Competence Development of Research Reactors Personnel in Indonesia

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Sidney, 5 November 2017
BATAN (National Nuclear Energy Agency of Indonesia)

Main duty:
to conduct government duties in the field of research, development and utilization of nuclear energy

Functions, among many:
• Doing Assessment and preparation of the national policies in the field of research, development and utilization of nuclear energy
• Facilitation and provision of guidance towards the activities of government institutions in the field of research, development and utilization of nuclear energy.
Sites of BATAN

HQ Jakarta

Nuclear Area in Pasar Jumat

Uranium Exploration area, Kalan of West Kalimantan

Sites of Observation, Central Java

Nuclear Area in Serpong

Nuclear Area in Bandung

Nuclear Area in Yogyakarta
# Research Reactors of Indonesia

<table>
<thead>
<tr>
<th>No</th>
<th>Research Reactor</th>
<th>Location</th>
<th>Power</th>
<th>Operation Commenced</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Triga 2000</td>
<td>Bandung</td>
<td>2 MW</td>
<td></td>
<td>Construction: 1 January 1964</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1965: 240kW</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>1971: 1 MW</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2000: 2 MW</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>February 20, 1965</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Kartini (Karya Teknisi Indonesia)</td>
<td>Yogyakarta</td>
<td>100 kW</td>
<td></td>
<td>Construction: 13 November 1974</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1979: 50kW</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1981: 100kW</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>March 1, 1979</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>G.A. Siwabessy MPR</td>
<td>Serpong</td>
<td>30 MW</td>
<td></td>
<td>Construction: 1983</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>August 20, 1987</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Issues on human resources

- Increasing average age of personnel
- The policy of zero growth by the government
- The policy of moratorium of civil servants recruitment by the government
Impact of human resources policy

- condition of scarcity of main competence holders
- loss of main competence
Outcomes of RR Personnel Competence Development

- Government regulations are met
- National programs are still in place
- Critical knowledge loss can be prevented
- Knowledge retention program can be done
- Research reactors can be operated in a safe, secure, and sustainable manner
IAEA Concept for Nuclear Capacity Building

- Education & Training
- Human Resources Development
- Nuclear Knowledge Management
- Knowledge Network
Capacity Building of BATAN

Objectives:

Education & Training
- Building Competences
- Preserving nat. comp. on NST
- Public Outreach

Human Resources Development
- Effective Human Capital Management

Nuclear Knowledge Management
- Preserving NK
- Preventing NK loss
- Harvesting NK

Nuclear Network
- Building competencies
- Stakeholders involvement
- Public outreach
- Increasing public support
Activities for Capacity Building of BATAN

Activities:

**E&T External**
- TC for teachers, students, lecturers
- IRL
- Public Outreach

**E&T Internal**
- System Improvement
- Method diversification
- Infrastructure improvement
- Networking

**NKM**
- Infrastructure development
- Self Assessment

**Nuclear Network**
- TC IAEA
- ANENT
- ANSN
- NSSC
- FNCA
- ICERR
- Stakeholders
- Foreign Univ.
- Domestic Univ.
The self-assessment addressed four fundamental questions (NAMA):

• What is needed? (Need),
• What is available and adequate to meet the needs? (Availability),
• What is missing or needs improvement in order to meet the needs? (Missing/gaps), and
• What actions are needed? (Actions).
NKM Self-Assessment

A. Manpower profile
B. Map of Knowledge
C. Transfer, Sharing and Dissemination of Knowledge
D. Critical Knowledge & Potential Knowledge Loss
E. Program for Improvement
**Critical Knowledges**

**Needed, non-existent knowledge**
- TOT: Medical application of RIs
- TOT: Reactor Engineering

**Existent, limited holders**
- TOT: Radiographer Level 2 dan 3
- TOT: Radiation Protection
- TOT: Nuclear Instrumentation

**Potential Knowledges Loss**

- TOT: Radiography Level 2 dan 3
- TOT: Radiation Protection
- TOT: Nuclear Instrumentation
- TOT: Teaching Methods, Learning materials development
- Maintenance of nuclear radiation detectors

**Knowledge Map: CET (Technical)**

- Nuclear Security Culture
- Isotope & Radiation
- Nuclear Security & Safeguard
- Radiation Emergency
- Radiation Protection
- Applications for Environment
- Engineering of Nuclear Instruments and Facilities
- Radiation detection

**Knowledge Map: CET (Management)**

- Planning and Development
- Competence Building
- Management of Finance
- Management of Infrastructure
- QA
- HRD

**Examples: CET - NKM Status**

- Status of Employees (Based on Work Types):
  - Total: 73 org
  - Male: 49
  - Female: 26
  - Management: 62 org
  - Technical: 11 org

- Age Profile:
  - Profil Usia
  - Non Teknik: 1
  - Teknik: 62

- Total: 73 org
  - Male: 49
  - Female: 26

- Critical Knowledges:
  - Needed, non-existent knowledge
    - TOT: Medical application of RIs
    - TOT: Reactor Engineering
  - Existent, limited holders
    - TOT: Radiographer Level 2 dan 3
    - TOT: Radiation Protection
    - TOT: Nuclear Instrumentation

- Potential Knowledges Loss:
  - TOT: Radiography Level 2 dan 3
  - TOT: Radiation Protection
  - TOT: Nuclear Instrumentation
  - TOT: Teaching Methods, Learning materials development
  - Maintenance of nuclear radiation detectors
Training Policy

every personnel who works in nuclear research, development, and application should be provided with adequate training in certain level of competence.

