IAEA Nuclear Knowledge Management Programme in the Department of Nuclear Energy

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Vienna International Center

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Nuclear Knowledge Management Section
Department of Nuclear Energy, IAEA
Nuclear Knowledge Management Programme

- Formally established in 2001;
- Increased awareness and understanding of risks and challenges of KM in the nuclear sector;
- Development and dissemination of good KM practices in all Member States;
- Facilitate nuclear knowledge flow to developing countries and newcomer countries.
IAEA Programmatic Areas of the Nuclear Knowledge Management (NKM) Section: Subprogramme 1.3.3.

• Nuclear Education and Supporting Networks;
• Knowledge Management (KM) guidance and methodologies / Assistance and peer reviews;
• KM Tools, Technology, and Products.
1. Nuclear education, collaboration and networking
   - Int’l Nuclear Management Academy (INMA);
   - Nuclear Energy Management (NEM) Schools;
   - University Programme Peer Review Assessments (UPPRA) of University Nuclear Engineering Degree Programmes;
   - Regional nuclear education networks;
   - HRKD national stakeholder network (key national players);
   - University collaboration in nuclear R&D (“Green Frontiers Initiative” – GFI).
2. KM Methodology, guidance and services

- Knowledge Management Assist Visits (KMAV);
- Nuclear Knowledge Management (NKM) Schools;
- Advanced Knowledge Management Workshops for Practitioners;
- Guidance documents and reports;
- Design Knowledge Management (DKM) of NPPs throughout their Lifecycle.
3. KM Tools, Knowledge organization systems (KOS) and supporting technologies

- Cyber Learning Platform for Network Education & Training (learning management system);
- Semantic technologies (linked data, portals, repositories etc.);
- Plant information models (PIM).
Nuclear Energy Management (NEM)
Schools
NEM Schools

• An IAEA certificate school (2 weeks);
• NEM School curriculum covers the most important topics related to the nuclear energy sector;
• Combination of managerial and technical knowledge elements;
• The programme is well-suited for both developed and developing countries including countries embarking on nuclear energy programmes;
• It is targeted at young nuclear professionals who have managerial potential;
• The programme is suitable for employees of
  – nuclear power plants and nuclear utilities,
  – TSOs and R&D organizations,
  – nuclear regulators,
  – suppliers,
  – education and training organizations.
NEM Schools in 2017

✓ Joint NEM IAEA/UAE School
  • 14-25 May, Abu Dhabi (UAE)

✓ Joint NEM IAEA/Japan School
  • 18 July - 3 August, Tokyo and Fukushima (Japan)

✓ Joint NEM IAEA/ICTP School
  • 21 August - 1 Sept, Trieste (Italy)

✓ Joint NEM IAEA/Rosatom School
  • 4 - 15 Sept, St. Petersburg and Obninsk (Russia)
Planned NEM Schools in 2018

✓ Joint NEM IAEA/South Africa, Johannesburg

✓ Joint NEM IAEA/Japan School, Tokyo and Fukushima

✓ Joint NEM IAEA/ICTP School, Trieste

✓ Joint NEM IAEA/Rosatom School, St. Petersburg and Moscow

✓ Joint NEM IAEA/Rosatom School for Managers, Sochi
NEM Schools cover a broad range of subjects

Examples:

1. IAEA Milestone approach; Integrated nuclear infrastructure review (INIR) missions;

2. Nuclear safety and its fundamentals; Overview of IAEA Safety Standards;

3. Leadership, safety culture, and management; Integrated management systems;

4. Financial management in a NPP programme; Economics of nuclear power;

5. International nuclear law; Conventions and agreements; International legal framework for nuclear safety, security, and civil liability for nuclear damage;

6. IAEA safeguards implementation; Overview of nuclear non-proliferation regime;

7. Regulatory framework and nuclear licensing fundamentals;
NEM Schools cover a broad range of subjects

Examples (continued):

