



United Arab Emirates



United Arab Emirates (UAE) Nuclear Program Update

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Wednesday, January 14th, 2015

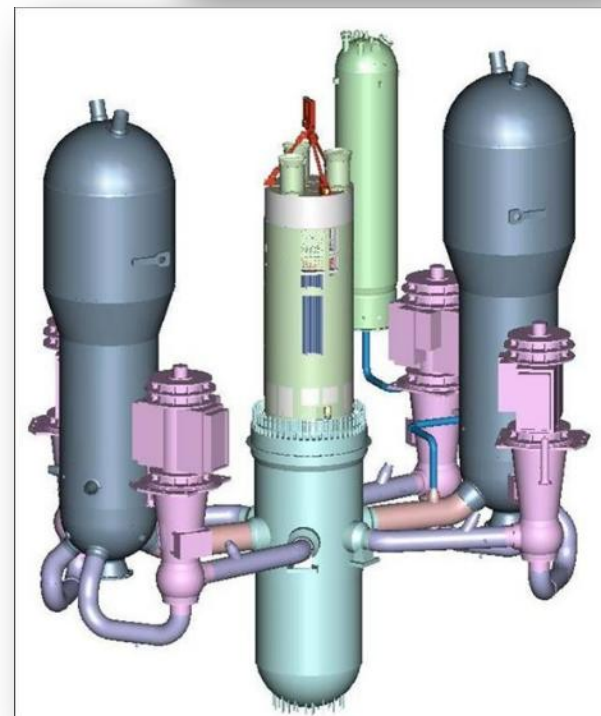
Hyatt Regency Pier Sixty-Six

Ft Lauderdale



Outline

- ⊗ The United Arab Emirates (UAE)
- ⊗ Federal Authority of Nuclear Regulation (FANR)
- ⊗ APR1400 Reactor
- ⊗ Barakah Nuclear Power Plants (NPP)
- ⊗ Radiation Protection at Barakah NPP
- ⊗ FANR Current/Near Term Activities
- ⊗ Challenges facing an emerging nuclear country



United Arab Emirates (UAE)

The United Arab Emirates is a constitutional federation of seven emirates, formed in 1971:

- Abu Dhabi,
 - Dubai,
 - Sharjah,
 - Ajman,
 - Umm al-Qaiwain,
 - Ras al-Khaimah
 - and Fujairah
- UAE lies along the south-eastern tip of the Arabian peninsula. Occupying an area of about 83,600 sq. km





