
# 1st NATIONAL REPORT ON

# MEASURES TAKEN BY THE UNITED ARAB EMIRATES

# TO IMPLEMENT THE CONVENTION ON NUCLEAR SAFETY

**AUGUST 2010**

**This report has been prepared by the UAE Government to be submitted to the IAEA, August 2010 in fulfillment of Article 5 of the Convention on Nuclear Safety for review at the 5th review meeting to be held in April 2011**

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# I. Introduction

The United Arab Emirates (UAE) deposited its instrument of accession to the Convention on Nuclear Safety (hereinafter called Convention or CNS) on 31 July 2009. Under Article (31.2), the Convention entered into force for the UAE 90 days later on 29 October 2009. Although the UAE currently does not have a "nuclear installation" as defined by the Convention under its jurisdiction, the country has embarked on an active programme for construction and operation of a number of civil nuclear power plants (NPP). As will be discussed in this first UAE CNS *National Report*, from the outset of developing its national Nuclear Policy for nuclear development the UAE has recognized the importance of becoming a Contracting Party to relevant international instruments for nuclear safety, security, and non-proliferation and establishing the necessary national legal framework to meet its obligations under those instruments.

The UAE appreciates the opportunity to participate in the review process established under the Convention, believing that this will contribute to the goal of enhancing the safety of its developing nuclear energy programme. The UAE intends to play an active and positive role in the upcoming Review Meeting of the Parties to the Convention scheduled for April 2011.

# II. Development of Peaceful Nuclear Energy

Analysis conducted by official UAE entities concluded that national annual peak demand for electricity is likely to rise to more than 40,000 MW's by 2020, reflecting a cumulative annual growth rate of roughly 9% from 2007 forward. Based upon these projections, the UAE evaluated viable options for the purpose of meeting future energy demands. Reviewed against several options, the UAE concluded that nuclear power generation would be the most reliable, efficient, safe, commercially competitive and environmentally friendly means of producing electricity. Recognizing the potential role of nuclear energy as an indispensable part of the UAE's future energy strategy, the UAE Government developed and publicly issued an in-depth policy paper titled, *Policy of the United Arab Emirates on the Evaluation and Potential Development of Peaceful Nuclear Energy*. This policy paper (hereinafter referred to as the Nuclear Policy) was adopted by the UAE Cabinet of Ministers in April 2008. The Nuclear Policy outlines the role of nuclear energy in the UAE's energy programme and the UAE's commitment to operational transparency and the highest standards of non-proliferation, safety and security, throughout the life of the nuclear programme. The non-proliferation commitment was enshrined in the UAE decision to forgo uranium enrichment and domestic reprocessing of spent fuel. It also discusses the UAE's intent to develop its peaceful domestic nuclear power capability in partnership with governments and firms of friendly and responsible nations, as well as the assistance of appropriate expert organisations, including the International Atomic Energy Agency (IAEA), in a manner that best ensures long term sustainability.

This Nuclear Policy statement is available for review at:
http://fanr.gov.ae/ar/media/get/20090430_uae-policy-white-paper.pdf
The UAE moved forward on commitments outlined in its Nuclear Policy in April 2009, by signing The Additional Protocol between the UAE and IAEA. The

Additional Protocol establishes a procedure for stringent inspections of nuclear facilities and operations.

The UAE has taken into account the obligations cited in the Additional Protocol and other international instruments in its Federal Law by Decree No. (6) of 2009, known as the Nuclear Law, and draft regulations established by the Federal Authority for Nuclear Regulation (FANR). The UAE is developing the required physical and legal infrastructure to ensure the obligations under these instruments are met by the time they are brought into force. Upon conclusion of these agreements, the UAE will be subject to the full obligations under its Comprehensive Safeguards Agreement and to the more rigorous regime of safeguards within standards of non-proliferation. The UAE views the application of the Comprehensive Safeguards Agreement, and the Additional Protocol as an important component of its model for the adoption of a peaceful nuclear energy programme, its commitment to complete operational transparency, and adherence to the highest standards of non-proliferation.

The UAE will also engage IAEA and the World Association of Nuclear Operators (WANO) to provide assessments and enter into exchanges of operational experiences and data to ensure safety is continuously maintained to the highest standards.

With the issuance of its Nuclear Policy, the UAE, through the Executive Affairs Authority (EAA) of Abu Dhabi, began early implementation of a National Energy Program Implementation Organization (NEPIO) as recommended by the IAEA, incubating the development of both the nuclear regulator and the owner/operator prior to its formal, legal establishment. In the early stages, the EAA developed an internal strategy document called the "Roadmap to Success" which, building on the guidance from the IAEA, set forth the early path for the programme. The Roadmap addressed the broad range of issues including legislation, capacity building, and radioactive waste management. Nearly two years later, the UAE has made many advances in developing a model programme which non-nuclear states could follow to gain international support in deployment of peaceful nuclear energy options.

The UAE is committed to ensuring that safety remains at the forefront of any peaceful nuclear energy programme by implementing a comprehensive regime of safety in accordance with the highest international standards and benchmarks. EAA continued to support the programme through the formal establishment of the FANR with Federal Law by Decree No. (6) of 2009 and formal establishment of the Emirates Nuclear Energy Corporation (ENEC) with Law No. (21) of 2009.

A nuclear energy programme in the UAE will contribute substantially and competitively to the UAE's basic power needs for decades and retain the continued support of international investment partners, while ensuring continuous improvement of safety practices and security in accordance with best global standards consistent with a high level of safety consciousness. The decision to proceed with a nuclear energy programme in the UAE was based on an extensive national advisory and consultative process, recognizing that the establishment of a nuclear energy programme in the country is a long term commitment covering all phases of the nuclear plant life cycle. Support through international cooperation is also an important part of the plan to adopt the highest standards of safety. It is clear that there is an acceptance of responsibility by all participants in the civil nuclear energy project with the operator, ENEC, retaining the ultimate responsibility of safety.

The UAE has chosen the advanced third-generation light water reactor (LWR), also known as APR1400 (Advanced Power Reactor), to ensure safety at the highest levels due to significant safety improvements including enhanced user-friendly instrumentation and controls, reduced fuel use and waste, design specifications ensuring lower vulnerability to operational disruptions, and 'passive' safety systems permitting a reduction in active controls or interventions to avoid accidents in case of a malfunction.

# III. Convention on Nuclear Safety Articles

## Article 4. Implementing Measures

**CNS Text:**

*"Each Contracting Party shall take, within the framework of its national law, the legislative, regulatory and administrative measures and other steps necessary for implementing its obligations under this Convention."*

**Discussion:**

The legislative, regulatory, administrative and other steps necessary for implementing UAE obligations under the CNS are discussed in this *National Report*. The report concludes that the approach being taken in the UAE provides for continuous fulfilment of the requirements presented in the articles of the Convention.

## Article 5. Reporting

**CNS Text:**

*"Each Contracting Party shall submit for review, prior to each meeting referred to in Article 5, a report on the measures it has taken to implement each of the obligations of this Convention."*

**Discussion:**

This *National Report* has been submitted in accordance with Article 5 of the Convention for review at the 5th CNS review meeting to be held in April 2011.

## Article 6. Existing Nuclear Installations

**CNS Text:**

> *Each Contracting Party shall take the appropriate steps to ensure that the safety of nuclear installations existing at the time the Convention enters into force for that Contracting Party is reviewed as soon as possible. When necessary in the context of this Convention, the Contracting Party shall ensure that all reasonably practicable improvements are made as a matter of urgency to upgrade the safety of the nuclear installation. If such upgrading cannot be achieved, plans should be implemented to shut down the nuclear installation as soon as practically possible. The timing of the shut-down may take into account the whole energy context and possible alternatives as well as the social, environmental and economic impact.*

**Discussion:**

As of the date of submission of this *National Report*, the UAE will have no nuclear installations as defined by the CNS.

## Article 7. Legislative and Regulatory Framework

**CNS Text:**

1. *Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of nuclear installations.*
2. *The legislative and regulatory framework shall provide for:*
    i. *the establishment of applicable national safety requirements and regulations;*
    ii. *a system of licensing with regard to nuclear installations and the prohibition of the operation of a nuclear installation without a licence;*
    iii. *a system of regulatory inspection and assessment of nuclear installations to ascertain compliance with applicable regulations and the terms of licences;*
    iv. *the enforcement of applicable regulations and of the terms of licences, including suspension, modification or revocation.*

**Discussion:**

The legislative and regulatory framework governing the safety of nuclear installations in the UAE consists of a number of instruments and documents. Given the early stage of the UAE nuclear energy programme, some of the regulatory measures are still under development.

### 7.1 Legislative Framework

The legislative framework includes three types of instruments: laws adopted within the UAE; multilateral instruments to which the UAE has become a party or is taking steps to join; and bilateral nuclear cooperation agreements with States that will be participating in the UAE programme. The following list of instruments (the relevant terms of which will be discussed separately) include:

#### 7.1.1 Laws of the United Arab Emirates

- Federal Law by Decree No. (6) of 2009 Concerning the Peaceful Uses of Nuclear Energy, which came into effect on 24 September 2009, (referred to as the Nuclear Law.) The official version of the Nuclear Law is in Arabic. An English translation version is included in this *National Report* as an annex to Article 7.
- Law No. (21) of 2009 Establishing the Emirates Nuclear Energy Corporation, issued on 20 December 2009 (referred to as the ENEC Law). An English translation version is included in this *National Report* as an annex to Article 7.
- Federal Law No. (24) of 1999 for the Protection and Development of the Environment, issued 17 October 1999.

- Law No. (14) of 2007 Concerning the Establishment of the Critical National Infrastructure Authority, which came into force on 27 May 2007.

### 7.1.2 Multilateral Instruments Adopted by the United Arab Emirates

- Convention on Nuclear Safety, acceded 31 July 2009.
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, acceded 31 July 2009.
- Convention on Early Notification of a Nuclear Accident, acceded 2 October 1987.
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, acceded 2 October 1987.
- Convention on the Physical Protection of Nuclear Material INFCIRC/274, acceded 16 October 2003.
- Amendment to the Convention on the Physical Protection of Nuclear Material, accepted 31 July 2009.
- Comprehensive Safeguards Agreement between the United Arab Emirates and the International Atomic Energy Agency ("Comprehensive Safeguards Agreement"), 2003.
- Protocol Additional to the Agreement between the United Arab Emirates and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons ("Additional Protocol"),2009.
- Non Proliferation Treaty (NPT) (1995).

### 7.1.3 Bilateral Cooperation Agreements

- UAE-Republic of Korea Agreement for Cooperation In The Peaceful Uses of Nuclear Energy), effective date 27 June 2009.
- UAE-United States Cooperation Agreement Concerning Peaceful Uses of Nuclear Energy, effective date 17 December 2009.
- UAE-France Cooperation Agreement on the Development of Peaceful Uses of Nuclear Energy, made on 15 Jan 2008 in Abu Dhabi.
- UAE-United Kingdom (MOU) Concerning Cooperation in Peaceful Uses of Nuclear Energy, 15 May 2008.
- Implementing Arrangements between FANR/MEST (Ministry of Education, Science & Technology) and FANR/KINS (Korean Institute of Nuclear Safety), May 2010.

## 7.2 Regulatory Framework

CNS Article 7.2 requires parties to ensure that the four key elements of a legislative and regulatory framework for nuclear safety are fully established. In brief, these four elements are: (i) standard-setting through regulations; (ii) authorization through licensing; (iii) inspection and monitoring of compliance; and (iv) enforcement. All

four elements are explicitly set forth in relevant UAE legislation, with implementing regulations in the process of development. The following summarizes the relevant Chapters and Articles of the Nuclear Law (see Annex 7 for details).

### 7.2.1 Regulations and Regulatory Guidance under Development in the UAE

The Nuclear Law Articles (NLA) (11), (38), and (39) describe the powers of the FANR Board of Management (Board) to issue regulations required for FANR's operation. In order to put in place requirements covering the early regulated activities under the Nuclear Law, the FANR has given priority to developing a number of regulations. These are as follows (until formally approved by process and issued, FANR regulations are considered draft regulations):

- FANR REG-01, "Management Systems for Nuclear Facilities;"
- FANR REG-02, "Siting of Nuclear Facilities;"
- FANR REG-03, "Design of Nuclear Facilities;"
- FANRREG-04, "Radiation Dose Limits and Optimisation of Radiation Protection for Nuclear Facilities;"
- FANR REG-05, "Application of Probabilistic Risk Assessment at Nuclear Facilities;"
- FANR REG-06, "Application for a Licence to Construct a Nuclear Facility;"
- FANR REG-07, "Nuclear Facility Construction;"
- FANR REG-08, "Physical Protection for Nuclear Material and Nuclear Facilities;"
- FANR REG-09, "Import / Export Controls;"
- FANR REG-10, "Safeguards and Nuclear Material Accounting and Control;"
- FANR REG-11, "Radiation Protection and Radioactive Waste Management for Nuclear Facilities;"
- FANR REG-12, "Emergency Preparedness at a Nuclear Facility;"
- FANR REG-13, "Transportation of Radioactive Materials;" and
- FANR REG-14, "Application for a Licence to Operate a Nuclear Facility."

Regulatory guidance that describes methods acceptable to FANR for the implementation of these regulatory requirements is also under preparation in the form of Regulatory Guides. For example, the Regulatory Guide, "Content of an Application for a License to Construct a Nuclear Facility," provides guidance to applicants on the content of applications for a Construction Licence (CL), including guidance on the content of the Safety Analysis Report that is submitted with the application.

FANR has also established within its management system a process for establishing and revising regulatory requirements and guidelines that includes provisions for internal and external stakeholder review and incorporation of comments, as appropriate.

### 7.2.2 System of Licensing

NLA (23-31) provide requirements for granting, revocation, and suspension of licences. NLA (23) prohibits any person from conducting any 'Regulated Activity' in the UAE unless licenced to do so by FANR. Regulated Activity includes the siting, construction, operation and decommissioning of Nuclear Facilities (noting that the definition of Nuclear Facilities incorporates the CNS definition of 'nuclear installation'). NLA (28) requires the applicant for a licence to submit detailed evidence of safety that shall be reviewed and assessed by FANR in accordance with defined procedure. NLA (6) gives exclusive authority to FANR for issuing licences to practice any of the Regulated Activities in the UAE and permits FANR to impose conditions on licences. Following review and assessment of a licence application, FANR determines whether to issue a licence, a licence with conditions, or to refuse a licence and record the basis for the decision. The licensing process is described in more detail in Article (14) of this National Report.

