

Newsletter #4

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What is PETRUS?

PETRUS III is a Euratom programme for nuclear research and training. The Consortium includes representatives from twelve different countries all over Europe who work in the nuclear domain at universities and different education and training institutions as well as established companies and agencies in the nuclear sector.

The essential objectives of the project are:

- the practical implementation of an accredited training programme following ECVET principals, leading to a recognised qualification in geological disposal
- the creation and design of a multidisciplinary training and research framework for PhD students
- the development of strategies and frameworks for maintaining the PETRUS initiative long-term.



Welcome to our fourth edition!

Welcome to our fourth edition of the PETRUS III newsletter.

*Leon Cizelj,
Walter Ambrosini,
Pedro Diéguez Porras
ENEN*



The objectives and activities of the PETRUS Consortium are at the heart of those of the European Nuclear Education Network, whose statutory mission is “the preservation and further development of expertise in the nuclear fields by higher education and training”.

Since the start of the European Nuclear Education Network association on September 22nd 2003 as a non-profit organisation under French law and as a product of the European Nuclear Engineering Network project, the initial focus on engineering was, in fact, extended to the broader field of education in nuclear matters. Waste management and geological disposal are some of the main fields addressed since the very beginning, together with nuclear engineering and safety and radiation protection.

The ENEN association already started developing the coordination of initiatives in the three nuclear fields during the ENEN-II project (2006-2009). Nowadays, the coordination and the development of education and training in the nuclear fields have become a necessity, thus the work of ENEN which facilitates the development of effective ways of achieving these goals.

The PETRUS consortium, currently the PETRUS III project, is implementing a leading initiative on education and training in geological disposal and waste management in Europe, as a continuation of previous PETRUS initiatives.

A priority for ENEN has been to provide support to the PETRUS III project in achieving its objectives and consequently securing the sustainability of the outcomes of the PETRUS III project after its conclusion. In favouring this initiative, ENEN will achieve a particular target in its afore-mentioned mission of preservation and further development of expertise in the nuclear fields.

Key achievements of the PETRUS-III project, such as the practical implementation of an ECVET-based training program defined by a competency based curriculum, will secure the preservation enhancement and knowledge transfer to new generations of researchers and scientists and to new countries. At the same time, the elaboration of a multidisciplinary training and research framework for PhD students will provide European countries with the possibility to fast-track research activities in geological disposal by proposing customized training programs, and organizing coordinated PhD workshops on a regular basis, aiming to favour multidisciplinary research.

The ENEN association will support the development of an agreed strategy to secure a sustainable framework for the PETRUS initiative in the long-term. The members of the PETRUS consortium will therefore have an established body through which to develop E&T activities for different European initiatives and the Implementing Geological Disposal Technological Platform (IGDTP). ►►



In fact, the new PETRUS working group inside the ENEN association will be used by PETRUS members to prepare and support their initiatives in Europe from now on, with greater emphasis after the year 2016, when the project will deliver its final outcomes. The dissemination of the results and best practices of PETRUS within the European community of education and training in all nuclear fields will provide the visibility and outreach of geological disposal and waste management knowledge in the industry, academia and society.

Being open to different contributions is at the core of the current policy of the ENEN association, which aims to provide as much support as possible to the development of nuclear education and training initiatives in coordinated patterns, as it does today with the PETRUS community as representatives of geological disposal and waste management. It must be mentioned that work package 5 of the PETRUS-III project, also aimed at the integration of the Consortium into the ENEN structure, is one of the key elements at the root of the broader coordination effort being developed in the EU ANNETTE Project (Advanced Networking for Nuclear Education and Training and Transfer of Expertise), which started recently under the coordination of ENEN. It was also as a consequence of the pilot experience being carried out in PETRUS-III that ENEN could propose a Pan-European coordination effort of education and training activities by ANNETTE. Thanks to this effort, the ENEN Association is enhancing collaboration among different communities of nuclear course providers, thus promoting itself to a higher level in its service to European citizens. The supra-national character of ENEN allows the proposal of standards and certifications applicable throughout Europe on the basis of an agreement among major stakeholders in each nuclear field. These standards and certifications will make the objective of cross-border mobility of professionals within Europe a reality and will promote better harmonisation among the courses provided in different regions of Europe.