8. Radiation protection;

9. Electric grid; Requirements on grid stability for connecting NPPs;

10. Human resource development; Competence building and nuclear education for sustainable nuclear infrastructure development;

11. Stakeholder involvement and building public support; Effective communication for nuclear power;

12. Site and supporting facilities;

13. Environmental protection;

14. Emergency planning, preparedness, and response;

15. Nuclear security fundamentals; Physical and computer security; IAEA Nuclear Security;
NEM Schools cover a broad range of subjects

Examples (continued):

16. Nuclear fuel cycle; Decommissioning nuclear facilities;
17. Radioactive waste management;
18. Industrial involvement during construction and operation;
19. Procurement in nuclear projects;
20. Basic principles of nuclear power development; Current reactor technologies; Advanced reactor development;
21. Mitigation of climate change; Role of nuclear power;
22. Architect Engineering and EPC contracting; Construction Technologies and Management;
23. Basics of nuclear knowledge management (NKM); Methods and tools for NKM.
International Nuclear Management Academy (INMA) in Nuclear Technology Management (NTM)
International Nuclear Management Academy (INMA)

• An IAEA-facilitated framework whereby universities collaborate to implement master’s level programmes in nuclear technology management (NTM);

• Students in the programme are managers or future managers working in the nuclear sector;

• Initiative launched in Nov 2013. First IAEA-endorsed programme started in 2015;

• NTM programmes must be designed in compliance with established IAEA requirements.
INMA-NTM Students

New university graduates
Working nuclear professionals
International students
IAEA Fellowship holders
Visiting INMA partner University students
Initial Assist Visits and Peer Reviews to Universities:

2014
- University of Tokyo, Japan  June
- University of Manchester, UK  July
- Texas A&M University, USA  October
- MEPhI, Russian Federation  October

2015
- North-West University, South Africa  Feb
- Wits University, South Africa  Feb
- Tsinghua University, China  April
- University of Manchester, UK  July

2016
- UOIT, Canada  May
- MEPhI, Russian Federation  December

2017
- Wits University, South Africa  June
- North-West University, South Africa  June
- Texas A&M University, USA  August
- University of Tokyo, Japan  October
- Harbin Engineering University, China  November
Requests for Future INMA Assist Visit

- UPC Barcelona, Spain
- University of South China, China
- Pavia University, Italy
- Cambridge University, UK
- University of Idaho, USA
- University of New South Wales, Australia
- University of Belarus
- National Polytechnical University, Armenia
- University of Milan, Italy
Common Requirements Defined in 47 Competency Areas

Divided into four Aspect Groups:

• External Environment (11 CA’s)
• Technology (14 CA’s)
• Management (18 CA’s)
• Leadership (4 CA’s)
## Aspect Group 1: External Environment