UAE Before and After

1958



Source: www.thenational.ae

Present



Source: www.thenational.ae

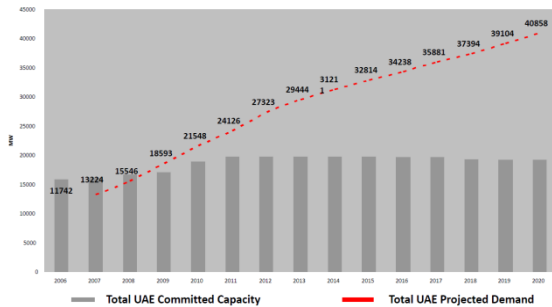


UAE Nuclear Programme





The Big Picture



**Energy
Planning
Study**

**Nuclear
Policy**

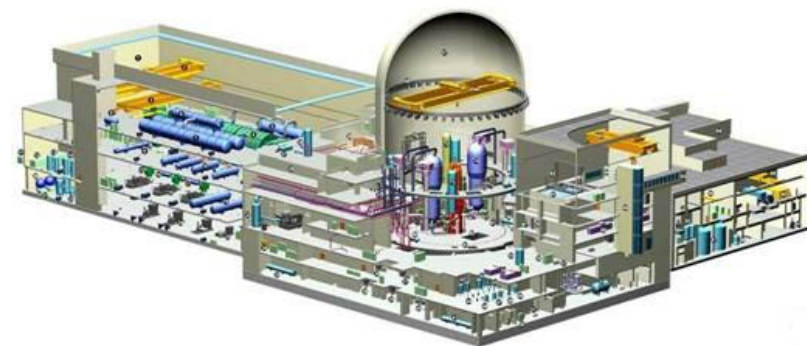
**Infrastructure
Development**

**First unit
followed by
sustainable
program**

2006

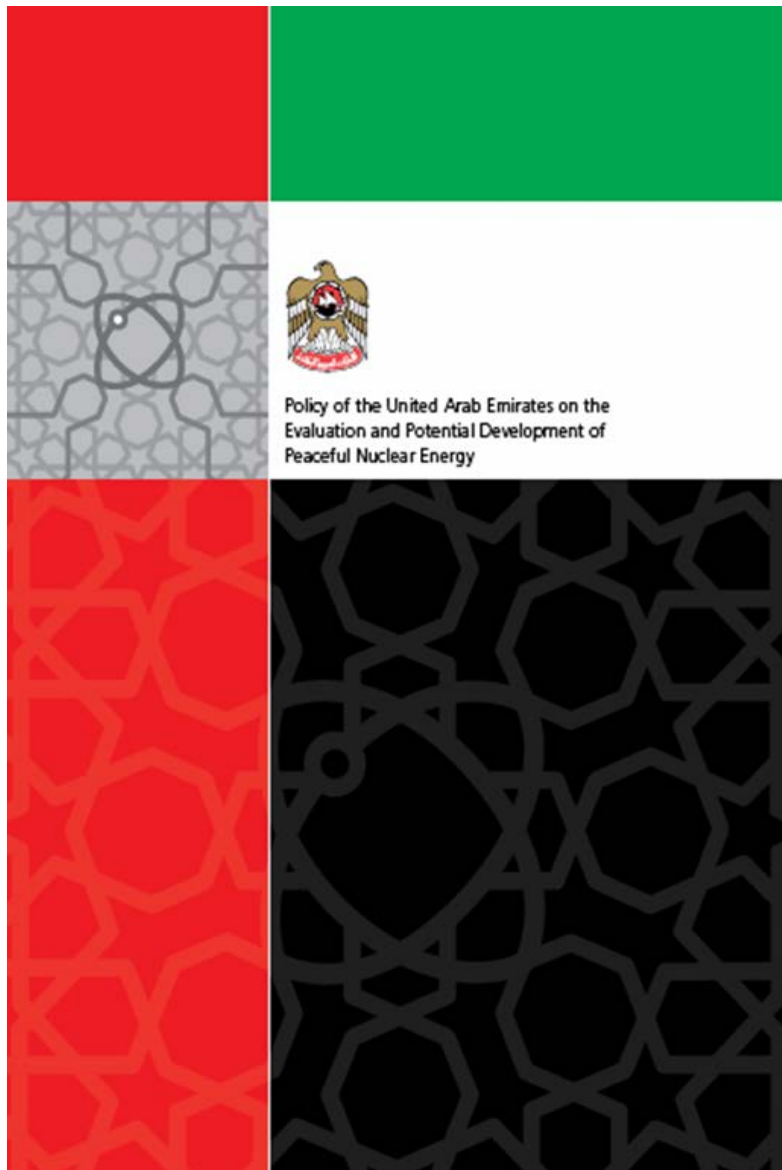
2008

2017





The Nuclear Policy and the Nuclear Law



دولة الإمارات العربية المتحدة



مجلس الوزراء
رئيس دولة الإمارات العربية المتحدة

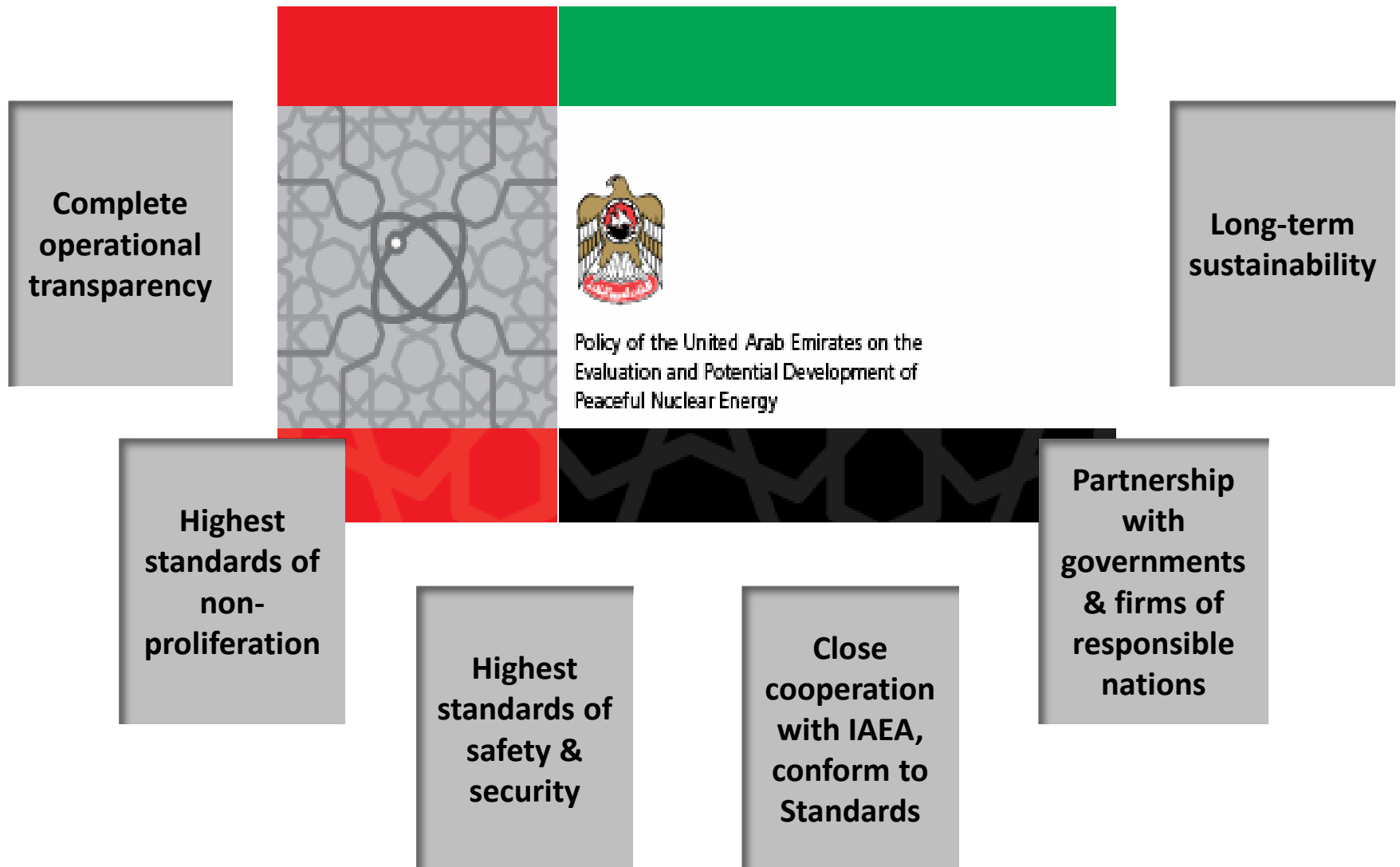
مرسوم بقانون إتحادي رقم (٦) لسنة 2009 في شأن الاستعمالات السلمية للطاقة النووية

نحن خليفة بن زايد آل نهيان رئيس دولة الإمارات العربية المتحدة.

- بعد الإطلاع على الدستور،
- وعلى القانون الاتحادي رقم (1) لسنة 1972 بشأن اختصاصات الوزارات وصلاحيات السوزراء والقوانين المعدلة له،
- وعلى القانون الاتحادي رقم (8) لسنة 1984 في شأن الشركات التجارية والقوانين المعدلة له،
- وعلى قانون المعاملات المدنية الصادر بالقانون الاتحادي رقم (5) لسنة 1985 والقوانين المعدلة له،
