International Conference on Human Resource Development for Nuclear Power Programmes: Building and Sustaining Capacity (Strategies for Education and Training, Networking and Knowledge Management) IAEA CN-215

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IAEA Introduction

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Strategic International Cooperation of Fukui Pref. Gov. in Human Resources Development for Nuclear Power Programmes

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The Fukui Prefectural Government has been hosting 13 nuclear power plants and FBR Monju. Fukui International Human Resource Development Center for Atomic Energy was established in April 2011 aiming to support capacity building, in particular human resource development, for emerging countries to introduce the first nuclear power plant.
The Fukui Pref. Gov. has signed the Practical Arrangement with IAEA in Oct. 2013 for the cooperation in promotion of nuclear technology for nuclear power and radiation/isotopes applications with emphasis on HRD. The Fukui Pref. Gov. has strategic plans to share its experience hosting nuclear power plants in terms of stakeholder involvement, better communication with communities near nuclear power plants, development of these communities, and improved coordination with the utilities operating nuclear power plants.
In addition to 13 NPPs there are training center for nuclear plant operators, radiation monitoring center, off-site center for emergency, Institute of Nuclear Safety System, University of Fukui and Fukui University of Technology which have nuclear engineering faculty in Fukui Pref. These facilities and academic institutes with a variety of experts of nuclear power are highly useful to the international HRD programmes.
Since 2011 Fukui International Human Resource Development Center for Atomic Energy has been organizing a number of international training courses in cooperation with the Ministry of Education, Culture, Sports, Science and Technology (MEXT), Ministry of Economy, Trade and Industry (METI), and IAEA focusing on the area of nuclear power to support emerging countries. These activities have been highly appreciated by the recipient countries.
In view of energy security, mitigation of GHG emission and economic competitiveness, nuclear power continues to be essential energy option for sustainable development, and nuclear HRD is inevitable.

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The Nuclear Power Institute Programs for Human Resource Development for the Nuclear Industry

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This paper reports on the programs of the Nuclear Power Institute at Texas A&M University. NPI is a unique partnership of universities, community colleges, industry, high schools and junior highs, teachers and students, government agencies, civic and elected leaders, and communities. NPI's goal is capacity building and developing the next generation of the nuclear workforce by informing and preparing individuals for careers in the nuclear industry, reaching out to schools, teachers and students, and fostering public acceptance and support for nuclear energy. At the baccalaureate and Master's levels, NPI offers a distance delivery program providing technical backgrounds in nuclear power plant technology for students in several engineering disciplines. The curriculum has been developed in collaboration with industry. For technicians/technologists, new two-year programs at the community and technical college prepare students for employment at nuclear power plants in the areas of non-licensed operators, electrical technicians, instrumentation and control, and radiation protection. NPI also has very active outreach programs at the high school and junior high levels that utilize nuclear energy as a means to inform and attract students into science and engineering. These outreach programs lead to a greater understanding of the role and benefits of nuclear energy, and an awareness of the career opportunities in nuclear. Finally, NPI reaches out to communities and families through the Science On Saturday (SOS) program that promotes enthusiasm and interest in nuclear technology. The NPI programs represent an integrated "end-to-end"approach that start as young as kindergarten going all the way through graduate studies. Furthermore, utilizing these

capabilities, NPI offers training courses and missions to countries with established nuclear programs and nuclear "newcomer"nations. There is much interest internationally to utilize and replicate these activities to support human resource development for the use of nuclear energy.

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Challenges to CB for Newcomers and Vision for HRD

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Building capacity through leadership development programmes in nuclear industry

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The State Atomic Energy Corporation "Rosatom"has ambitious business objectives both on the local market and internationally. One of the key challenges that is being faced is related to the managerial skills. New approaches and new systems that have been implemented in nuclear industry in Russia over the last few years require new competencies for all levels of management, from top-managers responsible for traditional and newly created businesses, to line managers responsible for managing small units and working groups.

To meet this challenge Rosatom has launched a number of initiatives in human resource development area:
• new corporate values and new corporate competencies have been developed and disseminated within the industry,
• procedures for assessing key managerial competencies have been designed and integrated into the HR management system; industry-wide asessment centre has been created in Rosatom Corporate Academy
• methodologies for identifying talents and potentially successful managers have been developed and put into practice; three levels of hi-po pool have been created;
• new modular development programmes for all levels of management and hi-po development programmes have been developed and launched in Rosatom Corporate Academy.

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Human Resources Development Challenges for Nuclear Newcomers

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One essential challenge for nuclear newcomers is to develop a national human workforce able to safely and efficiently implement the program and operate the fleet of plants over its life cycle. The scope of the workforce strongly depends on the nuclear strategy and the schedule for its implementation. For the majority of countries, the development of a nuclear energy program is an opportunity to create thousands of jobs for the local workforce.
The country must comply with international recommendations and regulations and establish a strong infrastructure with different stakeholders. The extent of the related local work force involved in nuclear regulation, supply chain, operation and research and education activities, will specify the development needs.
This lecture will present a general overview of resource needs, and possible paths of development and implementation of national human capabilities for the nuclear program. It will explain why and how the solutions for Human Resources Development (HRD) must account for all types of workforce needed in a nuclear energy program, be it nuclear specialists or not. Available options for development paths will be discussed, and their relations to industrial schemes as well as international cooperation.
The presentation will give a broad vision on the involvement of all stakeholders (government, education, research, industry) in HRD and the necessary integration of all initiatives in a global approach aligned with international standards.
Finally, the lecture will present resource needs figures for one development path, and illustrate it with an example of a successful cooperation between a historically nuclear country, and a nuclear newcomer.
Conclusions will be drawn for a future development strategy that will best contribute to the country's development objectives, and that effectively deals with the priority issues of excellent nuclear safety culture, enhanced safety requirements, and efficient nuclear power program implementation.

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EHRO-N AND THE HUMAN RESOURCES OF THE NUCLEAR ENERGY SECTOR. ANALYSIS OF DEMAND AND SUPPLY IN EUROPE

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In 2010, the European Human Resources Observatory for the Nuclear energy sector (EHRO-N) analysed the demand and supply of human resources (HR) in the European nuclear field in the short, medium and long term. Before this analysis, no comprehensive picture on the demand/supply of nuclear HR was available for the whole EU-27. Apart from France, UK and Finland, who have monitored their national demand and supply of the nuclear workforce through comprehensive national surveys, the availability of national data varies, indeed, from country to country. However, national data and reports on nuclear HR are missing for most EU's Member States (MSs). The same reports produced by international organizations, such as IAEA and OECD/NEA, do not always provide complete data.

The paper summarizes the result of the EHRO-N analysis. The focus is on the match (and mismatch) between the demand and supply of highly skilled workforce in the nuclear field (or ''nuclear experts") at present and in the future. Data was collected by EHRO-N through an EU-wide survey. The process of data collection and analysis also benefited from the co-operation with EHRO-N's Senior Advisory Group (SAG), which brings together the representatives of research organisations, industry, international organisations, etc. involved in nuclear energy across Europe. Finally, the paper puts the demand/supply of nuclear experts in the EU-27 into a broader perspective by highlighting the major lessons learnt and possible future areas of intervention and compares it to a top-down modelling study on HR needs based on the EU 2050 Energy Road map.

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PROGRESS IN HUMAN RESOURCES DEVELOPMENT OF OFFICE OF ATOMS FOR PEACE, THAILAND

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Introduction of Thailand's first nuclear power program (NPP) in Power development plan 2007 has drawn attention of relevant organizations in preparation for the project. The Integrated Nuclear Infrastructure Review (INIR) mission was conducted in 2008. One of results from the INIR mission indicated that Office of Atoms for Peace (OAP), as the national regulatory body, needs to develop a comprehensive human resources development plan (HRDP) that covers Milestone I and II of NPP. As a result, the HRDP of OAP has been developed in preparation for Thailand first NPP and a new research reactor. The training need analysis was conducted by Systematic Assessment of Regulatory Competence Needs for Regulatory Bodies of Nuclear Facilities (SARCoN) developed by IAEA, and the KSA list was selected in accordance with current and near-term responsibilities. Results of the analysis is used to develop the training plan of Bureau of nuclear safety regulation of OAP. The methodology will be applied to relevant departments of OAP in the future. In addition, the outreach program is provided by Nuclear and radiation capacity building center of OAP in order to promote public understanding and long-term capacity building. For example, a curriculum covering fundamental of nuclear and radiation and their application has been established for high school students. This paper provides insight into progress in the HRDP development and the long-term capacity building provided by the OAP.

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Vietnam's Human Resource Development for Nuclear Power: Status, Perspectives and Challenges

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The Resolution on the Investment Decision for the Ninh Thuan Nuclear Power Project was approved by the National Assembly of Vietnam in November 2009. Various activities have been actively carried out to develop the nuclear power infrastructure for the first nuclear power project, which includes two 2-unit plants (1000 MW per unit).
To develop the human resource for the nuclear power program, the Project on Training and Human Resource development in the Field of Atomic Energy was approved on August 2010. In 2012, EVN 's Human Resource Training Project for Nuclear Power Plant in NinhThuan, which focuses on training operator for the NPP, was also approved by the Prime Minister.
In 2012, the statistics of and the forecast on nuclear power workforce of Vietnam organizations (management agencies, regulatory body, utility, TSO and universities) up to 2020 was conducted. Vietnam has received the continuing support in human resource development from the International Atomic

Energy Agency, the Russian Federation, Japan and some other countries.
The oral presentation will provide the audience with an overview on status, perspective and challenges in human resource development for nuclear power in Vietnam.

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HUMAN RESOURCES DEVELOPMENT BY THE EASTERN EUROPE RESEARCH REACTOR INITIATIVE (EERRI)

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An increasing number of Member States (MS) request IAEA assistance to develop nuclear skills and resources in support of national nuclear science and technology programmes under development—including programmes related to nuclear power. For countries with little or no existing nuclear infrastructure, human resources and skills must be developed to support planning, analysis, evaluation and other prerequisite activities for the decision making process. The Eastern European Research Reactor Initiative (EERRI) was approached by the IAEA to organize and implement a Group Fellowship Training Program on Research Reactors (GFTPRR) to satisfy the increasing demand for the aforementioned skill development. The GFTPRR has been offered to participants from MS who have expressed interest in this subject to the IAEA. The first training course started in spring 2009 with six participants organised by the institutions listed in the title.
Until spring 2014 eight training courses have been carried out while rotating the course among the four involved institution with a total number of about 60 participants from nuclear emerging countries. This paper presents the planning procedures, the course content, the logistics and the experience of such an international nuclear training course, which could be of major interest for other regional training courses world-wide.

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Plans for Competency-based Human Resources Management in KINS

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From Education to employment-Inspiring and strengthening the pathways to secure nuclear future

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To construct and operate Hinkley Point C, a new nuclear power station in the South West of England, a sizeable workforce will be needed with skills that either do not currently
exist or do not exist in the quantities required. Due to the time scales of the build many of that potential workforce are currently in education at schools,colleges,further and higher education.

EdF Energy and their construction partners are also committed to recruiting a large percentage of those skills in the communities local to the station where the additional challenges include aspiration, education performance and rural location

The growth of UK infrastructure, including future nuclear plant, means a heightened demand for such skills not just locally but nationally. Consequently, a very competitive marketplace could evolve that could be detrimental to progress if not forecast and managed effectively.

Inspiring and developing the next generation to support such ambition is critical and it is a real skills challenge to create a large enough pool from which to recruit. To meet these needs the skill base is being developed and the pipelines from education into employment are being strengthened.

This paper addresses the challenges and opportunities Edf Energy face with building and operating the first EPR in the UK. These include the skills and education framework that has been put in place to encourage and facilitate a clearer pathway from education to employment, the lessons already learnt and what lies ahead. The paper will include the issues and importance surrounding the take up and performance in STEM subjects (science,technology,engineering and maths) This is fundamental to the future of the industry and how, collaboratively, a start is being made to address the recognised gap in the levels required to the levels needed to deliver the future nuclear power generation programme.

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BRIDGE of GENERATIONS. Project of JSC Atomenergomash

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The basic premise of the project idea KLRM «BRIDGE of GENERATIONS» was observed phenomenon of the ageing of the labour collectives of the enterprises of machine-building complex. In particular, we have a high part of workers of retirement and pre-retirement age, which having unique knowledge and experience in the field of design and production technology, and the share of young people is not sufficient. This fact carries the risk of loss of key knowledge on the horizon next 10-15 years.

And it's compounded by a lack of positive practices in Russia retention and transfer of knowledge, as well as low motivation the "possessors of knowledge"for the preparation of his « replacement».
The project started in 2010 on 2 key enterprises of the division. Today the project covers 6 division companies: ZiO-Podolsk (Podolsk, Moscow region), GIDROPRESS (Podolsk, Moscow region), Sverd-NIIkhimmash (Ekaterinburg), TSKBM (Saint- Petersburg), CNIITMASH (Moscow), OKBM AFRIKANTOV (Nizhny Novgorod).
The results of the project are first of all connected with increase of efficiency of HR-policy and achievement of strategic goals:
- creation of organizational conditions for the retention and transfer of knowledge in enterprises of JSC «Atomenergomash»
- retention of critical knowledge and technologies
- reducing the average age of the personnel
- development of young specialists and raising the level of staff involvement in the group.
The essence of the project is to develop the methodology and to implement the organizational approach, directed to the critical knowledge loss risk management, assessment of the risks of loss of critical knowledge, creation of conditions to ensure the succession of knowledge and retention of the best practices in our enterprises

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Initiatives of the Belgian SCK•CEN Academy to attract young talent in nuclear research and technology

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Several studies and reports show a concern for future availability of high-level nuclear competences. Moreover, it is often mentioned that there might be a shortage of specialized high-educated personnel in the broad sector where ionising radiations is used (being the nuclear industry, healthcare, research and governmental organisations). Therefore, measures should be taken to support young students in their need to gain and maintain high-level nuclear knowledge and to provide attractive career opportunities.

The SCK•CEN Academy contributes to this tasks and supports education for students through (i) supervising young students from Bachelor to PhD level, (ii) contributing to academic courses like the ones of the Belgian Nuclear higher Education Network (BNEN), the Radiation Protection Expert course and others, and (iii) familiarizing high school pupils and their teachers with the state of the art of nuclear research and with the daily activities performed at our research centre.

Students are given access to our research laboratories to prepare their experimental work. We work closely together with Belgian and international universities, and with end-users such as the industry and the medical sector. This combination provides an exceptional learning opportunity: students stay in close contact with the academic world and at the same time they enjoy a unique international research environment, with advanced nuclear experimental facilities and top-level guidance from our experts.

This presentation discusses the latest developments of the SCK•CEN Academy in this field, it highlights collaborations with e.g. universities and industry, and gives an overview of the numbers of participation.

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Hiring and Retaining the Next Generation of Nuclear Professionals

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A new generation of nuclear professionals is entering the workforce with attitudes, values, and beliefs considerably different than previous generations. Advanced technology, fast paced team activities, instant communication and quick decision making are just a few of Millennials' expectations in the work environment.

A "once in a generation"opportunity exists to improve nuclear station performance by welcoming the next generation and encouraging their active engagement. A key requirement is that they retain our strong, intrinsic commitment to nuclear, radiological and personnel safety –areas that may not yet be high on their value list. This challenge may be addressed, in part, by considering the affective domain in the hiring, training, and retaining of new employees.

The usual approach when recruiting candidates involves evaluating their work history, past performance, and cognitive ability. However, consideration to the affective domain should also be addressed. Piaget notes, "At no level can we find a behavior or a state which is purely cognitive without affect"(Clark & Fiske, 1982). Examples of essential skills that fit into the affective domain are: respecting diverse opinions and contributions of others; interacting with other teams to achieve corporate goals; and taking responsibility for one's actions and consequences. These skills are external expression of internalized attitudes, beliefs, and values.

The new generation of workers has aspirations beyond extrinsic rewards that motivated past generations. They expect that their contributions will be sought and highly valued –that they are truly making a difference. Application of affective domain concepts addresses these aspirations by matching where organizational needs and the individual's competence and passion intersect.

This paper develops the implications of the affective domain on the hiring and retention of the next generation of nuclear professionals who will contribute to the continued quest for excellence in all aspects of nuclear power.

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Overview of NRA Human Resource Development Center and NRA Cooperation and Support for IAEA/ANSN

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Hungarian-Vietnamese Nuclear Energy Train the Trainers Course

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Following an agreement between Hungary and Vietnam, nuclear training of 160 Vietnamese university lecturers was realized in four groups in year 2012 and 2013 in Hungary.

The 6 weeks long HUVINETT ("Hungarian-Vietnamese Nuclear Energy Train the Trainers Course") upgrading courses consisted of two parts: in the first three weeks the participants attended lectures and performed laboratory experiments in the Training Reactor of the Institute of Nuclear Techniques of the Budapest University of Technology and Economics (BME). In the second three weeks they improved their practical skills and knowledge at the Paks Nuclear Power Plant, among others in the Maintenance Performance Improvement Center and in the Full Scope Simulator. The efficiency of the training course was demonstrated by the results of the entrance and exit tests written by the participants.

The objective of the training program was to help the seven largest universities of the Asian country prepare for the education and training of highly qualified nuclear workforce. According to the decision of the Vietnamese government, Russian companies will build and put into operation two 1200 MW units of pressurized water reactors in Vietnam by 2020.

The paper describes the structure of the HUVINETT courses and the experience of the cooperation between the teaching experts of BME, Paks NPP and the Vietnamese universities.

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EDF Skills Management for Operations

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In a context where 50% of French NPP's personnel will get retired within 2015 (e.g. ˜1,000 people to recruit each year within a 10-year period) and substantial plant modifications are being made, EDF Nuclear Generation (DPN) decided in 2010 to implement a new competency management model to meet NPPs performance expectations. Being the French adaptation of the Systematic Approach to Training (SAT) model, all NPPs have started to apply it.

It is composed of a variety of elements regarding standards, facilities, organization and resources that make it easier to generate, capture, validate, transfer and preserve knowledge :
- A new frame of reference regarding competency management has been established in Oct. 2011 and contains eight performance objectives.
- Training infrastructures and tools are being developped to support local practical training courses. They include mock-ups of valves, pumps, C&I and electrical desks and new simulators.
- At each plant, three levels of training committees are established and scheduled every three month alternately to reinforce the role of managers as training programme owners, to identify the needs, to decide whether or not training is a solution to fix a performance gap and to prioritize training activities when chosen. National training committees are also running since 2013.
- One training expert is appointed at each of the training centres to give support to managers during training committees. New instructors are locally recruited in technical areas such as mechanics, electricity and C&I.
- Transfer of Knowledge methods are used to capture knowledge, skills and attitudes of experts and to transfer them to the new comers.
- Task-to-Training matrix (Job-Task-Analysis based) are being developped for technical job by DPN national job leaders.

