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**1ST SITUATION REPORT ON EDUCATION AND TRAINING IN THE NUCLEAR
ENERGY FIELD IN THE EUROPEAN UNION**

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1. EUROPEAN NUCLEAR ENERGY FORUM - ENEF

The European Nuclear Energy Forum (ENEF) is a unique platform for a broad discussion, free of any taboos, on transparency issues as well as the opportunities and risks of nuclear energy. Founded in 2007, ENEF gathers all relevant stakeholders in the nuclear field: governments of the 27 EU Member States, European Institutions including the European Parliament and the European Economic and Social Committee, nuclear industry, electricity consumers and the civil society.

ENEF goes back to an initiative of the European Commission that was endorsed by the leaders of the 27 EU Member States in March 2007. During their summit, they demonstrated that the EU is taking the lead in the fight against global warming.

EU heads of state and government adopted an energy policy for Europe which does not simply aim to boost competitiveness and secure energy supply, but also aspires to save energy and promote climate-friendly energy sources. Taking into account the substantial contribution of nuclear energy to meeting these challenges they endorsed the Commission proposal to organize a broad discussion among all relevant stakeholders on the opportunities and risks of nuclear energy.

As a concrete follow-up, the Prime Ministers of the Czech Republic and Slovakia agreed to jointly host this nuclear discussion forum, the "European Nuclear Energy Forum", which is organized successively in Bratislava and Prague.

During the inaugural meeting on 26 and 27 November 2007 in Bratislava, three working groups on "Risks", "Opportunities", and "Transparency" have been set up, which meet more frequently and prepare the ENEF gatherings.

The Working Group "Opportunities" covers in Sub-Working Groups the issues competitiveness, financing models and a legal roadmap.

The Working Group "Transparency" concentrates on establishing a roadmap on better information and transparency in the nuclear field, developing an appropriate consultative process and initiating concrete structured stakeholder dialogues beyond the European Nuclear Forum meetings to broaden the discussion basis.

The Working Group "Risks" covers in a number of Sub-Working Groups the topics nuclear installation safety, radioactive waste management, non-proliferation as well as education and training.

The Education and Training Sub-Working Group elaborated two concrete initiatives to deal with the increasingly challenging situation of nuclear human resources, both of which have been implemented by now: the European Nuclear Energy Leadership Academy founded last year by six companies has started its first course this year and the European Human Resources Observatory for the Nuclear Energy Sector (EHRO-N), see annex 2.

2. EUROPEAN HUMAN RESOURCES OBSERVATORY IN THE NUCLEAR ENERGY SECTOR - EHRO-N

In its conclusions of December 2008 the European Council pointed out that “there is a real risk of the loss of nuclear knowledge for the European Union if no measures are taken.” It also emphasized strongly that “the preservation of skills in the nuclear field requires a general effort involving public and private players and in particular the nuclear industry.” Furthermore, the Council Directive of 25 June 2009 on establishing a Community framework for the nuclear safety of nuclear installations in its article 7 reminded the Member States that arrangements for education and training needed to be made in order “to maintain and to further develop expertise and skills in nuclear safety”.

One of the European Commission' (EC) answers to the above challenges is the setting up of a European Human Resources Observatory for the Nuclear Energy Sector (EHRO-N) as proposed by the ENEF Working Group Risks. The EC's Joint Research Centre (Institute for Energy) was charged with the management and operation. A Senior Advisory Group (SAG) is providing guidance on conceptual issues.

EHRO-N shall:

- produce and regularly update a quality-assured data base on the short-, medium and long-term needs of human resources for the different stakeholders in nuclear energy and nuclear safety. The data should be structured according to the required qualifications (i.e. disciplines and specializations, main non-academic and academic levels, need for specific practical skills or theoretical knowledge) and allow proper analyses on the trends to be performed.
- identify gaps and deficiencies in the European nuclear E&T infrastructure and elaborate recommendations for remedial actions and optimizations.
- play an active role in the development of a European scheme of nuclear qualifications and mutual recognitions
- use existing information (e.g. results of existing national and sectoral surveys and data produced by specific nuclear stakeholders) but should critically review those data in order to ensure their consistency with European energy supply strategies and likely medium- and long-term developments of the global nuclear sector.
- regularly communicate by conventional and electronic means relevant data to the Member States governmental, academic and private organizations involved in nuclear education and training. Moreover the Observatory should take an active part in the communication of nuclear HR issues and their relevance to the public.