A similar objective is being carried out by the CORONA II project, in which the role of ENEN will be to support a Training Academy focused on VVER reactor technology training. This engagement of ENEN will be a further step in its qualification as the umbrella under which major education and training actions will be performed in an efficient and coordinated manner.

Finally, the TRASNUSAFE consortium has also been provided with sustainability by the ENEN Association, through a MoU which assigns ENEN the role of promoting the activation of the courses set up by the now-completed project in the years to come. For this purpose, an ad hoc Working Group is being set up within ENEN to manage related activities.

In summary, the PETRUS-III project is a fundamental pilot experience for the coordination of nuclear education and training within ENEN. The presence on the ENEN Board of Governors of representatives from the PETRUS Consortium (Prof. Bazargan-Sabet from Université de Lorraine) as well as from the Radiation Protection community (Dr. Michèle Coeck from SCK•CEN, among others) in addition to representatives from the nuclear Engineering and Safety community, testifies to the integration within ENEN of experience coming from the richness of different nuclear education and training fields. The coordination of these fields under the ENEN umbrella is an old wish that is being made a reality, generating a global win-win situation.

PhD early-stage researcher conference



Phil Vardon invites us to the second annual PETRUS PhD conference.



*Phil Vardon
Delft University*

The second annual PETRUS PhD/early-stage researcher conference and school will take place at Delft University of Technology (TU Delft) between 27th June and 1st July 2016. This conference is co-hosted by the PETRUS European project, the Dutch national research programme OPERA and TU Delft.

Delft is a city with over 1000 years of history in the Netherlands. It is the home of the famous Delft blue pottery, the painter Vermeer and was the location where Willem van Orange was assassinated.

It remains a small city with a historical feel and is home to Delft University of Technology – one of the world's leading technological universities.



The inaugural conference took place in 2015 in Nancy, France and brought together 65 participants from around the world. Participation included senior professionals, academics, early-stage researchers and PhD students making for dynamic networking and dialogue.

The atmosphere was extremely friendly and informal, leading to active discussions. This year the event coincides with the finalisation of OPERA, the current research programme into geological disposal in the Netherlands.

Therefore, it will be an opportunity to present some of the state-of-the-art information developed in OPERA and discuss this with current researchers.



The objective of the conference is to bring together experienced professionals, researchers, early career researchers and PhD students to present and discuss state-of-the-art research and current practice in a relaxed and informal environment.

Each day will offer lectures from reputed scientists involved in national and international programmes in geological disposal and presentations of research being undertaken by the participants. The programme will also offer a visit to the Delft Research Reactor, the COVRA storage facility and the Mol underground research laboratory in Belgium.

Participation is free of charge.



www.petrus-opera2016.eu

| Dr Phil Vardon : PhD-event@petrus-opera2016.eu

Our WP leaders walk you through the objectives of their work packages and the tasks at hand.



WP 1 Elaboration of the PD training program using the ECVET model

Abdesselam Abdelouas
Mines Nantes



The application of the ECVET system to the professional and trainee profile “Safety Engineer – Assessment and Performance Analysis for construction license of a selected site” allowed the breakdown of the profile into three units, composed of a multitude of Learning Outcomes (knowledge, skills, competencies).

The units’ programs were detailed as much as possible to better assess their credits. This helped identify non-nuclear industries that could potentially provide human resources for nuclearization with a good quality/cost ratio. The example of a qualification treated in WP1 could be extended to other qualifications related to radioactive waste management.

ECVET makes qualifications more transparent and understandable for someone who has no nuclear background. This is crucial in order to remediate the shortage in human resources expected in the nuclear field by 2020. Moreover, the ECVET structure of a qualification allows more flexible pathways to obtain or to improve a qualification (all Training & Education systems are accepted: formal, informal and non-formal) (Figure 1).

