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Advanced Networking for Nuclear Education and Training and Transfer of Expertise

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Procedures for the coordinated E&T efforts planned for WP2

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ABSTRACT

The reports discusses the desirable and current feasible quality assurance and accreditation procedures to be established for the coordinated E&T and VET efforts planned for WP2 (European Master Programme for Continuous Professional Development in Nuclear Science and Technology (EMP)).

An overview of the main elements of different accreditation systems, already implemented by the relevant and diverse individual E&T and VET providers, will be given in this report.

The proposed quality criteria for evaluating E&T and VET activities and accreditation procedures in this document were established taken into account the opinion of major stakeholders.

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LIST OF ABBREVIATIONS

ANNETTE	Advanced Networking for Nuclear Education and Training and Transfer of Expertise
CPD	Continuous Professional Development
ENEN	European Nuclear Education Network Association
ECTS	European Credit Transfer System
ECVET	European Credit System for Vocational Education and Training
ESG	European Standards and Guidelines
E&T	Education and Training
HEI	Higher Education Institute
KSA	Knowledge, skills and attitude
OJT	On the job training
MoU	Memorandum of Understanding
QA	Quality Assurance
SAT	Systematic Approach to Training
VET	Vocational Education and Training
WP	Work Package

1 INTRODUCTION

One of the objectives of WP1 in the ANNETTE project is to define the procedures for evaluating the coordinated E&T and vocational education and learning activities (VET) which are planned in WP2 (Design and implementation of coordinated E&T efforts). The evaluation of the E&T and VET activities includes quality assurance (QA) as well as accreditation. As the E&T and VET efforts in WP2 offered by different providers, are based on different technologies, cultures and quality/accreditation systems, coordination and a uniform approach for evaluation within ANNETTE is necessary.

This report describes the QA/accreditation approach for such coordinated E&T and VET activities with the following major outcomes in mind:

- Consistent quality of all courses
- Facilitating/enabling the accreditation of coordinated courses and/or certification of course attendees

An overview of the main elements of various quality assurance/accreditation systems (SAT, academic, ECVET system), already implemented by the relevant and diverse individual E&T and VET providers, will be provided.

Based on these existing accreditation systems and taken into account the input of E&T providers and stakeholders, the most desirable procedure for the evaluation and accreditation of E&T and VET efforts in WP2 will be proposed.

2 ACCREDITATION OF SYSTEMATIC APPROACH TO TRAINING

2.1 Definition of Systematic Approach to Training

A systematic approach to training provides a logical progression from the analysis of the competences needed to the design, development and implementation of training to achieve these competences, and subsequent evaluation of the training for feedback to the design stage [1].

A systematic approach to training usually include the following **five major stages of the training design and execution** ([2], [3])

1. analysis of the training needs;
2. design of the training;
3. development of the training;
4. implementation of the training;
5. evaluation of the training.

2.2 Accreditation of SAT training courses

The **quality of the training** provided may be supported by accreditation of some or all of the training offered. Courses may be accredited by the **regulatory body or by an independent body,** such as a professional association recognized by the regulatory body. The accreditation procedure normally involves the presentation of a **formal submission** to the accreditation body, which then analyses the information against established criteria. The submission should include information concerning the five major stages of training design and execution [1].

The main elements of the 5 major stages including the quality assurance procedures, internal audits and the mechanisms for evaluation and feedback on the training, are briefly outlined in **ANNEX I.**

3 EUROPEAN CREDIT SYSTEM FOR VOCATIONAL EDUCATION AND TRAINING (ECVET)

3.1 Vocational Education and Training

Surveys carried out since 2009 by the European Human Resource Observatory in the Nuclear Energy Sector (EHRO -N) indicate that maintaining the competences in nuclear technologies are becoming difficult to sustain in the near future. Given the aging workforce profile, there is the danger of competence being deteriorated and ultimately lost. Strategies adopted by universities to attract young people often encounter difficulties due to public denigration of nuclear activities and the lack of interest from the students. Thereby, the workforce needed in the nuclear sector can be alternatively obtained by **"nuclearization"** of people with suitable educational background in engineering or sciences. This means that an essential **entrance path for professional into nuclear sectors will be through professional development (PD)** in parallel with graduation from specialized higher-level educational programs.

3.2 Practical use of the ECVET system

The European credit system for vocational education and training (ECVET) is one of several European tools launched as an integral part of the 'Education and training 2010-20' and Copenhagen processes. The development of ECVET began in 2002 after the Copenhagen Process emphasized the need for a **credit system for vocational education and training** (**VET)**. The **voluntary system** has been developed by the Member States and the social partners in cooperation with the European Commission and has been adopted through a recommendation by the European Parliament and the Council in 2009.

ECVET is a tool designed to **facilitate the transfer, recognition and accumulation of learning outcomes of individuals** (acquired during a stay in another country or in different work situations) in the achievement of a certain qualification [4]. The ECVET system is meant to operate in coordination with other European tools (e.g., Europass), promoting borderless mobility and lifelong learning.

