International Conference on Physical Protection of Nuclear Material and Nuclear Facilities
13–17 November 2017, IAEA HQ, Vienna, Austria

Education, Knowledge, Competence –
Fundamental Prerequisites for Successful Implementation of Nuclear and Radiation Related Physical Protection
Example of Montenegro

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- Successful implementation of international norms on the safety and security of nuclear and radiation related activities and facilities – with physical protection in forefront place – requires a number of prerequisites at the State, including adequate legal, institutional, financial, technical and human resources. Among these, it is often taken for granted that necessary knowledge and competence do exist *per se*.
- However, this is not always the case, just the contrary – time, efforts and assets are frequently wasted because these fundaments are not set solid at first.

- Nuclear safety and security *knowledge* and based-on-it nuclear safety and security *competence* represent a broad range of both theoretical and practical achievements of research and experience accumulated in many years of extensive developments in the field.
- The need for nuclear knowledge in a society/country may vary substantially,

  depending primarily on two factors:
  - its level of general development and
  - whether the society/country utilizes (or intends to utilize) nuclear energy for power production or not.

- Finding itself in a triangle between
  - narrow scope of radiation activities/facilities (seemingly/deceptively not demanding);
  - limited resources available in the country, and
  - domestic responsibility and international norms/obligations in the domain of nuclear/radiation safety and security …

  … a small country will likely recognize two principles to be followed in order to meet its goals in a realistic (focused, effective and efficient) way: *commensurateness* and *competence*.
- Being competent and finding the right measure ("not less, not more") is thus imperative for all:
  - users and facilities
  - regulators and legislators
  - technical support organizations
  - educational institutions
  - and others

- Provision of adequate knowledge, competence and expertize represents consequently a major concern in small countries – if inadequate safety and security will eventually be jeopardized.
- The above are thus the fundamental prerequisites not only for the meaningful and purposeful utilization of radiation sources, but also for their safe and secure employment at all.

- **Universities**, state ones in particular, are the logical and regular points of creation, dissemination and preservation of nuclear (including safety and security) **knowledge, competence and expertize** in small countries.
- Let us note the **fundamental difference between state and private universities**: the former are meant for meeting the country needs in various aspects of fundamental and applied knowledge, the latter are meant for profit. Of course, both can serve the purpose at a standardized level, i.e. when regulated through accreditation of educational programmes.

- Hereby, the complexity and importance of formal education at universities should be pointed out. This includes the ensemble of
  - educational programmes accreditation
  - Education regulatory overview
  - teaching staff qualification and permanent development
  - selection and enrolment of students
  - international inter-university cooperation
  - student and staff exchange/mobility schemes
  - etc.

- One should also clearly distinguish between education and training.
- While education basically stands for knowledge, training contributes to its practical applicability – both being fundamental constituents of competence.
- Importantly, training cannot replace education – attempting so, one falls into a typical competence pitfall.
- Training is thus meaningful only when superposed onto an adequate education.

- Messing up these terms will lead to a false perception of knowledge and competence (quasi-knowledge and quasi-competence)
- Eventually, safety and security will inevitably be compromised.

adequate knowledge

minimal knowledge

critical knowledge

Education

Training

Education


Experience
Training
Education


Ethics
Experience
Training
Education

Competence

Education

Training

Education

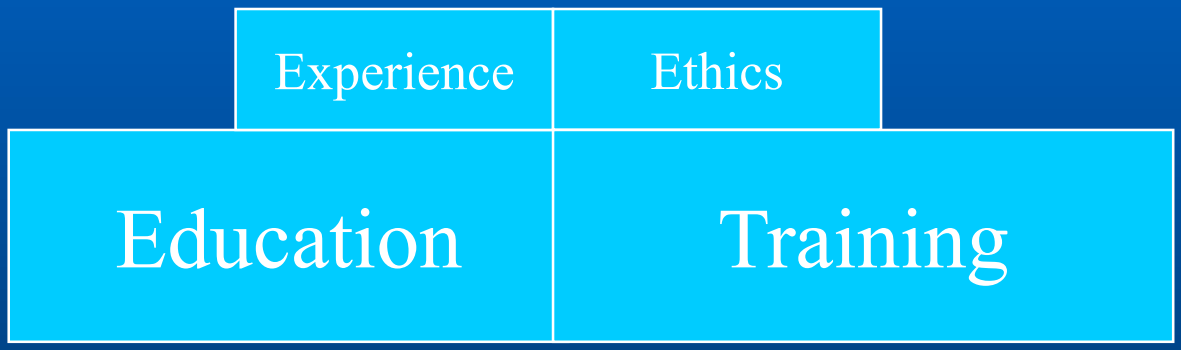

Experience
Training
Education

Quasi-competence

Quasi-competence

Quasi-competence

Education	Training


Experience
Ethics
Education
Training

Experience	Ethics
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Education	Training

