1. Introduction of the UAE Nuclear Program

UAE Nuclear Policy

- Policy commits UAE to "highest standards of safety and security".
- The UAE has moved forward on the commitments in its policy through:
  - adherence to the relevant international instruments for nuclear safety, security and non-proliferation,
  - the establishment of a legal, governmental and regulatory framework for safety, and
  - on-going support for the development of the UAE peaceful nuclear energy programme.
Roadmap for Developing a Successful Nuclear Power Program (Nov. 2009)

Developing UAE National Infrastructure

*Roadmap* prepared by consultants translated the IAEA *milestones* in developing a successful nuclear power program into an *implementation plan* customized to UAE needs:

- Evaluated current infrastructure and capabilities within UAE
- Assessed different industrial strategies and reported feasibility.
- **Recommendations to improve and develop new elements.**
- Outlined a *schedule* and *responsibilities* and set feasible *milestones.*

---

Overall Planning of UAE Nuclear Power Program

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2012</th>
<th>2014</th>
<th>2017</th>
<th>Ongoing</th>
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<tr>
<td>NPP, C. D.</td>
<td>Unit-1</td>
<td>2017</td>
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<tr>
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<td>2020</td>
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</tbody>
</table>

*Education Strategy*

- **Short term** HR Plan Development
- **Mid-Term** HR Plan Implementation for Reg., Construction and Operations
- **Long Term** HR Development for Sustainable Implementation
1. Following a year-long, intense evaluation of bids from France (EPR), Japan (ABWR), and Korea (APR1400), Prime Contract awarded to the team led by Korean Electric Power Corporation on December 27, 2009.

2. Decision criteria:
   - Safety
   - Deliverability
   - Contract Compliance
   - Human Resource Development
   - Commercial Competitiveness

3. APR 1400
   - Based on Generation 3 technology from the US
   - “Reference Plant” in Shin Kori 3 under construction
   - South Korea has continually upgraded the reactor design
   - South Korean operating record is among the world’s best
   - National support of South Korea

---

**Selection of Technology and Prime Contractor**

- Federal Authority for Nuclear Regulation, FANR
  - [Federal Authority](http://www.fanr.gov.ae/en/Pages/default.aspx)
  - Regulations, licensing, inspections, accounting and control of nuclear material

- Emirates Nuclear Energy Corporation, ENEC
  - Promotion and development of required infrastructure for nuclear power program in UAE

- Nawah Energy Company, Nawah
  - [http://www.nawah.ae/](http://www.nawah.ae/)
  - Operation of Barakah nuclear power plants

- Ministry of Foreign Affairs
  - Policy coordination and International Cooperation framework arrangements

- Other entities are assigned with specific responsibilities
  - CICPA: Responsibilities for implementing physical security
  - Khalifa U: Human Capacity building
  - NCEMA: National emergency and crisis management
2. UAE Nuclear Legal & Regulatory Infrastructure

2.1 UAE Nuclear Law

Nuclear Law (Decree): October 2009

The main part of the legislative framework is in place.

- In line with the UAE Policy & international treaties, the Federal Law by Decree No (6) of 2009, Concerning The Peaceful Uses of Nuclear Energy (the “Nuclear Law”) was issued by the President in September 2009 to:
  - develop & control UAE nuclear sector towards peaceful purposes
  - ensure Nuclear Safety & Security, and Radiation Protection
  - prohibit Enrichment & Reprocessing Facilities in UAE

2.2 Nuclear Regulations

(Examples are shown below)

- FANR-REG-03 Design of Nuclear Power Plants
- FANR-REG-05 Application of Probabilistic Risk Assessment (PRA) at Nuclear Facilities
- FANR-REG-08 Physical Protection for Nuclear Materials and Nuclear Facilities
- FANR-REG-11 Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities
- FANR-REG-10 System of Accounting for and Control of Nuclear Material and Application of Additional Protocol
- FANR-REG-12 Emergency Preparedness for Nuclear Facilities
- FANR-REG-14 Application for a Licence to Operate a Nuclear Facility
- FANR-REG-15 Off-site Emergency Plans for Nuclear Facilities
- FANR-REG-16 Operational Safety including Commissioning
- FANR-REG-17 Certification of Operating Personnel at Nuclear Facilities
- FANR-REG-21 Decommissioning of Facilities
- FANR-REG-23 Security of Radioactive Sources
- FANR-REG-26 Pre-disposal Management of Radioactive Waste
2.3 Nuclear Regulatory Guides
(Examples are shown below)

