Second Meeting of the Technical Working Group for
Small and Medium-sized or Modular Reactor (TWG-SMR)
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Education and Training Activity for Regulators of Saudi Arabia:

HCB Programme during 2018~2019



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Outlines

1. **Introduction of *HCB E&T Programme***
2. **Activities to E&T for CB**
3. **Outcomes**

1. Introduction of HCB E&T Programme

□ Initiatives

- ○ HCB programme was initiated under NSSC-K.A.CARE MOU Agreement on Nov 2016 aiming to contribute establishing nuclear regulatory infrastructure in Saudi Arabia.
- ○ KINS-K.A.CARE Framework Arrangement was signed on Oct 2017.
  - ***KINS-K.A.CARE HCB Program Task Order*** was issued on Oct 2017.





2. E&T for CB Programme (1)

E&T CB Programme

- Development of ***newcomer country-tailored capacity building program*** to be used as a basis in planning and organizing support project,
- ***KINS-K.A.CARE HCB Programme*** has specially developed to support building regulatory capacity for regulators in Saudi Arabia.
- Developed in accordance with the ***IAEA safety standards*** and ***KINS specialized courses for regulators*** over 40 year experiences on domestic regulatory activities and overseas projects





2. 2. E&T for CB Programme (2)

1. **Courses for Regional Training with the IAEA**
   - Basic Professional Training(BPTC), Nuclear Safety Regulation, Safety Review and Assessment, Radiological and Nuclear Emergencies
   - About 90 member countries of ANSN, ASEAN, ANNuR and FNRBA
2. **Courses of the Bilateral Cooperation Training**
   - NPP licensing, inspection of radioactive sources & radiation facilities, QA or pre-operational inspection for NPP under construction
   - UAE(FANR), Egypt(ENRRA), Jordan(JNRC), Vietnam(VARANS)
3. **KINS-KAIST MS Degree Program**
   - Operated jointly with Korea Advanced Institute of Science & Technology (KAIST) for educating international young generation since 2009. (10 ~ 15 students per year)
   - Delivers curricular on basic theory and fundamental research and safety regulation and regulatory practices