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The WINS Academy Security Certification Programme: The Route to Demonstrable Competence

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Being demonstrably competent or professionally certified to do your job is the norm in nearly all professions, be it medicine, teaching, engineering, project management or a host of other professional endeavours. This process of developing competence through certification is the hallmark of Professionalisation and leads to an identifiable mark of quality that is attached to practitioners. In the nuclear industry, it is highly likely that many of the accountants, engineers and safety professionals belong to chartered institutes that certify their members'competence on an on-going basis. But the same is not at all common for security professionals and others with senior managerial or regulatory responsibilities relating to security.

A number of States have recognised this gap and have begun to support the need for certified professional development. This is reflected in planned statements for the 2014 Nuclear Security Summit

that will encourage States to ensure that all personnel with management accountabilities for nuclear security are demonstrably competent. This new focus is of essential importance. Almost all systems, be they for nuclear security or any other field of human endeavour, rely on the effectiveness of human performance.

To help the internationally community meet this need for demonstrably competent personnel, WINS has launched the Academy: a programme of certified professional development designed in partnership with the world's largest professional education provider. The Academy programme is centred on a core Foundation Module that sets out security as a strategic, operational activity to be implemented across the organisation and as a fundamental aspect of risk management and corporate reputation. Implementing such a programme requires the collaboration of a number of key organisational roles and WINS is developing Modules for eight Stakeholders. All of the Modules will be available online and at over 5,000 accredited test centres in 177 countries.

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Nuclear Human Capability Building Program in Saudi Arabia

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The paper describes the human capability building (HCB) program that has been designed to enable successful development of the atomic and renewable energy (A&RE) sectors. The paper is focusing in atomic energy sector. Phase-one of the work investigated existing and future trends in demand and supply, concluding with an assessment of the workforce gap and human capability challenges facing the A&RE sectors in Saudi Arabia. Phase-two work provided a considered response to findings from Phase one including detailed individual implementation plans for twelve strategic focus areas. The HCB Roadmap draws on the views, experiences and expectations shared by stakeholders throughout the project and in several major workshops.

Nuclear workforce roles, qualifications and competencies including the knowledge, skills and behaviours were identified in design, construction, operations and maintenance phases. New, changing and/or existing roles were identified, forming the basis for understanding where the K.A.CARE working with the local education and training system will need to place the greatest emphasis. A detailed model on the need of the nuclear workforce as a function of timeline and ramp up speed of the programme, number and type of power plants and co-location assumptions was created. The supply of existing workforce and graduates from the local education and training system was modelled in order to identify and analyse the workforce gaps over time. As a result of the modelling work, identification of local and international institutions for nuclear training, best practices, value chains and involvement with the stakeholders, K.A.CARE has a detailed taxonomy database of roles in the A&RE sectors and possibility to create demand and supply models that can project out and analyse workforce gaps out to 2045 and beyond, as well as a stakeholder engagement tool and HCB Roadmap with implementation plans.

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Human Resource Management in the Belgian TSO Bel V

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Within the Belgian TSO Bel V, an integrated management system (IMS) has been developed and is certified according to ISO 9001:2008. One of the main processes of the IMS is the Human Resource Management (HRM) process.
This process is subdivided into three sub-processes: Administrative & Social HRM, HRM & Development by competences and Assessment of the HRM Process.
This presentation will summarise the structure and content of all documents and procedures of the HRM process and will describe how the process is implemented.
In particular the following sequence of activities will be presented:
1. Definition of all the roles necessary to fulfil the regulatory functions attributed to Bel V, with description of all the tasks and duties assigned to each role and to each staff member, including the qualification requirements.
2. Identification of the individual existing competence (KSA) gaps using the SARCoN tool, on the basis of a reference list of KSAs and the role descriptions.
3. Periodic evaluation of the training needs on the basis of the competence gaps leading to the definition, organisation and evaluation of the training activities by application of the systematic approach to training (SAT).
The recruitment process will be described: actually, the analysis of the competence gaps may lead, in addition to training of present staff, either to internal job rotations or to announcement of new positions through the Bel V website if no internal expertise is available.
In the frame of the competence gap analysis, the interaction between competence management, knowledge management and a new interpersonal effectiveness development project will be explained.

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Strengthening Technical Specialist Training for an Expanding Nuclear Power Programme in the UK

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Nuclear power plants require a highly-trained, multi-skilled, competent workforce with a range of technical skills, some of which are highly specialist and nuclear-specific. The anticipated expansion of nuclear power in the UK will significantly increase demand for such skills and it is therefore essential that utilities and training providers work together to provide education and training in the most effective and efficient manner.

In the UK, the development of technical staff has tended to follow one of two traditional routes. The academic route involves study at university (up to 4 years), usually followed by a work-based graduate development programme (2 years) in which personnel learn to apply their engineering knowledge to real problems within the industry. The vocational route usually involves a work-based engineering apprenticeship (4 years) which includes part-time study for nationally-recognised technical qualifications developed in a particular engineering discipline and therefore not usually nuclear-specific. Neither of these routes is necessarily the most efficient or effective way of developing a sustainable resource of advanced, technical-competent specialists with the blend of knowledge, skills and operational experience, combined with the behavioural traits and safety culture required by the industy.

Gen2 has worked closely with our major client and partner, Sellafield Ltd, to develop an alternative education and training programme for young, high-calibre, technically-motivated school-leavers which combines academic and vocational learning to provide an innovative, accelerated route to qualification as an advanced technician in nuclear-related operations.

This paper will describe the development and implementation of the Technical Specialist Trainee Scheme (TSTS) for Sellafield Ltd. While currently servicing the training requirements for a major

nuclear fuel reprocessing plant, the paper will describe proposals to extend the scope of the programme to nuclear power plant operations.

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Q&A

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Ukraine Keynote Speaker

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Human resource development for the new nuclear build programme in South Africa

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The South African Government has identified the need to install new power generation capacity if it is to maintain the growth of the country. As part of this increase capacity, it has been proposed that 9.6 GW will come from new nuclear power stations to be built at various locations within the country.
Like many countries around the world and because there has been no new nuclear power stations constructed, South Africa has seen the decline in the numbers of people who have the necessary nuclear skills to build, commission, operate and finally decommission a nuclear power station. To this end a number of academic institutes have put forward plans to enlarge or even develop from new, various courses and training programmes.
To meet this need for such qualified individuals this paper will consider a number of different solutions that have been developed to train and educate students for entry into the nuclear new build programme. Amongst the concepts considered will be Professional Development Courses (PDCs) that have been created under the auspices of a Mentor/Protege programme, jointly created by King's College London and Wits University Johannesburg South Africa, a programme in nuclear technology leadership at a Masters level (Wits University) and an undergraduate programme in nuclear science and engineering also running at Wits. Where appropriate mention will also be made of what other academic and training institutions are doing in South Africa to uplift and develop the nuclear workforce

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Improving education, training and communication with public on ionizing radiation

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In order to improve the education, training and communication processes for informed behaviour and decision-making related to ionizing radiation risk the European Commission has launched special project EAGLE in the framework of FP7-EURATOM. The project aims at coordinating the information and communication strategies related to ionizing radiation for the general public, in order to get a better understanding of the effects of ionising radiation, taking into consideration also the lessons learnt from the 2011 accident in Fukushima (Japan). For this purpose, the EAGLE project will analysis the education, information and communication needs for the general public at EU level on ionizing radiation, identify and exchange good practices in communication with citizens, address the gaps between information sources, media and the general public and provide provision for support based on modern communication tools for the coordination of information and communication strategies for the general public.
The project will review national and international data, tools and methods within different organisation who are providing the information on ionizing radiation (like, formal nuclear and responsible institutions, provider of medical services, research and industry), will look at different ways of information transfer and transformation true classical and new media and investigate the reception of information in general public. Several interactions with public will be organised and established. The results from workshops, dialogue groups and pilot actions aiming at generating a better understanding of different perspectives, perceptions and information needs on ionizing radiation will be presented. Consequently, a special Platform on communication related to ionizing radiation will be introduced with the mission to establish a forum for dialogue and exchange of education, training and communication material between all European organizations. The contribution will present the EAGLE research plan, first results and possibilities for participation.

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Nuclear Training Excellence Project in Slovenské elektrárne, a.s

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The aim of the paper is to present and share experience with design and implementation of Nuclear Training Excellence Project.
As a reaction to several WANO Peer Reviews, NSAC and IAEA-OSART missions in the recent years bringing in recommendations for improvement in nuclear training area, Nuclear Training Excellence Project was launched for both SE NPPs (Mochovce and Bohunice) in 2011. As part of the project preparation and design phase, an organizational change aimed at strengthening of nuclear training role in NPPs was approved. Almost 30 new jobs were created and fulfilled with internally hired professionals.

Project goals for 2013-2015 are as follows:
- Set and implement nuclear training process in accordance with the best nuclear practice
- Apply Systematic Approach to Training (SAT) methodology thoroughly.
- Change understanding of nuclear training by plant line management so that they consider it as part of core business.
- Develop and start implementing new practical training programs based on SAT methodology, and prepare Practical Training Centers in both NPPs for run
- Identify and implement improvements in MCR simulator training based on the best nuclear practice

The project consists of 4 sub-projects: 1) team focused on thorough implementation of SAT methodology; 2) team focused on development and standardization of practical training; 3) team focused on improvement of MCR simulator training; and 4) team focused on change management –managing people side of change.

Main project activities to date:
•Localization of SAT methodology and ensuring its IT support
•Launching activities of Nuclear Training Committees
•Organizing trainings on SAT methodology for NPPs Top Management and nuclear training personnel
•The first SAT phase - Analysis almost completed in both NPPS - Maintenance, Safety, Operation
•Starting practical training in newly established Mochovce and Bohunice Practical Training Centers

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Q&A

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The Nuclear Technology Education Consortium: Helping to Build and Maintain Nuclear Capacity Globally

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Universities offering nuclear courses must work closely with industry to provide employable graduates from full-time courses and the flexibility to cater for part-time students returning to universities to enhance their skills. The UK Nuclear Technology Education Consortium (NTEC) was established to meet these twin demands and has the capacity to educate students from all over the world. International students have the option of accessing the programme through eLearning and also have the option of attending modules at any of the ten UK partner universities as they are delivered in an accessible one-week format. Twenty modules are currently offered covering reactor technology, decommissioning, waste management, regulation, safety and environmental impact. Experts deliver the modules augmented by industry lectures on real-life examples to support the technical and theoretical content.

Due to the modular nature of the programme students can decide on the level of qualification that best meets their needs. A full Master's in Nuclear Science and Technology option is available as well as a Postgraduate Diploma and Certificate and individual modules can be taken with or without assessment as part of a continual professional development programme. Part-time Master's students normally complete four modules in each of the first two years with their project in the third year. Accreditation of the programme by the Professional Institutes in the UK is co-ordinated by the Engineering Council.

Students from, for example, China, Canada, France, South Africa, Malaysia, United Arab Emirates and Austria as well as the UK have already successfully completed the NTEC programme demonstrating how it is helping to build and maintain nuclear capacity globally.

In this presentation I will explain how NTEC operates and how it keeps up to date with industry requirements and maintains its relevance to an ever-evolving global nuclear industry.

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NUCLEAR BUSINESS ACUMEN TRAINING FOR EXECUTIVES

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Most corporate strategies fail –not primarily because of poor strategy definition but due to deficiencies in strategy implementation. Like in so many human activities, proper training seems to be the way forward. We have developed a methodology for scenario training of nuclear business acumen for executives. This training is based on groups addressing realistic simulated challenges, typical for the executive management team of a nuclear power plant. This training has resulted in improved nuclear business acumen as well as more efficient strategy implementation.

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Lessons Learned in Performing and Implementing the Results of Training Need Assessment in a Newly Developed Regulatory Body: A Case Study of Pakistan Nuclear Regulatory Authority

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One of the important pre-requisite for a country embarking on or expanding its nuclear programme is careful planning and implementing its manpower development programme. Qualified manpower is essential for the safety and reliability of nuclear power. Pakistan's journey towards development of nuclear safety infrastructure began with the creation of Pakistan Nuclear Safety Committee (PNSC) in 1965, however, an independent regulatory body (PNRA) was established in 2001. A central challenge faced by PNRA after its emergence was to attain and maintain the qualification and competence of its staff member with due consideration to country's expanding nuclear power programme. In order to cope with this challenge, a project was launched in PNRA in 2004 to conduct an organizational review, assess the training needs, determine the existing competency gaps and develop training strategies for PNRA. Organizational review of PNRA was conducted based on the interviews of the senior management and review of documents of PNRA, IAEA and regulatory bodies of other countries. Moreover, the competency need analysis was conducted by applying the four-quadrant competency framework proposed by IAEA for nuclear regulatory bodies. As a result , major strengths as well as several areas of improvement were identified and a number of measures were proposed to fill the gaps. To assess the effectiveness of the measures taken by PNRA, and foster continuous improvement , a similar project was launched in 2011 and significant improvements were observed in area of HRD and in the overall performance of the organization . This paper presents the major challenges faced by PNRA in conducting organizational review, competency need analysis as well as in implementing the measures to fill competency gaps proposed in 2004. In addition, this paper also reveals the strategies and action plan adopted by PNRA to overcome its weakness in the area of HRD.

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New Initiatives for International Cooperation for Nuclear Education in Russia

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The paper describes the main elements of the new ambitions Federal program for leading Russian Universities - the Competitiveness Growth Program among the world's leading research and educational centers for 2013—2020. This Program provides new opportunities for enhancement of nuclear education in Russia and strengthening international cooperation via educational networks. The main aspects of the NRNU MEPhI Program and the action plan to support the Federal Competitiveness Growth Program are under consideration in this paper.
National Research Nuclear University "MEPhI" is a strategic partner and the primary university of the SC "Rosatom" providing professionals and scientific-and-innovative support for the nuclear industry, which is aimed to have a multiplier effect on the Russian economy and to strengthen its positions in the world markets. Strengthening University's competitiveness is the research and education part of the SC "Rosatom"development strategy. Beyond the focus on nuclear industry University aims to actively diversify and expand its positions in areas such as nuclear medicine, radioactive hard electronics, composite materials, cybernetic technologies as well as in technological management and economics. The diversification enables to further strengthen the University as a leading edge multidisciplinary world educational and research centre.
The global expansion of SC «Rosatom» (construction and operation of "nuclear sites", assets and long-term commercial interests in 74 countries) is a natural driver for the radical increase of the share of foreign students and foreign scientists. NRNU MEPhI provides graduates of all categories to support construction of nuclear sites abroad and is positioned as a global center of nuclear knowledge management, considering its close co-operation with the IAEA.

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Panel Discussion, Q&A

Session 4A - Knowledge Management / **197**

IAEA Introduction

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NRC Keynote Speaker

Session 4A - Knowledge Management / **152**

A knowledge transfer program for engineering students at master level at the UPM

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Nuclear technology, developed over more than fifty years, comprises a broad set of branches of knowledge such as mechanical engineering, nuclear physics, automation, etc. During the operational experience of existing reactors it has been developed a vast knowledge that is needed to manage adequately to allow the present and future generations make use of this technology.

The IAEA has selected some universities to train teachers for the implementation of a course of nuclear knowledge management in different countries (Albania, Mexico, Russia, Czech Republic, Spain, etc.). Around 20 teachers with different backgrounds received a training course in Karlsruhe (Germany) in December 2011, including a representative of the UPM (Prof. G. Jimenez). Another edition was held in November 2012 for new teachers. This experience has been repeated after.

Motivated by the previous initiative, during 2012 and 2013 it was held at the Department of Nuclear Engineering at the UPM's the first editions of "Knowledge Management Seminar in the nuclear sector" which was attended by students of Master of Nuclear Science and Technology and the Master in Power Generation respectively. The scope of those seminars is to create a culture of knowledge management in the new generations entering the field of nuclear engineering. This culture will facilitate the necessary knowledge transfer, which shall be given by the more experienced. This transfer is key to ensuring the highest standards of safety of existing nuclear facilities and for optimizing those reactors whose construction will be in the future

Session 4A - Knowledge Management / 147

Evolution of Knowledge Management: From Expert Systems to Innovation 2.0

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Creation, retrieval, evaluating and using knowledge - summarized as knowledge management –becomes more important in the digitalized world. Hence the evolution of knowledge processing having its root in information technology and artificial intelligence resulting in Web 2.0 and moving towards Innovation 2.0 challenge thorough foundations and raise the question if theoretical framework are capable in dealing with the flexibility of the real world. The University of Vienna studies conceptual modeling as an instrument for knowledge management, resulting in the PROMOTE framework. This paper observes how it is continuously put into practice, by introducing projects in (a) research, (b) industry, (c) national governmental organizations and (d) international organization. In research we can see different waves starting with process-orientation like in PROMOTE, integrating with semantics like in AsIsKnown, moving towards hybrid solutions including workflows, knowledge workers and agents like in eHealthMonitor and moving towards collaborative innovation with game storming. Knowledge management using conceptual models in Industry is often coupled with existing management approaches such as business process management that is extended by information management or Big Data aspects. Projects in national governmental organizations –like the Austrian Defense Academy, or CBRN defense school –demonstrate the potential of conceptual models in form of knowledge scorecards monitoring not only the business process performance, but also the scompetences and necessary resource provision for a safe operation. International organizations - like IAEA –also benefit from conceptual models, as demonstrated with the CA process. Reflecting the observations over the past fifteen years of knowledge management, it can be clearly stated that thorough foundations dealing with the core aspects of knowledge can appropriately be adapted for real world challenges. This paper introduces foundations in conceptual modeling, introduces its application in aforementioned areas and provides an outlook how to approach the upcoming hype of innovation 2.0.

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Q&A

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HACETTEPE Keynote Speaker

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How knowledge mapping is being used to integrate plans for safe and reliable operations

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For any nuclear program locally or nationally, understanding what knowledge is essential for long-term operations and project delivery enables operators and governments alike to plan for success and manage the risks that could affect a successful outcome.

When prioritizing and planning for scarce knowledge resources it is essential that first we identify what we need to know and when we need to know it. Often different agencies and departments take different approaches to describing their future knowledge needs, ranging from the types of educational qualifications required through to the numbers of experienced personnel in each professional discipline that need to be hired and technology development roadmaps. This approach makes it more difficult to represent all of these highly-related and interdependent requirements in one integrated plan.

Knowledge mapping is a systematic and rigorous analysis tool for identifying the knowledge, competencies, qualifications, skills, information, data, technologies and other knowledge-related resources, when and where the resources will be required and the associated risks.

At Sellafield in the UK we rigorously employ a systematic knowledge mapping tool to develop a long-term knowledge management plan. This tool can be used to generate a range of structured and interrelated knowledge-based resource management plans ranging from national nuclear manpower planning to record retention schedules.