This first unit constitutes the basic learning outcomes for a quantitative safety assessment, in particular the quantification of the migration of radionuclides. This includes rock characteristics, water/rock interactions and underground water flow. ►►

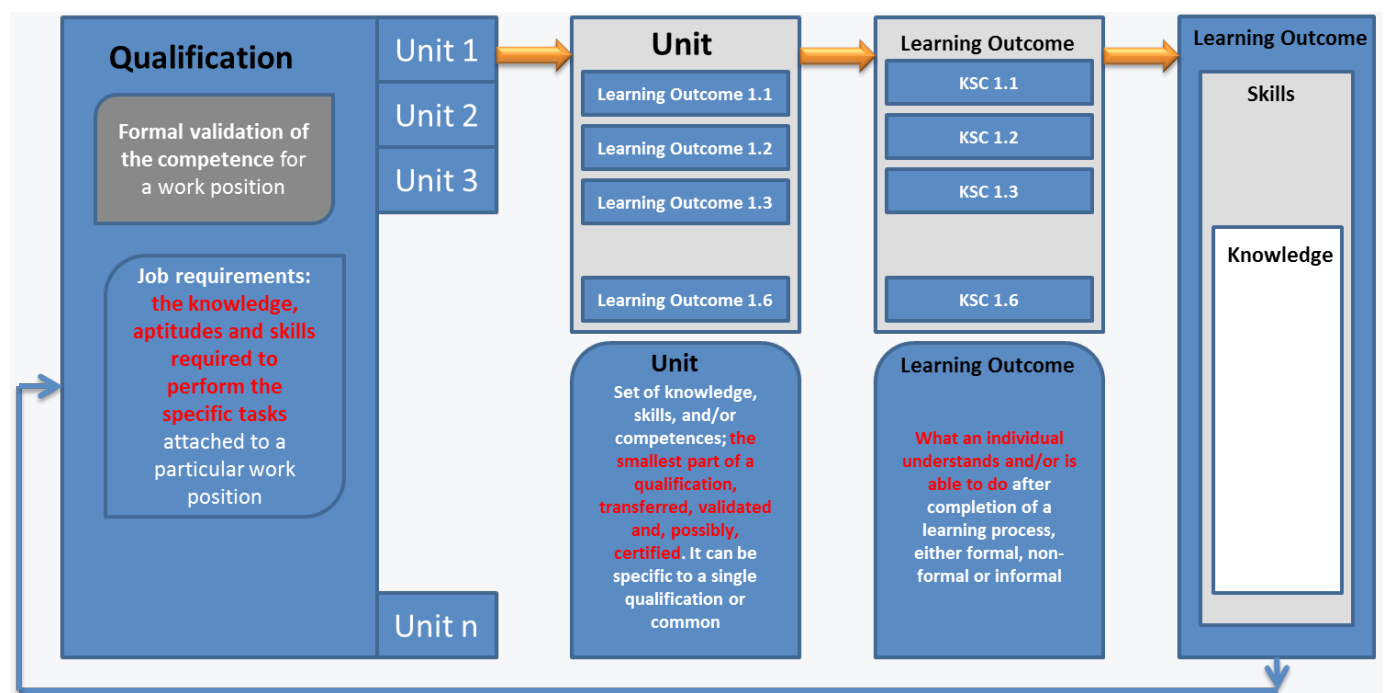


Figure 1. Qualification structure based on ECVET approach

WP summaries



The content of this basic unit is classically covered in master programs specialized in **hydrogeology**.

Thus, nuclearization of professionals with hydrogeology background seems to be adequate for the designed qualification.

This second unit includes the fundamental learning outcomes on radioactivity, safety, waste disposal sites, the engineered barrier system (EBS) and site evolution with time. Unit 2 constitutes the core unit for nuclearization of professionals originating from non-nuclear industrial fields.

This third unit is based on the learning outcomes of Unit 1 and Unit 2 including data gathering and management, mathematical and numerical modelling, uncertainties and quality management.

We applied the ECVET system to design a qualification in the field of safety analysis and performance related to radioactive waste geological disposal. The qualification (job profile) was broken into three units, each composed of a set of Learning Outcomes (knowledge, skills, competencies) that could be easily assessed. The units were designed to easily allow the nuclearization of human resources from a non-nuclear industry. Thus, unit 1 concerns professionals from earth science fields including hydrogeology, geology and geochemistry. Unit 2 is meant for the nuclearization of non-nuclear human resources in the field of geological disposal of radioactive waste. Finally, unit 3 is based on Learning Outcomes from unit 1 and unit 2 in addition to specific Learning Outcomes including quality management and procedures.

The qualification described in this report is a key example in the field of geological disposal where a multitude of knowledge, skills and competences are required to achieve the essential tasks. Thus, classical education and training models (university degrees) may not be adequate to provide trainees with multi-disciplinary profiles. In this case, ECVET will play a fundamental role in human resources development in the field of radioactive waste management. The outcome of WP1 can be used to design different qualifications related to radioactive waste management.