<table>
<thead>
<tr>
<th>Competency Areas (CA)</th>
<th>INMA common requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aspect group 1</strong></td>
<td></td>
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<tr>
<td>External Environment</td>
<td></td>
</tr>
<tr>
<td>1.1 Energy production, distribution and markets</td>
<td>A</td>
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<tr>
<td>1.2 International nuclear organizations</td>
<td>R</td>
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<tr>
<td>1.3 National nuclear technology policy, planning and politics</td>
<td>A</td>
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<tr>
<td>1.4 Nuclear standards</td>
<td>R</td>
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<tr>
<td>1.5 Nuclear law</td>
<td>A</td>
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<tr>
<td>1.6 Business law and contract management</td>
<td>R</td>
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<tr>
<td>1.7 Intellectual property (IP) management</td>
<td>A</td>
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<tr>
<td>1.8 Nuclear licensing, licensing basis and regulatory processes</td>
<td>R</td>
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<tr>
<td>1.9 Nuclear security</td>
<td>A</td>
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<tr>
<td>1.10 Nuclear safeguards</td>
<td>A</td>
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<tr>
<td>1.11 Transport of nuclear goods and materials</td>
<td>A</td>
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<tr>
<td>Competency Areas (CA)</td>
<td>If CA is required (R) or as appropriate (A)</td>
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<tr>
<td>2.1 Nuclear power plant and other facility design principles</td>
<td>R</td>
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<tr>
<td>2.2 Nuclear power plant/facility operational systems</td>
<td>R</td>
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<tr>
<td>2.3 Nuclear power plant/facility life management</td>
<td>A</td>
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<tr>
<td>2.4 Nuclear facility maintenance processes and programmes</td>
<td>R</td>
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<tr>
<td>2.5 Systems engineering within nuclear facilities</td>
<td>A</td>
</tr>
<tr>
<td>2.6 Nuclear safety principles and analysis</td>
<td>R</td>
</tr>
<tr>
<td>2.7 Radiological safety and protection</td>
<td>R</td>
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<tr>
<td>2.8 Nuclear reactor physics and reactivity management</td>
<td>A</td>
</tr>
<tr>
<td>2.9 Nuclear fuel cycle technologies</td>
<td>A</td>
</tr>
<tr>
<td>2.10 Nuclear waste management and disposal</td>
<td>R</td>
</tr>
<tr>
<td>2.11 Nuclear power plant/facility decommissioning</td>
<td>R</td>
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<tr>
<td>2.12 Nuclear environmental protection, monitoring and remediation</td>
<td>R</td>
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<tr>
<td>2.13 Nuclear R&amp;D and innovation management</td>
<td>A</td>
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<tr>
<td>2.14 Application of nuclear science</td>
<td>A</td>
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</tbody>
</table>
## Aspect Group 3: Management

<table>
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<th>Competency Areas (CA)</th>
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<tbody>
<tr>
<td></td>
<td>If CA is required (R) or as appropriate (A)</td>
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<tr>
<td>3.1 Nuclear engineering project management</td>
<td>R</td>
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<tr>
<td>3.2 Management systems in nuclear organizations</td>
<td>R</td>
</tr>
<tr>
<td>3.3 Management of employee relations in nuclear organizations</td>
<td>R</td>
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<tr>
<td>3.4 Organizational human resource management and development</td>
<td>R</td>
</tr>
<tr>
<td>3.5 Organizational behaviour</td>
<td>R</td>
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<tr>
<td>3.6 Financial management and cost control in nuclear</td>
<td>R</td>
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<tr>
<td>3.7 Information and records management in nuclear</td>
<td>R</td>
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<tr>
<td>3.8 Training and human performance management in nuclear organizations</td>
<td>R</td>
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<tr>
<td>3.9 Performance monitoring and organization improvement</td>
<td>R</td>
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<tr>
<td>3.10 Nuclear quality assurance programmes</td>
<td>R</td>
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<tr>
<td>3.11 Procurement and supplier management in nuclear organizations</td>
<td>R</td>
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<tr>
<td>3.12 Nuclear safety management, risk-informed decision-making</td>
<td>R</td>
</tr>
<tr>
<td>3.13 Nuclear incident management, emergency planning and response</td>
<td>R</td>
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<tr>
<td>3.14 Operating experience feedback and corrective action processes</td>
<td>R</td>
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<tr>
<td>3.15 Nuclear security programme management</td>
<td>A</td>
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<tr>
<td>3.16 Nuclear safety culture</td>
<td>R</td>
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<tr>
<td>3.17 Nuclear events and lessons learned</td>
<td>R</td>
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<tr>
<td>3.18 Nuclear knowledge management</td>
<td>R</td>
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</tbody>
</table>
## Aspect Group 4: Leadership

### Competency Areas (CA)

<table>
<thead>
<tr>
<th>Aspect group 4 Leadership</th>
<th>INMA common requirements</th>
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<tbody>
<tr>
<td></td>
<td>If CA is required (R) or as appropriate (A)</td>
</tr>
<tr>
<td>4.1 Strategic leadership</td>
<td>R</td>
</tr>
<tr>
<td>4.2 Ethics and values of a high standard</td>
<td>R</td>
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<tr>
<td>4.3 Communication strategies for leaders in nuclear</td>
<td>R</td>
</tr>
<tr>
<td>4.4 Leading change in nuclear organizations</td>
<td>R</td>
</tr>
</tbody>
</table>
IAEA Knowledge Management Assist Visits (KMAV)

