UNITED ARAB EMIRATES

THIRD NATIONAL REPORT ON COMPLIANCE WITH THE OBLIGATIONS OF THE JOINT CONVENTION ON THE SAFETY OF SPENT FUEL MANAGEMENT AND ON THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT

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Contents

List of Acronyms

ADWEA	Abu Dhabi Water and Electricity Authority
APR	Advanced Pressurised Water Reactor
CFSI	Counterfeit, Fraudulent, and Suspect Items
CSS	Commission on Safety Standards
DOE	Department of Energy
DTF	Decommissioning Trust Fund
EAD	Environment Agency—Abu Dhabi
EAL	Emergency Action Levels
ECL	Emergency Classification Levels
ENEC	Emirates Nuclear Energy Corporation
EPR	Emergency Preparedness and Response
EPREV	Emergency Preparedness Review
EPRI	Electric Power Research Institute
FANR	Federal Authority for Nuclear Regulation
FSAR	Final Safety Analysis Report
GDF	Geological Disposal Facility
GNEII	Gulf Nuclear Energy Infrastructure Institute
HAAD	Health Authority Abu Dhabi
HLW	High Level Radioactive Waste
HRD	Human Resources Development
ILW	Intermediate Level Radioactive Waste
IMS	Integrated Management System
INIR	Integrated Nuclear Infrastructure Review
IPPAS	International Physical Protection Advisory Service
IRRS	Integrated Regulatory Review Service
ISFSI	Independent Spent Fuel Storage Installation
ISSAS	IAEA State Systems of Accounting for and Control of Nuclear Material (SSAC) Advisory Service
ISV	Independent Safety Verification
JLOC	Joint Local Operation Centre
KEPCO	Korea Electric Power Company
KM	Knowledge Management

LLW	Low Level Radioactive Waste
MOI	Ministry Of Interior
Nawah	Nawah Energy Company
NCEMA	National Emergency Crisis and Disaster Management Authority
NEI	Nuclear Energy Institute
NOC	National Operation Centre
NORM	Naturally Occurring Radioactive Material
NPP	Nuclear Power Plant
NQAP	Nawah Quality Assurance Program
NRCB	National Regulatory Capacity Building
NS	Near-Surface
NSGC	Nuclear Security Guidance Committee
NSRWDF	Near-Surface Radioactive Waste Disposal Facilities
Nuclear Law	UAE Federal Law by Decree No. 6 of 2009
NUPIC	Nuclear Procurement Issues Committee
NUSSC	Nuclear Safety Standards Committee
ORPAS	Occupational Radiation Protection Appraisal Service
OSART	Operational Safety Review Team
PJSC	Private Joint Stock Company
QA	Quality Assurance
QMS	Quality Management System
RAIS	Regulatory Authority Information System
RASSC	Radiation Safety Standards Committee
RPC	Radiation Protection Committee
SARCoN	Systematic Assessment of Regulatory Competence Needs
SER	Safety Evaluation Report
SSDL	Secondary Standard Dosimetry Laboratory
TSO	Technical Support Organisation
UAE	United Arab Emirates
USNRC	United States Nuclear Regulatory Commission
WMO	Waste Management Organization

Section A. Introduction

A.1 This is the Third National Report of the United Arab Emirates (UAE) that has been prepared in accordance with the Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management for review at the Sixth Review Meeting of the Convention to be held in May 2018. This National report describes the legislative, regulatory, and administrative measures and other steps taken by the UAE to fulfil its obligations as a Contracting Party to the Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

The structure of the report is based on IAEA Information Circular INFCIRC/604/Rev.3 "*Guidelines regarding the Form and Structure of National Reports*.

As was the case with the UAE's Second National Report submitted to the Fifth Review Meeting held in May 2015 this Third National Report is a collective effort of various national organisations including the Federal Authority for Nuclear Regulation (FANR), the Emirates Nuclear Energy Corporation (ENEC), the National Emergency, Crisis and Disaster Management Authority (NCEMA), the Environment Agency—Abu Dhabi (EAD) and other leading organisations.

The UAE appreciates the opportunity to participate in the Sixth Review Meeting of the Parties to the Convention and looks forward to contributing to the discussion.

A.2 In July 2012 FANR issued Construction Licences for Barakah Units 1 and 2 and in September 2014 FANR issued Construction Licences for Barakah Units 3 and 4. On 26 March 2015, an Operating License Application was submitted for Barakah Units 1 and 2. The Licences to Operate the Barakah Nuclear Energy Plant Units are under consideration by FANR, with a decision expected to be made on the Operating Licence for Unit 1 by the time of the Sixth Review Meeting. Fresh nuclear fuel assemblies intended for Unit 1 have been received and are stored at the Barakah Nuclear Power Plant site, subject to regulatory oversight by FANR.