2. E&T for CB Programme (3)

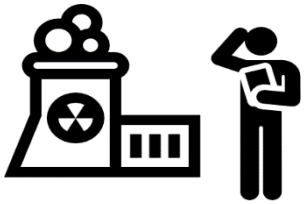
Overview of E&T Programme



Lecture



Simulated OJT



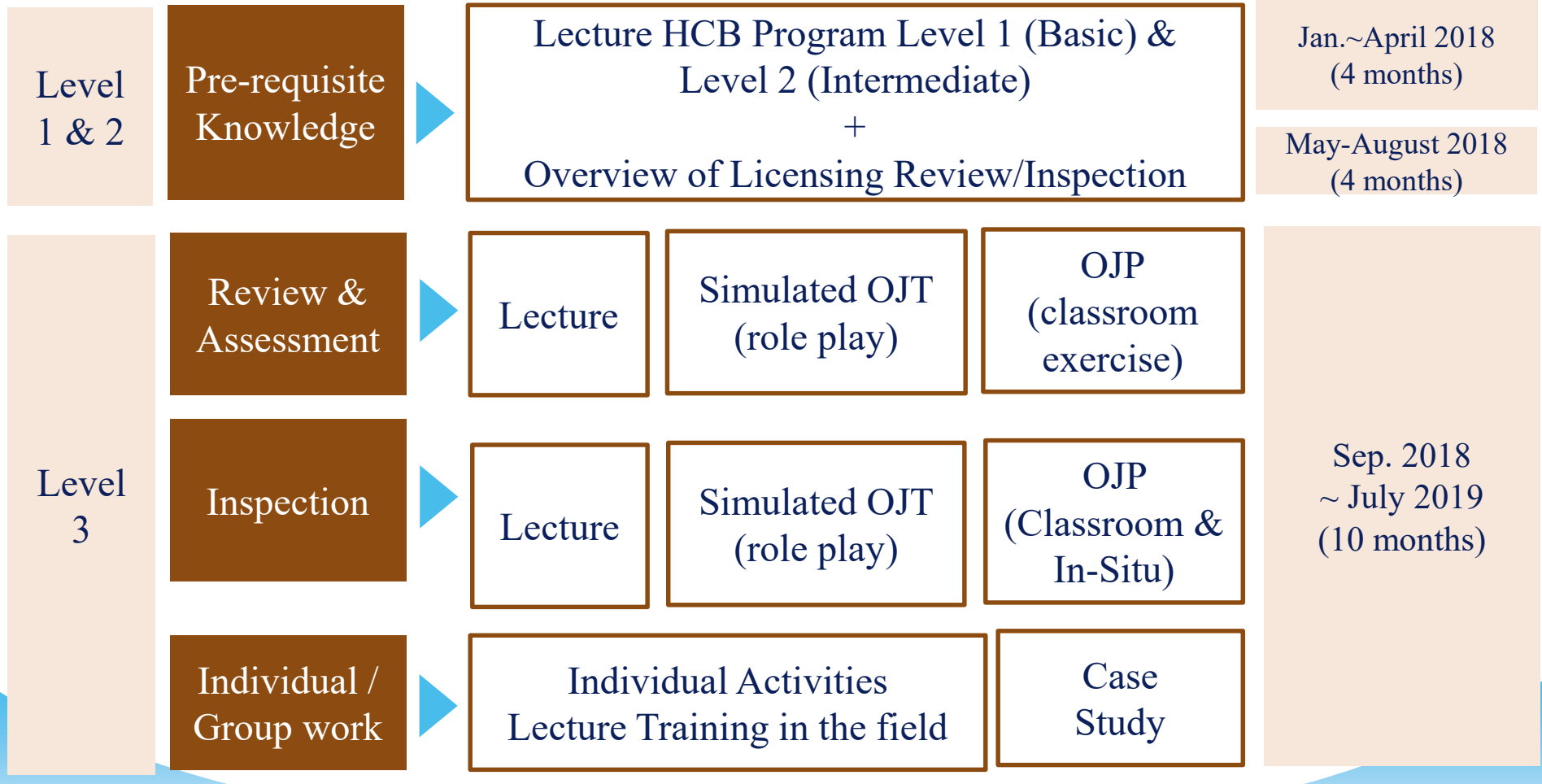
OJP

Objectives	• Basic and professional courses on nuclear and radiation safety regulation	• Understand regulatory documents (safety review guides, inspection guides for regulatory activities	Practical exercise on skills how to prepare, manage and perform the regulatory activities

- Level 1 (Basic) and 2 (Intermediate)
- Level 2 (Professional Course)

2. E&T for CB Programme (4)

Overview of E&T Programme



HCB Program : Levels and Modules

Level 1 : Basic Course on Nuclear and Radiation Safety (10 modules)

<Module 1.1> Overview of Nuclear Safety Regulation

1.1.1 Overview of IAEA Safety Standards (IAEA SF, GSR, SSR)
1.1.2 Regulatory Infrastructure of a NPP (IAEA SSG-16)
1.1.3 Governmental, Legal and Regulatory Framework for Safety (IAEA GSR Part1)
1.1.4 Introduction of INSAG Report
1.1.5 Licensing Process
1.1.6 Introduction to Nuclear Facilities
1.1.7 Overview of Nuclear Regulations
1.1.8 Construction of NPP
1.1.9 Commissioning of NPPs
1.1.10 Operation of NPPs
1.1.11 Safety Analysis Report
1.1.12 Review and Assessment of NPPs

<Module 1.2> Overview of NPP Design

1.2.1 Safety Requirements of Nuclear Power Plant Design (IAEA SSR 2/1)
1.2.2 Basic Nuclear Engineering & Design
1.2.3 System design of Nuclear Steam Supply System(NSSS)
1.2.4 System design of ESF System
1.2.5 System design of Safety-Related and Auxiliary System
1.2.6 Steam and Power Conversion System
1.2.7 Plant Protection, Control & Monitoring System
1.2.8 Siting and Structural Engineering
1.2.9 Mechanical and Material Engineering
1.2.10 Electrical Power System
1.2.11 Technical Specifications
1.2.12 Overview of APR 1400