- وعلى قانون العقوبات الصادر بالقانون الاتحادي رقم (3) لسنة 1987 والقوانين المعدلة له،
- وعلى قانون الإثبات في المعاملات المدنية والتجارية الصادر بالقانون الاتحادي رقم (10) لسنة 1992 والقوانين المعدلة له،
- وعلى القانون الاتحادي رقم (24) لسنة 1999 في شأن حماية البيئة وتنميتها والقوانين المعدلة له،
- وعلى القانون الاتحادي رقم (1) لسنة 2002 في شأن تنظيم ورقابة استخدام المصادر المشعة والوقاية من أخطارها والقوانين المعدلة له،
- وعلى القانون الاتحادي رقم (13) لسنة 2007 بشأن السلع الخاضعة لرقابة الاستيراد والتصدير والقوانين المعدلة له،
- وعلى المرسوم بقانون إتحادي رقم (11) لسنة 2008 بشأن الموارد البشرية في الحكومة الاتحادية،
- وعلى المرسوم الاتحادي رقم (38) لسنة 1996 في شأن انضمام دولة الإمارات العربية المتحدة لمعاهدة عدم انتشار الأسلحة النووية لعام 1968،
- وعلى المرسوم الاتحادي رقم (84) لسنة 2000 في شأن اتفاقية الحظر الشامل للتجارب النووية لعام 1996 والبروتوكول الملحق بها،
- وعلى المرسوم الاتحادي رقم (66) لسنة 2003 في شأن انضمام دولة الإمارات العربية المتحدة لاتفاقية الحماية المادية للمصادر النووية،



