TRAIN-THE-TRAINER COURSE FOR RADIATION PROTECTION EXPERT: ESSENTIAL TO DEVELOP COMPETENCES

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ABSTRACT

The perceived growth of the use of ionizing radiation (medical, industrial and research), requires an advanced understanding of radiation protection in order to protect workers, the public and the environment from the potential hazards of ionizing radiation.
Within this perspective, maintaining a high level of competences in radiation, assuring the ongoing skills development of personnel and adequate knowledge management, is crucial to ensure future and safe use of ionizing radiation and the development of new nuclear activities in a safe way.
The ENETRAP III project is a proactive leader for bringing forward solutions in the development of competences for RPEs and/or RPOs.

Until now, radiation protection E&T projects focused mainly on the development of scientific and technical training contents. Little consideration has been given to help lecturers with developing the programs following the European standards and guidelines such as ECVET and EQF, or to update those providing training with information on recent developments in the use of modern learning tools.

Aware of the importance of appropriate didactic and andragogic skills, the ENETRAP III project dedicates a work package to the development and implementation of a train-the-trainer course in order to enable lecturers to acquire the necessary teaching and training competences to ensure their mission as trainer. Since the Euratom BSS describes training as one of the outstanding tasks of RPEs and RPOs, this train-the-trainer course is designed to meet their specific needs.
As such, the RPE train-the-trainer course has the following objectives:
- Design training activities using the ECVET approach
- Identify the different European tools designed to support professional mobility

- Design playful and relevant learning situations, involving participants in applicable situations
- Identify innovative learning resources training tools
- Implement the basic principles and good practices of training
- Give a short training session in front of a specialized audience

The training course consists of a one-week face-to-face session. To achieve the above objectives, the course consists of various innovative teaching tools and methods: lectures, pedagogical scenarios, digital tools, workshop, discussions and role-play. Activities are built to stimulate, involve and interact constantly with the participants.
Participants will be assessed throughout the training course through reflective questions (using an interactive training animation tool), individual and/or group practical exercises and case studies. A learning assessment, covering all the themes of the training, will be held at the end of the training.
Two training sessions are scheduled (February in French and June 2017 in English). The February session reached a maximum capacity (in two weeks only). It shows the interest and willingness of radiation protection professionals to improve their E&T skills.

1. Introduction

The ENETRAP III project is a continuation of the ENETRAP and ENTRAP II projects, created and implemented with the aim of developing high-quality technical training programs on the topic of radiation protection. The perceived growth of the use of ionizing radiation requires an advanced understanding of radiation protection, in order to adequately protect workers, the public and the environment from the potential hazards of ionizing radiation.
Until now, E&T projects in radiation protection focused mainly on the development of scientific and technical training contents. Little consideration has been given to help lecturers and trainers with developing the programs following the European standards and guidelines such as ECVET and EQF, or to update those providing training with information on recent developments in the use of modern learning tools. Acknowledging the importance of appropriate didactic and andragogic skills, a train-the-trainer course for radiation protection professional has been developed to enable trainers to acquire the necessary teaching and training competences to ensure their mission as a trainer in radiation protection matters.

2. Inventory of the existing train-the-trainer courses

An inventory of existing TTT courses allows to compare the available programs and used methodologies, and highlight the points of convergence and divergence between these offers. Both generic as specialized TTT courses are considered without the intention to serve as an exhaustive benchmark on the subject.

2.1. Generic train-the-trainer courses

Examples of training centers and number of trainings		Programme / themes covered	Pedagogical methods
French TTT courses	Demos : 18 trainings Duration : Face-to-face: 2 to 5 days Certification: 14 days	*Sample programme* The fundamentals of teaching adults Prepare training Animate his training to create interest and encourage learning Manage a training group Evaluate the effectiveness of training	role play, group exchanges, theoretical contents and practical case studies