- FANR-RG-001 Content of Nuclear Facility Construction and Operating Licence Applications
- FANR-RG-002 Application of Management Systems for Nuclear Facilities
- FANR-RG-003 Probabilistic Risk Assessment: Scope, Quality and Applications
- FANR-RG-004 Evaluation Criteria for Probabilistic Safety Targets and Design Requirements
- FANR-RG-006 Transportation Safety Guide
- FANR-RG-007 Radiation Safety
- FANR-RG-017 Operator Certification Guidance
- FANR-RG-019 Radiation Safety in Industrial Radiography

In addition to the above guides, US regulatory guides and IAEA safety guides are specified for use in Review Instruction of each chapter for review of CLA (Construction License Application CLA (PSAR) and Operation License Application OLA (FSAR).

2.4 Integrated Management System Instructions of FANR

2.4-1 Instructions for Review and Assessment of NPP
1). Work Instructions (WIs)
2). SAR Review Instructions (RIs)

2.4-2 Instructions for Inspection of Nuclear Facilities
1). Administration
2). Management System
3). Construction
4). Commissioning
5). Operation
6). Maintenance
7). Radiation Protection
8). Emergency Preparedness

2.4-3 Radiation and Nuclear Emergency Instructions
2.4-4 Safeguards Instructions
2.4-5 Education and Training Instructions
2.5 UAE Regulatory Authority FANR

Establishment of a Regulatory Authority for the Nuclear Sector in accordance with White Paper

“...the establishment of an independent, vigilant and effective regulatory authority is a cornerstone for any stable, credible, safe and secure nuclear energy program.” UAE White Paper, April 2008

The Regulatory Authority would be endowed with powers to:

- Establish requirements and regulations
- Issue Licenses
- Inspect and assess facilities
- Monitor and enforce compliance with regulations
- Establish a State System of Accounting and Control (SSAC)

FANR Organizational Chart

Source: FANR
3. Licensing Activities in the UAE Nuc Program

3.1 NPP Activities that Require Licenses
(Article 25 of UAE Law)

- Selection of a site for the Construction of a Nuclear Facility
- Preparation of a site for the Construction of a Nuclear Facility
- Construction of a Nuclear Facility
- Commissioning of a Nuclear Facility
- Operation of a Nuclear Facility
- Closure or a change in the Closure date of any Nuclear Facility
- Decommissioning of a Nuclear Facility
- Modifications having significance on Safety to the Management System and organizational arrangements of the structure, systems and equipment of or contained in any Nuclear Facility
- Possession, use, manufacture or handling of any Regulated Material in the State

Status of NPP Licensing

Licenses issued:
- Site Selection Licence
- Site Preparation Licence
- Limited Construction Licence
- Construction Licence for Units 1 & 2 (July 2012)
- Construction Licence for Units 3 & 4 (Sept 2014)
- Import of Nuclear Fuel
- Nuclear Fuel Handling and Storage
- Nuclear Fuel Transportation

ENEC submitted application for an Operating Licence for Units 1&2 in March 2015
- Authorization of fuel load, start up, nuclear commissioning, commercial operation, and possession of regulated material

followed by application for an Operating Licence for Units 3&4 in September 2016
3.2 Construction License

Construction License Application for Barakah 1 & 2
(Received on 27 Dec 2010)

- Application Letter
- Preliminary Safety Analysis Report
  - 9000 pages
  - 21 Chapters covering Safety, Safeguards and Physical Protection and 2 Supplements

Separate Submittals
- Physical Protection Plan for construction
- Preliminary Safeguards Plan
- Preliminary Probabilistic Safety Assessment Report summary
- Severe Accident Analysis Report