The **practical use** of the ECVET system can be described as follows:

- applicant registers at a home institution;
- the applicant enters into a **"learning agreement**" which defines the requirements for obtaining the "qualification" (i.e. number of units) and identifies different pathways (i.e. training programs, training providers and timeframes) available for fulfilling these requirements;
- a first assessment is carried out by a qualified jury allowing to award possible exemptions from core courses (e.g. a full units or part of a unit) based on the prior knowledge of the applicant;
- the applicant achieves learning in different institutions identified in the learning agreement;
- each host institution assesses the applicant learning outcomes and **validates the results**;
- partial results are recorded by the home institution;
- the validation of all the units corresponding to a training program allows the delivery of the "**qualification" by the home institution**; criteria for the ECVET quality assurance procedures can be found in ANNEX II.

3.3 Accreditation in ECVET system

A well-functioning European credit system needs to be embedded in a qualifications framework. National qualifications need, according to the ECVET principles, to be described in terms of **units of learning outcomes**, defined as 'a coherent set of Knowledge, Skills and Responsibility/Autonomy (KSR/A) (following the current paradigm [4]) that can be assessed and validated with a number of associated ECVET points'.
Learners can **accumulate required units** for a given qualification over time, **in different countries,** and in different learning situations (e.g. modular courses, practical training). The validation of all the units corresponding to a training program allows the delivery of the "qualification" by the home institution.This qualification requires a well-developed process of validation, with quality assured assessment and recognition procedures.
Generally, the **technical components** for ECVET qualification can be classified in three main categories [4]:

- transparency of qualifications (qualifications, units of learning outcomes and credit points);
- the accumulation process (assessment, validation and recognition of learning outcomes);
- the transfer process (memorandum of understanding, learning agreement and learners' transcript of records).

Key ECVET principles in the transfer process important for applying the ECVET system in the ANNETTE accreditation procedures are:

- Partnership agreement - memorandum of understanding
  The partnership agreement or **memorandum of understanding** (MoU) is a key device which creates the **climate of trust** in which credit transfer can operate. The MoU has to be established between the institution in charge of delivery of "qualification" and external course providers. The agreement recognizes the quality of courses delivered by external course providers and the validity of their assessment and validation procedures. The key point of such agreement is that the learning outcomes for which validation is awarded by one partner can be recognised irrefutably by the others.
  The memorandum of understanding provides information about [5]:
  - the nature of the sending and receiving institutions on either side of the transfer arrangement; each institution needs to be able to trust the other in relation to assign or allocate credit; this need may be met through the quality assurance framework;
  - the equivalence of the learning involved on either side of the transfer arrangement (relative level, units nature of learning process - formal/non-formal, theory/practice - vocational relevance);
  - the validation (and recognition, if appropriate) agreement; the partners describe what procedures and processes are followed to ensure fair validation and recognition (units and credits) and equal treatment;
  - the quantification of the credit allocation;
  - the volume of the learning activities regarding one or several formal learning pathway of reference (typical formal learning pathway) and the number of credits to be obtained.
- Principles of learning agreement
  In the case of a training pathway comprising a transfer of units and credits, **the learning agreement is drawn up jointly by the sending and receiving institutions**. The learning agreement must be agreed by the mobile learner. This document would notably specify the learning outcomes expected at the completion of each module as well as the

assessment modalities, list of external courses that are recognised as valid by the home institution. The learning agreement is established **before the learner's departure** and must be updated immediately when changes in organisation and contents of modules or courses occur. It concerns the drawing up of an individual agreement between each applicant and the home institution related to resources, behaviour, support, learning and teaching, and assessment and feedback. This document would notably specify the learning outcomes expected at the completion of each module as well as the assessment modalities, list of external courses that are recognised as valid by the home institution.

Implementation of ECVET in European countries was initially expected in 2012. Today, **the system is still in development** and the final framework has yet to be fixed. Given this situation, the implementation of ECVET as a "standard" tool for certification of the offered VET courses within WP2 of ANNETTE, is not fully possible at this moment.

4 ACADEMIC ACCREDITATION SYSTEMS

4.1 The Higher Education System in Europe

The birth of the European Higher Education Area (EHEA) can be traced back to the so-called "Sorbonne declaration (1998)" [6]. Some of the main objectives of the declaration, made between France, Germany, Italy and the UK at the time, were mobility for student, graduates and teachers and the promotion of qualifications, with regard to the job market.

One year later (1999), the process envisaged at the Sorbonne was made to be approved at a wider level (29 European Countries) by **the Bologna declaration** [7]. In this new declaration, it was stated:

> *"While affirming our support to the general principles laid down in the Sorbonne declaration, we engage in co-ordinating our policies to reach in the short term, and in any case within the first decade of the third millennium, the following objectives, which we consider to be of primary relevance in order to establish the European area of higher education and to promote the European system of higher education world-wide:*
>
> *Adoption of **a system of easily readable and comparable degrees**, also through the implementation of the Diploma Supplement, in order to promote European citizens employability and the international competitiveness of the European higher education system.*
>
> *Adoption of **a system essentially based on two main cycles**, undergraduate and graduate. Access to the second cycle shall require successful completion of first cycle studies, lasting a minimum of three years. The degree awarded after the first cycle shall also be relevant to the European labour market as an appropriate level of qualification. The second cycle should lead to the master and/or doctorate degree as in many European countries.*
>
> *Establishment of **a system of credits** - such as in the ECTS (*European Credit Transfer System) *system – as a proper means of promoting the most widespread student mobility.*
>
> *Credits **could also be acquired in non-higher education contexts, including lifelong learning,** provided they are recognised by receiving Universities concerned.*
>
> *Promotion of **mobility** by overcoming obstacles to the effective exercise of free movement with particular attention to:*
>
> - *for students, access to study and training opportunities and to related services;*
> - *for teachers, researchers and administrative staff, recognition and valorisation of periods spent in a European context researching, teaching and training, without prejudicing their statutory rights."*
>
> *Promotion of **European co-operation in quality assurance** with a view to developing comparable criteria and methodologies.*
>
> *Promotion of **the necessary European dimensions in higher education**, particularly with regards to curricular development, inter-institutional co-operation, mobility schemes and integrated programmes of study, training and research."*

