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## **WP8: Final Report**

### **DELIVERABLES WD 8.1, 8.2**

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## SUMMARY

This report summarises both Interim Reports of Work Package 8 (WP8: Organise Pilot Sessions, test proposed methodologies and monitor the training scheme effectiveness) dealing with Deliverable WD8.1 “Organisation and Performance of Several Pilot Sessions”. Main emphasis is laid on WD8.2 “Monitor the Training Scheme Effectiveness”.

The previous work of the first interim phase is summarised. The requirements for RPE and RPO competencies with respect to training relevance are evaluated and the Reference Standard for RPE training is described. Experiences from previous training events are compiled. Existing training courses fitting to the agreed standards are identified. A remodelled modular Radioisotope Training including the modules 1, 2, 3 of the Common Basis and an additional Optional Module 6 on “Unsealed Sources and Research” has finally been chosen for pilot sessions for RPE. Spring 2011 as date and Karlsruhe as host location were fixed.

In the second phase a Memorandum of Understanding with ITU/JRC as participants’ employer was developed. Learning Outcomes were fixed, learning objectives of lectures defined and the jointly designed programme implemented. The practical orientated training modules were delivered and the results evaluated with respect to the outcomes in terms of knowledge, skills and attitude. From the successful assessments, two evaluation questionnaires and furthermore through discussion periods with the participants it turned out that the RPE modules performed were straightforward, effective and successful. Conclusions were drawn and recommendations made for feedback with the other work packages. These include

- finalizing an EU wide data base of training events and providers for more effective advertisement (WP6) and
- providing EU wide mutual recognition as early as possible e.g. by “Europass stamps” and credit points (WP9).

The final work addressed to efforts for the organisation of two additional optional modules on NORM (8) and Medical (7), and a preliminary evaluation of the existing RPO training courses with respect to the guidance given by WP3.

# 1 Introduction and Work Programme

A sustainable education and training (E&T) infrastructure for Radiation Protection (RP) is an essential component in combating the decline in expertise and in ensuring the continuation of a high level of radiation protection knowledge in the future. Therefore the harmonisation of high-quality “reference standards” and good practices for E&T in RP, specifically with respect to the training of Radiation Protection Experts (RPE) and Radiation Protection Officers (RPO) in Europe is a major objective of the ENETRAP project [1]. This includes an efficient and transparent European mutual recognition system for training events and providers following the agreed standards.

## 1.1 Objectives

Work package 8 (WP8) concentrates on the organisation and supervision of pilot sessions of a series of different modules of the European Radiation Protection Training Scheme (ERPTS) as developed in WP4 (WD.06). Pilot courses were foreseen to be organised for RPEs of “Common Basis” of ERPTS as well as of “Optional Modules” on occupational radiation protection at different installations where ionising radiation is applied. From the evaluation and experience of these pilot events, the effectiveness of the proposed methodologies according to the agreed standards and the ERPTS in the whole will be monitored. Thus, recommendations and possible improvements will be expected for the future to ensure mutual feedback with the previous work packages. This report summarises the previous work of the first interim phase and describes the Organisation and Performance of the pilot sessions. Main emphasis is laid on WD8.2 “Monitor the Training Scheme Effectiveness” from the evaluation of the outcomes.

## 1.2 Deliverables and Milestones

The main deliverables of WP8 are

- “Organisation and Performance of Several Pilot Sessions” (WD8.1) and
- “Monitor the Training Scheme Effectiveness” (WD8.2).

The outcome and summary of results will be dissipated to the Steering Committee and Advisory Board to ensure mutual feedback. FTU-KIT is responsible to produce the WP8 deliverables and report to Steering Committee and Advisory Board.

WP8 is responsible or involved in the following ENETRAP II milestones:

- |   |             |
|---|-------------|
| - Select pilot sessions and evaluate (No. 15), expected date month 6 to 8 | completed   |
| - Organise and implement pilot sessions (No. 16), expected date 12 to 28  | completed   |
| - Evaluate outcome of events (No. 17), expected date 16 to 32             | completed   |
| - Summarise and make recommendations (No. 18), expected date 24 to 36     | completed   |
| - Mutual recognition methodology (No. 19), expected date 18               | in progress |
| - Design of European training passport (No. 20), expected date 24         | in progress |

## 1.3 WP Meetings and Reporting

Altogether four WP8 meetings have been held, in Lisbon November 2009, Grenoble March 2010, Helsinki June 2010 and Bucharest November 2010. Detailed information can be found in the Second Interim Report [3].

The identification and selection of existing training events fitting to one or more of the modules of ENETRAPS' ERPTS has been finalised at the 3<sup>rd</sup> Steering Committee Meeting in Grenoble (First Interim Report May 2010 [2], see also public version [2a]). A Second Interim Report mainly on the Organisation and Performance of the Pilot Modules was delivered in April 2011 [3]. The Effectiveness of the proposed methodologies as a result of the evaluation process has been reported at the 5<sup>th</sup> SCM in Berlin and recently during the 6<sup>th</sup> SCM and 2<sup>nd</sup> AB Meeting in Brussels in January 2012. The present status of WP8 was summarized at the AB web conference in December in Brussels. The conclusions and recommendations are described in more detail in this final report, which covers the whole working period of WP8 from 1 September 2009 to 29 February 2012.

As WP8 is linked to number of other work packages appropriate citations are made whenever possible.

## 2 Previous Work

### 2.1 Summary and Results of First Interim Phase

In the first interim phase scope and objectives of ENETRAP II WP8 were defined. A detailed work programme with expected deliverables and milestones are elaborated with corresponding time schedule. Focus was laid in the selection of appropriate pilot sessions and locations.

The following preconditions for RPE training events were fixed:

- Subjects and time frame should be according to ERPT Scheme to successfully fulfil the agreed learning outcomes.
- Modular training events are favourable.
- Criteria of Quality Management (QM) should apply.
- Workshops, laboratory exercises and technical visits must be included.

The main results of the first reporting period from 1/9/2009 to 28/2/2010 were

- Compilation of experiences from previous training events; Selection of appropriate pilot sessions and locations:
- Remodelled modular training event for “Acquisition of the Requisite Competence for ‘Strahlenschutzbeauftragte’ in NPPs” (corresponding to modules 1, 2, 3, 4) and/or “Radioisotope Training Course” (corresponding to modules 1, 2, 3, 6) in Karlsruhe to be performed in spring 2011.
- Identification of NRG and HPA as training provider for optional module 8 on NORM
- Acquisition in form of poster contribution and leaflets at 3rd European IRPA Congress in Helsinki.

### 2.2 Requirements for RPE and RPO Competencies (WP2 and WP3)

In the EU Draft Basic Safety Standards BSS (version February 2010 [6]), the “qualified expert” is now described in more detail as

**Radiation Protection Expert (RPE):** *an individual having the knowledge, training and experience needed to give radiation protection advice in order to ensure effective protection of individuals, whose capacity to act is recognized by the competent authorities.*

**Radiation Protection Officer (RPO):** *an individual technically competent in radiation protection matters relevant for a given type of practice who is designated by the undertaking to oversee the implementation of the radiation protection arrangements of the undertaking.*

A survey of the present situation [7] showed that it is generally difficult to draw any common, unambiguous dividing line between an RPE and an RPO. Some RPE have also the function of an RPO in the institution and some RPO can certainly be considered as RPE [8].

In agreement with the European Qualification Framework EQF [11] and as a result of a questionnaire which was distributed within WP2 to the EU member states the following criteria for the requirements to act as **RPE** have been evaluated:

- Key aspects of *Competence* in the process of RPE recognition should be an appropriate combination of education, training and experience.
- Aspects to be addressed by training are
  - o *Knowledge and understanding* of each of the topics in the basic/reference syllabus (ENETRAP FP6)
  - o *Knowledge* of operational radiation protection methods in the fields
    - + Interpretation/application of radiation protection data,
    - + Radiological measurements,
    - + Control procedures (work involving potential for significant exposure), and
  - o *Ability* to give advice to duty holders.

The assessment of practical core competence must be demonstrated in the areas of legislation, hazard/risk assessment, optimisation, area monitoring, personal dosimetry, designation of areas and classification of workers.

The competence of an **RPO** includes educational and training requirements. The RPO must be provided with sufficient training (successful completion of a suitable course) to enable him to effectively carry out his supervisory duties, but needs further experience by practice-specific training.

We have reported in WP3 [8] that the formal training of an RPO should cover a core syllabus and, as appropriate, a supplementary module pertinent to the practice in question. These materials may be covered separately or combined into a single course depending on availability of participants. This usually classroom based training may be followed by additional experience in the workplace and on-the-job-training. A competent and effective RPO will also need good communication skills and the ability to supervise and to exercise sound judgement in addition to technical skills. Ideally the overall competence of an RPO to perform the required duties should be assessed by appropriate means addressing both “soft” and technical skills (“Knowledge, Skills, and Attitudes”). This is in accordance with the recent IAEA recommendations for training requirements for RPO [9].