- After completing the trainings, personnel have to get license from BAPETEN.
- training program is manage for all employees,
- a grading model is used to set priority,
- modalities of classical and non-classical are blended,
- utilizing network with partners.
Modalities for Competencies Development

**Education**
- Formal education
- Domestics/Foreign Universities

**Training**
- Classical: Face to Face
- Non Classical: *e-learning*, mentoring, distance learning, coaching, etc.
## Grading Model

<table>
<thead>
<tr>
<th>Elements</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Program</td>
<td>5</td>
</tr>
<tr>
<td>Required for Certification of Personnel</td>
<td>5</td>
</tr>
<tr>
<td>International Cooperation</td>
<td>4</td>
</tr>
<tr>
<td>Potential Loss of Knowledge</td>
<td>4</td>
</tr>
<tr>
<td>Program of BATAN</td>
<td>4</td>
</tr>
<tr>
<td>Program of Technical Centers</td>
<td>3</td>
</tr>
<tr>
<td>Program for Dissemination/Outreach</td>
<td>2</td>
</tr>
<tr>
<td>Others</td>
<td>1</td>
</tr>
</tbody>
</table>
# Training Scheme
## Research Reactor Personnel

<table>
<thead>
<tr>
<th>Specialization</th>
<th>Topic of Trainings</th>
<th>Basic ~ 3 years</th>
<th>Junior 3 ~ 6 years</th>
<th>Senior 6 ~ years</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operation</strong></td>
<td></td>
<td>Reactor Operator</td>
<td>Reactor Kinetics and Dynamics</td>
<td>Reactor Supervisor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reactor Heat Transfer</td>
<td>Thermohydraulics</td>
<td>Safety of Installation Operation</td>
</tr>
<tr>
<td></td>
<td>Radiation Protection</td>
<td></td>
<td></td>
<td>Reactor core modelling</td>
</tr>
<tr>
<td><strong>Maintenance</strong></td>
<td>Radiation Measurements</td>
<td>Operator of Maintenance Reactor</td>
<td>Reactor Instrumentation System</td>
<td>Supervisor Maintenance Reactor</td>
</tr>
<tr>
<td></td>
<td>Working Health and Safety</td>
<td>Reactor Controlling Technique</td>
<td>Reactor Controlling Technique</td>
<td>Safety of Installation Operation</td>
</tr>
<tr>
<td></td>
<td>Basic of Nuclear Safety</td>
<td>Radiation Protection Officer</td>
<td>Radioactive waste management</td>
<td>Design Reactor Controll System</td>
</tr>
<tr>
<td></td>
<td>Safety Culture</td>
<td>Accounting of Nuclear Material Health and Safety Specific (Thermal, Electric, Mechanic etc)</td>
<td>Nuclear Safety Management</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Safety of Installation Operation</td>
<td>Safety of Installation Operation</td>
<td>Human Performance</td>
</tr>
</tbody>
</table>
## Critical Knowledges and Knowledge with Potential Loss

<table>
<thead>
<tr>
<th>RR</th>
<th>Critical Knowledge</th>
<th>Potential Knowledge Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Reactor core physics (Neutronik and Thermohydraulic Analysis), Radiation safety, Radiometric analysis, Process of radioisotopes (extraction of Tc-99m, Iodium-131, P-32, Br-82 etc.), Marked-substances production, Radiochemistry, Radiometric analysis, Treatment of TRIGA Instrumentation and Control Systems, Calculation of fuel burn-up</td>
<td>Calculation of reactor fuel burn-up, Neutron flux measurement, NDT for ageing management, Analysis and development of Neutronic and thermohydraulics, Nuclear Instrumentation</td>
</tr>
<tr>
<td>C</td>
<td>Accounting of nuclear materials and reactor irradiation services, Electrical, Mechanical, Instrumentation and reactor control, Waste control of reactor facilities, and Safety of reactor operations</td>
<td>Radioactive waste control of reactor facilities, Pre and post irradiation services</td>
</tr>
</tbody>
</table>
Actions for Preventing or mitigating potential loss of knowledge

Training program is focused on the subjects of knowledge with potential loss.

Managing coaching and mentoring on the subjects of knowledge with potential loss.

Knowledge sharing program by personnel who will be retired in 2-3 years ahead.

Intensifying utilization of knowledge network with the IAEA, ICERR and others.

Request the IAEA to support the implementation of nuclear knowledge management (NKM).
Competence development of research reactors (RR) personnel in Indonesia is very important in order to operate and maintain the research reactors in safe, secure and sustainable manner.

A training scheme for RR personnel has been established and implemented in regular basis to be in compliance with the regulation.

A self assessment on human resources has been done and the result showed indication of demotivation and decline in employee competence since there are no major programs in the last 25 years, ageing of employees because of moratorium program for new recruitment, limited competency budgets, as well as existence of potential of knowledge lost.

In order to handle the possible occurrence of knowledge loss, BATAN takes a policy and plan incorporating policies on education and training, knowledge sharing, knowledge network, as well as NKM.
Terima Kasih

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