Submitted PSAR Followsurface Article (8) of FANR RG-001: SAR Content

1. Introduction and General Description of Plant
2. Site Characteristics
3. Design of Systems, Structures, Components, and Equipment
4. Reactor
5. Reactor Coolant and Connecting Systems
6. Engineered Safety Features
7. Instrumentation and Controls
8. Electric Power
9. Auxiliary Systems
10. Steam and Power Conversion System
11. Radioactive Waste Management including Storage prior to Disposal
12. Radiation Protection
13. Conduct of Operations
14. Inspection, Test, Analyses and Verification Programmes
15. Transient and Accident Analyses
16. Technical Specifications
17. Management of Safety, Security and Safeguards
18. Human Factors Engineering
19. Probabilistic Risk Assessment and Severe Accident Analysis
20. Physical Protection
21. Safeguards
22. Decommissioning and End-of-Life Aspects
S1. Reference Nuclear Facility, Modification and Independent SV
S2. Safety issues and use of OPEX
FANR Effectively Uses Safety Information from RBCoO

Category 1 → Full review and assessment
Category 2 → Capitalize on the RBCoO review and assessment

**Category 1 Review** is assigned to any item of the SAR that does not meet all criteria for a Category 2 Review or
- new technology,
- new findings,
- large risk contributors,
- site specific conditions/designs.

**Category 2 Review** is assigned to any item of the SAR that meets the following criteria:
- The documentation submitted by the applicant is adequate to the extent that the reviewer has sufficient information to assess topics below.
- The submission demonstrates that the RBCoO’s regulatory requirements associated with this item are consistent with and meet those of FANR.
- The technical basis used by the RBCoO to perform their review and assessment is clearly described and explained.
- With respect to the reference plant there is no design change with significant impact on nuclear safety.
- With respect to the reference plant there is no change in operational activities with significant impact on nuclear safety.

Examples of Factors Causing Design Changes from Reference Plant

- High Sea Water and Air Temperature
  - Systems evaluation (all effected systems)
  - Equipment evaluation
  - Layout impact evaluation
  - Operational impact evaluation

- Sand Storm

- Oil Spill in Sea

- Effect of Geology

- Electrical Grid Frequency (Design change from 60 Hz design to 50 Hz design)
  Software / Hardware (Electrical Equipment, Mechanical Equipment; Equipment qualification)

- New Requirement: Effect of Air Craft Crush Measures

Source: Licensing Report, FANR/ENEC
See next slide
Seismic Design Verification Inspection for CEDM and ESW Pump House of Barakah NPPs (Excerpts from T. Saito Presentation at Inspection Technique Training Workshop, Nov. 5, 2012)

1. How the inspection be performed based on 3 requirements from a selected Inspection Instruction

Background
- Reference plants (SKN 3&4) is built directly on hard rock but BNPP NPPs will be built on soil
- BNPP containment is much heavier due to air-craft crash measure
- Electrical frequency of the SKN 3&4 is 60Hz while that of BNPP is 50 Hz (resulted in in different pump designs – ESW pump)
- Soil-structure analysis needed
- Preliminary analysis shows reference design floor response does not envelope at lower frequencies
- ITS (important-To-Safety) equipment in containment and auxiliary building selected for design verification

FANR Review Using Technical Support Organizations (Effective Use of World Experience)

- FANR engaged three TSOs in the US and Europe to support review and assessment of CLA / OLA to augment in-house resources
- FANR provided alignment and direction to TSOs ensuring consistency across the CLA and OLA review.
- FANR retains responsibility for regulatory decisions, through its in-house team of seasoned staff.
Review Process: Request for Additional Information (RAI)