ENEC is wholly owned by the government of Abu Dhabi. The Barakah project is implemented through two distinct entities: (i) the financing vehicle, Barakah One Company, and (ii) the Operator, Nawah Energy Company (Nawah). Both Barakah One and Nawah are joint ventures between ENEC and the Korea Electric Power Corporation (KEPCO), with KEPCO being a minority shareholder.

On 27 March 2017, an Operating License Application was submitted for Barakah Units 3 and 4. Nawah is the Applicant for the Operating Licenses for Barakah Units 1, 2, 3 and 4. Nawah has the contractual authority and responsibility for the pre-disposal radioactive waste management.

In May 2017, ENEC announced that it has, together with Korea Electric Power Corporation (KEPCO), completed initial construction activities for Unit 1 of the Barakah Nuclear Energy Plant and the turnover of all plant systems to Korea Hydro and Nuclear Power (KHNP) (a subsidiary of KEPCO) for testing and commissioning, in preparation for safety-led nuclear operations.

What is New Since the Last Report

A.3 Since the Fifth Review Meeting, Nawah Energy Company (Nawah) was established as a subsidiary of ENEC in 2016. As a result of the Joint Venture Agreement between ENEC and KEPCO, Nawah is a Private Joint Stock Company (PJSC) with 18% owned by KEPCO and 82% owned by ENEC. Nawah will operate the four

nuclear reactors that form the Barakah Nuclear Power Plant (NPP) and will be generating up to a quarter of the electricity needs of UAE.

A.4 FANR has also continued to focus on development of regulations and guides for the safety of waste management and has issued FANR-REG-21 "*Decommissioning of Facilities*" in 2015 setting the safety requirements for all aspects of planned facility decommissioning from the siting and design of a facility to the termination of the licence.

Two other regulations are drafted FANR-REG-22 "*Decommissioning Trust Fund*" and "FANR-REG-27 "*Disposal of Radioactive Waste*", and supporting regulatory guide FANR-RG-027 "*Near-Surface Disposal of Radioactive Waste*"

A.5 The UAE has continued to cooperate extensively with the IAEA through hosting several missions and safety services since the Fifth Review Meeting. At the request of the Government of the UAE, a follow-up IRRS mission took place in February 2015. The purpose of the follow-up mission was to review the measures undertaken by the UAE to respond to the recommendations and suggestions from the initial IRRS mission conducted in 2011. In addition, the follow-up mission was extended to include a review of the transport of radioactive material.

An Emergency Preparedness Review (EPREV) mission was conducted by the IAEA in the UAE in March 2015. The specific purpose of the EPREV mission was to review emergency preparedness and response (EPR) arrangements and capabilities associated with the Barakah Nuclear Power Plant based on the IAEA Safety Standards. In addition, at the UAE's request, an Occupational Radiation Protection Appraisal Service (ORPAS) mission was conducted in November 2015 to review the regulatory framework and practical implementation of occupational radiation protection arrangements in the nation.

An International Physical Protection Advisory Service (IPASS) mission took place in November 2016.
The UAE has also requested a preoperational Operational Safety Assessment Review Team (OSART) mission prior to start-up of the first unit at the Barakah NPP.

An Education and Training Appraisal (EduTA) mission was conducted by the IAEA in August 2017. The objectives of the mission were:

- To carry out a detailed appraisal of the status of the provisions for education and training in radiation protection and the safety of radiation sources;
- To identify areas in education and training, where the provisions should be improved to meet (i) the IAEA safety standards, (ii) the national education and training needs;
- To provide the host Member State with recommendations and suggestions for improvement;
- To provide key staff in the host Member State with an opportunity to discuss the legislative framework and the national policy and strategy in the field, with the EduTA team members who have experience in the issues at stake.

Annex C Lists references to official national and international reports related to safety.

A.6 Table A-6 presents an overview of the UAE programme for management of radioactive waste with references to the relevant sections of this national report.