There are now opportunities to ensure consistency in the activities and plans of different departments and agencies, by collaborating on a unified and comprehensive map of knowledge resources. Ultimately this can be extended into a single plan to facilitate a national program of education, training, recruitment, development, research and development and knowledge application through analyzing the underlying knowledge needs. This holistic approach will ensure that we always have the right people with the right knowledge, skills and information in the right place at the right time.

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NUCLEAR KNOWLEDGE LOSS RISK MANAGEMENT (lessons learned, implementation experiences)

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The paper seeks to develop a model for risk management of nuclear knowledge loss in a process-based organization in the Czech Republic. The study uses a project lessons learned approach. In the first stage, existing practices are examined to develop both the model for risk management of knowledge loss and the knowledge loss risk assessment. In the second stage, the KM model is evaluated by testing it in a real life of our two power plants (Temelín and Dukovany). The methods integrated as the foundations of the integrated KM and risk management model are based on the latest innovation management solutions, with strong focus on knowledge and risk management in energy and utilities and ČEZ risk assessment framework. The analytical approach includes a six-dimension integrated model that manages all critical success factors of knowledge management risk management. The results show that, after 7 years of implementing the model became a part of working life in our plants. The integrated KM and risk management model can be used to assist the planning, establishment and evaluation of knowledge loss in projects and operations. This helps to ensure that key issues regarding knowledge loss are covered during the planning and implementation phases. The study provides an integrated perspective of KM in process-based organization. It offers valuable guidelines that can help decision makers consider key issues during a risk assessment of knowledge factors in project management. Outputs of this model can prepare an extensive assessment report about the risk of knowledge loss in a nuclear business.

Session 4B - Knowledge Management / **132**

Approaches to maintaining and building organisational knowledge in a nuclear expert organisation

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The context of the presentation is an in-house nuclear design and R&D organisation whose role is to support safe and economical operation of Fortum's NPPs and to identify, maintain and develop the required knowledge. The employees are nuclear experts with engineering/science background. Managing knowledge embedded in the expert work, working culture and collaboration across the expertise areas has been found critical for the organisation.

The current KM challenges are mainly related to human resources. The turnover rate of young experts is high and considerable effort needs to be put in job induction. At the same time, due to the low number of recruitments after the Chernobyl accident, there are generation gaps in the experienced workforce. Thus knowledge is being transferred from a small experienced group to a large group with considerably less experience and high turnover rate. Consequently, strategies for maintaining knowledge and organisational learning need to be revised.

The increased attrition risk of young experts is believed to be caused by a change in the learning curve after the intense job induction phase. To maintain continuous learning the new expert needs support from the organisation e.g. in building their professional networks and finding more possibilities for developing their expertise. During the recent years, there has been more possibilities for full and small scale job rotation and the opportunity has been most popular among young experts.

It is typically believed that developing a nuclear expert takes at least 5 years. Because of the lack of experienced workforce, the new experts are, however, relatively quickly given responsibility of

challenging tasks. When the working culture supports teamwork, also learning and knowledge transfer are enhanced. Thus new experts are able to perform well in demanding positions. This also provides them with more challenges and variation in tasks.

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Q&A

Session 4C - Knowledge Management / **111**

The Strategy of Knowledge Management for Human Resource Development

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Knowledge management has fairly rapidly moved from the category of purely academic concepts to the organizational routines in corporate and government practices. It happened just in the last couple of decades, that the world's largest companies, consulting organizations, business schools, government agencies and international organizations started to pay increased attention to the topic. There are three reasons for that. First, the development of information technologies, resulted in wide range of new tools for knowledge management. Second, the increased role of expert community and public in making business decisions. Third - is the rising cost of non-material (in fact, knowledge) component in the business processes.
One of the main problems is the people who are knowledge creators and knowledge bearers, thus establishing the competent human resources is the most important part of Knowledge Management. The alienation of knowledge from its founder and bearer is a subtle, complex and not always successful process.
In Russia, and in ROSATOM in particular, bearers of critical knowledge in the field of nuclear science and technology, as a rule, are people with the old tradition background without understanding the market-based approach to knowledge management. At the same time they are the real knowledge bearers - the knowledge, they possess, simply do not exist in any other, alienated, codified form that assumes its smooth transfer. Historically predefined generational gap in science and engineering schools is a barrier for the conversion of the richest knowledge accumulated during the Soviet era into commodity and further into market capitalization.
Working with the bearers of critical knowledge is one of the main components of the effective knowledge management system, which is an attempt to create a system of formalization (if possible), transformation and transfer of this knowledge to the next generation.

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Human Resource Development Activities in Japan and Contribution to the Global Standards

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Japan Nuclear Human Resource Development Network (JN-HRD.net) was established in 2010 as a unique framework for HRD throughout Japan. It has five panels including one for HRD for new comer countries. Even though the Fukushima nuclear accident happened, the nuclear HRD is still/hence considered to be more important than ever for safe operation and decommissioning and for transfer of knowledge, including lessons learned from the accident.
We are collecting all the HRD-related activities in the country, especially ones for new comer countries, and making data base and a web site. They are open to the world and designed to be user friendly. We are intensively discussing a comprehensive HRD roadmap for the future using the information there.
JN-HRD.net and my university annually organize IAEA Nuclear Energy Management School since 2012. The alumni association has been formed in Japan so that the participants can keep communication.
My university is developing practical educational contents; the nineteen textbooks, e-learning materials on fifteen subjects, and DVD textbooks on two subjects. These e-learning contents will be carried on the IAEA's CLP4NET. We also aim to contribute them to IAEA Virtual Nuclear Management University. Our e-leaning contents can contribute to educating those who don't have nuclear knowledge.
Some of university curricula are closely connected to national and international licenses. We are surveying the licenses all over the world to make our curricula to meet the requirement of the license.
Experiments and on-site trainings at facilities having nuclear materials and radiation sources are inevitable. Those facilities must be properly upgraded based on innovative R&D. For this purpose, global cooperation should be promoted in the nuclear society in the world.

Session 4C - Knowledge Management / **78**

Knowledge Management Strategy Adopted by PNRA: A Case Study

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Nuclear power operators and regulatory bodies are facing problems related to shortage of technical and experienced human resource, due to the lack of interest of youngsters in the fields of nuclear science and engineering; and ageing of the existing, experienced manpower. This poses a serious concern for the nuclear industry vis-à-vis its survival and progress. Therefore it is essential for the organizations working in this area, to devise a strategy for the proper management and preservation of knowledge and the intellectual capital.
Pakistan Nuclear Regulatory Authority has devised a comprehensive strategy for tackling the issue mentioned hereinbefore. Extensive discussion sessions with knowledge experts for the identification of knowledge domains important for PNRA; assessment of their criticality and maturity using the two assessment models, one developed by Mr. Jean Louis Ermine and the other by International Atomic Energy Agency; and the development of a proper Knowledge Management System are the important planks of PNRA's knowledge management strategy. Moreover, brain storming sessions with knowledge experts have also enabled us to identify the practices, important for Knowledge Management. As a result of these sessions, PNRA has started a number of activities, in order to support its KM strategy for the preservation and reuse of knowledge for future usage. These include Talent Programs, Job Profiles, Work Force Planning, Succession Planning, Portals and Simulation Tools. Moreover, PNRA is currently developing its own Knowledge Management Portal, based on international standards, state of the art IT tools and professional expertise.
This paper provides the strategy adopted by PNRA for the implementation of a Knowledge Management System. It would enable us to identify, preserve and make reusable the knowledge important for a nuclear regulatory body. Effort has also been made to analyze the efficacy of each measure adopted in the overall strategy.

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Knowledge Management Integration into Strategic Human Capital Management Systems

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Palo Verde Nuclear Generating Station has developed and successfully integrated a knowledge management approach into their strategic human capital management systems. This approach integrates knowledge management strategies into organizational assessments/business planning, workforce analytics, talent selection and development, and organizational key performance indicators. The presentation will provide the attendees with a practical approach to understanding how Palo Verde implemented the elements of an integrated human capital approach to managing knowledge, skills and the competencies to safely operate a nuclear power plant. The management of this process is accomplished through the utilization of a "People Health Committee"governance and oversight process. The higher level strategy has also been incorporated in to the Palo Verde Leadership Model for long-term sustainability. This approach has yielded several "Strengths"from the Institution of Nuclear Power Operations (INPO). The development of these processes are linked to the various supporting IAEA documents:
1. MANAGING HUMAN RESOURCES IN THE FIELD OF NUCLEAR ENERGY
IAEA NUCLEAR ENERGY SERIES NO. NG-G-2.1
2. RECRUITMENT, QUALIFICATION AND TRAINING OF PERSONNEL FOR NUCLEAR POWER PLANTS
SAFETY STANDARDS SERIES NO. NS-G-2.8
3. WORKFORCE PLANNING FOR NEW NUCLEAR POWER PROGRAMMES, NUCLEAR ENERGY SERIES, NO. NG-T-6.2
4. THE NUCLEAR POWER INDUSTRY'S AGEING WORKFORCE: TRANSFER OF KNOWLEDGE TO THE NEXT GENERATION, IAEA TECDOC 1399
5. KNOWLEDGE MANAGEMENT FOR NUCLEAR INDUSTRY OPERATING ORGANIZATIONS, IAEA TECDOC 1510
6. RISK MANAGEMENT OF KNOWLEDGE LOSS IN NUCLEAR INDUSTRY ORGANIZATIONS, STI/PUB/1248

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Q&A

Session 5A - Knowledge Networks / **200**

IAEA Presentation

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ETSON Keynote Speaker

Session 5A - Knowledge Networks / **66**

Contribution of IAEA, FNRBA and ANNuR as Networking in Developing and Maintaining Capacity Building for a nuclear power programme: comparative study

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Capacity is defined as; —the ability of individuals and organizations or organizational units to perform functions effectively, efficiently and sustainably. Capacity building is an evidence-driven process of strengthening the abilities of individuals, organizations, and systems to perform core functions sustainably, and to continue to improve and develop over time.
This paper will explain the contributions of knowledge networks at the national, regional and international level in developing and sustainable existing capacity building and human resources for regulatory body and other institutions in Sudan to confront the future challenges regarding to nuclear power program- safety and security.
FNRBA and ANNuR are two regional networks that form part of the Global Nuclear Safety and Security Network (GNSSN). The GNSSN provides open access to general information on nuclear safety and nuclear security through a common, collaborative platform designed so that experts can exchange and share information easily and quickly
In this paper will compare the advantages and effectiveness of these knowledge networks (IAEA(GNSSN), FNRBA, ANNuR) in capacity building and will explain their major role in enhance the infrastructure of national regulatory body and to enabled the RB in Africa and Arab countries, to establish and strengthen the regulatory infrastructure for nuclear power programme Consistent with international standards and recommendations as well as the recommendations resulting and deduced from comparative study to promote the exchange of knowledge, experience and information among its members.

Session 5A - Knowledge Networks / **108**

AFRA-NEST: A tool for Human Resource Development

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Investigation carried out in Ghana in 2003 revealed that Nuclear Scientists were dwindling in numbers. This threatened and endangered the Human Resource base of Nuclear Scientists. It also seemed to be the trend in Africa as a region and the whole world. With this awareness, it became necessary that measures should be taken to reverse this situation.
In Ghana, the Ghana Atomic Energy Commission in collaboration with the University of Ghana, and in cooperation with the International Atomic Energy Agency, (IAEA), established the Graduate School of Nuclear and Allied Sciences (SNAS) which has become a Regional Designated Centre, to improve the Human Resource base of Nuclear Scientists in Ghana and Africa.
The Africa Regional Cooperative Agreement for Research Development and Training related to Nuclear Science and Technology (AFRA) also established the African Network for Education in Nuclear Science and Technology (AFRA-NEST) in order to implement AFRA strategy on Human Resource Development (HRD) and Nuclear Knowledge Management (NKM).
The establishment of AFRA-NEST, and the recent installation of its e-learning platform (CLP4NET) with the assistance of the NKM Unit of the IAEA which went on-line on about October 25, 2013 with the URL; http://lms.afra-nest.org is a further step to enhance the Human Resouce Development.

Essentially, the main function of the AFRA-NEST is to foster sustainable human resource development and nuclear knowledge management to satisfy the needs of African countries with/without higher education in the priority areas of non-power and power applications of nuclear energy. In this regard, Ghana was nominated to host the Cyber Learning Platform for Nuclear Education and Training for the AFRA region.

This presentation gives the status of the project so far.

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European Nuclear Education Network (ENEN). Ten years of experience

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The European Nuclear Education Network, whose mission is the preservation and further development of expertise in the nuclear fields by higher education and training, has recently celebrated its 10th birthday (September 22, 2013). During the last decade the Association was established as a spin-off of a European Project, took off and gained momentum, acquiring a huge number of member Institutions (64 presently).
Several European projects were run in this period under the coordination of the Association or with its active cooperation, leading to tangible results in terms of mutual recognition of curricula, of the establishment of the European Master of Science in Nuclear Engineering certification, of organising PhD Events and of contacts among Member Institutions, thus favouring student and teacher exchanges. Part of this effort was spent in order to address non-European Countries, aiming at enlarging the cooperation already established at the European level with several MoUs and practical agreements.
In particular, in these years ENEN actively participated in several Euratom Fission Training Schemes (EFTS) and coordinated contributions coming from its Members to better achieve mutual recognition and harmonisation of their high level studies. The initial focus on Nuclear Engineering broadened to include also the fields of waste management and radiation protection, providing full scope educational opportunities in the nuclear sector and making use of the European Credit Transfer system (ECTS) to promote curricula establishment and recognition. Training was also added to the classical educational core business of academic institutions, involving industry and training centres in the development of curricula for specific target groups of engineers. The initiatives of the Members during these years also involved the use of instruments developed to favour borderless mobility and high level education and training, including the Erasmus scheme and KIC-InnoEnergy. Currently is running the NUSHARE project.

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National Nuclear Regulatory Portal (NNRP) –a useful regulatory knowledge network

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The National Nuclear Regulatory Portal (NNRP) is a part (sub-site) of the Global Nuclear Safety and Security Network (GNSSN) and contains relevant information on the national regulatory authorities in Member States (MS). NNRP is a set of existing networks and information sources (open or password protected) and serves as a common access point and provides access to scientific, technical and regulatory resources (including databases, websites, applications, publications, safety standards ect.). The NNRP is based on an uniform structure and administered by the respective country itself. At present the content and structure developed in pilot phase is adequate and comprehensive enough. The NNRP contains the Country Nuclear Regulatory Profile (CNRP) as well as further country specific information on items of interest for nuclear regulatory purposes. As a rule, the main architecture of the CNRP contains the following issues: 1) Radiation and nuclear facilities and activities of the country; 2) Responsibilities and functions of the government; 3) Global safety regime; 4) Responsibilities and functions of the regulatory body.
In this paper the main objectives and concept of NNRP will be presented. Potential users of NNPR as well as the benefits for MS likes: 1) Making national information resources visible and available via web; 2) Serving as a platform for more effective international cooperation between MS and as a platform for national information and cooperation; 3) Providing easy access to all relevant nuclear regulatory information and sources available on the web (incl. access to all IAEA sources); 4) Increasing transparency; 5) Demonstrating national achievements and current status of nuclear safety infrastructure will be discussed. Bulgarian experience with NNPR will be also described. At the end some suggestion for future improvements of NNPR will be given.

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NUCLEAR EDUCATION, TRAINING AND OUTREACH IN LATIN AMERICA AND THE CARIBBEAN REGION

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In December 2010, at a technical meeting of the International Atomic Energy Agency (IAEA) held in Lima, Peru, the Latin-American Network for Education in Nuclear Technology (LANENT) was formally created.
Diversity and contrast are key characteristics of the Latin-American and Caribbean region. For instance, while some countries have very active nuclear programs, including the existence, construction and planning of Nuclear Power Plants and Research Reactors, the use of nuclear technology is below optimum in others. Similar disparities are also observed in nuclear education, training and outreach (NETO) activities, where some countries have ample experience and tradition, with adequate or even exceptional facilities, while others lack them completely.
Since its creation, LANENT is actively pursuing joint activities for networking educational institutions at a regional level, the creation of distance learning initiatives and the use of shared facilities are basic cornerstones for the efficient cooperation. Its endeavors are being eased by the recent emergence of e-learning, while providing a way to overcome the vastness of the region.

The absence of cultural or idiomatic barriers is an important asset of the region, which certainly facilitates LANENT activities. So are some pre-existing proactive networking initiatives, the open access to high quality equipment for nuclear education, the availability of well trained and highly specialized teachers and programs tailored to the needs of each country throughout the region, and the will to support NETO activities for the common development. Furthermore, most of the areas of Nuclear Education are covered by different countries in the region, even though some few vacancies in specific areas could be detected.
All these issues, with emphasis on the status and trends of NETO activities and its key actors in the region, will be analyzed in the present communication.

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President's Summary

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Establishing a National Network for Nuclear Education, Science and Technology in Africa

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The purpose of this report is to highlight the progress being made towards establishing networks for nuclear education, science and technology (NEST) in the African region by juxtaposing and interrelating national efforts taking place in Tanzania with the broader strategies at the regional level.

This paper will describe the initiatives in the United Republic of Tanzania for establishing, a national nuclear network for education, science and technology,(TAN-NEST) taking into account the recommendations of the 1st AFRA-NEST General Assembly at the regional level, as well as results of a Consultative Meeting of Stakeholders in Tanzania at the National level.

The report will also identify possible areas for IAEA and government interventions as well as the role of TAN-NEST in helping to maximize the return on the government's investment in nuclear

technology research, training and education by promoting and sustaining key collaborative activities for infrastructure and human resources development.

While the focus of this report would be on highlighting efforts at establishing national networks for nuclear education, science and technology, it is recognized that developing countries in other regions could greatly benefit from the strategies and lessons learned from the region. Therefore it is hoped that the approaches described in this paper will spark more interest in establishing national networks that can be applied to other countries as appropriate.