	Examples of training centers and number of trainings	Programme / themes covered	Pedagogical methods
	MMC formations : 3 trainings Duration : 1 or 2 days	Mastering pedagogy Designing a training action Select and control the training materials The 4 highlights training Master training Facilitate a group	Not indicated
	Cégos : 21 trainings Duration : Face-to-face: 1 and days Certification: 9 or 11 days	*Sample programme* Appropriating specifications Set a course suitable to participants and objectives Develop good training materials (trainers / participants) Facilitate training with ease Create a group dynamic Assessing learning outcomes Adopted a trainer posture oriented participants	Training action: case studies and practical workshops
English TTT course	ATD : 11 trainings Duration: Face-to-face: 0,5 to 3 days Certified: 1 year	*Sample programme* Purpose & assessment : needs, date analysis, learning objectives Planning & preparation : adult learning principles, preparing the material, environment & yourself, the 4 dimensions of learning Presentation & facilitation: establishing a positive learning environment… Performance: level of evaluation, self-assessment …	Not indicated
	AMA : 1 training Duration: 3 days	Active adult learning Assessment Objectives, planning active training Facilitating presentations & activities : opening exercises, brain friendly-lectures, lectures alternatives, experimental activities Extending the value of training Evaluating training Closing activities	Workshop, performance, discussion, role-play, games and simulation,
	Total Success : 2 trainings Duration: 1 or 2 days	Fundamentals for becoming a trainer Running a training course Delivering a training session successfully How to write and structure training Factors for effective training skills What makes a good trainer? Effective training practice and procedure Body language and voice projection skills Classroom training versus one-to-one training	Lectures, performances

Table 1: Comparison of French and English generic train-the-trainer courses

<u>Points of difference</u>

Table 1 above, highlights two points of divergence

- The number of French TTT courses seems much larger and varied than those in English. This may be due to the fact that internet searches were conducted from a French browser or from ignorance of UK or US training centers.
- The types of French TTT courses seems more diverse than the English versions.

<u>Points of convergence</u>

Regarding the other comparative point of Table 1, namely the program and the topics covered and the pedagogical methods, the generic French and English TTT courses are very similar.

- Program and themes covered: training design and animation (at different levels depending on the programme)
- Various pedagogical methods fostering interactivity

2.2. Specialized train-the-trainer courses

Training centers and number		Programme / themes covered	Pedagogical methods
Aeronautics	NAWC: not a training but only a guide No duration provided	Psychology of learning Prepare the lesson plan Instructional methods How to conduct classroom presentations The use of transitions Advantages of questions Quick list of hints for good instruction	Not provided as it is a guide and not a training
	APAVE (FR) Duration: 5 days	Pedagogical methods and techniques with the aim to share their knowledge and skills Communication and management of group dynamics	Interactive lecture Case studies
Aviation	IATA: 1 training Duration: 5 days	Developing a course: needs, objectives, lesson plans Delivering a course Teaching aviation security Closing a course	Practical exercises Performances Oral presentation
	Plane Training : 9 trainings Duration: between 1 & 5 days according to the subject	Teaching and learning process Training preparation Training delivery and feedback Group dynamics, practice session, report writing How to design and deliver technical knowledge Technical knowledge depending on the training course	Practical exercises Performances + video Group discussion
	Squadra consultants (FR) Duration: 5 days	The pedagogical situation The relationship process The teaching process The learning process The human factors applied to instruction	Lectures Discussions Performances
Automotive	SMRT Duration: 60 days (certification)	Training skills, curriculum design and assessment development Develop performance and learning strategies Develop and deliver competency-based training Develop and deliver competency-based assessment	Not indicated
	Joe Verde Sales & Management Training Duration: 2 days	Create a continuous 30-60 day training plan to develop the specific skills you know you need Prepare for daily training in 10 minutes or less Get every salesperson involved in every meeting, every time, without exception Get everyone involved in practicing each topic so they can develop the skills they need to improve Get verifiable results from every meeting you hold	Very interactive course
Nuclear	IAEA (FR/EN) Duration: 5 days	Learning factors (motivation, perception, memorization, understanding); Communication phenomena (active listening, teaching styles); Training rules and techniques; Designing a training programme; Tools and teaching aids. Familiarize participants with the training material developed by the IAEA	Interactive: discussions and course delivery on technical topics
	CEA / INSTN (FR/EN) Duration: 5 days	Information-sharing and experience feedback in your mission as an occasional trainer: success, difficulties, needs and ideas for improvement The ECVET approach: principles and implementation Training design methodology The training basic principles and good practices Innovative teaching tools: digital training tools Technical visits and experimentation of training materials developed by the INSTN within the framework of specific trainings	Various innovative teaching tools and methods : lectures, pedagogical scenarios, digital tools, workshop, discussions and role-play

Tab 2: Comparison of specialized TTT courses

<u>Points of difference</u>

Table 2 above does not highlight fundamental differences.

