations in the Euratom project / 8 Participants: ENEN, FR, as coordinator

- Studiecentrum voor Kernenergie SCKCEN BE; Ceske Vysoke Uceni Techniske V Praze CTU CZ; Ustav Jaderneho Vyzkumu Rez UJV CZ; Universität Stuttgart IKE Germany; University Politehnica Bucharest UPB RO; Slovenska Techniska Univerzita Bratislave STUB SK; Technatom ES
(2) "ENETRAP II":
EUROPEAN NETWORK ON E&T IN RADIOLOGICAL PROTECTION

Focus on competences required by nuclear safety authorities

- Legal basis = Euratom legislation on Basic Safety Standards (96/29/EURATOM) and forthcoming revision (including “RPE Recognition”)
- EU standards for initial education and continuous professional development for radiation protection experts (RPEs) and radiation protection officers (RPOs)
- Development of the "European radiation protection training scheme" (ERPTS) for RPE training

12 Participants: SCK•CEN, BELGIUM as coordinator

- + CEA-INSTN, FRANCE; KIT-FTU, GERMANY; BfS, GERMANY; ENEA, ITALY; NRG, THE NETHERLANDS; CIEMAT, SPAIN; HPA-CRCE, UK; ENEN Association (TKK, ISAR), FRANCE; ITN, PORTUGAL; BME-NTI, HUNGARY; UPB, ROMANIA

Focus on long-term cooperation in Education and Training and Knowledge Management in the areas of Nuclear Engineering, Radiation Protection and Waste Management and Disposal.

- Exchange of information on courses, curricula and training programmes and by evaluation of the needs for academic education and professional training
- Design and development of pilot courses in the three areas
- Identification, technical description and access modalities and conditions of infrastructures and laboratories accessible for the student and researcher exchange programme. The mirror project financed by the Chinese Atomic Energy Authority

Seven organizations involved in the mirror project on the Chinese side:
1. Tsinghua University (THU) as the coordinator in the Euratom-CAEA cooperation
2. North China Electric Power University (NCEPU)
3. Southwest University of Science and Technology (SWUST)
4. Harbin Engineering University (HEU)
5. Shanghai Jiao Tong University (SJTU)
6. China National Nuclear Corporation, Graduate School (CNNC/GS)
7. Xi’an Jiao Tong University (XJTU)

Organizations in the Euratom project / 8 Participants: ENEN, FR, as coordinator

+Studiecentrum voor Kernenergie SCKCEN BE; CEA-INSTN FR; INSTITUT NATIONAL POLYTECHNIQUE DE LORRAINE INPL FR; Karlsruher Institut fuer Technologie KIT Germany; Consorzio Interuniversitario Nazionale per la Ricerca Tecnologica Nucleare CIRTEN Italy; UNIVERSIDAD POLITECNICA DE MADRID UPM Spain; IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE ICL UK
(4) "ENEN III" Training Schemes: Generation III and IV Engineering

Focus on competences required by nuclear system suppliers

- Four training schemes:
  - Basic Nuclear Topics for Non-Nuclear Engineers
  - Design Challenges for Generation III NPP (2 professional profiles)
  - Construction Challenges for Generation III NPP (2 professional profiles)
  - Design Challenges for Generation IV Reactors

Special attention to the following competences: System and Process Engineering, Safety Analysis Evaluation, HVAC Project Implementation, digital I&C Engineering

19 Participants: ENEN Association as coordinator

- + SCK-CEN, UCL, TKK, LUT, INSTN, AREVA, ISAR, BME, CIR TEN (POLITO, UNIPI), DUT, UPB, UL, JSI, TECNATOM, UNED, UPM, UPC, SULTAN
(5) "TRASNUSAFT" : NUCLEAR SAFETY CULTURE

Focus on competences required by the health physics sector (e.g. ALARA principle)

- Designing, developing and validating two training schemes on nuclear safety culture, with a common basis: nuclear industry and installations making use of ionising radiation

- Target public: professionals, at the managerial level, in charge of health physics control in nuclear power plants and of radiotherapy services in hospitals

19 Participants: UCL (BE) as coordinator

- + TECNATOM (E); SCK•CEN (BE); ITN (P); JSI (SLO); CEPN (F); EAN (EU); UPB (RO); UNIMAN (UK); STUBA (SK); CIRTN (I); UPM (E); ND-DACTM (UK); ENEN association (INSTN, TKK, BME); CNCAN (RO); TRACTEBEL ENG. (B); EITA (EU); SNN (RO); SEAS (SK)
(6) "CORONA":
“ESTABLISHMENT OF A REGIONAL CENTER OF COMPETENCE FOR VVER TECHNOLOGY AND NUCLEAR APPLICATIONS”

Focus on competences required by VVER personnel
unify existing VVER related training schemes according to IAEA standards and commonly accepted criteria recognized in EU.