While the focus of this report would be on highlighting efforts at establishing national networks for nuclear education, science and technology in the African region, it is recognized that developing countries in other regions could greatly benefit from the strategies and lessons learned from the region. Therefore it is hoped that the approaches described in this paper will spark more interest in establishing national networks that can be applied to other countries as appropriate

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Knowledge Management in the Development and Use of Radiation Technologies

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The problem of ensuring the safe application of radiation technologies is especially important. The methods of knowledge management are successfully used in the solution of this task.
Main directions of such usage are:
1. Knowledge capturing.
• Specialists' training the basics of radiation methods and equipment creation and retraining of experts; studying of methodical and normative documents on radiation safety. Last year (2013) over 35 scientists, engineers and workers passed such training.
• Application of available practical experience and knowledge, provided by unification of plant elements.
• Creation of new knowledge by development of new methods and innovative equipment.
2. Preservation of knowledge.
• Preservation of knowledge on electronic carriers. The digitization of the library documents of scientific and technical character and technical documentation on numerous developments of the institute for 50 years of its existence also has been carried out in 2012-13. This material will be available to developers of new generations.
• Restoration of some competences which can be lost in several years, with paying of special attention to questions of radiation safety provision.
3. Transmission of critical knowledge.
Within the solution of this task the following activities have been carried out:
• Mapping of knowledge and the competences existing at Institute;
• Allocation of knowledge with high risk of their loss;
• Definition of the circle of specialists who are the carriers of critical knowledge;
• Development of work program on transmission of this knowledge to possible successors.
Thus, the problem of continuity of generations of researchers and developers, and also development and safe application of radiation technologies is being solved now.

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Integrating Knowledge Management into Everyday Practices: the Case of the Intellectual Capital Section at CNEA

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Researchers and scholars have argued that one process that is key to achieve a successful KM initiative is the creation of a culture that values the sharing of knowledge, ideas and experiences among staff members or groups.
Therefore, it is necessary for organizations to set up mechanisms by which new ideas may be shared in order to produce innovative changes; detect improvement opportunities and analyze new procedures or ways of carrying out work. On the other hand, personnel need to have sufficient understanding of the benefit of integrating such tasks into their everyday duties.

Taking into consideration this theoretical framework, the Intellectual Capital Section (ICS), Department of Planning, Coordination and Control of the Argentine Atomic Energy Commission (CNEA), has encouraged the use of KM tools as a part of its daily work. This Section coordinates the Scholarship Programme "Learning by Doing", which fosters knowledge transfer amongst CNEA experts and young professionals and, also, provides support to qualified students to receive high quality nuclear education. As the ICS has the responsibility for conducting Knowledge Loss Risk Assessment, the following tasks have been performed: identification of people with critical knowledge and the generational gap in CNEA, amongst others activities related to KM.

Within the context of these activities, the purpose of this paper is to describe the experience of the ICS which encompasses the use of open source software to promote collaborative work and knowledge sharing, as well as the development of a database of practical cases and solutions, among many other related activities undertaken at the ICS. All that the Section has done to date is hereby evaluated, and, consequently, the results are presented herein. Besides, a challenge is posed in the near future: the proposal to implement a KM Project at an institutional level embedded in CNEA Strategic Plan.

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Method of Competences System Estimation for the Ukrainian NPP Personnel

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The main objective of the research is the scale development for system assessment of NPP employees competences in real time.
The following expert methods were used by authors for this research: Delphi Method and ranking.
Two questionnaires were developed. The first questionnaire includes three questions about industrial environment conditions. Answering those questions, the employees had to define the concept "Industrial Environment".
The second questionnaire includes six questions. The purpose of the first was determination of the quality indexes for the respondents. Next two questions were directed to the identification of the indicators characterizing the competences of NPP personnel.
40 employees from Ukrainian NPPs were questioned.
After processing of the answers given by respondents the primary structure of a scale was developed. That structure was then approved on statistical data showing operational injuries on the NPPs.
Further the following assumptions were considered:
1. In oder to assess the quality of personnel decisions taken it is possible to use the statistics on casualties which took place on the enterprise.

2. The competences of atomic power complex employees should allow them working without violations of regulations.
3. Industrial environment should assure the conditions which allow working without violations of regulations.
4. If the reasons of traumatism coincide with the proposed scale, then the scale could be considered as justified and it could be used for estimation of the safety culture level on an NPP.
The further analysis of the above statistical data showed that each element of the offered scale was shown, to some extent, in all registered cases of operational injuries.
At the last stage the weight coefficients for the scale elements were calculated. The constructed model will be recommended as basis for development of the standard for Ukrainian NPPs.

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MULTIMEDIA COURSE ON NUCLEAR REACTORS PHYSICS, APLICATION TO A TAILORED ON THE JOB TRAINIG COURSE

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In order to improve the quality in nuclear engineering education and training programs a Multimedia on Nuclear Reactor Physics has been developed.

The multimedia has been distributed through IAEA to 126 institutions from 53 countries.

A tailored on the job training course of two weeks based on this multimedia is organized in nuclear power plants and nuclear institutions world wile on request.

The teacher uses the multimedia during his lectures and students use it at home to study this course.

This multimedia can be used in Nuclear Reactor Physics course for education and training:

1. Engineers in Master of Nuclear Engineering at universities.
2. Training for engineers, chemistries, informatics, etc., at Nuclear Power Plant, modular course 2 weeks.
3. Training Operators of Nuclear Power Plants.

When the multimedia is used for proposals 2 and 3, it is useful to escape the chapters 5 and 6.

Nowadays, this multimedia has about 785 slides and the text is in English, Spanish, French and Russian.

The same CD-ROM has the four languages. The user chooses the language that they want.

The figures, animations, tables and equations are the same in the four languages; the only difference is the text language.

The multimedia has the following content:
1. Introduction to the Nuclear Energy.
2. Neutron interaction.
3. Fission process in a nuclear reactor.
4. Neutron multiplication in a nuclear reactor.
5. Neutron balance in a material medium.
6. Criticality in multiplier medium.
7. Reactor kinetics.
8. Control rod effect.
9. Soluble poisons.
10. Burnable poisons.
11. Reactivity temperature effects.

12. Fission products poisoning.
13. Neutron Sources.

http://www.iaea.org/nuclearenergy/nuclearknowledge/education/NKM-Education/NRPcd/Multimedia-on-NRP.html

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EUROPEAN MASTER IN INNOVATION IN NUCLEAR ENERGY (EMINE), DEVELOPED IN THE FRAME WORK OF THE EUROPEAN INSTITUT OF INNOVATION AND TECHNOLOGY, KICINNOENERGY.

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The 4th Edition of European Master in Innovation in Nuclear Energy (EMINE) in the frame work of the European Institute of Innovation and Technology –KIC InnoEnergy is on progress. EMINE is may be the most complete program in Europe in the field of nuclear energy. A very practical oriented programme with strong involvement of nuclear industry.

The experience achieved with master EMINE is presented.

Master description:

Duration: 120 ECTS, two years.

Language: English

Mobility track:

• First year: at UPC (Barcelona, Spain) or KTH (Stockholm, Sweden)

• Second year: at Grenoble INP (Grenoble, France) or Paris (France)

Scholarships:
The European Institute of Innovation and Technology grants scholarships to the best EMINE students. The scholarships consist of a monthly allowance of 750 € during 24 month, as well as the participation costs at the hosting universities. These scholarships are the same for European and no European students.
Academic partners: Grenoble INP, UPC, Paristech, KTH, CEA-INSTN

Industrial partners: EDF, ENDESA, CEA, AREVA, Vattenfall, KIT

Several technical visits are organized to nuclear facilities.

The students get dual degree from the two universities where they study the 120 ECTS, and the label of the European Institut of Innovation and Technology.

In 2012, 352 applications for EMINE were received, and 22 scholarships were granted.

MSc EMINE helps tomorrow's nuclear engineers take up the challenges that the nuclear energy industry faces in terms of safety, social acceptability and waste management. By offering outstanding technical training and addressing the economic, social and political issues of nuclear energy, the programme broadens the scope of traditional nuclear education.

http://www.kic-innoenergy.com/emine/home/

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Knowledge Pipeline: A Task-oriented Way to Implement Knowledge Management

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Nowadays, web 2.0 tools are widely used in many organizations. However, people can't get the correct and proper knowledge for their work easily and quickly owing to the features of those systems. They have to make their own decisions to pick out the correct knowledge among the results. This paper introduces a concept of knowledge pipeline, which helps to present the proper knowledge to someone who needs it at a specific time. Knowledge is put into the corresponding pipelines. Users can get knowledge just like opening a faucet. This methodology is task oriented, and will be useful to the users who want to finish their work with good quality as soon as possible. It emphasizes human's effort in knowledge management activities and would be a developing direction of knowledge connection and knowledge management in the future.

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Challenges for a Developping Country in Building Human Resource Development for Nuclear Power Programmes: Case of Mali

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Mali is a large Country with limited energy resources mainly based on two rivers (Niger and Senegal).Up to now, the country does not have petrol or gas for electricity. But, it appears evident to all that any development lies on availability of electrical power. Hence nuclear power could help in great part to solve energy issues. After participating to the IAEA General Conference of September 2012, the Ministry in charge of Energy has introduced a Written Communication to the Conceal of Ministry, requiring the Government of Mali to embark for nuclear power. After adopting that communication, the Government has charged the Ministry of Energy to find the appropriate way for embarking for Nuclear power Programmes.
Such task, when considering the present level of nuclear activities development in the country, needs a lot of competencies. One of the most importance points of that programme is the human Resource Development. The Regulatory Body is the only existing nuclear institution with competencies in

nuclear issues. Therefore, it appears that the task is with many challenges.
The presentation will consist of analyzing the challenges as : how to come up the identification of what are available as legislations and regulations, human resource development institutes schools or universities, trainers, areas of interest and the needs in terms of experts, trainers, schools and institutes; how to get the necessary political commitment; how to bring in the decision makers to support the programme and involved activities; how to make the field interesting for young students, etc.

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Nuclear Education in Sudan

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Up to the first years of the 21est century, there was no teaching programme in Nuclear Sciences in any Sudanese university. There are some courses in different Nuclear Sciences at the level of undergraduate studies. In 2004, Sudan Academy of Sciences has been established as postgraduate university under the umbrella of Ministry of Science and Technology. Atomic Energy Council is one of the eleven councils in the academy. The main objective of the AEC is to promote the nuclear education and training in Sudan and the region. Four programmes in postgraduate education by courses have been provided since then; these are: Postgraduate Diploma in Nuclear Sciences, Master degree in Medical Physics, Master degree in Radiation and Environmental protection, and Master degree in Nuclear Sciences and Technology. The last one programme was adopted from the harmonized syllabus for Master degree in Nuclear Sciences for Africa that has been approved in Khartoum in mid nineties on the last century under the umbrella of IAEA. On the other hand, many displences in nuclear sciences have been provided for studies by research.
Over hundred students have been graduated from the diploma programme (Nuclear Physics, Nuclear Chemistry and Radiation Biology), around hundred from Medical physics, around 120 from radiation and environmental protection and 30 from Master of Nuclear Sciences and Technology. Most of the graduated students are now working in gulf countries (brain drain).

Also, Sudan University of Science and Technology starts providing B. Sc. (Honour) in Nuclear Engineering and Master Degree in Medical Physics, Alnailin University has an undergraduate programme in Medical Physics.

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Knowledge Management: Applications for Nuclear Facilities

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The problem of nuclear knowledge management adoption is important for nuclear facilities of IAEA member states. In the report the following results of the development of the knowledge management framework for regulatory body project and the critical knowledge preservation project fulfilled for few ROSATOM nuclear facilities will be presented: used methodology of knowledge management process development (processes description, link with Safety Culture, knowledge management roles, health check tools and methods, knowledge map development, competence map), critical knowledge preservation (knowledge engineering, mental models, cognitive psychology applications, cognitive structures and so on), criteria to identify critical knowledge and experts in an organization, tools

and techniques to elicitate, structure, store, formalize and share critical knowledge, problem points when knowledge elicitation from experts, formalized critical knowledge examples, critical knowledge management process development and introduce.

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THE RESEARCH ON CULTIVATING MODE OF INNOVATIVE TALENTS BASED ON DISCIPLINARY CONSTRUCTION

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21st Century is the century of innovation. In order to promote the economy structure adjustment and transformation in China, the developing nuclear industry also needs innovative talents. Shanghai nuclear engineering research and design institute (SNERDI), a state-owned key enterprise with national commitment to the historic mission, needs to cultivate a large number of innovative talents. Disciplinary construction is a method and platform of cultivating talent. The extent of disciplinary construction is mainly reflected in scientific research, innovative team building, human resource development and relevant infrastructure preparation. The development of disciplines will impact the cultivation of innovative talents. Disciplinary construction is considered as a system of trinity for scientific research, technology promotion and talent cultivating, which is an effective and practical way to build innovation capacity. This paper introduces the research and practice case in SNERDI, and discusses the issues on disciplinary construction, especially on talents cultivation, and then analyzes the root reasons. Through the research, three elements of innovative talents cultivation are concluded which are high-level talents planning, interdisciplinary training system and innovative team construction. These elements will strengthen the dominating and leading role of disciplinary construction in innovative talents cultivation. The paper also provides some practical manners of disciplinary construction, which helps us to explore a feasible way for innovative talents cultivation in nuclear research and development organizations.

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How IAEA NKM approaches support the Building and Sustaining Nuclear Capacity in the Member States.

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The IAEA NKM subprogramme was established more than 10 years ago. The main objectives was set as to increase Member States'application of nuclear knowledge management strategies through the development and dissemination of methodology, guidance and tools, as well as their implementation in national programmes, and by providing knowledge management services and assistance. Three projects are supporting the Nuclear Organizations in the implementation and dissemination of the NKM methodology. The first project supports the implementation of methodology and guidance for nuclear knowledge management, the second facilitates the sustainable education and training in nuclear science and technology, while the third provides products and services in nuclear knowledge management area. The last several years IAEA also increased the efforts to help to integrate NKM into day-to-day activities and also integrate KM tools into Management Systems if they implemented already according to the IAEA Safety Standards GSR-3 (The Management Systems for Facilities and Applications). Through the Technical Cooperation Projects many countries –like Armenia, Belarus, Bulgaria, China, Estonia, Iran, Kazakhstan, Lithuania, Malaysia, Russia, Slovakia, Tanzania, Thailand, Ukraine, Vietnam –received support in form of workshops, expert missions and knowledge

management assist visits. In addition to the regular budget, the subprogramme also supported from several Member States with extra budgetary contribution, or providing cost free experts (France, Germany, Japan, Russian Federation, UK). IAEA appreciated these efforts and welcome the future contributions.

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Policy, development and delivery of education and training programmes in radiation protection: a crucial contribution to the safe use of ionising radiation

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Radiation protection is a major challenge in the industrial applications of ionising radiation. As is the case with all nuclear expertise, there is a trend of a decreasing number of experts in radiation protection due to various reasons. On the other hand, the perceived growth of nuclear technologies in the industrial, medical, research and other sectors, requires an advanced understanding of radiation protection in order to protect workers, the public and the environment of the potential risks. Within this perspective, maintaining a high level of competence, assuring sufficient well-trained personnel and adequate knowledge management is crucial to ensure future safe use of ionising radiation and the development of new technologies in a safe way.

This paper presents the work that has been achieved by European initiatives such as the ENETRAP projects and the EUTERP Foundation. These initiatives focus on the development of a European policy in education and training in radiation protection, and its implementation. Collaboration at international level with policy makers and radiation protection authorities (such as the EC and HERCA) was established. The importance of lifelong learning was emphasized, and the introduction of reference training schemes and common qualification frameworks facilitating international mutual recognition (and thus cross-border mobility of workers) were introduced.
The ultimate goal is to contribute to a common high-level safety and radiation protection culture and to ensure the availability of adequate radiation protection knowledge, skills and attitudes which can meet the future demands.

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Knowledge Management (KM) Risk Assessment of Critical Knowledge Loss in an Organization with Expanding Nuclear Power Program

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A major workforce planning exercise undertaken for up to the year 2021 in PAEC, depicts a rising trend in attrition of its knowledge workforce. This attrition of workforce carries a risk for the organization of loosing critical expertise acquired over the years that may be in possession of the worker as 'Intellectual Assets'in the form of tacit knowledge. For an organization planning to expand its nuclear power generation capacity from existing 787 MWe to 8800 MWe by year 2030, the attrition

related knowledge loss threats needs to be identified, prioritized and addressed. Identifying, capturing and transferring knowledge from the departing experts to their younger replacements can enormously aide in the organizational HR planning and capacity building. The IAEA in its TEC-DOC-1510 section 4.2.3(1) has documented KM initiatives introduced by a Nuclear Power Utility of developed country (TVA, USA) as response to the aging nuclear workforce issue. Our broader plans are to apply and stage wise develop the information shared in the above referred section of the TEC-DOC into knowledge through its assimilation, adaptation and adoption to gain insight and understanding based on our own contextual experience. In the first phase of this larger project, we are conducting KM risk assessment at Chasma Nuclear Power Plant to identify areas / departments / positions / individuals where the potential for knowledge loss is greatest and most imminent and where critical knowledge and skills are at risk to the organization. The data collected for this exercise would be through surveys, individualized assessment forms and interviews of the exiting workforce as well through secondary sources. The critical knowledge loss risk assessment is expected to enhance awareness of the need to develop a considered KM based approach and action to establish knowledge retention plans matching with the strategic organizational needs.

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Challenges in Building Capability for a Nuclear Programme in the Philippines

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The Philippines was among the eighty two (82) countries which joined the International Atomic Energy Agency in 1956 but has remained to be among the countries in Southeast Asia which do not harness nuclear power for peaceful means. Efforts to start research and development of materials for atomic energy production in the past started with the creation of the Philippine Atomic Energy Commission in 1962, and took off with the construction of the first nuclear plant in the country, the Philippine Nuclear Power Plant in 1979 under the administration of Ferdinand Marcos.

Due to the occurrence of two (2) nuclear- power- plant related disasters abroad, specifically the Three Mile Island and the Chernobyl incidents, in 1979 and 1986, respectively, and the staging of a "people-power"revolt against Marcos in 1986 leading to changes in government leadership including the legislative, the construction of the Philippine nuclear plant was stalled. These and the presence of some non-governmental groups strongly opposing the use of nuclear energy in the country adversely affected the construction of the plant which was renamed the Bataan Nuclear Power Plant. The plant has not been operational up to the present.

To date the country's atomic and nuclear activities are confined only to research activities carried out by the Philippine Nuclear Research Institute, the lone nuclear research institute in the country mandated to carry out research and development activities in the peaceful uses of nuclear energy. Capacity building has become mainly dependent on funded trainings and human resource development activities sponsored by relevant agencies, and government scholarships given by the country' s science department. This paper intends to present proposed actions to address challenges within the purview of the science department .

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Necessities of Nuclear Programmes in Cameroon: Environmental impact and Safety analysis

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Misconception about nuclear power programmes (NPP) safety has led several abandoned nuclear power projects either by the government or pressure from the society. Safety of NPP was taken into consideration even before the first fission chain reaction was initiated. These safety precautions have been constantly reviewed for up to half a century for safe operation in nuclear power generation. This eventually has made nuclear power the best choice for high graded unperturbed electricity generation in several countries across the globe. In the area of nuclear waste storage, enough studies have been extensively carried out over the years. Nuclear power production is seen today as the only possible green house effect (GHE) option in respect to carbon emissions of several countries. NPP safety reports through coordinated projects have been provided in many IAEA documents readily available. In general a literature survey of nuclear waste management has been discussed along with the comparison with other sources of electricity to give a clear reason for the promotion of nuclear power programme in Cameron. The experiences of research reactor in ten member states in Africa are discussed to improve the preparedness of Cameroon to have nuclear power plants. The international and local regulations that are available for ensuring safe nuclear practice have been highlighted to ensure confident for this programme in Cameroon.
Key words: capacity building, green house effect, environment, nuclear power plant.