Some areas, in particular aviation and aeronautics, offer a sizeable offer of train-the-trainer courses and for different audiences. It seems that these sectors are committed to the quality of trainings and that « training [shall be] conducted by 'suitable qualified persons' [i]».

Points of convergence

Similarities are identified in Table 2 on items such as: the program and themes, duration (except certified training) and pedagogical methods, the different trainings – regardless of specialty:

- Program topics: training design and animation (at different levels depending on the program) with specific sequence linked to the area of expertise (tools, regulations, technical knowledge ...)
- Duration: between 1 and 5 days
- Varied pedagogical methods fostering interactivity

2.3. Advantages and interest for a train-the-trainer course of specialization

When analyzing the two tables and their data, the main difference between a generic TTT course and a specialized TTT course appears to be the programme and themes.

While the two types of trainings (generic & specialization) clearly cover aspects of training design and animation, specialized TTT courses incorporate one or more specific sequences related to the area of expertise in their program, for example with regard to pedagogical tools, regulations or technical knowledge.

This point in particular is discussed later in this article.

3. ENETRAP III train-the-trainer course for radiation protection professionals

3.1. Objectives and programme

Objectives

As it has already been mentioned in the introduction, the ENETRAP III project dedicates a work package to the development and implementation of a TTT course in order to enable lecturers to acquire the necessary competences to ensure their mission as a trainer in radiation protection matters.

As such, the train-the-trainer course for radiation protection professionals has the following objectives:

- Design training activities using the ECVET approach
- Identify the different European tools designed to support professional mobility
- Design playful and relevant learning situations, involving participants in applicable situations
- Identify innovative learning resources training tools
- Implement the basic principles and good practices in training
- Give a short training session in front of a specialized audience

Programme

The TTT course consists of a one-week face-to-face session:

	Morning	**Afternoon**
Day 1	*S1. Introduction to the training session* : Objectives, programme, rules, training organization, trainers presentation Self-assessment of one's learning (**before**/after) *S2. Round table & sharing experience:* Crossed presentation, sharing and feedback experience *S3. ECVET approach:* Context and methodology	*S3. ECVET approach:* European tools to promote occupational mobility Principles of the approach Group workshop: design a learning unit according to the ECVET approach

	Morning	Afternoon
Day 2	*S4. Training design methodology:* Group workshop and contribution: how to design a training course Practical work *S5. The fundamentals of training adults:* Self-assessment: what kind of trainer are you?	*S5. The fundamentals of training adults:* Learning factors and good practices *S6. INSTN teaching tools & innovations:* Practical field school
Day 3	*S6. INSTN teaching tools & innovations:* Digital tool to create training resources Calculation software for dose calculation: how to design exercises?	*S6. INSTN teaching tools & innovations:* DOSEO workshop VERT virtual space: presentation of the tool and developed scenarios
Day 4	*S6. INSTN teaching tools & innovations:* Works and demonstrations: detection of ionizing radiation *S7. Teaching practices* Designing relevant training materials	*S7. Teaching practices* Practical work: prepare a training session
Day 5	*S7. Teaching practices* Deliver a training session in front of a specialized audience Self-assessment of one's training sequence	*S7. Teaching practices* Analysis and debriefing of the training sessions *S8. Evaluation and conclusion of ENETRAP III training session* Self-assessment of one's learning (before/**after**) Assessment of learning

Tab 3: Programme of the TTT course

3.2. Pedagogical tools and methods

To achieve the training objectives, various innovative teaching tools and methods are implemented for every sequence.

	S1	S2	S3	S4	S5	S6	S7	S8
Lectures	X		X	X	X	X	X	
Performances							X	
Digital tools					X	X	X	
Practical exercises				X		X	X	
Questionnaire	X				X		X	X
Workshop			X	X				
Discussion		X	X	X		X	X	X
Technical visit						X		

Tab 4: Use of tools and methods during the TTT course

The whole training course and associated activities are built to stimulate, involve and interact continuously with the participants to enhance the group dynamics and facilitate an acquisition of the different sequences and contents.

3.3. Evaluation activities

« *To "evaluate training" means finding out what the "value" of training really is – to the trainees, their managers, their colleagues, the organization for which they work, and for the wider community. Thus, it is important to define clearly the training objectives so that the results of the training can be measured against them.* »[ii]

To echo the World Health Organization (WHO) study, the Kirkpatrick evaluation model (4 levels) was used for the TTT course for radiation protection professionals.

