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PP	Restricted to other programme participants (including the Commission Services)	x
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WP5 : New concepts and tools for a European Radiation Protection Course

Author : Marisa Marco

CONTENT

1. INTRODUCTION

The development of a common European Radiation Protection (RP) and safety culture and, based on that, the mutual recognition for RP courses and the acquired competencies of RP experts have become a real need. The harmonisation of Education and Training (E&T) is a good starting point. Moreover, harmonisation will favour the mobility of workers and students throughout the European countries.

The ENETRAP project intends to develop a sustainable E&T infrastructure for Radiation Protection, to reach the objectives mentioned before and to ensure the required high level of RP knowledge in the future. Such infrastructure has to be built in such a way that both the initial training (Education) and the unceasing maintenance of the level of competencies (referred to as "Training") are available.

Nowadays, these objectives can only be reached using modern computer technologies (TIC) and cooperation technologies. Especially in this case we are preparing postgraduate courses in the European dimension.

The ENETRAP WP5 "New concepts and tools for an European Radiation Protection Course" (ERPC) has been focused in evaluating modern educational tools such as distance learning. In order to create a strategy and implementation plan to support e-learning in radiation protection, WP5 have prepared this study that includes an analysis of e-learning methodologies and resources. An electronic pilot module of the ERPC has been prepared using an open platform.

This report presents the results obtained by the WP-5 group, in the study of methodologies and possibilities to introduce these technologies in the European RP training System (1). The main goals of this report are to review open and distance learning in the context of present challenges and opportunities, to examine the concepts, to suggest strategy considerations address to the RP training system and to identify the initiatives in this area.

The first task that we have done was an approach to the development and usage of learning resources.

After that, a review on the e-learning methodologies, the present state of the art and its evolution has been carried out. The obtained results have been used to select the best way to host learning activities in the framework of the ENETRAP project. In addition, the study of the current existing e-learning platforms and pedagogical methodologies were an important part, in order to choose the best e-learning tools and to develop the future activities in E&T in RP. Another important task was to identify, analyse and evaluate the Open and Distance learning tools and the existing material for training in Radiation Protection. The investigation has been focused in the current electronic tools in education and training in RP used in the European Universities, Institutions and as well as International Organizations.
In practice, the report details the elements of the e-learning systems, e-learning experiences delivered or enabled by new technologies and incorporates a wide variety of learning strategies.
From the scope described above, the goals of the WP-5 group can be summarized as:

- to analyse the feedback from the previous deliveries of the ERPC, as regards its content, its methodology and also concerning its feasibility;
- to perform a survey of the new concepts, new training tools, their availability and suitability in the ERPC;

- to increase the quality and the adequacy of the accessibility to these different tools;
- to identify and propose the most appropriate learning resources in order to develop one e-learning ERPC module.

In this background, ENETRAP WP-5 tries to encourage a strategy and implementation plan to adapt the RP education and training to e-learning methodologies, stressed on identifying the best learning resources for the ERPC. In order to prepare a pilot session run, based on e-learning, It has been carried out an evaluation of the capabilities of e-learning technologies and methodologies. The pro and contra of the existing tools had also been carried out. This study was performed in two ways: 1) e-learning educational models or methodologies (the method to management didactical resources in time, pace and environment); and 2) e-learning platform to indicate which one is the most adequate for fitting the requirements for the implementation and validation of the ERPC.

2. CURRENT EDUCATIONAL SCENE. INTRODUCTION TO THE ODL (OPEN AND DISTANCE LEARNING)

There is an increasing worldwide drive to use the technologies based around the WWW as a means of addressing a number of challenges which face higher (and further) education.

The rapid development of information and communication technologies ICT's and the move towards more intensive knowledge, create new challenges and opportunities for the design and delivery of education. The main potential is to increase the capacity and cost-effectiveness of education and training systems.

Nevertheless, the new technologies for education are in continuous development and contain many different aspects, which are depending of the users, for that reason it is necessary to define the terms used through the analysis.

2.1 OPEN AND DISTANCE LEARNING

The term *open and distance learning* (ODL) reflects both, the fact that all or most of the teaching is conducted by someone removed in time and space from the learner, and that the mission aims to include greater dimensions of openness and flexibility, whether in terms of access, curricula, teaching/learning, strategies and techniques, learning material or other elements of structure (2). In this sense, e-learning is considered as part of ODL, in which new multimedia technologies are used to improve the quality of learning and teaching, facilitating access to resources and services as well as remote exchanges and collaboration. Obviously, teachers in conventional classroom may use technology as supplement, but since it is not their principal means of communication the classroom is not considered distance education. In the e-learning system, the educational decisions are made and communicated by a technology (fig.1).

E-learning is based on material and communication tools through a virtual learning environment, supported by an e-learning platform. It also offers tools to follow the track of students performance and sometime other tools as glossary, virtual library, searching tool, working group creation, etc.
One of the most important advantages of e-learning is the overcoming of barriers (anytime, anyplace, any pace and any subject). This removing distance barrier allows a wider participation with the same standardised material, easily updated which, in most of the cases, decreases

learning costs. E-learning tailors individual learning needs. In addition, students are in charge of their own learning.