Example: RAI 4.2-1002

<table>
<thead>
<tr>
<th>RAI Number</th>
<th>Originator Name</th>
<th>Originator Organization</th>
<th>FANR</th>
<th>Date Submitted</th>
<th>Work Package</th>
<th>Chapter/Section</th>
<th>Page No</th>
<th>SERs and Interfaces</th>
<th>Date Submitted</th>
<th>Applicable FANR Regulations</th>
<th>RAI Topic</th>
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<tr>
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<td></td>
<td></td>
<td>FANR REG-03, Article (4), Item 2; Article (4), Item 1 &amp; 3</td>
<td>Fuel thermal conductivity degradation &amp; fuel enthalpy limits</td>
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</table>

SUMMARY OF THE INFORMATION PROVIDED BY THE APPLICANT

SPECIFIC ADDITIONAL INFORMATION NEEDED TO DEMONSTRATE THAT THE APPLICABLE FANR REGULATION(S) HAVE BEEN MET

Safety Evaluation Report (SER) Preparation: Content of SER Section

1. Area of Review
2. FSAR Interfaces
3. Licensing Basis References
   3.1 Applicable FANR Regulations
   3.2 Review Guidance and Industry Standards to Meet FANR Regulations
4. Regulatory and Safety Review
   4.1 Review Methodology
   4.2 Applicability of Previously Approved Review Performed under the Barakah Units 1 and 2 Construction License
   4.3 Review of Changes and/or Additions to the Preliminary Design Approved under the Barakah Units 1 and 2 Construction Licence
   4.4 Generic Issues and Operating Experience
   4.5 FSAR Interface Evaluation
5. Open Items and Commitments
6. Post Operating Licence Commitments
7. Conclusions
BNPP 1&2 CLA Review Project Schedule

<table>
<thead>
<tr>
<th>Task / Milestone</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Receive CLA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Completeness Review</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Issue Acceptance Letter</td>
<td>Initial SER sent by NSD &amp; RNL</td>
<td>May</td>
</tr>
<tr>
<td>4. Consolidate Review Plan</td>
<td>Review of PSAR sent to ENEC</td>
<td></td>
</tr>
<tr>
<td>5. Produce Initial SER with RAIs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. ENEC response to RAIs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Produce Draft Final SER &amp; Licence conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Issue Draft Final SER &amp; overall conclusions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Final SER, draft licence, and recommendation by NSD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Analysis &amp; licensing recomm. by DG &amp; submission to the Board</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Licensing Decision</td>
<td></td>
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<td></td>
<td>Last Bal Expenditures</td>
<td></td>
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<td></td>
<td>Meeting with ENEC (April 2012)</td>
<td></td>
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<tr>
<td></td>
<td>(July 2012)</td>
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</tr>
</tbody>
</table>

PSAR Review (Summary)

- IAEA IRRS Mission Evaluation on PSAR Review of FANR
  "FANR has regulations and a review process for effectively conducting the review of the application."
  "Review and assessment in FANR with the support of TSOs is organizationally a well arranged and managed process."

- Request for Additional Information (RAIs) Sent to ENEC - 1599

- Safety Evaluation Report (SER) Sections - 223

- Safety Evaluation Report
  - Part 1: Summary (70 pages)
  - Part 2: Detailed SER (2500 pages)
Contents of Safety Evaluation Report Part-2

PART 2: SUPPORTING MATERIAL

1- DETAILED SAFETY EVALUATION REPORT
2- REVIEW OF ENEC’s FUKUSHIMA LESSONS LEARNED REPORT
Appendix 1: ACRONYMS AND ABBREVIATIONS
Appendix 2: LICENSING CORRESPONDENCE
Appendix 3: LIST OF DEFERRED COMMITMENTS
Appendix 4: REFERENCES
Appendix 5: PRINCIPAL TECHNICAL REVIEWERS
Appendix 6: RAI History Record
FANR Assessment on Construction Licence Application and Follow-up Actions

Conclusion and Grant of CL for Barakah Units 1 & 2

• The staff found that the information submitted by ENEC is sufficient to demonstrate that the proposed facility complies with FANR regulations, and satisfies the relevant principles, objectives and criteria for safety, radiation protection, nuclear security and non-proliferation as required by Law.

