Human Resource Development for Korean Nuclear Power Programs

May 26, 2009

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I. Milestones of Nuclear Power Program in Korea
History of Nuclear Power Development

Over 30 year experience in nuclear power

1970s
Introduction of Nuclear Power

Construction of Kori #1 (`71-`78)

1980s
Promotion of Localization

Establishment of Localization Plan (`84)

1990s
Technology Self-reliance

OPR\textsuperscript{1000} Development (`95)

2000s
Development of Advanced Reactor

APR\textsuperscript{1400} /SMART Development

* OPR\textsuperscript{1000} (Optimized Power Reactor 1,000) is new name for the former KSNP
In operation
20 units
(17,716 MW)

Under construction
8 units
(9,600 MW)

planning
10 units
(15,400 MW)

Radioactive Waste Disposal Facility
(Under construction)

Nuclear Power Plants

Yong-gwang
6 units
Kori
8 units
Ulchin
8 units
Wolseong
6 units
Kori
8 units
Yong-gwang
6 units

In Operation
Under Construction
Milestones of Nuclear Program

- **1959.2.3**: Establishment of KAERI
- **1962.3.19**: KRR-1
- **1972.3.10**: KRR-2
- **1978.7.20**: NPP No.1 Operation
- **1987**: CANDU-6 Fuel
- **1995.2.8**: HANARO
- **2009.10**: FTL
- **2010**: CNS
- **2013**: APR1400
- **2012**: SMART DC
- **2009.10**: SFR
- **2020**: HANARO

**Timeline**

- **1960**: Establishment of KAERI
- **1980**: CANDU-6 Fuel
- **2000**: FTL
- **2020**: SFR

**Events**

- **1989**: PWR Fuel
- **2012**: SMART DC
- **2013**: APR1400
- **2020**: HANARO

**Historical Highlights**

- **1962.3.19**: KRR-1
- **1972.3.10**: KRR-2
- **1978.7.20**: NPP No.1 Operation
- **1987**: CANDU-6 Fuel
- **1995.2.8**: HANARO
- **2009.10**: FTL
- **2010**: CNS
- **2013**: APR1400

**Future Projects**

- **2012**: SMART DC
- **2020**: HANARO
II. History of Human Resource Development Program
An Overview of Human Resource Development to Support Korean Nuclear Programs

1960s
Preparation for Nuclear Energy
- Joining IAEA Research Reactor

1970s
Introduction of Nuclear Power
- Construction of Kori #1

1980s
Promoting Localization
- Establish Localization Plan

1990s
Technology Self-reliance
- OPR1000, Hanaro Development

2000s
Advanced Tech. Development
- APR1400 Development

Overseas Training
- Universities
  - NTC/KAERI
- Utilities
- KOPEC
- KNPEI/KHNP

Basic Training

IAEA Regional Training
- KNFC

Domestic NHRD
- KINS

Global NHRD
- INTEC/KAERI
<table>
<thead>
<tr>
<th>Year</th>
<th>1960’s</th>
<th>1970’s</th>
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<tr>
<td>Field</td>
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<tr>
<td>Turnkey Project for Nuclear Power</td>
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<td>Non-Turnkey Project for Nuclear Power</td>
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<td>Self-Reliance of Nuclear Power Project</td>
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<td>PA Training</td>
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<td>International Training Courses for fellow-Developing Countries</td>
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<td>Retraining for Nuclear Licensees (RO, RI, NDT, etc)</td>
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<td>Nuclear Fuel Cycle Technology for Industries</td>
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<td>Non-Destructive Testing for Industry</td>
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<td>Nuclear Power Technology for Utility, A/E, Manufacturer, Construction Companies</td>
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<td>Research Reactor Experiment for University Students</td>
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<td>Training Courses on RI Applications for Medical and Industrial Purpose</td>
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</table>
Established as the training section at Kori NPP
- CO of Kori Unit 1 (First Korea’s NPP)
- Simulator#1 for Kori Unit 1&2
- Simulator#1 for Ulchin Unit 1&2
- Established as the nuclear training institute
- CO of YKN Unit 3&4 (First OPR1000)
- Simulator#1 for Wolsung Unit 1,2,3&4
- Simulator#1 for Youngkwang Unit 3,4,5&6
- Awarded the “Letter of Recognition” from IAEA
- Separated from KEPCO, renamed as KNPEI