Instruments:

A. The EC-JRC-IE is the Operating Agent which provides the necessary infrastructure, networking, analyses capabilities and long term stability. Activities are focused on setting up and maintenance of a database and conduct of regular analyses, reviews, compilations, specification and the tendering of specific studies, production and the distribution of regular communications, organisation of workshops and meetings, support of the steering group,

establish and maintain close links to organisations involved and providing co-ordination as necessary. The Operating Agent is proposing initiatives to strengthen nuclear human resources capacity in EU

B. The Senior Advisory Group (SAG) is composed of senior experts from EU major nuclear stakeholders, meets two times per year and is focusing on providing general guidance on conceptual issues, such as, for example, type of data and data quality required, analysis to be performed, endorsement of major EHRO-N reports, preparation and conduct of major communication actions.

The actual operation of EHRO-N has resulted already in development of several surveys, studies and reports being in a final stage of preparation. The EHRO-N website for dissemination of relevant information is prepared. The Commission will provide to the Council regular updates on the progress of EHRO-N

3. INITIATIVES UNDER THE EURATOM FRAMEWORK PROGRAMME

One of the main goals of the Euratom research and training programs is to contribute to the sustainability of nuclear energy by generating knowledge and developing competencies. Euratom training programs aim at offering European responses most notably to the new structure of nuclear industry and regulation, that is: the increasingly international character on nuclear business, the deregulation and privatisation of the energy market, a trend towards outsourcing of activities, and new approaches for the management of advanced technologies and human resources.

As a consequence, the new schemes for knowledge creation and competence building in the EU should take special care of the requirements of borderless mobility and lifelong learning. One of the aims could be to produce, for example, "European Skills Passports", wherever appropriate, thereby preparing a new generation of leading European talents in nuclear fission technologies. Borderless mobility means, in particular, the mutual recognition of competences and qualifications amongst the Member States and, consequently, the free circulation of nuclear experts, with a view to continuously improve and disseminate the nuclear safety culture. Lifelong learning means, in particular, the qualification of continuous professional development (CPD) schemes, based on a variety of education and training paths, such as: formal or informal learning; traditional or virtual classroom training, using advanced videoconferencing systems; short technical visits to nuclear installations or longer internships in industry or research laboratories, etc.

Faced with the challenges of borderless mobility and lifelong learning, it is quite natural to adopt (like other large industrial sectors in the EU such as aeronautics and automotive) the European Credit system for Vocational Education and Training (ECVET) – see Recommendation of the European Parliament and of the Council of 18 June 2009¹. ECVET's objective is to promote mutual trust, transparency and recognition of competencies and qualifications in VET across the 27 EU Member States.

¹ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2009:155:0011:0018:EN:PDF>

As far as Euratom is concerned, the Sustainable Nuclear Energy Technology Platform (SNE-TP), composed of all stakeholders of nuclear fission and radiation protection (over 75 organizations), is a driving force, amongst others, in programmes for education and training as well as knowledge management (ETKM group). Euratom training activities are usually addressed to research and industry workers with higher education level, that is: corresponding to EQF levels 6 to 8 (European Qualifications Framework).

According to the IAEA definition, competence means the "ability to apply knowledge, skills and attitudes so as to perform a job in an effective and efficient manner and to an established standard (S.S.S. No. RS-G-1.4/2001)". Knowledge is usually created in higher education institutions (e.g., universities) and in (private and public) research organizations. Skills and attitudes are usually the result of specific training and on-the-job experience throughout professional life.