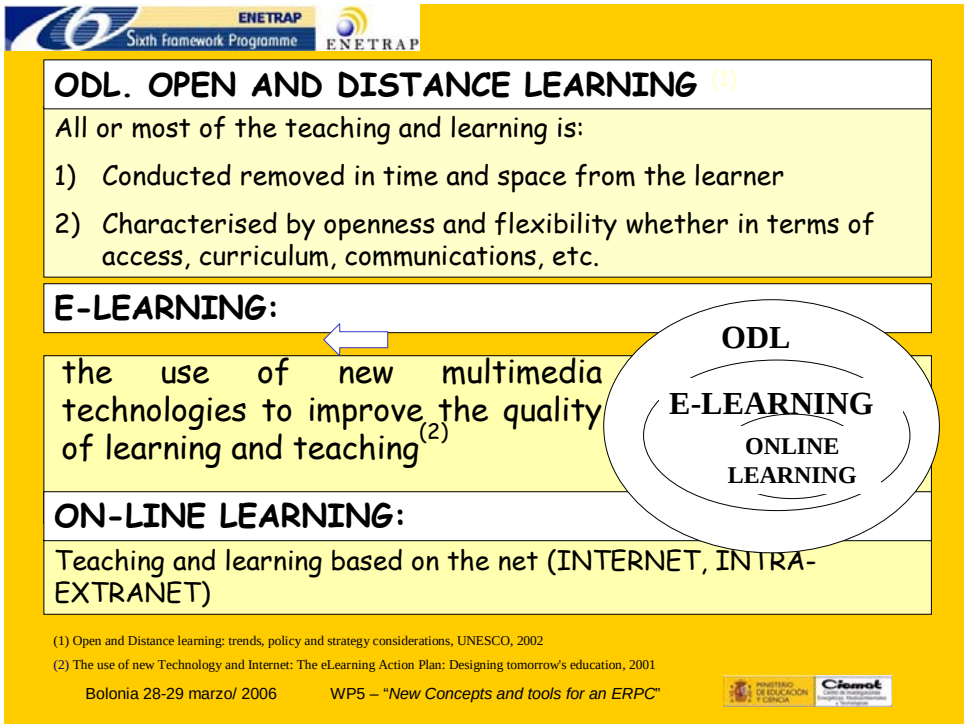

Fig. 1. - ODL scheme

A combination of both, classroom training and on line learning, named blended learning, is the best option for postgraduate courses or other superior learning experiences.

The term "blended learning" is used to describe a solution that combines several different delivery methods, such as collaboration software, Web-based courses, etc. For the purpose of this report the term refers to courses that combine face-to-face classroom instruction with on line learning
Blended learning is also used to describe learning that combines traditional learning methods with new technology to create a synergistic, dynamic learning structure (3). Studies done by the Universities hosting virtual campuses, show that students learning outcomes are higher that in comparable face-to-face training when b-learning activities are established.

3. EUROPEAN INITIATIVES SUPPORTING ODL

The European Union (EU) has in recent years consistently increased distance education components of its educational programmes, and has included open and distance learning explicitly in its Maastricht Treaty.
The ODL afford an alternative or integration available system to the classroom based training. The ODL can contribute to the educational methods diffusion, based in the student, as well as gives sense and educative content to the Internet use.
The e-learning, and the education in general, has become one of the EU action priorities. The

title homologation and teacher distance training courses acknowledgment have supposed the official admission to the ODL systems.
The EU has support the open and distance learning through the politic lines implementation in its innovation, education, training and research programs.

Several EU initiatives aim to create a 'critical mass' of resources to leverage ODL and e-Learning development and use. The Commission has adopted the "eLearning" initiative to adapt the EU's education and training systems.
At the Lisbon European Council on 23 and 24 March 2000, the Heads of State and Government set the Union the objective of becoming "the most competitive and dynamic knowledge-driven economy in the world". Europe, which, enjoys one of the highest levels of education, and has the necessary investment capacity, still lags far behind in the use of the new information and communication technologies. E Learning is designed to enable Europe to catch up by intensifying its efforts (4). It implements and extends into education and training the eEurope action plan, including in particular the guidelines for employment. The e-learning action plan is a reference point in the European initiatives because of the efforts made in the junction of all the programs, initiatives and European funds that support the e-learning.

The e-Europe 2005 Action Plan (5) sets its targets on e-learning. It takes action, encourages the effort convergence towards a common joint of action priorities, and establishes education and training politics, where there is included the e- learning, therefore set the following targets:

From e-Learning Initiative to Programme: the eLearning Initiative has been supporting the co-ordination of European e-learning efforts at both European and national level since 2001. Under eEurope 2005, the Commission will:
Launch the e-Learning Programme (2004-2006) to continue this work and support priority areas, including the deployment of virtual campuses (below). The programme was proposed on December 2002, to be adopted in the Education Council of November 2003.
Analyse the European market for e-learning, including the private sector, to identify obstacles and propose remedies;
Virtual campuses for all students. All universities should offer on-line access for students and researchers to maximize the quality and efficiency of learning processes and activities. In the final report (6) of the study on virtual campus, the Commission establishes recommendations for future actions.
Grids for e-Learning: the Commission has already launched research and pilot projects in using advanced distributed computing systems ("GRIDs") and broadband networks to provide high quality learning facilities.
The eContent*plus* programme to make digital content in Europe more accessible, usable and exploitable. The 4-year programme (2005–08), proposed, will have a budget of € 149 million to tackle organizational barriers and promote to take up of leading-edge technical solutions to improve accessibility and usability of digital material in a multilingual environment.

