

# Commissioning Experience United Arab Emirates

## FANR Perspective

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## Introductory Facts – Regulator/Developer

- UAE Nuclear Power Programme
  - Government Policy on the Evaluation and Potential Development of Peaceful Nuclear Energy adopted in 2008. Establishes following basic principles
    - Transparency
    - Highest standards of nuclear non-proliferation, safety and security
    - Working with the IAEA
    - Partnership with other nations and expert organisations
    - Ensure long-term sustainability
  - Federal Law Concerning Peaceful Uses of Nuclear Energy (Nuclear Law) issued in 2009 (based on the above Policy document)
  - The Federal Authority for Nuclear Regulation, FANR, established in 2009 based on the above Law, and is the competent and independent federal nuclear regulator for nuclear and radiation safety, security and nuclear non-proliferation (safeguards).
- Emirates Nuclear Energy Corporation, ENEC established in 2009 to develop the peaceful nuclear energy program in the UAE
- Khalifa University assigned the responsibility to develop nuclear masters, and Abu Dhabi Polytechnic to develop engineers and technicians to the program
- ENEC contracted KEPCO for delivery of 4 APR-1400 PWRs to be commissioned by 2020.



## Introductory Facts - Status

- FANR was set up with Experienced nuclear experts to start to develop the regulatory framework in view of fast emerging nuclear energy program
  - Also, with emphasis to recruit and train locals in nuclear regulation
  - FANR regulates also medical, and industrial uses of ionizing radiation
- Today FANR employs 220 staff, 60% locals
- The regulatory framework is fully developed as of today including
  - Binding non prescriptive and performance based regulations and advisory regulatory guides,
  - Assessment and two step Licensing system, (Construction and Operating Licenses issued separately)
  - Inspection regime, with HQ and Resident Inspectors
  - Enforcement in case of non-compliances
  - All based on international best practices.
  - Policies, Processes and Procedures are developed in the Integrated Management System of FANR (based on IAEA GSR-2 Safety Requirements)
- FANR issued construction licenses:
  - Barakah 1 and 2 in 2012.
  - Barakah 3 and 4 in 2015.
- ENEC applied for Operating licenses for Units 1 and 2 in 2015, and for Units 3 and 4 in 2017.
  - Barakah Unit 1 is essentially completely built, technical verification and operational readiness actions in progress
    - FANR's review of Operating License Application on-going, operating license for Unit 1 expected to be issued in 2018, Unit 2 about a year later
    - FANR issued license/authorization for Import, Transportation, and Storage of nuclear fuel for Barakah Unit 1 in second half of 2016
  - FANR review of the Operating License Application for Units 3 and 4 ongoing in parallel

## Introductory Facts - Regulatory Framework

- What are the underlying approaches to nuclear regulation in FANR?
  - Applying the Policy principles of 2008, including the independence of FANR as a federal regulator
  - Taking benefit from international experience (but not copying any established regulatory regime)
  - Employing highly experienced nuclear experts from around the world to contribute to best practices
  - Building on IAEA standards and guides, in particular
    - IAEA Milestone approach including 19 infrastructure element
    - IAEA safety standards and guides
    - IAEA Security guidance
  - Utilizing IAEA expert and peer review services and workshops
  - Joining important International Conventions/agreements
  - Joining safeguards and additional protocol of the IAEA
  - Close cooperation with national stakeholders
  - Close cooperation with recognized foreign regulators
  - “Partnership” with Country of Origin (Korean) regulatory bodies
  - Taking advantage of the reference plant concept, and previous design certification and licensing
  - Development of some unique approaches to manage licensing and oversight

## Introductory Facts – Inspections General

- FANR has established a Construction Inspection Program for all the phases of the construction
- FANR inspections are designed to verify licensee conformance to applicable requirements (Nuclear Law, FANR Regulations, and 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 areas of concern.
- FANR has deployed five Resident Inspectors (RI) at Barakah site who conduct site regulatory inspections on a continuous, on going basis.
- Head Office inspectors carry out Inspection planning and participate in site/vendor inspections supplementing the RIs in certain special domain areas. TSO support is used in specific areas of expertise.

## Challenges Commissioning

- First Nuclear Power Plant Construction in UAE (lacking previous nuclear infrastructure). Need to establish
  - Clear framework of regulatory controls for commissioning (Regulations, Regulatory Guides, License Conditions, Internal procedures and inspection instructions to ensure objectivity and consistency)
  - The Controls Necessary for commissioning prior to fuel load and following fuel load
- Licensee and contractors need to understand the established regulatory controls

## FANR Regulatory Elements - Commissioning

- Construction License included authorization of commissioning
  - Required detailed safety assessment of controls and processes for commissioning prior to fuel load
  - Established set of parameters under strict regulatory control by license condition
  - Routine reporting of parameters under strict control by license condition
  - Implemented inspections of commissioning execution
- Operating License will authorize commissioning following fuel load through full power operation

## License Condition in Construction License for Barakah 1&2

### Construction Inspection and Test Plan:

- a) The Licensee shall provide the Authority with written reports on the completion and status of all the inspection items identified in the construction inspection and test plan (**CITP**) at six monthly intervals.
- b) The Licensee shall submit the CITP Tables as described in Chapter 14 of **the** PSAR for Stage III (Cold Function Test) and Stage IV (Hydrostatic & Hot Function Test) pre-operational testing to the Authority for review and approval twelve (12) months following the grant of this Licence.

The Licensee shall not begin any of the activities at the Nuclear Facility for Stages III and IV until the Authority issues written approval for each stage.



## 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

## FANR Regulatory Elements – CITP Tables

- CITP Tables
  - Approximately 1200 parameters pre fuel load commissioning
    - Based on safety criteria
    - Tables approved by FANR during safety assessment of construction license application
  - Tables identify the system or component, parameters tested, method of testing, the testing procedure and acceptance criteria
  - Licensee cannot eliminate any parameter without prior approval and must notify FANR on any modifications tables
  - Licensee reports on results including any explanation of acceptance criteria not met, FANR samples supporting evidence
- Licensee and contractor procedures identify CITP items and ensure reporting process
- FANR inspects select commissioning test including use of CITP items for selecting inspection targets
- Effective and transparent process, took extensive time during the licensing review to finalize and clarify



## FANR Regulatory Elements – Organisational Readiness is Critical to Safety

- The new Operator (Nawah) must be fully ready to operate the plant safely – must be done right before the first reactor gets its Operating License
  - Sufficiently staffed and suitably qualified and experienced
  - Integrated Management System in place with plant procedures and instructions approved for use
- FANR will inspect the readiness of people, processes and procedures as soon as the operator is ready
  - Control room crew, training and qualification (e.g. chemistry, system engineers, Radiation protection, electrical, maintenance, ...), procedures implemented, security and emergency preparedness.
- A readiness report will be prepared by FANR as one of the inputs along with the SER, and “as built” report to the decision to issue the Operating License

## 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. In 2008.
- 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 oversight to nuclear 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
- ***Licensee has to manage nuclear safety – FANR manages regulation! Basic principle to keep in mind.***

# Thank you