The Euratom training strategy is based on three objectives, as a result of discussions with the main stakeholders in all areas (reactor safety and performance; radioactive waste management; radiation protection, medical applications of ionising radiations, etc):

- (1) Analysis of the needs of industry and society, in particular, with regard to training in nuclear safety culture. This issue raises questions, like: How can the current Continuous Professional Development (CPD) schemes be improved in view of the new structure of nuclear industry and regulation? Wherever a "European Passport" is appropriate, what kind of knowledge, skills and attitudes is needed, and what are the established standards?
- (2) Convergence toward a common vision that puts the above needs in an EU perspective. This means, for example: Identify new job profiles and competencies, focussing on the continuous improvement of not only safety and performance, but also sustainability, economics and proliferation resistance; Design new training schemes in the context of borderless mobility and lifelong learning and discuss them with the various human resource departments.
- (3) Development of common instruments that meet the above needs and vision. This necessitates, for example: the definition of "learning outcomes" in terms of knowledge, skills and competences that are recognized in the EU (ECVET); the identification of portfolios of learning outcomes that will allow an individual to prove his competencies in a coherent manner recognized by all employers in the EU; political support and funding sources at national and EU level.

In this context, a number of "Euratom Fission Training Schemes" (EFTS) were launched in specific areas where a shortage of skilled professionals has been identified. The EFTS is a significant development aimed at structuring training and career development across the EU. Each EFTS is a long-term (usually 3 years) and ambitious (up to 2 million Euros) training program, relying on the participation of all stakeholders concerned with nuclear competencies. To ensure the highest quality of these training activities, a non-profit association was formed

in September 2003. This legal entity, located at CEA-INSTN Paris, is the European Nuclear Education Network (ENEN²).

Currently there are five Euratom FP-7 projects of the EFTS type. They are examples of Euratom responses to the need of specific competencies in some selected domains, using the above ECVET tools:

- TRASNUSAFE - *Nuclear Safety Culture*: addressing mainly the health physics sector (e.g., ALARA principle)
- ENEN III Training schemes - *Generation III and IV engineering*: addressing mainly the nuclear systems suppliers
- ENETRAP II - *European Network on E&T in Radiological Protection*: addressing mainly the nuclear safety authorities (e.g., Radiation Protection Expert)
- PETRUS II - *Program for Education, Training, Research on Underground Storage*: addressing mainly radwaste agencies
- CINCH - *Nuclear and radio-chemistry*: addressing mainly the sector of the nuclear fuel cycle.

Two further EFTS will probably be funded following the 2011 call ("VVER safety culture" and "cooperation with Canada", resp.) and more are expected in the future.

(1) TRASNUSAFE - Nuclear Safety Culture

The focus in this EFTS (19 Participants) is on competencies required by the health physics sector (e.g., ALARA principle). This FP-7 project is designing, developing and validating two training schemes on nuclear safety culture, with a common basis. One scheme is related to the nuclear industry and the other to installations making use of ionising radiation. The target public are professionals in charge of health physics control in nuclear power plants and of radiotherapy services in hospitals.

(2) ENEN III Training schemes - Generation III and IV engineering

Here, the focus is on competencies required by nuclear system suppliers. This EFTS (19 Participants) is organizing four training schemes:

- Basic Nuclear Topics for Non-Nuclear Engineers;
- Design Challenges for Generation III NPP (2 professional profiles);
- Construction Challenges for Generation III NPP (2 professional profiles);
- Design Challenges for Generation IV Reactors.

² www.enen-assoc.org

(3) ENETRAP II - European Network on E&T in Radiological Protection

This EFTS (12 participants) focuses on competencies required by Euratom legislation in each Member State (96/29/Euratom Directive - EC proposal on revised Basic Safety Standards in 2011). The emphasis is on the development of European standards in synergy with the competent authorities and the setting up of an EU-wide recognised "European radiation protection training scheme" (ERPTS) for initial education and continuous professional development for radiation protection experts (RPEs) and radiation protection officers (RPOs).

(4) PETRUS II - Program for Education, Training, Research on Underground Storage

The focus here is on competencies required by radwaste agencies (e.g., repository and engineered systems design). In this EFTS (14 participants), a Science and Technology Passport is being developed. A preliminary survey of the "market" showed that a number of Training Courses do already exist in the areas of interest. To complete the passport, a series of new courses are being organized in the Euratom framework.

