Enhancing Collaboration on Nuclear Fuel Technologies: Indonesia’s Experience

Ridwan

Center for Nuclear Fuel Technology
National Nuclear Energy Agency, Indonesia
INDONESIA

MPR-30 GA Siwabessy
TRIGA-Modified 2M
TRIGA Type 100 kW
Nuclear Fuel Cycle Facilities in Indonesia

- Center for Nuclear Fuel Technology
- Fuel Fabrication
- Conversion
- Reactor
- Mining and Milling
- Waste Management
- Center for Nuclear Reactor Safety and Technology
- G.A. Siwabessy Research Reactor 30 MW
- Center for Radioactive Waste Management
- Center for Nuclear Minerals Development
Overview of Center for Nuclear Fuel Technology

• Aim to develop nuclear fuel technologies
• Facilities for development of fuel technologies
  - Fuel Element Production Installation (FEPI) used to supply material testing reactor (MTR) fuel for G.A. Siwabessy RR
  - Experimental Fuel Element Installation (EFEI) for R&D of nuclear fuel
• Facilities for irradiation and post-irradiation examination
  - G.A. Siwabessy 30 MWth research reactor, equipped with Power Ramp Test Facility (PRTF) for testing NF
  - Installation of Radio Metallurgy (IRM) for post-irradiation examination
Nuclear Fuel Technology Program in Indonesia

**R&D of fuel for research reactor and power reactor**
- Prototype of U-Mo and U-Zr based fuel for research reactor
- Powder-based LWR fuels, advanced particle-based LWR & HTGR fuel
- Modelling for PRTF fuel pin and cermet-based fuel

**Production of MTR fuel for research reactor**
- Previously developed $U_3Si_2-Al$ fuel to replace $U_3O_8-Al$
- Irradiation in research reactor
- Fuelling
- Storage of MTR spent fuel

**Fuel Element Production Installation (PT. INUKI)**
- G.A. Siwabessy Research Reactor

**Experimental Fuel Element Installation: Conversion and Fuel Fabrication**

"Took many years irradiation, Followed by time for decay"

Installation of Radiometallurgy
Constraints on the Program

- High operation and maintenance costs, with more equipment becoming obsolete and facilities aging
- Budget constraints from Government, obtained and reported on an annual basis
- Limited breadth of expertise in fuel technologies
- Limited access to information on advanced fuel technologies
- More retirement of skilled human resources in recent years, given low rate of recruits hence creating imbalance/gap in skills
- Difficulties to purchase nuclear materials (sparingly and in low quantity) from suppliers/industries, e.g. for structural material Zircaloy
Lessons Learned

1. Importance of good business plan / strategies
   - Consider well aging and obsolescence
   - Anticipate increase in costs, economic crisis, funding cuts
   - Incorporate strategies to acquire resources from outside
   - Set priorities
   - Prepare contingency plan

2. Mutual cooperation with external experts
   - Additional expertise
   - Lower cost
   - Information gain

3. Tactical strategies to approach suppliers of nuclear materials
   - Cooperate with international research groups
   - Sign longer-term deals
   - Others (?)

4. Additional human resources
   - Promote cooperation with universities, including for advanced degrees, and other institutions in the country

5. Importance to be more involved with IAEA fuel program
   - Participate in relevant activities
   - Consult fuel experts
   - Propose peer events facing similar issues under the Agency’s umbrella
Driving Forces for Collaborations

1. To promote fuel R&D in Indonesia to support nuclear power program for deployment of power reactor, including experimental power reactor

2. To optimize use of fuel facilities, e.g. joint R&D, sharing facilities, provision of services / training

3. To seek additional resources (funds, equipments/ spare parts) to enhance flexibility in program scheduling and operation capability

4. To ensure safe and secure operation of fuel facilities in Indonesia

5. To promote better communication with international fuel specialists and facilities / and nuclear industry

6. To increase competence of human resources in perform fuel technology activities, as well as to operate and maintain fuel facilities, e.g. on the job training

7. To find potential markets for services and products

8. To have access to better information / trends on advanced fuel technologies
Role of IAEA in Promoting Collaborations

IAEA is considered as central point to seek collaborations:

- Participation in INPRO activities, e.g. FANES, Disseminate Good Practices, Global Scenarios
- Participation in CRP, e.g. Nuclear Forensic, Reliability of Extended Burn Up and Advanced PHWR Fuels
- Access of modelling tool, e.g. FEMAXI-V from NEA
- Request of services in the form of training, workshop and consultancy, e.g. HTGR workshop bringing in relevant international fuel specialists to Indonesia; planned PIE related meeting to obtain expertise, establish network for sharing of experiences and use of facilities
- Potentials for assistance to approach suppliers of nuclear materials?
## Status of Fuel Collaborations

<table>
<thead>
<tr>
<th>Counterpart</th>
<th>Description</th>
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<tbody>
<tr>
<td>Japan</td>
<td>Researcher Exchange Program by MEXT: Nuclear fuel fabrication, Structural materials, Operation and maintenance of PIE facility</td>
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<tr>
<td>USA</td>
<td>Nuclear fuel for research reactor: LEU import, Spent fuel take back and U-foil for Mo production</td>
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<td>ANSTO</td>
<td>Nuclear forensic</td>
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<tr>
<td>Malaysia</td>
<td>Host trainings for fuel experts</td>
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<tr>
<td>China</td>
<td>Sign agreement to establish working group for long term R&amp;D of HTGR fuel study</td>
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<tr>
<td>Bandung Institute of Technology</td>
<td>Simulation for development of nuclear fuel technology for innovative reactor (2015)</td>
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| IAEA                   | • Decision to participate in INPRO Projects, i.e. FANES, Disseminate Good Practices  
                          | • NPTDS for HTGR fuel network  
                          | • Approach to NEFW for related fuel and PIE activities                                  |
Terimakasih
Thank You