Table A-6 Overview - UAE programme[1]

Type of Liability	Long-term management policy	Funding of Liabilities	Current practice / Facilities	Planned facilities
Spent fuel	'Reference Scenario' of direct disposal in a Geological Disposal Facility (GDF) in the UAE. Other options to be kept under review.	Annual Contributions by Nuclear Facility operator to 'Decommissioning Trust Fund' (DTF), to fund siting, construction, operation, closure and institutional control.	Storage in Spent Fuel Pool (20 years available).	On-site Interim Spent Fuel Storage Installation (ISFSI) to be constructed. GDF to come into operation 90 years after start of commercial operation.
See section	B.1-B3, F.5, F23, Table K.5	B.5, F4-F.6, F.8, F.38-F.39	B.4	B.4, G.8, G.14, G.18
Nuclear fuel cycle radioactive waste	LLW from Barakah NPPs Disposal in UAE near-surface (NS) repository.	Construction of NS repository and disposal after operation funded through DTF. Disposal during operation is an operating cost (paid by operator on a unit cost basis).	On-site storage facility for LLW (10 years of storage for all 4 Barakah Units)	Near-surface repository to be constructed and available prior to 10 years of On-site storage being filled. Alternatively build or extend current storage building.
	ILW from Barakah NPPs Disposal in the GDF with the spent nuclear fuel	Annual Contributions by Nuclear Facility operator to 'Decommissioning Trust Fund' (DTF).	ILW storage on-site for the life of the plant	Construct additional storage building or extend existing, prior to storage being filled.
See section	B.3, B.5, F.5, H.7	B.5, H.2, H.3	B.8	H.2, H.3
Decommissioning	Decommissioning to commence immediately after operation ceases. Decommissioning waste to be disposed of in NS repository and GDF as necessary	Annual Contributions by Nuclear Facility operator to 'Decommissioning Trust Fund' (DTF)	N/A	Interim storage facility for IL decommissioning waste
See section	B.5, D.6-D.7	B.5, F4-F.6, F.8, F.38-F.39		D.7
Application waste	NORM treatment and disposal.	NORM treatment and disposal is funded by waste generator	NORM treatment and disposal facility under licencing process.	N/A
See section	B.6	B.5, D.4, F.1	B.7, C.3, D.5	

[1] The statements on the UAE radioactive waste management programme for NPPs elaborate on the commitments made in the 'Policy of the United Arab Emirates on the Evaluation and Potential Development of Peaceful Nuclear Energy'.

Disused Sealed Sources	Disused Sealed Sources Return to the manufacture. Orphan Source Strategy (Storage of orphan sources.)	Licensee's bear costs Orphan source storage is a Government cost.	Return disused sealed sources to the manufacturer Orphan source store.	N/A N/A
See section	B.6, B.7, D.4	J.2	J.2	

Section B. Policies and Practices

Article 32.1: Reporting

In accordance with the provisions of Article 30, each Contracting Party shall submit a national report to each review meeting of Contracting Parties. This report shall address the measures taken to implement each of the obligations of the Convention. For each Contracting Party the report shall also address its: (i) spent fuel management policy (ii) spent fuel management practices (iii) radioactive waste management policy (iv) radioactive waste management practices (v) criteria used to define and categorize radioactive waste

Spent Fuel Management Policy

B.1 The UAE Policy Paper (referenced in Annex B) sets out several important commitments that bear on the development of the UAE's spent fuel policy. These commitments include the following;

- Renouncing an intention to develop a domestic enrichment and reprocessing capability and undertaking to source fuel from reliable and responsible foreign suppliers
- Development as required, of a comprehensive waste management system that reflects the highest standard of international practice and which does not include domestic reprocessing
- Issuance of rigorous regulation of the management of spent fuel and radioactive waste management by the national nuclear regulatory authority independently from operators, licensees, Government, and any other body or organization involved in spent fuel or radioactive waste reflecting current international best practices.

These commitments are described in detail in the UAE Policy Paper section 2, pages 9 and 10 and were included in the first UAE National Joint Convention reports.

B.2 The *UAE Nuclear Law* enshrines the commitment to no domestic enrichment and reprocessing and contains provisions related to spent fuel and radioactive waste management policy.

B.3 In considering its spent fuel management strategy the UAE is striving to achieve a suitable balance between keeping options open and establishing a sufficiently concrete planning basis. It seeks to take into account:

- fuel cycle choices (fuel leasing, direct disposal or foreign reprocessing of spent fuel)
- the technologies that are foreseen for waste treatment, storage and disposal
- where waste management facilities might be located (independently or co-located with others)
- when activities must be initiated (as early as possible, technically optimized or delayed for economic optimization) and for how long.

The current reference option for the UAE is direct disposal of spent fuel together with intermediate level radioactive waste (ILW) in a Geological Disposal Facility (GDF) in the UAE. This forms the basis for the planning being undertaken by ENEC/Nawah and FANR and the costing model for the fees to be paid into the DTF.