(5) CINCH - Cooperation in education in Nuclear Chemistry

The consortium of this EFTS (7 participants) includes academia and "future employers", who represent all the key players. The EU experience is faced with the Russian expertise. A set of compact joint modular courses (including internships) is being produced in different branches of modern nuclear chemistry. A long term strategy for the nuclear chemistry education will be established, including a roadmap for its implementation.

4. JRC INITIATIVE "THE EUROPEAN SCHOOL FOR NUCLEAR SAFETY AND SECURITY"

4.1. Nuclear Education and Training: a key to innovation and growth

Education and training in the field of Nuclear Science and Technology must be considered a key component of the nuclear infrastructure worldwide, as clearly stated at the G8 2009 Summit.³ However, concerns have been raised that nuclear education and training is not at the level where it should be, as summarized in the OECD/NEA report⁴ "*Nuclear Training and Education. Cause for Concern?*" due to:

- The decreasing number and the dilution of nuclear programmes.
- The decreasing number of students taking nuclear subjects.
- The lack of young faculty members to replace ageing and retiring faculty members.
- Ageing research facilities, which are being closed and not replaced.
- The significant fraction of nuclear graduates not entering the nuclear industry.

³ http://www.g8italia2009.it/static/G8_Allegato/NSSG_ET-ICB_Final_28May_OK%5B1%5D,0.pdf

⁴ <http://www.nea.fr/ndd/reports/2000/nea2428-education.pdf>

These concerns as well as the aim to maintain the current high level of nuclear safety, led the Council of the European Union to conclude that "*it is essential to maintain in the European Union a high level of training in the nuclear field*"⁵

In contrast to other fields of science and technology, nuclear education and training has not been primarily the domain of the academic institutions because of the specific infrastructure needs. Whereas nuclear reactor technology is generally well covered at universities, the knowledge and capabilities of handling nuclear materials are traditionally concentrated in national and international research facilities that have the appropriate infrastructure, ensuring the high level of operational safety and security required. As a result, nuclear education and training have been the common effort of universities and (inter)national laboratories in many countries. The role of the European Commission in this context was defined in the Euratom Treaty (Rome, 1957) in which it is explicitly mentioned that "*The Commission shall be responsible for promoting and facilitating nuclear research in the Member States and for complementing it by carrying out a Community research and training programme.*"

In the light of this, the Joint Research Centre of the European Commission will make its nuclear facilities available to enhance existing graduate programmes at leading universities in Europe providing a unique set of tracks, with the goal to offer specialisation in fields of nuclear science related to nuclear security and safety, nuclear materials, nuclear data, and actinide science. These tracks will enable the students to get hands-on experience in JRC's unique and specialised nuclear laboratories and participate to cutting-edge research, increasing the value of their curriculum significantly. In parallel, the JRC and its academic partners will join efforts to offer post-graduate training courses for (young) researchers and engineers working in, among others, industry, consultancy companies, public authorities, or regulatory agencies, to enhance their knowledge, with emphasis on issues related to the nuclear fuel cycle for which the nuclear materials issue plays an important role.

4.2. Education

During the last decade a number of universities in the European Union have initiated Master of Science degrees in nuclear science or nuclear technology, or have embedded nuclear oriented specialisation in other tracks. They offer a wide scope of courses and training in the nuclear field for the MSc graduates, but are generally lacking the possibility of specialisation in tracks strongly related to the nuclear fuel cycle, for which the handling of nuclear materials is required. European universities have nowadays limited opportunities for working with radioactive materials in practical quantities and must rely on collaboration with specialised non-academic institutions. For that reason the following tracks are under consideration for the graduate programme between the JRC and its partner universities in the frame of the *European School for Nuclear Safety and Security*:

- E1. Nuclear Security, Safeguards and Forensics
- E2. Nuclear Fuels
- E3. Nuclear Fuel Reprocessing
- E4. Nuclear Waste and Decommissioning
- E5. Physics and Chemistry of the Actinides
- E6. Nuclear Data

⁵ <http://register.consilium.europa.eu/pdf/en/08/st15/st15406.en08.pdf>

The students enrolled in these tracks will be hosted by the JRC laboratories, but will remain affiliated to the universities, which are responsible for the assessment of the work and the awarding of the degree. They will follow common courses (by laboratory staff and university teachers), will be tutored by a specialist in the field of their chosen track, and perform practical work. A limited number of places will be available each year and selection of the applications from the partner universities will be made by an evaluation committee, considering that the proposed research must be of common interest. The goal is to attract highly talented students to the field of nuclear science, with the prospect to be educated by European specialists from academic community, and work in a world-class laboratory.