Education

Training


Experience
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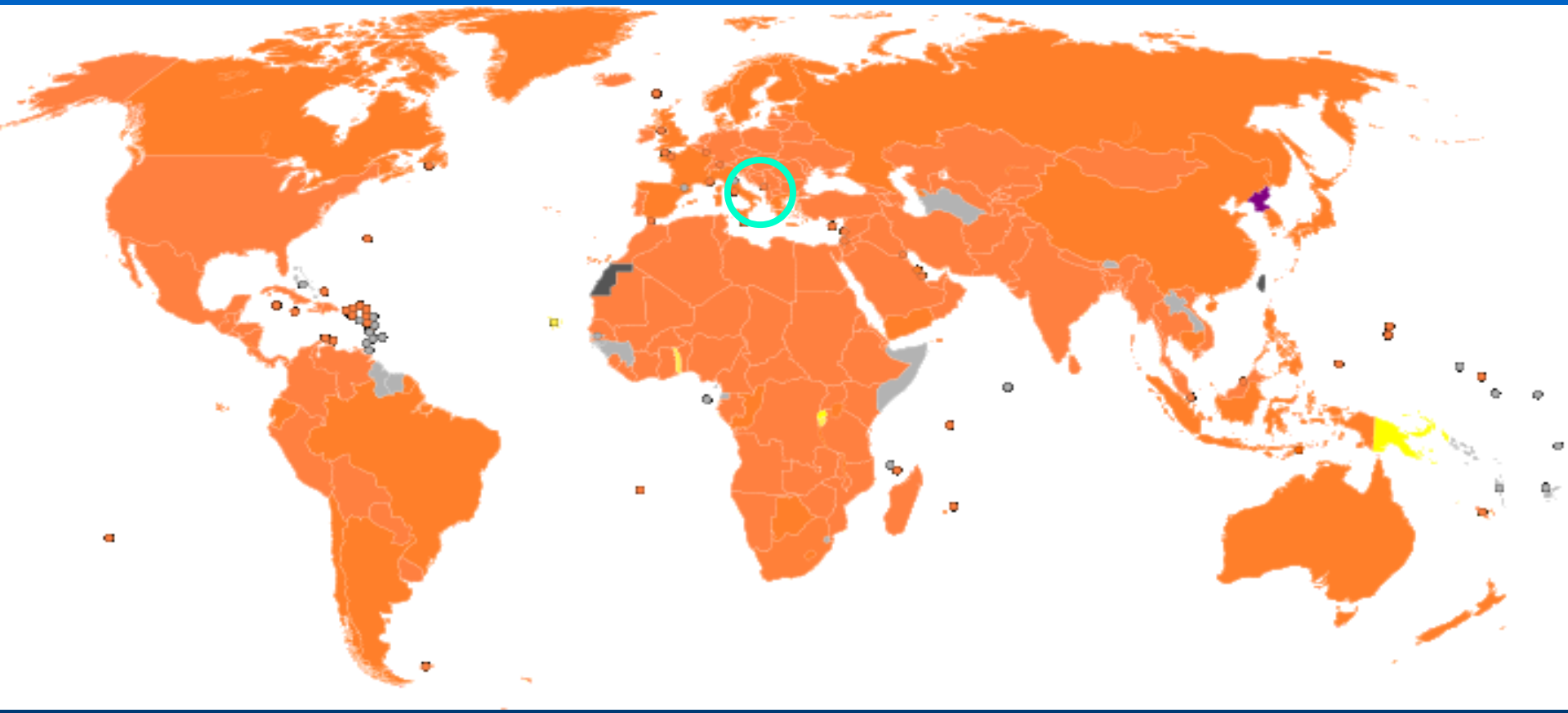
Education