Though it is clear that the EU policy in relation to several aspects, including education, is imprinted by the "**subsidiarity principle**", e.g. leaving to each Member State to decide and implement higher education policies, the tendency to mutual recognition and harmonisation, though **cannot be enforced by the law**, is anyway a strong motivation to ease the access to knowledge and the cross-border mobility. In a globalised education market, in which doubts can be raised in relation to the level of an increasing number of institutions releasing certifications, quality assurance has the highest importance. In Europe, higher education institutions have the responsibility for the quality of their educational offer, but the release of European Standards and Guidelines (ESG) in 2009 and later in 2015 [8] resulted helpful in **converging on common practices in quality assurance.**

The document on European Standards and Guidelines [8] is authored by a **number of relevant institutions established in the field**, as the European Association for Quality Assurance in Higher Education (ENQA), the European Students' Union (ESU), the European University Association (EUA), the European Association of Institutions in Higher Education (EURASHE), in cooperation with Education International (EI), BUSINESSEUROPE and the European Quality Assurance Register for Higher Education (EQAR). Therefore, in the following these guidelines are mainly considered to describe the principles at the basis of academic quality assurance in higher education in Europe. This does not mean that all the European higher education systems really adhere completely to these guidelines, though a report of the European Commission issued in 2014 on the subject [9] states that:

> *"The vast majority of HEIs (Higher Education Institutes) have established explicit QA structures and processes. Over 75% of HEIs have a public strategy for continuous quality enhancement and in some countries this reaches 100%."*

In relation to the effectiveness of the European Guidelines, the report suggests :

> *"At European level, the European Standards and Guidelines (ESG), developed in 2005, have **helped convergence of QA across countries and provided a framework for cooperation between QAAs**. However, their current generic nature means that they are understood differently and applied unevenly. Further many HEIs consider that although the generic frameworks exist, there is not enough practical advice on how to develop a strong quality culture. **The ESG are being revised**, to improve their clarity, applicability, usefulness and scope."*

As a consequence of their recognised relevance, the guidelines [8] will be considered in the following with awareness that each Member State is presently applying its own QA strategy in higher education, though these **guidelines are inspiring to establish good QA practices throughout Europe.**

4.2 Standards and Guidelines for Quality Assurance in the European Higher Education

The outcomes of the revision of the ESG drafted in 2005 are published in the document to be described hereafter is referred to as ESG 2015 [8]. The table of contents of the document, shown in Figure 1, highlights the rationale at the basis of the document.

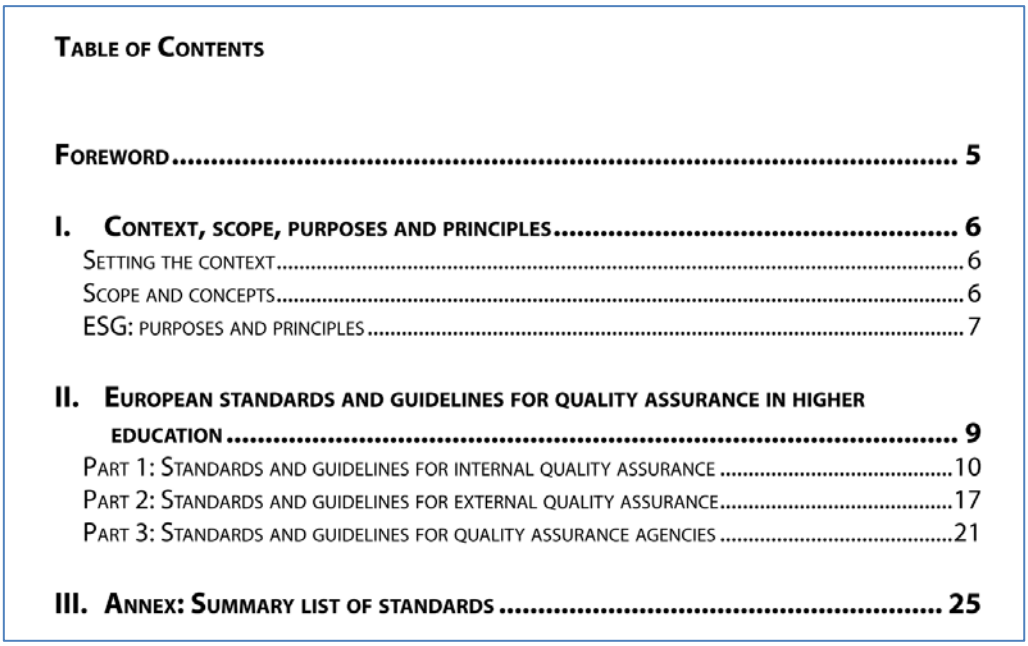

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Figure 1. Index of the ESG 2015 [8].