4.3. Training

Parallel to the education of students, a series of post-graduate training courses for professionals working in the field of the nuclear fuel cycle will be organised in the frame of the *European School for Nuclear Safety and Security*, with emphasis on nuclear materials management. The goal of these courses is to enhance the knowledge of young professionals via a series of dedicated training courses with on-site practical demonstrations and exercises. In the first phase the following one-week to three-week courses will be offered on a yearly basis:

- T1. Nuclear Safeguards and Forensics
- T2. The Nuclear Fuel Cycle (from mine to waste)
- T3. Nuclear Materials
- T4. Practical Aspects of Nuclear Fuel Cycle Facilities
- T5. Safety of Current and Future Nuclear Reactors
- T6. Decommissioning of nuclear installations

The courses will be comprehensive and timely, integrating the current advances in experimental and simulation techniques. They will have an advanced level, with particular attention on the practical aspects of handling of and working with nuclear materials, with demonstrations on-site. A training passport will be issued to the participants that will follow four courses within a period of three years. Lecturers will come from the consortium partners, but also recognised international experts will be involved. The course content will be defined in close consultation with the members of the advisory board, composed of representatives of industry, consultancy companies, and regulatory bodies in the nuclear field.

5. EUROPEAN NUCLEAR ENERGY LEADERSHIP ACADEMY - ENELA

The European Nuclear Energy Leadership Academy (ENELA) was established in January 2010 by six of Europe's leading nuclear companies (AREVA, Axpo, EnBW, E.ON Kernkraft, URENCO and Vattenfall) to train future leaders in the nuclear industry. The European Commission actively supported the launch of the Munich-based academy whose idea was created in ENEF. The mission of ENELA is to equip those working in and those working alongside the nuclear energy industry with the skills and expertise they will need to become future leaders and to ensure the further development of sustainable European nuclear energy solutions.

ENELA's training programmes are based on a practice-oriented management and leadership scheme. They will focus on technical, scientific, legal, economic, political, strategic and business aspects. Also communications and public affairs are key themes throughout.

The ENELA Leadership Cycle (ELC) is dedicated to experienced professionals, the full-time one-year ENELA Management Programme (EMP) to young professionals and graduates. In addition to the training programmes, the ENELA Conference Cycle (ECC) is under development, which is destined to become a centre of excellence for presenting and debating facts about nuclear power as part of the wider energy mix.

ENELA Leadership Cycle – ELC

ENELA Leadership Cycle candidates are future top-level managers. ELC aims to give high-potential professionals and senior managers – with technical and non-technical backgrounds – a broad understanding of the global nuclear energy sector.

The cycle covers the whole nuclear value chain and is designed to fully equip candidates as they prepare to move toward the next levels of leadership and management in their professional spheres.

When training is complete, an alumni network will be established to ensure that fellows can continue to build on the ENELA experience and maintain contacts with the academy while networking with each other.

ELC is a specifically-designed, practical approach to prepare fellows for the future by examining all key issues impacting the nuclear energy industry.

ENELA Management Programme – EMP

This training programme is designed for young professionals and graduates, with technical and business management or administration backgrounds – not necessarily with a nuclear energy component – and whose goal is to acquire an in depth understanding of the nuclear energy context, technology and business, to take part in the further development of economic, safe, reliable and clean nuclear energy.

During the programme, fellows will have an opportunity to acquire a complete, all-round nuclear experience with training adapted to enhance personal management and communication skills via classroom training, practical exercises, case studies, team-building activities and direct access to organisations and industrial installations.

ENELA Conference Cycle - ECC

ENELA Conference Cycle is a networking centre of excellence for nuclear policy-makers and opinion formers to debate and tackle the most challenging issues involving nuclear power as part of the global energy mix and to equip those who need to know about nuclear energy with the knowledge they will need to make informed decisions.