- Training schemes for VVER nuclear professionals; for non-nuclear specialists and subcontractors, involved in nuclear sector; and for students
- VVER related knowledge management system, which will accumulate information regarding design data, operational experience, training materials, etc.
- Specialized regional training center for supporting VVER customers with theoretical and practical training sessions, training materials and general and special assignment training tools and facilities, …

11 Participants: KOZLODUY NPP PLC, Bulgaria, as coordinator (lipironkov@npp.bg)

- + AEKI Hungary, FORTUM Finland, INRNE Bulgaria, JRC-IET Netherlands, MEPHI Russian Federation, CVREZ Czech Republic, PM Dimensions GmbH Austria, RISK ENGINEERING LTD Bulgaria, TECNATOM S.A. Spain, INTELLECTUAL TECHNOLOGY-SLAVUTICH Ukraine
(7) "CINCH-II"
- COOPERATION IN EDUCATION AND TRAINING IN NUCLEAR CHEMISTRY

Focus on competences required by the nuclear and radio-chemistry sector (e.g., chemistry of nuclear fuel cycle, separation chemistry, chemistry of actinides, radio-analytical chemistry, low-level radionuclide detection, radio-pharmaceutical chemistry, etc.)

- To further develop and implement the plan for the European master's degree in nuclear chemistry (NRC EuroMaster)
- To implement the course system developed in CINCH-I => modularity of courses and common qualification criteria
- To develop a Training Passport in Nuclear Chemistry and prepare the grounds for the European Credit system for Vocational Education and Training (ECVET) application in nuclear chemistry
- To implement modern e-learning tools developed in CINCH-I (e.g. NukWik /Nuclear Wiki/ and Moodle e-learning platform and to further develop new tools for the distance learning
- To lay down the foundations of a Nuclear Chemistry Education and Training Platform as a future sustainable Euratom Fission Training Scheme (EFTS) in Nuclear Chemistry

11 Participants: Czech Technical University (CTU), CZ, as coordinator

- + Chalmers University of Technology, SE; University of Helsinki (UH), FI; National Nuclear Laboratory Ltd. (NNL), UK; Gottfried Wilhelm Leibniz University Hannover (IRS), DE; Loughborough University (LU), UK; Evalion s.r.o., CZ; Commissariat à l’énergie atomique et aux énergies alternatives (CEA), FR; University of Leeds, UK; Norwegian University of Life Sciences (UMB), NO; University of Oslo, NO
(8) "PETRUS III" - IMPLEMENTING SUSTAINABLE E&T PROGRAMMES IN THE FIELD OF RADIOACTIVE WASTE DISPOSAL

Focus on competences required by radwaste agencies (e.g., repository and engineered systems design)

- Lifelong learning and borderless mobility: convergence of ECTS and ECVET systems
- DACUM process (= "developing a curriculum" - http://www.dacum.org/)

  = competency-based approach created by the British Columbia University in 1968), based on 3 premises:

  1) Expert workers can better describe their job than anyone else,
  2) Any job can be effectively described in terms of the tasks that successful workers in that occupation perform, and
  3) The specific knowledge, skills, attitudes and tools required by workers in order to correctly perform their tasks can also be described.

- Aligned with the “Implementing Geological Disposal of Radioactive Waste Technology Platform (IGD-TP) “ - Competence Maintenance, Education and Training (CMET) working group

18 Participants: Université de Lorraine (UL), FR, as coordinator

+ POSIVA Oy, FI; ENEN, FR ; Ecole des Mines de Nantes (EMN), FR; Cardiff University, UK; Linnaeus University, SE; Microbial Analytics SE AB, SE; Radioactive Waste Repository Authority (RAWRA), CZ; Agencija za radioaktivne odpadke (ARAO), Slovenia; Empresa Nacional de Residuos Radiactivos, S.A (ENRESA), ES ; Aalto University, FI; Universidad Politecnica de Madrid (UPM), ES; Czech Technical University (CTU), CZ; Universitatea Politehnica Din Bucuresti (UPB), RO; French Alternative Energies and Atomic Energy Commission (CEA); Instituto Superior Técnico (IST-ID), PT; Delft University of Technology (TU Delft), NL; Studiecentrum voor Kernenergie (SCK.CEN), BE
"EUTEMPE-RX" - EUROPEAN TRAINING AND EDUCATION FOR MEDICAL PHYSICS EXPERTS IN RADIOLOGY