The different practices of RPOs include industrial radiography, irradiators and accelerators, gauging techniques, tracer techniques, mining and milling, nuclear installations, use of unsealed sources, diagnostic radiology, nuclear medicine, radiotherapy and others. Details of the required competencies according to RPOs area of work and guidance for RPO training have recently been reported at 6<sup>th</sup> SCM in Brussels [4] in WP3 (under WP3 Documents WD3.2: “Training-RPO-Medical Sector/NPP/Radiation Sources/X-Ray). Training recommended by IAEA can be found in [9, Annex 2].

## **2.3 Reference Standard for RPE Training (WP4)**

Along with experiences gained from previous training events of EU (ERPC) and IAEA (PGEC) and the requirements for RPE competencies (WP2) a syllabus for RPE training has been developed in WP4. It foresees a modular approach and puts forward a general Common Basis and a series of specialised Optional Modules on occupational radiation protection in different installations where ionising radiation is applied.

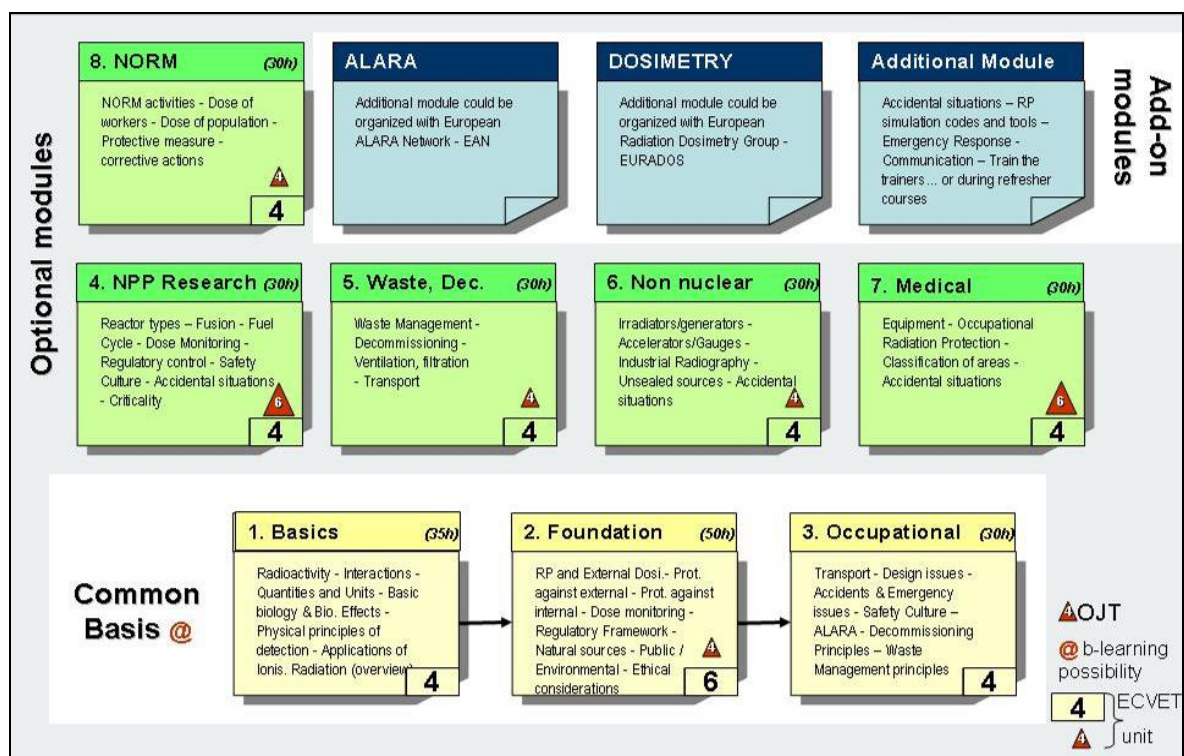
The “Common Basis” is constituted of three modules “Basics”, “Foundation” and “Occupational RP”, lasting each approx. one week as shown in figure 1.

Specialised Optional Modules concern Radiation Protection in the different wide domains of activity:

- Module 4: Radiation Protection in the domain of nuclear power plants and research reactors
- Module 5: Waste Management and Decommissioning
- Module 6: Unsealed Sources, Research and Non Nuclear
- Module 7: Medical
- Module 8: Naturally Occurring Radioactive Material – NORM and
- Additional modules on ALARA, Dosimetry, Accidental Situations etc.

The Common Basis Modules can be organised traditionally and/or electronically using e-learning or b-learning. All programmes are defined through the formulation of Learning Outcomes LO with respect to knowledge, skills and attitudes as reported recently in WP4 [4] in more detail. The time duration is tentative and should just reflect a rough orientation. Upon successful completion of the unit credit points as indicated are foreseen to be delivered. This “theoretical” part is extended by a period of on-the-job-training (OJT) which could be organised either immediately after the module or later in the participant’s home country. Details on OJT can be found in a previous report [10].





**Figure 1:** Modular Structure of the Remodelled European RP Training Scheme ERPTS for RPE (WP4, [4])

### 3 Organisation and Performance of Pilot Sessions for RPE

Suitable existing training events for RPE in agreement to the reference standards (chapter 2.3) have been identified earlier as being

- Radioisotope Training Course (SA210), Karlsruhe 3 weeks, and
- TC for Requisite Competence of “Strahlenschutzbeauftragte SSB” in Nuclear Power Plants (SK300), Karlsruhe 5w.

They have to be rearranged into modules as already described in our First Interim Report [2]. Missing parts with respect to soft skills had to be added. Furthermore, courses should be held preferentially in English language in order to enable other EU countries to participate. Due to practical reasons the Radioisotope Training Course option has finally been chosen for the pilot sessions. In the following the preparative work and course performance is described in more detail.

#### 3.1 Preparative Work

##### Advertisement

As a result from previous experiences promotion in order to acquire participants is considered to be a most important issue in international training unless participants are provided with funds or are compensated by a third party (IAEA). Advertisement of the selected training events was initiated in forehead of the 3<sup>rd</sup> IRPA Congress in Helsinki in June 2010. A poster contribution has been presented [2, 3]. Furthermore, two leaflets (flyers) were prepared and distributed during the Congress. One addressed to the ERPTS and the objectives of WP8 in general (Annex 1). The second one was compiled in order to dissipate more detailed information on the pilot modules in Karlsruhe, their contents, learning outcomes and administrative arrangements (Annex 2). Additional effort was done to spread the electronic leaflet as wide as possible. The flyers were sent to the vast list of European contact points. Advertisement of the courses was made on the EUTERP website and ENEN nuclear engineering network data base. One page with information on the forthcoming training events has been published in the ENS News Special Edition on Education & Training [12].

As experienced in previous international training events training fees play an important role for financially weak EU countries. Therefore an introductory 50% cut-rate package fee of 1.680 EUR for Module 1 to 3 and 6 was agreed

Despite the entire effort only one participant from the Swiss regulatory board registered. Similar disappointing results followed for Module 8 on NORM promoted by NRG and scheduled for May 2011 in Petten.

A leaflet (flyer) based on that for the pilot sessions in Karlsruhe was compiled in order to dissipate more detailed information on the pilot NORM module. The course was also added to the course brochure of NRG Petten, which was sent to almost 150 companies in the Netherlands in fall 2010. The module with an advertised fee of 1.995 EUR was scheduled for 23/05/11 – 26/05/11 in Petten but had to be postponed due to lack of participants.

In parallel to our ENETRAP based acquisition work the Institute for Transuranium Elements ITU requested in 2010 a training event on Radiation Protection in English language for some of their academic staff members. ITU is one of the Joint Research Centres JRC of the European Commission at the KIT Karlsruhe Campus. It employs foreign guest scientists in Nuclear Research and Radiation Protection, most of them temporarily, which usually rotate in the different EU countries. We agreed that the participation in the whole ERPT pilot block might be a beneficial option. As the certificates issued upon successful completion are foreseen to be mutually recognised within the EC, this might facilitate the mobility and international exchange of ITU personnel. Thus, a total of 7 participants from 7 different countries (FR, GE, IT, RO, SW, CH, MEX.) could finally be won for the Karlsruhe sessions.