UAE Nuclear Policy – Six Goals





Issuance of Nuclear Law

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:

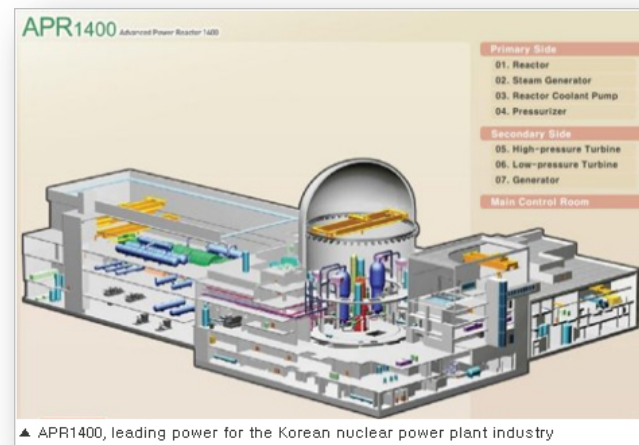
- ⚗ develop & control UAE nuclear sector towards peaceful purposes.
- ⚗ ensure Nuclear Safety & Security, and Radiation Protection.
- ⚗ prohibit Enrichment & Reprocessing Facilities in UAE .



FANR Functions and Responsibilities

- The UAE Nuclear Law establishes FANR as the independent regulator with respect to nuclear safety, security, radiation protection and safeguards in the UAE
- FANR's authorities include:
 - ⦿ Issuing regulations
 - ⦿ Issuing licenses to conduct regulated activities; Site Selection, construction, Design, and operation
 - ⦿ Carrying out safety assessments
 - ⦿ Implementing an inspection and control regime
 - ⦿ Establishing and maintaining a state system of accounting for and control of nuclear material
 - ⦿ Establishing frameworks for physical protection and emergency preparedness and response for nuclear facilities and activities
 - ⦿ Determine civil and criminal penalties