### 7.2.3 System of Regulatory Inspection and Assessment

NLA (32-37) provide requirements on inspection and control of licensee activities. NLA (35) requires FANR to establish a planned and systematic inspection programme. NLA (36) requires FANR to conduct inspections covering all areas of regulatory responsibility to ensure that the operator is in compliance with the law, regulations and licence conditions. In undertaking inspections, FANR is required to take account of the activities of suppliers of services and products to the operator. NLA (5.8) provides FANR with the power to enter sites and facilities to carry out inspections. Regulatory inspection is discussed in more detail in Chapter 14 of this National Report.

### 7.2.4 Enforcement and Terms of Licences

NLA (5.17) gives FANR the power to undertake enforcement actions, which are defined by the Law to include corrective actions, written warnings, revocation of a licence, and administrative penalties and fines. NLA (36.2) empowers FANR to take enforcement action compelling the operator to take actions necessary to remediate any breach. NLA (36.3) empowers FANR itself to remedy a breach if the operator does not do so. In such cases, the operator would bear the necessary costs of such an intervention. NLA (37) obliges the operator to comply with FANR decisions and to remedy any breach, undertake an investigation related to the breach, and take any measures necessary to prevent a recurrence. NLA (57-64) provides provisions for civil liabilities and criminal penalties for various offences related to the requirements of the Nuclear Law.

## Article 8. Regulatory Body

**CNS Text:**

1. *Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 7, and provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities.*
2. *Each Contracting Party shall take the appropriate steps to ensure an effective separation between the functions of the regulatory body and those of any*

*other body or organisation concerned with the promotion or utilization of nuclear energy.*

**Discussion:**

The Federal Authority for Nuclear Regulation (FANR) is the federal governmental agency designated as the Regulatory Body which gets its powers from the Nuclear Law.

The Environmental Agency - Abu Dhabi (EAD) is an Abu Dhabi governmental agency. EAD is responsible for establishing and regulating the Construction Environmental Permit (CEP) process that applies, inter alia, to the construction and operation of nuclear power plants in Abu Dhabi including the format and content of the Terms of Reference (TOR), Environmental Impact Assessment (EIA), and Construction Environmental Management Plan (CEMP). Although EAD has environmental responsibilities, FANR has the functions and authority in accordance with NLA (11) to protect the environment from radiation hazards.

### 8.1 Establishment of the Regulatory Body

Three chapters of the Nuclear Law establish the structure, responsibilities and resources of the regulatory body entrusted with implementing the legislative and regulatory framework for nuclear safety in the United Arab Emirates.

Chapter 2, NLA (4–9) establishes the Federal Authority for Nuclear Regulation (FANR) as the regulatory body to implement the legislative and regulatory framework.

- NLA (4) establishes FANR as a public organisation with an independent balance sheet, an independent legal personality, full legal competence and financial and administrative independence. It states the aims of FANR as the assurance of safety, security and radiation protection within the UAE nuclear programme with the development of the nuclear sector towards only peaceful purposes.
- NLA (5) gives power to FANR to determine all matters relating to the regulation of the nuclear sector in regard to safety, nuclear safety, nuclear security, radiation protection and safeguards. FANR must also implement obligations under relevant international instruments entered into by the UAE. This Article lists certain powers of FANR in 33 sub-articles.
- NLA (6) gives FANR exclusive jurisdiction over the licensing of the UAE programme.
- NLA (7) requires FANR to co-operate with relevant government bodies on matters related to the nuclear programme.
- NLA (8) authorizes FANR to investigate potential breaches of the Nuclear Law.
- NLA (9) requires FANR to maintain the highest standards of transparency in its regulatory activities while allowing it to protect confidential information.

Chapter 3, NLA (10-17) sets forth provisions on the management of FANR.

- NLA (10) establishes the FANR Board to manage the organisation.

- NLA (11) establishes the general authorities and functions of the Board including that it establishes the general policy of FANR, adopts its budget and organisational structure, and issues the range of regulations and requirements needed for FANR's operations and functions.
- NLA (12) sets forth conditions of Board membership.
- NLA (13) identifies the grounds on which Board members may be replaced.
- NLA (14) provides for the appointment of a Director General to manage FANR and oversee its financial, administrative and technical affairs.
- NLA (15) establishes that the Director General manages FANR's business and oversees its financial, administrative and technical affairs under the Board of Management control. It sets out the duties of the Director General in nine sub-articles, including that the Director General reviews all licence applications and makes appropriate recommendations to the Board.
- NLA (16) identifies the grounds on which the Director General may be replaced.
- NLA (17) authorizes FANR to appoint employees.

Chapter 4, NLA (18-22) deals with FANR's financial affairs.

- NLA (18) gives FANR the powers to manage its finances and identifies the means of funding for FANR as: funding allocated by Government; income generated from its functions (fees); and other income that is accepted and that does not conflict with FANR's objectives.
- NLA (19) establishes the dates of the fiscal year for FANR financing.
- NLA (20) makes FANR subject to UAE tender and procurement laws and applicable financial and auditing regulations.
- NLA (21) grants FANR exemption from UAE taxes.
- NLA (22) provides that the FANR Board will appoint an independent auditor to report on the Authority's financial affairs.

### 8.2 Status of the Regulatory Body

The Nuclear Law clearly establishes FANR as the independent government body charged with the regulation and licensing of all nuclear activities within the UAE, which includes NPPs, design, siting, construction, and operation, as well as the regulation of radioactive materials and radioactive sources used in medical, research, oil exploration, and other industries.

Pursuant to the commitments set forth in UAE Nuclear Policy and consistent with the CNS and other relevant international instruments to which the UAE is a party, FANR has committed itself to the following core values:

- Transparency – visible to public, the regulated, and other government bodies; independently communicate decisions and opinions to the public, communicate information to the public in a transparent, technically sound, accurate, reliable and understandable manner; and cooperation and sharing of information throughout the government.

- Safety – first safety principles tied to the unique nature and risks of nuclear technology; legal commitment to safety, security, and safeguards as high as reasonably achievable; in full compliance with national law and international treaties; and no compromise on public health and safety.
- Independence – achieve and maintain public and international acceptance; make appointments for key personnel for defined terms with clear removal criteria and without conflict; sufficient and predictable financial resources; adequate technical expertise in-house to be able to make independent decisions.
- Competence – prerogative to ensure that safety is the basic responsibility; maintain the confidence and trust of operators and the public; in-house mentoring and development of human resources as national treasure; and effectively interact with international associations.

The FANR Board Members are appointed for a renewable fixed term and can only be removed by a resolution of the Cabinet for defined reasons (NLA (13)). NLA 23 of the law establishes FANR's regulatory independence definitively. That Article prohibits any person from conducting a Regulated Activity (which includes all relevant activities relating to a nuclear installation) without a licence from FANR. FANR is the sole decision-maker in licensing, and its decisions are not subject to any external review. FANR is entirely independent of ENEC and any other entity charged with promotional responsibilities. Board members are forbidden by law from engaging directly or indirectly in the conduct of any Regulated Activity and must not have any personal interest that conflicts the interests of FANR.

The Chairman of the Board is required by the Law to submit a report, at the end of each financial year, to the Minister of Presidential Affairs. As reflected in Chapter 4 of the Nuclear Law discussed earlier, FANR has also been assured of having sufficient, predictable and autonomous financial resources to fulfil its responsibilities independently.

## 8.3 Summary of Approach to Addressing CNS Article 8

The following outline summarizes approaches being taken by FANR to satisfy the basic provisions of CNS Article 8:

### 8.3.1 Mandate and Regulatory Functions (also see discussion of CNS Article 7)

FANR's regulatory responsibility includes all activities related to the nuclear sector including the licensing of prescribed activities, nuclear safety, nuclear security, radiation protection and safeguards, and inspection and enforcement. Its mandate includes liaison with other UAE governmental agencies in such areas as health and safety, environmental protection, security, and transportation of hazardous materials. FANR is authorized to liaise or cooperate with the IAEA or other national regulatory bodies outside the UAE through the UAE's representative. FANR is also authorized to implement protocols or other arrangements, implement responsibilities required of UAE as a party to relevant international instruments, and implement the obligations of bilateral agreements with other States entered into by the UAE.

### 8.3.2 Organisation and Staffing (FANR organisation chart provided in Figure 8.1)

FANR has created two main branches in the organisation to fulfil its responsibilities: Administration and Operations. The Administration Branch includes the Departments of Administration and Finance, Government and International Affairs, Education and Training, and Human Resources; the Operations Branch includes the Departments of Nuclear Safety, Radiation Safety, Nuclear Security, and Safeguards. FANR currently employs about 100 persons.

### 8.3.3 Financial Resources

FANR has its budget set by its Board of Management and receives funds made available by government allocation. In the long-term, licensees will pay fees based on the regulatory scale of services provided by FANR. FANR is free to deal with its funds, including all banking activities according to auditing and financial regulations applicable to FANR. Sources of FANR funds include government allocations and income generated by conduct of FANR regulatory functions. FANR manages its financial resources according to the applicable financial and auditing regulations within the UAE. The FANR Board of Management appoints an independent auditor registered with the appropriate UAE authorities to audit annual accounts and prepare reports regarding the results of the audit.

### 8.3.4 Position in the Government Structure

This reporting structure within the UAE government demonstrates that within the chain-of-command FANR can maintain its independence. For example, FANR senior staff reports to the Board of Management. The members of the Board of Management are appointed by a resolution of the UAE Cabinet. The Chairman of the Board is required by the Law to submit a report at the end of each financial year to the Minister of Presidential Affairs. FANR and ENEC are developing a working relationship within the government structure, but are mindful to ensure the independence of both organisations from one another.

### 8.3.5 Integrated Management System

As recommended through IAEA publications on safety requirements and guidance, FANR has developed and is implementing an Integrated Management System (IMS) that is tailored specifically to the regulator. The IMS includes a set of interacting processes that address the objectives and requirements of the organisation. Elements included in the IMS are the structure, resources, and processes of the core business areas of nuclear regulation, licensing and inspection, as well corporate support functions.

### 8.3.6 Knowledge Management Programme

FANR is in the process of assuring that significant activities involving the generation and use of knowledge unique to the nuclear sector are being systematically identified and developed to ensure the sustainability of such knowledge from in-house sources. A Knowledge Management (KM) programme will comprehensively address the knowledge, experience and expertise generated in the regulatory, technical, scientific, administrative, legal and managerial areas. Implementation of these activities by FANR has already begun.

### 8.3.7 Recruitment and Maintenance of Competent Staff (see also, discussion of CNS Article 11)

Currently, FANR is recruiting a core team of experienced international technical personnel to perform all of the functions for which FANR is responsible. FANR plans to maintain the core team and develop a group of skilled UAE nationals in key areas – through the National Capacity Building Programme, which includes development of programmes for education and training, college graduates and new engineers being trained overseas (38 currently enrolled in BS and MS programmes), and specialized, individual training plans. Individual Development Programmes (IDPs) will be prepared for specific positions in the developing workforce. Over the long-term, FANR will establish its own in-house nuclear expertise as provided by UAE nationals with support from international experts.

### 8.3.8 Technical Judgment

Efforts are being made to retain in-house expertise and expand the workforce to include a growing complement of Emirati nationals. In areas where technical knowledge is still being developed, FANR has contracted with Technical Support Organisations (TSOs). The role of TSOs includes the preparation of regulatory documents (regulations, regulatory guides and review procedures), the conduct of expert reviews in selected areas, and participation in inspection activities until such time as educated and qualified Emiratis can fulfil that role.

FANR is responsible to take ownership of technical reviews, but will also utilize assessments by the regulatory body of the country-of-origin of the imported technology. Criteria are being developed to determine acceptability of crediting review by the regulatory body of the country-of-origin and areas requiring independent review.

**FANR Board of Management**

The UAE Cabinet has issued Resolution No 1/386 of 2009 regarding the formation of the FANR Board of Management. The names of the Board members are as follows

- H.E. Dr. Ahmed Mubarak Al Mazrouei, Chairman
- H.E. Abdulla Nasser Al Suwaidi, Deputy Chairman
- H.E. Dr. Abdulqader Ebrahim Al Khayat, Board Member
- H.E. Dr. Ali Mohamed Shaheen, Board Member
- H.E. Advisor/Ali Al Shar Sultan Al Daheri, Board Member
- H.E. Hamad Ali Al Kaabi, Board Member
- H.E. Saif Mohamed Obaid Al Zaabi, Board Member
- H. E. Majid Ali Al Mansouri, Board Member
- H.E. Dr. Mariam Ali Al Shenasi, Board Member