In the following the salient aspects of the sections I and II of the document ESG 2015 are shortly summarised in order to draw conclusions about the lesson we can learn from the ESG 2015 in relation to the quality assurance programme to be established within the ANNETTE project.

Context

The ESG underlines the pivotal role of higher education in view of **socio-economic and cultural development**. The dynamic nature of the context is also pointed out, considering that the requests for higher education are evolving in terms of a continuously increasing demand.
Some items in this regard can be highlighted, revealing the role of Quality Assurance as a crucial one:

- the development of a student-centred approach;
- the introduction of "flexible" learning paths;
- the recognition of competences gained outside formal curricula.

The ESG in this regard represent an effort to demonstrate quality and increase transparency, to build **"mutual trust"** and better **"recognition"** of programme qualifications in Europe.

Scope and Concepts

The ESG are not "standards for quality" nor do they define how the quality assurance process should be implemented; they just provide **guidance for implementations** that should take into account the qualification frameworks (EQF), ECTS and diploma supplement, contributing to the mentioned transparency and mutual trust.

It is explicitly stated that:

- *"the focus of the ESG is on quality assurance related to learning and teaching in higher education, including the learning environment and relevant links to research and innovation";*
- *"the ESG apply to all higher education offered in the EHEA regardless of the mode of study or place of delivery."*

An interesting aspect mentioned in the text is that **quality is not easy to define, being the result of the teaching and learning processes**; nevertheless, the target of quality assurance should be to ascertain that this process (including programmes, structures, etc.) is **fit for the purpose**.

Accountability and **enhancement** are two concepts that are particularly stressed: the first is related to the information that must be provided on the quality of HEIs; the second is related to the process of improvement of quality that must be always in place. An outcome of this process is reaching a **"quality culture"**, involving students, teachers and managers as a priority.

So, quality assurance is related to this process of **continuous improvement**, to be considered by all the stakeholders, defined as all actors interested in the education process (students and staff, employers and external partners).

Purposes and principles of ESG

ESG are conceived to set a common framework for QA systems in higher education in Europe and national and institutional levels. They are aimed to enable the assurance and improvement of quality. **Mutual trust** is one of the objectives, enabling **recognition** and **mobility**. Information on quality assurance in the EHEA is an additional purpose.
The guidelines are expected to be implemented in different ways throughout the EHEA, owing to the local different regulations and traditions. HEIs have the primary responsibility for this aspect, while an explicit goal is a "quality culture", in view of satisfying the expectations of students and of the society at large.

Internal quality assurance

The Part 1 of the document is devoted to the internal phase of quality assurance. Remarks on each one of the mentioned relevant aspects are reported hereafter.

1. In a nutshell, the **"internal" quality assurance should be a clear policy of HEIs**, implemented in appropriate structures and processes. This policy should be made public, involving external stakeholders.
2. The **design and approval of programmes must be subjected to a QA process**, in which the objectives and learning outcomes should be clearly set and communicated.
3. Learning, teaching and assessment should be **"student-centred"**, as to encourage students to have an active role in shaping the learning process.
4. The regulations governing the **"life of students"** (admission, progression, recognition and certification) should be pre-defined and made public.
5. The competence of the teaching staff should be assured, by **transparent processes of recruitment and development**.
6. The **level of resources** put in place for funding the learning and teaching activities should be adequate; these resources should be at the disposal of the students.
7. Information for the **effective management of study programmes** and related activities must be collected, including performance indicators, the profile of student population, the students' progression along the programme and their satisfaction, the learning resources and the career paths.
8. The **public information on the programmes** should be objective and clear, also to guide prospective students in their choices.
9. A **periodic review and monitoring process of the programmes** should be in place, to assure continuous improvement.
10. **Cyclical external quality assurance** calls for what is described in the next part of the document: external visits and audits should be programmed, also in order to check the internal quality assurance provisions.

External quality assurance

1. As above mentioned at previous item 10, the **external quality assurance has firstly to check the effectiveness of the internal quality assurance** provisions.
2. Needless to say, **also external quality assurance practices should be designed adequately**, taking into account the specific regulation context and providing a useful follow-up for HEIs.
3. **Implementation of external quality assurance processes** should be **systematic** ("reliable, useful, pre-defined, implemented consistently and published").
4. **Peer-reviewing experts** should be involved to perform external quality assurance, also including in the group of experts one or more students.
5. The external quality assurance practices should also be based on **explicit and published criteria**: since their results may have a strong impact on the reviewed institutions equity and reliability, inter alia, should be assured to the process.
6. The reports of **the experts should be published** in a clear format and available to the academic community and to any interested party. Any decision should be supported by the report.
7. **The HEI subjected to external review should be allowed to propose complaints** and appeals in relation to the conclusions of the agencies that performed the review.

Quality assurance agencies

The quality assurance agencies are called into play in the third part of the document [8] in order to carry on the **external quality assurance activities** defined in the second part.

1. The agencies should have clear and **explicit goals** embedded in their mission, to be made public. **Stakeholders** should be involved in their work and the agencies should be trusted by institutions and the public.
2. These agencies should have a **legal basis** and they should be recognised by competent public authorities.
3. An important requirement is the **independence of these agencies** by any third party, being fully responsible for their operations and for the related outcomes.
4. The work performed by the agency should be published regularly in order to allow for "thematic analyses", aiming at the reflection on the QA practices at institutional, national and international level.
5. Expectedly, these agencies should be equipped with the necessary resources in terms of finance and personnel to carry out this action.
6. The **agencies themselves should have in place an internal quality assurance system**, aiming at keeping high levels of quality and integrity.
7. Finally, **the agencies should be subjected to external quality procedures** at least each five years.

