FANR
الهيئة الإتحادية للرقابة النووية
FEDERAL AUTHORITY FOR NUCLEAR REGULATION

Federal Authority for Nuclear Regulation UAE

2012 International ISOE ALARA Symposium

Session VIII: New Developments in ALARA Programs

Development of the FANR RP Program During Design Phases of New Builds

8-11 January 2011

By Hussain Al Katheeri

OUTLINE

1. Federal Authority of Nuclear Regulation (FANR)
2. Braka Nuclear Power Plants (NPP)
3. Radiation Protection of Braka NPP

UNITED ARAB EMIRATES

UAE FOUNDED IN DECEMBER 1971
40 YEARS OLD IN 2011

Federation of seven Emirates. UAE constitution allows certain flexibility in distribution of authority between Federal and Local governments

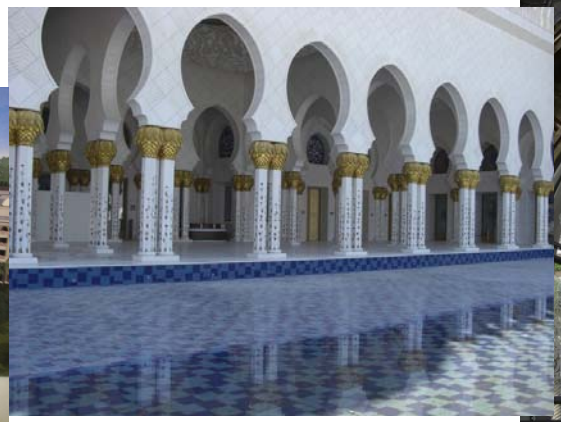
UAE FACTS

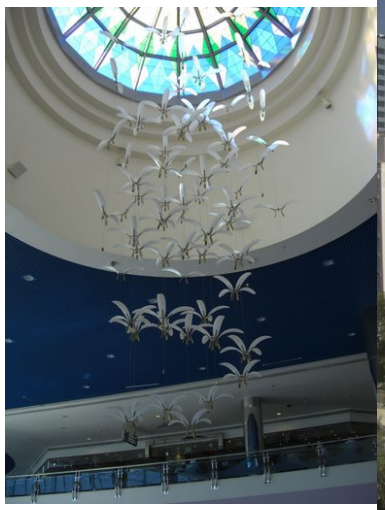
- Population 8.2 M
- GDP in 2009 AED 914.3 B (~ $250 B)
  - 72% non-oil sector including:
    - manufacturing 16%
    - construction 11%
    - wholesale/ retail trade 9%
    - real estate 8%

1975- 200,000 inhabitants

Abu Dhabi, 1970s







2011- 1,600,000 inhabitants

Abu Dhabi, today

United Arab Emirates

FANR
الهيئة الإتحادية للرقابة النووية
FEDERAL AUTHORITY FOR NUCLEAR REGULATION

Federal Authority of Nuclear Regulation (FANR)

UAE NUCLEAR POLICY

- White Paper "*Peaceful uses of Nuclear Energy*" (2008) set the policy for nuclear energy in UAE:

  - National annual peak demand for electricity likely to exceed 40,000MW by 2020 (14,000 MW -2008).

  - Concluded nuclear power was optimal for meeting this demand increase in an environmentally appropriate manner.