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Bulgaria
Adriatic Sea
Podgorica
Sofia
Black
Sea
N
Skopje
acedonia
Turkey
(EUROPE)
Italy
Albania
Greece
Aegean Sea
Athens
Turkey
(ASIA)
Sicily
(Italy)
Mediterranean Sea
Sea of Crete
EUROPE
The Balkan Peninsula

- Montenegro is a small “non-nuclear” country – 13.812 km2, population 625.000, GDP cca 5.000 USD/year/capita
- There are no NPP’s or fuel cycle segments, the use of radiation sources being limited to ordinary medical and a few industrial applications
- Even though (and strange enough), having present and possible future needs in mind, there is a surprisingly long list of items which need to be adequately backed by nuclear safety and security related knowledge
- And that is the case not only in Montenegro, but in most other small “non-nuclear” countries
- Small problems in big countries are often big problems in small countries

- **medical** applications, including diagnostics
  (from simple X-ray radiology to CT, PET and other advanced techniques), radiotherapy (from tele-therapy and e-beams to e.g. hadron therapy), palliation, sterilization (of equipment, consumables, blood products, etc.), radioisotopes, radiopharmaceuticals, etc.
- **industrial** applications including polymer technology, semiconductors, process control, welding diagnostics, material sciences, mining, petrochemistry, etc.
- **agricultural** and biochemical applications
- **food** processing
- **water resources** management

  …

…

- household applications, e.g.
  - smoke detectors
  - radon insulation
  - constructing materials radioactivity monitoring, etc.
- scientific and educational applications, e.g.
  - radioanalytical methods
  - radiotracers
  - Dosimetry
- radiation protection of people and environment, including
  - radioecology
  - personal and environmental dosimetry
  - low and medium activity radioactive waste management
  - analytical and monitoring services
- …

…

- legislative and regulatory aspects, including
  - complying to international safety/security norms and
  - joining international conventions in the field
- preparedness and response to radiological and nuclear emergency situations
- security issues
  - combating nuclear terrorism and illicit trafficking of nuclear and radioactive materials
  - nuclear forensics
  - security systems based on X-rays, neutrons and other nuclear methods
- possible introduction of some future topic. e.g.
  - nuclear power for electricity generation
  - sea water desalination
- public information and communication with media
- etc …

UCNC Core Team

IAEA NKM Expert Mission at the University Campus

- **UCNC** works towards development of HR (knowledge and competence in particular) in radiation and nuclear related issues – **commensurate to the country needs**
- UCNC also has consultancy/expertize role for all relevant stakeholders in Montenegro

University Centre for Nuclear Competence and Knowledge Management (UCNC) has the mission to:

- be national center of competence and expertise in nuclear related issues
- act towards assessing, creating, preserving and transferring NK, according to Montenegro needs
- offer consultancies and technical support services to regulatory authorities and stakeholders
- be advisory body to the government for nuclear related issues
- be focal point for dissemination and exchange of NK, in particular with the IAEA

…

… cont'd

- promote nuclear applications for peaceful purposes, in particular in medicine and in environmental protection
- be national radiation protection centre in the country
- develop curricula for nuclear related studies at all levels (from elementary education to university degrees)
- support young students and scientists in nuclear related field and facilitate their exchange with reputed institutions abroad
- give proper information and comments to the public and media on relevant subjects
- etc.

- **Networking** is becoming increasingly important for building/sustaining the national body of knowledge, competence and expertize
- This is particularly valid for those countries whose domestic resources are limited and/or where no critical mass of the above three constituents exists, which could sustain the system on its own
- IAEA-based international networks for nuclear security education (**INSEN**) and training&support (**NSSC**), even relatively recent, proved pivotal/fundamental in this respect

- As a result of our INSEN activities, curricula for several nuclear safety and security related courses were developed and courses were introduced (as part of optional courses menu) into post-graduate educational programmes of Applied Nuclear Physic at the University of Montenegro, Department of Physics
  - Fundamentals of Nuclear Safety and Security
  - Radiation and Nuclear Security – Practical Aspects
  - Nuclear Forensics
  - Nuclear Physics for Regulators
  - Nuclear Knowledge Management
- Training is addressed within NSSC


Thank you!
Montenegro
a great heart of the Mediterranean