*CO : COMMERCIAL OPERATION
<table>
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<th>Year</th>
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<td>1958</td>
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<td>1959</td>
<td>Seoul National University</td>
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<td>1979</td>
<td>Kyunghee University</td>
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<td>1981</td>
<td>Korea Advanced Institute of Science and Technology</td>
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<td>1985</td>
<td>Chosun University</td>
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</table>
III. Nuclear Education and Training System
Coordination Framework for Nuclear HRD

**Nuclear R&D Institutes**
- Development, Acquisition, Dissemination of Nuclear Technology
- Nuclear Manpower Training

**Universities**
- Education in Nuclear Eng.
- Education in Science & Eng.
- BS, MS, PhD Degree

**Government**
- Nuclear Policy and Promotion
- Planning of Nuclear Power
- Nuclear Regulation and Control

**Regulatory Authority**
- Licensing
- Inspection
- Evaluation and Analysis of Nuclear Safety

**Industries**
- Construction, Design & A/E
- Manufacturing of Component and Equipment
- Manufacturing of Nuclear Fuel

**Utilities**
- Operation and Maintenance of NPP
- In–house Training for NPP Personnel
- Distribution/Transmission

**Society & Associations**
- Korea Nuclear Society
- Korea Radioisotope Association
- NDT Promotion Association
Legal Requirements for Nuclear Education and Training

- Licensing and Examination
- Education and Training
- License and education of nuclear related employees
- Qualification for license examination
- Supplementary education
- Specific requirements and procedures for license examination and education
- Procedures for training and qualification of NPP personnel at industries

Industrial Codes and Standards, Procedures

- Atomic Energy Act
- Enforcement of Decree of the Act
- Enforcement of Regulation of the Act
- Notice of the Minister of Science and Technology
Nuclear Licenses in Korea

- **Reactor Operator Licenses**
  - Supervisor
  - General

- **Radioisotope Treatment Licenses**
  - Supervisor
  - General

- **National Qualifications**
  - (Engineer, Technician, Craftsman)
    - NDT
    - Nuclear
    - Welding
IV. Major Nuclear Training Programs
Provide managers with the opportunity to discuss pending managerial problems

Cover advanced knowledge that are first taught in the practical courses

Cover essential & practical knowledge to improve the employee’s expertise

Provide new employees with basic knowledge of NPPs
Nuclear Training Programs at KHNP

**KNPEI**
- Fundamental Courses
- Practical Courses
- Advanced Courses
- Managerial Courses
- Nuclear industries training courses
- Cyber training courses
- International courses

**Local TC**
- Fundamental Course (NPP Sys.)
- Operational Courses
  - Simulator education
- Engineering Courses
  - Practical, Advanced

**Trainees**
- New employees
- Existing staff at KHNP
- External employees
- Overseas people

**Curriculum**
- Operators at it’s site
- New employees at it’s site
Training Programs for New Employees

Orientation (3w) – KNPEI
Nuclear Theory Fundamenta (7w) – KNPEI
Plant Sys. Fundamental (3w) – KNPEI

Practical courses
Total 33w

OJT-2 (6w) – Plants
Plants Specifics For NPP Types (7w) – TCs
OJT-1 (7w) – Plants