WP summaries

WP 2 Actual implementation of the PD training program



*Jussi Leveinen
Aalto University, Finland*



Prototyping the Petrus professional development program

The PETRUS professional development (PD) program aims to bring together vocational training on nuclear waste management and formal academic training provided by the partner higher education institutions.

The combination of vocational training and professional work experience with academic qualifications has been applied for a long time in France as a part of the VAE system. In Finland parts of academic studies can also include practical training to some extent. The preparation of professional reports can be included as individual and independent research and credited based on their extent and preparation time. In addition, the European Crediting system for Vocational Education and Training (ECVET) has been created to promote transnational mobility primarily within the European Union and to facilitate lifelong learning. Consequently, ECVET systems are strongly supported as tools for implementation e.g. E&T activities by Euratom.

In preparation for an ECVET program, the key knowledge, skills and competences (KSCs) required in different job profiles in the nuclear waste management sector have been compiled as shown in figure 1. The KSCs needed for qualifications are linked with expected learning outcomes, defined as statements of what a learner is expected to know, understand and/or be able to do at the end of a certain learning period. The qualification is described in terms of “units” of learning outcomes.

Each of these units is associated with a certain number of “credit points” defined on the basis of common European guidelines in order to provide an illustration of the relative weight of the unit and associated learning outcomes in the overall qualification. Learners can accumulate required units for a given qualification programme over time, in different countries, and in different learning situations (e.g. modular courses, practical training).

In order to integrate the achieved ECVET points in an academic MSc-degree, they must be transferred to credit points of the European Curriculum Transfer System applied in European Universities. This process is becoming increasingly smoother, because in many universities competence-based engineering curriculums are being developed utilizing similar concepts of KSC's. Once the student has reached all the expected learning outcomes and the transfer to ECTS credits has been completed, he or she can apply for the degree certificate of the ECVET program and the diploma of the hosting university. The selection of courses and alternative forms of learning to build up a personalized syllabus can be a time consuming and difficult task. Therefore, the development of automated tools can help teachers and students analyse the different available courses and compare them to the requirements for professional qualifications.

The Petrus program prototype is assumed to take two years of full time study. However, the program is essentially a vocational training program and consequently, the scheduling can be more flexible than that of formal academic programs. ►►

WP summaries



Implementing sustainable E&T programmes in the field of Radioactive Wastes Disposal

Ref.	Job Title	Occupational Category
PETRUS3	Safety Engineer – Assessment and Performance Analysis	Engineer
Phase / Area	Alternate job title(s) – specialisations	Functional Category
Radioactive Waste Disposal	-----	Specialist
Role / Functions		
The safety engineer in the field of geological disposal of radioactive waste is in charge of integrating a variety of geochemical and hydrogeological data on a specific site using simulation tools to predict a dose to the Public due to radionuclides migration through the geosphere.		
<ul style="list-style-type: none"> Perform numerical simulations to provide phenomenological and conceptual description of the behaviour of each repository and geological component during operating and post-closure periods, in space and time (thermal, chemical, mechanical, hydraulic- gas, radionuclide/toxic release and transfer), including uncertainties analysis. 		
JOB REQUIREMENTS		
KNOWLEDGE (Cognitive competence)		EQF level (1-8)
Numerical simulations		5-6
Basis of Hydrology, (Bio)Geochemistry and Solution Chemistry		4-5
Introduction to Radioactivity and Fuel Cycle		4-5
Basis of safety, reliability and risk management		4-5
Radioactive Waste Management (physical and radiological inventory, conditioning, waste forms...)		4-5
Repository Technologies (multi-barriers concept, geological site, experimentations...)		4-5
Radioprotection and Chemical Impact		4
SKILLS (Technical and functional competence)		EQF level (1-8)
Select, use and improve the appropriate simulation tools		6
Provide normal/altered evolution scenarios		5-6
Provide phenomenological description of the behaviour of each repository and geological components during operating and post-closure periods		5-6
Determine the long-term impact (assessment of individual dose)		5-6
Provide solutions to improve the design and progressive management of storage		5-6
COMPETENCE (Attitude; behavioural and personal competence)		EQF level (1-8)
Good team work		5-6
Great ability of data integration, Ability to synthesize, Analytical thinking		5-6
Accountability		5-6
DRAFTED BY:	1ST REVIEW:	2ND REVIEW:
A. ABDELOUAS		
30.09.2014		

The prerequisites for the students include a BSc or equivalent qualification in relevant areas and entrance to an MSc program in one of the Petrus program partner universities. The studies must be able to combine formal academic courses in the partner universities. Alternatively, the student can include in the program studies carried out by applying the PETRUS ECVET-procedures to be jointly agreed in the Memorandum of Understanding between the program partners. These studies can comprise vocational courses, self-studies and practical training activities in relevant associated institutions defined in the MOU.