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JANSI's activities for reflecting lessons learned from Fukushima Daiichi Accident

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Under the conviction that the Japanese nuclear operators should never cause an emergency situation like the Fukushima Daiichi accident, they have established the Japan Nuclear Safety Institute (JANSI) November 15, 2012. The mission of JANSI is "pursue the world's highest level of safety - untiring pursuit of the highest standards of excellence."

The nuclear operators should play a role of main actors on a stage. JANSI should be expected to play a role of a tutor or a trainer on the wings. Based on the lessons learned from the Fukushima Daiichi accident, it was reported that the Japanese nuclear operators had a tendency to fall into a trap of "complacency"caused by human natural character of cognitive dissonance and self-justifications for their approaches. Against this tendency, JANSI will lead the nuclear operators to the safer place by benchmarking of the worldwide good practices and will afford the peer pressure among operators by the various mechanisms and platforms.

JANSI's one-year activities for human resource development such as an enhancing Top's commitment mechanism and an expanded platform for global perspectives will be introduced in this paper.

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The Nuclear Energy Management Curriculum - experience gained and lessons learned

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The increased interest to develop nuclear power programs in developing countries requires competent nuclear managers, decision makers and strategy planners that need to be trained in leadership, management and nuclear culture development. A dedicated curriculum linked to the IAEA's "Basic Principles for Nuclear Power"has been designed and implemented to meet this requirement as the most elite management and leadership training programme the nuclear sector can envision.

The effectiveness of the training process has been demonstrated by highlighting the hot current topics of nuclear power development as well as basic nuclear power economics, fuel cycle issues and solutions, nuclear safety principles and nuclear safety culture. Risk communication and nuclear sociology are a key element in the development of a new class of managers, competent in nuclear issues, economics and nuclear policy. A globally renowned faculty drawn from current and former IAEA experts and leading world professionals has waranted the success of the training process. Specific training conducted at nuclear facilities also adds to the overall effectiveness of the program.

As part of the training, participants are provided access to online materials and lecture notes, in addition to the reading list provided by lecturers, specifically for each topic. Various evaluation measures including group discussions, case studies, written assessments, and participants'presentations, ensures that they are able to grasp the content taught. The design of the training program, the exposure given to participants and the interactive approaches used in the training ensures that the participants benefits a great deal from various critical aspects of global nuclear sector. A total of more than 400 from countries in Asia, Africa, Europe, North America and Middle East have been participating in the training. The paper is a summary and analysis of four years experience and implementation of the Nuclear Energy Management Curriculum.

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Contribution of a Master program to building competencies in nuclear sciences in Morocco

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Nuclear techniques have known an increased contribution to medicine, agriculture and industry in Morocco. The development of human resources is essential for maintaining and developing nuclear infrastructure. It represents also a major step for any country that is planning to introduce nuclear power programme.

This technological progress has been accompanied by significant involvement on the part of Morocco in international conventions and agreements in compliance with the IAEA recommendations. Recently, a new law on radiological and nuclear safety and security, and the creation of the agency to ensure control are under approval.

Some educational and training programs have been elaborated to develop human resources needed in different domains. University of Ibn Tofail, has launched, since September 2010, a national master program titled Nuclear Techniques and Radiation Protection which aims to provide knowledge and know-how directly used in the various sectors using nuclear techniques and requiring radiation safety. This master contributes also to the development of women in nuclear and human resources from sub-Saharan African countries.

The Master program was established with national and international institutions and non-governmental organizations in nuclear field. This two years program includes mandatory modules and training graduation for a period of approximately five months in a professional environment. We are also

working with our partners to introduce a course on nuclear safety, security and safeguards to provide our students with the fundamental knowledge in these three important topics.

The presentation will describe the detailed program of this master and how this program contributes to building capacity of human resources in nuclear sciences capable to manage properly the radioactive and nuclear material.

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E-Catalogue of Knowledge Management Practices in Nuclear Organizations

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As part of its Statutory obligations, the IAEA has been supporting the development of guidance on and methodologies for planning, designing and implementing nuclear knowledge management programmes, and the continuation to enhance tools and methods to capture, retain, share, utilize and preserve nuclear knowledge. This facilitates the management of an entire life cycle of nuclear knowledge and has helped nuclear organizations to establish their own knowledge management programme.
Today, many nuclear organizations from different countries have considerable experience and excellent achievements in the use of Nuclear Knowledge Management (NKM) methodology and tools to improve their organisational performance. Depending on their business type and strategy, they choose various methods and tools of knowledge management for realizing their aims. NKM systems support nuclear organizations in achieving effective and consistently reliable decision making in complex nuclear technology environments.
For the purpose of sharing knowledge management practices from nuclear organizations, it is planned to form a specific e-catalogue "Knowledge Management Practices in Nuclear Organizations."This catalogue will contain all good examples of NKM implementation - already collected and published in any earlier NKM documents. After completion the catalogue will be available to all Member States interested in knowledge management practices in order to enhance and support of the implementation of their own knowledge management programmes. Moreover, this collection of practices will be used in nuclear knowledge management courses for educational purposes, as well as for development of knowledge management methodologies and tools.

This presentation will introduce the concept and the requested information from Member States to facilitate the collection of good practice in the implementation of the NKM activities and will be make as on interactive.

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Human Resources Capacity Building as a Strategy in Strengthening Nuclear Knowledge Sustainability in the Experimental Fuel Element Installation of BATAN-Indonesia

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Human resources capacity is a valuable asset of an organization and an indicator of its sustainability. In the Experimental Fuel Element Installation (EFEI) of BATAN, many of the employees who had gained valuable knowledge and skills have retired, while recruitment of new ones cannot fulfill the need, both in quantity and in quality. In order to maintain human resources capacity related to nuclear fuel production technology, a nuclear knowledge preservation program is implemented in the EFEI. The program consists of coaching and training, mentoring and documenting important knowledge. Coaching and training activities are conducted regularly. In average, there are four to five of such activities in a year. In addition to them, mentoring plays a very important role in the transfer of knowledge activities. The purpose of mentoring is to provide junior employees with the skills to get the works done appropriately. All employees are also encouraged to express their ideas openly on matters related to their works, so that a culture of knowledge sharing can be well developed within the organization. Employees are given the opportunities of sharing and exchanging ideas in the daily briefing and in the monthly "coffee morning"forums. Another one is the setup of a nuclear knowledge management portal in the EFEI's intranet for information storage and exchange which can be used by all employees. Employees are obliged to upload the information that they have related to their works to the portal database directly or with an assistance from the portal operators. Information uploaded includes notes, pictures, and videos. The program activities are monitored and evaluated quarterly for its improvement in the following year. Aspiring employees are encouraged to get further education and training with both internal and external scholarships. They are also encouraged to conduct research and development collaborations locally and internationally.

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Building Human Resources for Nuclear programmes: The Syrian Experiences

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It is well known that human resource building is one of the processes needed for any country preparing to have NPP Project. It should include, inter alia, nuclear engineers and radiation protection officers. Therefore, special education and training programmers have to be put in action.

The Atomic Energy Commission of Syria (AECS) has strengthened education and training in radiation protection since early 1990's, due to the rapidly increasing demand for energy and nuclear technology and to the insufficiency of knowledge, experience, resources, and facilities in the nuclear knowledge management.

The Post-Graduate Training Course on Radiation Protection and Safety of Radiation Sources (PGEC) was one of the major activities hosted by the AECS and supported by IAEA. With the collaboration with Damascus University, the IAEA standard syllabus of the PGEC was adopted to be the core for a Master degree in Radiation Protection since 2006. In addition, collaboration between Damascus University and AECS was also started in 2008 to establish a Nuclear Engineering Section for Undergraduates at the Faculty of Mechanical Engineering. Syrian research reactor MNSR is used as a training tool to perform selected nuclear engineering experiments.

Finally, AECS established the Nuclear Science and Technology Training Center (NSTTC) in February 2010. The strategy of the NSTTC is to meet training plans and needs of the AECS, the government and private sectors, in addition to the Arab and international organizations. It aims at establishing a dynamic structure capable of studying and assessing the national training needs and plans to build training capacity to meet these needs.

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The Concept of Training System for Newly Established Operator in Embarking State

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Specialized training is an essential prerequisite to create and sustain a competent workforce for operating organization. In the case of new-comer countries this necessarily means implementing an appropriate knowledge and skills transfer strategy based on well working relationship with particlular counterpart in a vendor country. In addreessing this issue on October 21, 2011, State Atomic Energy Corporartion "Rosatom"issued a special resolution on developing the "training infrastucture" in support of nuclear new build of WWER based NPPs outside of Russia.The key element of this resolution is establishing the Consortium for NPP Personnel Training (CPT-NPP) to be responsible body in creating and maintaining effective training programmes for national operating personnel and Russian personnel engaged in NPP construction and commissioning stage in recipient countries. The projected training trajectory is split in two phases- training in Russia and training on the new build site. The Russian phase is covered by three organizations following the logic of the training process

• Theoretical courses on general issues of Safety&Operation in Rosatom Central Institute for Continuing Education&Training (Rosatom CICE&T) in Obninsk;

• Training on NPP NPP Systems&Equipmemt in Novovoronezh Training Centre of JSC "Atomtechenergo";

• On-the-Job Training at reference NPP in Russia provided by JSC "Concern Rosenergoatom".

Depending upon the request from recipient countries the training could be performed either in Russian or in English. For the last option the Consortium relies upon previous experience and best practices of JSC "Atomtechenergo"realized in training the operating personnel for Kudan-Kulam NPP (India) and the set of technical training courses recently developed in Rosatom CICE&T under the general contract with JSC "Concern Rosenergoatom".

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The Role of Computer-Based Educational Laboratories in Nuclear Engineering University Programmes

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With access to reactor laboratories becoming more difficult in some countries the creation of computer-based educational laboratories allows far greater access. The National Research Nuclear University MEPhI at Moscow (Russian Federation) has developed a simulator system for making real-time and archived NPP with WWER-1000 reactor data available for student practical sessions and research. The specialized computer-based laboratory "Reactor physics, control and safe operation of NPP"offers nearly all the same real-time and archival data acquisition capability as available to the WWER-1000 reactor control room operators, and provides a possibility to investigated reactor behavior in

normal and abnormal situations. The learning laboratory supports interactive technologies and team-based activities that enable students to build their knowledge through required gateway courses and explore problems relevant to real life situations. Innovative teaching and learning technologies are at the heart of this laboratory to ensure that future nuclear engineers have every opportunity to succeed.
The laboratory established at the NRNU MEPhI in 2010 is intended for training at technical universities and training centers for personnel of nuclear industry and supports implementation of educational programs on nuclear engineering and nuclear control engineering, as well as programs of vocational training of specialists in the nuclear field.
In 2011-2013 under the IAEA TC programme the laboratory was successfully implemented at technical universities of Armenia, Belarus and Ukraine.
The paper describes purpose and scope of the laboratory, its composition and structure, mathematical model, HMM interfaces, training task support system, teaching approach and practical session structure as well as three year experience in usage of this laboratory for different categories of students and specialists.

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New Nuclear Engineering E&T Programmes in Far East Federal University –To Meet The Challenge of Nuclear Development in South-East Asia

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It is generally recognized that Fukushima accident had no big impact on nuclear power development, the strongest growth being projected for the Asia Pacific Region contributed by several newcomer countries in addition to China and Korea Republic of. The lessons learned from localization of nuclear power technology identified the challenge of safety culture transfer at the pre-operational phase in newcomer countries that is expected to be implemented in multinational and multicultural environment with limited direct experience of local contractors. In addressing these issues there was a decision made in 2011 to organize in Far East Federal University the Centre for Nuclear Technologies and Radiation Safety. The Centre in cooperation with IBRAE and Rosatom CICE&T plays the role of driver to start new nuclear research and E&T programmes. In the focus is the new BS programme in nuclear engineering. For more than 50 yrs FEFU has been providing engineering education in power technology , electrical, mechanical and chemical engineering –those programmes that could cover the non-nuclear portion of nuclear-power engineering education. The nuclear portion is designed by Rosatom-CICE&T based on the requirements for nuclear power sector of Rosatom. The specific of this BS programme is its emphasis on building the competence in cross-cultural communication. FEFU possesses a long experience in teaching the languages, culture and history of the Asia-Pacific countries and compulsory extensive language courses combined with nuclear engineering education give the Russian students appropriate competitive advantages in getting promising career perspective and well-paid jobs in embarking nuclear states. For students from embarking states this programme provides an opportunity to be taught in mixed groups with Russian students thus establishing their personal communications prior to getting the jobs by ones on the vendor side and by others –on the side of recipient.

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Interface Network Groups

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A network database consists of a collection of records connected to one another through links. Presence of database network increases transmission speed and accuracy of information, which are the most important factors for good regulatory functions. Therefore, an establishment of a data bank for Nuclear Regulatory Authority is an urgent need. Interface network groups (ING) are the workers in the data network. They are divided into three groups; scientific managerial (SMG), system analyst (SAG), and network managerial (NMG) groups. Their primary task is collect of data and information from different sectors in regulatory authority (SMG), and to transform these data to the organized database forms (SAG), which are available for all workers on the computer network (NMG). Meanwhile to face the very broad range of technical matters on which the regulatory related research activities, regulatory authority will need to rely on the ING. ING can act as the mediator between the regulatory authority and technical support organizations (TSO). Accordingly, regulatory authority can address to the ING subsidiary tasks, which are not less important than their main duties. Hence, The SMG can concern about scientific communications and demands, follow up plans and track scientific problem solutions. On the other hand, SAG can help in building of computer codes for verification purposes. Finally, NMG can perform the role of time alter. The interface network groups are a strategy to manage human capabilities and resources

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HUMAN RESOURCE DEVELOPMENT FOR NUCLEAR POWER PROGRAMME IN UGANDA

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Uganda is one of the countries in East African and African countries engaged in the development of Energy and Minerals in the World through Ministry of Energy and Mineral Development, Agencies, Companies and different stakeholders.
The existing generation mix for Uganda is predominantly hydro power with thermal plants as on standby totaling to 851.5 MW showing forecasted power demand between 2011 and 2020. With the growing population and the high demand of power consumption in the country this will not be able to meet the Notational Development Plan and consumption per capita target in 2040 which will 3,668kwh/capita.
The central location of Uganda encourages sharing of infrastructure, regional power demand, drop in the water levels that makes the hydro power generation unreliable
Despite the challenges of power shortage in the country, the Government of Uganda has continued to improve on the power supply in the country through Policies, legal and institutional framework. Among others are the National Development Plan 2012/11/ -2014/15 that provide for specialized training of human resources in the nuclear energy, Vision 2040 identifies nuclear energy as an option for meeting the energy deficit, signed and launched a Country framework between IAEA and Government of Uganda.

Though the capacity building in nuclear power programme is low, the Government is training a number of human resources in different field of nuclear science and technology with aim to promote the development of nuclear power programme.

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A Systematic Approach to Human Resource Development Plan for a New Nuclear Power Programme

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Newcomer counties entering into nuclear power programme requires a long term commitment of at least 100 years, high capital investment and several generations of human resource with necessary knowledge and skills across various science and engineering disciplines. Proper planning of human resource is essential for successful implementation of the programme. The Human Resource Development (HRD) plan for a nuclear power programme, especially for the first Nuclear Power Plant, should address the human resource requirements starting from pre-project phase to plant operation phase of various organizations like Nuclear Energy Implementing Organization (NEPIO), Regulatory Body, Owner Organization, Operating Organization and other supporting organization like education and training Institutes etc.

Many of the IAEA guidelines for human resource, except TRS 200 and NG-T-3.10, are exclusively developed for specific organization while others cover either workforce planning, training or managing human resource for various organizations (Refer Table-1). The latest IAEA guideline NG-T-3.10 has satisfactorily addressed this issue but it is only limited to workforce planning. Apart from this, it has only given an idea on what factors to be considered and on how to get started for workforce planning; but not a complete idea for developing a HRD plan.

In this paper, a systematic approach to HRD plan, based on relevant IAEA guidelines, for a new nuclear power programme is presented in five simple steps i.e. Plan, Recruit, Train, Deploy and Manage (Refer Figure-1). It primarily focuses on human resource required for nuclear organizations based on its organizational structure, roles and responsibilities, qualification and skills, staffing requirement, their identification, recruitment, training, deploying and managing them throughout the entire programme. This paper will help the new comer countries as a guideline supporting IAEA guidelines to develop a HRD plan in an easy manner.

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Knowledge management system in the State Atomic Energy Corporation «ROSATOM»

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Knowledge Management System (KMS) of ROSATOM is aimed to provide full life cycle of Knowledge Management processes: from knowledge generation to commercialization.

The first step was implementation of Knowledge Management tools in scientific institutes. Implementation has been operated by Management Company of ROSATOM Innovation Management Unit –ZAO "Science and Innovation".
ROSATOM's Knowledge Management System has a stable three-tier structure. This is the management of the rights of the results of intellectual activities (RIA), the digitization and content management, and the management of scientific and technical communities, with a focus on the transfer of poorly formalized and non-formalized knowledge.
During the development process of Knowledge Management System Target Model, a set of components, its objects, processes, tools and requirements for its functionality have been identified.
The idea of life cycle of corporate knowledge is used as a prerequisite for selection of KMS objects. Initially, there is an idea. Then, during research, the array of non-formalized knowledge is produced on its basis. After that, the knowledge is formalized, transformed into digital form and transferred onto the physical media. The end of the cycle is in revealing the results of intellectual activity, subject to legal protection and commercialization as a final phase.
In order to create the effective KMS it is necessary to engage several different groups of corporate professionals —lawyers, patent engineers, IT specialists, human resources practitioners and even PR experts. To collect all this together into one team is possible only by creating a focal point for preparation and implementation of decisions as a separate KMS division.
This paper presents the main feature of the KMS and the best ROSATOM experience with its implementation and maintenance in different organizations, in particular in research and development sector.