Spent Fuel Management Practices

B.4 The UAE does not yet have any spent fuel but ENEC and its affiliates have taken the following measures for the future management of spent fuel:

- The design of the Barakah NPP provides sufficient capacity in the spent fuel storage pool for 20 years of operation for each unit.
- ENEC and its affiliates intend to establish an independent spent fuel storage installation (ISFSI) to support on-going NPP operations. The ISFSI will be established before the spent fuel storage pool reaches capacity. A dry storage feasibility study has been conducted to identify the ideal location within the current site boundary for a future dry storage facility. The study also evaluated the existing and planned reactor site infrastructure, including the design of the spent fuel pool and the fuel handling area, to determine any design changes or improvements required at this stage of the project in order to allow safe and efficient transfer of the spent nuclear fuel. The study also evaluated the future transportation path requirements for spent fuel movement from the reactor spent fuel pool to the ISFSI. The requirements and the recommendations of this feasibility study have been implemented and incorporated in the current development and construction of the Barakah NPP site.
- In addition, ENEC and its affiliates are also looking at long-term spent fuel management options for different scenarios.

Radioactive Waste Management Policy

B.5 In addition to the references to radioactive waste management in the *Policy Paper* as stated above, Chapter 8 of the *UAE Nuclear Law* (Articles (40-42)) addresses issues of radioactive waste and decommissioning, where:

- Article (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
- Article (40.2) obliges the licensee to comply with duties and responsibilities for the safe management of radioactive waste determined by the Authority
- Article (40.3) states that the Board of FANR shall by detailed rules determine the requirements, responsibilities and duties for the safe management of radioactive waste
- Article (41.1) states that the UAE Cabinet shall issue a policy regarding long-term management and disposal of spent fuel and nuclear waste and identify the entity in charge of implementing the policy. It also states that the spent fuel and radioactive waste will become property of the state from the time of its delivery to the state or to the entity designated by the Cabinet
- Article (41.2) states that regulations shall specify terms and procedure for waste delivery to the entity designated by the Cabinet, including waste which is not subject to delivery, and the regulation shall also specify time limits for the delivery and fees to be paid by the radioactive waste producers
- Article (41.3) prohibits import of spent nuclear fuel and nuclear waste derived from nuclear energy applications outside the UAE, for the purpose of long term storage or disposal in the UAE's lands and sites.
- Article (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. The fees are to cover the costs of construction, operation and closure of a radioactive waste management facility, decommissioning costs, costs of regulatory oversight and for management of the Trust Fund.

  The current reference option for the UAE is disposal of low-level waste in a near-surface disposal facility in the UAE and disposal of spent fuel and high-level waste in a deep geological facility. This

forms the basis for the planning being undertaken by ENEC/Nawah and FANR and the costing model for the fees to be paid into the DTF.

B.6 The UAE adopts an approach to management of radioactive waste tailored to each particular application. This is described in FANR-REG-11*"Radiation Protection and Predisposal Radioactive Waste Management for Nuclear Facilities"*, FANR-REG-26 "*Predisposal Management of Radioactive Waste"* and the corresponding regulatory guide FANR-RG-018;

- Radioactive waste generated from nuclear facilities that is not authorized to be discharged or cleared from regulatory control will be conditioned and/or packaged for storage and disposal.
- Laboratory and medical waste can be discharged as non-radioactive waste when decayed below clearance levels indicated in FANR-REG-24. The clearance levels adopted by the UAE are the same as those in IAEA GSR Part 3.
- The licensees are required to send disused radioactive sources to their supplier or the manufacturer. If return to manufacturer or reuse are not viable options, then the sources should be managed as radioactive waste and stored locally by the licensee, under the conditions indicated by FANR, until UAE waste acceptance criteria for disposal are developed and published.
- The UAE has developed an Orphan Source Strategy and Action Plan to manage the orphan sources.
- Treatment and disposal of Naturally Occurring Radioactive Material (NORM) contaminated material and waste is assessed on a case by case basis. A NORM treatment and disposal facility license application for NORM arising from oil and gas extraction is under review by FANR and an operating licence is expected to be granted prior to the Sixth Joint Convention Review Meeting.

For FANR-promulgated radioactive waste regulations and guides, see Sections E.8-E.9

Radioactive Waste Management Practices

B.7 Users of radioactive sources are required to return disused sources to the manufacturer. However, some licensees have legacy sources stored on their premises (See Section J). As new arrangement to minimize the potential for orphan sources, FANR does not issue an import permit for a radioactive source if there is no "return to supplier agreement" between the licensee and the manufacturer in place.