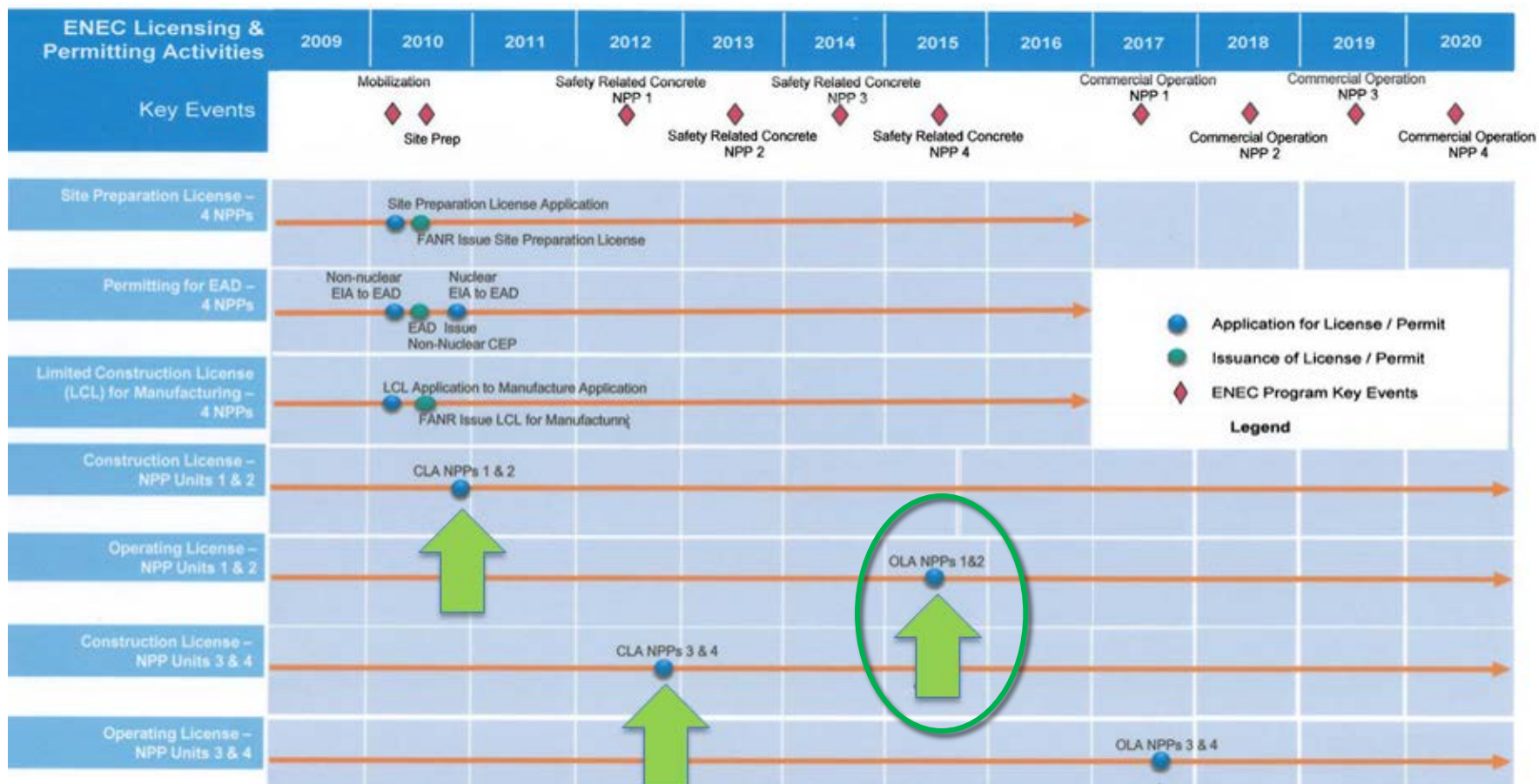
Barakah Nuclear Power Plants (BNPP) Korean APR1400





Emirates Nuclear Energy Company

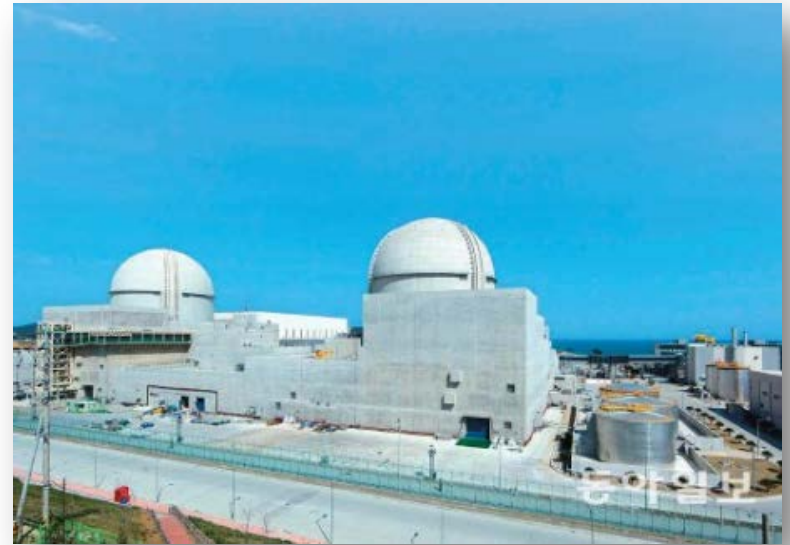
In December 2009, His Highness Sheikh Khalifa Bin Zayed Al Nahyan, President of the UAE, established ENEC, the organization charged with implementing the UAE nuclear energy program as it produces electricity, supports economic development, and provides opportunity for the people of the nation





APR1400 Background

- Started with technology transfer from Combustion Engineering (CE) [System 80+] to Korea Electric Power Corporation (KEPCO) – mid 1980's
- KEPCO enhanced the existing OPR-1000 design with features from System 80+ into APR1400
- Design of APR1400 started in 1992, certification given by Korean Institute of Nuclear Safety (KINS) in May 2002
- Shin-Kori 3 & 4 began construction in 2008 – these form the “Reference Plant” for Barakah Units 1 & 2