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Sudan Country Profile - Human Resource Development for the first Nuclear Power Program

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Sudan has been decided to prepare a strategy plan for the first nuclear power plant for various reasons like production electricity and increase the national industries besides the capabilities to do the scientific and research activities.
Sudan has been started to establish and develop a master plan for the human resource development and makes a comprehensive realistic assessment about the organizational, educational and industrial capabilities and determines the requirements for developing the quality and quantity of human resources needed.
The national nuclear regulatory authority has been started to update all legislation and regulations and also reviews and evaluates the international agreements and conventions related to the nuclear energy.
In this profile we used the methodology of the international atomic energy agency to assess and evaluate the capacity building in Sudan. The expected outcomes from this profile are identified the gaps regarding the strengthening the national infrastructure and nuclear regulatory framework and issuing regulations to met the requirements for safety and security of the nuclear power plant.
The availability of the human resources skills are important for effectively monitors the activities of the companies and facilities involved in nuclear power plant.
The new nuclear law and the new national policy of the nuclear program are now under the process of approval.

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Role of Pakistan Institute of Engineering and Applied Sciences

(PIEAS) in capacity building for nuclear power program of Pakistan.

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Electricity is vital to the survival of modern civilization. With nuclear energy, it is possible to create enough electricity to meet the world's energy demands. Pakistan has a small nuclear power program, with 725 MWe capacity in operation and 680 MWe capacity under construction. Pakistan aims to enhance it to 8800 MWe by year 2030. Pakistan Institute of Engineering and Applied Sciences (PIEAS) has played a vital role in capacity building for a sustainable nuclear power program by developing highly educated human resource. This has been mainly done by initiating an MS Nuclear Engineering program along with other supporting educational programs in engineering disciplines. The main strategy is to select the best graduates from the basic engineering disciplines and provide them education and training in nuclear engineering through a two year MS Nuclear Engineering program. This program has five semesters (4 semesters of 16 week duration and a summer semester of 8 weeks). The participating students for the educational programs of PIEAS are selected through a nation-wide comprehensive technical test and rigorous technical interview. The selected students are offered a handsome amount of fellowship sponsored by Pakistan Atomic Energy Commission. This fellowship grant covers all the expenses during the MS program including a stipend equivalent to basic salary of young engineer/scientist graduate in the country. All successful graduates of MS program from PIEAS are offered jobs and additional service benefits, like early promotion and additional salary increments. Nuclear orientation courses are arranged by PIEAS for directly recruited engineers/scientists (without going through MS Nuclear Engineering program). More than 3000 graduates from PIEAS and the affiliated institutes, such as KINPOE (Karachi Institute of Power Engineering), are currently contributing in nation-wide nuclear power program. Training of the technical staff is conducted at KINPOE through special practical training courses.

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Benchmarking Nuclear Science And Technology Educationa and Research in Tanzania

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The United Republic of Tanzania is striving to build national capacity to support on-going and future nuclear applications, as such a high demand for competent personnel with knowledge in nuclear science and engineering has been arising in the fields of health, agriculture, livestock, industry, research, mining and energy production due to fast economic development in recent years. Insufficient number of qualified human resources in this field has been the stumbling block for converting such achievement into sustainable national development. Education is necessary to sustain and develop the peaceful utilization of nuclear technology by providing qualified specialists. As part of the preparatory activities to enhance the nuclear education in Tanzania, TAEC, with the assistance of the International Atomic Energy Agency (IAEA), Nuclear Knowledge Management Section, has undertaken a quantitative analysis and evaluation consisting of; i) a baseline study of the current nuclear educational capability of the leading universities and institutions involved in nuclear education, and ii) a self-assessment by the same institutions. The baseline report on national nuclear self-assessment exercise is being used to perform gaps and needs analysis, determine common factors, strengths and weaknesses of the level of nuclear education in Tanzania that can be used to to establish a network of sharing knowledge and resources and establish and strengthen nuclear education programmes in Tanzania. This study will also provide a baseline analysis of the current status

of engagement of Tanzanian universities and research institutions in nuclear technologies that are relevant to Tanzania's growing needs and investment for higher education.

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Virtual Nuclear Management University

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Currently, there is no full Master's degree programme specializing in the management aspects of nuclear technology, science and engineering. University programmes of business, technology and public administration provide courses of general management, but none of them teaches how it is specifically applicable to nuclear sector. Some existing departments of nuclear technology provide courses related to management, but the number of such departments and the courses are very limited.
However, effective management is critical throughout the nuclear technology life cycle in order to achieve and maintain the high-level safety and economics. "Virtual Nuclear Management University (VNMU)"is the initiative focusing on the needs of and potential benefits to Member States to develop educational capacity in Member States and will provide management courses for managers or future managers working in nuclear sector to obtain a diploma or a master's degree.

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Capacity Building: How to provide E+T, HRD, KM and KN for the Brazilian Nuclear Programme.

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For the purpose of this paper it is to present briefly the role of the Brazilian Federal Government to accomplish the challenge of the Brazilian Nuclear Policies that includes: (1) Construction of the Multipurpose Brazilian Reactor (RMB); (2) Development of the project to hold tailings from medium and low activity, (3) Development of design and prototype for fuel tank used; Brazilian Nuclear Regulatory Agency; (4) Production of nuclear energy to provide autonomy and sustainability for the country; (5) Be self-sufficiency of the fuel cycle stages with the possibility of exporting surplus; (6) Expanding the supply of products and services technologies in nuclear area (health, environment, agriculture and industry) and, least but not least,(7) Meet the standards required by the National Defense Strategy, in relation to the development of nuclear-powered submarine. The question that rises in this paper is the following; "How the Brazilian Government (Industry, Universities, Research Institutes, Educational Institutions and others players⋯) is going to prepare professionals taking into consideration the concept of Capacity Building of the IAEA: "a systematic and integrated approach that includes education and training, human resource development, knowledge management and knowledge networks to develop and continuously improve the governmental, organizational and individual competencies and capabilities necessary for achieving a safe, secure and sustainable nuclear power programme", for the Brazilian Nuclear Programme?"Moreover, since in Brazil as in any other member countries of IAEA, the value of educations and training is highly regarded, especially considering the ageing of this specialized workforce; the reduction of staff; lack of attractive nuclear educational programmes and a few Colleges, Universities and Research Institute offering Nuclear Education.

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The Gulf Nuclear Energy Infrastructure Institute (GNEII) Four Years On

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Established in 2011, the Gulf Nuclear Energy Infrastructure Institute (GNEII) provides a regional mechanism for developing responsible nuclear energy infrastructure. Combining education and research, GNEII helps increase understanding about nuclear energy infrastructure, including safety, safeguards, and security (3S), among Gulf and Middle East professionals in regional nuclear-power programs. GNEII is affiliated with the Nuclear Engineering Department at Khalifa University of Science, Technology and Research in Abu Dhabi, United Arab Emirates (UAE). GNEII's mission is to engender, through professional development and education of decision makers from the region' s nuclear-energy programs, a responsible nuclear-energy culture, including institutionalized safety, security and nonproliferation norms. GNEII is a strategic partnership among the UAE's Federal Authority for Nuclear Regulation (FANR), the Emirates Nuclear Energy Corporation (ENEC), the Critical Infrastructure and Coastal Protection Authority (CICPA), and Khalifa University, along with US Department of Energy's National Nuclear Security Administration Office of Nonproliferation and International Security and the US Department of State's Partnership for Nuclear Security. Sandia National Laboratories and Texas A&M University's Nuclear Security Science and Policy Institute (NSSPI) work with Khalifa University to implement GNEII. GNEII's UAE partners will assume responsibility for GNEII operations by 2017, making it a fully indigenous regional institute. GNEII will complete four years of operation in 2014, including its signature Fundamentals Course in May. During its first three years, the GNEII Fundamentals Course has graduated nearly 60 Fellows from four Gulf Cooperation Council (GCC) countries (UAE, Saudi Arabia, Kuwait, and Qatar) plus Jordan.

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Nuclear Security Education in "non-Nuclear"Countries –Inseparable Component of Global Nuclear Security Scheme; Example of Montenegro

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Global scheme of nuclear security is not limited to nuclear countries –there should be no "blank" spots on the world map, which could jeopardize security as a whole. Small "non-nuclear"countries are particularly sensitive and should be paid due attention in this respect. Human resource development, education in particular, is to start with.

Montenegro is such a small, developing "non-nuclear"country (no nuclear installations), the use of radiation sources being modest and limited to ordinary medical and industrial applications. Even though –and taking into account current and near-future status of the field –there is (or will be) significant need in nuclear knowledge (NK).

At present, there is an obvious shortage of NK in the country, resulting from recent political and economic history of the region, brain drain and attrition, poor interest of young students for the subject, etc. Perhaps the most in need are nuclear security specialists, since human resource development in this particular field had to start from the scratch.

University of Montenegro effectuates practically complete high education in natural and technical sciences. Centre for Nuclear Competence and Knowledge Management (UCNC) was established in 2009 with support of the IAEA, with intention to help the country cope with the problem. At UCNC we soon realized the need for appropriate nuclear security education (commensurate to country needs) and consequently took part in the IAEA-based International Nuclear Security Education Network (INSEN) from its beginnings in 2010.
As a result of our INSEN activities, curricula for several nuclear security related courses were developed and courses were introduced into post-graduate educational programmes of Applied Nuclear Physic (Department of Physics).
Last but not least, the role of INSEN Portal should be emphasized –we find it the most valuable source of information and mean of communication on the subject.

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Knowledge Management Course for Master Program in Nuclear Engineering

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Knowledge management in the last 20 years has established itself as a key strategic approach for management of intellectual assets in many successful organizations. In the area of nuclear science and technology, knowledge management can improve safety and efficiency, increase innovation and help preserve and enhance current nuclear knowledge.
Considering the critical importance of nuclear knowledge for power generation and other nuclear applications, it is timely to introduce the concept of managing knowledge at the university level. A substantive curriculum is vital for a successful nuclear knowledge management course. While there is no international standard as to the contents of such curricula, there is substantial consensus among educators in different organizations including the IAEA of what constitutes a good quality nuclear knowledge management curriculum.
Taken the IAEA recommendations in the subject area as guidance, a university course on Nuclear Knowledge Management has been developed and introduced for Nuclear Engineering Master program at the NRNU MEPhI supporting the establishment of managerial competences of graduates as a part of managerial courses on communication, team working, basic business, project management and knowledge management.

The expectations of degree recipients at a Master's degree level are that the student shout be able not only to analyze, synthesize and evaluate knowledge gained but also apply this knowledge to nuclear power systems and facilities. In particular, specific competences that the graduate with the qualification of Master of Nuclear Engineering must have include:
—Project management skills to carry out collaborative efforts with other team members, for assessing the quality and efficiency of the personnel, and upgrading the personnel performance;
—Organizational and managerial decision tools including knowledge management to achieve optimum outcomes with respect to quality, reliability, economy, safety and the protection of the environment.
The paper describes the course structure, content and two year experience of implementation.

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Human resources development in Tajikistan

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The availability of nuclear knowledge is the result of the past and present conditions of organizations of knowledge in the field of atomic and nuclear physics in Tajikistan. It is shown, that despite today's weak material resources, with the support of IAEA and other intergovernmental contracts and the international funds, and also presence of rich intellectual fund of the republic, it is possible to reserve Nuclear Knowledge in Tajikistan.
The Republic of Tajikistan is not a nuclear country, but it uses achievements of nuclear science and technology in a number of manufacturing branches. That is why the important problems for us are training of staff and preservation of nuclear knowledge. During the Soviet period we did not have such problems, as during that time well-educated specialists, both in central institutes of higher education and particularly in the Chair of Nuclear Physics of the Tajik State National University (TSNU) were trained regularly and according to plan.
Chair of Nuclear Physics of TSNU was established in 1961. Well known physicists from Moscow worked in the field of cosmic rays in the Chair of Nuclear Physics. They simultaneously worked in Pamir expeditions of the Physical Institute of the Academy of Sciences of USSR (PIAS). The research theme of the Chair of Nuclear Physics until 1975 has been devoted to research in the field of physics of space beams. In 1970 and the beginning of the 1980, employees of the Chair were also engaged in physics activation analysis and radiation physics. Sometimes scientific themes and training directions were changed.

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Knowledge management implementation issues faced by nuclear organizations in Sri Lanka

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International Cooperation Division of the Atomic Energy Authority of Sri Lanka possesses the data of the nuclear knowledge base of the country as it coordinates all activities related to the implementation of all nuclear related programmes in the country. The goal of KM is to capture, store, maintain and deliver useful knowledge in a meaningful form to anyone who needs it anyplace and anytime and it consists of three fundamental components: people, processes and technology. Although KM is primarily process-oriented, it needs the right methods, technologies and tools for a successful implementation. A number of issues have badly been caused on the implementation of KM in Sri Lanka due to non-availability of sufficient human resources, policies technology, etc. Recruitment of manpower in Sri Lanka is not easy and it will take time and lack of opportunities for the staff to obtain training on KM has also become a very difficult task. Effective measures or any policy decision has not been taken to avoid invisible fear of employees on knowledge sharing as sometimes people fear that sharing knowledge will cost their jobs and loss the inherent advantage in organization. Lack of long term planning for enhancement and preservation of nuclear knowledge, insufficient information collection, absence of integrated approach and non-recognition of KM as an important pillar or an element for sustainability have also become issues to be considered.

Database for KM is not properly maintained for its better implementation and nuclear institutes in Sri Lanka are also not in a position to provide immediate basic technological amenities for KM activities. Human Resources, Procedure and technology required for KM implementations should be enhanced to get the maximum use of KM. Weaknesses and threats caused on the implementation of KM should be addressed by using its own strengths and opportunities.

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Human Resources Development for Jordan's Nuclear Power Program

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The role of adequate human resources for achieving the objectives in the field of peaceful use of nuclear energy cannot be overestimated. The nuclear field, comprising government authorities; industry; various regulators; research, development, technical support and training organizations; educational institutions; vendors; construction and commissioning organizations; and international and professional organizations; relies heavily on the competent, specialized, highly trained and motivated managers and personnel for its safety and sustainability.

The Nuclear Engineering Department (NED) at Jordan University of Science and Technology (JUST) was founded in early 2007 in cooperation between JAEC and JUST, it is the first and only department of its kind in Jordan, and is designed to fulfill Jordan's needs of nuclear engineers and scientists.

The establishment of a Nuclear Engineering department at JUST is another step in Jordan's efforts to develop its nuclear infrastructure, and to introduce nuclear power as part of its energy mix.

JAEC signed a contract with the China Institute of Atomic Energy (CIAE) on November 24, 2008 for the construction of Jordan's first nuclear facility (Jordan Subcritical Assembly (JSA)) at the premises of the Jordan University of Science & Technology (JUST).

JSA will be used mainly for the education and training of nuclear engineering students.

JAEC signed a contract with the Korean Consortium on March 31, 2010 for the construction of Jordan' s first Nuclear Research Reactor, JRTR is Jordan's world-class research reactor, which will serve as an integral part of the nuclear technology infrastructure and will become the focal point for a Nuclear Science and Technology Center (NSTC)
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The Value of the Junior Professional Officer Program to the IAEA and its Member States

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The IAEA's Junior Professional Officer (JPO) program provides the opportunity for early career professionals to obtain valuable work experience while helping the IAEA perform basic, yet essential work that would otherwise be performed by an experienced staff member. JPO assignments include open source information collection and analysis, equipment evaluation, testing, and installation, statistical analysis of data, satellite imagery analysis, and database and software development. JPOs are college graduates with degrees in science, engineering, or other disciplines relevant to the work of the IAEA, generally less than 32 years of age, having less than two years'professional experience, who work with the IAEA in entry-level positions for one or two years under extrabudgetary funding provided by an IAEA member state. Ten member states have JPO agreements with the IAEA. The

United States initiated its JPO program in 2004 and has found that the program has advantages for both the IAEA and the United States.

The IAEA is an excellent environment for introducing young scientists and engineers to the practical application of their education, to international civil service, to the challenges facing the global nuclear industry, and to the industry's practitioners.

This paper will summarize the advantages of the JPO programs to the IAEA and to the member state

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Promoting Intercultural Competencies

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While many professionals in the nuclear field have significant levels of experience with foreign travel, foreign colleagues, and foreign languages, a standardized approach to intercultural awareness is beneficial to all human capital development programs. Intercultural understanding and communication competencies can improve the effectiveness of collaborative work between professionals. Such competencies should be developed on multiple levels. The first level is developing intercultural awareness on a broad platform. The second is to provide employees with culture-specific, targeted information and training to allow them to maximize their professional experience abroad. Employees with technical and substantive expertise, as well as those with social science or other backgrounds, can benefit from intercultural training, and organizations can develop approaches to providing this training that is tailored to their needs.

DOE/NNSA's Next Generation Safeguards Initiative is currently funding a study at Brookhaven National Laboratory to gain a comprehensive understanding of how a tailored approach for NNSA-officials and contractors could improve the effectiveness of their intercultural communication and, by extension, their project effectiveness. The paper is addressing both the need for such training, and also the mechanisms and approaches by which such training can be efficiently delivered to busy professionals.

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Importance of Knowledge Management in Human Resource Development

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Increasing energy demands which cannot be met by the conventional energy sources require new approach to nuclear science and technology which could give wanted solutions. For efficient use and progress of nuclear science, it's important to ensure availability of suitable educated and trained staff. Attrition of the knowledgeable professionals in this field due to the long-term lack of developing and maintaining human resources for nuclear technology purposes is a problem. In human resource management is important to identify crucial knowledge base on which competitiveness of company depends, and according this ensure appropriate development of human resources. Work of human resource departments almost overlaps with core knowledge management challenges.

Faculty of Electrical Engineering and Computing (FER), University of Zagreb is the leading institution in Croatia for education in the field of nuclear engineering. Following some recommendations of the International Conference on Human Resource Development for Introducing and Expanding Nuclear Power Programmes, Abu Dhabi, 2010, author decided to propose course of Knowledge Management for Master Engineering Study at FER. Program of the course got accreditation and started in academic year 2010/2011. Main idea was to teach students basic principles of knowledge management, how to produce, capture, evaluate, transfer and preserve knowledge in the knowledge life cycle, and finally how to integrate knowledge management in work activities in different organizations. Program of the course was improved every year. Last academic year more than 120 students attended the course which was great achievement for such program. Author, and teacher of this course, is also involved in preparation of international curricula for knowledge management course for nuclear science and engineering studies.
Since knowledge management could be concerned as a key strategic element of human resource development, some national activities, efforts and experience in this field will be presented.

