Regulating Nuclear Reactor Construction and Commissioning, and Preparation for Operation
“Challenges for a New Regulatory Body”

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PRESENTATION OUTLINE

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   - Overall Program Status

II. COMPLETING THE UAE REGULATORY FRAMEWORK
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   - New staffing and competencies needed

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I. INTRODUCTION AND BACKGROUND [ FANR Organisation ]

- FANR was established by the issuance by the President of the UAE Law by Decree No.6 of 2009 Concerning the Peaceful Uses of Nuclear Energy (the “Nuclear Law”).

- The FANR Board of Management exercises FANR’s legal powers contained in the Nuclear Law.

- The current Board is comprised of seven Emirati citizens, including the Chairman and Deputy Chairman, who are appointed for a term of three years by resolution of the Cabinet.

- Board members are prohibited from having an interest in any activity that is regulated under the Law, ensuring independence in their official capacity.
The **Director General** leads the FANR staff organisation.

Reporting to the Director General are **Deputy Directors General** who head the Operations Division and the Administration Division, respectively.

The Operations Division consists of: Departments for **Nuclear Safety**, **Radiation Safety**, **Safeguards**, **Nuclear Security** and **Education and Training Department**.
I. INTRODUCTION AND BACKGROUND [ FANR Staffing ]

- **FANR Total:** 202 Employees
  (61% Males, 39% Females)
- **UAE Nationals:** 125
  (83 Operations, 35 Administration, 7 DG Office)
- **Expats:** 77
  (63 Operations, 7 Administration, 7 DG Office)
- 62% are Emirati citizens.

**FANR EMIRATISATION %**

- **Expats:** 38%
- **UAE:** 62%

**ADMINISTRATION DIVISION**

- **Expats:** 17%
- **UAE:** 83%

**OPERATIONS DIVISION**

- **Expats:** 43%
- **UAE:** 57%
I. INTRODUCTION AND BACKGROUND [ FANR Staffing ]

- FANR’s human resource strategy for long-term sustainability concentrates on developing Emirati nationals to take increasingly responsible positions in the regulatory body, while retaining an appropriate cadre of international experts.

- FANR complements its in-house training programmes through collaboration with ENEC, Khalifa University, the IAEA and other partner institutions in a national programme of capacity building which offers a range of education, training and development opportunities to UAE citizens.
I. INTRODUCTION AND BACKGROUND [ Overall Program Status]

- Four units under construction at Barakah NPP.
- Located on the Arabian Gulf approximately 300 km from Abu Dhabi.
- Korean Advance Power Reactor (APR 1400).
- Supplied to Emirates Nuclear Energy Corporation (ENEC).

Figure: Barakah Nuclear Plant: (Unit 1 Foreground) Courtesy of Emirates Nuclear Energy Corporation
I. INTRODUCTION AND BACKGROUND [ Overall Program Status]

- **Construction License, FANR issued construction licenses:**
  - for Barakah 1 and 2 in 2012.
  - and Barakah 3 and 4 in 2015.

- **Operating License:**
  - ENEC applied for Operating licenses for Units 1 and 2 in 2015.
  - Barakah Unit 1 is 85% constructed and in early stages of non-nuclear commissioning.

- **Other Licenses and Authorizations:**
  - Transportation of nuclear fuel for Barakah Unit 1.
  - Import of nuclear fuel Unit 1.
  - Storage of nuclear fuel for Barakah Unit 1.
II. COMPLETING THE UAE REGULATORY FRAMEWORK

- FANR Board may issue regulations specifying requirements which all operators must comply with and follow.

- FANR to consider:
  - Comments from stakeholders
  - Information made available by experts
  - Internationally recognised standards and recommendations such as IAEA Safety Standards.

- FANR has established within its Integrated Management System (IMS) a process for establishing and revising regulations and guides that includes provisions for consultation with stakeholders and the public, and review and incorporation of their comments.
II. COMPLETING THE UAE REGULATORY FRAMEWORK

- FANR has issued 20 regulations related to the nuclear power programme up to date.
- Regulatory guides describe methods and criteria acceptable to the Authority for implementing its requirements. FANR has found it effective to adopt many guides issued by the regulatory body in the country of origin.
- FANR regulations and regulatory guides found on (www.fanr.gov.ae).
II. COMPLETING THE UAE REGULATORY FRAMEWORK