## Programme Evaluation

It was agreed upon that courses should follow the recent EU ECVET approach for Borderless Mobility and Life-long Learning [13]. The cornerstone of ECVET is the formulation of “Competence Building” schemes in terms of “Learning Outcomes” LO related to Knowledge, Skills and Attitudes/Competence (KSC). The definition of LO was considered as being an efficient training strategy as it gives clear and concise statements of the intended outcomes of a training event. LO are statements of what a learner knows (knowledge), understands is able to do (skills), or is able to demonstrate or to be (attitude) on completion of a learning process or at the end of a period of learning [13]. They are specific, measurable and realistic observable. In order to maintain maximum feed-back between FTU as training provider and ITU as sending provider/employer of participants a Memorandum of Understanding (MoU) was developed. The appropriate learning outcomes LO foreseen were jointly agreed in conformity with the agreed standard. For “knowledge” based competence classroom training was fixed while for “skills” practical training, laboratory exercises and analytical calculations were chosen. Topics and lecturers should orientate widely on the ITU praxis. As a wide fundamental knowledge of the participants in Nuclear Science exists, more focus was laid on practical part and technical visits. Presentation of laboratory results by the participants and a variety of visits to RP facilities should promote competence in the “attitude” based area. The participation in the whole ERPTS block (Module 1 to 3, 6) was foreseen to meet the training needs for a European RPE for “Unsealed Radioactive Substances in Non-Nuclear and Research”. Not included is the OJT part of Modules 2 and 6 which might be offered later on request.

In accordance with the reference standard of WP4 and following the experiences from the regular Karlsruhe Radioisotope Training a final training programme (Annex 3) was established which was considered as being appropriate to successfully provide the preliminary formulated learning outcomes for participant’s competence. Details on the LO and their grading for the different modules can be found in WP8 Second Interims Report [3] and in WD4 [4].

Competent and experienced lecturers from the Karlsruhe Institute of Technology KIT, the Nuclear Industry and other European organisations were recruited and instructed. They were requested to provide a manuscript as training document with a common template for title page and format. It should include summary, learning objectives, contents of teaching with the appropriate grading, accompanying text and power point slides. Test questions at the end of each training unit should facilitate evaluating the outcome.

Special features foreseen for the courses were active involvement of the participants by means of practice-oriented laboratory exercises, workshops and technical visits. For the latter the following institutions cooperated and have been visited during the training:

- Decontamination of Personnel and Toxicological Laboratory (KIT-MED)
- Body and Lung Counter (KIT-KSM)
- Nuclear Emergency Response Assistance Team (KHG)
- Waste Management, Decontamination and Clearance Facilities (WAK-HDB)
- Decommissioning of Research Reactors (WAK-MZFR)
- Accredited Radiochemical and Nuclear Measurement Laboratory (KIT-KSM)
- Synchrotron Radiation Accelerator Facility (KIT-ISS)
- Cancer Research Centre (DKFZ): Waste Storage and Heavy Ion Therapy (HIT) Irradiation Facility.

From the detailed programme in Annex 3 it can be seen that the knowledge driven part with lectures in general was held in the morning followed by exercises to train skills and ability in the afternoon session. Lecturers from ITU were integrated in the programme as jointly agreed.

### 3.2 Implementation, Supervision and Performance

The effective organisation of the course was considered as being of outmost importance for the remaining work in WP8, namely the measurement of the effectiveness of the work done in the previous WP's.

The following modules have been implemented and performed within the period from 14 March to 1 April:

#### Common Basis

- |                          |                        |                  |
|--------------------------|------------------------|------------------|
| - Module 1: Basics       | KIT Karlsruhe, Germany | 14/03-18/03/2011 |
| - Module 2: Foundation   | KIT Karlsruhe, Germany | 21/03-25/03/2011 |
| - Module 3: Occupational | KIT Karlsruhe, Germany | 28/03-30/03/2011 |

#### Optional Module

- |  |                        |                  |
|--|------------------------|------------------|
| - Module 6: Unsealed Sources, Research and Non-Nuclear | KIT Karlsruhe, Germany | 30/03-01/04/2011 |
|--|------------------------|------------------|

Module 4 (NPP) was not yet selected for performance due to technical reason, while Module 8 (NORM) was postponed due to lack of participants. Module 5 (Waste Management and Decommissioning) has already been performed in June 2008 within the first ENETRAP project. Details and results have been described earlier [1, 10].

Because of the limited availability of the radioisotope training laboratory the basic modules 1 and 2 were run in parallel to the regular Radioisotope Training Course (SA210) which was held in German language. While lectures, in timely harmonisation, were provided in different class rooms (English, German), laboratory sessions were held jointly together. This facilitated as well the preparation of materials (equipment, standards, and chemicals) for the exercises and simplified the supervision of trainees. Exercises were done in groups of 2 to 3 participants each. They were guided by at least 3 to 4 experienced supervisors. Seminars held included

- Shielding of Ionising Radiation
- Radioactive Decay and Ingrowth
- Moderation and Absorption of a Neutron Source
- Use of and Work with Nucleonica

Participants were provided with a complete set of manuscripts, lecture notes and practical procedures ("loose-leaf form", Annex 6). Additionally, an electronic version on CD-Rom was distributed at the course end.

Course materials were later printed as paper-back version (3 booklets: Module 1, Module 2 and Module 3/6) and are available for further training runs on request. This will overcome the present shortage of suitable training material in English language until the translation of the French textbook is completed ("Personne Compétente en Radioprotection", see also WP7: Development of some course material examples) [4].

While modules 1 and 2 were held at the FTU Karlsruhe Training Centre and were jointly performed with the Radioisotope Training Course, topics were branched off in the 3<sup>rd</sup> week. Module 3 and 6 of the ERPTS were hosted inside KIT Campus. This enabled easier access to the technical installations visited. The training ended with a half day excursion to the German Cancer Research Centre in Heidelberg, where the responsible RPE/RPO explained and demonstrated the RP work in the medical field sector.

In order to assuring an efficient transfer of knowledge a daily wrap-up of the training programme and lectures held was organised in order to identify immediately any weakness.

Module 1 was performed in cooperation with WP7 ("Development of some course material examples"). It was agreed upon that selected units should be Video recorded in order to test the preparation of e-learning material. Two lecture units (Magill and Frenzel, Annex 4) and a demonstration have been chosen as example and the material was further processed. Results and conclusions were reported by Livolsi at the EUTERP Workshop in Cyprus [5].

## 4 Evaluation of the Proposed Methodologies and the RPE Training Scheme Effectiveness

The definition and necessarily as well the evaluation and assessment of LO are a boundary condition in ECVET. It was used to provide feedback of the effectiveness of the recommendations and proposed methodologies made by the previous work packages and the RPE training scheme in general.

### 4.1 Evaluation Procedures

Evaluation procedures in forehead of the training event concern to learning provider, learning programme in terms of learning outcomes as defined in WP4, and training materials.

For the evaluation of training providers and training materials fixed data sheets from WP5 were applied.

The outlined learning programme and LO can easily be compared with reference standards established in WP4 [WD4.2], with respect to reference syllabus, and required levels/grades of knowledge, skills and attitudes.

The achieved results for LO are assessed after completion of each training unit/module for knowledge both by oral and/or written examination as questionnaires. Skills are assessed during the course through supervision in exercises and reporting of results by the participants.

Course evaluation in term of acceptance and contentment by participants was investigated by daily wrap-up, discussion periods and by questionnaire after each module.

#### 4.1.1 Evaluation With Respect to Agreed Standards

In WP5 we have fixed evaluation sheets for the quality criteria of training providers in general and for the content of the course with respect to the agreed standards for RPE. All general and organisational quality criteria as defined in Appendix A of WP5 second years report (WD5.3) and as formulated by the QSK (“Qualitätsverbund Strahlenschutzkursstätten”) - FTU is a foundation member of QSK - are fulfilled by FTU-KIT as training provider. The criteria are:

*General and Criteria concerning the content of the course*

- Formulation of learning outcomes on the level of knowledge, skills and attitude
- Availability of programme, including lessons, subjects, teachers and methods, regularly updated
- Course responsibility by an adequate RPE/RPO
- Regular up-date of course programme
- Content of course according to the agreed standard
- Competent teachers, practical tutors and programme coordinators, all regularly assessed

*Organisational Criteria*

- Participant’s registration associated with document and participants identity control system
- Examination regulations for assuring the formulated learning outcomes
- Written course evaluation and complaint procedures

Thus it was assured that FTU represents a well qualified training provider in RP.

The agreement of the learning programme and learning outcomes with the reference standard was tested in the first phase of WP8 during the selection of suitable training events [2]. Missing topics from the evaluation procedure like “Ethics of Radiological Risk Governance” and “Communication Skills” were introduced. Additionally, LO preliminary introduced were synchronised with those evaluated in a later phase of WP4. Training Materials with respect to topics, learning objectives and their grades were compared with the tables jointly evaluated in WP5 (WD5.1).

It turned out that all items were in concordance with the agreed standards.

#### 4.1.2 Assessment

The formulation of LO, as precondition for training course recognition, provides a most effective tool for learning assessment. It gives clear and concise statements on the intended outcomes of a training event. They communicate expectations to the learners, clearly communicate graduates' skills to prospective employers and guide and organise the instructor and the learner. These are specific, their outcomes measurable and realistic observable. The work with LO is of special advantage when participants have a different background and an entrance level thus cannot be defined. Using e-learning modules, as option e.g. for module 1 and 2 the Training Scheme Effectiveness cannot be evaluated by the number of hours present.

