



SESSION 4

KNOWLEDGE MANAGEMENT AND SKILLS PRESERVATION

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This presentation is my personal and independent opinion based on my 33 years of professional experience:

- Commissioner at the Spanish Nuclear Safety Council (CSN) 2015-
- Chairman Spanish Nuclear Energy Technological Platform CEIDEN 2019-
- Professor Chair in Nuclear Engineering at UPC-Barcelona Tech Spain, for 30 years.
- Vice President of European Nuclear Education Network ENEN, 2013-2016.
- Has published more than 240 papers on nuclear Engineering.
- Has managed 15 PhD in Nuclear Engineering.
- Author of Multimedia on Nuclear Reactor Physics with about 800 pages, translated to 6 languages and distributed through IAEA to more than 110 countries.
- Has participated in 13 missions (Argentina, Austria, China, Ghana, Malaysia, Saudi Arabia, South Africa, Tailandia, USA, Vietnam) of the International Atomic Energy Agency (IAEA).
- Coordinator IRRS-ARTEMIS mission to Spain 2018.



3 | Content

- **Background.**
- **Overview on Nuclear Knowledge Management.**
- **Attract talented people to the regulatory body, to the nuclear sector and to the nuclear education programs.**
- **Recruitment system for the nuclear sector.**
- **Key Points**



4 | Background

- The nuclear sector operates in varied conditions: Long term operation of nuclear power plants, building new NPP, decommissioning, non-power nuclear applications, etc.
- The safe and sustainable deployment and use of nuclear technology will always depend on a highly educated and specialized workforce. With solid knowledge in nuclear engineering, radiation protection, nuclear safety.
- Prepare and develop specialists requires considerable time and effort.
- Ageing of nuclear workforce is a reality in most of the countries. Hence, long-term sustainability will be only achieved by attracting new talent.

5 | Overview on Nuclear Knowledge Management

University

- Attract students to nuclear programs and nuclear sector
- Nuclear education

Nuclear
organization

- Recruitment
- Training Programs
- Promotion schemes
- KM Plans & Retirement

From a nuclear safety point of view, knowledge management is of paramount importance



6 | Key Points: University

- **Enhance support to Universities** with well established master's degrees:
 - International level (example: IAEA-DNE-NKM)
 - European level (example: EC, ENEN, ENEN II, EMINE)
 - National level (example: - CSN & Nuclear Chairs,
 - collaboration with utilities in education programs
 - country nuclear associations (ANS, SNE, etc.)

Currently, in most European countries no more than 2-3 Universities should develop specialized master's degrees in nuclear engineering / nuclear safety / radiation protection. Otherwise, current lack of students in this field may provoke the closure of well-established programs if new master's degrees are created.

7 | Key Points: University - IAEA

- **Enhance support to Universities** with well-established master's degrees:
 - International level (example: IAEA-DNE-NKM)
 - During last 20-30 years IAEA-DNE-NKM did a very good job.
 - Develop and support nuclear education networks (Africa, Asia, Europe, START-NET, ...)
 - Further develop of education material (ref. 1)
 - Stimulate sharing of education material and best practices (ref. 1)
 - Promote the organization of a master in management in nuclear technology, one or two for region
 - Develop schemes that attract students to nuclear engineering / nuclear safety / radiation protection programs
 - Award top-ranked student of each promotion

8 | Key Points: University - European level

- **Enhance support to Universities** with well established master's degrees:
 - European level (example: EC, ENEN, ENEN II, EMINE)
 - During last 20-30 year very good job.
 - Develop and support European Nuclear Education Network (ENEN)
 - Further develop of education material (ref. 1).
 - Stimulate sharing of education material and best practices (ref. 1)
 - The European Commission should support the existing master programs in nuclear engineering / nuclear safety / radiation protection, with programs such as ENEN, ENEN II, EMINE, etc. **However, more courses should not be created → support existing ones**, improve their quality, better professors, better laboratories, better education material, **use of NPP simulators (ref. 2), more technical visits to nuclear facilities.**
 - Focus in countries that have or will have nuclear programs.
 - Develop schemes that attract students to nuclear engineering / nuclear safety / radiation protection programs
 - **Award top-ranked student of each promotion**
 - **Scholarships for fees in master's degrees and accommodation.**



9 | Key Points: University - National level

- Enhance support to Universities with well established master's degrees:
 - National level
 - CSN Nuclear Safety council & Nuclear Chairs,
 - Collaboration with utilities in education programs
 - Country Nuclear Associations (ANS, SNE, etc.)
 - ✓ This support should keep adequate sizing, but improve quality of programs (professors, laboratories/facilities including simulators (ref. 2) educational material, technical visits to nuclear facilities, etc.)
 - ✓ Develop schemes that **attract students** to nuclear engineering / nuclear safety / radiation protection programs and, in the end, to the nuclear sector



10 | Attract talented people to the regulatory body, to the nuclear sector and to the nuclear education programs

One issue that happens in several European countries is the difficulty to attract talented people to:

- Master's degrees in nuclear engineering / radiation protection
- Regulatory body
- Nuclear sector

If the media says that the future of the nuclear Energy in the country is decommissioning, it is very difficult to attract talented people

It is easy in the countries that say:

- will operate NPP until 60 years or 80 years
- will build new NPP



11 | Attract talented people to the regulatory body, to the nuclear sector and to the nuclear education programs

Develop schemes that **attract students** to nuclear engineering, or radiation protection programs, and to the nuclear sector.