The programme aims at facilitating access to digital content, its use and exploitation, enhancing quality of content with well-defined metadata, and reinforcing cooperation between digital content stakeholders. Programme No 456/2005/EC(7).

E-learning is also among the objectives of the Information Society Technologies (IST) programme, which is part of the EU Research Framework Programme. The focus of research in this area is on applications of technologies for user-centered learning, building on the concept of ubiquitous computing and on sound pedagogical principles.

4. DEFINITION AND UTILITY OF A VIRTUAL LEARNING ENVIRONMENT

The term **Virtual Learning Environment (VLE)** is used to refer to the "online" interactions of various kinds which take place between learners and tutors. The VLE refers to the components in which learners and tutors participate in "online" interactions of various kinds, including online learning.
VLE may be used to support a range of learning context, distance learning and on line learning.
The principle functions that the complete VLE needs to deliver are:

- Controlled access to curriculum that has been mapped to elements that can be separately assessed and recorded.
- Tracking student activity and achievement against these elements using simple processes for course administration and student tracking that make it possible for tutors to define and set up a course with accompanying materials and activities to direct, guide and monitor learner progress.
- Support of on-line learning, including access to learning resources, assessment and guidance. The learning resources may be self-developed, or professionally authored and purchased materials that can be available for use by learners.
- Communication between the learner, the tutor and other learning support specialists to provide direct support and feedback for learners, as well as peer-group communications that build a sense of group identity and community of interest.
- Links to other administrative systems, both in-house and externally.

In addition, a VLE will need to record certain basic information about students such as registration details, course details, course pre-requisites, qualification aims and study time. Moreover, the VLE should be simple to use and conformed to accessibility standards. The VLE system is provided by the ining platform.

Review of technical criteria for the platform selection

An e-learning platform consists of a software specifically designed to support course management and online communities in a secure and scalable manner by means of a modular architecture and defines the VLE where the courses are delivered.

E-learning platform analysis

During this period of ENETRAP, different platforms have been studied in order to guess which one could fit better to ENETRAP objectives. In this way, we drew up a list of requirements and vendor's supplies on e-learning have informed us about their platforms.

We have considered two groups of platforms:

1) Free or open source platforms, available in internet, which are updated by a very active and dynamic community of users and developers. This is the case of MOODLE and ATUTOR.
2) Commercial platforms as: ORACLE e-learning (ORACLE), QS-TUTOR (SATEC), IDT(DOMÈNECH S.A) E-TRAINING (ENCYCLOMEDIA) and others.

In order to obtain the most appropriate platform for ENETRAP needs, it has been necessary to analyse certain aspects and compare them among all the studied platforms. Some of these aspects are: functionality, architecture, course organisation, design possibilities, communication

tools, files management, multilanguage possibilities, assessment tools, methodological resources, multimedia resources, compatibility with other platforms, use and access conditions, necessary requirement, cost and security (8).

Some of the commercial platforms (1-4 inc.) and free or open source platforms analysed (5-6 inc.) are listed next:

1. ORACLE I-LEARNING MANAGEMENT SYSTEM (ORACLE)
2. QS-TUTOR (SATEC)
3. IDT (DOMÈNECH S.A.)
4. E-TRAINING (ENCYCLOMEDIA)
5. ATUTOR (UNIVERSITY OF TORONTO, CANADÁ)

Nº	PECULIARITIES	DISADVANTAGES
1	• **human resources**: educational itineraries; training virtual groups • **evaluative tools**: random generator of examination tests	**cost** high **installation time**: high
2	• **compatibility**: integrated with a tool qs-author to create scorm courses • **contents**: multimedia objects and contents formatted as html	**cost** : high
3	• **contents**: didactic units, exercises, glossaries, exams, …	**cost**: high
4	• **contents**: easy way to design a course • **cost**: acceptable	**concurrency**: limited **multilanguage module**: still developing
5	• **interface**: simple and intuitive • **concurrency**: unlimited • **compatibility**: scorm • **statistical tools**: register of learners access • **multilanguage module:** 34 languages • **contents**: multimedia and html format • **evolution:** groups of developers • **resources:** multiple educational resources	**edition of contents**: difficulties **maintenance**: none **course administration**: none **documentation about administration and use**: limited
6	• **compatibility**: scorm • **multilanguage module:** package for 13 languages	**contents**: No multimedia possibilities

Table1. Characteristics of analysed e-learning platforms

6. MOODLE (UNIVERSITY OF TECHNOLOGY OF PERTH, AUSTRALIA)

In the table 1, the most relevant characteristics of each platform are shown.

5. REVIEW OF PEDAGOGICAL METHODOLOGIES: DESIGN AND DEVELOPMENT

Didactic methodology can be defined as the way to administrate the didactic resources in order to ease the learning process to an individual or an individuals group.

This management implies how the educational material and the use of didactic tools must be programmed in the time and in the environment.

In this way, the didactical methodologies can be classified according to the main characteristic that we want to stick out. In accordance with it, a classification can be the way to receive the information: distance learning, classroom based training, or mixed training. Another one could stick out the acquired knowledge evaluation way, or for example based on the used tools organisation (9).

Evaluation of modern educational tools:
There are many didactic methodologies that depend on the organizer entity, the objectives and the specific receiver. Because of that we are going to difference among three on-line methodological systems. This classification is supported by didactic methodological studies done by professional entities. This three kind of models can be distinguish by the teaching-learning process complexity and accordingly by the used electronic tools complexity, as well as by the objectives ambition.