• FFANR granted Construction License for Barakah Units 1 & 2

Follow-up Actions (Licensing Conditions)

• During its evaluation FANR identified requirements for a number of follow-up submittals from ENEC “Conditional Acceptance”
  - Update PSAR
  - Additional submissions to confirm technical solutions meet FANR requirements
  - Fukushima follow up actions
  - FSAR commitments

3.3 Operating License

Application for Barakah 1 & 2 Received on 26 March 2015

• Final Safety Analysis Report
  – 15,000 pages
  – 22 chapters and 2 supplements covering Safety, Security and Safeguards
  – Technical Specifications
  – Independent Safety Verification and Independent Design Review

• Separate Submittals
  1) Quality Assurance Manual
  2) Updated Safety Assessment Report on lessons Learned from Fukushima Accident
  3) Severe Accident Analysis Report (SAAR)
  4) Physical Protection Plan (PPP)
  5) Safeguards Plan (SP)
  6) Emergency Plan (EP)
  7) Probabilistic Risk Assessment (PRA) Summary Report
  8) Decommissioning Overview

• Parts of OLA provide updates on previously approved submissions:
  – site characteristics
  – N555 design
Supporting Submittals

1. Radiation Protection Program
2. Fire Protection Program and procedures
3. Fire Hazards Analysis
4. Structural/seismic analysis for new and spent fuel racks
5. New fuel emergency response plan
6. Chemistry Program
7. Physical Protection Plan

Review of Operating License Application for Barakah 1 & 2

Current Barakah 1 & 2 OLA Review Milestones

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<th>Task Name</th>
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<td>Applicant</td>
<td>26/03/2015</td>
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<td>Complete Initial Review of OLA</td>
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<td>31/05/2015</td>
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<tr>
<td>Complete Detailed Review of OLA</td>
<td>FANR</td>
<td>31/08/2015</td>
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<tr>
<td>Issue First Round of RAIs - Majority</td>
<td>FANR</td>
<td>31/10/2015</td>
</tr>
<tr>
<td>Complete Draft SERs with Open Items - Majority</td>
<td>FANR</td>
<td>29/12/2016</td>
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<tr>
<td>Receive late OLA submittals including all OLA Rai responses and Operational Ruddiness Report</td>
<td>Applicant</td>
<td>2018</td>
</tr>
<tr>
<td>Complete review of late submittals</td>
<td>FANR</td>
<td>2019</td>
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<tr>
<td>Approve all SERs and supporting documents</td>
<td>FANR</td>
<td>May/ 2010</td>
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<tr>
<td>Issue Operating License</td>
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### List of Nawah Operation Management Programs to Be Reviewed and Documented (Total of 42 Programs)

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<th>Nawah Program Description Doc. No.</th>
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<td>DCM-PGD-001</td>
<td>Nawah Document Control and Programs Description Management</td>
<td>17.0</td>
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<td>OP-PGD-003</td>
<td>Equipment Clearance Safety Program Description</td>
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<td>SFG-PGD-001</td>
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<td>HRM-PGD-AZ-001</td>
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<td>Nawah Security Program Description</td>
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<td>EXP-PGD-001</td>
<td>Export Control Program Description</td>
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<td>FANR-REG-09</td>
</tr>
</tbody>
</table>

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### 3.4 Other NPP-Related Licenses

- Limited Construction Licence
- Construction Licence for Units 1 & 2 (July 2012)
- Construction Licence for Units 3 & 4 (Sept 2014)

**ENEC submitted application for an Operating Licence for Units 1&2 on 26 March 2015**

- Authorization of fuel load, start up, nuclear commissioning, commercial operation, and possession of regulated material
- Licence will be granted by February 2018

**ENEC has made further applications for authorization**

- Fuel Handling and Storage
- Transportation
- Import
4. Other Activities in the UAE Nuclear Program

4.1 Activities Related to Construction and Operation of NPPs

4.1.1 Inspection and control

FANR Inspection: Scope

- ENEC and Prime Contractor
- Vendor
- Site Construction
  - Commencing testing (pre-operational tests)
  - Operational Readiness