New regulations for NPP operation

- FANR-REG-16 “Operational Safety including Commissioning”
- The thirty two articles of this regulation cover a wide range of programmatic areas for the operating phase including, operational limits and conditions, configuration control, ageing management and core management and nuclear fuel handling.
- All regulations necessary for regulatory control of operating nuclear power plants are in place.
- FANR to perform systematic periodic reviews to determine if amendments to issued regulations are necessary, taking into account the continuous development of the international standards (e.g. IAEA Safety Standards) and international operating experience.
- Additional Regulations and supporting Regulatory Guides will developed on specific needs identified.
III. REGULATORY INSPECTION OF NPP CONSTRUCTION AND COMMISSIONING

Licensee Responsibility for Oversight

- Licensee (ENEC) has overall responsibility for managing safety.
- ENEC’s oversight program is documented in its Management System Manual, Quality Assurance Manual and the implementing procedures.
- Licensee applies its oversight process on the design, procurement and construction activities of its Prime Contractor, vendors and sub-vendors.
- Licensee oversight program is applied in a graded manner consistent with safety importance of item / activity.
III. REGULATORY INSPECTION OF NPP CONSTRUCTION AND COMMISSIONING

Objective and Scope of FANR Inspection Program

- FANR has established a Construction Inspection Program (CIP) for all the phases of the BNPP.
- FANR inspections are designed to verify licensee conformance to applicable requirements (Nuclear Law, FANR Regulations, issued licenses).
- FANR conducts routine, planned inspections that cover vendors, site construction / commissioning and programmatic inspections. The inspections include direct examination of SSCs and evaluation of the Licensee oversight process.
- Annual Licensee Performance Appraisal is conducted to identify the performance trends and to determine if enhanced focus is required in specific areas of concern.
III. REGULATORY INSPECTION OF NPP CONSTRUCTION AND COMMISSIONING

Counterfeit, Fraudulent and Suspect Items (CFSI) Challenges

- FANR has taken early cognizance of CFSI phenomenon, particularly in view of CFSI related issues in Korean domestic nuclear program.
- FANR has conducted specific CFSI focused inspections at Barakah site as well as vendor shops and verified ENEC and Prime Contractor CFSI oversight program.
- So far no CFSI related issue has been reported for BNPP project.
Head Office and Resident Inspectors

- FANR has deployed five resident inspectors at Barakah site who conduct site regulatory inspections on a continuous, ongoing basis.
- Head Office (HO) inspectors carry out Inspection planning and participate in site inspections supplementing the RIs in certain special domain areas.
- Development of inspection instructions, management of TSOs, vendor inspections etc. are shared by HO inspectors and RIs.
IV. REVIEW AND ASSESSMENT OF THE FIRST OPERATING LICENSE APP.

BARAKAH OLA for Units 1 and 2

- ENEC submitted the Operating Licence Application (OLA) for the first two units at Barakah in March, 2015.

- According to the Nuclear Law, FANR must conduct a thorough review and assessment of the applicant’s technical submissions consistent with the nature and potential magnitude of the hazards in order to determine whether the facility complies with applicable safety objectives, principles, and criteria.
IV. REVIEW AND ASSESSMENT OF THE FIRST OPERATING LICENSE APP.

FANR Regulations Requirements on FSAR

- FANR REG-14 “Regulation for an Application for a Licence to Operate a Nuclear Facility” provides a description of the required OLA content.

- The regulation requires a Final Safety Analysis Report (FSAR) with an updated description of the final design and operational arrangements as well as descriptions in areas such as physical protection, safeguards and decommissioning.

- The information shall demonstrate that the proposed NPP will be operated safely and securely in compliance with the applicable laws and the regulations.
IV. REVIEW AND ASSESSMENT OF THE FIRST OPERATING LICENSE APP.

FANR review to FSAR and preparations of SER

**Detailed review instructions in place:**
- For the review and assessment of FSAR.
- For the preparation of a Safety Evaluation Report (SER).

**For the recommendation to the Board of Management regarding the operating license:**
- SER
- Assessment report (the constructed facility is constructed in accordance with requirements).
- Assessment report (Operators programs, procedures and staff are ready to operate the facility safely).
IV. REVIEW AND ASSESSMENT OF THE FIRST OPERATING LICENSE APP.

Fukushima Impact on Safety

- FANR requested that ENEC address initiating events, consequential loss of safety function (station blackout and ultimate heat sink), severe accident management procedures and identify any proposed safety improvements.

- ENEC completed the assessment and reported the results to FANR and identified a number of safety improvements for Barakah to further improve the robustness of the plant.
IV. REVIEW AND ASSESSMENT OF THE FIRST OPERATING LICENSE APP.