E-learning educational models can be grouped as:

A) VLE based on the elaboration, management and distribution of didactical content, including basic communication tools (Table 3).
B) VLE based on communication and teaching-learning activities, which includes didactical material management tools (Table 4).
C) Virtual management systems of Human Resources or Academic Communities, which include training tools, having their objectives a gatherer scope than simple training.

It should be take into account that model B could be a good solution for delivering e-learning or b-learning training courses.
A resume with the most important tools and properties of e-learning educational model B is shown in table 2.

DIDACTICAL MATERIAL TOOLS	COMMUNICATION TOOLS	STUDENT TRACKTOOLS	OTHER TOOLS	GLOBAL PROPIERTIES
WBT	e-mail	% Platform use	Help	Access Control
e-books	Telephone	Evaluations	Search	Disability Assistance
Files (pdf, doc, ppt, etc)	Chats	Exams	Links	Standard Compatibility
Videos (avi, etc.)	Forum	Exercises	Virtual Library	Antivirus and Worm Scam
Executables (exe)	Advertisements Table		Notebook	Security Copies
e- blackboard	Distribution List		Personal Web Site	Previous Training for Trainers and Trainees
Videoconference	Videoconference		Working Group Creation	
...	...		Progress Control Auto evaluation (trainees)	
			Send and download Files to Server	

Table 2: Tools and properties of the e-learning educational model B

MODEL A: EDUCATIONAL METHODOLOGY FOR SIMPLE E-LEARNING (TABLE 3)

TRAINING DURATION	WORKING CALENDAR: START AND END		**NO**
SCHEDULE	SCHEDULED CONTENT AND ACTIVITIES		**NO**
PACE	SELF-LEARNING		**YES**
	TUTORIZED STUDY (A TUTOR/EXPERT FOR HELP AND LEARNER REQUESTS: (Instructor-led group)		**SOMETIMES**
DELIVER OF CONTENT	ON-LINE		**POSSIBLE**
	DOWNLOAD		**POSSIBLE**
	FACE TO FACE MEETING		**-**
	POST DELIVERY		**POSSIBLE**
CONTENT:	HTML/DOC/PPT/PDF; VIDEO; AUDIO; MULTIMEDIA; INTERACTIVE MULTIMEDIA; SOFTWARE/SIMULATIONS	ASYNCHRONOUS LEARNING:	**MOST**
		SYNCHRONOUS LEARNING: MULTICASTING (video-tele-audio conferencing); presential learning	**POSSIBLE**
COMMUNICATION TOOLS	E-MAIL/CHAT/FORUM/TELEPHONE/POST/VIDEO CONFERENCING/ETC		**SIMPLE/ SOMETIMES**
LEARNING TRACK	STATISTIC OF PLATFORM USAGE		**NO**
	STATISTIC OF PARTICIPATION IN ACTIVITIES (forum, exercises, etc)		**NO**
	EVALUATION AND EXAMS		**POSSIBLE**
MOTIVATION	DAYLY OR WEEKLY TUTOR TOUCH (via e-mail, etc.)		**NO**
OTHER TOOLS	BIBLIOGRAPHY/GLOSSARY/FAQs/ NEWSGROUP/BBS/ETC		**NO**

MODEL B: EDUCATIONAL METHODOLOGY FOR E-LEARNING/BLENDING LEARNING. (TABLE 4)

TRAINING DURATION	WORKING CALENDAR: START AND END		**YES**
SCHEDULE	SCHEDULED CONTENT AND ACTIVITIES		**YES**
PACE	SELF-LEARNING		**YES**
	TUTORIZED STUDY (A TUTOR/EXPERT FOR HELP AND LEARNER REQUESTS: (Instructor-led group)		**YES**
DELIVER OF CONTENT	ON-LINE		**YES**
	DOWNLOAD		**YES**
	FACE TO FACE MEETING		**YES**
	POST DELIVERY		**POSSIBLE**
CONTENT:	HTML/DOC/PPT/PDF; VIDEO; AUDIO; MULTIMEDIA; INTERACTIVE MULTIMEDIA; SOFTWARE/SIMULATIONS	ASYNCHRONOUS LEARNING:	**YES/ POSSIBLE**
		SYNCHRONOUS LEARNING: MULTICASTING (video-tele-audio conferencing); presential learning	**YES/ POSSIBLE**
COMMUNICATION TOOLS	E-MAIL/CHAT/FORUM/TELEPHONE/POST/VIDEO CONFERENCING/ETC		**YES**
LEARNING TRACK	STATISTIC OF PLATFORM USAGE		**YES**
	STATISTIC OF PARTICIPATION IN ACTIVITIES (forum, exercises, etc)		
	EVALUATION AND EXAMS		
MOTIVATION	DAYLY OR WEEKLY TUTOR TOUCH (via e-mail, etc.)		**YES**
OTHER TOOLS	BIBLIOGRAPHY/GLOSSARY/FAQs/ NEWSGROUP/BBS/ETC		**YES**

Proposed options to adapt RP education and training to e-learning methodologies (TABLE 5)

1. Initial training:	Exposed worker with a low level of responsibility	**MODEL A**
	Exposed worker with a high level of responsibility	**MODEL B**
	Qualified expert on RP	**MODEL B**
2. Continuous training:	Exposed worker with a low level of responsibility	**MODEL A**
	Exposed worker with a high level of responsibility	**MODEL A/B**
	Qualified expert on RP	**MODEL A/B**
3. On the job-training: training of a new practice or equipment		**MODEL A**
4**.** Information to stakeholders		**MODEL A**

Table 5 resumes the best option proposed to adapt RP education and training to the e-learning methodologies.