5 ACCREDITATION IN VIEW OF THE E&T AND VET ACTIVITIES IN ANNETTE

5.1 Implication on accreditation of variation in E&T and VET offers in ANNETTE

It is clear that the ANNETTE project is aiming to continuous professional development (CPD), **mixing courses** that are delivered by Universities, research centres and various companies and institutions. The reasons of the mix of courses are multiple and are related to the specific historical period of low nuclear career attractiveness and to the panorama of the expected audience as described in relevant documents and as reported in the discussions had purposely for the stakeholders. These reasons have been reported in details in two deliverables of WP2 [10-11], whose reading is warmly recommended in order to understand the path that led to major decisions in setting up the ANNETTE Courses programme.

We summarise hereafter the various types of offers and some important characteristics of the programme in view of the creation of suitable QA procedures for its pilot delivery evaluation.

- **Some of the courses are delivered by Universities.**
  The ANNETTE project and the Bologna declaration are aligned with each other via following common aspects:
  - the **aim to achieve a real mobility of learners** (more specifically "students" in the academic field);
  - the **attention to lifelong learning** via means not necessarily strictly related to academic routine, to be recognised by Universities assigning ECTS credits;
  - the **attention for quality assurance in a European frame**, being the very subject of the present deliverable.

  The offered academic courses are accredited within their Countries by systems in compliance with ESG 2015. The problem of QA for these courses in terms of "initial accreditation" is already overcome, since they exist in a European frame and the concepts of mutual recognition and trust do apply.

- There are a few **programmes in nuclear disciplines delivered by Universities having a modular structure** which were offered in the frame of ANNETTE (e.g., by BNEN (Belgian Nuclear higher Education Network) and ANPS@KIT, part of the offer from the University of Manchester) sharing the character of being full programmes for nuclear experts delivered with a "modular" structure. Though, many university programmes in nuclear matters are available in Europe, released on a semester basis, the modularity of courses is very instrumental for serving both the nuclear experts, who will preserve bulky competences in the field, and the specialists in other disciplines (e.g., mechanical, electrical, civil, chemical engineers), who need a "minor" education in nuclear matters to operate in the nuclear field (e.g., on nuclear safety culture, on radiation protection, on nuclear technology aspects, etc.).

- Other courses, not being modular, may be released by **e-learning**, in order to serve again both populations of prospective attendees.
  It must be mentioned that e-learning raises problems of QA of its own that should be specifically discussed.

- **Part of the courses are delivered by research centres and companies.** These courses are not necessarily supposed to be involved in systems of QA similar to those suggested by ESG

2015 for higher education institutions. In relation to these courses, the problem of assigning ECTS represents a clear difficulty, unless the courses will be recognised ("a priori" or "a posteriori") by some University.

In relation to this challenge, it must be also admitted that the further development of ECVET, more suitable for training and professional development, seems to be needed to arrive at **useful tool for the activities within and beyond the ANNETTE Project.**

However, it is conceivable to take benefit from the general "philosophy" of ECVET system to propose the framework for building the "ENEN certifications" as accreditation method for ANNETTE (more specific for the European Master Programme for Continuous Professional Development in Nuclear Science and Technology, being developed in WP2 of the ANNETTE project). The ENEN certifications must follow the same rules than an "accreditation" process without being seen as an official process. These practical and technical principles of the ECVET system, could be adapted to the ENEN certifications. However several difficulties exist, one of them is related to the construction of the programs. This concerns the content of the training programs and curricula construction. Indeed, a "Competency-Based Curriculum**"** is needed for Professional Development training program (i.e. curricula based on job profiles) while "competency standards" do not exist at the European level. Other problems linked with the lack of commonly agreed procedures and methodologies for skills and competences evaluation and comparability of competences must be overcome.

It is possible to forecast that ANNETTE and the ECVET system in the nuclear fields will develop together, interacting to provide a first-of-the-kind experiment.

5.2 Stakeholders

Most of the stakeholders of ANNETTE interviewed in regard to accreditation of the courses denied the need to have accreditation by Universities, in particular in the frame of a second level Master, favouring an accreditation or a **certification released by ENEN** [11].

6 PROPOSAL FOR ANNETTE ACCREDITATION

A proposal for the evaluation of the pilot courses being prepared by ANNETTE participants and to be delivered in pilot sessions starting with June 2018 is summarised in the following.