FANR Regulation FANR-REG-24, Revision 1 *"Basic Safety Standards for Facilities and Activities involving Ionizing Radiation other than in Nuclear Facilities"* has been issued which permits the clearance of radioactive material from regulatory control. FANR has also issued FANR-REG-26 "*Predisposal Management of Radioactive Waste"* and its corresponding regulatory guide FANR-RG-018 "*Predisposal Management of Radioactive Waste*" to systematize the process of disposal of radioactive waste by the user.

The UAE has 15 medical facilities dealing with nuclear medicine, radiotherapy and teletherapy that are generating small amounts of radioactive waste, usually with very short half-lives. These facilities temporarily store radioactive waste on their premises for a defined period until they decay to activity levels below the limits given in Table I-1 of Schedule 1 of FANR-REG-24. Then the waste is appropriately discharged.

B.8 Activities by ENEC and its affiliates related to radioactive waste management at the Barakah NPP are outlined below:

- ENEC and its affiliates are not currently generating any radioactive waste
- An internal assessment of different strategy options for radioactive waste storage and disposal has been prepared.
- Radioactive waste management includes principles such as:

- Minimization of volume of waste generated from Barakah NPP through effective operations and the use of proven technology
- Storage of low and intermediate level radioactive waste at the Barakah NPP site
- Possible longer term radioactive waste storage through the construction of a separate Low/Intermediate Radioactive waste storage building near the Barakah NPP.

Criteria used to define and categorize radioactive waste

B.9 The *UAE Nuclear Law* defines Radioactive Waste as *"Waste that contains, or is contaminated with, radionuclides at concentrations or activities greater than levels as established by the Authority".*

FANR-RG-018, Article (4) *"Predisposal Management of Radioactive Waste"* classifies radioactive waste based upon the IAEA safety standard GSG-1 "*Classification of Radioactive Waste*" Safety Guide.

Section C. Scope of Application

Article 3: Scope of application

1. This Convention shall apply to the safety of spent fuel management when the spent fuel results from the operation of civilian nuclear reactors. Spent fuel held at reprocessing facilities as part of a reprocessing activity is not covered in the scope of this Convention unless the Contracting Party declares reprocessing to be part of spent fuel management.
2. This Convention shall also apply to the safety of radioactive waste management when the radioactive waste results from civilian applications. However, this Convention shall not apply to waste that contains only naturally occurring radioactive materials and that does not originate from the nuclear fuel cycle, unless it constitutes a disused sealed source or it is declared as radioactive waste for the purposes of this Convention by the Contracting Party.
3. This Convention shall not apply to the safety of management of spent fuel or radioactive waste within military or defence programmes, unless declared as spent fuel or radioactive waste for the purposes of this Convention by the Contracting Party. However, this Convention shall apply to the safety of management of spent fuel and radioactive waste from military or defence programmes if and when such materials are transferred permanently to and manage within exclusively civilian programmes.
4. This Convention shall also apply to discharges as provided for in Articles 4, 7, 11, 14, 24 and 26.

Spent Fuel at Reprocessing Facilities

C.1 A declaration of reprocessing as part of spent fuel management will be considered if the UAE determines that reprocessing of spent fuel outside the UAE is part of its long-term management of spent fuel.

Naturally occurring radioactive material

C.2 The UAE does not declare waste that contains only NORM and that does not originate from the nuclear fuel cycle as radioactive waste for the purpose of the Joint Convention, pursuant to Article 3(2), as long as the NORM is stored at the source location without treatment.

C.3 FANR received in December 2012 an application from a UAE oil and gas producer to construct a treatment and disposal facility for the NORM generated during oil and gas producing processes. The NORM treatment facility is planned to include activities such as decontamination, volume reduction, NORM handling and immobilization of NORM into packages suitable for final disposal in a landfill. The application is under review by FANR. The NORM waste in this planned treatment and disposal facility when operational will be declared as radioactive waste for the purpose of the Joint Convention pursuant to Article 3(2).

Military or defence programmes

C.4 No spent fuel or radioactive waste from military or defence programmes is declared as spent fuel or radioactive waste for the purpose of the Convention pursuant to Article 3(3).

Discharges

C.5 Regulatory requirements have been established to ensure that radioactive discharges shall be limited and consistent with international standards. This is included in Sections G.4, G.16 and H.24 of this report.