The ECVET procedures require the intended learning outcomes to be pre-described and linked to the Petrus ECVET qualification system and their evaluation and validation to be agreed by the sending and the receiving institution in the Learning Agreement, signed by the student and the official representatives of the sending and receiving institutions. ►►

Figure 1. An example of a job description and required knowledge, skills and competences.

WP summaries

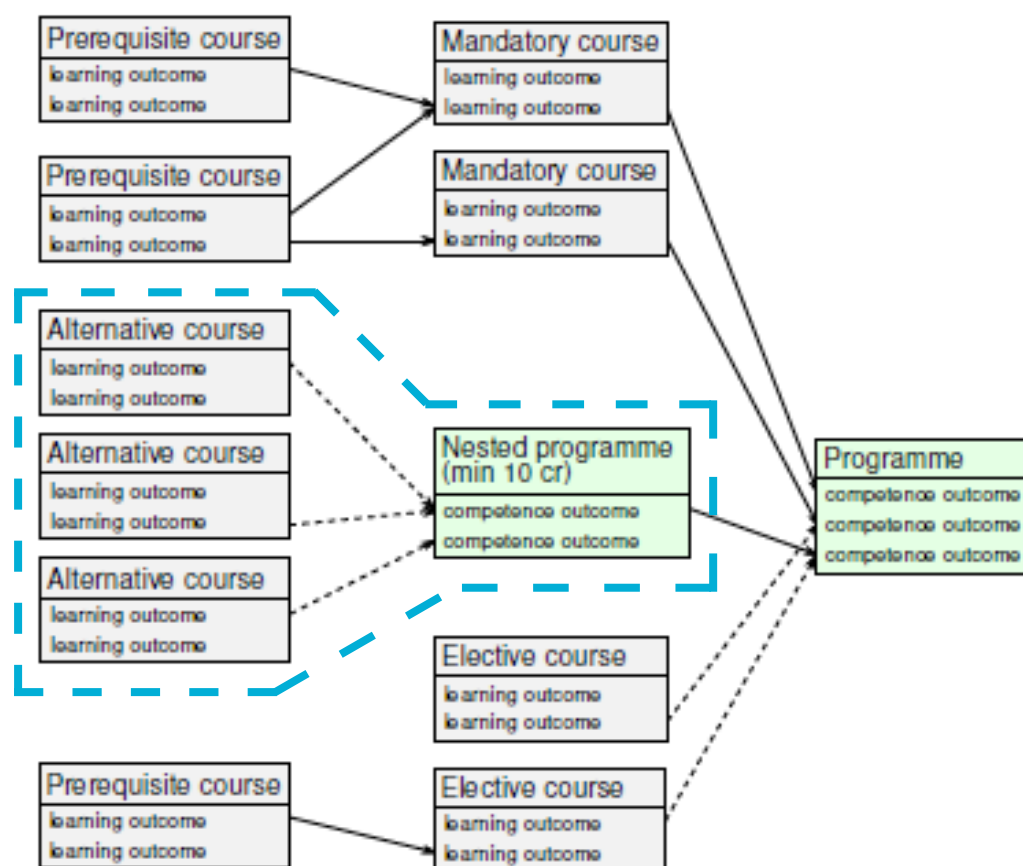


Figure 2. *The combination of teaching resources available in different academic institutions and vocational training will allow students to trace the learning outcomes obtained by courses in different universities and non-formal and vocational learning methods to the professional competences.*

Achievement of the mutual recognition of qualifications and learning outcomes of the Petrus Professional Development Program including the nuclear industry/ the end users as well as national education authorities will also require the development of an accreditation process to ensure that the program provides the education basis for the entry route to professional practice. Regulations concerning the validation and recognition of the professional qualification vary substantially among countries and currently there are no European standard procedures and requirements for ECVET programs. Also different nuclear waste management programs represent diversity in the present stage of implementation as well as geological conditions making accreditation challenging.