2. E&T for CB Programme (6)

Level 1 : Basic Course for Nuclear and Radiation Safety

<Module 1.3> Commissioning and Operation of NPP

1.3.1 Safety Requirements; Commissioning and Operation (IAEA SSR 2/2)
1.3.2 License Amendment Review
1.3.3 Regulatory Inspection
1.3.4 Introduction to Configuration Management
1.3.5 Introduction to Nuclear Plant Analyzer
1.3.6 Introduction to KINS simulator
1.3.7 Technical Visit to the NPP site

<Module 1.4> Safety Assessment

1.4.1 Safety Assessment and Verification (IAEA GSR Part 4)
1.4.2 Defence in depth and Safety Margins
1.4.3 Safety Analysis; DSA, PSA
1.4.4 Severe Accident Analysis
1.4.5 Accident Management

<Module 1.5> Radiation Safety and Waste Management

1.5.1 Radiation Protection and Safety Radiation (IAEA GSR Part 3)
1.5.2 Radiation Protection
1.5.3 Predisoposal Management of Radioactive Waste (IAEA GSR Part 5)
1.5.4 Radioactive Waste Management
1.5.5 Decommissioning of Facilities (IAEA GSR Part 6)
1.5.6 Decommissioning
1.5.7 Radiological Accidents & Response
1.5.8 Technical Visit to Wolsong LILW Disposal Site

<Module 1.6> Emergency Preparedness & Response

1.6.1 Preparedness and Response for a Nuclear or Radiological Emergency (IAEA GSR Part 7)
1.6.2 Preparedness and Response for a Nuclear or Radiological Emergency
1.6.3 Emergency Management System, Roles and Responsibilities
1.6.4 Managing Operations in an Emergency Preparedness and Response
1.6.5 Introduction to Emergency Management System

2. E&T for CB Programme (7)

Level 1 : Basic Course for Nuclear and Radiation Safety

<Module 1.7> Regulation of Nuclear Fuel Cycle Facilities & Research Reactors

1.7.1 Overview of Nuclear Fuel Cycle Facilities
1.7.2 Overview of Research Reactors
1.7.3 Technical Visit to KNF & Hanaro
1.7.4 Technical Visit to KAERI URL & Irradiation Facility

<Module 1.8> Management and Leadership

1.8.1 IAEA GSR Part 2
1.8.2 Safety Culture and its oversight; SC for RB, Oversight of Licensee's SC

<Module 1.9> Global Nuclear Safety Regime

1.9.1 International obligations and arrangements
1.9.2 Sharing of operating and regulatory experiences
1.9.3 Global Nuclear Safety Network

<Module 1.10> Quality Assurance (QA) in General

1.10.1 Introduction to QA Regulation
1.10.2 International Standards to QA

2. E&T for CB Programme (8)

Level 2 : Intermediate Course for Nuclear and Radiation Safety (13 Modules)

<Module 2.1> Siting and Structural Engineering

2.1.1 Site Characteristics
2.1.2 Seismic Safety
2.1.3 Structural Engineering

<Module 2.2> Mechanical and Material Engineering

2.2.1 Thermal-Hydraulics Area
2.2.2 Solid Mechanics Area (Mechanical Loads, Stress, Fracture Mechanics, etc.)
2.2.3 Material Area

<Module 2.3> I&C and Electrical Engineering

2.3.1 I&C System Evaluation
2.3.2 Electrical Power System Evaluation
2.3.3 Human Factors Engineering
2.3.4 Equipment Qualification
2.3.5 Power System Analysis

<Module 2.4> Radiation and Radwaste Management

2.4.1 ALARA
2.4.2 Source Term Evaluation for Radiation Protection
2.4.3 Radiation Protection Design Features
2.4.4 Operational Radiation Protection Programme
2.4.5 Radiation Safety and Security for Radioisotopes and Radiation Generators
2.4.6 Radioactive Waste Management System
2.4.7 Safe Transport of Radioactive Material