Section D. Inventories and Lists

Article 32.2: Reporting

2. This report shall also include:
   (i) a list of the spent fuel management facilities subject to this Convention, their location, main purpose and essential features
   (ii) an inventory of spent fuel that is subject to this Convention and that is being held in storage and of that which has been disposed of. This inventory shall contain a description of the material and, if available, give information on its mass and its total activity
   (iii) a list of the radioactive waste management facilities subject to this Convention, their location, main purpose and essential features
   (iv) an inventory of radioactive waste that is subject to this Convention that:
      (a) is being held in storage at radioactive waste management and nuclear fuel cycle facilities
      (b) has been disposed of or
      (c) has resulted from past practices
      This inventory shall contain a description of the material and other appropriate information available, such as volume or mass, activity and specific radionuclides
   (v) a list of nuclear facilities in the process of being decommissioned and the status of decommissioning activities at those facilities

Spent Fuel Management Facilities and Inventory of Spent Fuel

D.1 At this stage of the UAE civil nuclear energy programme, the UAE has no spent fuel or spent fuel management facilities in operation. Spent fuel pools are under construction at the Barakah NPP.

Radioactive Waste Management Facilities

D.2 Currently there is a NORM handling, treatment and disposal Facility under construction in the UAE. Operating licences for the NORM Treatment Facility and Disposal Facility are expected to be granted by FANR prior to the Sixth Joint Convention Review Meeting.

One storage facility for orphan sources has already been identified, and is under development.

Inventory of Radioactive Waste

D.3 Radioactive sources are used in the UAE in a range of industrial and medical applications. FANR did a waste survey in 2011 which was presented at the Fourth Joint Convention review meeting in May 2012 and no more updated survey has been conducted since then.

D.4 During the licensing or license renewal process, FANR requires the licensees to present a 'take-back' agreement with the supplier or manufacturer when the sources becomes disused. FANR replaced its for keeping an inventory of radiation sources that are in use or disused based on the Regulatory Authority Information System (RAIS) software system with a module in the FANR E-Licensing System. The E-Licensing System became operational in 2016 to provide online access to FANR services related to facilities other than nuclear facilities. Services available in the E-Licensing System comprise an integrated approach to licensing between safeguards, security, and radiation safety departments for licensing, inspection, import/export, inventory keeping, and management of the dose records for occupationally exposed workers.

D.5 The UAE has 15 medical facilities dealing with nuclear medicine, radiotherapy and teletherapy. These facilities have radioactive waste storage measures to store the waste on their premises for a defined period of time until their activity decays to levels below the limits (i.e. clearance levels) given in Table I-1 of Schedule 1 of FANR-REG-24. Then the waste is appropriately discharged. Also, these facilities may implement direct discharge under appropriate controls.

Decommissioning of Nuclear Facilities

D.6 There are no nuclear facilities in the UAE at present that are in the process of being decommissioned.

ENEC has submitted to FANR an operating licence application based on the reference plant that previously was granted an operating licence by the authorities of the Republic of Korea. The operating licence application includes the Final Safety Analysis Report (FSAR) and other supporting documents required by FANR for review. The FSAR includes complete information concerning facility operation, including the organizational structure, responsibilities and authorities, managerial and administrative controls to be used to assure safe operation, plans for start-up testing and initial operations, plans for conduct of normal operations, including maintenance, surveillance, and periodic testing, plans for coping with emergencies, decommissioning plan and proposed technical specifications. The FSAR is the principal document upon which FANR is basing its review and assessment to support a decision to issue an operating licence. An operating licence for Barakah Unit 1 is expected to be granted by FANR by the time of the Sixth Joint Convention Review Meeting.

D.7 An Initial Decommissioning Plan (IDP) for the nuclear power plant was submitted as part of the Operating License Application for Barakah Units 1 and 2 and in accordance with the requirements of FANR-REG-21 "*Decommissioning of Facilities*". The IDP includes cost estimates for the decommissioning of the Barakah units and for disposal of the spent fuel. The IDP decommissioning strategy for Barakah NPP is based on an immediate decommissioning scenario and programme following a 60-year reactor operational lifetime. The IDP assumes that the fuel is used once and not reprocessed; instead, it is stored in interim storage awaiting disposal.

Section E. Legislative and Regulatory System

Article 18: Implementing Measures

> 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.

Steps to Implement Obligations

E.1 The UAE has established the legislative framework needed to implement its obligations under the Joint Convention, principally through the *UAE Nuclear Law.* Articles (11), (38), and (39) of the *UAE Nuclear Law* empower the FANR Board of Management to issue regulations and regulatory guides, which are required for FANR's operation, "*taking into consideration comments from stakeholders, information made available by experts, and internationally recognized standards and recommendations, such as IAEA standards."*

E.2 FANR has established within its Integrated Management System (IMS) a process for establishing and revising regulations and guides that includes provisions for consultation with stakeholders and the public, and review and incorporation of their comments.