Overcoming this challenge will be helped by the fact that the European academic educational and exchange programs already share several key principles of ECVET-programs. Universities committed today to the so called Bologna-process are also committed to the accreditation processes. They will introduce to their everyday practices quality assurance procedures which can provide the basis for mutual trust and validation and recognition of the learning outcomes and qualifications achieved in the planned PD program. The internal and external accreditation procedures that still need to be implemented concerning the PD-program can be focused on the assessment of the training programme against a specific set of KCS needed in nuclear waste management.

WP summaries



WP 4 Think-Tank activities and link with the IGD-TP

*Bojan Hertl
Arao*



The spent (or used) nuclear fuel from the operation of nuclear power plants needs to be managed in a safe, responsible and effective way. How this should be done comes from the adopted Council Directive 2011/70/ EURATOM on the “responsible and safe management of spent fuel and radioactive waste” which requires EU Member States to establish a dedicated policy, including the implementation (and notification to the Commission) of “national programmes” for the management of spent fuel and radioactive waste.

Joint Programming on Radioactive Waste Disposal RD&D based on “national programmes” at the European level is the aim of the JOPRAD Project. Joint Programming will contribute to the EU objective of building the European Research Area through enhanced cooperation and coordination of national research programmes.

According to the Council Directive 2011/70/ EURATOM, all “national programmes” also need to ensure that the necessary core competences and skills required in waste management are built up and further maintained at the national level.

Across Europe there are several initiatives operating to enhance knowledge transfer between disposal programmes and to aid national competency development, in particular the IGD-TP operate a working group on competence maintenance, education and training (CMET).

It is linked with the PETRUS III project which represents the continuation of the PETRUS initiative aiming at taking further steps towards geological disposal education and training goals.

Different stakeholders’ views on the aforementioned topic, CMET WG results and PETRUS III project results will be presented in Ljubljana, Slovenia, April 12th-14th, 2016, where ARAO will organize synchronously PETRUS III project meeting No.6, PETRUS III Extended End-User Council meeting No.2 and under umbrella of PETRUS III the IGD-TP CMET WG meeting No.7.



Triple bridge in Ljubljana, Slovenia

WP summaries



WP 5 Sustainability, external collaborations and link with ENEN

Pedro Dieguez Porras
ENEN



Similar to the Bologna Agreement, which regulates the mobility of university students and the mutual recognition of degrees by European universities across national borders, the European Credits System on Vocational Education and Training (ECVET) aims to facilitate the recognition of education and training sessions at all levels.

This includes the lower EQF levels as well as post-doctoral courses and lifelong learning and professional development across European borders. The purpose is to enhance the mobility of the work force, thus also providing a larger field for job opportunities for the individual as well as a larger recruitment area for Geological Disposal and Waste Management.

The recognition of the training provider at the national level is not sufficient for a trainee from abroad. The training also needs to be validated and recognized as part of the trainee's personal transcript in his own country or in the country where he is seeking employment. There is not yet an agreed template or definite list of items to be included in a memorandum of understanding between universities, although ongoing pilot projects are experimenting different approaches (from a 'minimalist' to a much more detailed version). An example of an agreement of this kind, to be established university-by-university in order to facilitate the exchange, is proposed in the deliverable 5.3 of the PETRUS III project.

It is advisable to mention the generic principle within ENEN, where students moving from one ENEN University to another do not normally pay any enrolment fee.

So far the best practices recommend that:

- the exchanges should be granted by bilateral agreements,
- exchanges can be eased by establishing ERASMUS links among partner universities
- if the principle of ENEN is established, free circulation of students should be granted by "some means", including bilateral agreements.

NEW PROJECT

ANNETTE Project started



On February 9-10, 2016, the ANNETTE Project kick-off meeting was held in Pisa, Italy.

ANNETTE (Advanced Networking for Nuclear Education, Training and Transfer of Expertise) aims at enhancing the Europe-wide efforts initiated in the past decades by different organisations belonging to academia, research centres and industry to maintain and develop education and training in the different nuclear areas.