2. E&T for CB Programme (9)

Level 2 : Intermediate Course for Nuclear and Radiation Safety

<Module 2.5> Safety Assessment

2.5.1 Design-Basis Accident Analysis
2.5.2 Severe Accident Analysis
2.5.3 Probabilistic Safety Assessment
2.5.4 Application of Safety Analysis Codes
2.5.5 Application of PSA Codes

<Module 2.6> Reactor System

2.6.1 Performance Evaluation of Systems/Components
2.6.2 Functional Design, Qualification and Inservice Testing Programs for Pumps, Valves
2.6.3 Design of Ovverpressurization Protection (high pressure transient; operating at low temperatures)
2.6.4 Design of the Residual Heat Removal
2.6.5 Design of Emergency Feedwater System Pump Drive and Power Supply Diversity
2.6.6 Design of avoiding Water Hammers (Steam Generator, Process Piping Systems)
2.6.7 Fire Protection System

<Module 2.7> Quality Assurance

2.7.1 Statue related to QA
2.7.2 QA Criteria
2.7.3 Introduction to Special Process
2.7.4 QA Inspection Skill and Practice
2.7.5 QA Inspection Simulation
2.7.6 Review of QA Inspection Report
2.7.7 Configuration Management

<Module 2.8> Radiological Impact Evaluation

2.8.1 Overview of Environmental Impact Assessment
2.8.2 Radiological Impact Assessment
2.8.3 Non-radiological Impact Assessment
2.8.4 Monitoring food, sea water, etc.

2. E&T for CB Programme (10)

Level 2 : Intermediate Course for Nuclear and Radiation Safety

<Module 2.9> On-site Accident Management

2.9.1 Emergency Operating Procedure (EOP)
2.9.2 Severe Accident Management Guideline (SAMG)
2.9.3 Extensive Damage Management Guideline (EDMG)

<Module 2.10> Emergency Preparedness & Response

2.10.1 Technical Standards of EPR
2.10.2 Evaluation of Radiological Consequence and Effects
2.10.3 Study on Strategies of Public Protection and Practical Examples

<Module 2.11> Operational Experience Feedback

2.11.1 Event Analysis and Investigation
2.11.2 Utilization of Operating Experience Data
2.11.3 Notification of Events and Reporting
2.11.4 Nuclear Plant Analyzer (e-Fast)

<Module 2.12> Regulator Training

2.11.1 APR1400 Simulator
2.11.2 APR1400 Nuclear Plant Analyzer

<Module 2.13> Design of SMART

2.13.1 Safety Analysis
2.13.2 Mechanical and Material Engineering
2.13.3 Site and Structural Engineering
2.13.4 Reactor System
2.13.5 I&S and Electrical Engineering
2.13.6 Radiation Protection and Radwaste
2.13.7 Passive Safety System

2. E&T for CB Programme (11)

Level 3 : Advanced Course for Nuclear and Radiation Safety

<Module 3.3> OJT on Inspection of NPP (at site)

3.3.1 Siting Inspection
3.3.2 Pre-Operational Inspection
3.3.3 QA Inspection
3.3.4 Periodic Inspection
3.3.5 Supplier Inspection
3.3.6 Resident Inspection
3.3.7 EPR Drill & Exercise

<Module 3.4> Licensing Review Exercise for SMART (at classroom)

3.4.1 Siting & Structural Engineering
3.4.2 Mechanical & Material Engineering
3.4.3 I&C and Electrical Engineering Evaluation
3.4.4 Radiation and Radwaste Management
3.4.5 Safety Assessment
3.4.6 Quality Assurance
3.4.7 Reactor System/Components

3. Outcomes

- **Contributed to establishing robust nuclear regulatory infrastructure in Saudi Arabia**
  - Trained the trainees (regulators) to understand the fundamentals of the review & assessment and inspections in the licensing process such as objectives, management, performance, regulatory enforcement, etc.;
  - to be familiar with preparing, managing and performing regulatory activities such as safety review and inspections.





Thank you for your attention!



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