When the modules were terminated the stated MoU with the employer was evaluated against the LO achieved. We have assessed the LO both through knowledge and skills. To exam the knowledge a questionnaire has been prepared covering aspects of the whole spectrum of subjects taught. Main emphasis was laid on shielding and dosimetric calculations as key tasks for a RPE.

Examples of questions are

- Define Absorbed Dose, Equivalent Dose and Effective Dose, and give the appropriate units!
- Describe the Radiation Weighing Factor and give its value for electrons, alpha-particles and slow neutrons!
- Explain the Build-up Factor for shielding calculations!
- Sketch a suitable shielding for neutrons including Boron and Cadmium!
- Describe the INES Scale for communication of nuclear emergencies and rate the Fukushima accident according to present information! Explain your decision!

A written examination was held at the end of the first week for module 1, and additional at the course end for both common basis module 3 and module 6.

At the end of the second module (end of 2<sup>nd</sup> week) an oral assessment was organised. In addition to the knowledge, skills gained were assessed by supervision of the work with contamination monitors and the calculation of body doses from dose rate measurements.

In analogy to the German regulations a total of more than 70% of the available credits was considered as necessary to pass the exam. According to the time demand in module 1 and 2, one third of credits were addressed to exercises. A participant has considered being skilled when the results of the exercise and its findings were appropriate and correct, and the discussion period finalised successfully.

The result with respect to the Knowledge Part (written examination) was that for

- 5 participants > 90% credits
- 1 participant > 80%
- 1 participant 75%

and to the Skills Part (practical assessment)

- all (7) > 95%

1 participant was evaluated only for module 1, 3 and 6 due to absence.

All learners met the expectations stated initially as what she/he should know (knowledge), be able to do (skills), and to demonstrate (attitude) at the end of the pilot sessions. They consequently received a certificate on behalf of ENETRAP II and FTU-KIT (Annex 8).

In conclusion, the RPE Pilot Training Event was judged as effective and successful!

#### 4.1.3 Course Evaluation

Quality criteria for training providers and training programme as formulated previously have been successfully assessed beforehand. In order to provide maximum feedback of the course acceptance by the participants, daily wrap-ups, discussion and module evaluation sessions were organised. Finally, questionnaires were distributed for course evaluation both at course end and after a period of 6 months.

The two questionnaires addressed to the technical content of the workshop, the organisational items, and the overall training scheme; aspects as well correlated to the idea of harmonisation of training in

RP, development of a “Europass” and mutually agreed credit points have been inquired for. The course end questionnaire is attached in Annex 7. Comments to key questions are compiled below.

### **General Questions on Harmonisation in RP and ERPTS for RPE**

#### ■ *European wide harmonisation of E&T in RP, Advantages*

- Mobility; less barriers and free circulation of people
- Positive effect on the possibility to work in different countries and minimise the “recognition” process
- Harmonisation of RP training should have as well the effect to harmonise yearly dose limits for radiation exposure (see SWE and CH)

#### ■ *Revised modular ERPTS for RPE, OJT*

a) *Is the training part appropriate in length and content?* Yes 6 x

b) *Is the **OJT** part appropriate?*

- Yes, but I would like to know where we can follow this part (FR)

c) *Have the modules thoroughly been selected?* Yes 5x

### **Questions Based on the Training Modules**

#### ■ *Time frame, overall?* Yes 5x; more time needed 1x

#### ■ *Main strengths of the training?*

- Mixture of theory and practice; the experimental work was by far the best experience in which we had to use the knowledge in the classroom; practical exercises are very well organised and extremely helpful in fixing some concepts in mind
- The study visits, especially in the last week
- Good theoretical presentations, qualified speakers, well equipped laboratory
- Very interactive, very practical, real life
- Course materials and lecture notes excellent and very helpful

#### ■ *Main weaknesses of the training?*

- Neither national nor EC recognition of the training available (German participant)
- Too much information in too short time 2x (module 3 and 6)

#### ■ *Were the aims and learning objectives of the training course clearly explained and defined?*

- Very well for each presentation 2x; Yes 5x

#### ■ *To what extend did the training course met its stated objectives/outcomes?*

- Excellent, very well 4x

#### ■ *Knowledge and understanding of the presenters?*

- Presentations were done in a very professional way; 75% rated 5, the rest 4 (from a rating scale of 1 to 5 = strongest)

#### ■ *Applicability to the needs of your organisation?* 5 participants rated 4, one each 5 and 3

#### ■ *Should a similar workshop be organised routinely?*

- 100% yes, definitively; it should be compulsory for everyone working in the nuclear field

Less than 50% of the Follow-up Questionnaires were returned, confirming the previous statements of applicability to present daily work and strength of the practical work.

### **Inquiry of the Employer: Is the pilot course now recognised EU-wide and to which degree?**

## 4.2 Conclusions and Recommendations

The main **objectives** achieved in the working period are summarised below:

- Several WP8 meetings have been organised; results have been reported regularly to the Steering Committee and Advisory Board.
- Existing training courses meeting the agreed standards were identified, remodelled and selected for pilot session packages.
- Comprehensive advertisement for the selected pilot modules including poster presentation, distribution of leaflets, announcements and using existing data basis were implemented.
- As preparative work a MoU with the employer was agreed, learning outcomes fixed in terms of knowledge, skills and attitude, and programme evaluated.
- A remodelled modular radioisotope training modules (1, 2, 3 and 6) has been organised and implemented in Karlsruhe in March 2011. The participation in the whole ERPTC block (3 1/2 weeks) met the training needs of a European RPE for Unsealed Sources in Non-Nuclear Industry and Research.
- A comprehensive training manual has been compiled in English language and is available for further training events.
- Training provider (FTU) and pilot sessions have been evaluated with respect to the agreed standards. Formulated LO of participants have been examined for knowledge and competencies acquired.
- Regular wrap-ups, discussions and course evaluation by questionnaires have been implemented to assure the acceptance of the initiated steps for the harmonisation of training for RPE in Europe.

The following **conclusions** are drawn from the work of WP8 in general and with respect to the outcome from the pilot sessions:

- General: RPE Pilot Training Event was straightforward, effective and successful!
- Effective advertisement represents an utmost important item for successful training organisation. The participants were selected mainly from ITU as local EC institution with a high mobility of nuclear scientists and RP personnel. A further module on NORM had to be postponed due to lack of participants.
- International training events for RPE are only attractive when mutually recognised certificates, stamps or credit points are available.
- Training costs (fee, travel etc.) to be afforded by participants and/or employer play another key role. Motivation by involvement of the end-user (nuclear industry) into the training activities was helpful.
- Definition of LO has proven to be straightforward and represented an effective tool for learning assessment.
- Training of Skills and Attitude (Laboratory Exercises, Workshops, and Technical Visits) was highly welcomed.
- Facilities for optional OJT are wished by participants.

Taking into account these observations the following **recommendations** are given as outcomes in RPE training for feedback to the previous work packages:

- Introduce an effective advertisement procedure for those training events conforming to the agreed standard for RPE and RPO, e.g. by finalising a EU wide Data Base of training events and providers on RP (WD6)!
- Provide mutual recognition for agreed and endorsed training events as early as possible, both European wide by “Europass Stamps” and nationally!
  - Implement the European Credit System for Vocational Education and Training ECVET approach to further promote borderless mobility in lifelong learning (WD9) and to increase the attractiveness of the training events!
- Leave the ERPTS for RPE flexible with respect to time frame. Define LO for knowledge, skills and competences instead (WD4)!
- Let the sending provider participate wherever possible by jointly defining training agreements!



- Leave the optional modules flexible! A separate module on “Unsealed Sources” might be adapted from module 6, as it addresses to a substantial number of RPE.
- Use training materials as loose-leaf form as these give an added value to the accompanying brochures or books (WD7)! They allow simple exchange of updated manuscripts and enable participants to introduce personal notes.
- Work together with other institutions, e.g. IAEA, IRPA or AREVA in order to obtain an acceptable number of participants!

### **4.3 Recognition Procedure**

Within the framework of a European harmonization of trainings for Radiation Protection professionals, a training scheme has been established, which is now considered as the reference for RPE.

The objective of WP9 is to set up the procedure for the endorsement and mutual recognition of curricula, courses and training sessions. During the 6<sup>th</sup> SCM in Brussels it was agreed that the jointly developed pilot sessions of ENETRAPII training should be used to test the framework and procedures.

This will result in an endorsed Reference Program at the end of ENETRAPII project. The validation procedure for the Karlsruhe pilot courses in 2008 (Module 5: Specificities of Waste Management and Decommissioning”) and 2011 (Module 1, 2, 3 and 6) has been initiated in joint agreement with WP9.

The methodology suggested for qualifying Radiation Protection courses is based on the following scheme:

- 1) Compare the contents of teachings with the reference: a method has been set up within Work Package 5 for the comparison of training materials and the same tool is used to compare the contents of a course to the reference developed in Work Package 4!
- 2) Evaluate the quality of the teachers and the organization of the courses according to the quality criteria established in WP5 (Appendix A, Second Years Report).