Evaluations implemented in the context of the training

Level 1: Lecturers evaluation – Participant opinion

Each training sequence is subject of an evaluation from the participants, at the very end of the instructional sequence. This assessment focuses on five criteria: Interest for the subject, Duration, Pedagogical expertise, Presentation documents, Documents distributed.
The scoring is made according to four-level Likert scale: **++** very satisfactory / **+**: satisfactory / **-**: unsatisfactory / **- -**: really unsatisfactory

Level 1: Evaluation of the training – Debriefing at the end of the 5 days
At the end of one-week training, a comprehensive debriefing of the whole training is scheduled. It seemed necessary, in addition to a written evaluation, to have a roundtable discussion allowing each participant to express their opinion about the training: whether in form and/or content. The aim is obviously to capitalize and improve the programme of this pilot training session.

Level 2: Knowledge assessment – Self-assessment (before / after)
At the start of the training session, the participants are requested to self-assess their knowledge on the topics that are addressed during the training. The aim for the participants is to measure their progress at the end of the training.
This self-assessment focuses on the 3 main themes of the training, each with 4 sub-themes.

Themes	Sub-themes
The ECVET approach and tools for occupational mobility	• The various existing tools • What is the ECVET approach • Principles of the approach ECVET • The learning outcomes approach
Designing a teaching sequence	• Training design methodology • Formulation of consistent learning outcomes • The different teaching methods and activities used in training • Rules of relevant training material
The fundamentals of adult learning	• Adult learning factors • Managing a training group • Training technics and good practices • Distance on my practices as a trainer

Tab 5: Themes and sub-themes of self-assessment before and after

Participants' self-assessment according to a four–level Likert scale:
- I have vague notions or it does not mean anything to me
- I generally understand what it is but I need to deepen the subject
- I understand and I feel able to implement it
- I master the subject very well and I feel confident to implement it

Level 2: Learning assessment – After the training
To measure the knowledge and understanding at the end of the training, participants are asked to complete a learning assessment. 25 questions (+ 1 extra issue that dealt with a subject that was not addressed during the training) on the three main topics of the training are treated: The ECVET approach, design of a training sequence, the fundamentals and good practices of adult learning.
The 25 questions are of a various type: multiple-choice, open questions, connect the related definition, order logically and open questions, thus avoiding to leave nothing to chance.

Complemented by the evaluations formalized on paper, the suggestions made throughout the training session of the first pilot session (in French) were also taken into account to optimize the first pilot session (in English).
The result of these evaluations are presented in the following chapter.

4. Results of the pilot session in February 2017 and areas for improvement

4.1. Analysis of results

Level 1: Lecturers evaluation – Participant opinion

As mentioned previously, an evaluation was made after each sequence: 5 criteria were evaluated according to four levels of satisfaction (see section 3.3).

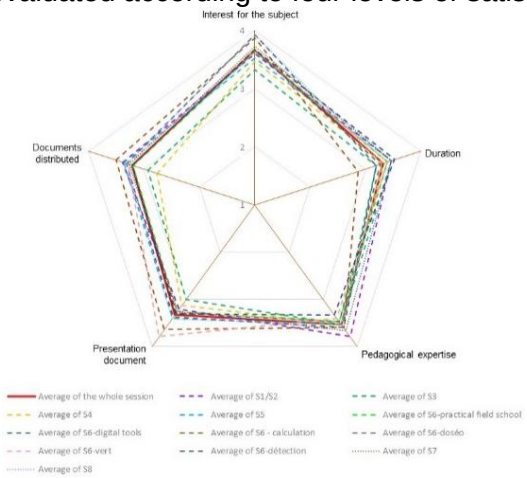

Fig. 1: Lecturers evaluation

	Highest average	Lowest average
Interest for the subject	Tie: S6 (digital tools) & S8	S3
Duration	S6 (calculation software)	Tie: S3 & S6 (Digital tools)
Pedagogical expertise	S1/S2	S6 (VERT)
Presentation document	S3	S6 (VERT)
Documents distributed	S6 (calculation software)	S4

Tab 6: Highest & lowest average of lecturers evaluation

The evaluations were sometimes accompanied by comments, providing additional information on the sequence. Given the number of comments, they are not included here but are taken into account in the part “New course programme”.