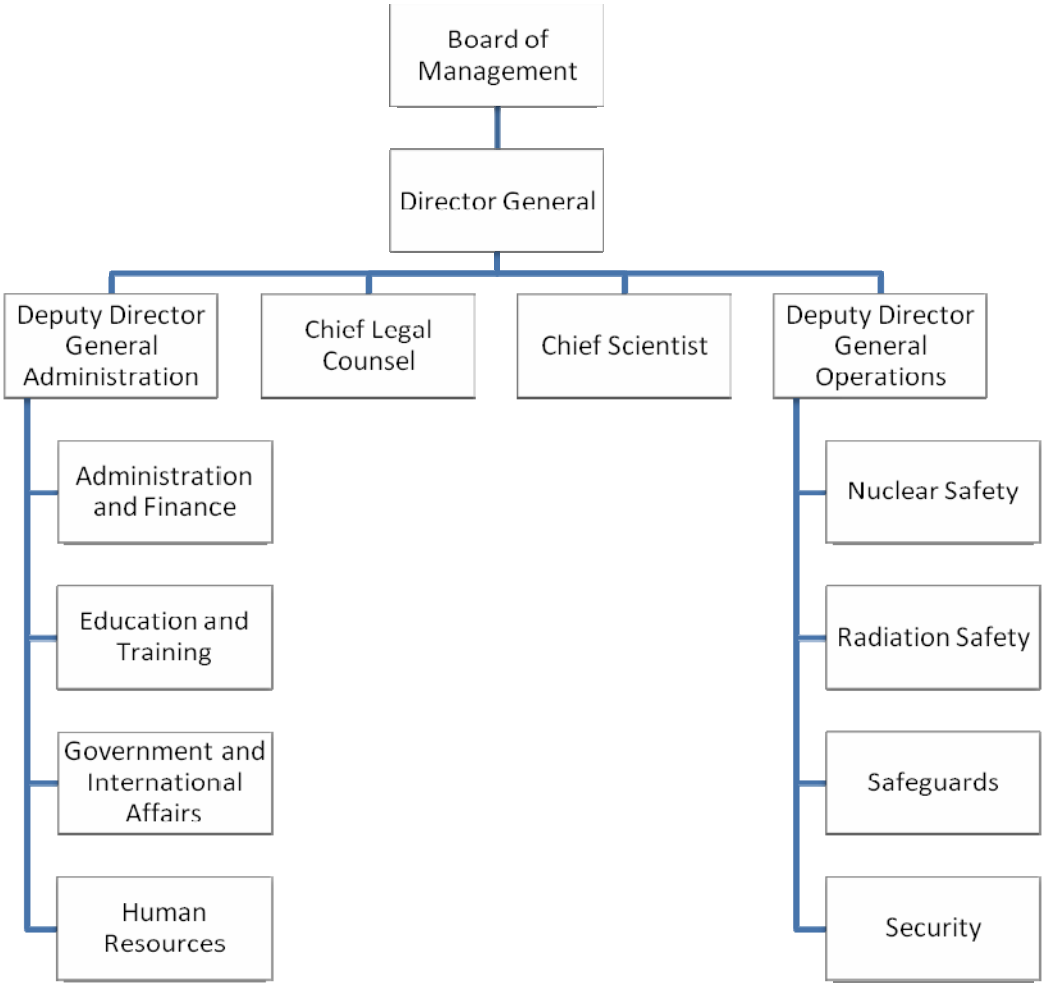


**Figure 8.1 - FANR Management Organisation Chart**

## Article 9. Responsibility of the Licence Holder

**CNS Text:**

*Each Contracting Party shall ensure that prime responsibility for the safety of a nuclear installation rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility.*

**Discussion:**

Nuclear Law:

- NLA (43) makes clear that each licensee is responsible for all steps necessary to reduce the risk of an accident to a level that is as low as reasonable achievable. This article sets forth eight specific aspects of safety that are to be addressed by the licensee.
- NLA (57) makes the operator liable "on all matters related to safety, nuclear safety, nuclear security and radiation protection."
- NLA (36) requires that FANR conduct a regulatory inspection programme covering all areas of regulatory responsibility to ensure the operator is in compliance.
- NLA (5) grants FANR the authority to ensure compliance to attain effective nuclear safety, including the use of enforcement actions on operators to compel necessary actions.

### 9.1 Emirates Nuclear Energy Corporation Roles and Responsibilities

NLA (36.5) states,

*Regulatory Inspections shall not diminish the Operator's prime responsibility for Safety or substitute for the control, supervision and verification activities that the Operator must carry out.*

Article (2) of the ENEC Law, specifically states,

*[t]here shall be an establishment pursuant to this Law a corporation called Emirates Nuclear Energy Corporation which shall have an independent legal personality and full legal capacity to conduct its activities, achieve its objectives and shall have a financial and administrative independence to manage its affairs, wholly owned by the government.*

As per the ENEC Law, ENEC has the responsibility:

- To operate pursuant to the internal, financial, administrative, personnel, tendering, purchasing and procurement regulations issued by the Board;
- For all employees of ENEC to be subject to the civil law and regulations of the civil service applicable in the emirate of Abu Dhabi to the extent that the administrative regulations issued by the board of directors of ENEC provides otherwise; and

- To undertake and implement an effective plan for the hiring and training of UAE nationals so that they are able to carry out to the extent reasonably possible, the business and activities.

As licensee and operator of the UAE civil NPPs, ENEC will be responsible for ensuring that safety is maintained at all levels of the organisation. ENEC has ensured that the importance of nuclear safety is cascaded not only to ENEC employees, but to all contractors and stakeholders associated or working with civil NPPs.

The objectives of the ENEC safety programme are to:

- assign safety as the overriding primary business objective
- reflect the highest standards for safety – including industrial and nuclear
- demonstrate excellent safety performance by all personnel affiliated with the Programme
- create a skilled and competent workforce that has the highest regard and respect for nuclear technology
- establish and follow world class work practices that result in excellent human performance
- create a work environment aimed at continuous improvement and effective communications

## Article 10. Priority to Safety

**CNS Text:**

> *Each Contracting Party shall take the appropriate steps to ensure that all organizations engaged in activities directly related to nuclear installations shall establish policies that give due priority to nuclear safety.*

**Discussion:**

As discussed in other parts of this *National Report*, the fundamental commitment of the UAE to high standards of safety in developing its nuclear energy programme was adopted by the Nuclear Policy. On page 4 of the Nuclear Policy, the following statement on nuclear safety policy is emphasized:

> *With regard to safety of facilities, as required by the IAEA Convention on Nuclear Safety, the UAE will implement a comprehensive regime that maintains a high level of safety according to international benchmarks and ensures that all nuclear-related installations are operated in a safe, well-regulated and environmentally sound manner.*

The following additional points of the Nuclear Policy apply in a balanced way between FANR and ENEC and contribute to the commitment and priority to nuclear safety:

- Establishing an independent and effective regulatory authority with appropriate powers and authorities to oversee nuclear activities (FANR);
- Working with the IAEA and conforming to its standards in evaluating and establishing a safe nuclear energy programme (FANR, ENEC);

- Establishing the licensing scope and authority, which would be in accordance with international best practices in the nuclear energy sector, and the process of issuing a licence would be characterized by thoroughness and a pervasive culture of safety (FANR, ENEC);
- Selecting an advanced generation of light water reactors to enhance safety (ENEC); and
- Making extensive use of the operational safety experience gained by the most highly regarded operators of nuclear plants around the world (FANR, ENEC).

The UAE has also codified the essential principles and priorities established in the Nuclear Policy and governed by Nuclear Law. NLA (1) defines "Nuclear Safety" as,

> *The achievement of proper operating condition, prevention of Accidents or mitigation of Accident consequences, resulting in protection of workers, the public and the environment from undue radiation hazards.*

Through numerous Articles, the Nuclear Law affirms a strong commitment to the priority to nuclear safety. Additionally, NLA (4) through (6) and (38) confirm the independence of FANR and the policy of reflecting international best practice, as embodied in IAEA Safety Standards Series and other internationally recognized guidance documents, and integrate these into the UAE regulatory framework.

Further affirmation of the priority to nuclear safety may be found in the specific draft regulations developed by FANR. Draft regulations have been prepared that include requirements to promote nuclear safety and express related FANR expectations in the areas of safety management systems, siting of nuclear facilities, design of nuclear facilities, radiation dose limits and optimisation of radiation protection for nuclear facilities, and the application of probabilistic risk assessment (PRA) at nuclear facilities. As in most developed nuclear nations, the regulator is responsible for developing and establishing the safety requirements and the operator is responsible for achieving safety. In UAE, ENEC bears the primary responsibility for safety.

Draft regulation FANR REG-01, "Management Systems for Nuclear Facilities," adopts the internationally accepted definition of "Safety Culture" as:

> *The assembly of characteristics and attitudes in organisations and individuals which establishes that, as an overriding priority, protection and safety issues receive the attention warranted by their significance.*

This regulation specifically requires that applicant's or licensee's Management System promotes and supports a strong safety culture.

As an example of the implementation of safety culture, ENEC line managers encourage personnel to identify known conditions adverse to quality and ensure sufficient and timely corrective and preventative actions are taken in accordance with procedures. Reports of conditions adverse to quality are analysed to identify trends. Significant conditions adverse to quality and significant adverse trends are documented and reported to appropriate levels of management. The corrective action programme in itself is the largest and most efficient tool to promote and demonstrate the ENEC safety culture.

Further, the objective of draft regulation FANR REG-03, "Design of Nuclear Facilities," is clearly to establish design requirements, operator actions and

functioning of emergency equipment and procedures that must be met for safe operation of a NPP, and for preventing or mitigating the consequences of potential events that could jeopardize safety. Additionally, the principle objective of draft regulation FANR REG-05, "Probabilistic Risk Assessment," is to ensure that the applicant or licensee conducts a PRA prior to constructing or operating a nuclear facility.

In the discussion of other CNS articles, this *National Report* documents other legislative, regulatory and institutional measures taken by the UAE to ensure that this fundamental policy of ensuring safety will be effectively and consistently implemented by all relevant bodies.

UAE has taken early actions to fulfil its responsibilities to nuclear safety as recommended by IAEA guide NG-G-3.1, "Milestones in the Development of a National Infrastructure for Nuclear Power." IAEA publication, "INIR Integrated Nuclear Infrastructure Review Mission – Guidance on Preparing and Conducting INIR Missions," provides guidance for nations intent on developing a nuclear programme and infrastructure. The IAEA assembles and sends Mission Teams to Member States to conduct infrastructure reviews and provides feedback on areas in need of improvement. The UAE has developed and submitted to IAEA an action plan in response to the IAEA INIR Mission Report.

ENEC reinforces safety as an overriding priority through the Culture of Safety Policy, which encourages workers to:

> *strive for excellence in safety, to raise safety concerns with their management, and to identify concerns internally or to the appropriate regulatory authorities without any fear of possible reprisal.*

Culture of Safety training has been developed within the organisation, is on-going, and will be reinforced.

In addition to the Nuclear Policy and other measures, the UAE has established a high-level International Advisory Board (IAB) to offer guidance for ensuring that the nuclear energy programme meets high standards of safety, security and non-proliferation. The IAB will meet twice a year and issue regular, public reports on its findings and recommendations. The IAB includes independent experts with broad experience in nuclear affairs, including safety. The membership includes:

- Dr. Hans Blix (Chairman) - former IAEA Director General
- Mr. Jacques Bouchard - special adviser to France's CEA (Atomic Energy Commission) and former Chairman of Generation IV International Forum
- Dr. Kun Mo Chung - former South Korean Minister of Science and Technology
- Ambassador Thomas Graham - former US Ambassador for Non-Proliferation
- Mr. Takuya Hattori - President of Japan Atomic Industrial Forum, Inc.
- Lady Barbara Judge – Former Chair, United Kingdom Atomic Energy Authority
- Dr. Mujid Kazimi – Massachusetts Institute of Technology Professor of Nuclear and Mechanical Engineering

- Mr. Jukka Laaksonen - Director General of Finland's Radiation and Nuclear Safety Authority
- Sir John Rose - Rolls-Royce Chief Executive

### 10.1 ENEC Focused Actions over the Next Year

While the efforts to build and maintain a culture of safety are on track and have been successful in 2009, the UAE recognizes that building and maintaining a culture of safety across a large and varied infrastructure requires a continuous commitment and ongoing effort. With the initial integration of significant additional personnel from the Prime Contractor (KEPCO) into the overall UAE team in 2010, ENEC recognizes and is planning for the ongoing challenges to ensure that the culture of safety becomes and remains a key driver of the programme. ENEC will also adopt KEPCO's strong Safety Culture and apply its lessons-learned to ensure all aspects of a good safety culture are met and maintained.

## Article 11. Financial and Human Resources

**CNS Text:**

1. *Each Contracting Party shall take the appropriate steps to ensure that adequate financial resources are available to support the safety of each nuclear installation throughout its life.*
2. *Each Contracting Party shall take the appropriate steps to ensure that sufficient numbers of qualified staff with appropriate education, training and retraining are available for all safety-related activities in or for each nuclear installation, throughout its life.*

**Discussion:**

While CNS Article 8 addresses the need for adequate resources for the regulatory body (see discussion above), this article pertains to resources needed by the applicant or licensee to support safety.

### 11.1 Financial Resources

The ENEC Law establishes a corporation, ENEC, to undertake the development of nuclear energy as part of the UAE's future energy strategy. ENEC was created as a wholly owned Abu Dhabi government corporation, which has independent legal personality and the full legal capacity to conduct its own activities and manage its own affairs. The ENEC Law addresses the issue of financial resources in Part Three (Articles 5-7). Specifically, Article 6 establishes a share capitalization of 370 million UAE Dirhams, to be fully paid by the government. Article 8 provides that government funding may be supplemented by funds generated by ENEC in pursuit of its activities or other sources approved by the ENEC Board. Article 13 exempts ENEC from all local taxes and fees, as well as from any tendering, purchasing or procurement laws or regulations applicable to UAE government entities to the extent they may conflict with regulations issued by the ENEC Board. With regard to qualified staff, Article 14 of the ENEC Law requires the Corporation to:

*implement an effective plan for the hiring and training of United Arab Emirates nationals so that they are able to carry out to the extent reasonably possible, the business and activities of the Corporation.*

It is important to note that the activities of ENEC must be conducted in a manner consistent with the Nuclear Policy, which emphasizes the central importance of safety and security.

ENEC strives to achieve the highest standard in conducting its operation as efficiently and economically as possible, while maintaining health, safety, non-proliferation and environmental protection as primary ENEC goals. ENEC seeks excellence in its business performance with the aim to further enhance the long term benefits to the shareholders, employees, and UAE society.

ENEC has developed a finance policy statement stating:

*The Emirates Nuclear Energy Corporation (ENEC) will transact and report financial, treasury and accounting information in order to achieve the development of safe, clean, efficient, and reliable civil nuclear energy. Financial and accounting activities will be performed in accordance with approved fundamental accounting guidelines and principles associated with the scope of operations, leading industry practices and International Financial Reporting Standards (IFRS) to ensure consistent application and accurate, ethical and professional reporting to management.*

The funding and financing strategies supporting the UAE's civil nuclear energy programme have been developed in step with the UAE's commitment to establish a sustainable nuclear programme. The fact that ENEC is a wholly-owned entity of the Abu Dhabi government mitigates the financial risk to the programme.

The draft regulations, FANR REG-06, "Application for a Licence to Construct a Nuclear Facility," and FANR REG-14, "Application for a Licence to Operate a Nuclear Facility," mandate that the applicant demonstrate its projected financial and human resource requirements for the proposed nuclear project and provide details regarding its financial and technical qualifications to complete the proposed activities. Additionally, draft FANR REG-14 requires applicants to address the adequacy of decommissioning funding and the adequacy of plans for radioactive waste management.