Shin Kori 3 and 4 – Under Construction



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Current Status of Facility Licensing

- FANR licenses issued to Emirates Nuclear Energy Corporation (ENEC):
 - ❖ Site Selection Licence (2010)
 - ❖ Site Preparation Licence (2010)
 - ❖ Limited Construction Licence (2010)
 - ❖ Construction Licence for Barakah Units 1 & 2 (July 2012)
 - ❖ Construction Licence for Barakah Units 3 & 4 (September 2014)
 - ❖ *Application for licence to Operate Units 1 and 2 expected in Q1 2015*
 - » Will include programs such as RPP, REMP, etc
- FANR Approved transport package for fresh fuel [per TS-R-1]





Google Earth Image of the Site (~early 2014)





Google Earth Image of the Site (~early 2014)

Concrete
Batch
plant and
Lab

Warehouses

Units 3
and 4

Units 1
and 2

Construction
workers
village

Currently
~ 17,000
workers



Abu Dhabi
(~220km)



Units 1 and 2 Status



All images from Google image search



Units 1 and 2 Status



All images from Google image search



Units 1 and 2 Status



All images from Google image search



Units 1 and 2 Status

- Unit 1 containment dome enclosed
- U1 reactor in place
- U1, 2x steam generators in place
- Simulator building complete





Units 1 and 2 Status

- Completion of the construction of the concrete dome for the Unit One Reactor Containment Building





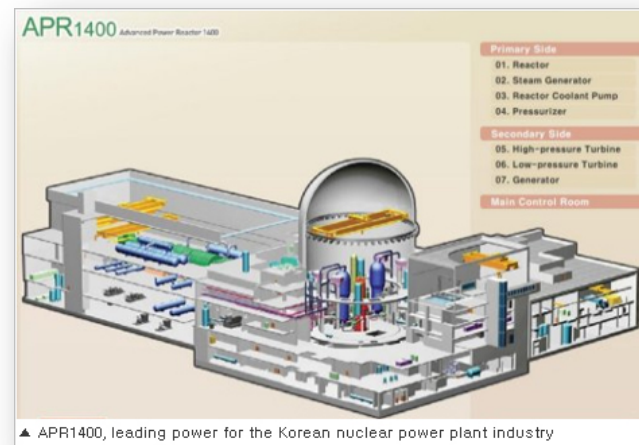
Key FANR Regulations relating to Radiation Protection and ALARA

- FANR-REG-01 '*Regulation for Management Systems for Nuclear Facilities*'
- FANR-REG-03 '*Regulation for the Design of Nuclear Power Plants*'
- FANR-REG-04 '*Regulation for Radiation Dose Limits and Optimisation of Radiation Protection for Nuclear Facilities*'
 - 20 mSv/yr, averaged over 5 years (50 mSv in a single year) – workers
 - 1 mSv/year – public
 - Establish dose constraint lower than above, to be approved by FANR (0.2 mSv/yr for max offsite individual)
 - ENEC established, 10 mSv/yr (max), 2 mSv/yr (average) as a design objective
- FANR-REG-06 '*Regulation for an Application for a Licence to Construct a Nuclear Facility*'
- FANR-REG-11 '*Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities*'

All Regs and Reg Guides @
<http://www.fanr.gov.ae/En/RulesRegulations/RegulationsGuides/Pages/default.aspx>
(in English and Arabic)



Radiation Protection at Barakah NPP





Implementation Of Radiation Protection Programmes by The Licence Holder

- Barakah NPP incorporates radiation protection measures to ensure that occupational radiation exposures in future operation will be as low as is reasonably achievable(ALARA), e.g.:
 - Separation of radioactive and non-radioactive components
 - Use of shielding
 - Use of remotely operated equipment
 - Ventilation systems – cascading airflow from least to potentially highest contamination areas
 - Installation of permanent radiation and contamination monitoring systems
 - Training of personnel in radiation protection
 - Development and implementation of administrative policies and procedures to maintain exposures ALARA
 - Dosimetry, alarming dosimeters, etc.
 - Radiological Environmental Monitoring Programme (REMP)
 - Emergency response infrastructure, offsite emergency center, etc.