Focus on competences required for medical physicists in departments of Diagnostic and Interventional Radiology (thereby “excluding” nuclear medicine and radiotherapy)

- "BSS" - Proposal for a COUNCIL DIRECTIVE laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation (Brussels, 30.05.2012) (final approval expected by the end of 2013), A number of "Requirements for radiation Protection Education, Training and Information" (Article 15) are mentioned in this Directive. Definitions and tasks are given, in particular, to the "Radiation protection expert" (Article 84), the "Medical physics expert" (Article 85) and the "Radiation protection officer" (Article 86).

- Three groups of “end-users”:
  - Physicists in hospitals & research institutions: they can have a high impact on radiation dose (safety) and image quality by optimising and monitoring the relevant devices
  - Physicists and engineers in industry (R&D departments of medical device companies): they design, realise and promote new devices with their associated exposure characteristics.
  - Physicists in competent radiation protection authorities: they define criteria for good clinical working practice, limiting values and auditing procedures.

13 Participants: Katholieke Universiteit Leuven, BE, as coordinator

- + European Federation of Organisations for Medical Physics (EFOMP), UK; Complutense University and San Carlos Hospital (SERMAS), ES; Universita degli studi di Pavia, IT; Universitat Politècnica de Catalunya (UPC), ES; Università di Ferrara, IT; Technical University of Varna, BG; National Co-ordinating Centre for the Physics of Mammography, UK; Hospices Cantonaux CHUV, CH; Landelijk ReferentieCentrum voor Bevolkingsonderzoek, NL; University of Crete, GR; Azienda Ospedaliero Universitaria S. Maria della Misericordia, IT; Klinikum Braunschweig, DE
(10) NUSHARE – PROJECT FOR SHARING AND GROWING NUCLEAR SAFETY COMPETENCE:
TRAINING AND INFORMATION PROGRAMME, DRAWING THE LESSONS FROM FUKUSHIMA

ETI initiative requested by two Commissioners (Research and Innovation, and Energy) as a consequence of the Fukushima accident in Japan (11 March 2011)

“Coordination action” of 4 years (Jan 2013 – Dec 2016), coordinated by ENEN

OBJECTIVE:
Share and grow across the EU the nuclear safety culture at all levels in all nuclear sectors (in particular, in nuclear installations and applications of ionizing radiations (in line with the conclusions of the “stress tests”) + provide nuclear information to knowledgeable non-specialists

Three target publics:
(TG1) policy makers (including the medical community)
(TG2) regulatory safety authorities and technical safety organisations
(TG3) industry (systems suppliers and energy providers)

⇒ “associated stakeholders” in charge of setting up the NUSHARE education, training and information (ETI) catalogue and carrying out the proposed action plan
(11) GENTLE:
GRADUATE AND EXECUTIVE NUCLEAR TRAINING AND LIFELONG EDUCATION

Focus on Theory and Simulations, Nuclear Energy systems, Nuclear Fuel Cycle, Economics and Operation

Specifically, the project aims at the implementation of the following joint E&T tools:

- Student research projects to facilitate students to get hands-on experience in Europe's unique and specialised laboratories and student internships in research and industry
- Intersemester courses for graduate and post graduate students on industry related topics, which will be provided by academics and specialists from research and industry.
  
  ➤ executive European Master of Science, for young professionals

The stakeholders ("employers" supporting the project) are: AREVA (France), Compania Nationala a Uraniului (Romania), Eesti Energia (Estonia), ENEN (Int'l), Foratom (Int'l), NNL (UK), NRG (Netherlands), RWE (Germany), SNE-TP (Int'l), TVO (Finland).

12 Participants: Delft University of Technology (Netherlands) as coordinator
+ BME (Hungary), CIRTEN (Italy), I2EN (France), JRC (EU), KIT (Germany), SCK•CEN (Belgium), UPM (Spain), UMAN (UK), UT (Estonia), PSI (Switzerland), LUT (Finland)