E.3 The relevant IAEA safety requirements have served as the basis for many of FANR's regulations. FANR contributes to the development of the IAEA Safety Standards through membership on the Standards Committees. Through its participation on the Committees, FANR has also observed the actions taken by the IAEA to strengthen its safety requirements following the accident at Fukushima-Daiichi.

E.4 An Integrated Regulatory Review Service (IRRS) Mission was conducted by the IAEA in December 2011, covering the UAE regulatory framework for all nuclear activities regulated by FANR. The UAE report on the relevant outcomes of this IRRS mission at the Fourth Review Meeting in May 2012. The IRRS mission to the UAE examined the status of FANR's regulations and confirmed that the regulatory framework development is appropriate for that stage of the programme. The mission noted good practices in the UAE system and also made recommendations and suggestions for the nuclear regulatory authority. This mission also took into account the lessons learned up to that time from the accident at the Fukushima Daiichi Nuclear Power Station. A follow-up IRRS Mission was conducted in February 2015 to review the measures undertaken following the recommendations and suggestions from the initial IRRS mission conducted in 2011. In addition, the follow-up mission was extended to include a review of the transport of radioactive material.

The IRRS Follow-up mission concluded that the recommendations and suggestions made at the time of the initial IRRS mission in 2011 had been taken into account systematically by a comprehensive action plan. Significant progress had been made in many areas and many improvements were carried out following the implementation of the action plan. Specifically, the Team determined that 13 out of 14 recommendations and 30 of 34 suggestions had been effectively addressed and therefore could be considered closed. The Team found that FANR has further strengthened its regulatory oversight and has demonstrated commitment for an effective implementation of the IRRS suggestions and recommendations.

The IRRS missions were also supported by IAEA EPREV mission in 2015, IAEA Occupational Radiation Protection Appraisal Service (ORPAS) mission in 2016, International Physical Protection Advisory Service (IPPAS) mission in 2016, and EduTa per review mission in 2017 in order to identify opportunities for improvement in the field of emergency preparedness and response, occupational radiation protection, and

to assess the national education and training infrastructure, in terms of the legislative framework, national policy and strategy, and training capabilities in radiation protection related to all practices involving exposure to ionizing radiation, and review the legislative and regulatory framework for nuclear security and implementation of the 2005 Amendment to the Convention on the Physical Protection of Nuclear Material (CPPNM).

Article 19: Legislative and Regulatory Framework

1. Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of spent fuel and radioactive waste management.
2. This legislative and regulatory framework shall provide for:
   (i) the establishment of applicable national safety requirements and regulations for radiation safety
   (ii) a system of licensing of spent fuel and radioactive waste management activities
   (iii) a system of prohibition of the operation of a spent fuel or radioactive waste management facility without a licence
   (iv) a system of appropriate institutional control, regulatory inspection and documentation and reporting
   (v) the enforcement of applicable regulations and of the terms of the licences
   (vi) a clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of radioactive waste management.
3. When considering whether to regulate radioactive materials as radioactive waste, Contracting Parties shall take due account of the objectives of this Convention.

The establishment of applicable national safety requirements and regulations for radiation safety

E.5 Article (11) (4) of the *UAE Nuclear Law* gives the Board of Management of FANR the power to establish, develop or adopt regulations and guidelines upon which its regulatory actions are based, including the objective of protecting 'individuals, society and the environment from radiation hazards both for the present and in the future.'

E.6 Article (38) of the *UAE Nuclear Law* specifies that the Board shall issue the regulations specifying the requirements which all operators must comply with and follow.

E.7 The *UAE Nuclear Law* also defines the Regulated Activities for which a Licence is needed. It defines Radioactive Waste as *"waste that contains, or is contaminated with, radionuclides at concentrations or activities greater than the levels as established by the Authority"*.

E.8 FANR has issued or has drafted five regulations containing requirement on management of radioactive waste:

- *FANR-REG-11 "Radiation Protection and Predisposal Radioactive Waste Management for Nuclear Facilities"*
- *FANR-REG-24 (Version 1) "Basic Safety Standards for Facilities and Activities involving Ionizing Radiation other than in Nuclear Facilities"*
- *FANR-REG-21 "Decommissioning of Facilities"*
- *FANR-REG-22 "Decommissioning Trust Fund" (draft)*

- *FANR-REG-26 "Predisposal Management of Radioactive Waste"*
- *FANR-REG-27 "Disposal of Radioactive Waste" (draft)*

For a complete list of FANR Regulations and Guides see Annex B and www.fanr.gov.ae.