6. EUROPEAN NUCLEAR SAFETY TRAINING AND TUTORING INSTITUTE - ENSTTI

The European Nuclear Safety Training and Tutoring Institute, ENSTTI is an initiative of European Technical Safety Organizations. ENSTTI provides vocational training and tutoring in the methods and practices required to perform assessment in nuclear safety, nuclear security and radiation protection. ENSTTI calls on European Technical Safety Organizations' expertise to maximize the transmission of safety and security knowledge, practical experience and culture.

ENSTTI offers short applied training sessions and longer tutoring periods both for young professionals and for those with some professional experience in the nuclear sector. All course programs include working groups, simulator sessions, technical visits and open discussions. Certificates are delivered at the end of training periods reflecting the knowledge acquired.

During the tutoring periods customized to each applicant's future work, trainees work alongside an expert with safety responsibilities within its own organization. The content and duration of tutoring periods are adapted to the profile of each individual. The personalized support is continued through regular contacts with safety experts once the trainee returns to work.

ENSTTI lecturers and trainers are recognized experts in their technical domain coming from European Technical Safety Organizations.

The 2011 Programme covers

- Reactor safety
- Accident Prevention

7. WORLD NUCLEAR UNIVERSITY - WNU

The World Nuclear University is a global partnership committed to enhancing international education and leadership in the peaceful applications of nuclear science and technology. The central elements of the WNU partnership are:

- The global organizations of the nuclear industry: World Nuclear Association (WNA) and World Association of Nuclear Operators (WANO)
- The inter-governmental nuclear agencies: International Atomic Energy Agency (IAEA) and Nuclear Energy Agency of the Organization for Economic Cooperation and Development (OECD-NEA)
- Leading institutions of nuclear learning in some thirty countries.

The WNU was inaugurated in 2003.

As non-profit corporation, the WNU pursues its educational and leadership-building mission through programmes organized by a Coordinating Centre (WNUCC) in London.

Operationally, the WNU is a public-private partnership. On the public side, the WNUCC's multinational secretariat is composed mainly of nuclear professionals supplied by governments; the IAEA further assists with financial support for certain WNU activities. On the private side, the nuclear industry provides administrative, logistical and financial support via the WNA.

Structure and Resources

During its start-up phase, WNU operations have relied mainly on assigned cost-free staff and are designed to be largely self-financing.

In a second stage, it is envisaged that the WNU agenda will expand to include an even more ambitious slate of programmes, to include the management of a major scholarship endowment financed by philanthropic contributions.

WNU Programme Overview

WNU programmes are intended to complement existing institutions of nuclear learning by filling unmet educational and training needs on the international level. These programmes are designed to capitalize on the WNU's strength as a partnership that draws on support from industry, governments and academia.

To date, WNU programmes have focused on building nuclear leadership and providing orientation on the main issues that affect the global nuclear industry today. As of September 2009, nearly 2,000 nuclear professionals and students from over 60 countries will have participated in such programmes.

Plans for future WNU programmes envisage widening their scope to include:

- Fostering industry and regulatory consensus on issues affecting nuclear industry operations
- Building policy consensus on a sound multinational framework to govern expanding nuclear commerce and power production
- Facilitating multinational academic cooperation
- Enhancing public understanding of nuclear science and technology

WNU Summer Institute

The WNU Summer Institute is a six week leadership development programme held annually at Christ Church, Oxford, UK.

The WNU Summer Institute curriculum provides cutting-edge presentations on the full range of topics relevant to the future of nuclear technology:

8. OECD NUCLEAR ENERGY AGENCY - OECD/NEA - AD HOC EXPERT GROUP ON EDUCATION, TRAINING AND KNOWLEDGE MANAGEMENT (ETKM)

Since the 2000 OECD/NEA report "Nuclear Education and Training: Cause for Concern?" flagged the magnitude and urgency of the issue to governments, a number of actions have been taken which have led to significant improvements in several areas. In some countries, specific plans to support universities have been successful in reversing the declining trends of the number of graduates in nuclear engineering, whilst various international programmes have been initiated which strive to foster regional and trans-national co-operation and to improve educational infrastructure at universities, research institutes and industrial facilities in the nuclear field.

