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ABSTRACT:

The main objective of the project for the first period has been the establishment of a job profile according to ECVET principle. Following the proposal of WP1, the consortium agreed that the first concern should be about the safety and defined the profile of a safety engineer in charge of the performance analysis for the construction license of a selected disposal site. This engineer must basically be specialised in integrating and analysing site specific geochemical and hydrogeological data as an input data for carrying out numerical modelling and calculations for dose estimation under various likely scenarios for the [future] repository. The consortium defined the related job requirements in terms of knowledge, skill and competence. Then, after defining the learning outcomes expected for this profile a tentative programme has been proposed comprising 3 units. This programme is currently under discussion. A prototype of the learning agreement has also produced.

The first Petrus PhD conference has been scheduled on 22-26 June 2015 in Nancy (Fr). A specific web site has been designed for this event. Apart from the presentation of ongoing PhD works, the programme includes 7 lectures that will be taught by outstanding specialists in key topics related to the radioactive waste disposal.

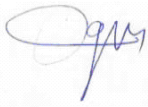
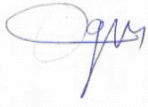
In order to foster the organisation and the management of both existing PETRUS educational programme and future Professional Development training programme and to ensure the sustainability of the initiative, a Steering Board has been established. The Terms of Reference for this board has been produced. The board has met every 3 months by videoconference. The pace of the meetings will be intensifying with the project progress.

The Petrus End-users Council has been reactivated. In conjunction with the IGD-TP CMET group the council had two meetings during the reporting period.

The Petrus Master's courses have been organised for the 4th time in a row in June and September 2014. 10 students have followed the courses.

Two project meetings have been organised; the first one in Cardiff (UK) and the second one in Kalmar (Se). The project has also produced the PETRUS Newsletter. The first and second issue has been distributed to a large audience outside the consortium. The third one is under preparation.

Signatures

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Deliverable D6.67

Version n°1

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1. Summary description of project context and objectives

Radioactive Waste management organisations (WMOs) need new type of approaches to meet their human resources demands and to maintain the competence and availability of personnel over the life time of a repository operation. In line with the Lisbon strategy and the 2020 perspective, the “Petrus” initiative coordinates since 2005 universities, WMOs, training organisations and research institutes efforts to develop cooperative approach to education and training (E&T) in the geological disposal.

Under the “Petrus II” project (2009-2011), the PETRUS end-users council was established, the existing needs and resources in E&T were analysed, a European Master's curriculum based on common courses was successfully implemented in several partner universities and a professional development (PD) scheme for training professionals was developed. The present PETRUS III project aims at the continuation of the European Cooperation in this area. PETRUS III project includes:

- Practical implementation of PETRUS training programme following ECVET principles: Starting from the outcomes of the previous project, we will experiment the elaboration and the implementation of training modules defined in term of learning outcomes in a “Competency-Based Curriculum”. The objective is to set up qualification in geological disposal that can be achieved, accredited and recognised both through formal and PD training programmes.
- Elaboration of multidisciplinary training and research framework for PhD student: The objectives are i) to fast-track the research activities in geological disposal by proposing customised training programmes, ii) organizing periodic PhD workshops and iii) favouring the emergence of multidisciplinary researches.
- Development of strategies and frameworks for maintaining PETRUS initiative over the long-term: Following the recommendations of the PETRUS End-users Council, the PETRUS III project will establish strategic plan for sustainability of the PETRUS initiative through i) establishment of a steering board for coordination and follow up of the PETRUS educational programme, ii) collaboration with the IGD-TP's Competence Maintenance Education and Training (CMET) Working Group with the aim of finding a continuing structure for the PD scheme and its coordination, and iii) creation of framework for the integration to the ENEN

structure for the overall management of the radioactive waste disposal E&T activities under the association umbrella.

PETRUS III will strive also to continue the international cooperation by strengthen the links already established notably with China under ECNET project and with IAEA under PETRUS II project.

2. Project objectives for the period

The objectives of this first period were mainly related to the application of the ECVET principle in the development of training programmes for professionals. Elaboration of PD programme using ECVET model started by the identification of the qualifications and skills most needed in the field of radioactive waste disposal. The consensus among the consortium members has designated safety as the most critical work function for which important training efforts have to be done. Thereby the consortium worked on the job profile relative to a safety engineer specialised in integrating and analysing site specific geochemical and hydrogeological data as an input data for carrying out numerical modelling and calculations for dose estimation under various likely scenarios for the repository. For this work function the consortium established the knowledge, skill and competence requirements.