- The Stakeholders suggested to be in favour of an accreditation / certification to be released by ENEN, **"ENEN label"** which will have no legal value in any of the European member states. From this proposal, it seems clear that setting up a system comparable to that proposed and being still implemented for Universities in the European Higher Education Area could be too ambitious for the time being of the ANNETTE project. The **supranational character of ENEN** and the presence in it of diverse institutions, ranging from Universities to research centres and private companies, may suggest shortening the path by creating the "trust" and "mutual recognition", being more formally pursued at academic level, within the frame of the ENEN Association. Such "trust" and "mutual recognition" may be based on "internal consensus" and "peer-reviewing" in the frame of ENEN through the pattern that the recently constituted **ANNETTE Steering Committee** will consider appropriate. In this panorama, the pioneering role of the ANNETTE project in proposing QA procedures for the related courses and of supranational certifications based on consensus instead of being recognised by any of the EU Member States, must be recognized. This is the same rationale adopted for establishing the certification of European Master of Science in Nuclear Engineering (EMSNE).
- Courses are being developed by ANNETTE participants, being Universities or other renowned research institutions; it is not necessary nor feasible to have a formal "initial accreditation" as it is prescribed for Universities according to ESG 2015. However, an a posteriori evaluation of the courses based on indicators to be attentively selected is possible and necessary in view of assessing the effectiveness of the courses and how they were received by the European nuclear community.
- In similarity with what is performed at Universities, learners' questionnaires should be distributed (or an online evaluation system should be set up) to assess the level of satisfaction of the attendance. If possible, the questionnaires (or online evaluation forms) should involve the mentors / employees of the learners (if any), aiming to assess the benefits that the course has produced in the learners from an external point of view.
- At the prescribed time during the ANNETTE project, the already envisaged deliverables D2.5 (Evaluation of the pilot European Programme for CPD and the summer courses), D5.4 (Evaluation of courses on nuclear safety culture) and D6.5 (Participation in the Courses) should summarise the success obtained by courses on the basis of the identified indicators.
- After the ANNETTE project, in the phase of long term sustainability, which is one of the objectives of the project, a panel of experts should be constituted to discuss the adequacy and suitability for the specific needs of the moment of the offer to be proposed each year, introducing new courses and proposing again old ones. In this respect, the "internal" and "external" QA procedures envisaged by ESG 2015 for HEI can be rephrased for the ANNETTE courses in the long term. This will include an internal assessment by course providers and by the ANNETTE Steering Board as well as the collection of judgements by stakeholders, in a process of continuous interaction and improvement, similar to the one suggested by ESG 2015.

7 CONCLUSIONS

The European Master Programme for Continuous Professional Development in Nuclear Science and Technology, being developed in WP2 of the ANNETTE project, needs Quality Assurance procedures that must be implemented coherently with the supranational nature of ENEN and the diversity of the involved course providers.

The previous sections showed clearly that the envisaged procedures inherit some key elements from procedures active in the academic field as well as in in the field of training and from the development of an appropriate metrics to qualify and quantify Knowledge and Skills at the appropriate level of Responsibility / Autonomy (i.e, the ECVET system).

As it is customary for ENEN certifications, such a procedure will take the form of by-laws, to be developed and submitted to the Teaching and Academic Affair Committee of ENEN and to be finally approved by its Board of Governors.

At the time of writing, a draft of these by-laws has been already set up and is being subjected to revision by the Steering Board of ANNETTE Courses, limited in this phase only to ANNETTE beneficiaries. In a further phase, these by-laws and the presently sketched procedures will be subjected also to the consideration of the ANNETTE Advisory Board and End-User Group, in order to achieve their final validation and to establish that climate of “trust” which only can make ENEN certifications understood in their present relevance and accepted for establishing possible future standards in Europe.

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ANNEX I

Major stages in systematic approach to training

A systematic approach to training usually include the following five major stages of the training design and execution ([2], [3]):

1. Analysis of the training needs;
2. Design of the training;
3. Development of the training;
4. Implementation of the training and
5. Evaluation of the training.

Analysis of the training needs

Training needs and the competences required to perform a particular job should be identify. In order to identify the training needs ([2], [3]):

- A plant specific task/competency inventory, developed from a job analysis performed by NPP personnel, training staff, and other appropriate subject matter experts, should be available;
- Job scope changes, unit/plant changes, procedure changes, unit/plant and industry operational experience, and feedback from other sources should be analysed for additions, deletions, or modification to the task/competency inventory;
- Tasks/competencies should be systematically selected for initial and continuing training;
- Tasks/competencies should be analysed to support development of training materials;
- The plant specific task/competency inventory should be clearly linked to training material to indicate the current supporting training programme content for each task/competency.

Design of the training

The aims and learning objectives of the course

The aims of the training should be determined by considering the needs of all interested parties, including the requirements set by the regulatory body [1]. A statement of the aims of the training should include:

- Identification of the body of knowledge to be included in the training;
- Specification of the regulations, guides or other requirements relating to the topics covered;
- Delineation of the work practices, equipment usage and procedures for which the training is to be provided.

A list of objectives will state and describe the competences that the student will be able to demonstrate upon successful completion of the training [1]. Training objectives should be

developed and maintained current to establish the essential training content, the desired progression of learning, and the expected standards of trainee performance [3].

The prerequisites of the course
Trainee entry level requirements should be considered when developing training objectives [3].

The maximum number of participants
The class sizes should be optimized and not too large. To ensure that, trainees should be scheduled [3].

The training syllabus
The syllabus should provide an outline of the content of the training for the guidance of the trainers or supervisors [1]. For preparing the training programme [3]:

- A systematic approach to training should be used to identify, establish and maintain the training programme content. Existing information in the form of guidelines, procedures, training materials, etc. should be taken into account in the identification of training programme content).
- The initial training programme should be based on the performance requirements of the job for which training is being conducted. The consideration of job performance requirements should include an analysis of both the technical and human factors KSAs (knowledge, skills and attitude) required for effective job performance.
- The continuing training programme should maintain and improve the KSAs of job incumbents and should include programme evaluation feedback, regulatory changes, changes in job scope, results of external evaluations and inspections, changes to relevant industry documents, changes in procedures, changes in unit/plant systems and equipment, similar unit/plant experience, results of root cause analyses, equipment and personnel performance trends, and industry experience.