6. SPECIFIC REQUIREMENTS FOR RADIATION PROTECTION TRAINING

Considering the changes in the E&T procedures and the importance of the ICT in this framework, the WP5 has made an effort to include these technologies in the Radiation Protection Education Systems stressing the links between practitioners and researchers in the field of e-learning.

For the specific field of RP, depending on the level, specialization, responsibility and type of training (initial, continuous, etc) of a particular teaching, e-learning could be a solution.

The WP5 has been carried out a strategy plan in order to adapt RP education and training to e-learning methodologies, taking into account the advantages and disadvantages of e-learning as well as the different RP training. In this sense, initial training and the unceasing maintenance of the level of competencies has to be available with such educational tools.

6.1 Keys for e-learning succeed

To succeed in e-learning, a carefully and sensitively change from traditional teaching to e-learning is necessary. An easy and friendly Virtual Learning Environment and good communication tools are essential. A synergy between educators, instructors, designers, curriculum developers, e-learning technologist, etc. is, then, critical to prepare the learning material for this specific training. The quality of the learning material is other important point to succeed. Finally, highly motivation of both trainers and learners is crucial.
E-learning also offers individualized instruction and can target specific needs. Additionally, synchronous e-learning is self-paced. Advanced learners are allowed to speed through or bypass instruction that is redundant while beginners slow their own progress through content.

Advantages of e-Learning to the Trainer or Organization and Learner (10)
Some of the most outstanding advantages to the trainer or organization are:

- **Overcome barriers -** place, pace, time
- **Wider participation -** removing distance barrier
- **ICT support tools -** assistance for learning and physical disabilities
- **Tailor learning to individual needs:** Instant feedback, track student performance...
- **Increased retention** and application to the job averages an increase of 25 percent over traditional methods (11).
- **Empowerment**: students are in charge of their own learning
- flexibility
- **Consistent delivery** of content is possible with asynchronous, self-paced e-learning, easily up-to-date content
- **Consistent: same standardised set of materials**
- **Socio-inclusive:** relatively anonymous environment
- **Reduced overall cost** is the single most influential factor in adopting e-learning
- **Cost effective**: wider participation with same material
- **Expert knowledge** is communicated with good e-learning and knowledge management systems.
- **Proof of completion and certification,** essential elements of training initiatives, can be automated.
- **On-demand availability** enables students to complete training conveniently at off-hours or from home.
- **Self-pacing** for slow or quick learners reduces stress and increases satisfaction.
- **Interactivity** engages users, pushing them rather than pulling them through training.

Disadvantages
In the negative aspects, e-learning is technology dependent. It is also strongly reliant on both learners and teachers IT (information and technology) skills. It is also reliant on the quality of the training material, the motivation and the human support (material and software).
It does have limitations, among them:

- **Investment** required of e-learning
- **Technology issues** that play a factor include whether the existing technology infrastructure can accomplish the training goals.

- **Cultural acceptance**

6.2 Strategy Plan for adapting Radiation Protection education and training to e-learning methodologies

The **RP regulated training** could be classified in some groups considering the objective of the teaching. For each group, different level of learning should be taken into account in view of the tasks and responsibility to be trained.

1) Initial training:
   - 1.1 Exposed worker with a low level of responsibility
   - 1.2 Exposed worker with a high level of responsibility in a laboratory or radioactive installation (usually a license is required by the Regulatory Body as operator or supervisor)
   - 1.3 Qualified expert on RP

2) Continuous training:
   - 2.1 Exposed worker with a low level of responsibility
   - 2.2 Exposed worker with a high level of responsibility
   - 2.3 Qualified expert on RP

3) On the job training: training of a new practice or equipment

4) Information to stakeholders

For continuous training and training of basic concepts (initial training for exposed workers with a low level of responsibility), the first e-learning educational model analysed (model A, table 3) could be a good training tool. Students are in charge of their study (self-study) with multimedia content, which can include exercises and evaluations. Sometime, a tutor can be behind the educational material in order to complement and answer student requires. In order to train a specific RP practice (new technology, equipment, practice…) E-learning can support multimedia demonstrations and it can allow students to practice without exposure to ionising radiation and expensive equipments.

For the purpose of the ENETRAP project WP5 has considered that the combination face-to-face classroom and distance learning, named blending learning, is the best option for a high level RP education and training. We believe that using both options combined, education and training will be optimize in ways impossible in other formats.

In this sense, for the ERPC, blended learning should be the best option to offer a high quality, successful and complete training. Model B (table 4) will be the most adequate for ENETRAP objectives. In this model, teachers and tutors are always connected to the course to follow the learning process and complement the student's requirements.
Information to stakeholders can be offered by simple electronic tool as multimedia or interactive multimedia. Offering an information point, through web, etc, should be a good instrument to give clear, believable and complete information.

Model A and B are described in tables 3 and 4. Table 5 resumes the best option proposed to adapt RP education and training to the e-learning methodologies.