Elaboration of multidisciplinary training and programme for PhD student has been another objective of this first period. A customised programme has been elaborated including 7 lectures that will be taught during the first PETRUS PhD event in June 2015.

The development of strategies and frameworks for maintaining PETRUS initiative over the long-term has been initiated by restoring the PETRUS End-users Council. Furthermore, a steering board for coordination and follow up of the PETRUS educational programme has been set up. Dialogue with the IGD-TP's Competence Maintenance Education and Training (CMET) Working Group with the aim of continuing the development of Professionals' training scheme and its coordination has been concretised in one hand by the interaction with PETRUS End-users Council and by the other hand with the organisation of common meeting.

PETRUS Newsletter has been set up as one of the dissemination tools expected in the project.

3. Work progress and achievements during the period

3.1 WP1: Elaboration of the PD training programme using ECVET model

The objective of this work-package is to use the “European Credit system for Vocational Education and Training” (ECVET) principles and to develop “competence-based” curriculum for the elaboration of the radioactive waste disposal Professional Development training programme that will be accredited for qualification at academic Master’s level in WP2.

The work done in the first project period included the analysis of the training needs in radioactive waste disposal through 3 sequences of investigation:

- 1) Identification of work function with key occupational tasks
- 2) Definition of trainee profile with selected core competencies that relate directly to the professional profile
- 3) Determination of the learning outcomes that shape the curriculum and include both domain-specific and generic competencies

The first sequence has been investigated in connection with WP4 and the end-users council allowing the identification of safety engineer as most critical function. Key tasks related to this function are determined.

The job profile related to safety of radioactive waste disposal has been developed using ECVET principles. The job is entitled “Safety Engineer – Assessment and Performance Analysis for construction license of a selected site”. The profile has been reviewed and improved by the Petrus 3 end-users Council in addition to the French agency Andra. The profile was then broken into 3 Units including basics and general knowledge and specific knowledge and competencies for radioactive waste disposal. Each Unit has been explicitly described in term of learning outcomes that could be evaluated and associated to credit points. The complete profile will be reviewed by the consortium

during the Petrus3 meeting in Lisbon (23-24 April 2015). Upon this review, the corresponding deliverable will be produced. The next step on the works foreseen in WP1 will be the finalization of the programme units and associated ECVET credits.

3.2 WP2: Actual implementation of the PD training programme

The objective is to implement the PETRUS training programme at least in one of the partner university as a pathway for the obtainment of a Master degree with recognition agreements from other partners.

The requirements for the implementation are a description of the qualification system, an agreement on the identification principles of credits and documentation expressing the mutual objectives to emplacing the qualifications within the national framework and the European Qualifications Framework.

A tentative approach at the first stage shown that accreditation of the ECVET- could be to a certain extent similar to inter-university co-operation such as double degree and exchange programs. A memorandum of understanding between the participating universities and stakeholder companies of PETRUS III-consortium should confirming the basis for mutual trust as well as the special arrangements for credit transfer or learners. The contents of the MOU should include the following:

- state the mutual acceptance of the status of competent institutions involved,
- state the mutual acceptance of quality assurance, assessment, validation
- recognition criteria and procedures as adequate for credit transfer,
- agree upon the terms of partnership, such as objectives, duration and the revision of the Memorandum of Understanding,
- agree upon the comparability of qualifications for credit transfer and use
- the reference levels defined in the European Qualifications Framework,

In addition MOU should identify any other actors and competent institutions possibly related to the procedure in question as well as their duties. Instead of developing and maintaining resource-demanding procedures for ECVET-program specific QA/QC-procedures, the educational institutes should commit themselves to the implementation to the Standards and Guidelines for Quality

Assurance in the European Higher Education Area including the country and institute specific external and internal procedures for quality assessment.

The planning of the accreditation procedures will continue by consultation with FNBE and CIMO representatives as well as Aalto legal personnel. The comments and conclusions made after such consultations will be reflected in the Accreditation procedures report to be submitted to the project partners as a D2.1 (DL June 28)

The Draft Learning Agreement prepared in WP1 of this project will be compared to draft agreement of FINECVET and need for amendments will assessed.

Although the possibly revised MOU and Learning Agreements appear to be necessary for the implementation of ECVET-programs, such documents do not assure the smooth implementation of the program. The students will need to plan and schedule their study or professional development programs. Also the educational institutes need to be able to assess how well the different learning outcomes obtained can be matched with their degree requirements. In order serve these implementation activities the possibility to utilize a Software for Target-Oriented Personal Syllabus (STOPS) is investigated. A STOPS software tool for competence based learning called O4, developed in Aalto University, is currently used for planning of new BSc- and MSc-programs following *knowledge, skills and competences* based description of the learning process.