## 11.2 Human Resources

The UAE has adopted the following two strategic goals associated with National Regulatory Capacity Building (NRCB):

1. Support the national capacity building approach through effective coordination with and support for national efforts to develop human resources in the nuclear sector.
2. Establish and maintain a National Regulatory Capacity Building (NRCB) Programme aimed at developing and sustaining an international-standard UAE national regulatory workforce.

The UAE human resources policy will be guided by the IAEA Milestone Document recommendation that the relevant expertise required for each phase of the nuclear project be established ahead of time. Initiation of the NRCB Programme at FANR

will, therefore, be a priority and FANR will seek to achieve substantial progress in developing national regulatory human resources in advance of facility construction and operation. Specific implementation strategies have been developed to realize these goals.

The significance and need for the appropriate human resources to execute a nuclear programme were also recognized in the Nuclear Policy, as stated:

> *Experiences of other countries implementing nuclear energy programmes indicate that continued education and training constitute a cornerstone of the critical infrastructure necessary to sustain a nuclear power programme. Aware of this condition, and consistent with the high importance placed on the development of its human resources, any undertaking by the UAE to develop a nuclear energy programme would be accompanied by a strategy to strengthen human resources to meet future staffing requirements. Such an undertaking would involve steps to develop sufficient resources to regulate, manage, operate, and maintain the safety of nuclear facilities. The development of a skilled cadre of nuclear engineers, technicians and regulatory personnel would involve leveraging any opportunities provided by bilateral cooperation partners to attend comprehensive, high-quality nuclear technology programmes and making maximum use of training available through the IAEA.*

The Nuclear Policy also states that UAE will follow the IAEA recommendation for the sequencing of human resource programmes that the *expertise necessary to guide each project phase be established ahead of time.* This also includes ensuring the continuous development of the overall human resources, including a special mechanism to fund the ongoing human resource development programmes.

The NRCB effort is being implemented by FANR, ENEC and Khalifa University. These three entities are working together across education, training, and recruitment lines to ensure that the nuclear programme's human resource needs are met at every stage of its development. The UAE estimates that it will need 2,300 qualified personnel to staff its nuclear energy programme by 2020. In March 2010, the UAE hosted the International Conference on Human Resource Development for Introducing and Expanding Nuclear Power Programmes. Delegates from 30 nuclear nations were in attendance.

In 2009, ENEC, FANR, and the Khalifa University of Science, Technology and Research (KUSTAR) launched the UAE Nuclear Energy Scholarship Programme, which provides UAE nationals with a full scholarship to enroll in some of the world's finest universities and pursue a Bachelor or Masters degree in nuclear, mechanical, or electrical engineering. Once the studies are complete, the selected UAE national scholars will be provided with premier career opportunities in the UAE's growing nuclear energy industry.

Selected candidates from the UAE have been enrolled in nuclear, mechanical, and electrical engineering programmes in the United States and partnerships with local educational institutions have strengthened the potential pipeline for talented employees. FANR has also enrolled nine UAE nationals in a post-graduate programme in the United Kingdom (UK) in nuclear risk and safety management leading to a Masters degree.

FANR has arranged for assistance and support from several experienced nuclear support organisations, including Lightbridge Corporation, ISL/Baynuna, law firms, and IT support companies. In addition, FANR will procure services from well-known technical organizations in support of reviews and assessments, in particular, ENEC Licence applications. With regard to staffing philosophy, FANR intends to develop an in-house cadre of intelligent, experienced nuclear professionals in key safety areas with extensive experience in licensing and safety in order for FANR to conduct its own safety assessment while still maintaining the ability to intelligently utilize external support. It is FANR's intention to maintain sufficient competent and experienced staff to train and mentor inexperienced UAE nationals to become qualified safety assessors and inspectors. Also, FANR intends to enter into agreements to obtain access to research capabilities/results as well as to sharing with other regulators the regulatory and technical information related to complicated safety assessments.

Emphasis on pursuing the human resources development strategy can be found in the recent plans for development of the UAE nuclear energy programme. A consortium led by KEPCO was awarded a contract on December 27, 2009, by ENEC to supply the UAE with four nuclear power reactors. The scope of the contract covers engineering, procurement, construction, fuel, and operations and maintenance support. Besides KEPCO and several of its subsidiaries, the consortium includes Hyundai Engineering & Construction, Samsung C&T, Doosan Heavy Engineering, and Westinghouse. The contract calls for human resource development, including extensive training and education programmes to help the UAE build the capacity to eventually staff the majority of the nuclear energy programme with national talent, and the development of an industrial infrastructure and commercial businesses to serve the programme.

Under the contract, a multi-lateral agreement for education and human resource development was inked between KUSTAR, Institute of Applied Technology (IAT), Korea Advanced Institute of Science and Technology (KAIST), KEPCO, Human Resources Development Service of Korea (HRD) and Korea Development Institute (KDI).

### 11.2.1 Future Education

ENEC is working to build the human resource capacity for the nuclear energy programme in coordination with FANR and the educational sector in the UAE. Through the development of public communications and education programmes, UAE residents will be able to understand the nuclear energy programme and have information on the programme's progress.

In order to ensure that sufficient numbers of qualified staff with appropriate education, training and retraining are available for all safety-related activities in or for each nuclear installation throughout its life, ENEC has established a relationship with several universities and technology institutes within the UAE. A relationship with KUSTAR located in the UAE has been developed in order to support a bachelor degree programme in mechanical engineering and a master degree programme in nuclear engineering to develop indigenous capabilities. FANR is also supporting the KUSTAR and is establishing relationships with universities outside of the UAE as further options for the capacity building.

ENEC is also establishing relationships with the Institute of Applied Technology (IAT), a secondary educational programme whose focus is to produce the scientists, engineers, and technicians needed for the UAE to build a knowledge-based economy. By infusing the academic requirements of the nuclear technician programmes into the IAT curriculum, a local source of future technicians will become available to support the national nuclear energy programme.

Selected candidates from the UAE have been enrolled in nuclear, mechanical, and electrical engineering programmes in the United States and partnerships with local educational institutions have strengthened the potential pipeline for talented employees. FANR has also enrolled over ten UAE nationals in a programme in the UK leading to a Masters degree in nuclear safety and risk management.

## Article 12. Human Factors

**CNS Text:**

> *Each Contracting Party shall take the appropriate steps to ensure that the capabilities and limitations of human performance are taken into account throughout the life of a nuclear installation.*

**Discussion:**

A commitment to human factors can be found in the draft regulation FANR REG-03, "Design of Nuclear Facilities." This regulation addresses human factors requirements including considerations such as:

- employing ergonomic best practices and a design objective of limiting the effects of human errors
- developing plant layout and procedures (administrative, operational, maintenance, and emergency) to facilitate the interface between the operating personnel and the plant
- integrating systematic consideration of human factors and the human–machine interface in the design process at an early stage and continuing throughout the entire process, to ensure distinction of functions between operating personnel and the automatic systems
- designing the human–machine interface to provide the operators with comprehensive but easily manageable information, compatible with the necessary decision and action times
- including verification and validation aspects of human factors at appropriate stages to confirm that the design adequately accommodates all necessary operator actions

Information on capabilities and limitations of human performance are also used in the ENEC training programme to ensure heightened attention to detail regarding construction and operational safety, security and radiation protection needs associated with nuclear plants. ENEC's "Book of Knowledge" process identifies, evaluates and employs lessons-learned studies from relevant past and current domestic and international experience in order for ENEC to learn from and develop its own lessons-learned programme. Management will provide training, such as human performance techniques, and tools and equipment, such as properly erected and

inspected scaffolds, mock-ups, and personal protective equipment, to achieve and maintain a safe work environment and minimize radioactive uptakes during operation.

ENEC Management Model controls ensure safety and quality in the performance of work activities. These controls are part of the "Culture of Safety" that governs work in a systematic manner so that nuclear safety, worker health and safety, protection of the public and protection of the environment are all achieved. To ensure that the Management Model (policies, programme requirements, process descriptions and tools) will endure the organisational and work scope changes that occur over time, Functional Elements (areas) have been established. The Functional Elements allow the Management Model to remain stable while the organisation is flexible. Each Functional Element is assigned a Lead who is responsible for the maintenance of policies, programmes and processes in that element. The Functional Element Lead is also responsible for conducting annual self-assessments for monitoring performance and driving continuous improvement.

## Article 13. Quality Assurance

**CNS Text:**

> *Each Contracting Party shall take the appropriate steps to ensure that quality assurance programmes are established and implemented with a view to providing confidence that specified requirements for all activities important to nuclear safety are satisfied throughout the life of a nuclear installation.*

**Discussion:**

NLA (1) defines "Quality Assurance" as, "The function of a Management System that provides confidence that specified requirements will be fulfilled." Draft regulation FANR REG-01, "Regulation for Management Systems for Nuclear Facilities," implements the Nuclear Law and provides management system requirements for applicants and licensees in terms of the Management Model (System); management responsibility; resource management; process implementation; generic management system processes; measurement, assessment and continuous improvement; and non-conformances, corrective and preventive actions.

For example, draft regulation FANR REG-01 requires the applicant (ENEC) to use the Management Model (System) to promote and support a strong safety culture and security culture by:

- Ensuring a common understanding of the key aspects of safety culture and security culture within the organisation;
- Providing the means by which the organisation supports individuals and teams in carrying out their tasks safely and successfully, taking into account the interaction between individuals, technology and the organisation;
- Reinforcing a learning and questioning attitude at all levels of the organisation;
- Providing the means by which the organisation continually seeks to develop and improve its safety and security culture; and

- Ensuring that security measures balance any conflicting objectives of safety, operations, and security. Safety and security shall be considered together, such that one does not compromise the other. Potential conflicting requirements should be carefully analysed to ensure that they do not jeopardize nuclear safety.

With respect to operators, NLA (44) specifically addresses quality assurance, requiring a licensee to set up management safety systems and adopt policies to define and adhere to appropriate Quality Assurance requirements. Appropriate elements of quality assurance requirements for licensees are addressed in draft regulation FANR REG-01, "Regulation for Management Systems for Nuclear Facilities."

## 13.1 ENEC's Quality Assurance Policy

As part of a commitment to implement best practices in quality systems, ENEC has established Quality Assurance requirements, performance expectations, and a self-assessment regime that will meet all FANR and Nuclear Law requirements while driving continuous improvement. KEPCO has a Quality Assurance Programme that has been reviewed and approved by the Korean Institute of Nuclear Safety (KINS), the Korean nuclear regulatory body, but is also required to work to ENEC's Quality Assurance Programme and Management System. The ENEC Quality Assurance Programme requirements are based upon ASME NQA-1, IAEA GS-R-3, the Management System for Facilities and Activities, ISO 9001 and the European Foundation for Quality Management. ENEC is responsible for integrating quality into the performance of all activities that have the potential to adversely impact nuclear safety, workers, the public or the environment and to provide extensive oversight of KEPCO to ensure all FANR requirements are met.

In accordance with the NLA 44, ENEC developed a Quality Assurance programme that covers all phases of the UAE nuclear facilities, including but not limited to: site selection and characterization, licensing, design, procurement, construction, pre-operational, operation and maintenance, and decommissioning. FANR will review ENEC's QA programme to ensure nuclear safety is continuously maintained at a high standard at every phase and stage of the project. The programme covers all activities affecting the quality of safety-related structures, systems and components (SSCs) including, but not limited to: analyzing, assessing, auditing, cleaning, commissioning, installing, licensing, maintaining, modifying, operating, pre-operational activities, procuring, receiving, fuel loading, repairing, shipping, site selection, storing, testing and training.

The level of detail in each of the requirements has been selected to ensure that safety-related items and activities meet specific requirements and regulations and comply with internationally accepted quality programmes and processes.

## 13.2 ENEC's Management System

ENEC's Management System has been developed and includes provisions for technical oversight by ENEC engineering, licensing, and permitting organisations. The Management System for Quality Assurance implements the ENEC Quality Assurance Manual (EQAM) and its implementing procedures. The EQAM is consistent with internationally recognized quality standard ASME NQA-1:1994. These requirements will be implemented in each phase of the project in accordance

with the described EQAM and applicable implementing procedures. Appropriate quality assurance audits, assessments and surveillances will be conducted, findings and observations identified, and acceptable resolutions documented.

ENEC, as applicant or licensee, is committed to providing a rigorous management oversight role over the prime contractor and its contractors and suppliers during technical and administrative activities to ensure safety. The contractors, under their contractor-specific Quality Assurance programmes, as approved by ENEC, will perform Regulated Activities under the jurisdiction of FANR issued licences with extensive guidance and oversight from ENEC. The technical oversight programme will include periodic inspections, audits, and assessments to assure compliance with the ENEC-approved contractor Quality Assurance programmes and procedures.

For example, Project individuals are encouraged to demonstrate a questioning attitude by challenging assumptions, investigating anomalies and considering potential adverse consequences of their actions prior to work.

### 13.3 FANR's Management System

With regard to regulatory activities, NLA (5.33) authorizes FANR to "apply the Quality Assurance principles on all procedures related to its functions." As discussed under Article (8.5) of this *National Report*, FANR has established an Integrated Management System (IMS) that comprises the elements of quality assurance and is being implemented by FANR in its regulatory activities.

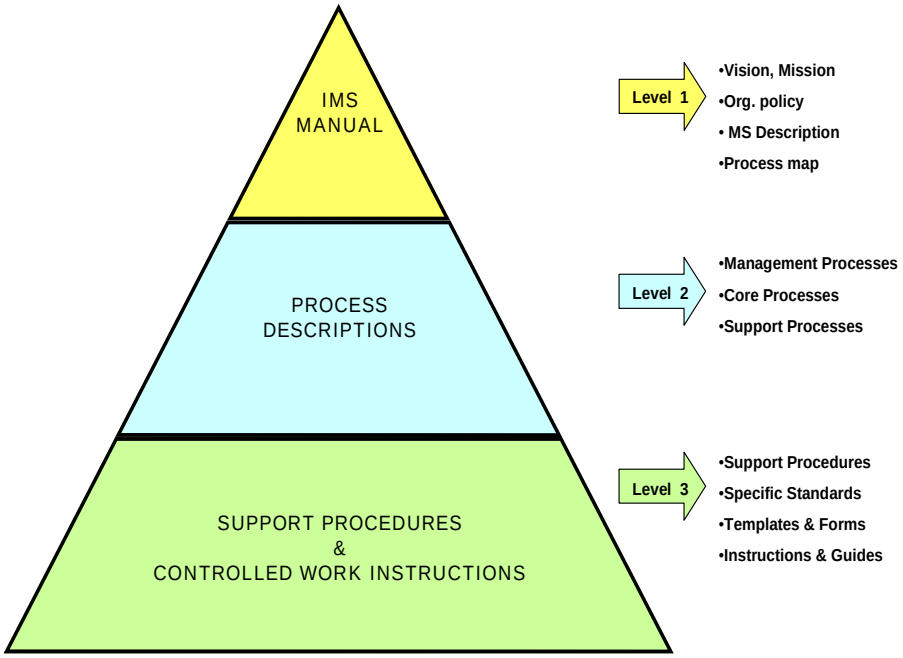


**Figure 13-1 FANR Management System Pyramid**

The IMS includes a set of interacting processes that address the objectives and requirements of the organisation, and includes structural elements; resources and processes of the core business areas of nuclear regulation, licensing and inspection; as well as corporate management and support functions.