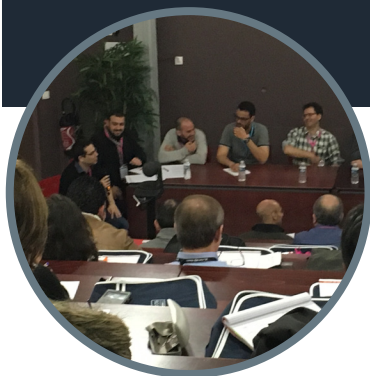
The main aim of this action is to consolidate and better exploit the achievements already reached in the past and to tackle the present challenges in preparing the European workforce in the different nuclear areas, with special attention to continuous professional development, life-long learning and cross border mobility. The ANNETTE project receives funding from the EURATOM Research and Training programme under grant agreement N° 661910.

A European survey on E&T and VET initiatives was launched by ANNETTE project, which can be accessed via the following link: <https://survey.app.sckcen.be>

By participating in this survey, you help shape the future of education and training in nuclear.

Read more about the ANNETTE Project.

EVENTS



Training course in radioactive waste disposal

June 1 - 10, 2016 
SCK•CEN Mol, Belgium

This intensive one and a half week course will give a comprehensive overview of different aspects involved in the stepwise implementation of a radioactive waste disposal facility. The course will focus on international best practices and regulations, national and international state-of-the-art, different RD&D activities related to radioactive waste disposal, and hands-on practical exercises related to safety and performance assessments of disposal facilities.

academy.sckcen.be 

ATALANTE 2016

June 5 - 10, 2016 
Montpellier, France

Organized by the French Alternative Energies and Atomic Energy Commission (CEA), the ATALANTE Conferences provide an international forum for presentations and discussions on advances for future fuel cycles and waste management.

www.atalante2016.org 



SENIX 2016

June 13 - 15, 2016 
Stockholm, Sweden


The title of SENIX 2016 is "The Role of Social Sciences in a Low-Carbon Energy Mix". In conjunction with SENIX, on Monday June 13 in a venue just adjacent to SENIX, the Swedish National Council for Nuclear Waste will host a seminar: "Ethical Perspectives on the Nuclear Fuel Cycle".

www.karnavfallsradet.se 

WNE (2nd edition) World Nuclear Exhibition 2016

 June 28 – 30, 2016
Paris Le Bourget, France
 www.world-nuclear-exhibition.com



NENE 2016

 September 5 - 8, 2016
Portorož, Slovenia

The Nuclear Society of Slovenia invites you to attend the traditional 25th meeting of professionals from nuclear research organizations, educational institutions, nuclear utilities, industrial companies and regulatory bodies. The conference will be held in the sea resort of Portorož, Slovenia.

 www.nss.si/nene2016

RPW 2016 Radiation Protection Week

 September 19 - 23, 2016
Oxford, United Kingdom
 www.melodi-online.eu

DAEF

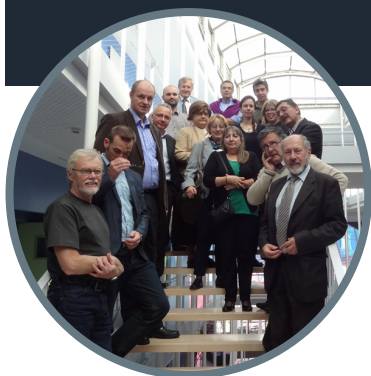
 September 26 - 28, 2016
Cologne, Germany

2nd Conference on Key Topics in Deep Geological Disposal
Challenges of a Site Selection Process:
Society – Procedures – Safety

 www.daef2016.org

IAEA International Conference on the Safety of Radioactive Waste Management

 November 21 - 25, 2016
Vienna, Austria
 <http://www-pub.iaea.org>



Partners

PETRUS



Partners:

Université de Lorraine | Mines Nancy (FR) | POSIVA Oy (FI) | ENEN (FR) | Mines Nantes (FR) | Cardiff University (UK) | Linnæus University (SE) | MICANS (SE) | SÚRAO (CZ) | ARAO (SI) | ENRESA (ES) | Aalto University (FI) | Universidad Politécnica de Madrid (ES) | Czech Technical University (CZ) | Universitatea Politehnica Din Bucuresti (RO) | CEA (FR) | IST-ID (PT) | Delft University of Technology (NL) | SCK.CEN (BE) | CIRTEC (IT) | REC (SI) | Nidia (IT) |

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