Construction Inspection Test Plan (CITP)

- CITP tables are required for non-nuclear commissioning as part of the construction license review.
- The CITP tables document required testing for key safety related structures, systems and components.
- For SSCs in the CITP Tables the licensee was required to identify:
  - Key safety functions to be verified during commissioning
  - The test procedures where the functions would be verified and the source of the design requirement for the functional parameters.
- The licensee is required to report on the results of completion of CITP items as a license condition requirement of the construction licenses.
IV. REVIEW AND ASSESSMENT OF THE FIRST OPERATING LICENSE APP.

Applicant’s Readiness to Commence Operations

- The applicant is required to describe the means and supporting evidence by which they will establish that the programmes, procedures and staff are ready to operate the facility safely in accordance with requirements.

- **FANR to perform the following:**
  - Review the technical basis of this information.
  - Inspect on a sampling basis the supporting evidence identified by the applicant.
  - Ensure that all elements of operating programs required by the operator’s management system have been adequately demonstrated.
V. PREPARATIONS FOR OVERSIGHT OF NPP OPERATION

New regulatory processes for NPP oversight

- FANR’s mission will shift focus from review activities of large applications to regulatory oversight of plant operations and licensing reviews of changes.
- FANR will continue to use the core regulatory functions of safety assessment and inspection to evaluate the performance of the operations of the facility.
- The focus of preparations for oversight of NPP operations will be on activities necessary for monitoring the activities at Barakah Nuclear Power Plant (Units 1 to 4) in all operating conditions.
- FANR must be able to address new and emerging international operating experience and issues and have the necessary capability for emergency preparedness and incident response.
- FANR must also continue to develop the needed regulatory programs for high level waste management and disposal, and decommissioning.
Licensee Event Reports (Safety, Safeguards, and Security)

Licensee Routine Safety, Safeguards, and Security Reports

International Operating Experience (OpEx)

Inspection of Safety, Safeguards, and Security Operating Programs and Procedures Implementation

On-site Emergency Plan Exercises

Security Plans Exercises

Assessment of Events, Routine Reports, and International OpEx

Inspection Findings

Assessment of Inspection Findings

Exercise Results

Assessment of Exercise Results

Oversight Decision-making Framework

Assessment of Licensee Performance (Dynamic)

Determination of Need for Licensee and/or FANR Action

Regulatory Intervention Decisions, e.g.:
- Enforcement Actions
- New FANR Requirements
- Licensee Requested License Amendments

Communicate Licensee Overall Performance
V. PREPARATIONS FOR OVERSIGHT OF NPP OPERATION

FANR Future Regulatory Activities

**Regulations and Guides**
- Activities will be focused on maintenance of the regulatory framework in light of operating experience and developments in international standards, along with occasional new requirements.

**Licensing**
- Will transition from project management of review and assessment of major license applications to administration of existing licenses.
- A significant activity in the medium term will be periodic safety reviews.

**Review and Assessment**
- For major NPP license applications will taper off.
- The focus will shift to safety during operations from siting, design and construction.

**Inspection**
- Construction inspection program will continue at a high level until the first unit enters service in 2017 and will taper off as construction activities wind down at the site.
- Overseas vendor inspections will decrease focusing on new vendors or any major modifications or replacement components.
- The focus of inspection activity will shift to oversight of the licensee’s conduct of operations, oversight of outage management and contractors, and reactive inspections of events and incidents.
V. PREPARATIONS FOR OVERSIGHT OF NPP OPERATION

FANR Future Regulatory Activities

**Emergency Preparedness**

- When the first plant goes into operation FANR must have an emergency response organization, procedures and trained staff capable of discharging its duties in the national nuclear emergency response plan, including participation in emergency response exercises.

**Operating Experience Feedback**

- OEF will grow in significance as a source of information on the licensee performance (via licensee event reports) and through international OEF.

- This function will be tightly integrated with inspection and safety assessment experts.

**Licensee Performance Assessment**

- During operations, FANR will implement a decision-making process that considers licensee submitted reports and FANR inspection results is a systematic manner to evaluate licensee performance.

- The decision-making process will inform FANRs regulatory interaction with the licensee, and could result in additional actions on the part of the licensee or additional regulatory actions by FANR.
V. PREPARATIONS FOR OVERSIGHT OF NPP OPERATION

New staffing and competencies needed

FANR established a project with the objective of identifying the staffing and competencies needed to perform its work with less reliance on external technical support organizations, and with more Emiratis occupying managerial and advanced technical positions in the organization.