Reference:
Planning and Execution of Knowledge Management Assist Missions for Nuclear Organizations, IAEA TECDOC-1586, IAEA, Vienna (2008)
Knowledge Management Assist Visits (KMAV)

- A Peer Review service provided to Member States’ nuclear organizations (organizational or national levels);
- Provide sharing and training on good KM practices, facilitate self-assessments and recommend improvements;
- Knowledge Management Maturity Assessment;
- Assist and support the counterpart in establishing its NKM programme;
- Overview of the IAEA’s NKM activities & services available to MS;
Knowledge Management Assist Visits (KMAV)

• SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis;

• Integration of KM processes in IMS for Nuclear Organizations: practices and lessons learned;

• Governance, Roles and responsibilities for KM, Leadership and ownership;

• NKM implementation methodology and guidelines, including specific criteria for successful knowledge management programme implementation;

• Design Knowledge Management across nuclear facility life-cycle; DK transfer and Design Authority
KMAV Highlights of 2016

Three Knowledge Management Assist Visits (KMAVs) completed in:

- **NPPD Iran (April 2016)**
  Focus: DKM programme development on management of design basis information through BNPP-2&3 units life cycle;

- **Leningrad NPP Russia (June 2016)**
  Focus: Russian industry experience in KM and development of unified KM programme for NPPs;

- **SNERDI China (October 2016)**
  Focus: Design knowledge management approaches and practices applied in R&D sector.

Mission reports are delivered to the Counterparts with practical recommendations/roadmaps on aspects of establishing or improving KM programmes.
KMAV Highlights of 2017

Five Knowledge Management Assist Visits (KMAVs) completed in 2017:

- **Daya Bay NPP, China (RB)**
  Focus: SWOT analysis, KM maturity assessment, overall KM programme;

- **ASE, Rosatom, Russian Federation (RB)**
  Focus: Application of design knowledge and plant information models;

- **CEZ a.s. HQ, Czech Republic (TC)**
  Focus: Corporate KM programme for performance improvement analysis;

- **Ignalina NPP, Lithuania (TC)**
  Focus: KM programme for decommissioning phase;

- **Mochovce NPP, Slovakia (RB)**
  Focus: KM programme important for safe operation analysis.
Document plan for KMAV


Include separate chapters for KMAVs at
- Operating NPPs
- New build NPP projects
- R&D and Technical Support Organizations
- National nuclear regulators,
- Decommissioning organizations

Additional areas to include:
- KMAVs at organizational or national levels
- Potential use of CLP4NET
- KM Community of Practice – Forum of KM Practitioners
- Making use of the IAEA NKM new publications
Regional Nuclear Education Networks

Objectives:
• Facilitating collaboration among MS institutions of regions on nuclear education;
• Supporting the continued availability of qualified human resources in the region to ensure the sustainability of nuclear technology applications.

Four regional nuclear educational networks established with the support of IAEA:
• Asian Network for Education in Nuclear Technology (ANENT);
• African Network for Education in Nuclear Science and Technology (AFRA-NEST);
• Latin American Network for Education in Nuclear Technology (LANENT); and
• Eastern Europe and Central Asia Education and Training Network in Nuclear Technology (STAR-NET).
Education networks

Networking in education:

• regional and interregional cooperation to share educational experience and resources;

• establishment of a forum for discussion of policies and strategies for nuclear education and training;

• sharing best practices and lessons learned.