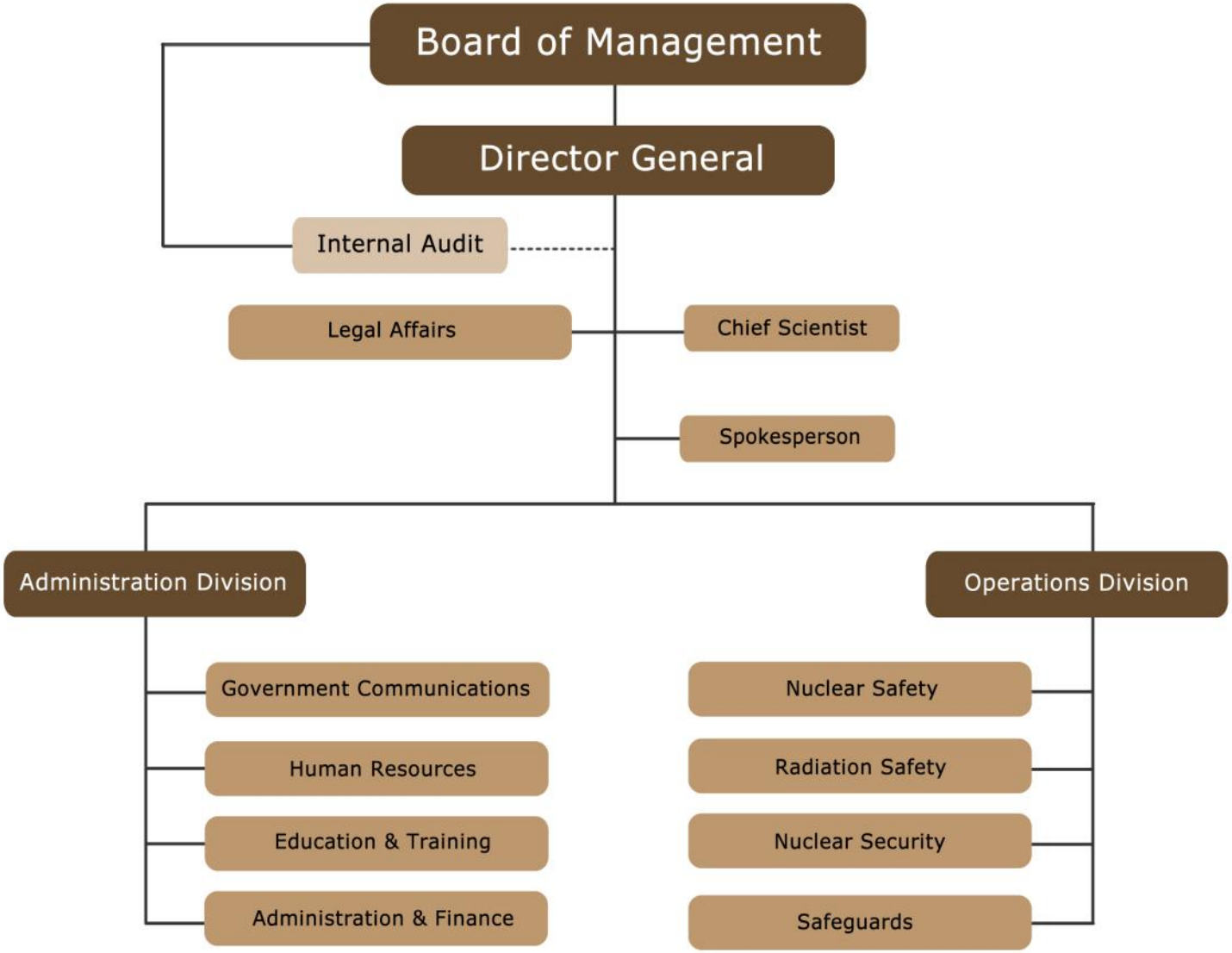
Setting the need and the vision

Nuclear Law of United Arab Emirates

In September 2009, the *Federal Law by Decree No 6 of 2009, Concerning the Peaceful Uses of Nuclear Energy* was approved. And the law includes:

- **Establishment of the Federal Authority for Nuclear Regulation (FANR) as the UAE's nuclear regulatory body**
- Management of the Authority
- Financial Affairs
- **Licenses**
- Inspection and Control
- **Regulations, Guides and Safeguards**
- Radioactive Waste and Decommissioning
- Management of Safety and Quality Assurance
- Civil Liabilities and Penalties

FANR ORGANIZATIONAL CHART



LICENSING OF NUCLEAR FACILITIES

- **Regulated activities applying to nuclear facilities:**
  - Selection of a site for construction
  - Preparation of a site for construction
  - Construction
  - Commissioning
  - Operation
  - Closure (or change in closure date)
  - Decommissioning
  - Modifications having significance for safety