Figure 13-1 shows the hierarchy of the procedures, instructions, and process descriptions within the IMS. Figure 13-2 shows the relationship of the management, core, and support processes.

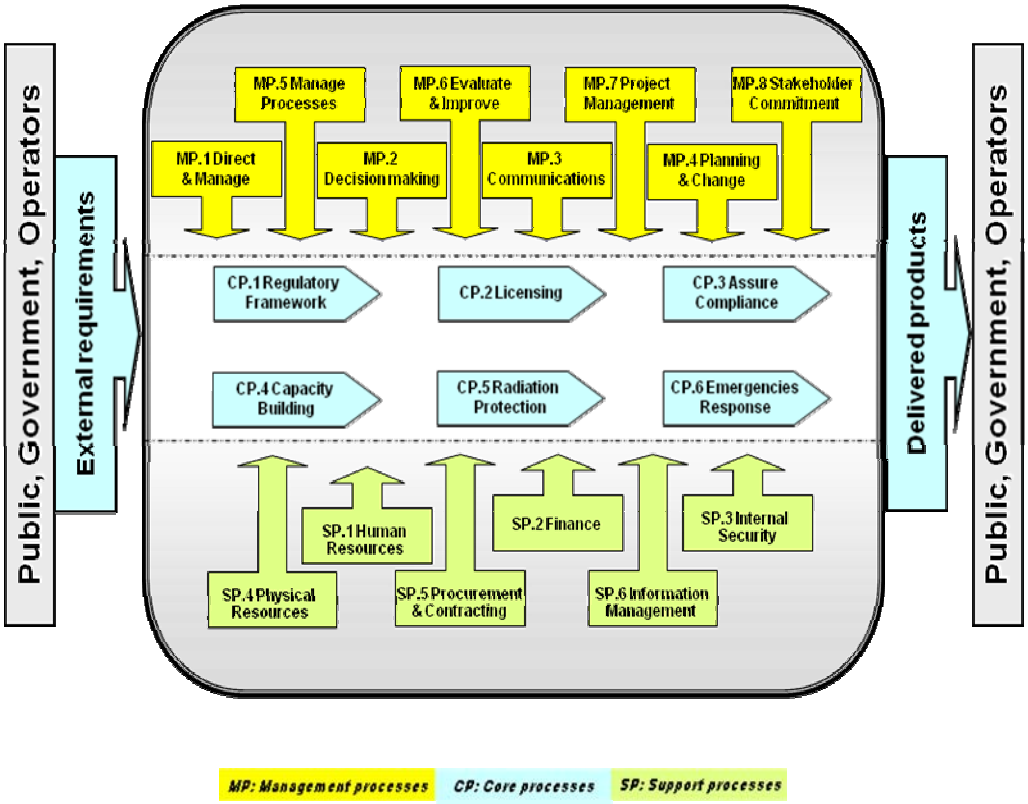


**Figure 13-2 FANR Management System Overall Process Map**

## Article 14. Assessment and Verification of Safety

**CNS Text:**

*Each Contracting Party shall take the appropriate steps to ensure that:*

*i. comprehensive and systematic safety assessments are carried out before the construction and commissioning of a nuclear installation and throughout its life. Such assessments shall be well documented, subsequently updated in the light of operating experience and significant new safety information, and reviewed under the authority of the regulatory body;*

*ii. verification by analysis, surveillance, testing and inspection is carried out to ensure that the physical state and the operation of a nuclear installation continue to be in accordance with its design, applicable national safety requirements, and operational limits and conditions.*

**Discussion:**

### 14.1 Assessment of Safety

NLA (5) gives powers to FANR to establish the requirements for systematic Safety Assessments and Periodic Safety Reviews. NLA (28) makes it clear that detailed

evidence of safety is required at all relevant licensing stages of any nuclear installation. NLA (29) and (43) require the licensee to perform safety assessments over the lifetime of the nuclear facility, address any deficiencies, and provide FANR with any information relevant to the Authority's regulatory responsibilities. NLA (32) requires review and assessment of the licensee or applicant at every stage of the regulatory process.

Draft regulation FANR REG-06, "Application for a Licence to Construct a Nuclear Facility," and draft regulation FANR REG-14, "Application for a Licence to Operate a Nuclear Facility," define an Independent Safety Verification (ISV) as, "A written verification performed by suitably qualified and experienced individuals, who did not participate in the original Safety Assessment, to determine whether the approach taken in conducting such Safety Assessment was reasonable and in accordance with international best practice." Each of these draft regulations requires that an ISV report be provided as part of the licence application request describing all proposed departures from or changes to the reference design.

### 14.1.1 Assessment of Safety through the Licensing Process

The safety verifications and inspections are implemented by the licensing system. The licensing strategy and system for nuclear facilities consistent with the Nuclear Law have been established for assessing applications to construct and operate a nuclear facility that will leverage the expertise of the vendor prime contractor, KEPCO, and the nuclear safety experience of the Country of Origin, including the expertise and experience of the country of origin regulatory body, KINS.

Article (25) of the Nuclear Law requires that a licence be obtained prior to engaging in any "Regulated Activities," which include:

- Selection of a site for construction
- Preparation of a site for construction
- Construction of a nuclear facility
- Commissioning of a nuclear facility
- Operation of a nuclear facility
- Change in closure date of a nuclear facility
- Modifications having significance for safety
- Possession, use, manufacture, handling, import, export, transportation, storage, and disposal of Regulated Material
- Introduction or removal of Regulated Material to or from a nuclear facility
- Decommissioning of a nuclear facility

ENEC has developed an approach to applying for and obtaining licences for these activities that is consistent with the Nuclear Law and that meets established safety, design, and construction timeline requirements, and follows the principles of the Nuclear Policy.

Each licence application and environmental permit is required to meet all FANR regulations, applicable legal and regulatory requirements of the UAE and its political

subdivisions, including the requirements of EAD. For each licenced activity and in support of licence applications, ENEC will perform a systematic safety assessment or a periodic safety review over the lifetime of the nuclear facilities and provide to FANR any information it deems necessary for FANR to perform its duties, including the information related to ENEC's suppliers, even if such information is proprietary.

### 14.1.2 Construction Licence (CL) for Nuclear Installations

To obtain a Construction licence (CL), the applicant must submit a Construction Licence Application (CLA) to FANR for review and approval in accordance with the Nuclear Law and draft regulation FANR REG-06. The key parts of the CLA include a Preliminary Safety Analysis Report (PSAR), Safeguards Plan, Security Plan (for construction), preliminary Emergency Preparedness Plan, ENEC's and Prime Contractors Quality Assurance Plan for design and construction and ENEC's Management Model (System).

Prior to approval of the Construction Licence Application, FANR will perform a comprehensive safety review of the CLA to confirm that all aspects of the application are in conformity with relevant regulatory requirements and technical guidelines. It includes, but is not limited to, safety reviews of the Country of Origin's reference plant design, the implementation of the regulatory criteria, the evaluation of the environmental effects resulting from the construction, and a proposal from ENEC for minimizing those effects. See Figure 14.1 for a diagram of the summary content of the CLA.

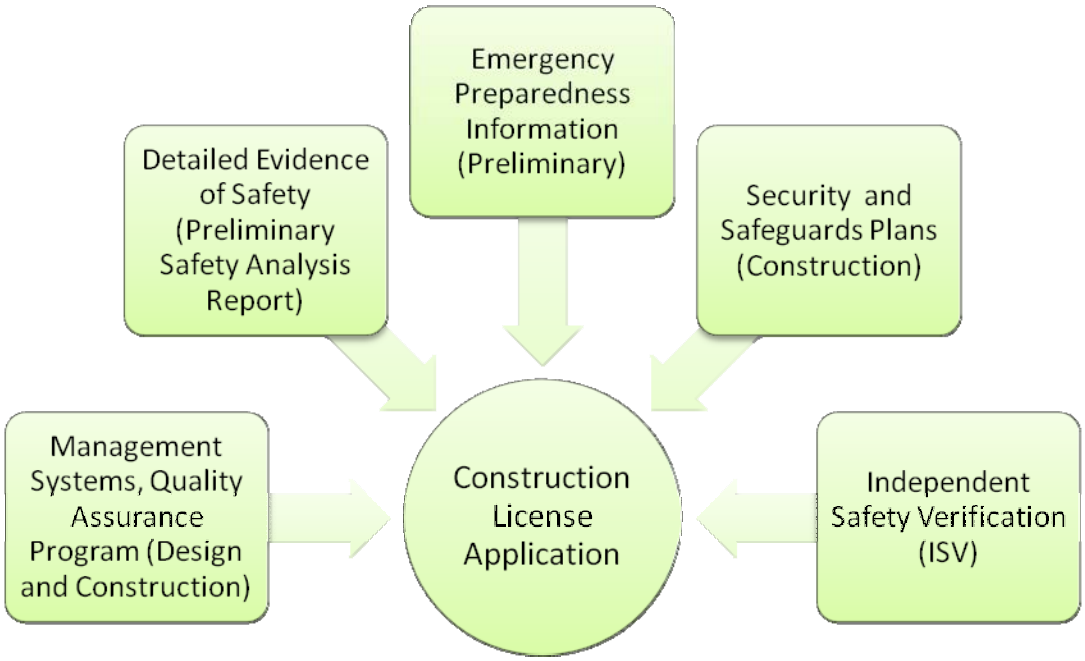


**Figure 14.1 - Summary Content of the CLA**

The Nuclear Environmental Impact Assessment (N-EIA) at the CLA stage is submitted to Environmental Agency of Abu Dhabi (EAD) for review and approval under its law. Prior to issuing a Construction Environmental Permit (CEP), EAD will review the project Environmental Impact Assessment Report and Construction Environmental Management Plan (CEMP) to approve the construction phase impacts

of the project. The CEP issued by EAD must be renewed annually. Furthermore, EAD must be notified of modifications in the project in order to adjust the scope of work of the CEP accordingly.

### 14.1.3 Operating Licence (OL) for Nuclear Installations

To obtain an Operating Licence the applicant must submit an Operating Licence Application (OLA) to FANR for review and approval in accordance with the Nuclear Law and draft regulation FANR REG-14. The OLA updates and provides final information originally provided in the CLA and also includes information on the commissioning programme, safeguards controls, detailed information pertaining to operational limits and conditions (OLC), and decommissioning. An updated Independent Safety Evaluation will be included with the OLA. See Figure 14.2 for a diagram of the summary content of the OLA.

A safety review of the OLA will be conducted to confirm that the final design of the nuclear installation is in conformity with all regulatory requirements and technical guidelines and that the nuclear installation will operate safely throughout its prescribed lifetime. Based on the results of an acceptable safety review by FANR of the OLA and the results of pre-operational inspections, FANR will issue an Operating Licence (OL).

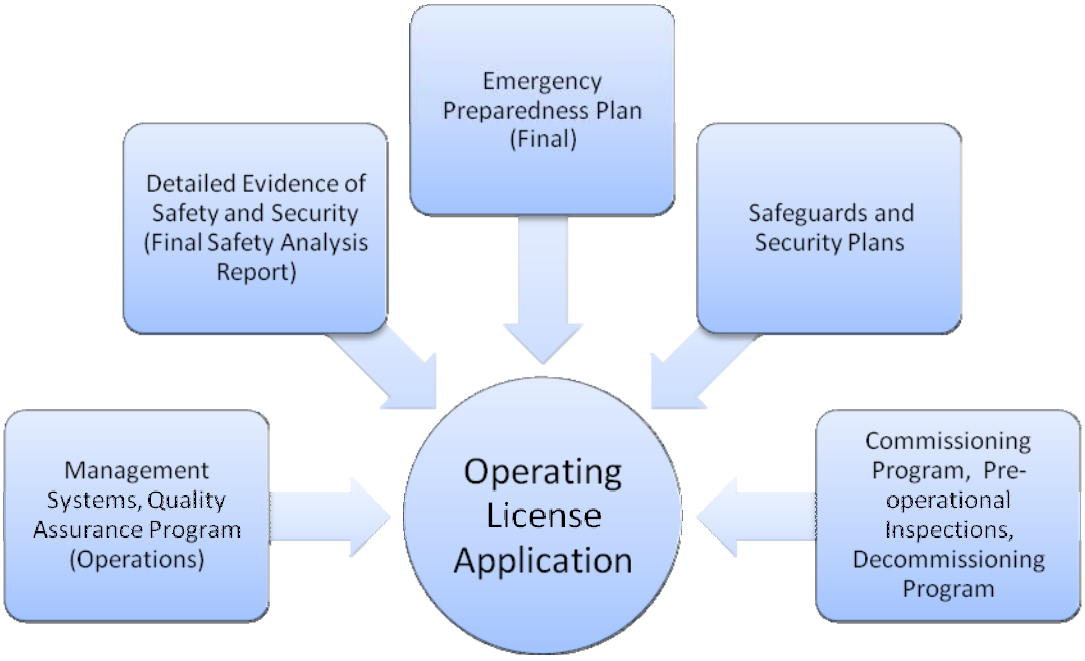


**Figure 14.2 - Summary Content of the OLA**

The Nuclear Environmental Impact Assessment (N-EIA) at the OLA stage is updated from the CLA stage and finalized information is submitted to EAD for review and approval under its law. An Operation Environmental Permit (OEP) and an Operation Environmental Management Plan are prepared based on the mitigation measures listed in the EIA. The OEP issued by EAD must be renewed annually. Furthermore,

EAD must be notified of modifications in the project in order to adjust the scope of work of the OEP accordingly.