Development of the training

The type of training (e.g. whether it is classroom based training, distance learning or on the job training).
Training activities should encourage direct trainee participation in the learning process ([1], [3]):

- Instructors should use teaching techniques appropriate to the training objectives and lesson content.
- When individualized instruction is used, sufficient guidance and supporting materials should be provided to achieve the training objectives.
- In classroom based training, the lecture content should be restricted to a maximum of six hours and there should be several short breaks during the day.
- It is suggested that the practical classes account for 40 to 50% of the duration of the course.

The training schedule (including the length of the training) and lesson plans if appropriate.
Training schedules should be prepared based on the syllabus [1]. For on the job training (OJT), it is important to prepare a training schedule that takes into account the availability of equipment and the operation of the facility.

A lesson plan should present a more detailed guidance for the trainers and supervisors and typically includes the following information [1]:

- Specific content and key points that should be emphasized.
- Order of learning so that new material will, in most cases, build on material presented previously.
- Details of the key points to be included in the assessment of the course, and when this should take place.
- Suggested training tools, such as demonstrations and practical work.
- A list of available resources (e.g. videotapes, computer simulations, reference material, technical equipment, local rules and procedures).

The training materials and resources available.
Some suggestions regarding the training materials are listed below ([1], [3]):

- The scripts for practical exercises and group work (case studies) need to be clear and concise, and model answers should be provided to the participants at the end of any group activity.
- The training staff should have necessary training aids and equipment.
- Technical reference materials, including plant procedures and drawings, should be current and readily available to trainees and instructors.
- Models, mock-ups, and part task training simulators should be representative of the actual unit/plant.

An example of the relevant equipment in the classroom is in [1].

The practical exercises.
Theoretical information should be reinforced by the effective use of demonstrations, laboratory exercises, case studies, simulations and technical visits [1]. Advices, related to the practical exercises are listed below [3]:

- Training facilities and equipment including simulators should meet current training needs and should be adequately maintained.
- Plant laboratories and workshops used for training purposes should adequately support training activities.
- OJT and simulator training should be delivered by using approved training materials which are well organized and current.
- OJT should be conducted only by designated individuals who are qualified to perform the job and who can provide consistent and effective training and assessment.
- The OJT programme should be implemented by using a planned and logical instructional sequence.

- When the task cannot be performed as OJT, but is simulated or walked through, the conditions of task performance, references, tools, and equipment should reflect the actual task.
- Instructors should use appropriate teaching techniques for the exercise and for the OJT being conducted.
- Assessment of trainee performance should conducted by using established criteria to ensure that the trainee has obtained the essential knowledge and performance skills associated with the job and task before independent job and task assignment; the assessment should conducted by a qualified independent assessor.
- A suitable simulator, representative of the power plant control room, should be used for hands-on training, to demonstrate operational characteristics, and for recognition and control of normal, abnormal and emergency conditions.
- If simulator training is conducted on other than a plant referenced simulator, the training should be adapted to the trainees' home plant.
- Contracted simulator training should be conducted with NPP approved training materials and monitored by utility training personnel to ensure that trainees are achieving the specified training objectives. Contracted training should require vendor instructors to be familiar with differences between the simulator and the trainees' home unit/plant.
- Differences between the simulator and the plant should be reviewed with the trainees before training sessions.
- Procedures used in the trainee's unit/plant should be used whenever possible during simulator training.
- Training should be enhanced by the use of pre-exercise briefs, post-exercise critiques, and self-assessments.
- Individual trainee and team performance should be assessed regularly by line management and training personnel against established objectives by using appropriate methods and performance criteria.

Implementation of the training

The qualifications and experience of the course manager and trainers (including technical abilities in the training topics, teaching and/or training skills and communication skills).

The responsibilities and authorities of personnel involved in managing, supervising, and implementing training should be clearly defined in writing and permit effective control of training activities.

In selecting trainers or supervisors, the following criteria should be considered ([1], [3]):

- Technical ability: the trainer should show evidence of being technically competent in the topic or subject matter being taught and should have relevant practical experience.
- Teaching ability: the trainer should be an experienced instructor with good communicational skills and a demonstrated record of success in teaching and training.
- Training programmes should develop and maintain the necessary instructor capabilities to fulfil training programme requirements in all applicable settings.

- Language skills: the trainer should be fluent and understandable in the language in which the training is being offered.
- The involvement of international trainers and trainers from other centres in the region has significant benefits for participants. The trainers' input to the learning process is enhanced by familiarity with the relevant IAEA publications.
- Training personnel should meet and maintain the educational, technical, and experience qualifications required for their respective positions.
- If occasional instruction is provided by personnel without formal training in teaching KSAs (knowledge, skills and attitude), the training should be monitored by qualified training personnel.
- Personnel who conduct on the job training and assessment should be cognizant of the policies, practices, methods, and standards for conducting on the job training and assessment.
- Instructor performance should be assessed regularly and the results should be used to improve performance.

The academic management of the course (for defining policy, monitoring and evaluating the training or deciding on changes to the training).