4.1.2 Emergency Preparedness

IAEA Emergency Management: Drills and Exercises

- FANR completed IAEA Convex 2b exercise – reporting to IAEA via USIE, transmitting data and requesting assistance (August 2015)
- NCEMA conducted first tabletop joint and coordination exercise in addition to assessment of the emergency procedures for each government entity (September 2015)
- NCEMA conducting exercise of the offsite emergency plan to demonstrate the notification process, reception centers operation, activation of the EOC/EOF, implementation of protective actions, capability for radiological monitoring and measurements (October 2015)
- Barakah NPP full scale exercise – onsite and offsite plans - February 2016
### IAEA EPREV Mission 2015 (21 – 31 March 2015)

- To review emergency preparedness and response (EPR) arrangements and capabilities associated with the Barakah Nuclear Power Plant (NPP):
  - The on-site emergency preparedness and response plan;
  - National and local off-site EPR arrangements;
  - The interface between the NPP and the off-site EPR authorities; and
  - Arrangements for international notification as per IAEA safety standards

- **Evaluation: Recommendations:**
  - Need to develop a formalized process for determining protective actions, based upon all available information, including plant status and field surveys and including use of OILs
  - Review requirements for the emergency planning zones (UPZ, PAZ, EPD and ICPD) consistent with IAEA safety standards
  - Detailed evacuation plans for the construction population, and procedures for reception center operations to be established
  - All stakeholders should expedite the completion of relevant emergency plans and procedures, test them and fully implement them prior to the exercise scheduled before fuel receipt (February 2016)

### IAEA Workshop on “Capability in the Review/Assessment of Preventive & Mitigative SEOPs and SAMGs, Feb. 2016

**ENECE Presentation on UAE Symptom Based Emergency Operating procedures (SEOPs) and Severe Accident Management Guidelines (SAMGs),**

---

**UAE ACTIVITIES ON SEOPs / SAMGs**

**BNPP ACCIDENT MANAGEMENT PROGRAM**

AGUSTIN URUBIRU RODRIGUEZ

ABU DHABI

January – February 2016
4.2 Human Resource Development at FANR

FANR Career Path Development Framework

Young Professional Development Program

FANR Newsletter Issue 11 February 2016

Emirati Engineers join Nuclear Training Program

FANR welcomed nine fresh graduate Emirati engineers to embark on a year-long nuclear regulatory development program that will provide them with the fundamental knowledge they need in order to understand technical concepts applicable to nuclear engineering and regulation.
The UAE has added to its existing international agreements by:

- Signing an additional protocol to the safeguards agreement with the IAEA;
- Becoming a party to:
  - Convention on the Physical Protection of Nuclear Material;
  - Convention on Nuclear Safety;
IAEA Integrated Nuclear Infrastructure Review – INIR  
(Visited UAE in Jan. 2011)

- The UAE, ENEC, FANR and MoFA, the parties most directly involved in the INIR program, found the process to be a valuable, comprehensive and methodical way to ensure that the country was fulfilling its commitments and requirements as outlined in the IAEA's Milestones approach to implementing a nuclear power program.

- The value derived is due in no small part to the fact that the UAE relied extensively upon the Milestones Approach as it developed its Roadmap for Success, the extensive document that laid out the path the UAE would take to implement peaceful, civil nuclear power.

- The mission team recognized that the UAE infrastructure is progressing rapidly and is well advanced. The Team also made some recommendations supporting the on-going development of the program.

IAEA Integrated Regulatory Review Service IRRS  
(Visited UAE in Dec. 2011)

- The UAE opted for a full scope mission, which covers all the 10 core modules.