The training providers make these evaluations by self-assessment and submit the results to a committee composed of qualified members (e.g. EUTERP, EFOMP, HERCA). The committees’ validation for the course provides the basis for the recognition of the course as part of the curriculum leading to the RPE qualification according to the European standard.

A complete set of basic and specialized modules for RPE being recognized and accredited by the relevant authorities would be of utmost benefit for the EU Member States in the future.

## 5 Evaluation of the Effectiveness of Existing RPO Courses

As guidance for the RPO training has been given in WP3 a selection of training events for RPO should be considered for implementation. This could be done in the future on the evaluation of existing RPO courses in different working areas. Presently more than 150 TCs for RPO in various fields are organised annually only at FTU-KIT. They are recognised by the German authorities and in the first approach do not differ considerably with respect to guidance and training objectives/subjects and time duration recommended in WP3 (6<sup>th</sup> SCM Brussels, WP3 Documents). Similar training events for RPO are available in other EU countries like Switzerland, Poland and Czech Republic. Thus, a large number of experiences exist.

From a preliminary evaluation of the effectiveness of existing RPO courses in Germany the following results can be given:

- Most existing courses follow the guidance for RPO training (WD3), e.g. handling of sealed and unsealed radioactive substances, technical irradiation (see also RPO course evaluation “Industrial Radiography SR180/181) [2].
- TCs for RPO combine participants from different origination, with variable education and work experience. Consequently the training events are time driven and have a defined programme. Learning Outcomes are assessed strictly by written examination. It cannot be assured by individual learning agreements that participants pass exams.
- RPO courses are more knowledge driven compared to RPE; skills are assessed by authorities through work experience/OJT.
- The actual German system is most structured;
  - o training providers must often combine groups of similar working areas (e.g. X-ray equipment) in order to reach a minimum number of participants;a simplification would certainly be helpful for countries with a lower number of PRO.
- Borderless mobility for international training events for RPO at the moment is hindered by
  - o Language: Only training events and assessment in German language is recognised (“RPO must communicate”).
  - o Legislation: Considerable part of training is national legislation.
- For Refresher Training Courses the preconditions with respect to subjects are less detailed. They are both for RPO and RPE widely performed as In-house Training for a given group of addresses in the company. Topics are flexible and the definition of jointly agreed LO with the sending provider is a common way.

## **6 Last Phase Events**

The postponed RPE Module 8 on NORM in Petten (NRG) foreseen for November 2012 could not be performed due to lack of participants. A repetition of modules 1 to 3 and additionally 4 depends on future demands, which will probably be limited unless modules are mutually recognised.

Discussions during the 2<sup>nd</sup> Advisory Board Meeting initiated ideas to test a further pilot module7 on Medical together with EFOMP expertise.

### **6.1 Pilot Session on NORM**

In accordance with the ERPT Scheme (ENETRAP) and following the experiences from the regular (NORM Refresher) Training in Dutch language a training programme (Annex 4) was established which was considered as being to successfully fulfil the learning objectives and to provide the formulated learning outcomes of module 8 on NORM.

At the end of the training module the participant will have basic knowledge on:

- NORM
- Detection of NORM
- International legislation about NORM
- European BSS about NORM
- Dose assessment for occupational workers and the public
- NORM waste
- Transport
- Procedures.

Based on the learning objectives competent and experienced lecturers were selected from NRG Petten and the Dutch process industry. The module was originally scheduled for May 2011 at the NRG facilities in Petten with an advertised fee of 1.995 EUR. Because of lack of participants it was postponed to November 2012. But even the Netherlands' new registration system could not promote participants.

### **6.2 Pilot Session on Medical**

Attempts for a 4 days optional RPE Pilot training event on the Medical Sector were made together with Carmel Caruana as EFOMP's (European Federation of Organisations in Medical Physics) chair on Education and Training as counterpart. Cyprus as attractive training location was selected. A draft program satisfying the agreed LO in WP4 with respect to Module 7 for RPE training has been compiled (Annex 9). The information was spread during the 5<sup>th</sup> Alpe-Adria Medical Physics Meeting [14] to a larger audience in order to advertise and investigate possible addressees. But the Council of Cyprus Association of Medical Physics and Bio-Medical Engineering CAMPBE was finally not in a position to organize this event in the short time period available.

However, the cooperation with EFOMP with respect to Medical RPE should not interrupt in the future.

## 7 References

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- [2a] S. Möbius, P. Livolsi, F.S. Draaisma, M. Marco, J. Stewart, P. De Regge, P. Vaz, WP8 First Interim Report WP8, ENETRAP II May 2010 public version
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- [4] 6<sup>th</sup> Steering Committee Meeting Brussels, 23 – 25 January 2012
- [5] EUTERP Workshop Agia Napa, Cyprus 2011, 28-30 March  
[http://www.euterp.eu/Cyprus\\_Workshop\\_2011/index.html](http://www.euterp.eu/Cyprus_Workshop_2011/index.html)
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- [7] The status of the radiation protection expert in the EU Member States and applicant countries, Radiation Protection 133, European Commission, DG-TREN H4, ISBN 92-894-5682-5, 2002
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- [9] Syllabus for the training of Radiation Protection Officers – Syllabus, Final Draft, April 2007 (to be published as IAEA Training Course Series); see also Safety Standards Series No. RS-G-1.4, 2001
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- [11] Recommendation of the European Parliament and of the Council of 23 April 2008 on the Establishment of the European Qualifications Framework for Lifelong Learning 2008/C 111/01
- [12] ENS News Special Edition on Education & Training, Issue No. 31
- [13] TWG ECVET European Credit System for VET (ECVET). Technical Specifications (Report 2005 of the Credit Transfer Technical Working Group)
- [14] S. Möbius, P. Livolsi, F. Draaisma, M. Marco, J. Stewart, P. de Regge, P. Vaz, C. Pesznyák, C. Caruana, M. Coeck: Organisation of a Medical Physics Pilot Session of the ERPTS, Presentation at 5<sup>th</sup> Alpe-Adria Medical Physics Meeting, Trieste, May 3-5, 2012

## Annex 1: Leaflet for Advertisement of ENETRAP Training Activities

### ENETRAP II Project

The overall objective of this 7<sup>th</sup> Framework Programme project is to develop European high-quality "Reference Standards" and good practices for training in radiation protection (RP), specifically with level to become radiation protection expert (RPE) and radiation protection officer (RPO). These "Standards" will reflect the needs of the RPE and the RPO in all sectors where ionising radiation is applied.

It is envisaged that the outcome of this project will be instrumental for the cooperation between regulators, training providers and customers (nuclear industry, research, non-nuclear industry, etc.) in reaching harmonisation of the requirements for, and the education and training of RPEs and RPOs within Europe, and will stimulate building competence and career development in radiation protection to meet the demands of the future.

One major goal of ENETRAP II project is to monitor the effectiveness of the proposed methodologies by organising pilot sessions of selected training events within Work Package 8. The modular courses in the 1<sup>st</sup> phase are designed for RPE according to the agreed standards.



<http://enetrap2.sckcen.be/>  
<http://www.euterp.eu/>

### Subject

A syllabus has been developed as ENETRAP Training Scheme. Based on a modular approach, it foresees a general "Common Basis" and a series of specialised "Optional Modules" on occupational radiation protection in different installations where ionising radiation is applied. The modules offered comprise nuclear power plants, research reactors and fuel cycle industry, and unsealed sources for non-nuclear industry and research laboratories.

Special features of the courses are active involvement of the participants by means of practice-oriented laboratory exercises, workshops and technical visits. A certificate will be issued upon successful completion of a training module. The certificates will be mutually recognised within the European Community facilitating international exchange of RP personnel.

The modules offered can be booked separately or as a complete European Radiation Protection Training Course ERPTC.

The participation in the whole ERPTC block meets the training needs of the European RPEs, e.g. Module 1 to 4 for RPEs in NPPs and Research Reactors, and Module 1 to 3 and 6 for RPEs in Non-Nuclear Industry and Research.

Not included is the On-the-Job Training part which might be offered on request.

### Information and Contact:

The Courses will be held in English language and as part of the activities of Work Package 8 of EU Project ENETRAP II.

#### Venue:

The Training Courses will take place at Karlsruhe Institute of Technology KIT, Centre for Advanced Technological and Environmental Training

**Introductory Fee (50%):**  
(if registered before 31/12/2010)

|  |             |
|--|-------------|
| Module 1, 2, 4 each                                    | 620. - EUR  |
| Module 3, 6 each                                       | 420. - EUR  |
| Whole ERPTC programme<br>(Module 1 – 3 and 6 or 1 - 4) | 1680. – EUR |

If not indicated otherwise, the course fee is free of VAT, includes lecture notes and refreshments and is to be paid within 2 weeks after receipt of the invoice. Otherwise reservation of a course vacancy cannot be guaranteed.