Training should be implemented as outlined by approved training materials which should be well organized and current [3]. Policies and procedures to implement a systematic approach to training should be defined and used as the primary means for the management of training programmes [3]. To support the information needs, training records should be maintained.

Evaluation of the training

The means and criteria of assessment of the participants' competence by examination and other means of assessment; the procedures for preparing and approving examination questions; the secure production and storage of examination papers; the procedures for reporting results.

Assessment of the competence of participants should take place at the end of, and sometimes during, the training. Examinations, tests and evaluation of practical work should be used to determine whether the learning objectives have been met and the necessary level of competence has been achieved [1]. In designing an assessment process, the trainer should consider its purpose (legal, administrative or technical). Suggestions, related to the assessment of the participants' competence are listed below ([1],[3]):

- Trainee mastery of training objectives should be assessed regularly by using written and/or oral examinations and tests.
- Written and oral examinations and tests should be administered and graded in a consistent manner.
- Acceptance criteria to be used during the administration of oral examinations should be defined in advance of the examination.
- Regardless of the question style, the questions should generally be designed to test understanding and application rather than just memory.

- The method of conducting practical assessments normally consists of observing the participant, thus the trainer and/or supervisor should use a specific checklist of skills that the participant is expected to demonstrate or actions that he or she should take.
- Remedial training and reassessment should be provided when performance standards are not met satisfactorily.

The quality assurance procedures, internal audits and the mechanisms for evaluation and feedback on the training.

The purpose of evaluation is to determine the effectiveness and impact of the training. Evaluation conducted at the end of a course provides input to the design of future training programmes, allowing modifications and improvements to be made [1]. An evaluation can be performed by [3]:

- To evaluate and improve training programmes, an input from supervisors, managers, trainers, trainees, and job incumbents should be used.
- The conduct of training should be monitored and evaluated regularly in all settings.
- Trainee performance assessed during training should be used to evaluate and improve training programmes.
- Changes such as regulatory changes, changes in job scope, results of external evaluations and inspections, changes in relevant industry documents, changes in procedures, plant systems, and equipment, similar unit/plant experience, results of root cause analysis, equipment and personnel performance trends, and industry experience should be evaluated for applicability to initial and continuing training programmes.
- Improvements and changes to initial and continuing training should be systematically initiated, monitored and incorporated in a timely manner.
- Evaluations of individual training programmes should be conducted on a continuing or periodic basis to identify programme strengths and weaknesses.
- Contracted training should be evaluated for its contribution to meeting job performance requirements and to ensure that its quality is consistent with training standards.
- In addition, there is merit in having periodic (independent) assessments of training by individuals who have expertise in the subject matter and in training methodologies. Such reviews would typically take place every two or three years and include an evaluation of training in terms of course content, presentation methods, qualifications of the trainer, course organization, lesson plans, training materials, participant assessment, record keeping and administrative procedures. An evaluation of this type is essentially an independent audit of the training.

It is noted that similar factors are listed for internal and external evaluation of the programmes for example in [3]

ANNEX II

Criteria for the ECVET quality assurance procedures

Criteria for the ECVET quality assurance procedures can be deduced from the 4 steps model generally used for management purpose consisting in: input, process, output, and review.

Input

Program design: The proposed program belongs to the institution's mission and its regulatory framework. It benefits from sufficient resources, identified and assigned by the institution. The program is coherent and corresponds to the expected academic level. It is compatible with the other already accredited program and follows the current national/European standards and regulations.

Applicant admission: Potential applicants have freely access to documents explaining clearly the objectives of the training, the level, conditions and requirements for entrance to and achievement of the program. Admission rules comply with respect of the equity principle. The number of accepted applicants takes into account both professional needs of the business sector and the capacity of the institution to supply high quality training.

Staff: Teaching staffs have the necessary qualifications and experience. Staffs have sufficient resources to assure high quality training. Staffs master teaching methods so all activities related to the program can be carried out effectively.

Teaching strategy: The teaching strategy is defined and is appropriate for the delivery modes. The program has plans for implementation, and mechanisms to monitor progress and evaluate impact. The program is provided with sufficient resources to make any necessary improvement.

Assessment policies and procedures: The evaluation includes all procedures intended to measure the results of the applicants in assimilated knowledge and understanding and in acquired skills. Evaluation objectives and modality are clearly defined and are accessible to the applicants.

Program management: The program has effective management and administrative services for providing the integrity of processes and achieving the qualification objectives.

Process

Coordination: The program is effectively coordinated by a team comprising academics and administrative staff that can quality-assure the overall processes. The program has suitable resources for achieving its expected outcomes.

Delivery: Teaching methodology is adequate respective to expected outputs, resource allocated and program curriculum. There are transparent rules for applicant selection and admission. Responsibility of both teaching staffs and applicants are clearly stated.

Student assessment: The program has assembled necessary tools to guarantee the validity, reliability, and security of the applicant assessment procedure.

Output

Communication: The program has effective strategy for benchmarking and monitoring information on applicant retention, rate of success and employability.
External impact: The program is acknowledged by the end-users and by other institutions. A plan exists for monitoring the impact of the program in the workplace and put into operation improvement actions if necessary.

Review

The program is provided with appropriate mechanisms to allow end-users' survey. The review of the program is planned in regular interval. Adequate mechanisms exist to improve program design, delivery and resources.