7. RESULTS

One of the starting points of the analysis to be successful in e-learning processes is to be carefully in the change from traditional teaching to e-learning or b-learning. An easy and friendly Virtual Learning Environment is essential. In this case the use of ODL methodologies have the potential to increase student learning outcomes.

For education and training in Radiation Protection in the framework of the ENETRAP project, the model of distance learning selected during the study is the b-learning approach. We consider this pedagogical model the best option for a postgraduate level in RP training. In this sense, for the ERPC blended learning should be the best option to offer a high quality, successful and complete training.

It should be take into account that learners should get practice using technology in a guided session and should have a support on technical details needed to start the course completion. During the course, the students are following up by lecturer's specialist in the subject of the module, which should work with the learners to apply the training skills, evaluate the training and analyse the course feedback.

To prepare the course we have determined the part of the curricula could be offered as e-learning. We have designed the content based on the material supported by the lecturers of the previous ERPC, including exercises after the main concepts, questions, case studies and tests. The quality of the training package is one of the most important points for the training effectiveness.

7.1 REVIEW OF EXISTING TOOLS

An exhaustive analysis of the existing RP distance courses and tools within the European Union Countries has been carried out in order to study the state of the art in RP education and training programmes in EU. For finding the training activities, one of the most obvious starting points has been the survey realized, the analysis of the main EU radiation Protection Organizations and the search engines.

Different types of e-learning courses and distance learning models have been investigated and as a result, the information has been settled on a matrix of tools in RP. Five groups of learning tools have been considered such as downloadable material, b-Learning, e-Learning, Thematic Portal and Traditional distance learning.

In this survey, we have detected 22 training courses, mainly addressed to health professionals. The results show a prevalence of e-learning methodologies over traditional distance learning, which is still being use by some Learning Institutions.

Over 29 of the websites investigated provide downloadable training material based on the net. This material is available in different formats such as pdf, html, CD- Rom, multimedia, etc. Most of them addressed to health professionals or sanitarian staff and these institutions usually deliver it free.

One of the most interesting tools detected is a web portal for E&T in RP, NUCLEONICA (12). It

is a new nuclear science web portal from the European Commission's Joint Research Centre (Institute for Transuranium Elements in Karlsruhe, Germany). The portal provides a customisable, integrated environment and collaboration platform for the nuclear sciences using the latest internet "Web 2.0" dynamic technology. NUCLEONICA is aimed at professionals, academics and students working with radionuclides in fields as diverse as the life sciences (e.g. biology, medicine, agriculture), the earth sciences (geology, meteorology, environmental science) and the more traditional disciplines such as nuclear power, health physics and radiation protection, nuclear and radiochemistry, and astrophysics.

It is also used as a knowledge management tool to preserve nuclear knowledge built up over many decades by creating modern web-based versions of so-called legacy computer codes.

NUCLEONICA provides "software as a service" on the web rather than through installed software, adding a greater level of stability and security and avoiding version compatibility and update problems. In addition, all NUCLEONICA's web applications are browser and operating system independent and can therefore be accessed by most web browsers. (See figure 2)

The Portal is particularly suitable for E&T in the field of RP. It is currently being used by the European Commission's Joint Research Centre for education and training purposes.

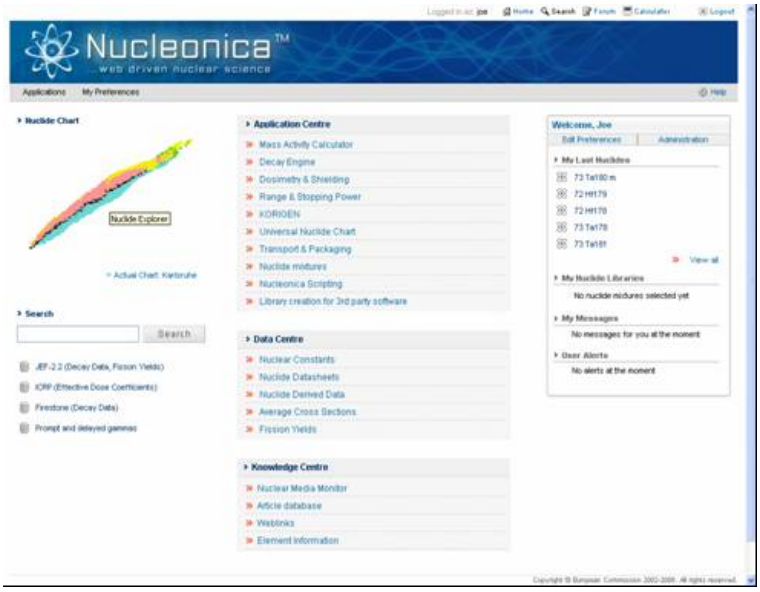

Fig.2. NUCLEONICA nuclear science web portal with personalised entry page

In the Annex 2, the total survey already done is showed.

7.2 MOODLE: THE SELECTED PLATFORM

As a result of the e-learning platform evaluation, MOODLE the open platform developed by the University of Technology of Perth Australia, under the Gnu Public license has been the chosen platform for the ENETRAP project. The selection has been based on the following features:

- simple and intuitive interface,

- powerful (great number of users),
- plenty of activities for learners, not only related to communication,
- compatibility with SCORM,
- statistical register of learners access,
- Multilanguage package for 34 languages,
- files loading by means of a web interface for teachers and learners,
- creation of html contents directly on the platform
- evaluative tools
- provided freely as Open Source software

After the implantation Plan, the Moodle platform is actually installed in the CIEMAT server, the access is open to all the participants in the ENETRAP Project and it' s hosting the pilot module of ERPC which includes the e-learning methodologies.
It could be visited in:

http://elearning.ciemat.es:4444
Using **mmarco**, as user name and password.