The software can be used by the university staff for Curriculum planning and development, and by the students to the planning of their studies. Therefore, the next activities to be taken in Aalto will include an assessment if this software could be modified to provide information such as listings of achieved learning outcomes and obtained KSC. Therefore this software could likely serve students and staff as a tool for validation and recognition in a future program.

Therefore, further actions in WP2

- Consultation of the stakeholder organizations (FNBE, CIMO) on necessary documentation and accreditation procedures of the Petrus ECVET/ECTS-program and finalization of the Accreditation procedures report

- Review of WP1 deliverables and FINECVET-requirements for Learning Agreements and proposal of possible assessments
- Assessment of a potential of a STOPS-software tool for competence based learning developed in Aalto as a tool for validation and recognition of the achieved learning outcomes and KSCs.

3.3 WP3: Addressing the challenge of multidisciplinary skills at PhD level

The objective of WP3 is to promote and develop the scientific research potential, notably by pooling human and material resources and by facilitating PhD students' exchange.

Development of the PETRUS training courses for PhD students has been the main work of the first period with the objective of assembling multi-disciplinary lectures to support the development of **transferable and generic skills and competencies** exceeding the specific topic of the PhD. For this purpose, WP3 proposed 7 training lectures around subjects that either can be tackled from different disciplines point of view or understanding of them necessitates combination of different types of skills.

The second objective was the organisation of PhD annual event that intends to bring together PhD students and young researchers, along with professionals and academics in radioactive waste disposal. The event is an opportunity for selected PhD students to present their works in all areas related to radioactive waste management and disposal. It will also give attendees an opportunity to follow the 7 subject-specific lectures indicated above that will be taught by acknowledged academics and experts.

The event will be split into morning and after-noon sessions. During the morning sessions PhD Students selected for oral presentation will give a short overview of their works followed by discussion with the jury and audience. The afternoon sessions will consist of high quality interdisciplinary lectures in various fields of studies on radioactive waste disposal. The event will be held on 22-26 June 2015 in Nancy. More details can be found at www.petrus2015.eu

WP3 has also followed the organisation of the 4th PETRUS Master's courses that held on June and September 2014 with 10 students.

The next step on development of WP3 works will consists in Improving mobility at doctoral level that is seen as an important building block in securing the long-term future of the radioactive waste disposal research. The objective is to create a framework to promote mobility of doctorate candidates within

PETRUS III universities and research centres partners through the development of doctoral school and an exchange agreement comparable with the learning agreement developed in WP1. Although the usual rule is that incoming candidates have to seek their own funding, the consortium will also work in finding more flexible solution for cover the mobility costs through existing national or/and European mechanism (e.g. Marie Curie fellowship).

3.4 WP4 Think-Tank activities and link with the IGD-TP

The works done in WP4 had as an objective to be more responsive to the needs of waste management organizations and stakeholders in large, to bring inputs and to get support from the platform, and to ensure more efficient and permanent coordination of the PETRUS initiative in order to facilitate its sustainability.

The IGD-TP has initiated as part of the deployment of its SRA a working group on Competence Maintenance, Education and Training (CMET). Creating the link between PETRUS III project and IGD-TP's CMET appears as a natural process since many of the consortium participants are already member of the IGD-TP and have expressed their interest in the CMET Working Group membership.

CMET has received special assistance from PETRUS III members, especially UPM Madrid (CMET no 2), Cardiff University (CMET no 3A) and TU Delft (CMET no 3B) for making the participation of the Petrus III members and their inputs to the CMET meetings possible during the first period. Related input has been provided to the WP4 leader on the expectations of the IGD-TP CMET on Petrus III, the job profiles developed in WP1 following the ECVET principles are the most import inputs. They have been reviewed from the end-user perspective.

Extended end user council meeting will be organised by PETRUS III WP4 leader in Lisbon addressing following questions: What kind of profiles are needed addressing the knowledge, skills and competences? How to create, maintain, transfer and manage the knowledge needed? How to assure skills and competences related to required safety culture? CMET members, PETRUS III members and IAEA representatives are expected.

CMET as a part of the SecIGD2 project organized a special session at the IGD-TP's Exchange Forum no 5 at the end of October 2014. This walkabout session, lead to the formulation of the questions

including the inputs from the Petrus III partners. Further the Petrus III project provided for 8 walkabout station hosts out of the 13 hosts in total.