CONTROL OF MEDICAL EXPOSURE

- **FANR-REG-24** Basic Safety Standards for Facilities and Activities involving Ionizing Radiation other than in Nuclear Facilities, has a chapter on medical exposures based upon **IAEA Safety Requirements No. GS-R-3** The Management System for Facilities and Activities

- **Covers**
  - Justification of medical exposures
  - Optimisation of medical exposures
  - Calibration and clinical dosimetry
  - Quality assurance
  - Protection of women
  - Release of patients following radionuclide therapy
  - Unintended or accidental medical exposures
  - Radiological reviews

FANR COOPERATION WITH HEALTH AGENCIES

- FANR issues licenses to facilities under the Health Authority Abu Dhabi (HAAD), Dubai Health Authority (DHA) and Ministry of Health (MoH) to practice radiology and/or nuclear medicine and license facilities

- A national Diagnostic Reference Levels (DRLs), release guidelines, dose constraints are yet to be established for the UAE
  - Planned to be accomplished by the Radiation Protection Committee

OCCUPATIONAL RADIATION PROTECTION

- **FANR-REG-24** Basic Safety Standards for Facilities and Activities involving Ionizing Radiation other than in Nuclear Facilities, has a chapter on occupational exposure, based upon **IAEA Safety Requirements No. GS-R-3** The Management System for Facilities and Activities

- **Covers**
  - Controlled and supervised areas
  - Local rules and personal protective equipment
  - Workplace monitoring
  - Personal monitoring
  - Monitoring of complaints
  - Information, training and special requirements

RADIATION PROTECTION RELATED ISSUES

- National occupational dose register is required under the Nuclear Law of UAE
  - FANR has commenced on planning for a dose register programme
  - FANR dose register programme will cover the current regulated activities and for the NPPs

- Workforce language and training issues
  - Especially in industrial radiography

United Arab Emirates

FANR
الهيئة الإتحادية للرقابة النووية
FEDERAL AUTHORITY FOR NUCLEAR REGULATION

Braka Nuclear Power Plants (NPP)

SITE OF BRAKA NPPS IN THE UAE

BRAKA NPPS UNITS 1&2

- Emirates Nuclear Energy Cooperation (ENEC) selected Korean APR1400 design in December 2009.
- Four units, operation of first unit as scheduled by ENEC is 2017. Others 2018, 2019, 2020.
- Two Basic Steps Licensing Process: Construction and Operation
- Licenses issued to-date
  - Site Selection
  - Site Preparation
  - Limited Construction Licence – Allows manufacturing of major components

BRAKA NPPS UNITS 1 & 2 PEDIGREE

Braka NPPs Units 1 & 2, reference plant is Shin-kori 3&4 design.

- APR1400 Korean design (1992-1999)

  - Includes CE System 80+ innovations
  - System 80+, US NRC design certification as a Generation III reactor
  - Standard Safety Analysis Report for this design adheres closely to U.S. NRC guidance of 1996 -1997 vintage
  - APR 1400 was certified by Korean regulatory body on May 2003

- APR1400, deployed in Korean Shin-kori 3 & 4 units (start operation 2013, 2014)

CONSTRUCTION LICENCE

- Construction Licence Application (CLA) for Braka NPP Units 1&2 received by FANR on 27 December 2010
- CLA is currently under review and assessment by FANR
- Nuclear Environmental Impact Assessment (N-EIA) report has been submitted to Environment Agency – Abu Dhabi (EAD) for their review and assessment

REVIEW PROCESS

- FANR specialists and Technical Support Organization (TSO) review of the Braka NPP PSAR is in accordance with applicable review category of the item and review procedures.

- Request for Additional Information (RAI)s are used to gather supplementary information from the applicant to complete the assessment.

- Safety Evaluation Report (SER) with findings/conclusions is currently being prepared.