7.3 ERPC PILOT SESSION: "Interaction of Radiation with Matter".

Using a blended approach, after determine the general aspects of nuclear physics, is the best option for the ERPC curriculum available to be virtualized. WP5, taking into account the previous results, have developed an on-line pilot RP session based on educational model B and supported by MOODLE. This session was prepared in order to be included in the delivery of a pilot session for a revised ERPC.

The chosen topic for the e-module is "Interaction of Radiation with Matter".
The on-line pilot RP session is based on a high quality material provide by the lecturers from different European organizations.

This initiative requires a planned and well supported approach that includes a theory-based instructional model, course development assistance, learner support and ongoing formative assessment. All the learning activities and assessments that make up the course should be clearly related to the Learning Outcomes of the course.

A high level of motivation stressed on the communication tools and a continuous tracking of the student is developed through exercises and evaluations.

Content can be followed via Internet and it can be downloaded as PDF or html format. For the pilot session, three types of exercises are available: numerical questions, short-answer questions and problems. A calendar with objectives and tasks distributed in time has been well defined.

Some communication tools as forum, chat, email, etc are accessible. The teacher has to motivate and track the learner study.

A final evaluation of the knowledge acquired has to be carried out. In figures 3 and 4, the virtual learning environment and the different tools offered in the developed on- line pilot RP session of

the specific matter “Interaction of Radiation with Matter” are showed.

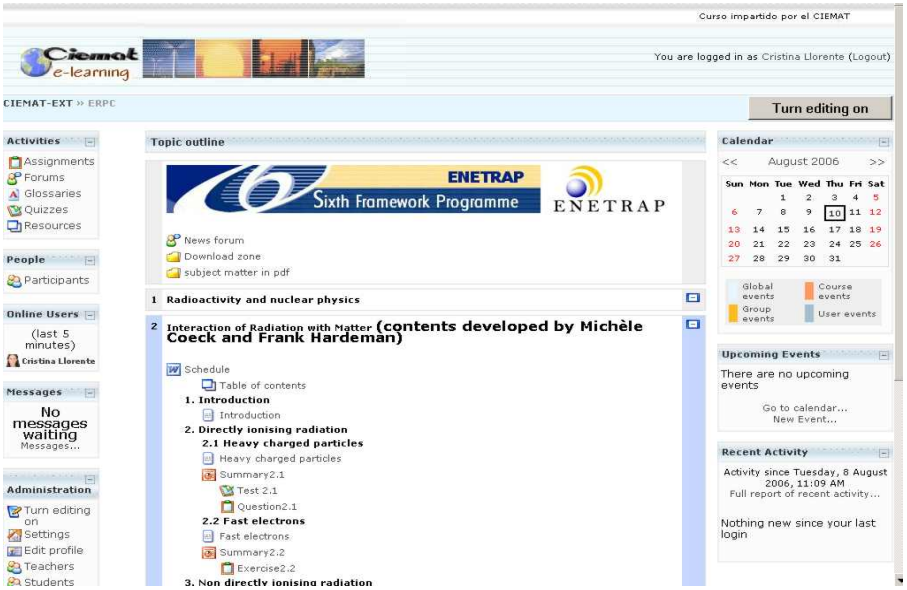

Fig. 3. Pilot session: Virtual Learning Environment
(Moodle Platform and module developed)

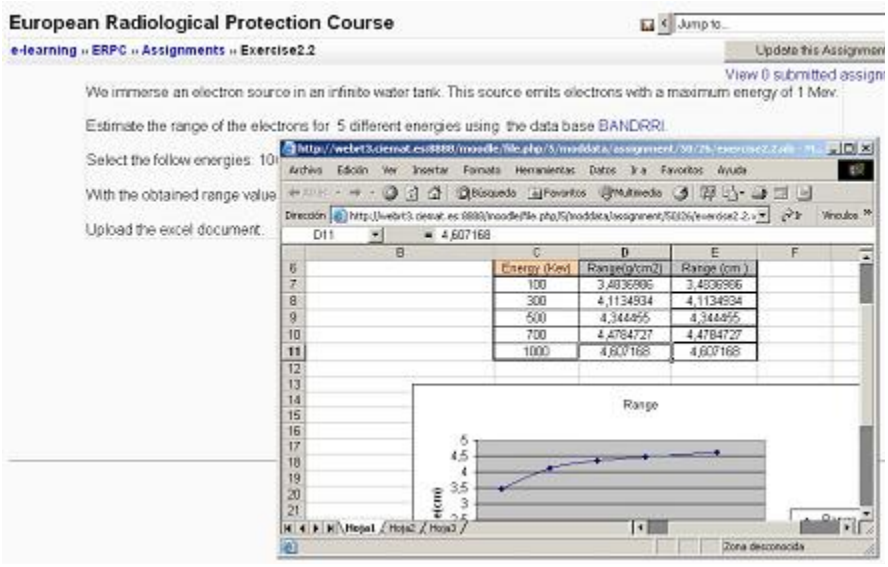

Fig. 4. Pilot session: Exercises using standards BD’s.