**Number of Participants/Application:**  
Due to the practical parts the number of participants will be limited.

#### Information and Registration:

Dr. Siegmund Möbius  
Karlsruhe Institute of Technology  
**Phone:** +49 7247 82-3791  
**Fax:** +49 7247 82-4857  
**Email:** [siegmund.moebius@kit.edu](mailto:siegmund.moebius@kit.edu)

*I am interested in Module.....*  
*Please keep me informed.*  
*Name/Email.....*

### Lecturers

Lectures will be given by internationally recognised experts from Karlsruhe Institute of Technology, the Nuclear Industry and other European organisations.

### Target Group

The courses are designed for radiation protection professionals such as Radiation Protection Experts (RPE) and Radiation Protection Officers (RPO) who want to be trained according to the agreed standards or improve their knowledge in RP generally and/or with regard to occupational RP.



### Learning Objectives and Outcomes

The "Common Basis" is constituted of three modules, lasting each about 1 week. By the end of the course, the participant will be able among others:

**Module 1:** to understand the physical aspect of ionising radiations, the biological basis of radiological protection; to describe and use the principal type of radiation detectors.

**Module 2:** to estimate the dose rate from a radioactive source vs distance; to determine the collective and individual protective means for external and internal exposure; to assess individual doses; to determine a dose monitoring program according to recommendations and regulations.

**Module 3:** to know the regulatory process for transportation of radioactive material; to mitigate the consequences of an accident or emergency issues; to integrate the ALARA principle and safety cultures; to know the principles of waste management and decommissioning.

The "Optional Modules", each lasting about 1 week, concern Radiation Protection in the different wide domains of activity.

**Module 4:** Radiation Protection in the domain of nuclear power plants and research reactors  
**Module 5:** Waste Management and Decommissioning (on request)

**Module 6:** Unsealed Sources, Research and non-nuclear domains



## European "RADIATION PROTECTION EXPERT" Training Course

### Pilot Modules KIT Karlsruhe

**Module 1: Basics**  
14/03 → 18/03/2011  
**Module 2: Foundation**  
21/03 → 25/03/2011  
**Module 3: Occupational RP**  
28/03 → 30/03/2011  
**Module 4: NPPs and  
Research Reactors**  
04/04 → 08/04/2011  
**Module 6: Unsealed Sources,  
Research and Non-Nuclear**  
30/03 → 01/04/2011

## Annex 2: Leaflet for Advertisement of Pilot Courses

### The ENETRAP II Project

The overall objective of this 7<sup>th</sup> Framework Programme project is to develop European high-quality "Reference Standards" and good practices for training in radiation protection (RP), specifically with level to become radiation protection expert (RPE) and radiation protection officer (RPO). These "Standards" will reflect the needs of the RPE and the RPO in all sectors where ionising radiation is applied.

It is envisaged that the outcome of this project will be instrumental for the cooperation between regulators, training providers and customers (nuclear industry, research, non-nuclear industry, etc.) in reaching harmonisation of the requirements for, and the education and training of RPEs and RPOs within Europe, and will stimulate building competence and career development in radiation protection to meet the demands of the future.

One major goal of ENETRAP II project is to monitor the effectiveness of the proposed methodologies by organising pilot sessions of selected training events within Work Package 8. The modular courses in the 1<sup>st</sup> phase are designed for RPE according to the agreed standards.



### The (draft) ERPTS Scheme

A syllabus has been developed as ENETRAP Training Scheme "ERPTS" for RPE. Based on a modular approach, it foresees a general common basis and a series of specialised modules on occupational radiation protection in different installations where ionising radiation is applied. This comprises nuclear power plants and fuel cycle industry, the medical sector, non-nuclear industry, research laboratories, waste and disposal sites.

The "Common Basis" is constituted of three modules, lasting about 3 weeks.

**Module 1:** deals with physics related to ionising radiation, e.g. radioactivity and nuclear physics, interaction of radiations with matter, quantities and units, biological effects of radiation and detection.

**Module 2:** covers fundamental aspects of the operational radiation protection, external and internal exposures, dose monitoring, regulatory context, natural sources, public and environmental RP, ethical considerations and communication.

**Module 3:** covers all other aspects common to the different domains of radioprotection, as for example transportation, accidental and the emergency situations, ALARA and safety culture, design issues and principles of waste management.

### Information and Contact:

The Courses will be held in English language as part of the activities of Work Package 8 of EU Project ENETRAP II "Organise Pilot Sessions, Test Proposed Methodologies and Monitor the Training Scheme Effectiveness".

**FTU Karlsruhe**  
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### WP8: Pilot Courses in Radiation Protection according to the ERPTS Training Scheme



### The (draft) ERPTS Scheme

The "Optional Modules", each lasting about 1 week, concern Radiation Protection in the different wide domains of activity.

**Module 4:** Radiation Protection in the domain of nuclear power plants and research reactors

**Module 5:** Waste Management and De-commissioning

**Module 6:** Research and non-nuclear domains

**Module 7:** Medical domain

**Module 8:** Naturally Occurring Radioactive Material – NORM

Besides theoretical lectures practical exercises and on-the-job-training are foreseen in most of the modules.



### Pilot Sessions

Pilot Sessions will be held at different European training centres and are mutually recognised. Course fees for each module will be announced by the local organisers.

#### Common Basis

**Module 1: Basis**  
KIT Karlsruhe, Germany 14/03-18/03/2011

**Module 2: Foundation 1**  
KIT Karlsruhe, Germany 21/03-25/03/2011

**Module 3: Foundation 2**  
KIT Karlsruhe, Germany 28/03-30/03/2011

#### Optional Modules

**Module 4: NPP**  
KIT Karlsruhe, Germany 04/04-08/04/2011

**Module 5: Waste Management**  
not yet defined

**Module 6: Unsealed Sources, Research and Non-Nuclear**  
KIT Karlsruhe, Germany 30/03-01/04/2011

**Module 7: Medical Domain**  
not yet defined

**Module 8: NORM**  
HPA Leeds, UK not yet defined  
NRG Petten, Netherland not yet defined

## Annex 3: Agenda of Karlsruhe Pilot Modules

SA210E

Date:

Location:

Lecture Room:

Course Director:

14/3 – 14/2011

Fortbildungszentrum für Technik und Umwelt - KIT

221, 207, 208

S. Möbius, B. Breustedt

### Module 1: Basics

|                                | 8:45 – 9:30   | 9:45 – 10:30                                | 11:00 – 11:45  | 11:45 – 12:30  | 13:30 – 14:15   | 14:30 – 15:15  | 15:30 – 16:30  |
|--------------------------------|---|---|--|--|---|--|--|
| Monday<br>14/3<br><br>Module 1 | 9:00:<br>Opening,<br>ENETRAP and<br>ERPTS<br><br>Möbius, Breustedt                            | Nucleonics and Radioactivity<br><br>Fischer |  | Decay Modes<br><br>Fischer   | Radiation Detection, Principles<br>- Gas Counters<br><br>Wilhelm  |  | Exercise:<br>Statistics,<br>Calibration Measurements<br><br>S. Möbius, T. Möbius           |
| Tuesday<br>15/3                | Chart of Nuclides<br>Gamma Emission and Internal Conversion<br>Use of Nuclonica<br><br>Magill |   | Interaction of Radiation with Matter<br><br>Geckels  |  | Demonstration:<br>Interaction of Neu-<br>trons, Moderation<br>Absorption<br><br>S. Möbius   | Exercise:<br>Attenuation of Gamma-Radiation,<br>Square Law of Distance<br><br>Sittler, Letsch, Kuglstatler | RP and Safety In-<br>structions<br><br>S. Möbius   |
| Wednesday<br>16/3              | Quantities and Units<br><br>Breustedt   |   | Radiation Detection, Principles<br>- Scintillation Counters and<br>Semiconductors<br>- Spectrometry<br><br>Frenzel |  | Exercise:<br>- High Resolution Gamma-Spectrometry<br>- Identification of Unknown Gamma-Emitters<br>- Aerosol Measurement by Gamma-Spectrometry<br><br>S. Möbius, T. Möbius, Kuglstatler |  |  |
| Thursday<br>17/3               | Radioactive Decay and Ingrowth<br>With Exercise<br><br>S. Möbius, T. Möbius                   |   | Nuclear Reactions,<br>Cross Section,<br>n-Activation,<br>Nuclear Fission<br><br>Walenius                           | Nuclear Forensic and<br>Safeguards<br>- Fingerprinting of<br>Radioactive Materials<br><br>Walenius | Radiochemical Methods,<br>Adsorption and Scavenging<br>- Demonstration<br><br>S. Möbius, T. Möbius  |  | Exercise:<br>Carrier Precipitation,<br>Half-Life Determination<br><br>S. Möbius, T. Möbius |
| Friday<br>18/3                 | Biological Effects<br><br>Welbezahn   |   | Production of Artificial Radioactive Sub-<br>stances<br>- Medical, Industrial Purposes, Generators<br><br>Wendel   |  | Shielding of Ionising Radiation<br>- Seminar<br><br>Magill  |  | Assessment and<br>Module Evaluation<br><br>S. Möbius, Breustedt                            |