## 14.2 Verification of Safety

### 14.2.1 Regulatory Inspection

NLA (32-37) details the FANR role in inspection and verification of safety requirements, as follows:

- NLA (32) on review and assessment requires such measures "in every stage of the regulatory process", according to the Authority's programme of review and assessment "from initial selection of the site, through Design, Construction, Commissioning, and Operation, to Decommission or Closure".
- NLA (35) on general inspection guidance for FANR requires that a planned and systematic inspection programme be set up by FANR. The Article mandates this as a continuing activity that can be conducted on an announced or unannounced basis. Inspection reports are to be fed back into the regulatory process to enhance safety.
- NLA (36) on specific inspection guidance for FANR sets forth, in five sub-articles, the detailed inspection process to be conducted by FANR, including the ability to take needed enforcement action in the event of violations of regulatory requirements or other actions jeopardizing safety (NLA (36.2)).
- NLA (37) contains other responsibilities of the operator including requiring the operator to comply with the Authority's decisions and to remedy violations and to perform needed investigations into safety-related issues.

As specified in NLA (36),

> *The Authority shall conduct Regulatory Inspection programs which shall cover all areas of regulatory responsibility in relation to the regulatory Activity to ensure that the Operator is in compliance with this Law, implementing regulations, applicable regulations and the conditions set out in the Licence. In addition, the Authority shall take into account, as necessary, the activities of suppliers of services and products to the Operator.*

FANR is in the process of developing a comprehensive inspection programme covering all aspects of its regulatory responsibility to ensure compliance and safety. FANR is also in the process of recruiting and training the necessary personnel to meet this obligation. This is being done in accordance with a systems approach to training. IAEA TECDOC-1254 is being used to identify the necessary training needed to qualify team leaders and inspectors. FANR plans to supplement their inspection staff with experienced TSO personnel, who are also being used to provide training and mentoring in inspection techniques.

### 14.2.2 Inspections Conducted by the Licensee

ENEC is responsible to ensure that all necessary measures are taken related to inspections and inspector qualification to cover activities performed by ENEC, KEPCO, contractors, and suppliers. ENEC's inspection and surveillance activities will assure that items, services and activities affecting safety meet established requirements and conform to applicable documented specifications, instructions,

procedures, and design documents. As applicant or licensee, and as required by FANR, ENEC must provide oversight and quality surveillance activities at the inspection site. Inspections are and will continue to be performed by qualified persons independent of those who performed or directly supervised the work. Inspection results will be documented and records maintained to show proper evidence of conformance with the regulatory requirements and the Nuclear Law.

ENEC, KEPCO and their subcontractors will ensure that all inspections and surveillances are conducted, as necessary, to verify quality (1) at the source of supplied items or services; (2) in-process during fabrication at a suppliers facility or at an ENEC facility; (3) of fabricated and/or installed items during construction, including final acceptance; (4) upon receipt of items for a facility; and (5) during maintenance, modification, construction, in-service, and operating activities.

## Article 15. Radiation Protection

**CNS Text:**

> *Each Contracting Party shall take the appropriate steps to ensure that in all operational states the radiation exposure to the workers and the public caused by a nuclear installation shall be kept as low as reasonably achievable and that no individual shall be exposed to radiation doses which exceed prescribed national dose limits.*

**Discussion:**

### 15.1 Legislation

The Nuclear Law gives FANR regulatory authority to regulate radiation protection in the overall 'Nuclear Sector' of the UAE which includes nuclear facilities and industrial and medical application of radioactive materials.

NLA (43) covers radiation safety and radiation protection. This article provides the basis for safety requirements in matters affecting radiation protection and states:

> *The Licensee shall ensure that Occupational Exposures and Public Exposures to Ionizing Radiation and any releases of Radioactive Material to the environment caused by the conduct of Regulated Activities are kept below the prescribed limits during all operational states and Activities, and shall undertake to achieve Doses as low as reasonable achievable. The licensee shall keep records of measured and estimated Doses and release data and report them to the Authority as specified in the applicable regulations.*

### 15.2 UAE Regulations

FANR has developed the following draft regulations and key provisions dealing directly with radiation protection as applied to nuclear installations:

- Draft FANR REG-04, "Regulation for Radiation Dose Limits and Optimisation of Radiation Protection for Nuclear Facilities" covers:
    - Dose Limits for Occupational Exposure ,
    - Dose Limits for Members of the Public,
    - Optimisation of Protection for Workers , and

- Optimisation of Protection for the Public.

This regulation adopts the internationally accepted dose limits for occupationally exposed workers during the normal operation of a nuclear facility.

- Draft FANR REG-11, "Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities," covers:
  - Radiation Protection Programme,
  - Predisposal Management of Radioactive Waste,
  - Clearance Levels and Discharges of Radioactive Material,
  - Environmental Monitoring Programme, and
  - Training.
- Draft FANR REG-13, "Transportation of Radioactive Material," will adopt IAEA document TS-R-1 (2009 Edition), "Regulations for the Safe Transport of Radioactive Material," in its entirety.

### 15.3 Implementation

ENEC has incorporated radiation protection into all phases of the NPP Project. ENEC's Management System includes Radiation Protection in the Health and Safety Function. Planning for environmental radiation monitoring is in progress and the overall radiation protection plan will be submitted to FANR for approval with the CLA. Early licence activities do not pose any radiation risks as no nuclear material is introduced. Radiation protection training and development are currently in progress within ENEC, and an employee training programme has been established to provide all employees with knowledge of the fundamentals of radiation protection.

Future training for any "radiation workers" that will require access to areas of potential radiation or contamination has been planned. The expansion of regulatory and specialist organisations has commenced with the recruitment of additional staff, planning for upgrading infrastructure, and implementation of training programmes.

## Article 16. Emergency Preparedness

**CNS Text:**

3. *"Each Contracting Party shall take the appropriate steps to ensure that there are on-site and off-site emergency plans that are routinely tested for nuclear installations and cover the activities to be carried out in the event of an emergency.*

   *For any new nuclear installation, such plans shall be prepared and tested before it commences operation above a low power level agreed by the regulatory body.*

4. *Each Contracting Party shall take the appropriate steps to ensure that, insofar as they are likely to be affected by a radiological emergency, its own population and the competent authorities of the States in the vicinity of the nuclear installation are provided with appropriate information for emergency planning and response.*

5. *Contracting Parties which do not have a nuclear installation on their territory, insofar as they are likely to be affected in the event of a radiological emergency at a nuclear installation in the vicinity, shall take the appropriate steps for the preparation and testing of emergency plans for their territory that cover the activities to be carried out in the event of such an emergency.*

**Discussion:**

## 16.1 Emergency Plans and Programmes

### 16.1.1 Legislation

Chapter 9 of the Nuclear Law sets out a structure for emergency preparedness. The relevant articles include:

- NLA (49), which requires measures for Emergency Preparedness and Emergency Response for protection of the population, property and environment (off-site Emergency plan) and for each Nuclear Facility and any facility that contains sources of ionizing radiation (on-site Emergency Plan).
- NLA (50), which requires preparation, maintenance and coordination of the off-site Emergency Plan by the competent authorities and Licensees in order to provide protection of the public.
- NLA (51), which stipulates that the material, technical, and human resources for the preparation, maintenance, and implementation of the off-site Emergency Plan shall be financed by the State's national budget.
- NLA (52), which requires that a licensee provide its Emergency Plan to FANR for approval and other competent authorities of the State before the Commissioning of a Nuclear Facility and that the Emergency Plan be tested before Nuclear Facility Commissioning and during the course of Operation.
- NLA (53), which requires that the Licensee familiarize its employees with the Emergency Plans and conduct related training.
- NLA (54), which requires, in case of an accident, Licensees to:
  - notify FANR immediately;
  - warn the population and municipalities within the Emergency Zones and other competent authorities immediately;
  - take Emergency Action to mitigate and remedy the consequences of the Accident;
  - control and regulate the exposure of the individuals engaged in Accident mitigation and elimination;
  - ensure continuous monitoring of radioactive releases into environment; and
  - perform any other obligations as may be established in the Emergency Plans, the Nuclear Law, or the applicable regulations.
- NLA (55), which requires that the terms and procedures for preparation of Emergency Plans, the responsibilities and duties for implementation, the measures for mitigation and remediation of the consequences, and the arrangements for warning of the public be established by regulation.

- In addition, NLA (7) requires that FANR cooperate with and advise relevant Government entities concerned with emergency preparedness and response.

### 16.1.2 UAE Regulations

Draft FANR REG-12, "Regulation for Emergency Preparedness for Nuclear Facilities," covers FANR requirements for applicant or licensee preparation and planning for and response to emergencies at nuclear facilities.

The purpose of the regulation is to ensure that the applicant has an organisation that is capable of coping with emergencies and mitigating their consequences, and that the applicant or licensee can perform assessment actions and implement notification procedures. It also requires the applicant or licensee to demonstrate that it has adequate emergency facilities and equipment, provides appropriate training, maintains emergency preparedness, and is capable of recovery after an emergency. The requirements for training arrangements and procedures for exercising emergency plans are also included.

Draft FANR REG-12 does not apply to the plans and activities of the off-site coordinating agencies or response organizations.

Draft FANR REG-12 also requires the licensee (ENEC) to develop an Emergency Plan as part of the Construction Licence Application and to submit this to FANR along with a description of the concept, policy and objectives of operations for the onsite response to an Emergency. The licensee shall also describe the structure, authorities and responsibilities for a systematic, coordinated and effective response that serves as the basis for the development of other plans, procedures and checklists.

### 16.1.3 ENEC Plans to Address Emergency Planning

ENEC will develop and implement a standard emergency classification scheme based on system and effluent parameters on which Federal and local response organisations may rely for determining initial off-site response measures. As per the draft FANR regulation on Emergency Preparedness, the Emergency Plan shall provide for four classes of emergencies: (1) General Emergency, (2) Site Area Emergency, (3) Facility Emergency and (4) Alert.

The Emergency Plan shall include predefined Emergency Action Levels (EALs) which shall be based on the abnormal conditions for the nuclear facility, security related concerns, releases of radioactive material, environmental measurements and other observable indication. The Emergency Plan will also include EALs for all abnormal conditions that correspond to each of these classes of emergency.

The emergency plan developed by ENEC will be implemented by emergency procedures in the form of documents and instructions that will detail the implementation actions and methods required to achieve the objectives of the requirements in the Regulation FANR REG-12.

### 16.1.4 Critical National Infrastructure Authority (CNIA)

The Critical National Infrastructure Authority (CNIA) was created in May 2007 with the aim to secure Abu Dhabi's infrastructure and key assets. CNIA is an independently established entity based in Abu Dhabi and affiliated with the Abu Dhabi Executive Council. It is responsible for protecting the Emirate's vital facilities

while working to maintain the highest standard of security to nurture the economic stability that comes from a safe and secure Abu Dhabi.

### 16.1.5 National Crisis and Emergency Management Authority (NCEMA)

The National Crisis and Emergency Management Authority (NCEMA) was created in 2006 to enhance the UAE resiliency to respond to emergencies and crisis and managing them as they occur through joint planning, training, and coordination with various agencies in the UAE. It is responsible for developing a National Response Plan (NRP) for the response to nuclear emergencies.

NCEMA is developing an all hazards National Response Plan (NRP) which will include offsite response to nuclear emergencies. For this effort NCEMA is engaging the first responders and other stakeholders directly involved in radiological emergencies. As necessary, NCEMA will also integrate the responsibilities of FANR, ENEC, and CNIA into its development of its offsite planning efforts. As the NRP is an all hazards plan designed to deal with incidents at national level including nuclear incidents, it will ensure that primary responsibilities for offsite response to emergencies of ENEC as well as Federal and local responders have been assigned and that federal resources are available on a continuous basis.

## 16.2 Public Emergency Notification

UAE is a party to IAEA Conventions on early Notification of a Nuclear Accident and Assistance in the Event of a Nuclear Accident. Under the terms of these Conventions, the UAE has nominated a contact point for purposes of providing prompt notification and coordinating any needed assistance. Measures for informing the public about emergency preparedness in the vicinity of the nuclear installation are still under development.

# Article 17. Siting

**CNS Text:**

*Each Contracting Party shall take the appropriate steps to ensure that appropriate procedures are established and implemented:*

i. *for evaluating all relevant site-related factors likely to affect the safety of a nuclear installation for its projected lifetime;*

ii. *for evaluating the likely safety impact of a proposed nuclear installation on individuals, society and the environment;*

iii. *for re-evaluating as necessary all relevant factors referred to in sub-paragraphs (i) and (ii) so as to ensure the continued safety acceptability of the nuclear installation;*

iv. *for consulting Contracting Parties in the vicinity of a proposed nuclear installation, insofar as they are likely to be affected by that installation and, upon request providing the necessary information to such Contracting Parties, in order to enable them to evaluate and make their own assessment of the likely safety impact on their own territory of the nuclear installation.*

**Discussion:**

The intent of the discussion under this Article is to report on siting actions that the UAE has taken and will continue to take until the NPP site is selected, prepared, and construction can begin. The selected site will have characteristics that, taken in combination with reactor safety characteristics, will provide a high level of protection for public health and safety and the environment throughout the life of the nuclear installation.

The UAE has enacted two Federal Laws that pertain to the nuclear safety and environmental aspects of siting nuclear facilities in the UAE. NLA (25) identifies specific "Regulated Activities" for which a licence is required. There are two "Regulated Activities" related to siting that require a licence: (1) site selection; and (2) site preparation related to the construction of NPP units. These activities are considered part of the construction licensing process. Licences granted for site selection and site preparation permit these activities but do not constitute final regulatory approval on the suitability of a given site for construction of a NPP. This decision to approve the site will be based on the application for the construction licence.

Federal Law No. (24) of 1999, "For the Protection and Development of the Environment," includes Article (3), which establishes arrangements to set the standards, specifications, principles and regulations for the assessment of environmental impact of projects that require permits under that Law.

Draft FANR regulation, FANR REG-02, "Regulation for Siting of Nuclear Facilities," specifies the regulatory requirements for NPP siting in the UAE. The draft regulation, establishes the requirements for site evaluation that would apply to one or more NPP installations. The site evaluation characterizes fully the site-specific conditions so that the NPP is protected against the site's external hazards, and so that any environmental impacts to the NPP that might arise from its operation at the site are minimized. FANR has provided ENEC with an early draft version of the regulation and guidance to which ENEC could refer while ensuring regulatory compliance during site selection activities. Article (2) of this regulation defines the extent of the information describing a proposed site to be presented to FANR by the applicant.