- Award top-ranked student of each promotion
- Scholarships for fees in master's degrees in nuclear engineering and scholarships for accommodation.
- Set up a national system to connect nuclear engineers with new positions in nuclear sector.
- Strive for a good alignment between **demand** and **supply of nuclear professionals**. Foster connection between **Academia** and **Industry**.
- Foster TV programs / media to explain for the general public: how a NPP operates, description of NPP safety systems, nuclear medical applications (radiotherapy, radiodiagnostic, protontherapy, radon, environmental programs around NPP. how work a nuclear fuel factory, management of irradiated fuel, management of radioactive waste, food conservation, research programs in nuclear field (accident tolerant fuel, long term operation, etc.).
- **In secondary schools curriculums, previous topics should be explained.**



12 | Recruitment system for the nuclear sector

- Strive for a good alignment between **demand** and **supply of nuclear professionals**. Foster connection between **Academia** and **Industry**.
- Set up a system that put in contact the graduates from these masters with the employment needs in NPPs, regulatory body and all nuclear sector.

Once a new nuclear-related position appears in the country, each graduate registered in a data base should receive an e-mail with the vacant description, and contact details of the company or institution.



13 | Key Points: Nuclear Organizations

Recruitment

- Establish **national workforce plans** to meet recruitment needs of several organizations.
- Set up a national system to **connect nuclear graduates** with **nuclear organizations** → minimize brain drain towards other industries.
- Add value to the recruitment process by **increasing weighting** for **education in nuclear safety / radiation protection / nuclear engineering** at a bachelor or master level.
- In the **regulatory body**, consider **constant calls of public competition** to attract the best candidates, following a transparent and rigorous process, in compliance with foreseen recruitment needs.

14 | Key Points: Nuclear Organizations

Recruitment

- Number of new staff in the regulatory body / nuclear sector should be more or less constant → better 20 newcomers/year during three years than 60 newcomers one year and no newcomers during the next ones.
- It is not easy, when recruiting 60 people:
 - attraction of talented newcomers in one year
 - knowledge transfer to new staff from existing staff

15 | Lack of technicians in the nuclear sector

Professional
Training School

- Professional Training School **near the site of NPP**
- Collaboration between NPP and professional training school, in order to align the curriculum to the needs of the NPP.

Nuclear
organization

- Recruitment
- Training Programs
- KM Plans & Retirement

From a nuclear safety point of view, knowledge management is of paramount importance



16 | Lack of technicians in the nuclear sector

- Achieve **communication** with students at an early stage → building a community-based support & stimulate **interest in the future careers in nuclear technology**.
 - Pursue strategic location of specific Professional Training Schools in the vicinity of nuclear installations.
- **Enhance support** to these **Professional Training Schools** and their activities.
 - Precisely, at a national level (Government, nuclear organizations, etc.)
- Strive for a good alignment between **demand** and **supply of nuclear professionals**. Foster connection between **Academia** and **Industry**.
 - Avoid loss of competence among suppliers (subcontractors, down to those that provide welding services, for example)



17 | Key Points: Nuclear Organizations

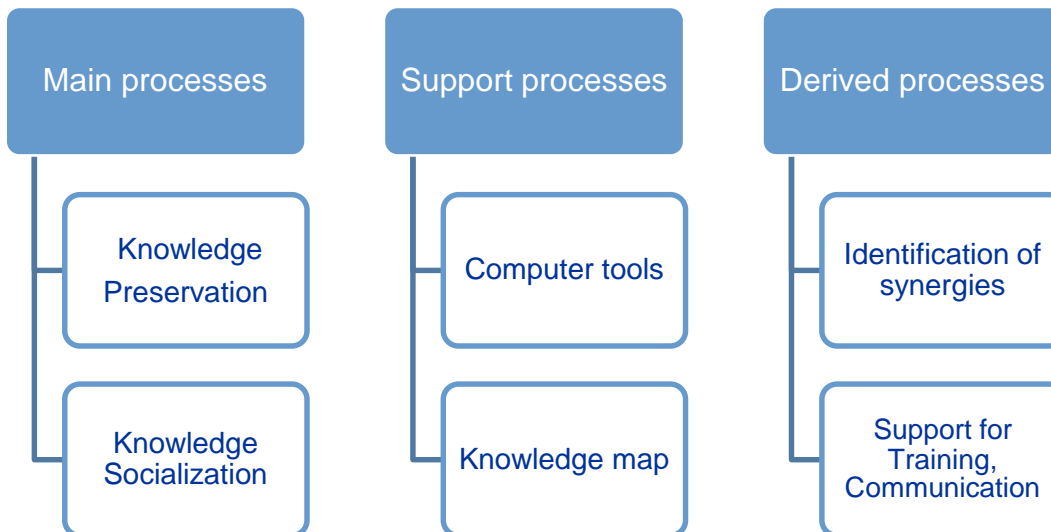
Training

- **Safety leadership** and **safety culture** shall be promoted among all the staff.
- A **systematic approach to training** should be implemented to build clusters of competences.
- Structured **Training Plans** should meet and satisfy the training needs in accordance with organizational needs on an annual basis.
- **Managers** should have strong competence in: nuclear technology, nuclear safety and radiation protection, management, project management, and communication.
- **Use of management systems** should be based on updated information technologies that allow all staff access to their documentary databases.
- **Agreements or collaborative arrangements with other organizations** (both international and national) should be settled to exchange practices, experiences and knowledge.
- There are very good private companies that develop training programs for all nuclear sector.

18 | Key Points: Nuclear Organizations

Knowledge Management (ref. 3)

- **Develop** a specific methodology to **recover**, **transfer** and **preserve** the **implicit** and **tacit knowledge**, and **experience** cumulated by the staff
 - Critical issue following the retirement or departure of experienced staff, including inter-generational knowledge transfer
 - Impact to staff with critical knowledge, required to comply with nuclear organization mission that is in risk of loss for different reasons.



Key aspects:
Objectives, strategic planning, boundary conditions, and metrics

19 | References

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Thank you!

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