The special introduction to the Petrus III project meeting no 3 in Kalmar, Sweden about the IGD-TP's EF5 walkabout is one of the main direct contributions for the linking of the activities of the Petrus III and the CMET working group. The walkabout outcomes themselves also served directly also the Petrus III objectives, especially the outcomes of the station 2. (The station 2 report by Jussi Leveinen, Aalto and Walter Ambrosini, ENEN).

The contribution of the Petrus III project partners formed a direct link between the Petrus III and the CMET by participating in the CMET activities as part of the Petrus III work.

During the Cardiff meeting, the Steering board was created in order to foster the organization and the management of both existing PETRUS educational programme and future Professional Development training programme that will set-up in WP1 and WP2 and to ensure the sustainability of the initiative.

First steering board meeting was organized in Kalmar. Master's program, PhD program, video conferencing methods, technical information and interesting stand points about PETRUS quality label and ENEN added value in the process were discussed.

To foster the interaction inside the board and to widely spread information related to the progress of different WPs it was decided to organize a teleconference every two months.

Further works will include organization of extended end-users meetings and exchanges with other EU nuclear initiatives as ENS, ENSREG, SNETP, FORATOM as well as getting feedback from ongoing Euratom Fission Training Schemes projects (EFTS).

3.5 WP5: Sustainability external collaboration and link with ENEN

- Report about the ENEN association

The deliverable D5.51, being under the responsibility of ENEN, was submitted on schedule containing a presentation of the ENEN Association and of its structure for the purposes of the PETRUS-III Project. This information is intended to be the basis for the procedure to integrate the PETRUS Consortium into ENEN in the near future. With this aim in mind, the report collected material built up

over the years in relation to the ENEN Association and its continuous development since its establishment in 2003. The history of ENEN has been summarized and its structure presented. Recent developments of specific interest to the PETRUS-III Project were highlighted. In particular, the presence in the Association of Working Groups coordinated by the Secretary General is suggested as a useful means of integration of the PETRUS Consortium into ENEN. Moreover, the useful dynamics recently generated around ENEN by the attention of the PETRUS Consortium and of the MELODI platform are also featured in the report, referring to a proposal submitted for the recent Horizon 2020 call under Euratom, aiming at achieving a better coordination of E&T initiatives in the various nuclear fields. The further actions to be performed in the frame of WP5 involve the actual integration of the PETRUS Consortium into ENEN, exploring how to set up a certification similar to the European Master of Science in Nuclear Engineering (EMSNE) also for the Geological Disposal sector, agreements for student exchanges, international cooperation and, finally, the definition of a roadmap for PETRUS Consortium sustainability.

- Integration to European Master Label Report

The European Master of Science in Nuclear Engineering (EMSNE) certification was established under the European Commission since 2005. It establishes a common reference curricula and mutual recognition among ENEN members in Nuclear Engineering. It also promotes and facilitates the mobility of students and teachers.

The requirements for the EMSNE certification were analyzed for the needs for the PETRUS III project and comparison and/or future establishment of a similar certification in Waste Mg. and Geological Disposal. The work in WP1 is elaborating a Professional Development program in three units which will be practically implemented during the works of WP2. This work is currently being undergone. In order to establish the compatibility with this program with the EMSNE certification, or the creation of a new certification, it is indispensable to know the size of this program into ECTS of ECVET.

- Report on the status of integration into the ENEN

The 13th ENEN General Assembly in Helsinki was hosted by Aalto University in March 2015 with the ENEN Special Event fully dedicated to the “Nuclear Waste Management & Geological Disposal”. This

event allowed the PETRUS community to be fully exposed and its outcomes disseminated to all the members of ENEN raising the interest and awareness of its works in Nuclear Waste Management & Geological Disposal among the ENEN members. More initiatives will be launched to integrate this Nuclear fields among the different areas of the interest and expertise of the ENEN members.

4. Project management during the period

• Consortium management tasks and achievements

WP6 dedicated to the project management provides the support framework for all the project activities and thus interacts with every above mentioned work packages. The overall management of the project includes general activities such as:

- maintaining contact between partners,
- controlling the progress of the work packages,
- convening and conducting the project progress meetings and project general assembly,
- organising PhD annual event and workshops,
- supervising the provision of the deliverables.

WP6 is also in charge of knowledge management activities, communication and dissemination of the outcomes of the project. It organises and financially manages the annual events expected in WP3 and promotes and advertises training courses developed in the frame of the project.

During the first period WP6 produced the consortium agreement that has been agreed and signed by all project participants.

Procedure for preparing deliverables has been prepared according to the quality assurance procedure.

The project home page has been prepared and integrated to the web site hosted by the ENEN Association.