The goals for this project:

1. Identification of FANR future work, including:
   - Types of work (regulatory activities and tasks) that FANR needs to perform in the future.
   - Regulatory areas that require close focus over the next five years based on perceived risks, operating experience, etc.

2. Identification of FANR long term staffing requirements to carry out FANR future regulatory activities, including:
   - skills
   - core competencies
   - approximate number of staff
   - gaps between current and future needs

3. Identification of measures to hire, develop and retain Emiratis to hold advance technical positions.

4. Outlining a future FANR organization to effectively and efficiently implement the future regulatory activities.
VI. INTERNATIONAL COOPERATION

Over the last eight years FANR has gained international recognition as a competent regulatory body and for its close cooperation with the International Atomic Energy Agency (IAEA).

Non-Proliferation

- In 2015, FANR gained further recognition for adhering to the high standards of the International Atomic Energy Agency (IAEA). The IAEA conducted Complementary Access visits to locations in Dubai and Abu Dhabi.

- The UAE received an official statement from the IAEA confirming that no indications of undeclared nuclear material or nuclear activities were identified.
VI. INTERNATIONAL COOPERATION

Convention on Nuclear Safety

- The UAE is a Contracting Party to the Convention on Nuclear Safety.
- UAE has participated fully in the 5th and 6th review meetings of the Convention held in 2011 and 2014 as well as the Extraordinary Meeting held after the Fukushima Daiichi accident.
- FANR currently is working on the preparation of the national report for the 7th review meeting scheduled for April 2017.

Regulatory Body Country of Origin

- FANR maintained an ongoing relationship with the Korean Institute of Nuclear Safety (KINS).
- FANR had frequent meetings with manager and technical staff of KINS and also maintained a full time seconded employee from KINS working directly in the Nuclear Safety Department at FANR.
VI. INTERNATIONAL COOPERATION

IRRS mission

- A follow-up mission on IRRS was conducted in 2015.
- The follow-up mission was to review the measures undertaken following the recommendations from the IRRS mission conducted in 2011.
- The mission compared the UAE regulatory framework for nuclear and radiation safety against IAEA safety standards as the international benchmark for safety.
- The mission team concluded that FANR has further strengthened its regulatory oversight and made significant progress in addressing the findings of the 2011 IRRS mission.

Emergency Preparedness Review Mission (EPREV)

- conducted by IAEA in UAE in March 2015.
- The purpose of EPREV mission was to review emergency preparedness and response (EPR) arrangements and capabilities associated with the Barakah Nuclear Power Plant.
VI. INTERNATIONAL COOPERATION

Occupational Radiation Protection Appraisal Service (ORPAS) mission
- At the UAE’s request, the IAEA assembled an ORPAS mission to review the regulatory and practical implementation of occupational radiation protection arrangements in the nation in November 2015.
- The ORPAS team delivered a preliminary report of its review, which covered important findings that were identified during the mission, some of which were recognized as good practices.

International Physical Protection Advisory Service (IPASS) mission
- At the 3rd Nuclear Security Summit (March 2014, Netherlands), the UAE has announced that an IPPAS mission would be requested from IAEA for 2016.
- An official request by UAE was sent to the IAEA on February 2015.
- UAE will be hosting the IPPAS mission in quarter 4 of 2016.
VI. INTERNATIONAL COOPERATION

Technical Cooperation (TC) programme


- The UAE National ranked the first in the Asia & Pacific region in implementation of TC projects.

- The UAE Permanent Mission supported the TC program by recommending a large number of UAE personnel to participate in IAEA activities.

Figure: More participants from the UAE engage in IAEA activities since 2010
VII. CONCLUSIONS

- UAE has made many advances in implementing its civil nuclear energy programme since the adoption of the national policy on peaceful uses of nuclear energy.
- The UAE has operationalized a plan which includes international agreements, a legal framework, establishment of an independent regulatory body and an implementing organization, technology procurement, human resource development and capacity building.
- The UAE experience may serve as a model for other states who wish to gain international support in deployment of peaceful nuclear energy options.
- The issuance of construction licenses and regulatory oversight of construction have been successful as of this time and provided a foundation for developing regulatory skills and practices.
- FANR has now reached another transition point, from construction to commissioning and operations.
- Managing this transition will require continued diligence and commitment to safety culture.
- The UAE is committed to continuing those actions necessary to build and sustain a world-class nuclear safety culture.
THANK YOU
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