Level 1: Evaluation of the training – Debriefing at the end of the 5 days

Questions	Answers
What do you think of the size of 5 consecutive days?	Mixed opinions: some found the training too short (not enough time to assimilate and practice some points), others too long (in particular the first day) but overall the duration of 5 days is well appreciated
What do you think of the structure and sequence of the sequences?	• Bring a better balance between theoretical contribution and technical visits: the first 3 days were very dense
What sequence did you find most relevant? Why?	• Footage sequence: useful to have an outsider’s view and matches to the reality on the ground • Technical visits are good illustrations • Formalization of the training design methodology • The self-assessments: helpful to learn how to analyze one’s trainer practices
And the least relevant sequence? Why?	• Some technical visits because the educational value was low and difficult to reproduce • Self-assessment: what trainer are you? Because no nuances in the proposals
What would you add, delete, and see differently in this training (sequence, type of activity, theme ... for example)?	• Evaluation of learning to answer every day: allows everyone to make a synthesis of acquired • The ECVET approach arrived too early / too technical • Give more time on practical work sequences: writing LO + preparation • Add a sequence on speaking, oral fluency with improvisational theater exercises + add other footage, group management • 1 or 2 days REX 6 months after the training • Present digital tools earlier

Level 2: Knowledge Assessment – Self-assessment before / after

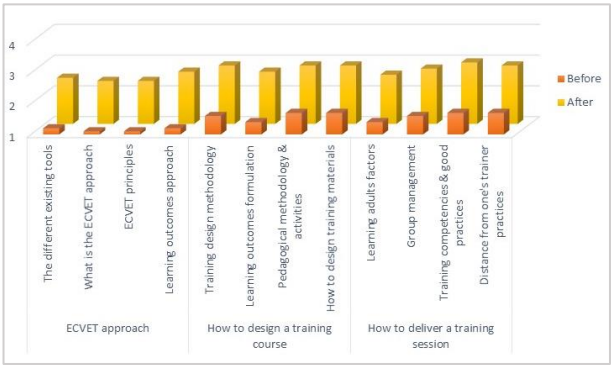

Fig. 2: Evaluation of knowledge – average before-after

This graph shows that most participants consider to have improved their knowledge throughout the training.

The ECVET approach is the sequence for which the progress of learning seems to be the most significant. The "after" average of the ECVET theme, however, is lower than the 2 other themes.

Level 2: Learning assessment – After the training

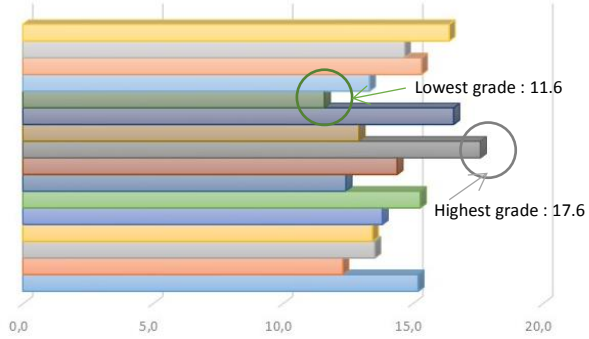

Fig 3 : Learning assessment – grades of the 16 participants

The session average is 14,3/20. The bonus issue is not taken into account.
2/3 of the participants scored between 10 and 15/20 and 1/3 scored higher than 15/20.
The evaluation was made on the last day of training (on Friday afternoon). It took longer than expected (1:20 h instead of 30 minutes). Some participants did not respond to several questions. Thus, the scoring system was adapted not to penalize the grades.

The unanswered questions were not taken into account. Thus, the grades of figure 3 scheme may not be the real reflection of learning.

Evaluations to come

As mentioned in the WHO study, "The assumption that training automatically leads to changed behaviour or improved work standards is simply not valid. Not all trainees change their work methods, or their approach to work, after training – even if they say they appreciate and enjoy the training sessions", or got a good grade for learning assessment. Indeed, assessments of level 1 and 2 reflect assessments made at a time T. To measure the impact of training, medium-term, level 3 "Behavior "and level 4" Results " evaluations are planned.
These evaluations would be executed by individual interviews and would include the following points:

- Level 3 "Behavior": evaluating participants' changes following the training and implementation of the learning in their work environment.
  Sample questions (to participants):
  - What has changed in your way of designing or delivering trainings since the training?
  - Which learning (methods, activities, etc.) have you implemented after the training?
  - Which learning (methods, activities, etc.) do you think are not suitable, and why?

  Most participants have agreed to take part in this evaluation.