IAEA supported

Additional Key Collaboration with University Networks: ENEN, NTEC, BNEN, UNENE
CLP4NET

Cyber Learning Platform for Nuclear (Network) Education and Training

support capacity building and knowledge transfer in the nuclear sector by empowering web-based development and dissemination of learning resources in a way that is cost-effective, scalable and easy to use

✓ All IAEA Departments have e-learning materials in CLP4NET;
✓ 19,000 registered users!
✓ ~ 200 new users every month;
✓ > 50 unique courses;
✓ CLP4NET has been recognised as the Agency standard and single eLearning platform.

http://elearning.iaea.org
CLP4NET

Cyber Learning Platform for Network Education and Training (CLP4NET) is an online platform that allows users to find educational resources easily and contains a learning environment to support instructor-led courses and disseminate e-learning self-study resources to a wider audience. The use of the IAEA’s platform is provided as a cost-free service to all of the IAEA and its cooperation partners.

Click the logos below to visit the websites of Nuclear Education Networks

AFRA NEST  ANET  LANET  SNEP

Learning Object Repository

IAEA

60 Years
Atoms for Peace and Development
Publications by the NKM Section
NKM documents published in the last 10 years:

1. Nuclear Accidents Knowledge Taxonomy
2. Knowledge Management and its Implementation in Nuclear Organizations
3. Nuclear Engineering Education: A Competency Based Approach in Curricula Development
4. The Impact of Knowledge Management Practices on NPP Organizational Performance – Results of Global Survey
5. Knowledge Management for Nuclear Research and Development Organizations
6. Comparative Analysis of Methods and Tools for Nuclear Knowledge Preservation
7. Status and Trends in Nuclear Education
8. Development of Knowledge Portals for NPPs
10. Planning and Execution of Nuclear Knowledge Management Missions
11. Web Harvesting for Nuclear Knowledge Preservation
   Fast Reactor Database 2006 – Update
Draft NKD documents in the pipeline (25):

• A Framework for Sustainable Nuclear Education: Education Capability Assessment and Planning (ECAP)
• Managing Nuclear Design Knowledge Over the Life Cycle – Stakeholder Perspectives, Challenges, and Approaches
• Approaches to Management of the Risk of Knowledge Loss in Nuclear Organizations
• International Nuclear Management Academy (INMA) master’s programmes in nuclear technology management
• Approaches and Strategies for Nuclear Knowledge Management
• Application of Plant Information Models to Support and Manage Design Knowledge throughout the NPP Life Cycle
Draft NKM documents in the pipeline:

- Mapping Organizational Competency in Nuclear Organizations
- Exploring Semantic Technologies and their Application to Nuclear Knowledge Management
- Guide on Nuclear Knowledge Management
- Knowledge Organization System for VVER Water-Cooled Water-Moderated Power Reactors
- Establishing international communities of practice for managing nuclear knowledge
- Knowledge management for radioactive waste management organizations
- Nuclear Knowledge Management Course for Nuclear Engineering Master Programmes at Universities
Draft NKM documents in the pipeline:

- Practical Approaches to Retain Tacit Knowledge in Nuclear Organizations
- KM Perspectives on External Services and Outsourcing in Operating Facilities
- Case Studies to Support the Nuclear Education Capability Assessment and Planning (ECAP) Process – Examples Related to National Stakeholder Networking for Human Resource and Knowledge Development (HRKD)
- Methodology for Conducting KM Assist Visits for University Programme Peer Review Assessments (UPPRA) of Nuclear Engineering Degree Programmes
- A Road Map for Implementing Knowledge Management in Nuclear Organizations
Draft NKM documents in the pipeline:

- Approaches to Lifecycle Management of Technical and Design Requirements Specifications for Nuclear Facilities
- Proceedings for the 3rd Int’l Conference on NKM
- IAEA Nuclear Energy Glossary
- Challenges and Approaches to Nuclear Knowledge Management for Decommissioning and Environmental Remediation
- CRP Report on Sustainable Education in Nuclear Science and Technology
- Guidelines for Taxonomy Development and Maintenance
THANK YOU

http://www.iaea.org/nuclearenergy/nuclearknowledg

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