Current/Near Term ALARA Activities for FANR

- FANR specialists and Technical Support Organization (TSO) review of U 1 & 2 FSAR:
 - Prepare Requests for Additional Information to gather supplementary data needed for complete review against applicable requirements
- Inspections, most recent inspections include:
 - RadWaste Systems:
 - RO Units, Ion Exchangers
 - Spent resin transfer piping, flushing capabilities, 5D bends, etc
 - Spent resin valve modules
 - Review ALARA analysis for transfer of spent resins
- Review LADTAP/GASPAR calculations (based on updated source terms and meteorological data)
- Review of the Low & Medium Level Radioactive Waste Storage Building:
 - Essentially an IRSF, 10 years of storage for spent resins, filters, and DAW
- *Review application for receipt of fresh fuel*
- Recently established FANR resident inspectors for Units 1 and 2

Challenges Encountered in an Emerging Nuclear Country From a Regulatory Perspective





Challenges Encountered in an Emerging Nuclear Country From a Regulatory Perspective (1)

- **Training**

- Maintaining adequate levels of expertise:
 - Scholarship programs
 - Assignments to Korean Institute for Nuclear Safety (KINS) and US-NRC
 - RISKTEC programme in UK
 - Gulf Nuclear Energy Infrastructure Institute (GNEII) at Khalifa University
 - Institute of Radiation Protection and Nuclear Safety (IRSN)
 - International Nuclear Safeguards and Engagement Programme (INSEP)
 - Various IAEA missions





Challenges Encountered in an Emerging Nuclear Country From a Regulatory Perspective (2)

- **Diversity:**

- FANR staff from many different countries, with differing regulatory approaches
- Important to develop a common approach to radiation protection
- Important to develop effective communication and cultural awareness



- **Dosimetry service:**

- Developing an approved dosimetry service provider under an adequate quality management system
- IAEA mission on Occupational Radiation Protection Appraisal Service (ORPAS) to develop an action plan for the infrastructure and monitoring of exposed workers





Challenges Encountered in an Emerging Nuclear Country From a Regulatory Perspective (3)

- **Emergency Preparedness:**

- Coordinating between all involved entities:
 - ENEC
 - FANR
 - Ministry of Interior
 - Police
 - Civil Defense
 - Military
 - National Emergency Crisis and Disasters Management Authority (NCEMA)
 - Health Authorities, etc.
- Setting up Emergency Centers (e.g. FANR, ENEC)
- SPDS integration into FANR Emergency Center
- Training staff in responding to emergencies (customizing and use of RASCAL, etc)

مؤسسة الإمارات للطاقة النووية
Emirates Nuclear Energy Corporation

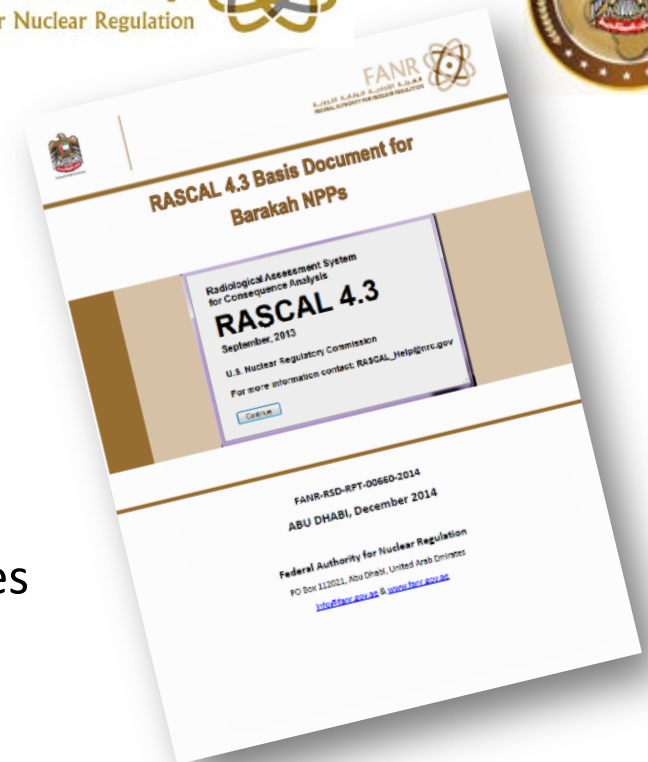


United Arab Emirates

Ministry of Interior

FANR

الهيئة الاتحادية للرقابة النووية
Federal Authority for Nuclear Regulation





شكراً
Thank you