SA216-1  
Date: 14/3 – 14/2011  
Location: Fortbildungszentrum für Technik und Umwelt - KIT  
Lecture Room: 221, 207, 208  
Course Director: S. Möbius, B. Breustedt

Stand: 18. März 2011 / Kursprogramm - Seite 1 von 1

## Module 2: Foundation

|                                       | 9:00 – 9:45  | 9:45 – 10:30                                | 11:00 – 11:45  | 11:45 – 12:30  | 13:30 – 14:15   | 14:30 – 15:15   | 15:30 – 16:30                     |
|---------------------------------------|--|---|--|--|---|---|-----------------------------------|
| Monday<br>21/3<br><br><b>Module 2</b> | Ethics of Radiological Risk Governance (ALARA, Safety Culture etc.)  |   | Measurement of Personal Dose (Beta, Gamma, Neutron)  |  | Hand-held Measuring Devices in Radiation Protection, Functionality Control and Errors | Exercise:<br>- Dose Rate Measurements and Contamination Control<br>- Decontamination of Materials |                                   |
|                                       | Meskens  |   | Breustedt  |  | Naber   | S. Möbius, Wendel   |                                   |
| Tuesday<br>22/3                       | Biokinetic Models and Behaviour  |   | Incorporation Measurements and Control   |  | Determination of Natural Radionuclides by Liquid Scintillation                        | Visit of<br>- Facility for the Decontamination of Persons<br>- Body and Lung Counter              | Visit of Toxicological Laboratory |
|                                       | Breustedt  |   | Breustedt  |  | S. Möbius   | Menges, Breustedt   | Stuhlfauth-Vonderau               |
| Wednesday<br>23/3                     | Regulatory Context: International Legislation in Radiation Protection, Recommendation and Guidelines (ICRP, IAEA, EC-Directives, National Regulations) |   | Precautionary Measures for Occupationally Exposed Personnel, Role of Medical and Tox. Labs                           | Decontamination of Personal  | Nuclear Emergency Preparedness and Response, Counter Measures in Case of Accidents    | Visit of Nuclear Emergency Response Assistance Team, Personal Protective Equipment                |                                   |
|                                       | Schmitt-Hannig   |   | List   | List   | Gustmann  | Gustmann, Pruessmann  |                                   |
| Thursday<br>24/3                      | Radiation Protection Safety and Technology: RP Planning, RP Organisation etc.  |   | Storage and Security of Radioactive Materials  | Natural and Man-Made Radiation Exposures                           | Radiation Exposure in the Environment, Radioecology                                   | Exercise:<br>Liquid Scintillation Spectrometry, Determination of Radon in Water                   |                                   |
|                                       | Pruessmann   |   | Zwernemann   | Koelzer  | Kaiser  | S. Möbius, T. Möbius  |                                   |
| Friday<br>25/3                        | Waste Management   | Seminar: Dose Calculation for NORM Articles | The German Atomic Energy Act (AtG) and the Radiation Protection Ordinance (StrSchV), Status, Tasks and Duties of RPE | Contractors Personnel in Nuclear Installations, Radiation Passbook | Assessment and Module Evaluation, Wrap-up   |   |                                   |
|                                       | Graf   | Liebe, Kuglstatler                          | Aures  | Meizer   | S. Möbius, Breustedt  |   |                                   |

Stand: 25. März 2011 / Kursprogramm - Seite 1 von 1

Date: 14/3 – 14/2011  
Location: Fortbildungszentrum für Technik und Umwelt - KIT  
Lecture Room: ISF R318  
Course Director: S. Möbius, B. Breustedt

## SA217-1 Module 3: Occupational RP

## SA219-1 Module 6: Unsealed Sources, Research and Non-Nuclear

|  | 8.30 - 9.15  | 9.30 - 10.15   | 10.45 - 11.30  | 11.30 - 12.15 | 13.15 - 14.00  | 14.30 - 15.15  | 15.15 - 16.00 | 16.00 - 16.45                                      |
|--|--|--|--|---------------|--|--|---------------|--|
| Monday<br>28/3<br><b>Module 3</b>        | Communication of Nuclear Issues to the Public and Media<br>With Exercise   |  | Principles of Waste Management - Waste Streams, Waste Classifications, Strategies for Waste Conditioning, Waste Preparation and Collection, Waste Minimisation |               | Release of Materials from Controlled Areas, Clearance  | Exercise:<br>Detection and Securing of Orphan Sources  |               | Application of in-situ gamma spectrometry          |
|  | Meskens  |  | Rittmeyer  |               | Naber  | Liebe, Breustedt, Kuglstatler, Mayer   |               | Naber  |
| Tuesday<br>29/3                          | Emergency Planning and Procedures, Actions and Behaviour in Case of Incidents and Accidents, Lessons Learned from Radiological Accidents                   |  | Medical Management in Accidental Situations, Medical Treatment in Case of Increased Radiation Exposure   |               | RP Principles During Decommissioning,<br>- Operative RP in the Central Decontamination Department<br>- Release of Buildings  | Optimisation During Decommissioning<br>- Radiation Protection Planning<br>- Preparation of Work<br>- Dose Estimation |               |  |
|  | Tachlinski   |  | List   |               | Vilgis   | Reichert   |               |  |
| Wednesday<br>30/3<br><b>Module 3 / 6</b> | Packing and Transport<br>- Regulations, Responsibilities, Types of Packages, Transport Indices, Signalisation and Labeling, Lessons Learned from Accidents |  | Case Study: Preparation for Radioactive Transport, Classification, Packing, Signalisation and Documentation, Shipping Documents                                |               | Possibility to Visit Installations under Radiation Protection Aspects at the Karlsruhe Institute of Technology<br>- Decontamination Facilities, Release Measurements, MZFR<br>Radiochemistry Laboratories<br>- Accelerator |  |               | Assessment, Wrap-up and Evaluation of Core Modules |
|  | Brand  |  | Brand  |               |  | Vilgis, Schwämmie<br>Hoepfner<br>Haneisen  |               |  |
| Thursday<br>31/3                         | Gammagraphy and X-ray Generators   |  | Exercise:<br>Monitoring of Fission Nuclides (Cs), Analysis of Radium in Water  |               | Technical Visit to Heidelberg DKFZ:<br>- Nuclear Medicine (Storage Facility)<br>- HIT- C- Accelerator and others   |  |               |  |
|  | Kaps   |  | Wendel, T. Möbius  |               | Knoch  |  |               |  |
| Friday<br>1/4                            | Management of Unsealed Sources<br>- Duties and Responsibilities  | Design Issues, Radionuclide Laboratory and Equipment (Hot Cells, Glove Boxes, Work Places) | Ventilation and Air Filtration   |               | NORM: Oil and Gas Industry<br>- Origination, Quantities and Safety Measures<br>NORM: Dwellings and Water Treatment<br>- Rn in Air/Water, Ra in Drinking Water  | Assessment and Wrap-up   |               |  |
|  | Wendel   |  | Paffrath   |               | R. Möbius, S. Möbius   |  |               |  |



## Annex 4: Programme of Module 8 - NORM



### PROGRAMMA\* "ENETRAP II NORM"



| Date        | Time              | Subject  | Location | Teacher |
|-------------|-------------------|--|----------|---------|
| 23 mei 2011 | 09.15 - 09.30 uur | Welcome  |          |         |
|             | 09.30 - 12.15 uur | Evaluation of dose of exposed workers:<br>Internal Exposure, ICRP models |          |         |
|             | 13.15 - 14.30 uur | Evaluation of dose for exposed workers:<br>External Exposure             |          |         |
|             | 14.45 - 16.00 uur | Presentation: Thermphas  |          |         |

|             |                   |  |  |  |
|-------------|-------------------|--|--|--|
| 24 mei 2011 | 09.30 - 12.15 uur | Evaluation of the exposure of population:<br>Dosis |  |  |
|             | 13.15 - 14.30 uur | Presentation: Corus                                |  |  |
|             | 14.45 - 16.15 uur | Presentation: Nauerma                              |  |  |



### PROGRAMMA\* "ENETRAP II NORM"



| Date        | Time              | Subject  | Location | Teacher |
|-------------|-------------------|--|----------|---------|
| 23 mei 2011 | 09.15 - 09.30 uur | Welcome  |          |         |
|             | 09.30 - 12.15 uur | Evaluation of dose of exposed workers:<br>Internal Exposure, ICRP models |          |         |
|             | 13.15 - 14.30 uur | Evaluation of dose for exposed workers:<br>External Exposure             |          |         |
|             | 14.45 - 16.00 uur | Presentation: Thermphas  |          |         |

|             |                   |  |  |  |
|-------------|-------------------|--|--|--|
| 24 mei 2011 | 09.30 - 12.15 uur | Evaluation of the exposure of population:<br>Dosis |  |  |
|             | 13.15 - 14.30 uur | Presentation: Corus                                |  |  |
|             | 14.45 - 16.15 uur | Presentation: Nauerma                              |  |  |