8. CONCLUSIONS

ODL is a very useful education and training system, which provides an integrated infrastructure complementary to the training based on classroom. It could be a powerful tool to support the innovations in the education and training world. They can contribute to create an active learning mode and a creative organization in the educational process. This training is more and more demanded because of the increased convenience and flexibility.

The promotion and implementation of e-learning in the specific field of RP in the European Union increases the participation because of the easier access to the training (anyplace), the less costs, avoiding travelling and stays, and the compatibility of working and training (any pace, anytime). This wider participation also decreases costs to organiser in a long-term. In addition, e-learning standardises training in all EU, offering the same material prepared by professionals who can be in different countries, and facilitating its updating. E-learning also favours student/professional relationship and experts in the EU. On the other hand, RP e-learning allows simulations and practical exercises without ionising radiation exposures, which contributes to promote the ALARA criteria. Therefore e-learning could be used to develop RP courses offering high quality material and relevant education tools.
Depending on the level, specialization, responsibility and type of training (initial, continuous, etc) of a particular RP teaching, e-learning can be a solution, offered as a self-learning with a basic communication tool or as a more complete teaching based on a combination of both presence and distance learning.

For continuous training and training of basic concepts, the first e-learning educational model analysed (model A) could be a good training tool. Students are in charge of their study (self-learning) with multimedia content which can include exercises and evaluations. Sometime, a tutor can be behind the educational material in order to complement and answer student requires. For postgraduate courses WP5 suggest the use of model B, the second mode analyzed.

An evaluation of the e-learning educational methodologies and existing e-learning platforms has been carried out. As an example of the e-learning potentialities, an e-learning pilot session focussed on “Interaction of Radiation with Matter” has being developed with MOODLE platform. The methodology selected is based on a high quality material, a high level of motivation stressed on the communication tools and a continuous tracking of the student performance through exercises and evaluations.
The pro's and con's of e-learning vary depending on program goals, target audience and organizational infrastructure and culture. But it is unarguable that e-learning is rapidly growing as form of training delivery and most are finding that the clear benefits to e-learning will guarantee it a role in their overall learning strategy.

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12. NUCLEONICA (www.nucleonica.net) For further information, contact: Dr. Joseph Magill (Joseph.Magill@ec.europa.eu)

10. PARTICIPANTS

The Research Centre for Energy, Environment and Technology CIEMAT. Spain

Marisa Marco Arbolí. WP5 coordinator.

Mónica Rodríguez Suárez.

Carlos González Giralda.

Almudena Bailador Ferreras.

Cristina Llorente Herranz.

Lara de Diego Chica.

The Institute for Nuclear Sciences and Technology INSTN. France

Paul Livolsi.

Cecile Etard.

Federal Office for Radiation Protection (Bundesamt für Strahlenschutz) BfS. Germany

Annemarie Schmitt-Hannig.

North Highland College NHC. Scotland

Jacky MacMillan

Annex 1: GLOSSARY:

Accreditation
The recognition or certification of an institution that has been reviewed and meets specific measures of quality.

Asynchronous Learning
Learning where people are not online at the same time and interaction does not occur without a time delay, allowing people to participate on their schedules. Examples are email, discussion groups, and self-paced courses delivered via Internet or CD-ROM.

Audio Conferencing
Voice-only-connection between three or more locations.

BBS (bulletin board system)
A system maintained by a host computer for posting information, carrying on discussions, uploading and downloading files, chatting, and other online services. BBSs are generally created for a specific group of users and are usually topic-specific.

CD-ROM (compact disk read-only memory)
An electronic data storage medium that uses optical technology for storing and playing back audio, video, text, and other information in digital form.

Certification
A valued credential awarded in several fields that proves competency upon satisfactory demonstration of particular knowledge and skills.

Chat
An online, real-time interactive communication method using text to send and receive instant messages

Email
Short for electronic mail; primarily text messages sent between two computers.

FAQ (frequently asked questions)
Highly useful, a list of common questions about a particular topic, product, or service directed primarily at new users.

HTML (Hypertext Markup Language)
Computer code used to structure text and images for viewing with a browser.

Interactive multimedia
Allows two-way interaction with multimedia course material, another computer, or another user with direct response to the input, as opposed to one-way communication from TV, video, and other non-responsive media. Interactive attributes commonly include data or text entry, mouse input, touch screens, voice commands, video capture, and real-time interaction.

Managed Learning Environment (MLE)
Is used to include the whole range of information systems and processes of a college (including

its VLE if it has one) that contribute directly, or indirectly, to learning and the management of that learning

Multicasting
An audio, video, email, or application broadcast over the web, from one computer to many.

Multimedia
The combination of text, graphics, audio, colors to create used to present information in an engaging and dynamic way.

Newsgroup
An information exchange forum where notes about a particular topic are posted and shared.

Simulations
Interactive multimedia presentations designed to model real scenarios and which allow the user to participate and experience without risk.

Software
Computer programming code that provides a computer with instructions to perform specific tasks; a program or application.

Teleconferencing
Video or audio conferences conducted over telecommunications channels such as telephone lines, local area networks, and the Internet.

Video Conferencing
Live video and audio communication between three or more locations.

Virtual classroom
The area where students and instructors interact online.

Virtual Learning Environment (VLE)
Is used to refer to the “online” interactions of various kinds which take place between learners and tutors. The VLE refers to the components in which learners and tutors participate in “online” interactions of various kinds, including online learning.

Annex 2: TOOLS (see excel file)