- Level 4 "Results": evaluation of the benefits of training in the company in terms of objectives and quantifiable results.
  Sample questions (to managers):
  - What did you expect from the train-the-trainer course for radiation protection expert in terms of objectives and results?
  - What improvements could you note?
  - What indicators are not satisfactory?

  Managers who would accept to be interviewed need to be found.

A feedback day could be organized 6 months after the training to make a review of operational learnings and give additional advice and information on a particular topic.

4.2. **Possible suggestions for improving the future TTT courses**

The following suggestions were taken into account when designing the programme of the next TTT course:

- Sequence on the ECVET approach: not at the beginning of the training course
- Distribution of face-to-face training and technical visits: better balance between classroom time and visits
- Incorporation of animation techniques: improvisational theatre exercises, group management, posture and public speaking
- Delivery of a short course in front of a specialized audience: additional sequence to measure the improvement
- Learning assessment: to be distributed during the whole course week
- Self-assessment « What trainer are you ? »: provide better instructions and support to participants to answer the questionnaire

Next to these improvements, one of the five technical visits (DOSEO workshop) was removed and the virtual space VERT was made optional for participants who are available after the training day.

New course programme

	Morning	Afternoon
Day 1	*S1 – Introduction of the training session* Objectives, programme, rules, training organization, trainers presentation Self-assessment of one's learning (**before**/after)	*S3. Training:* Short-training delivery (5 min) + debriefing Theory: learning process
	S2. Round table & sharing experience: Crossed presentation, sharing and feedback experience	*S4. Technical visit* Practical field school + debriefing
	S3. Training: Self-assessment: what type of trainer are you? + debriefing Short-training preparing	*Learning evaluation*
Day 2	*S4. Training design methodology:* Group workshop and contribution: how to design a training course Practical work	*S5. Training basic principles and good practices* Different teaching methods
	S5. Training basic principles and good practices Learning factors and good practices	*S6. Technical visit* Works and demonstrations: detection of ionizing radiation
		Learning evaluation
Day 3	*S7. Training materials* Digital tools: create training resources How to design relevant training materials	*S8. Speaking* Improvisational theatre exercises
		S9. Technical visit Calculation software for dose calculation: how to design exercises?
		S10. Optional technical visit Virtual space VERT
		Learning evaluation
Day 4	*S11. ECVET approach* Context + exercise + SAT method	*S13. Prepare a training session* Practical work
	S12. Training good practices Group management	*Learning evaluation*
Day 5	*S14. Deliver a training session to a specialized audience* Performances Self-assessment of one's training sequence	*S14. Deliver a training session to a specialized audience* Analysis and debriefing of the training sessions: what improvement?
		S15. Conclusion Self-assessment: before-after Conclusion of the training

5. Conclusion

Although there are still points of optimization, the first pilot session of the train-the-trainer course for radiation protection professionals is perceived relevant, effective and useful to participants. Indeed, most of the participants are experts in radiation protection – medical or industry – and carry out their mission as trainers without any training on didactic and andragogic skills. Any pre-existing knowledge and skills were learned on-the-job, without completing a train-the-trainer course.

This training-the-trainer training is focusing on radiation protection (including technical visits) and delivered by experts in radiation protection. «Without this technical side, the training loses its unique character (possible to find at any training center)"[iii].

This train-the-trainer course for radiation protection professionals can be extended to other areas of nuclear expertise: nuclear safety, safety culture, reliability interventions, dismantling for example. In this case, the technical part (visits, experts, examples ...) must be adapted to meet the target audience.

The ENETRAP III project is committed to improve the didactic and andragogic skills of professionals who are tasked to provide training in radiation protection matters. The evaluations of both pilot sessions (French and English edition) will be made available in deliverable 4.3 on the ENETRAP website http://enetrap3.sckcen.be/.

6. References

i Plane Training : http://www.planetraining.com/train-the-trainer-courses.htm
ii Evaluating Training in WHO (World Health Organization)
iii Comment of a participant of the (French) training session of February 2017

Generic training centres	Specialized training centres
• Demos (FR) • Cegos (FR) • MMC formation (FR) • ATD • Impact Factory • Total Sucess	• NAWC (Naval Air Warfare Center) • APAVE (FR) • IATA (International Air Transport Association) • Plane training • Squadra Consultants (FR) • SMRT (Safety & Service, Excellence, Mastery, Responsibility & Respect, Teamwork) • Joe Verde Sales & Management Training • IAEA (Internation Atomic Energy Agency) • CEA INSTN (FR) (Institut National des Sciences et techniques Nucléaires)