## Annex 5: Draft Programme Module 7 - Medical

**Pilot Course ERPC: Module 7 „Occupational Radiation Protection: Medical“**  
**Date:** September/October 2012  
**Location:** Cyprus  
**Lecture Room:** NN, S. Möbius  
**Course Director:** NN  
**Technical Assistance:** NN  
**Course Secretary:** Sibylle Mann  
**Breaks:**

Stand: 28/8/078, Februar 2012 / Kursprogramm - Seite 1 von 2

|                 |  |  |   |  |  |   |                                     |                           |
|-----------------|--|--|---|--|--|---|-------------------------------------|---------------------------|
| Monday          | 8:30 – 9:15                                    | 9:30 – 10:15   | 10:45 – 11:30   | 11:30 – 12:15  | 13:15 – 14:00  | 14:30 – 15:15   | 15:15 – 16:00                       | 16:00 – 16:45             |
| Equipment       | Scope and Introduction                         | Harmonisation in E&T in RP<br>ENETRAPPI and its Outcomes                             | Medical Exposures: Scope, Responsibilities and Training                         | Justification of Medical Exposure                              | Technology of the Equipment  |   | Specificities for Diagnosis Purpose | Specificities for Therapy |
|                 | Möbius, NN                                     |  |   |  |  |   |                                     |                           |
| Tuesday         | Regulatory Context                             | Licensing of Medical Installations   | Conception of Premises, Classification of Areas                                 | Personal Dosimetry   | Dosimetric Measurements and Calculations in Medicine (Calculation Exercises) | Visit to Local Hospital: Radiology, Radiotherapy, Nuclear Medicine Department |                                     |                           |
| Occupational RP |  |  |   |  |  | Local Staff   |                                     |                           |
| Wednesday       | Optimisation of RP in Interventional Radiology | Optimisation of RP in Brachytherapy  | RP of Operators in the Hot Laboratory   | Regulatory Control of Sources and their Shielding, Maintenance | Secondary Dosimetry Laboratory (IAEA)  | Practical Work: Management of a Contamination - Surface and Person            |                                     |                           |
|                 |  |  |   |  | IAEA   | Local Staff, Möbius, NN   |                                     |                           |
| Thursday        | Accidental Situations                          | Waste Management (Nuclear Medicine), Management and Transport of Radioactive Sources | Emergency Procedures and Interventions, Reporting - Workshop and Case Studies - |  | Lessons Learnt from Radiological Accidents                                   |   | Assessment and Module Evaluation    |                           |
|                 |  |  |   |  | IAEA   |   | NN, Möbius                          |                           |
| Friday          | On-the-Job Training<br>- if available          |  |   |  |  |   |                                     |                           |
|                 |  |  |   |  |  |   |                                     |                           |

## Annex 6: Training Materials





**Karlsruhe Institute of Technology (KIT) and  
European Network on Education and Training in Radiation Protection  
ENETRAP II**

**END-OF-WORKSHOP QUESTIONNAIRE**

---

(The personal information is voluntary)

**Name:** \_\_\_\_\_

**Job Title:** \_\_\_\_\_

**Company:** \_\_\_\_\_

**City:** \_\_\_\_\_

**Country:** \_\_\_\_\_

---

Workshop Code:     **SA215-1**

Workshop Title:     **ERPTS Module 1, 2, 3, 6: Common Basis,  
Unsealed Sources**

Workshop Location: **Karlsruhe, Germany**

Host Institute: **Karlsruhe Institute of Technology – KIT / Center for Advanced  
Technological and Environmental Training – FTU**

Workshop Dates:     **14 March – 1 April 2011**

---

|   |
|---|
| <p><b>Please fill in the Questionnaire and provide it to Sibylle Mann</b></p> |
|---|

*Please rate using a scale of 1–5*  
 (whereby 1 is the weakest and 5 is the strongest)

**1.1 What do you think about the following?**

**(a) Technical Content of the Workshop:**

|                             |                             |                             |                             |                             |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| 1: <input type="checkbox"/> | 2: <input type="checkbox"/> | 3: <input type="checkbox"/> | 4: <input type="checkbox"/> | 5: <input type="checkbox"/> |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|

**(b) Quality of presentation and other material:**

|                             |                             |                             |                             |                             |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| 1: <input type="checkbox"/> | 2: <input type="checkbox"/> | 3: <input type="checkbox"/> | 4: <input type="checkbox"/> | 5: <input type="checkbox"/> |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|

**(c) Workshop duration:**

|                             |                             |                             |                             |                             |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| 1: <input type="checkbox"/> | 2: <input type="checkbox"/> | 3: <input type="checkbox"/> | 4: <input type="checkbox"/> | 5: <input type="checkbox"/> |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|

**1.2 If you selected disappointing for any of the above, then explain why:**

**1.3 Did you know the content of the Workshop in advance?**

|                               |                      |                              |                      |
|-------------------------------|----------------------|------------------------------|----------------------|
| Yes: <input type="checkbox"/> | <input type="text"/> | No: <input type="checkbox"/> | <input type="text"/> |
|-------------------------------|----------------------|------------------------------|----------------------|

**1.4**

**(a) Were your specific aims of the Workshop met?**

|                             |                             |                             |                             |                             |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| 1: <input type="checkbox"/> | 2: <input type="checkbox"/> | 3: <input type="checkbox"/> | 4: <input type="checkbox"/> | 5: <input type="checkbox"/> |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|

**(b) If you answered "1" or "2" please explain why:**

*Please rate using a scale of 1–5*  
(whereby 1 is the weakest and 5 is the strongest)

**2.1 Did the presenters demonstrate a thorough knowledge and understanding of their subjects?**

1: ☐

2: ☐

3: ☐

4: ☐

5: ☐

**2.2 Please provide comments, if any:**

**3.1 Did the presentations at the Workshop relate theoretical knowledge concepts to real life situation?**

1: ☐

2: ☐

3: ☐

4: ☐

5: ☐

**3.2 Please provide comments, if any:**

**4. What would you now say were the main strengths of this Workshop? (Please try to be specific)**

*Please rate using a scale of 1–5*  
(whereby 1 is the weakest and 5 is the strongest)

5. What would you now say were the main faults or weaknesses of this Workshop? (Please try to be specific)

6. To what extent was the Workshop applicable to the needs of the organization for which you work?

1:

2:

3:

4:

5:

- 6.2 Please provide comments, if any:

7. Do you think the similar workshop on European Training Scheme for RPE shall be organized routinely?

|      |                      |  |     |                      |  |
|------|----------------------|--|-----|----------------------|--|
| Yes: | <input type="text"/> |  | No: | <input type="text"/> |  |
|------|----------------------|--|-----|----------------------|--|

*Please rate using a scale of 1–5*  
(whereby 1 is the weakest and 5 is the strongest)

**8. What do you think about the location of the Workshop?**

**Country**

1: ☐

2: ☐

3: ☐

4: ☐

5: ☐

**Host organization**

1: ☐

2: ☐

3: ☐

4: ☐

5: ☐

**9. What do you think about the organization and administration of the Workshop?**

1: ☐

2: ☐

3: ☐

4: ☐

5: ☐



*Please rate using a scale of 1–5*  
(whereby 1 is the weakest and 5 is the strongest)

**General Questions on ERPTS for RPE**

1. What do you think about the overall length of the training scheme for RPE?
  
  
  
  
  
  
  
  
  
  
2. Are the Modules of the “Common Basis” thoroughly selected?
  
  
  
  
  
  
  
  
  
  
3. Are the Modules of the specialized part selected appropriately?
  
  
  
  
  
  
  
  
  
  
4. Are the topics correctly weight?  
If not, please specify!
  
  
  
  
  
  
  
  
  
  
5. Were the aims and learning objectives of the course clearly explained and defined?
  
  
  
  
  
  
  
  
  
  
6. How well did the training course meet its stated objectives?



*This is to certify that*

***Ms. Nicole Rausch***

*participated in the*

***European RPE Radiation Protection  
Training Scheme***

- |             |                  |                     |
|-------------|------------------|---------------------|
| – Module 1  | Basics           | 14.03. – 18.03.2011 |
| – Module 2  | Foundation       | 21.03. – 25.03.2011 |
| – Module 3: | Occupational RP  | 28.03. – 30.03.2011 |
| – Module 6  | Unsealed Sources | 30.03. – 01.04.2011 |

*organized by the KIT-FTU  
in cooperation with the EU Project ENETRAP II*

*Karlsruhe, Germany*

*Bastian Breustedt*  
*For:*  
*Michèle Coeck*  
*Coordinator ENETRAP II*  
*SCK-CEN*  
*Belgian Nuclear Research Centre*

*Siegurd Möbius*  
*Course Director*  
*Karlsruhe Institute of Technology*  
*Fortbildungszentrum für Technik*  
*und Umwelt (FTU)*

## Annex 9: Documentation