United Arab Emirates

FANR
الهيئة الإتحادية للرقابة النووية
FEDERAL AUTHORITY FOR NUCLEAR REGULATION

Radiation Protection of Braka NPP

RADIATION PROTECTION

- **Chapter 12 of Braka NPP Preliminary Safety Analysis Report (PSAR):**

Describes the radiation protection measures and the operating policies to ensure that internal and external radiation exposure to personnel during operation, including Anticipated Operational Occurrences (AOOs), will be As Low As Reasonably Achievable (ALARA)

CHAPTER 12 OF BRAKA PSAR

- **Chapter 12, Radiation Protection addresses:**
  - Ensuring that occupational radiation exposures are As Low As is Reasonably Achievable
  - Radiation sources
  - Radiation protection design features
  - Dose assessment
  - Health physics programme

FANR REGULATIONS & GUIDES

- **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
- **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

FANR REGULATIONS RELATED TO ALARA PRINCIPLES

- **FANR-REG-03** Regulation for the Design of Nuclear Power Plants

  – Article (89)

  1. Provision shall be made in the Design and layout of the Nuclear Facility to minimise exposure and contamination from all sources. Such provision shall include adequate Design of SSCs in terms of: minimizing exposure during Maintenance and Inspection; shielding from direct and scattered radiation; ventilation and filtration for control of airborne Radioactive Materials; limiting the activation of corrosion products by proper specification of materials; means of monitoring; control of access to the Nuclear Facility; and suitable decontamination facilities.

FANR REGULATIONS RELATED TO ALARA PRINCIPLES

- **FANR-REG-01** Regulation for Management Systems for Nuclear Facilities
  - Article (10)

  1. The Licensee shall ensure that the processes of the Management System that are needed to achieve its goals, provide the means to meet all applicable requirements, and deliver the products of the organisation for each phase in the lifetime of a nuclear facility are planned, implemented, assessed and continually improved.

- **FANR-REG-04** Regulation for Radiation Dose Limits and Optimisation of Radiation Protection for Nuclear Facilities
  - Article (3) **Dose Limits for Occupational Exposure**
  - Article (4) **Dose Limits for Members of the Public**
  - Article (5) **Optimisation of Protection for Workers**

FANR REGULATIONS RELATED TO ALARA PRINCIPLES

- **FANR-REG-06** Regulation for an Application for a Licence to Construct a Nuclear Facility
  - 13. Preliminary information on the Radiation Protection programme including a description of all on-site radiation sources, the application of the “as low as reasonably achievable” principle (known as the ALARA principle) for the optimisation of protection, and design features for Radiation Protection of personnel and the Nuclear Facility.

- **FANR-REG-11** Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities
  - The Licensee in its Radiation Protection Programme shall minimise the need to rely on administrative controls and personal protective equipment for achieving protection and safety by maximising the provisions of well engineered controls and satisfactory working conditions in accordance with the following hierarchy of prevention principles:
    a) Engineered controls
    b) Administrative controls
    c) Personal protective equipment

BRAKA RADIATION PROTECTION PSAR COMMITMENTS

- 10CFR20, “Standards for Protection against Radiation”
- 10CFR50, “Domestic Licensing of Production and Utilization Facilities”
- 10CFR50.34 “Contents of applications, technical information, “Domestic Licensing of Production and Utilization Facilities.”
- 10CFR50, Appendix A, GDC 19 “II. Protection by Multiple Fission Product Barriers: Protection System Functions”
- **10CFR50, Appendix I, “Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion "As Low as is Reasonably Achievable” for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents."**

- NUREG-0713 "Occupational Radiation Exposure in Commercial Nuclear Power Reactors," Vol. 6 - Vol. 17, 1987 - 1996
- NUREG-0737 “Clarification of TMI Action Plan Requirements”
- NUREG-0017 "Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Pressurized Water Reactors," April 1985

- ANSI/ANS-18.1-1984 "Radioactive Source Term for Normal Operation of Light Water Reactors," American Nuclear Society, 1984