While significant progress has been triggered in some cases, strains in the human resources capacity remain strong. The retirement or impending retirement of many of the generation which built the existing nuclear power plants and were involved in nuclear R&D in the 1960s and 1970s enhances the risk that collective knowledge and experience of the nuclear industry may be lost over the next few years.

Against this backdrop, the NEA Committee for Technical and Economic Studies on Nuclear Energy Development and the Fuel Cycle (NDC) decided to undertake this activity on education, training and knowledge management.

The ETKM expert group was therefore established in October 2009 to conduct a study, with the assistance of the Secretariat. The publication of the results is foreseen at the end of 2011 in a report entitled "Nuclear Education and Training: Assuring a Competent Workforce". Building on existing work by the NEA, the International Energy Agency, the European Community and other organisations, the study will aim at:

- collecting and analysing data related to the issues of education, training and knowledge management, the current situation and future needs;
- assessing initiatives already underway or planned, measures which are being taken in different countries to preserve the nuclear knowledge base, and the contribution of international initiatives;
- drawing conclusions and recommendations for best practice on policy options to remediate any gaps, which could be more widely adopted by governments.

9. INTERNATIONAL ATOMIC ENERGY AGENCY – IAEA - NUCLEAR KNOWLEDGE MANAGEMENT

In 2006, the IAEA General Conference reiterated earlier resolutions on nuclear knowledge that request the IAEA to develop corresponding activities to address current challenges. To this end, the IAEA is implementing a special sub-programme on Nuclear Knowledge Management which focuses on:

- Developing methodologies and guidance documents for nuclear knowledge management;
- Facilitating nuclear education, training and information exchange; and

- Assisting Member States in maintaining and preserving nuclear knowledge.

Every year, the Department of Nuclear Energy issues numerous publications. Most are available as Nuclear Energy Series publications; they are organized hierarchically by area and topic, and can be searched and downloaded in PDF.

The IAEA also maintains a growing database of annotated links to Web sites on the Internet that are related to various fields of nuclear science and technology and the IAEA's work.

Furthermore, the IAEA maintains an edited worldwide listing of current and planned conferences, symposia, seminars, exhibitions and training courses related to nuclear energy and its peaceful uses. This on-line edition is updated regularly and features the most current information available to the IAEA

Finally, an IAEA's Agency's Reactors Knowledge Base serves the information needs of professionals in the field of nuclear reactor R & D.

10. INTERNATIONAL SCHOOL OF NUCLEAR LAW - ISNL

The International School of Nuclear Law (ISNL) was established in 2001 by the NEA and the University of Montpellier 1. Its objective is to provide a high quality, intensive course of education in international nuclear law to law students at doctoral or masters level and to young professionals in the nuclear sector who wish to develop their knowledge.

Participants study all essential aspects of nuclear law: radiological protection, nuclear safety, radioactive waste management, transport of nuclear materials, physical protection, non-proliferation, regulation of trade, environmental protection and nuclear third party liability and insurance.

The ISNL aims to provide a high quality course of education on the various aspects of this discipline. It is open to law students pursuing their studies at doctoral or masters level who wish to follow an introductory course on nuclear law and familiarise themselves with career opportunities open to them in this field. It is also open to legal professionals who are already active in the nuclear sector and who wish to develop their knowledge.

Independent of its teaching role, the School serves as a forum for students to meet renowned specialists in nuclear law in a studious yet convivial atmosphere.

In addition, participants enrolled in the ISNL programme have the possibility of applying for a University Diploma (Diplôme d'université - D.U.) in International Nuclear Law. This Diploma is recognised within the ECTS (European Credit Transfer & Accumulation System).

Lectures are delivered by renowned specialists in nuclear law, particularly from academic circles, specialised international organisations, the nuclear industry and insurance sector, and other experts in the nuclear field.

11. SUSTAINABLE NUCLEAR ENERGY TECHNOLOGY PLATFORM - SNETP

Within the European Union's energy policy, the Strategic Energy Technology Plan (SET-Plan) identifies a set of competitive low-carbon energy technologies to be developed and deployed in Europe, with nuclear fission representing a key contribution.