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Establishing Requirements for Nuclear Engineering Educational Programs

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A competent nuclear engineer can be produced through varying contributions of formal academic program and complimented by industry training. It is recognized that a robust nuclear engineering course is the sum of many subjects including Reactor physics; Nuclear fuel cycle; Thermal hydraulics; Materials; Radiochemistry; Radiological protection; Safety, security and safeguards; Dynamics, control and instrumentation; Nuclear instrumentation; Reactor systems and engineering; Communication, team working, basic business/economics, project management
A group of international experts under the IAEA umbrella has performed a project aimed at providing an understanding of the competencies expected of nuclear engineering graduates at the Bachelor' s and Master's levels. The expert group took into consideration a number of nuclear engineering educational programs in several countries and provided guidance to decision makers in Member States on a competence-based approach to curricula development, presenting the established practices and associated requirements for educational programs in this field.
The paper outlines the learning objectives (content, courses, and subjects) and the learning outcomes and related competencies that are sought in nuclear engineering educational programs. The focus is on the common requirements in developing the curricula, and outlines the competencies at the Bachelor's (undergraduate degree) and Master's (post-graduate degree) levels. It is recognized that due to a number of factors, no single approach would apply to all Member States. These conditions can include such considerations as the current extent of higher education and the university infrastructure, national traditions and legacies in education, the interaction and role of training with industry, the presence of a robust approach to apprenticeships, and other similar issues.
The paper provides as example the approach that is used for nuclear engineering education at the National Research Nuclear University MEPhI.

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The STOReR System A tool for Traceability and Radioactive Wastes Record Preservation.

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As part of an integrated KM System for the NRWMP and in the framework of the IAEA Project ARG9012, the STOReR system has been developed integrating KM into day to day Waste Management activities.

Since 1969 the CNEA has had a waste management area called AGE in Buenos Aires Province which, among its facilities, has laboratories for waste characterization, and facilities for radioactive wastes (RW) treatment, conditioning, packaging, storing and disposal of low level RW.

Among its duties, the NRWMP has the responsibility of maintaining a documented record system to preserve the available knowledge related to the mentioned facilities. The STOReR system has been designed with the purpose of ensuring traceability through all the steps of RW management since generation till storage or disposal. The purposes of this system are to upgrade the one in use since 2001, to improve the inventory calculations and to generate the proper QA records to fulfil the new regulatory requirements.

The new system incorporates and manages three remote features: monitoring the waste package using GPS during the transport; access to the records and the whole system using handheld computers through barcode identification of the waste forms and the use of QR (quick response) code provides package data directly through a proper mobile phone.

Basically the STOReR consists on two Websites, one on the Internet, where the RW generators can register to apply for all AGE provided services on line. The other Website is an Intranet application where the members of the AGE, with different roles and permissions can perform all the daily activities. In addition, the system provides outputs that facilitate National Congress Reports, Regulatory reports and IAEA information.

The STOReR is a tool for KM applied to process and it is expected to be used in other facilities such as Nuclear Power Plants.

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Nuclear Regulatory Authority Personnel Educating and Training within the National Nuclear Program Development

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The dynamics of national nuclear program development, especially addressing NPP construction, forms a number of challenges for the state nuclear regulatory infrastructure. One of these challenges is a necessity to provide the nuclear regulatory authority with the qualified personnel. The possible approach to this issue is to establish a throughout system of personnel educating and training covering the basic nuclear university education, additional specialized post-graduate training, on-job and practical training and periodical refresher training. In the Russian Federation such a

system is developed by the National Research Nuclear University MEPhI, Training and Methodological Center for Nuclear and Radiation Safety and a number of other educational institutions. The distinguishing feature of the system is deploying the integrated information environment of personnel educating and training of the required professional field, providing the knowledge management methodology.

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Human Resource Requirements For New Nuclear Power Operating Organizations

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Human Resources are one of the 19 infrastructure issues in the IAEA Milestones approach to the development of new nuclear energy programs. Human resources are the backbone of every nuclear energy program, and a significant variety of personnel, in terms of skills and training, are required to safely, effectively, and efficiently conduct a nuclear energy program. This paper will discuss the key drivers for identifying the required human resources needed, including those driven by the unique attributes of plant design, site layout, national regulatory requirements, centralization (in a multi-site environment), and opportunities for outsourcing. Additionally, this paper will discuss the varying lead time requirements needed to ensure that "the right number of the right people are in the right place at the right time." The paper will also include a discussion on labor costs, given that expected nuclear plant lifetimes are now 60 years, or potentially longer. Finally, the paper will discuss the impacts of these requirements on recruiting, and therefore on human resources capacity building. Examples of existing human resource and outsourcing approaches from current operating nuclear power operating organizations will be provided, with case study examples of under staffing and over staffing and their subsequent impacts.

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Knowledge Management for Business Process Management

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Business Process Management (BPM) has become a commodity nowadays. It has undergone an evolution from the initial business process re-engineering in the 1980s to a well-established management approach. This paper deals with the increasingly important domain of knowledge-sensitive BPM as a current challenge imposed from semantic web, the cloud, social networks or Web 2.0 not only to provide new technologies for BPM but also trigger a cultural change of people involved. Three aspects of knowledge sensitiveness in BPM are proposed. First, BPM can be seen as a domain itself focusing on BP-frameworks identifying basic concepts such as business model, domain, regulation, or model processing. Second, BPM needs to be applied using a management method such as the BPMS methodology. Third, BPM needs to be executed within an environment; hence, it is deployed. BPM can be seen as a basic concept for corporate knowledge leading to knowledge-sensitive BPM. Studying the knowledge-sensitiveness two forms of interpretation are distinguished: (1) knowledge engineering (KE) focusing on machine interpretable knowledge and (2) knowledge management (KM) relating to human interpretation of knowledge. In the following, the focus lies upon KE distinguishing three viewpoints: (a) KE is established in BP-frameworks as a realization within the used meta models for those frameworks; (b) knowledge-intensive actions within the BP method – which is typically performed by business process (BP) analysts –is supported by KE techniques; (c)

deployment of BPM within a typical execution environment is likely to include knowledge-based applications, hence those knowledge concepts need to be reflected. KE techniques are proposed for the areas above and empirical experiences as results of research projects are described. As a conclusion an outlook on the conceptual and technical integration summarizes the paper.

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Guarding the Gates: Confronting social engineering in nuclear power

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Security at our nuclear stations has historically been of great importance. The industry has long recognized that such valuable and potentially hazardous assets need to be guarded with the utmost care. Plants were generally built in isolated areas, behind chain link fences and visitors and workers were stopped at gates near the plants and asked for identification before entering the site. Kim (2012) notes that "⋯nuclear security should be based on the physical protection system, which serves to detect, delay, and respond effectively to attempts to harm a nuclear facility."(p. 88). However, the events of the last decade have caused us to heighten that security even more. Helman (2005) reports that "Since September 11, the nuclear industry has spent nearly $1 billion upgrading security at nuclear plants". (p. 92). With that in mind, we have built our fences stronger and higher, added security personnel, and utilized more technology for detection on the perimeters of our sites. A General Accounting Office (GAO) report in 2003 notes that the "NRC also has issued advisories and orders that were designed to increase the size and improve the proficiency of plant security forces, restrict access to the plants, and increase and improve plant defensive barriers".

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EU activities for Training and Tutoring of Regulatory Authorities and Technical Support Organisations (TSOs)

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The European Commission through the Instrument for Nuclear Safety Cooperation (INSC) promotes the Nuclear Safety culture outside the European Union. Training and tutoring projects involving the staff of the nuclear regulatory authorities (NRAs) and their technical support organisations (TSOs) is one of the key elements of the European Commission strategy to achieve its goals.
The objective of the Training and Tutoring (T&T) projects is the provision of training and tutoring for the experts of NRAS and their TSOs in view of strengthening their capabilities. The projects support the NRAs in their effort to become reasonably self-sufficient in terms of management and technical means.
The different courses are selected among existing EU offer of courses by the EU NRAs and TSOs, the IAEA or any type nuclear organizations or specifically developed upon requested of the specific needs expressed by the partner countries. Tutoring opportunities is to be provided within the EU NRAs and TSOs.

The main orientations of the training and tutoring activities cover the different areas of responsibilities and function of a NRA as authorization; review and assessment; inspection, and enforcement; and development of regulations and guides.
The T&T activities aiming at the transfer of the EU expertise are implemented by consortia of EU NRAs and TSOs contracted by the European Commission. Up to now partners from ANNur (regional organisation of the Arab regulators), Belarus, Brazil, Indonesia, Iraq, Malaysia, Morocco, Tajikistan, Ukraine and Vietnam have participated.
The projects are organised in different phases related to Annual Action programmes. Up to now projects for a total value € 6 million is contracted, project for € 3 million will be contracted this year and an additional € 3 million is planned for next year. It is expected to continue these projects during the INSC programme 2013-2020.

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EDUCATIONAL NETWORK ENVIRONMENT: MODELS AND IMPLEMENTATION

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This article presents an analysis of the way the distance learning models are implemented in Belarusian State University of Informatics and Radioelectronics and presents recommendations for their improvement.
Educational efficiency using network technology is caused by the shortening of the training period; reduction in the cost of electronic educational services; independence of educational services from exact time and geographical location; the ability to control the pace and trajectory of learning; improvements in the learning experience; the ability to quickly update training materials; transparency of the learning process; the possibility of repeatedly attending the course virtually (though viewing videos of lectures, workshops and seminars more than once); as well as the speed of feedback and the control over the educational progress. The urgent task today is to integrate the network of educational resources of various educational institutions in order to share best educational technologies; remotely use the best people; real-time access to information; organization of joint scientific and educational research and development.
The aim of this work is to analyze models of e-learning; develop recommendations for their implementation at the university; and demonstrate the experience of BSUIR in terms of the use of network technology in learning.

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Nuclear Knowledge Management –A National Infrastructure Issue for New Nuclear Power Programme

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Countries with new Nuclear Power Programme (NPPr) dealing with highly sophisticated and complex nuclear technology with no prior experience; with lengthy nuclear fuel cycles and Nuclear

Power Plant (NPP) project activities which requires high capital investment and long term commitment; with enormous R&D efforts; with no trained manpower to run NPPs and nuclear facilities safely; issues with public acceptance; issues with nuclear safety, security and safeguards; etc. requires huge amount of nuclear knowledge base and trained manpower through establishment of effective Nuclear Knowledge Management (NKM). IAEA NG-T-3.10 suggests that NKM plays a vital role in successful implementation of NPPr and for its long term sustainability. It may take years to build a nuclear knowledge base therefore a good NKM practice is needed. Hence, it is important to consider NKM as one of the infrastructure issue of the NPPr.

NKM as an infrastructure issue is different from Human Resource Development (HRD). NKM is a vast field by itself and it should be dealt separately. HRD focus on human resource required based on organizational roles and responsibilities, qualification and skills, their identification, recruitment, training, deploying and managing them throughout the entire programme whereas NKM focuses on knowledge creation, identification, acquiring, capturing, sharing, transferring, protection, validation, storing, dissemination, preservation and utilization, and NKM culture.

This paper addresses NKM as a national infrastructure issue for countries entering into new NPPr. The NKM conditions to achieve the milestones for the successful implementation of NPPr as per IAEA NG-G-3.1 and its basis for evaluation as per NG-T-3.2 are listed out. It will help the newcomer countries to self-evaluate the NKM as one of the infrastructure issue and to identify the gaps with action plan across different phases of NPPr.

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Human resource development for nuclear power programme in Bangladesh

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The development of an effective competent manpower is one of the fundamental requirements of success for any Nuclear Power Programme. Without capable manpower no nuclear power plant can be planned, constructed or operated appropriately and nuclear safety and reliability of power production cannot be assured. The number and qualification of manpower required for a successful nuclear power programme are usually underestimated and the resulting shortage of manpower is a restraining factor against the development of nuclear technology in developing countries. Before embarking on its first nuclear power project, it is essential for a newcomer country to determine its real manpower needs in the framework of the envisaged nuclear power programme and evaluate the existing organizational, educational and industrial capabilities for meeting these needs. Manpower development for domestic participation in the nuclear power programme should be considered within the broad context of the national industrial development strategy and its overall manpower requirements. Following IAEA guide and shaped by the country's culture, the Government of Bangladesh identified Human Resource Development as the top most priority for Rooppur Nuclear Power Plant (Rooppur NPP) Project and has pointed out 1660 personnel for Rooppur NPP for two 1000 MWe reactors. Out of the 1048 professional personnel of total 1660 personnel, 513 are qualified professionals, technologist are 325 and Craftsman are 210 and it will be finalized discussing with mainly the vendor. This paper reviews the present educational and training system of Bangladesh and its capability to contribute in the nuclear power programme. This paper analyses the measures needed to be taken up to restructure the current educational system that will accommodate the nuclear science and technology education properly in a sustainable manner. This paper also discusses the prospect of training programme through bilateral cooperation with different countries for implementation stage of "Rooppur NPP".

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Approaches to Education and Training for Kenya's New Nuclear Power Program

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The distinctive characteristics of nuclear energy and its fuel cycle give rise to special requirements for education and training necessary to build capacity at the institutional level, including the establishment of an adequate and sustainable regulatory framework. Manpower cannot be transferred from fossil fuel plants. This paper reviews the development of the new nuclear power program infrastructure in Kenya and assesses the current state of nuclear skills in the context of key drivers of the global revival of interest in nuclear energy. Drawing from the experiences of some 50 countries that in the past expressed desire for nuclear energy but lacked indigenous capacity to operate, regulate and maintain a nuclear reactor, much less construct one, the education and training infrastructure that is relevant to nuclear power is identified as the most critical challenge. The gaps and approaches towards realizing the broad spectrum of technical capacity to conduct a national nuclear power program, predominantly electrical, mechanical, and nuclear engineers and health physicists are outlined, drawing from our ten years plus experience in Applied Nuclear and Radiation Physics at Nairobi. The paper proposes a program whose purpose is to catalyze the educational infrastructure necessary not only to enable the country to construct, operate, regulate nuclear facilities, safely handle nuclear materials and set up a sustainable safety and security national infrastructure; the program also includes specific and aggressive education and training initiatives and time lines in nuclear science and engineering within the broader context of the national industrial development strategy and overall manpower requirements in the nuclear industry to produce high quality products and services. The approach is premised to be pursued in the context of a national nuclear policy and strategy, and funding for the complete life cycle including such issues as levels of technology transfer and localization.

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Training Solutions to Support Embarking Countries in the Frameworks of Practical Arrangements with IAEA: Lesson Learned in ROSATOM Central Institute for Continuing Education&Training

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Trilateral practical arrangements between IAEA, JSC "Concern Rosenergoatom"and Rosatom CICE&T were signed at the 55-th Session of the IAEA General Conference in 2011. These Practical Arrangements were established in order to promote joint and cooperative initiatives relevant to HRD, training and education for development of nuclear infrastructure and capacity building in the countries creating new or expanding the existing nuclear power programmes. Within the above mentioned practical arrangements the IAEA has been providing inter alia support to specialists from embarking states for scientific visits in Rosatom CICE&T. Based upon accumulated experience since 2011 and lessons learned in the present paper some recommendations are formulated for national stakeholders (first of all for NEPIO) involved in nuclear infrastructure development. Of highest priority is the investigation of NPP staffing options and associated competences of NPP personnel (both are very

much vendor dependent). This would help to facilitate self-evaluation of national nuclear infrastructure development and form the integrated work plan in the HRD area including training schemes of the key operating personnel in vendor country. Related to this issue is the necessity to form the joint working group for elaboration on the HRD Roadmap for operating organization at early stages of cooperation between vendor and recipient countries. Of particular importance for newcomer countries is construction of combined Information & Training Centre on the NPP site that is to be put into operation simultaneously with the first concrete in the foundation of reactor building. The Centre is necessarily to be used for training of local subcontractors at the stage of NPP construction. To address these issues the special training course for NEPIO managers "Start up of nuclear power programe"was developed and this is suggested as a platform to work on integrated HRD work plan under the IAEA umbrella.

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Developing an Education Capability Assessment and Planning (E-CAP) Framework for Establishing National Educational Networks

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The development and coordination of nuclear education, involving academia, governments, professional societies and industry is an essential activity that facilitates capacity building in nuclear science and technology. Currently, many countries not only face a shortage of qualified and experienced personnel in various fields of nuclear applications, but also mismatch and gaps exists between specialties of graduates and actual labour market requirements. Other challenges include a need for a national framework for identifying research priorities and strengthening coordination of the roles of different ministries, government departments and agencies for promoting nuclear contribution towards socio-economic development.
Therefore, the development of an integrated nuclear education planning methodology is needed and is being developed—referred to as the "Education Capability Assessment and Planning"(E-CAP) framework. It is focused at the national level, taking into consideration the full scope of government priority areas, capabilities and external factors that affect (or can benefit from) the implementation of a strategic and systematic approach for planning and establishing nuclear educational networks, including the identification of best practices within the current nuclear education provision.
In this connection, the focus of this paper would be to present the basic elements of the E-CAP, recognizing that it is still undergoing evolution, thanks to input from MS and emerging experiences from pilot countries in the African region.

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EDUCATION AND TRAINING OF NUCLEAR PERSONNEL: THE NIGERIAN INITIATIVE

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In order to meet its human resource needs the Nigeria Atomic Energy Commission (NAEC) evolved an initiative to partner with some national institutions to meet the challenging manpower training requirements for the implementation of the national nuclear power programme.
The partnership has resulted in the design of curricula for educational professional programmes, (3-months bridging and Masters progammes in Nuclear Science and Engineering), building of requisite

training and research infrastructure in educational institutions and catalyzed the creation and ownership of these training programmes in nuclear engineering, nuclear science and nuclear security by universities and polytechnics;
In addition to developing the critical human resources, this initiative would also lead to capacity building within the participating national institutions to effectively implement educational programmes in nuclear science and engineering on their own in the long term.
The modality of implementation of the Masters programme gives room for effective and efficient utilisation of national available resources where students from all the partnering universities will take the major courses at a centralized national facility while the remainder of courses, seminars and the final thesis shall be taken at their respective universities.
The partnership has graduated the first batch of 10 Masters Students each in Nuclear Engineering and Nuclear Science respectively. The process of admitting the second set of 60 students has also reached an advanced stage.
Furthermore, this partnership offers a broad national platform for effective management of bilateral and multilateral cooperation in nuclear technology development.
It would also introduce improved standards in the content and quality of education and professional training delivered to students.
However, special arrangements for the implementation of the programme would introduce additional costs, relative to straight university implementation. In addition class size may be larger than optimal and may negatively impact on effective teacher student interaction.