ENEC has referred to regulatory guidance from the US Nuclear Regulatory Commission (NRC), IAEA Safety Requirement NS-R-3, "Site Evaluation for Nuclear Installations," and the Electric Power Research Institute (EPRI) Siting Guide for integration with UAE Federal Law. ENEC strategy for integrating USNRC, IAEA and EPRI guidance with established Environmental Agency - Abu Dhabi (EAD) and FANR procedures results in an environmental review methodology that applies internationally accepted environmental and safety standards in a way that is both internationally comprehensive and uniquely responsive to the UAE environment.

### 17.1 Evaluation of Site-Related Factors

A team of UAE and international experts is continuing detailed scientific and safety studies on seismology, geology, environmental impact and other factors related to siting. These studies and others will contribute to the final decision on where to build the prospective NPP units. All site selection data collection and analysis are being done in accordance with the Quality Assurance Programmes of ENEC and

subcontractors.. The candidate sites are determined through a complete and comprehensive site characterization investigation programme performed by ENEC's subcontractors.

The preferred sites are being thoroughly investigated with regard to all the site characteristics that could be significant to safety in external natural and human induced events. The factors considered include:

- population density and use characteristics of the site environs
- physical characteristics of the site, including seismology, meteorology, geology, and hydrology
- existing infrastructure (e.g. roads, ports, and airports)
- suitable cooling water source
- distance to transmission lines, substations, or load centres
- topographic features
- potential to adversely impact valuable environmental, agriculture, residential, or industrial areas
- potential to adversely impact dedicated land-use areas (e.g. marine protected areas, historical sites)
- conflict with land-use planning programmes or other restrictions

Siting characterization studies have already been completed covering areas such as integration into the grid, geology and tectonic characteristics, seismology, heat removal capability, hydrology, demography, meteorology, environmental issues, external hazards, local infrastructure, access, legal issues, and security.

The main ENEC objective in site evaluation for nuclear installations in terms of nuclear safety is to protect the public and the environment from the radiological consequences of radioactive releases due to accidents. Draft siting regulation FANR REG-02 requires the following aspects to be considered by ENEC during the evaluation of the suitability of a site for nuclear installations:

- requirements for hazards associated with external natural and human induced events
- requirements for determining the potential effects of the nuclear facility in the region
- requirements derived from considerations of population and emergency planning
- specific requirements for evaluation of external events such as: earthquakes, surface faulting, meteorological events, tornadoes, sandstorms, flooding
- geotechnical hazards
  - slope instability
  - site surface
  - soil liquefaction
  - behaviour of foundation materials
- external human induced events

    - aircraft crashes
    - chemical hazards
    - human induced events
- electrical grid availability
- water availability
- atmospheric dispersion of radioactive material
- dispersion of radioactive material through surface water
- dispersion of radioactive material through groundwater
- population distribution
- uses of land and water in the region
- ambient radioactivity
- monitoring of hazards and industry experience

## 17.2 Impact of the Installation on People and the Environment

The main purpose of the site evaluation process is to ensure the protection of the public and environment from the radiological consequences of radioactive releases due to normal operation and accidents. In the evaluation of the suitability of a location as a site for a NPP, the following aspects are considered:

- effects of external events (natural in origin or human induced) occurring in the region or at the particular site and any results to the surroundings from the NPP
- characteristics of the site and its environment that could influence the transfer of released radioactive material to individuals or to the environment
- population density, population distribution and other characteristics of the external zone and how these characteristics may affect risk to individuals or the public and the effects on implementation of emergency measures
- integrated risk of the site based on the maximum number of NPPs to be located at the site

On 31 March 2010, ENEC submitted to EAD its Strategic Environmental Assessment (SEA) pertaining to the preferred site location at Braka in Abu Dhabi. The SEA is a Master Plan level document that addresses the environmental impacts of the project and includes information on mitigation measures and monitoring programmes. The study also addresses the construction activities on site.

## 17.3 Re-evaluation and Monitoring of Site Related Factors

The UAE, as a Contracting Party, will establish measures to continuously monitor and verify that site and plant characteristics remain within the assumptions used in the design and the safety analysis report throughout the life of the NPP units.

### 17.3.1 Monitoring Safety Impacts on the NPP from Site-Related Factors

Site characteristics monitoring will continue throughout the lifetime of the nuclear facility in accordance with various monitoring programmes for water quality (both

ground water and sea water), ecology (both terrestrial and marine), local and regional population growth and demographics, meteorology and air quality, noise and non-radiological waste. Each monitoring programme will describe monitoring requirements during pre-construction, construction and operation, and will be expanded and updated to include operational monitoring of radiological waste. Parameters will continue to be monitored and changes will be evaluated with consideration toward mitigative measures should site characteristics changes affect safety margins.

### 17.3.2 Monitoring Safety Impacts at the Site from the NPP

NPP unit impact monitoring will continue throughout the lifetime of the nuclear facility in accordance with established monitoring programmes and in accordance with the safety analysis report, including for example, gaseous, liquid and solid radioactive effluent monitoring programmes and other radioactive releases from the NPP.

## 17.4 Consultation with other Contracting Parties likely to be Affected by the Installation

The UAE is fully aware of its obligation to consult other neighbouring Contracting Parties and to provide them with all relevant information, as provided under Article 17.4 of the CNS. While no specific arrangements in this respect have yet been agreed, the UAE is determined to pursue forthwith this objective aiming at the conclusion of bilateral agreements or other suitable arrangements with the various countries concerned to meet the requirements of the Convention. The Gulf Cooperation Council, which membership includes Bahrain, Kuwait, Oman, Qatar, Saudi Arabia in addition to the UAE, provides a framework for consultations on this matter.

# Article 18. Design and Construction

**CNS Text:**

*Each Contracting Party shall take the appropriate steps to ensure that:*

*i. the design and construction of a nuclear installation provides for several reliable levels and methods of protection (defence in depth) against the release of radioactive materials, with a view to preventing the occurrence of accidents and to mitigating their radiological consequences should they occur;*

*ii. the technologies incorporated in the design and construction of a nuclear installation are proven by experience or qualified by testing or analysis;*

*iii. the design of a nuclear installation allows for reliable, stable and easily manageable operation, with specific consideration of human factors and the man-machine interface.*

**Discussion:**

## 18.1 Implementation of Defence in Depth

### 18.1.1 Overview

In accordance with FANR guidance, FANR-ENEC-OPR-0005/2010, "Guidance for an Application for a License for the Preparation of a Site for the Construction of a Nuclear Facility" (18 February 2010), ENEC submitted its site preparation licence application, "Request for Site Preparation License, UAE Nuclear Power Plants Units 1, 2, 3 and 4." The Site Preparation Licence application, the second of ENEC licenses after the Site Selection Licence as per Nuclear Law, includes requests for work authorization limited to SSCs not related to nuclear safety and work that will not impact future permanent plant work such that nuclear safety will not be jeopardized (subject to FANR approval).

An assessment of nuclear safety hazards associated with the site preparation activities provides justification that the list of preparation activities proposed will have no impact on nuclear safety functions and will not adversely affect safety-related equipment or SSCs.

The design of the plant will be adopted from the KEPCO Advanced Pressurized Reactor (APR)-1400 design with UAE specific design changes. Changes to the certified design will warrant original safety analysis to ensure that safety is maintained at a high level. In addition to a comprehensive Independent Safety Verification (ISV) of departures from the referenced design performed by a third party, a safety assessment of each design change will be conducted by ENEC and provided to FANR for review with the licence application. The APR1400, licenced by the KINS is an evolutionary design implementing lessons learned and modern technologies adding to the safety of the already proven Korean light water reactor designs. The Korean design has proven to be safe and reliable and in many cases producing world leading metrics for nuclear safety and operational capacity factors.

The Construction Licence Application (CLA) submitted by ENEC will be based on the Preliminary Safety Analysis Report (PSAR) that has been reviewed by Korea Institute of Nuclear Safety and has resulted in the issuance of a licence to construct at Korea's Shin-Kori 3 and 4.

The Nuclear Law stipulates that the manufacturing and assembly of nuclear safety-related SSCs are FANR regulated activities. In accordance with FANR guidance, FANR-ENEC-OPR-003/2010, "Guidance for An Application for a License for Parts and Stages of Construction of a Nuclear Facility" (17 January 2010), and draft FANR-REG-06, "Regulation for an Application for a License to Construct a Nuclear Facility" (03 February 2010), on 21 April 2010 ENEC submitted its limited construction licence application, "Request for a Limited Construction License for Manufacturing and Assembling Nuclear Safety Related Equipment, UAE Nuclear Power Plants Units 1, 2, 3 and 4."

The KEPCO scope on this Project covers engineering, procurement, construction, fuel, and operations and maintenance support. Besides KEPCO and several of its subsidiaries, the consortium includes Hyundai Engineering & Construction, Samsung C&T, Doosan Heavy Engineering, and Westinghouse. The KEPCO subsidiaries have the roles in the Project as indicated in Table 18-1.

| *KEPCO Subsidiary* | *Project Role* |
|---|---|
| Korea Hydro & Nuclear Power Company | Engineering, procurement, construction and operations |
| Korea Power Engineering Company | Nuclear plant design and engineering services |
| Korea Nuclear Fuel Company | Nuclear fuel |
| Korea Plant Service and Engineering Company | Plant maintenance |

**Table 18-1, KEPCO Subsidiary Project Roles**

### 18.1.2 Legislation

The Nuclear Law includes provisions in NLA (11) and (32) for FANR to exercise regulatory control to review, assess and inspect design and construction activities. It also includes provisions in NLA (43) for applicants or licensees to perform comprehensive and systematic safety assessments of the design and construction.

### 18.1.3 UAE Regulations

Draft FANR regulation, FANR REG-03, "Design of Nuclear Power Plants," specifies the regulatory requirements for NPP design and engineering activities, and is consistent with IAEA Safety Requirements NS-R-1, "Safety of Nuclear Power Plants: Design."

Draft FANR PRA regulation, FANR REG-05, "Application of Probabilistic Risk Assessment at Nuclear Facilities," Article (5), states that the PRA will be used to assess the safety of the Nuclear Facility, establish performance goals for safety significant SSCs, and compare the NPP risk with FANR probabilistic targets.

Draft FANR regulation, FANR REG-06, "Regulation for an Application for a Licence to Construct a Nuclear Facility," requires an applicant in its application to FANR for a construction licence to provide information necessary to demonstrate that the proposed NPP units will be designed and constructed in compliance with the applicable UAE Federal Law and FANR regulations. An applicant or licensee must submit with its application the PSAR containing the detailed evidence of safety for the design and construction of the NPP units. The PSAR provides a primary basis for the FANR regulatory decision whether or not to grant a Construction Licence.

Draft FANR regulation, FANR REG-14, "Regulation for an Application for a Licence to Operate a Nuclear Facility," requires an applicant in its application to FANR for an operating licence to provide information necessary to demonstrate that the proposed NPP units will be commissioned and operated in compliance with the applicable UAE Law and FANR regulations. An applicant must submit with its application the Final Safety Analysis Report (FSAR) containing the detailed evidence of safety for commissioning and operation of the NPP units. The FSAR provides a primary basis for the FANR regulatory decision whether or not to grant an Operating Licence, and if granted, based upon which conditions.

Draft FANR regulations, FANR REG-06 and FANR REG-14 allow applicants to apply for a Limited Construction Licence and a Limited Operating Licence, depending upon the scope requested in the applications.

### 18.1.4 Multiple Levels of Safety for Design and Construction

The FANR design regulation uses the term defence in depth based on the IAEA Glossary of Terms. The defence in depth design concept is based on a hierarchical deployment of different levels of diverse equipment and procedures to prevent the escalation of anticipated operational occurrences and to maintain the effectiveness of physical barriers placed between a radiation source and workers, members of the public, or the environment.

The draft FANR Design regulation, FANR REG-03, Article (7), provides defence in depth design requirements. The defence in depth design process provides:

- multiple physical barriers to the uncontrolled release of radioactive materials to the environment;
- sufficient safety margin and high quality construction so as to provide confidence that plant failures and deviations from normal operations are minimised and accidents prevented;
- control of NPP behaviour during and following events, using inherent and engineered features and consideration of less complex, highly reliable, passive safety features that can also reduce reliance on support systems and operator actions during and following events;
- supplementing control of the plant, by the use of automatic activation of safety systems to minimize operator actions;
- equipment and procedures to control the course and limit the consequences of accidents; and
- multiple means for ensuring that each control for reactivity, heat removal, inventory and confinement of radioactive materials is performed, thereby ensuring the effectiveness of the barriers and mitigating the consequences of any events.

Defence in depth design should prevent, as far as practicable, challenges to the integrity of physical barriers, failure of a barrier when challenged, and failure of a barrier as a consequence of failure of another barrier. The design will be such that the first, or at most the second, level of defence is capable of preventing escalation to accident conditions for all but the most improbable events.

### 18.1.5 Prevention and Mitigation of Accidents

The following are examples of accident prevention capabilities of the APR-1400 design:

- The reactor core is designed so that in the power operating range, the net effect of the prompt inherent nuclear reactivity characteristics tends to compensate for a rapid increase in reactivity. The reactor core is also designed to assure that power oscillations which can result in conditions exceeding

specified acceptable design limits are not possible, or can be readily suppressed.

- The reactor coolant pressure boundary is designed to have an extremely low probability of abnormal leakage and gross rupture. If any leakage of the reactor coolant takes place, it is promptly detected to prevent against proceeding to a severe accident. It is also designed to permit periodic inspection and testing to assess the structural integrity and leak-tightness.

The following are examples of the accident mitigation capabilities of the APR-1400 design:

- The emergency core cooling system is designed to automatically provide abundant emergency core cooling following any loss of reactor coolant at a rate such that any fuel damage that could interfere with continued effective core cooling is prevented. Even if the off-site power is lost, the necessary power will be supplied from reliable emergency diesel generators.
- The reactor containment is designed so that if any accident occurs, the radioactive material released from the reactor coolant pressure boundary is confined and reduced over a long period. A system is installed in the containment to control the concentration of any combustible gas as it accumulates inside. The safety features including the containment spray system are reflected in the design to lower the pressure inside the reactor containment and to reduce the level of radioactivity.
- The Emergency Response Facility (ERF) is installed so that if any radioactive material is accidentally released outside the NPP, the radioactive effect on the nearby population and the contamination to the environment can be managed and minimized. The ERF consists of the Technical Support Centre (TSC), the Operations Support Centre (OSC), and the Emergency Operating Facility (EOF). A Safety Parameter Display System (SPDS) is installed in the main control room, in the TSC, and in the EOF, so that major safety parameters are promptly recognized.