- USNRC Regulatory Guide 1.109 “Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the purpose of Evaluating Compliance with 10CFR Part50, Appendix I,” Rev.1
- USNRC Regulatory Guide 1.183 “Alternative Radiological Source Terms for Evaluation Design Basis Accidents at Nuclear Power Reactors”, July 2000
- USNRC Regulatory Guide 1.33 “Quality Assurance Program Requirements (Operation),” Rev.2
- USNRC Regulatory Guide 1.39 “Housekeeping Requirements for Water Cooled Nuclear Power Plants,” Rev.2
- USNRC Regulatory Guide 8.15, “Acceptable Programs for Respiratory Protection,” Rev.1
- USNRC Regulatory Guide 1.69 “Concrete Radiation shields for Nuclear Power Plants”, December 1973

BRAKA RADIATION PROTECTION PSAR COMMITMENTS

- USNRC Regulatory Guide 1.8 “Qualification & Training of Personnel for Nuclear Power Plants,” Rev.3
- USNRC Regulatory Guide 1.183 “Alternative Radiological Source Terms for Evaluation Design Basis Accidents at Nuclear Power Reactors”, July 2000
- USNRC Regulatory Guide 1.97 “Instrumentation for Light-Water-Cooled Nuclear Power Plants To Assess Plant and Environs Conditions During and Following an Accident,” Rev.3
- USNRC Regulatory Guide 8.13 “Instruction Concerning Prenatal Radiation Exposure,” Rev.3
- USNRC Regulatory Guide 8.15 “Acceptable Programs for Respiratory Protection,” Rev.1
- USNRC Regulatory Guide 8.19 “Occupational Radiation Dose Assessment in Light Water Reactor Power Plants Design Stage Man-Rem Estimates,” Rev. 1
- USNRC Regulatory Guide 8.2 “Guide for Administrative Practices in Radiation Monitoring,” Rev.2
- USNRC Regulatory Guide 8.4 “Direct-Reading and Indirect-Reading Pocket Dosimeters,” Rev.0
- USNRC Regulatory Guide 8.7 “Instructions for Recording and Reporting Occupational Radiation Exposure Data,” Rev.1
- **USNRC Regulatory Guide 8.8 “Information Relevant to Ensure that Occupational Radiation Exposures at Nuclear Power Stations will be as Low as is Reasonably Achievable,” Rev.3**
- USNRC Regulatory Guide 8.9 “Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program,” Rev.1
- USNRC Regulatory Guide 8.10 “Operating Philosophy for Maintaining Occupational Radiation Exposures as Low as is Reasonably Achievable,” Rev.1-R

- MEST Notice 2008-31 “Standards for Radiation Protection, etc.”
- ROK MEST, “Atomic Energy Act”

- ICRP-68 “Dose Coefficients for Intakes of Radionuclides by workers,” 1995
- ICRP-74 “Conversion Coefficients for use in Radiological protection against External Radiation”, 1996

REQUEST FOR ADDITIONAL INFORMATION

As a result of the review of Chapter 12, 17 Request for Additional Information (RAIs) have been raised requesting further details,

