Expanding Nuclear Power Programmes- Romanian experience:
Master- Nuclear Materials and Technologies Educational Plan

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Abstract: The main objectives of the Master Nuclear Materials and Technologies Educational Plan are: **1**. To deliver higher education and training in the following specific domains, such as: Powders Technology and Ceramic Materials, Techniques of Structural Analysis, Composite Materials, Semiconductor Materials and Components, Metals and Metallic Alloys, Optoelectronic Materials and Devices, Nuclear Materials, The Engineering of Special Nuclear Materials, **2**. To train managers of the Nuclear Waste Products and Nuclear Safety, **3**. To qualify in ICT Systems for Nuclear Process Guidance, **4**. To qualify in Environmental Protection System at the Level of Nuclear Power Stations, **5**. To train managers for Quality Assurance of Nuclear Energetic Processes, **6**. To deliver higher education and training regarding the International Treatises, Conventions and Settlements in force in the field of nuclear related activities.

- The plan was set in accordance with Romanian legal request as follow: it was needed the elaboration of a National Nuclear Programme (PNN), strategically document approved by the Governmental Decision no. 1259/2002 which contains the fundamental objectives and the derivates objectives and also the associated strategies for accomplishing these objectives. The strategic document was published in the Romanian Official Journal in order to be near at hand for the public and increase the debate and acceptance of the nuclear field. The National Nuclear Programme contains an associated plan of actions with responsibilities and terms of achievement for the activities which fall into the responsibility of public central administration institutions representing "the owner", into the responsibility of the national companies representing "the utility" and into the responsibility of nuclear units themselves representing "the operator".

All these above mentioned activities need a source of labour, human resources, qualified and specialised both on the research & development, design and exploitation component and the execution equipment, construction – assembling, exploitation and maintenance component. The qualification and the specialization of these types of human resources enforced the identification and the definition of associated programmes for the qualification of the staff starting from high schools and universities. Related to this education programme, the same strategic document nominates in an explicit manner 4 Romanian universities which have to take into consideration educational programmes in the nuclear field:

- Polytechnic University – Bucharest;
- **University from Pitesti;**

- Faculty of Phisics within University of Bucharest;
- Ovidiu University – Constanța.

Within the education framework of these universities are taking place lectures, seminars, workshops and also master and doctorate courses. These types of qualifications were selected based on 3 primordial criteria:

- The competence of the teaching staff;
- The geographical location nearside nuclear units/important Romanian research centers;
- The possibility of training stages within these units/centers.

A configuration of the 2 years study program is established in order to procure the following advantages:
– Assure preservation of current knowledge and facilitate configuration of specific programmes to develop the nuclear know ledges,
– Reduce risk of safety significant events,
– Reduce risk of shutdowns and extended outages,
– Facilitate modification design and implementation by providing timely access to facility configuration information,
– Avoid delays in maintenance activities,
– Facilitate regulatory review,
– Facilitate life management programs,
-Promotion of a safety culture.

The master study programme in Nuclear Materials and Nuclear Technologies (NMNT) has a series of specificities in Pitesti University. The NMNT Master Study programme offer solutions to the actual demand of highly qualified personnel in the field of nuclear activities. The NMNT Master Study programme will be delivered in a very flexible way. The educational plan, initially structured in a traditional manner, meaning "course modules, over classic semesters" can be easily re-structured in order to be delivered in a modular, accumulative procedure, without a compulsory succession of the modules.

There are several principles in this Educational Plan that should be observed such as: the continuity and synergy with the Bachelor in Physics Engineering, the possibility to enter into the educational process at any moment, on the basis of an Accreditation of Prior (Experiential) Learning made by a specific, individual initial evaluation, a rational staff and students mobility in order to efficiently use the human and logistic resources of both universities.

This paper intend to open also a debate in order to improve the curricula to sustain the general efforts of nuclear knowledge management and in this respect contain some proposals, such as:
General inputs:

- Implementation of a "national nuclear programme" (nnp) based on nuclear fuel cycle in each country;
- Based on nnp is necessary to evaluate the number of necessary staff and the level of knowledge for each part of the programme for medium and long term period;
- To develop and to implement 2 level of cooperation mandatory for each country:

1.The national level (between educational system, the patronages and the governmental agency's);
2.International level (bilateral or under AIEA, EU, etc coordination programmes)

- To ensure the continuity of the knowledge in both sense: for the generations and for the trainers, for operators, high level management and agency's.

Some important activities based on Romanian experience:

- General knowledge: reactor physics, reactor components, radioactivity & radiation; management of nuclear safety, management of nuclear waste & decommissioning, measurements & control;

- Phenomenology (Two-phase flow regimes pressure drop, critical flow, condensation & evaporation);
- BOP of nuclear plants;
- National regulations and specific standards;
- International conventions and treaties.