## 18.2 Proven Technologies

ENEC has adopted a basic principle that technologies incorporated in the design must be duly proven by experience, or qualified by testing or analysis. All nuclear installations under construction in the UAE are to be designed with technologies proven by operating experiences outside of the country.

### 18.2.1 Reference Nuclear Facility

Draft FANR REG-06 requires ENEC to provide in the construction licence application detailed safety information about the reference NPP, the Korean APR1400, including information from the APR1400 safety analysis report used by the Koreans to licence this design. The Korean nuclear industry developed the APR1400 over a 10-year period, beginning in 1992. The APR1400 is an evolutionary Generation III, pressurized water reactor with its origins in the Combustion Engineering (CE) System 80+ model. It offers enhanced seismic safety and has a 60-year design life. The first two reactors, Shin-Kori-3 and -4, are now under construction and will serve as the reference NPPs for the UAE programme. The

design will be supplemented with changes required to adapt to climatic conditions in the UAE and to any specific requirements of FANR.

### 18.2.2 Independent Safety Verification and Modifications to Reference Design

FANR must confirm that ENEC has performed its own Independent Safety Verification (ISV) and has reached conclusions from its safety review that are consistent with the conclusions in the safety evaluation report prepared by the KINS. ENEC's ISV safety conclusions must demonstrate the acceptability of the referenced design for construction and operation in UAE, and provide information relating to the comparison between the proposed UAE design and the referenced NPP design approved by the KINS, including, as described in Draft FANR Regulatory Guide FANR-RG-001, "Content of Nuclear Facility Construction and Operating Licence Applications:"

- A comparison of the applicable FANR requirements and acceptance criteria to the KINS requirements and acceptance criteria with an explanation as to why compliance with these criteria is sufficient to demonstrate compliance with FANR's requirements;
- Identification of any design or operational related changes that have been made to the SSC or area proposed for reliance from what was reviewed and accepted by the KINS, including an explanation as to their impact on compliance with FANR requirements;
- Identification of any design or operational related changes that have been made to the SSCs that rely on the reference plant design from what was reviewed and accepted by the KINS, including an explanation as to their impact on compliance with FANR requirements;
- Confirmation that the design conditions (e.g. temperature, humidity, design life, seismic, operational characteristics) for the SSCs that rely on the reference plant design envelop the conditions expected in the UAE;
- Confirmation that the technology licenced by the KINS is the same as that proposed for the UAE;
- Confirmation that the risk significance of the SSCs or area proposed for reliance has not substantially changed from the contribution to risk in the reference plant design; and
- An Independent Safety Verification of the above conclusions.

## 18.3 Design for Reliable, Stable, and Manageable Operation

FANR's draft design regulation, FANR REG-03, in Article (4) requires that important to safety SSCs be designed according to codes and standards proven by experience and analysis, and tested to be consistent with the plant reliability goals necessary for safety. Articles (25) through (30) of this regulation specifically relate to reliability as it pertains to design consideration of common cause failures, single failure criterion, fail-safe design, reliability of auxiliary services, testing and equipment outages, and the consideration of reliability for harsh environmental conditions.

See Article (12) of this National Report for specific considerations of human factors and the human-machine interface.

## Article 19. Operation

**CNS Text:**

*Each Contracting Party shall take the appropriate steps to ensure that:*

i. *the initial authorization to operate a nuclear installation is based upon an appropriate safety analysis and a commissioning programme demonstrating that the installation, as constructed, is consistent with design and safety requirements;*

ii. *operational limits and conditions derived from the safety analysis, tests and operational experience are defined and revised as necessary for identifying safe boundaries for operation;*

iii. *operation, maintenance, inspection and testing of a nuclear installation are conducted in accordance with approved procedures;*

iv. *procedures are established for responding to anticipated operational occurrences and to accidents;*

v. *necessary engineering and technical support in all safety-related fields is available throughout the lifetime of a nuclear installation;*

vi. *incidents significant to safety are reported in a timely manner by the holder of the relevant licence to the regulatory body;*

vii. *programmes to collect and analyse operating experience are established, the results obtained and the conclusions drawn are acted upon and that existing mechanisms are used to share important experience with international bodies and with other operating organizations and regulatory bodies;*

viii. viii. *the generation of radioactive waste resulting from the operation of a nuclear installation is kept to the minimum practicable for the process concerned, both in activity and in volume, and any necessary treatment and storage of spent fuel and waste directly related to the operation and on the same site as that of the nuclear installation take into consideration conditioning and disposal.*

**Discussion:**

Because the UAE nuclear development programme is still in its early stages, many of the provisions of CNS Article (19) will be implemented in practice at a future date. However, the UAE has taken steps to ensure that appropriate measures are taken from the outset to meet the obligations set forth in this Article.

The UAE nuclear energy programme is currently not at the operating stage, but rather the construction stage. ENEC plans to submit to FANR an operating licence application that will be based on an approved operating licence that will have been previously reviewed, found to meet international standards and resulted in the issue of an operating licence by KINS. The content of the ENEC operating licence application will meet appropriate international standards and regulations, as well as UAE-specific regulations and guides issued by FANR.

## 19.1 Initial Authorization

Draft regulation FANR REG-14, "Regulation for an Application for a Licence to Operate a Nuclear Facility," requires a comprehensive FSAR to be submitted for review of the operating licence application. This regulation also requires the detailed description of a commissioning programme that describes the details of the programme, including commissioning tests and activities, organisations and responsibilities, staffing qualifications, test schedules and durations, test results, reporting obligations, operating procedure development, and programme change processes.

## 19.2 Operational Limits and Conditions

Draft regulation FANR REG-14 requires that operational limits and conditions (OLCs) in the form of controls, limits, conditions, and rules that form the basis on which the licensee is authorized to operate the plant be submitted for an application to operate a NPP. It requires that OLCs be developed with a systematic approach based on the safety analyses and, where appropriate, justified by means of a PRA.

Each operating NPP in the UAE will have Technical Specifications providing operational limits and conditions derived from the safety analysis, tests and operational experience derived from the Korean reference plants. FANR will independently review and authorize for use the Technical Specifications as they will be supplied as part of the FSAR in the application for an operating licence. Safe boundaries for operation of the UAE plants will have already been proven by the review and approval by Korean Institute for Nuclear Safety and subsequent issue of the operating licence for Shin-Kori 3&4. Any operational experience gained from Shin-Kori 3&4 will be incorporated into the operational limits contained in the Technical Specifications including updates to the safety analysis and tests planned for the UAE NPPs.

## 19.3 Procedures for Operation, Maintenance, Inspection and Testing

NLA (43) establishes the provision that the licensee issue procedures concerning the performance of its activities, especially for the operation, maintenance, surveillance and testing of selected equipment. These procedures must be in line with the approved limits and conditions for safe operation and with the approved Quality Assurance programmes. Additionally, the licensee must update and amend these procedures.

## 19.4 Procedures for Responding to Anticipated Operational Occurrences and Accidents

In accordance with NLA (43.8), the licensee will issue procedures for operation of the nuclear plant, which will include procedures for anticipated operational occurrences and accidents. These procedures will be verified to be available and adequate before the issuance of an operating licence.

## 19.5 Engineering and Technical Support

The UAE commitment to the long term availability of expertise, including a skilled cadre of nuclear engineers, technicians and regulatory personnel, was made clear in

the Nuclear Policy regarding the development and funding of human resource capabilities as described in Article 11.2 of this National Report.

### 19.6 Reporting of Incidents Significant to Safety

Several provisions in Nuclear Law establish the obligation of a licensee to promptly and fully report to FANR any incidents or accidents relevant for safety. For example, NLA (24.7) mandates that any licence issued by FANR shall specify requirements for incident reporting. NLA (29) requires the operator to provide FANR with any information the Authority deems necessary to perform its duties, which must be taken to include incident response. NLA (39.2) requires persons holding licences to possess nuclear materials to notify FANR and other relevant competent authorities, without delay, of any loss or misappropriation of such materials or any accident that could lead to the violation of the integrity of regulated materials. NLA (54.1) requires licensees to immediately notify FANR of any accident at an installation.

ENEC will implement reporting of incidents significant to safety. Upon receipt of licences these reports will be provided to FANR in a timeframe and layout determined adequate by FANR.

### 19.7 Operational Experience Feedback

The Nuclear Law specifically identifies evaluation of operating experience as a FANR responsibility (NLA (5.22)). Also, the Nuclear Law requires FANR to establish requirements for systematic safety assessment or periodic safety review for the purpose of informing the operator to ensure compliance with relevant regulatory standards and requirements (NLA (5.23)). The operator is further required to perform a systematic safety assessment or a periodic safety review over the lifetime of a facility (NLA (29.2)).

ENEC will develop and implement an operating experience review programme commensurate with international standards and guidelines. This experience review programme will collect and analyse information and data obtained from international nuclear operating plant experience. The ENEC operating experience review programmes will also disseminate experience and lessons-learned from the operation of its civil NPPs. ENEC will implement FANR regulations and guides relevant to the operating experience programme. ENEC will participate with the international community in conferences, programmes and other interface activities whereby the exchange of information is beneficial to ENEC as receiving the information and beneficial to the participants with ENEC who seek to gain experience from ENEC experience.

### 19.8 Management of Spent Fuel and Radioactive Waste on the Site

Chapter 8 of the Nuclear Law (NLA (40-42)) addresses issues of radioactive waste and decommissioning. NLA (40.1) affirms the responsibility of licensees to safely manage and store radioactive waste from its generation until delivery to an entity designated by the UAE Cabinet to manage disposal of such material. NLA (40.3) requires FANR is to adopt rules for safe management of radioactive waste. NLA (41) provides that the UAE Cabinet will issue a policy regarding long-term management of spent fuel and nuclear waste. Importation of spent fuel and nuclear waste into the UAE is prohibited under NLA (41.3). NLA (42) establishes a legal regime for decommissioning of nuclear installations, including establishment by the UAE

Cabinet of a Decommissioning Trust Fund to be financed through fees collected from licensees.

# IV. Conclusion

The discussion contained in this first UAE CNS *National Report* of actions taken by the UAE, as a Contracting Party, regarding the obligations under relevant articles of the CNS confirms a conscientious and systematic effort by relevant bodies in the UAE to fully implement these provisions in developing the UAE programme for the peaceful uses of nuclear energy. Even at this early stage in the programme, the UAE government has recognized the need to put into place the necessary legislative, regulatory, and organizational framework to ensure the safety, security and environmental acceptability of the technology being used. This *National Report* is the first CNS report submitted by the United Arab Emirates and, thus, reflects the fact that additional measures will be needed over the coming months and years as the programme evolves and progresses. Relevant UAE organizations are fully committed to meeting the obligations of this CNS and actively participating in the peer review process established under the Convention. The UAE has adopted a policy of transparency regarding its nuclear programme and will continue to make available a full range of information on how it is meeting its responsibilities to ensure safety, security and safeguards in the future. The UAE looks forward to receiving the questions and comments of other CNS Contracting Parties on this *National Report* and is committed to clarifying any issues raised both in its responses to questions or comments and during the April 2011 CNS review meeting.

# ANNEX 1 – List of Acronyms

| | |
|---|---|
| APR | Advanced Pressurized Reactor |
| ASME | American Society of Mechanical Engineers |
| CEMP | Construction Environmental Management Plan |
| CEP | Construction Environmental Permit |
| CL | Construction Licence |
| CLA | Construction Licence Application |
| CNIA | Critical National Infrastructure Authority |
| CNS | Convention on Nuclear Safety |
| EAA | Executive Affairs Authority of Abu Dhabi |
| EAL | Emergency Action Level |
| EAD | Environmental Agency of Abu Dhabi |
| EIA | Environmental Impact Assessment |
| ENEC | Emirates Nuclear Energy Corporation |
| EOF | Emergency Operating Facility |
| EPRI | Electric Power Research Institute |
| EQAM | ENEC Quality Assurance Manual |
| ERF | Emergency Response Facility |
| FANR | Federal Authority for Nuclear Regulation |
| FSAR | Final Safety Analysis Report |
| GCC | Gulf Cooperation Council |
| HRD | Human Resources Development Service of Korea |
| IAB | International Advisory Board |
| IAEA | International Atomic Energy Agency |
| IAT | Institute of Applied Technology |
| IDP | Individual Development Programme |
| IFRS | International Financial Reporting Standards |
| IMS | Integrated Management System |
| INIR | Integrated Nuclear Infrastructure Review |
| ISV | Independent Safety Verification |
| KAIST | Korea Advanced Institute of Science and Technology |
| KDI | Korea Development Institute |
| KEPCO | Korea Electric Power Corporation |
| KINS | Korea Institute of Nuclear Safety |
| KM | Knowledge Management |
| KUSTAR | Khalifa University of Science, Technology and Research |
| LWR | Light Water Reactor |
| MOU | Memorandum of Understanding |
| MW | Megawatt |

| | |
|---|---|
| NCEMA | National Crisis and Emergency Management Authority |
| N-EIA | Nuclear Environmental Impact Assessment |
| NEPIO | National Energy Program Implementation Organization |
| NLA | Nuclear Law Article(s) |
| NPP | Nuclear Power Plant |
| NPT | Non-Proliferation Treaty |
| NRC | US Nuclear Regulatory Commission |
| NRCB | National Regulatory Capacity Building |
| NRP | National Response Plan |
| OEP | Operation Environmental Permit |
| OL | Operating Licence |
| OLA | Operating Licence Application |
| OLC | Operational Limits and Conditions |
| OSC | Operations Support Centre |
| PRA | Probabilistic Risk Assessment |
| PSAR | Preliminary Safety Analysis Report |
| SEA | Strategic Environmental Assessment |
| SPDS | Safety Parameter Display System |
| SSC | Structure, Systems, and Component |
| TOR | Terms of Reference |
| TSC | Technical Support Centre |
| TSO | Technical Support Organisations |
| WANO | World Association of Nuclear Operators |