The Sustainable Nuclear Energy Technology Platform (SNETP) promotes research, development and demonstration of the nuclear fission technologies necessary to achieve the SET-Plan goals in this field:

- For the year 2020: (1) maintain competitiveness in fission technology, (2) provide long-term waste management solutions,
- For the year 2050, act now to: (1) complete the demonstration of a new generation (Gen IV) of fission reactors with increased sustainability, (2) enlarge nuclear fission applications beyond electricity production.

The SNETP was officially launched on September 21, 2007. Today, SNETP gathers about 80 European stakeholders from industry, research and academia, technical safety organisations, non-governmental organisations and national representatives.

Since its launch in 2007, SNETP's aims to:

- Preserve and strengthen the European technological leadership and nuclear industry;
- Enhance Europe's technological leadership in nuclear science and engineering; and
- Contribute to the production of synthetic fuels and hydrogen needs on the basis of non greenhouse gas emitting production sources in an environmentally benign and sustainable economy.

The SNETP's tasks are multiple. One important task is to

- promote a coordinated training and educational system for developing nuclear competence in Europe as a significant cross-cutting activity.

A working group was created to provide a coherent approach for education, training and knowledge management (ETKM).

The ETKM Working Group includes stakeholders from research institutions, industry and EU organisations, with essential support from the European Nuclear Education Network (ENEN).

The Group will:

- identify education and training gaps and recommend actions at appropriate levels,
- take account of the knowledge that was accumulated in companies, research centres or regulators and recommend actions for transferring it to younger generations,

- support the dialogue on international cooperation in the field of education, training and knowledge management between EURATOM and non-EU countries.

The objectives of the ETKM Working Group are:

- to identify a course of action to secure an adequate resource of well educated and trained young professionals to support the research recommended in the Strategic Research Agenda (SRA),
- to identify the steps required to meet the demand of industry for new competent personnel and the need for teachers in academia,
- to collate the facilities, both existing and required, to develop the future human resource necessary to support the SRA.

The working group will recommend to the SNETP Governing Board a future framework for nuclear education, training and knowledge management at the European level; in a second step, it will implement this in a sustainable manner to ensure further development of nuclear energy technology in Europe.

In December 2010, the ETKM WG produced together with FORATOM a report entitled: "Nuclear Education and Training : Key Elements of a Sustainable European strategy". In this report, they provided a comprehensive overview of the current situation as seen by the group, along with the following dedicated recommendations how to address the challenges of the future:

- (1) Key stakeholders in nuclear energy and nuclear safety should develop a 'common language' for employments as well as education and training for nuclear energy, including a common taxonomy of skills and competencies linked to jobs.
- (2) Key stakeholders in nuclear energy and academic institutions should engage in a joint action to optimize the curricula of academic programmes related to nuclear energy with special regard to the needs by 2020 and to the potential synergies between academic and non-academic programmes for graduates.
- (3) Private-public partnerships for nuclear education and training need further support and funding in order to be able to cater for the expansion in E&T programmes, the training of trainers and providing the necessary guidance.
- (4) The framework for mutual recognition of qualifications should be further developed with the objective of gradually including non-academic qualifications and related vocational training. This should include the identification of 'Competent Institutions' in the EU that can provide qualifications or portfolios of learning outcomes, and pilot exercises to apply to 'learning outcomes' approach within ECVET partnership.
- (5) Recent European initiatives such as EHRO-N, ENEN and JRC databases, which depend on input from and cooperation with national organizations, should receive appropriate support.

- (6) The existing European initiatives for facilitating transnational access to facilities for the purpose of education and training should be optimized and coordinated in view of building a European platform for E&T-related facilities and IT infrastructure.
- (7) The existing European initiatives for cooperation with non-European countries in nuclear education and training should be strengthened and integrated as part of the general strategy of enhancing international cooperation in nuclear research and nuclear safety.
- (8) Key organizations within the EU should cooperate in the further development and maintenance of European databases and IT platforms intended to support nuclear education and training and in the provision of information on related programmes and opportunities.