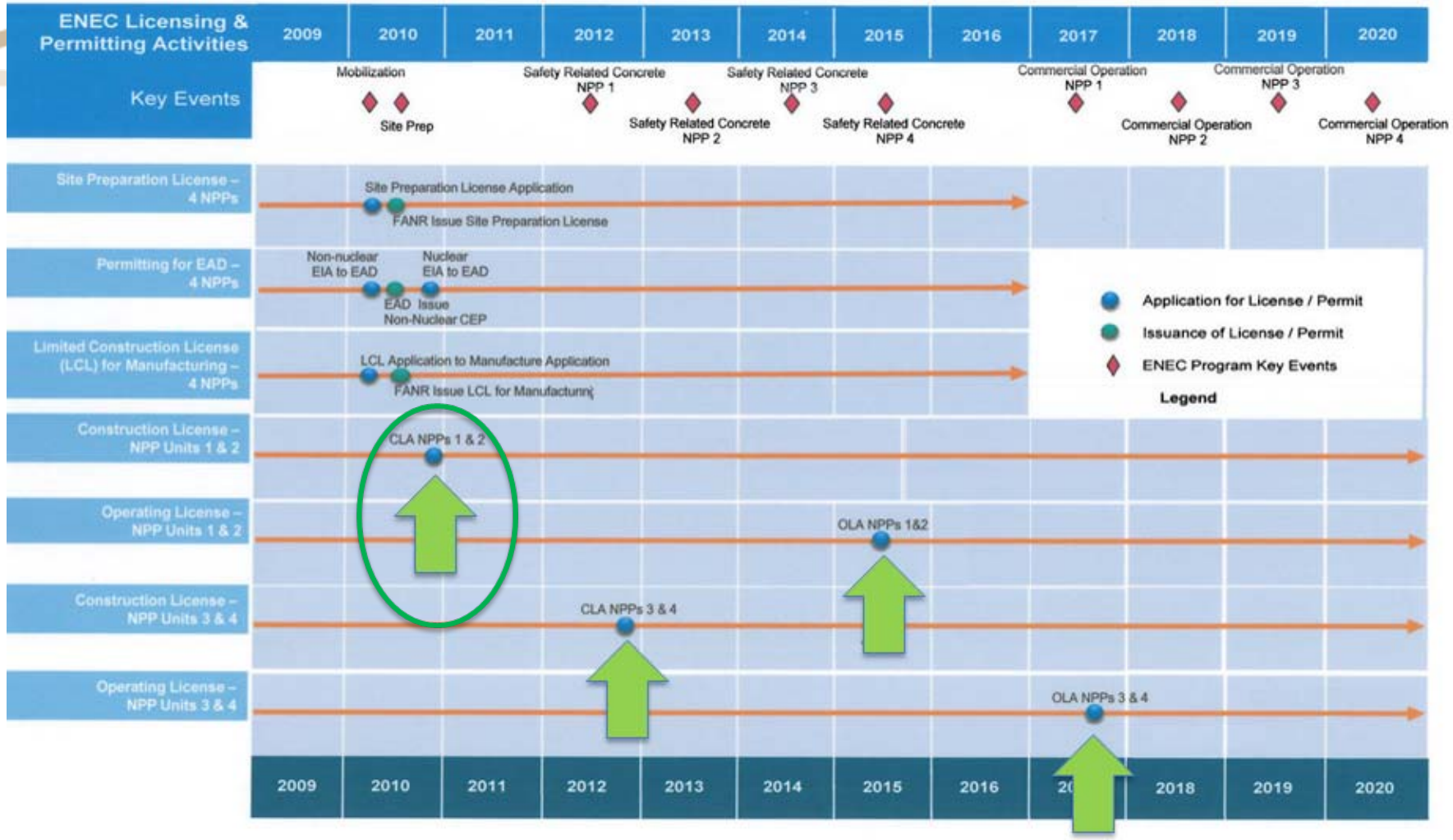
- **Open items**
  - Assumed radiological source terms
  - ALARA for Ventilation System Design
  - Post Accident Shielding Analysis
  - Minimization of Contamination and ALARA Design for Decommissioning
  - Construction Worker Exposure Calculation Methodology

REQUEST FOR ADDITIONAL INFORMATION

- **Approved and Closed**
  - Definition of dose constraint and ALARA Design
  - ALARA Lessons learned
  - Computer code used to calculate fission product inventories for shielding

- **Approved to be deferred to the FSAR stage**
  - Reference to appropriate occupational dose limits
  - Radiation protection organization hierarchy and coordination with ALARA design engineers
  - Source terms for occupational exposure, shielding design, and radiation zone designations
  - Very High Radiation Area (Zone 8) Access
  - Incorrect Radiation Zone Drawings
  - Portable and Laboratory Monitoring Equipment
  - Radiation Protection Program Implementation
  - Radiation Protection Facilities
  - Protective Clothing Requirements

ENEC'S FUTURE PLANS



FANR Schedule for issuing of Construction Licences and Operation Licences is not shown.

شكراً

Thank You

http://fanr.gov.ae