- In addition, the UAE decided to have three additional Modules covering:
  - Medical exposure control
  - Occupational exposure control, and
  - Safety and Security of Radioactive Sources

- Plus three policy discussions:
  - Response to the Fukushima accident
  - Capacity building and sustainability
  - Regulatory body in the country of origin
Other IAEA Review Service Missions UAE Received
(In addition to INIR, IRRS & EPREV)

- SEED Mission (Nov. 2011)
  Site and External Event Design Review Service Mission
- INSSP Mission (Sep. 2012)
  International Nuclear Security Support Plan
- ISSAS Mission (May 2014)
  IAEA Safeguards Advisory Service
- ORPAS Mission (Nov. 2015)
  Occupational Radiation Protection Appraisal Service
- IPPAS Mission (Nov. 2015)
  International Physical Protection Advisory Service
- EduTA Mission (Feb. 2017)
  IAEA mission to appraise the education and training provisions and infrastructure in radiation protection and the safety of radiation sources in the UAE
5. Summary of Progress in the UAE Nuclear Program

Nuclear Power Type and Construction Start Day

<table>
<thead>
<tr>
<th>Reactor</th>
<th>APR-1400</th>
<th>MW</th>
<th>Construction Start</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barakah 1</td>
<td>1400</td>
<td>July-2012</td>
<td></td>
</tr>
<tr>
<td>Barakah 2</td>
<td>1400</td>
<td>May-2013</td>
<td></td>
</tr>
<tr>
<td>Barakah 3</td>
<td>1400</td>
<td>Sept-2014</td>
<td></td>
</tr>
<tr>
<td>Barakah 4</td>
<td>1400</td>
<td>Sept-2015</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>5600</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1345 MWe each net

Source: ENEC (Emirates Nuclear energy Corporation, the entity responsible for the deployment, ownership and operation of nuclear energy plants in the UAE)
Remaining Critical Areas for Unit 1 Fuel Load and Updated Unit 1 Schedule

<table>
<thead>
<tr>
<th>Critical Areas</th>
<th>Details of Critical Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Resolution of Tech Issues Found at Pre-Operational Test</td>
<td>Resolving Outstanding Technical Issues such as Pilot Operated Safety Relieve Valve Issue, Battery Issue, Safety-related Pump Margins, etc.</td>
</tr>
<tr>
<td>2 English Proficiency of Operator</td>
<td>Training to attain required level, effective communication and safe operations, etc.</td>
</tr>
<tr>
<td>3 Maintenance</td>
<td>Conclusion (Sign) of Long-term Maintenance Agreement and Contracts, and Delivery of All Maintenance &amp; Engineering programs, Processes and Procedures</td>
</tr>
<tr>
<td>4 Operational Focus</td>
<td>Resolving Operational Issues Identified on: Operator Work Management &amp; Clearance Process, Operation Programs &amp; Procedures, Surveillance &amp; Periodic testing, Plant Configuration Control, etc.</td>
</tr>
<tr>
<td>6 Operating Licence Approval</td>
<td>Completion of FANR Inspection Activities, Demonstration of Integrated Operational Readiness, and FANR Issue (Approval) of Operating Licence</td>
</tr>
</tbody>
</table>

Update Milestone Dates

<table>
<thead>
<tr>
<th>Fuel Load</th>
<th>Commercial Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 2020</td>
<td>September 2021</td>
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</tbody>
</table>

Overall Summary

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Safety Paper Released</td>
<td>Apr 09</td>
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<tr>
<td>Initial Core Issued</td>
<td>Oct 5</td>
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<tr>
<td>NPOE Established</td>
<td>Sep 24</td>
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<tr>
<td>MCOC Established</td>
<td>Dec 24</td>
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<tr>
<td>CBP Regulation Issued</td>
<td>Oct 15</td>
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<tr>
<td>CBP Guidelines Released</td>
<td>Aug 09</td>
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<tr>
<td>Licence for Site Survey Issued</td>
<td>Mar 2</td>
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</tbody>
</table>

**Milestone Dates**

- **Pre-Contractor Selected**: May 27
- **LASS**
- **Initial Safety Oversight Plan Submitted**: Jul 17
- **CBP Submited**: Mar 25
- **License**
- **Commercial Operation**: Sep 09

**Status**

- **On-Submitted**: Dec 09
- **Off-Submitted**: Oct 17
- **CBP Finalized**: (Dec)
- **Initial Safety Oversight Plan Submitted**: (Nov 17)
- **CBP Finalized**: (Sep 17)
- **License**
- **Commercial Operation**: (Sep 2021)