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Management of Human Resources in CNCAN

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The paper work will provide information about the general human resources management within our institution regarding the following:
- Recruitment of personal
- Staff employments,
- Financial resources
- Legal framework regarding resources
- Knowledge management
- Continuous focus on improvement of staff performances through dedicated training programmes:
o the process to develop and maintain the necessary competence and skills of staff of the regulatory body, as an element of knowledge management. The necessary knowledge, skills and abilities are documented in the job descriptions for each job position. To maintain an appropriate competence level, an annual plan for staff training is in place and each staff member has an individual training plan.
o Training for CNCAN staff is provided either in-house or through technical cooperation programmes with other States or the IAEA. CNCAN has made arrangements for specific staff training using training courses and programs provided by international organizations. The specific training is provided predominantly with the economic support from outside of the country. Efforts for implementing a knowledge management programme are on-going.
- The role of human resources and organizational level for achieving safe, secure and sustainable nuclear power programmes;

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Creation of Knowledge networks –the best practices from Russian communities of practice

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One of the main objectives in the formation of scientific communities of ROSATOM should be the development of a corporate social network. Such a network should create the environment for mutual exchange, storage and structuring of knowledge. Like any complex project, the network will immediately help in solution of a complex of interrelated tasks: • creating a common space for online interaction of professional community; • search and identification of relevant for solution of specific issues; • providing a space for solution of weakly-structured and innovative tasks through involvement of a wide range of professionals (crowdsourcing, communities of practitioners); • establishment and replenishment of the bank of ideas; During the implementation and operation of a pilot version of the network, a lot of questions arose: who should moderate the discussion, under what tasks they can be opened, how should be formulated discussion topics, who are the system users, what are access requirements for users, what is a legal regime of the results that emerge from the discussion. And there are no ready answers to these questions. Therefore, it was decided that the first community of practitioners will be created from the users involved in the knowledge management system. They are patent specialists, IT specialists, professionals involved in digitizing archives of scientific institutions, those who create the portal of scientific and technical information. The communities of practice (CPS) are formed not as an expert club, not as the embodiment of abstract reasoning about their use, rather their mission is to support resolving practical tasks. In such a way the creation of CPS at the same time becomes a process of creating a community of practitioners for solving specific problems and enhancing the organizational performance.

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ENSI HCM Concept

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ENSI has worked out a human resources development concept in 2006 in order to stimulate the competences of the staff members and to promote knowledge transfer within the organisation. In the frame of a project for optimizing leadership and organisation, the concept has been refined in 2010. It has delivered a good performance so far. Nevertheless, it was not suitable for assuring the necessary resources within ENSI for the years to come. Therefore, it has been expanded to a "Human Capital Management"(HCM) concept.
The HCM concept concentrates on seven topics that have been identified as key elements for securing the resources on a long-term basis. The topics are:
- Recruiting: How to get new employees –and where;
- Education: Target-oriented education and training and the corresponding controlling;
- Career planning: Planning the next steps;
- Resource planning: Evaluate the needs for the next years;
- Succession planning: Identifying key persons and building up successors;
- Salary system: Making the organisation an attractive employer;
- Benefits: The cherry on the cake.

For each topic, the basic rules have been defined, a comparison of target and actual performance has been made, the risks have been analysed and an action plan has been elaborated. The plan has been approved by the ENSI board in August 2013 and the necessary corrective actions will be implemented till end of 2015.

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The Affective Learning Domain in Nuclear Training

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Nuclear training programs typically focus on the cognitive learning domain associated with the technical aspects of work. Aristotle said, "Educating the mind without educating the heart is no education at all."This paper will present why the affective domain, which addresses attitudes, values, and beliefs, should also be included in the design, development, implementation and evaluation of training.

The affective domain involves development of opinions, perceptions, or assessments of worth. These, when combined with a high degree of technical knowledge and skill, provide a strong basis for sound judgment and decision making when faced with uncertainty. Training that focuses on the affective domain emphasizes a motivational element and a degree of acceptance or rejection. Affective objectives vary from simple attention to selected phenomena to complex but internally consistent qualities of character and conscience. Such objectives are expressed as interests, attitudes, values, and beliefs. Implementing affective learning requires active involvement by the students in a way that involves emotion. The purpose is to develop an intrinsic sense of what is required and right. That sense, combined with technical skill, results in judgment.

Evaluating cognitive or psychomotor outcomes is relatively straight forward; however, assessing affective outcomes is difficult since it involves internal values and motivations. Evaluations in the affective domain focus on behaviors which the students link to their values in a meaningful ways. The next frontier in nuclear training is to influence students' attitudes and beliefs toward human performance, nuclear standards, and safety culture, and motivate them to strive for excellence. Training must educate students beyond information in the cognitive hierarchy and move instruction into the affective domain. Training must provoke students to respond to what they learn; to value it, to organize it and characterize themselves and the nuclear industry as special and unique requiring the highest levels of performance.

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Preliminary assessment of regulatory body competence by application of the SARCoN tool

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Recognizing the need to have the desired regulatory staff competence for a nuclear power programme, a competency gap analysis of the knowledge, skills and attitudes (KSAs) of the regulatory staff of the Philippine Nuclear Research Institute (PNRI) was initiated using the Systematic Assessment of the Regulatory Competence Needs (SARCoN) tool developed by the IAEA. The objective of this competence assessment is to identify the missing competency at the individual or organizational level. The scope of the assessment involves regulatory staff who performs job specific task in the five functional sections of PNRI's Nuclear Regulatory Division (NRD). The conduct of assessment is carried out with the assistance of the five-member NRD training needs assessment committee using the guidelines outlined in the SARCoN tool. Each position in the division occupying relevant tasks and responsibilities are well described to identify the applicable KSAs and its required level

of competence. The supervisor of each functional section provides the required KSAs and associated level of competence while each staff answers according to his or her existing competence based on the KSAs. The evaluation of the results of gap analysis is discussed vis-a-vis the main regulatory and supplementary functions identified in GSR Part 1 and GS-G-1.1. The preliminary result of this assessment is used as guide in preparing for a structured training program for each regulatory staff. Individual training plan is prepared by prioritization as to filling-in first those that have higher competence gap, by defining the type and method of training, by finding out training availability in collaboration with international organization or by other training means to fill-in the gaps. The results of this preliminary assessment will be an input to the human resource development plan envisioned for the regulatory body in the next five years.

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SEC NRS experience on training in nuclear safety regulation for states with first nuclear power programme based on Russian VVER technologies

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According to IAEA approaches on strengthening Global Nuclear Safety regime the State providing nuclear technologies should establish the effective transfer of competence in safety to develop the safety infrastructure in the countries embarking on first nuclear power programme (SSG-16).
The key tasks at early phases of establishing Safety Infrastructure are creation of national regulatory body and acquiring regulatory competences needed for regulatory body staff.
To support international obligations of Russian Federation on NPP building in several countries (Turkey, Vietnam, Belarus and others) Russian Regulatory Body Rostechnadzor has started on training in nuclear safety regulation for specialists from national Regulatory Bodies and TSOs.
Paper presents summary information about experience of SEC NRS (TSO for Rostechnadzor) on development of training courses, which cover the full set of regulatory competences. The courses take account of relevant IAEA documents, correspond to objectives of "Strategic Approach to Education and Training in Nuclear Safety 2013 –2022"and provide a really good insight into the whole range of activities performed by regulatory authority.
A brief overview is given on training programmes and structure of lectures, presented in the booklet "Safety infrastructure for a nuclear power program. Basic course".
Since 2011 SEC NRS staff has been providing training for specialists from countries embarking on nuclear power programme to help them to put in place appropriate regulatory infrastructure and to strengthen capacity building in nuclear safety. Some examples of SEC NRS's training practice are presented.

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The Role of Responsible Vendor in Assisting the HRD in Emerging Countries

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The paper adresses the specific issues of capacity building for nuclear infrastructure development in emerging nuclear states with the focuse on the HRD from the view point of vendor countries. JSC "Rusatom Overseas"(RAOS) esbalished in 2012 to support international business of State Atomic Energy Corporation "Rosatom"includes Department of Global Nuclear Infrastructure that covers the multidimensional activities in building and strengthening the nuclear infrastructure for the national nuclear energy programmes. In cooperation with Russian regulatory body and Rosatom CICE&T the RAOS initiated systematic and integrated approach to accumulate the potential of professional expertize available in Russian nuclear sector to support initialization and development of all the 19 nuclear infrastructure issues from "national position"to "procurement". The experts were selected to work out the guidelines, roadmap and training materials. Based on Russian experience RAOS offers to newcomer countries the concept of network of special centres featuring stakeholder involvement (Information Centre), emerging preparedness, continuing education&training, safety&security. The paper focuses also on the option of establishing operating organization from the zero level through the appropriate planning of HRD and building up the necessary competences and properly organized recruiting and stakeholder involvement based on the platform of integrated information and training centre at the NPP site under construction.

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International training program on nuclear engineering at Kinki University

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Kinki University started an international cooperative project in nuclear education in September 2013 with financial support from the Japanese government. The purpose of this project is to develop nuclear human resources who can work actively in an international environment.
Nuclear educations with a real research reactor (UTR-KINKI at Kinki University) were provided to the students from Kinki University (Japan), Kyushu University (Japan) and Kyung Hee University (Republic of Korea) in November 2013 as a first education of the project. The educational program involved the operation of UTR-KINKI, neutron flux measurements by the activation method, neutron radiography, radioactivity measurements for foods inspection and some lectures. The students got educations in a mixed group of students from different countries. The language used in the program was English, and students were required to communicate and discuss in English about the results of experiments and analysis processes with other members all through the program.
Students from Kinki University and Kyushu University were under graduate students, and students from Kyung Hee University were composed of under graduate students and graduate students. 80% of the students have already learned about nuclear physics, though 30% of the students did not learn about reactor physics and radiation measurements before the program.
We asked students with a paper form about the experiments and lectures after the educations. Most students were especially interested in the reactor operation and general explanation of UTR-KINKI. Details of this project will be reported at the conference.

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DDGs Opening Remarks

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ISIS Training Reactor: A reactor dedicated to education and training for students and professionals

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ISIS research reactor is located on the CEA Saclay site. Operated by the Nuclear Energy Division, ISIS is an open core pool type reactor with a nominal power of 700 kW. It is an essential tool for the education and training programs provided by the National Institute for Nuclear Science and Technology (INSTN). The hands-on experience on a training reactor has an invaluable impact on the trainees and ensures comprehensive understanding of the reactor principle and operation that cannot be gained only with theoretical courses associated with the use of simulators. Training courses on ISIS appear to be a very powerful tool for the development of the human resources needed by the nuclear industry and the nuclear programs. The training courses on ISIS reactor have been integrated both in academic programs and continuing education programs. A large panel of experiments has been developed and integrated in nine courses, each course with duration of 3 hours. In addition to the regular courses, specific courses can be designed on request. In addition to in-reactor training, CEA will propose in 2014 Internet Reactor Laboratories (IRL) broadcasted from ISIS reactor. Using video-conference equipment, trainees in a remote location will be able to interact with a lecturer and the operators in the control room of ISIS. They will be able to "conduct experiments"by asking the reactor operators to change the reactor settings and by following in real-time displays showing the evolution of the reactor parameters. This type of training courses will be an alternative to the actual face-to-face training courses.

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Capacity Building Challenges for Safety Culture Improvements: Strategies for training and practices

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Background:

Recent years have witnessed growing concerns over issue of safety culture within nuclear power plants, chemical, oil production facilities, aviation industry, power plants, train systems and other complex, "high-risk"industries. Accident investigations show that failure of either a subsystem often caused failure of entire ecosystem of organizations. Hence, search for how to manage high risk organizations with sound safety system accelerated. Safety culture became most important objective for organizational leadership. It was learned from major accidents that without having effective safety culture, it's impossible to manage unexpected events. Moreover, safety culture helped in identifying and controlling signs of declining safety within systems.

Fukushmia Accident Report:

In final report, Mr. Kiyoshi Kurokawa Chairman, National Diet of Japan, said "It was mindset that supported negligence behind Fukushmia disaster. What must be admitted –very painfully –is that this was a disaster Made in Japan". He added "its fundamental causes are to be found in ingrained conventions of Japanese culture: our reflexive obedience; reluctance to question authority; devotion to 'sticking with the program, groupism, and insularity". He said "this commission found that the actual relationship (between regulators and TEPCO) lacked independence and transparency, and was far from being a safety culture".

Paper's Objective:

To provide insights into different strategies to enhance capacities to improve knowledge and understanding regarding organizational safety culture. These insights are from conducting two safety culture assessment trainings at nuclear related organizations (NPP and Nuclear Regulator).

To suggest framework on how to influence basic assumptions, attitudes and behaviors through application of rational arguments, facts, evidences, and emotional appeal. Suggested framework is an attempt to understand and support managers and trainers in influencing old basic assumptions, believes, attitudes and behaviors not supporting organizational safety culture. Framework suggests dialogue, discussions, training and rewards to challenge basic assumptions and believes.

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KNOWLEDGE SHARING THROUGH VIRTUAL MODE: THE INFLUENCED FACTORS FOR KM DEVELOPMENT AMONG THE RESEARCHERS IN NUCLEAR MALAYSIA

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Malaysian Nuclear Malaysia (Nuclear Malaysia) is a research and development (R&D) organisation, established in 1972. Until December 2013, Nuclear Malaysia has 851 permanent employees from different level of backgrounds. The biggest slice of pie is from researcher position, with 335people in total. As the main employees of Malaysian Nuclear Agency (Nuclear Malaysia), researchers contribute significantly to the growth of the organization, especially in organizational core competency; R & D in nuclear science and technology. Researchers are in possession of high-knowledge-intensive and the determiners of organizational future development plan. Researchers'knowledge and expertise are vital to ensure the safety, security and safeguard of nuclear technology applied in the organization and at national level. In ensuring organization competitiveness, the management of Nuclear Malaysia is strongly emphasizes the practice of knowledge sharing as the subset of knowledge management (KM). Knowledge sharing is given a high priority and expressively stated in the organization'KM policy. Communication via knowledge sharing's virtual mode is the most preferred method in implementing KM in the organization. In line with that, this study examines the influenced factors of the knowledge sharing through virtual mode among the researchers in Nuclear Malaysia.

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How are global nuclear organisations attracting and retaining nuclear professionals?

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Drawing from our experience as a dedicated staffing provider to the international nuclear industry, I propose to deliver a presentation including the following:

Information about the supply and demand of qualified nuclear professionals in developed and newcomer countries, and information about the international mobility of nuclear professionals. This

insight is gained from our first hand experience as a specialist in relocating nuclear professionals from one country to another.

Information about what attracts qualified nuclear professionals to a project or organisation, as well as what the negative aspects are that may cause them to leave nuclear and work in another industry. Also what attracts qualified managers, engineers and technicians to join the nuclear industry from other relevant industries (such as oil&gas, rail, petrochemical etc). This insight is gained first hand by interviewing nuclear professionals from over 30 countries, and a core activity is searching for qualified professionals that could move in to the nuclear industry and apply their existing skills.

I also have a perspective from the 'soon to retire' and retired generation of nuclear professionals. We represent several hundred retired nuclear professionals that are interested in transferring their knowledge through paid work (paid consulting work) or unpaid work(focus groups or mentoring). I can provide information on how to engage with this 'knowledge network' and utilize them for knowledge transfer and mentoring.

Finally, I can offer practical advice for recruiting nuclear and non-nuclear professionals for nuclear work. I can draw from case studies of organisations in new build, NPP operation and decommissioning, paying particular focus to the success factors and lessons learned when recruiting for a major nuclear project.

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Development of the Knowledge Management and Management of Human Resources System for the Nuclear Regulator in the Republic of Belarus

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Three years ago on the Department on Nuclear and Radiation Safety (GOSATOMNADZOR) was developed the knowledge management and management of human resources concept. This concept was developed on the base of IAEA Requirements (GSR PART 1, GS-R-3, GS-G-1.1, GS-G-3.1, TECDOC-1254, NG-T-6.7). This concept include:
• Policy of Nuclear Regulator on NKM and MHR.
• Systematic Approach to Training.
• Relations between NKM and MHR.
• NKM for Embarking regulatory bodies.
• Methods and tools for Nuclear knowledge preservation
Full text article include description of the implementation NKM with using:
• Problems with the assessment of competencies of regulatory body.
• IAEA and EC TC Programs for the expert support and training of regulatory body personal.
• Networking NKM : GNSSN/RegNET, National Nuclear Regulatory Portals.
• Self assessment of NKM for regulatory body.

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Training Courses in Support of GEN-IV Development –The Case of SVBR Technology

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The present paper addresses the issues of nuclear workforce building for new generation of nuclear power reactors. In the framework of Federal Target Oriented Programme "Nuclear Power Technologies of the New Generation for 2010 - 2015 and until 2020", JSC "AKME Engineering"takes the responsibility for development of lead-bismuth cooled fast reactor (in Rus- SVBR), the demo version SVBR-100 being commissioned at the end of this decade in Dimitrovgrad, Ulyanovsk region, Russia. SVBR-100 belongs to GEN-IV reactors'family and is supposed to be referent design that starts implementation of these reactors throughout globe mainly in developing countries with lack of infrastructure or in remote areas for the purpose of electricity and/or heat generation, or water desalination. In 2013 JSC "AKME Engineering"in cooperation with Rosatom Central Institute for Continuing Education&Training (Rosatom CICE&T) launched international training programme to support SVBR related HRD activities. The uniqueness of this programme is that training materials were developed by scientists and engineers directly involded in R&D associated with SVBR. The first pilot training for international team (totally 17 trainees from Indoneisa, Malayisa, Italy, Singapore, Slovakia, Czech, China) was performed in October 2013.The training programme was divided in several modules –SVBR neutronics, thermohydraulics, safty issues and specific of SVBR based NPP staffing. Technical tours and facility visits were incorporated in the course as well. Each of these modules is to be developed into separate E&T discipline forming the curriculum for emerging nuclear engineering programme (BS level) in Russian universities and SVBR related Training Centres. Special training module covers practical exercises with the use of analytical simulator.

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From Critical Knowledge Preservation to New Training Courses: Experiense of ROSATOM Central Institute for Continuing Education&Training

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Recently many countries with a highly developed sphere of nuclear power have realized the problem of personnel's ageing caused by the need for prolonged personnel training before independent work, high requirements to the safety operation of nuclear facilities, and a decline in the influx of young specialists. It mostly concerns technical and research personnel. To facilitate this problem IAEA systematically develops and promotes the concept and methodology of knowledge preservation and sharing –Nuclear Knowledge Management, which provides a basis for a number of national programmes. Thus, in 2012 specialists of the Rosatom Central Instutute for Continuing Education and Training (Rosatom CICE&T) participated in the project of critical knowledge preservation in the enterprises of the Scientific and Technical Complex of Rosatom. The project was directed at establishing closest relations with critical knowledge holders for the purpose of capturing and formalizing unique and specific knowledge and its further transfer to the next generation. As a result, the methodology and technology of critical knowledge preservation were developed and validated in practice. The project also confirmed that formalization of knowledge provides a solid base for development and implementation of advanced training modules both as an addition to internal training and self-training in the e-learning form. The paper presented gives the meaningful illustration of the applicability of developed technology from capturing the essential facts of the lead-bismuth R&D to implication of these in the form of training materials available for specialists and researchers involved in the SVBR (GEN-IV reactor being developed in Russian Federation) development.