Dispatch to the plant
Main Training Facilities

**Lecture room**
- 21 rooms
- 540 trainees
- computer, projectors

**Conference room**
- international courses
- Simultaneous translation

**Simulator #1,2**
- training for normal, transient, and emergency situation

**Auditorium**
- Seating capacity for 320 people

**Library**
- 40,000 volumes of technical references

**Computer room**
- computers and a network system
Local TC : Site Specific Education

- **Local Operators Training based on site specific education**
  - MCR Operator
    - MCR refresher course (2 times/yr, 3Ws/time)
  - RO/SRO Licensee
    - License renewal course (1W/3yrs)
    - Cultivating RO/SRO Licensees:
  - Local Operator
    - Local refresher course (2 times/yr, 3Ws/time)
    - Simulator education for RO/SRO license test (10Ws)
  - 7 simulators in local training centers
    - Kori site - simulator #1&2, Wolsung site - simulator#1
    - Youngkwang site - simulator #1&2, Ulchin site - simulator#1&2

- **Local Engineers Training**
  - Local engineers training regarding the site specific issues on NPP operation & maintenance
    - Primary/secondary System
    - Pump, S/G, TBN, Valve, etc
    - Motor Generator, EDG
    - Core Detector/ Core/ Fuel
Transfer advanced knowledge between KHNP & overseas partners

- Workshop: IAEA, WANO, INPO
- Nuclear training: Nuclear developing countries

Provide external employees working for related companies with the basic nuclear knowledge

- Courses
  - Nuclear fundamentals
  - NPP System
  - Radiation QA, Etc
**KNPEI – International Cooperation**

- **China**
  - Operation & Maintenance Courses
  - 8 courses, 2Ws. 10 people/Course

- **Vietnam**
  - Nuclear Fundamentals Course
  - 2 times, 2Ws/time

- **Nigeria**
  - Nuclear Fundamentals Course
  - 1 time, 1W/time

- **Indonesia**
  - Project Management Course
  - 1 time, 4Ws/time

- **WANO**
  - Topic: Peer Reviewer

- **IAEA**
  - Topic: Decommissioning, Leadership (2 times)

- **INPO**
  - Topic: Safe Management for NPP

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**Yearly Participation**

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<tr>
<th>Year</th>
<th>China</th>
<th>Vietnam</th>
<th>Nigeria</th>
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Education and Training Programs at KAERI

- **IAEA’s Interregional Training Course**
  - Training for Professionals for Nuclear-interested Countries (Southeast Asia, Middle East, Africa, etc.)

- **International Courses in Nuclear Co-operation Programs**
  - International Training Courses under Bilateral Technical Cooperation Programs

- **Professional Education for Nuclear personnel**
  - Training for Nuclear Industry personnel
  - Re-training for Nuclear Related License Holders and Qualified Engineers
  - Co-operative Education with Universities

- **In-house Training**
  - Education for Managerial Staff
  - Various Career Development Education
  - Foreign Language and Computer Education
  - Education for KAERI Family
Training Areas at KAERI

- Advanced Reactor Design Technology
- Nuclear Power and Nuclear Fuel Cycle Technology
- Nuclear Safety Improvements
- Radioactive Waste Management Technology
- Radiation Protection
- Nuclear Policy and Experiences on Self-reliance Technology
- Radioisotope Production and Radiation Application Technology
- Non-Destructive Testing Technology
- Basic Nuclear Science and Technology
Figure Skating World Championship
2009.3.29

Yuna Kim
207.71 (World Record)

Thank You!
Government policy of nuclear human resources development

- Support for nuclear education program at universities
  - Enlargement of fellowship program for students
  - Providing intern job opportunities at research institutes and industries
  - Support for updating curricula, linkage with the advanced technology

- Maintaining qualified nuclear personnel at industries
  - Providing fringe benefits for radiation workers
  - Enhancement of training organizations and its training programs
  - Activation of exchange programs among industries, research institutes and universities

- Encouraging global competitiveness of nuclear manpower
  - Providing international career for young researchers and students
  - Fostering joint research projects with international organizations & advanced countries
  - Utilization of outstanding experts from overseas