The pre-financing paid by the European Commission at the beginning of the project has been distributed to the project beneficiaries in proportion of their share of grant.

Project meetings have been organised every six months according to the agenda.

The PETRUS Newsletter has been set up. Two issues of the Newsletter has been produced during the first period and widely posted outside of the consortium.

CTU has developed a web-based tool for project management. This tool combines functionalities for central document sharing, progress monitoring, accounting and reporting during the project life for co-operative work between participants and for producing internal project information and documents related to the management of the project.

Partners' financial statement for the first period has been collected and submitted to the European Commission.

• ***Problems which have occurred and how they were solved or envisaged solutions***

Contrary to what was foreseen in the preparation of the Consortium Agreement, the first version of the document that was almost identical to the version agreed in the previous project (PETRUS II) has not met the agreement of several partners. The main reason for this has been the change in the legal procedure and outsourcing-related service in some partners' institutions. The Consortium Agreement has been finally unanimously approved after several iterations with almost six months delay. This has slightly disturbed the preparation of the first deliverables that lagging behind but this delay is resorbing progressively.

• ***Changes in the consortium***

Nidia, a consulting company has expressed its interest to join the consortium without benefiting from the financial EC grant. In accordance with the Consortium Agreement Nidia application has been presented to the general assembly during project meeting in Cardiff and has been unanimously accepted. Thereby, the Coordinator submitted to the EC an amendment to the grant agreement. In parallel the project DoW (i.e. Annex I) has been modified in order to integrate the contribution of Nidia to the project.

• ***List of project meetings, dates and venues***

- PETRUS III kick off meeting 2-3 October 2013, Université de Lorraine, Nancy (Fr)

- 2nd PETRUS III meeting 10-13 March 2014, Cardiff University, Cardiff (UK)
- 3th PETRUS III meeting 29 Septembre – 3 October 2014, Lennaeus University, Kalmar (Se)

• ***Project planning and status***

The 4th PETRUS III meeting is scheduled on 21-24 April 2015 in conjunction with IGD-TP CMET meeting. The midterm common workshop will be held in the same period with the participation of IAEA and JRC representatives.

The production of project deliverables follows the initial agenda with the lag of about two months for the time being due to the delay reported above.

Link between PETRUS III project and ENETRAP III project has been established through the preparation of a specific radiation protection course relative to waste disposal case that will be taught in the frame of PETRUS training programme. A lecture relative to this course will be given during the PETRUS PhD conference in June 2015.

PETRUS consortium presented two papers at Euradwaste and Fisa meeting held in Vilnius on 13-17 October 2013.

The first Petrus PhD conference has been scheduled on 22-26 June 2015 in Nancy (Fr). A specific web site has been designed for this event. Apart from the presentation of ongoing PhD works, the programme includes 7lectures that will be taught by outstanding specialists in key topics related to the radioactive waste disposal.

5. Expected final results and potential impacts

PETRUS III addresses education, training and research objectives by networking relevant European stakeholders (i.e. academia, training centres, nuclear waste management agencies, research centres) in order to provide a common and integrated vision for the elaboration of training programmes which synthesises relevant principles and themes from numerous allied disciplines related to the radioactive waste disposal. Actual implementation of the training programme for Professional Development in the frame of higher education is the first topic of the project. The main issue is the accreditation of

vocational learning outcome through qualification process at academic Master level. Two workpackages are dedicated to this aim. The expected results are the use of the ECVET model and the development of competence-based curriculum for two professional profiles, and the concrete implementation of the programme in at least one of the partner universities as a pathway for the obtainment of a Master degree.

The development of training programmes dedicated to PhD students is another expected result of the PETRUS III project. A first event is scheduled on June 2015 by proposing 7 multidisciplinary lectures. The event is open not only to regular students but also to large external audience and professionals. A second event is expected on June 2016.

To create a more efficient market in E&T in geological disposal and to increase the sustainability of the E&T network on radioactive waste disposal the establishment of links between the PETRUS III project and the IGD-TP is necessary. The main objective is to ensure continuation of E&T initiatives and their deployment relying on the support of the whole radioactive waste community. Interaction between the PETRUS End-users Council and the IGD-TP CMET working group is already effective through the organization of common workshop. Further actions encompass preparation of common proposal to the EC framework programme. Sustainability and continuation of the PETRUS initiative is also expected through cooperation with other nuclear communities in the frame of ENEN Association. The objective targeted is the development of long-term vision and the creation of coherent and dynamic strategy for achieving the integration of the education and training on radioactive waste disposal in this Association. In parallel link already established with the radiation protection community will be reinforced by more structured interactions and exchanges with the ENETRAP III project.