E.9 FANR-REG-21, *"Decommissioning of Facilities"* establishes the safety requirements for all aspects of planned facility decommissioning from the planning, siting and design of a facility to the termination of the licence. The regulation covers also the decommissioning financing, the requirement for emergency response arrangements during decommissioning and the management of radioactive waste generated from the decommissioning process.

FANR-REG-22 "*Decommissioning Trust Fund"* will specify the procedures to be followed in relation to the Decommissioning Trust Fund (DTF) and in particular:

- Calculating and collecting the fees to be proposed by FANR to the Cabinet for its determination and required to be paid by the licensee to the DTF pursuant to Article (42) (1) of the Nuclear Law;
- Amount and character of the securities to be deposited by the Licensee with the DTF to cover the licensee's financial obligations with regard to the Activities referred to in Article (42) (1) of the Nuclear Law that are not covered by fees already paid.
- Management of the assets of the DTF by the DTF Board.
- Payments by the DTF Board from the DTF for the costs referred to in Article (42) (1) of the Law.

FANR-REG-26 "*Predisposal Management of Radioactive Waste*" is a complement to FANR-REG-11, "*Radiation Protection and Predisposal Radioactive Waste Management for Nuclear Facilities*", and the FANR-REG-24 *"Basic Safety Standards for Facilities and Activities involving Ionizing Radiation other than in Nuclear Facilities".* FANR-REG-24 was revised to give some needed clarifications identified during the IRRS mission in 2011.

FANR-REG-26 is supported by regulatory guide FANR-RG-018 "*Predisposal Management of Radioactive Waste* "which contains information on waste classification, generation of radioactive waste, treatment and conditioning of radioactive waste, storage and safety assessment and the content of the safety case. (A Safety Case is defined as: *"A collection of arguments and evidence in support of the Safety of a Facility or Activity including the findings of a Safety assessment and a statement of confidence in these findings").* The guide will assist FANR's Licensees implementing the regulatory requirements relating to the pre-disposal management of radioactive waste, including spent and disused sealed sources associated with the use of radioactive material in medicine, industry, research, agriculture and education as well as waste arising from the operation of nuclear facilities. This guide also contains annexes giving specific guidance for predisposal management of disused sealed sources (low and higher activity), laboratory and medical waste and residues from industrial processing.

FANR-REG-27 *"Disposal of Radioactive Waste"* will establish requirements for radioactive waste disposal in accordance with IAEA SSR-5 "*Disposal of Radioactive Waste*" which includes, but not limited to:

- Safety requirements related to planning for the disposal of radioactive waste.
- Requirement for the development, operation and closure of a disposal facility.
- Assurance of safety.

FANR-REG-27 is to be supported by FANR-RG-027 "*Near-Surface Disposal of Radioactive Waste*" which contains the guidance required for the disposal of very low level waste and low level waste in Near-Surface Radioactive Waste Disposal Facilities (NSRWDF). This guide includes, but not limited to:

- The content of the licence application.

- Safety assessment and safety case.
- Site characterization, construction, operation, closure and institutional control of NSRWDF.

A system of licensing of spent fuel and radioactive waste management activities

E.10 The *UAE Nuclear Law* Articles (23) to (31) provides requirements for granting, revocation, and suspension of licences. A licence is required to carry out any Regulated Activity defined in Article (25) including spent fuel and radioactive waste management activities. Regulated Activities include those related to Nuclear Facilities (according to the definition in the Law, a Nuclear Facility includes a Radioactive Waste Repository) and dealings with Regulated Material, which includes radioactive waste.

E.11 Article (28) requires applicants for a licence to submit detailed evidence of safety that shall be reviewed and assessed by FANR in accordance with defined procedures.

E.12 Article (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 in licences.

E.13 Following review and assessment of a licence application for a Regulated Activity with Regulated Material, FANR determines whether to issue a licence, a licence with conditions, or to refuse a licence and record the basis for the decision.

E.14 The licensing process for spent fuel and radioactive management activities in nuclear power plants is an integrated part of the licensing of nuclear facilities as described below.

Assessment of Safety

Overview of the UAE's arrangements and regulatory requirements to perform comprehensive and systematic safety assessments

Article (5) of the *UAE Nuclear Law* gives powers to FANR to establish the requirements for systematic Safety Assessments and Periodic Safety Reviews. Article (28) of the Law makes it clear that detailed evidence of safety is required at all relevant licensing stages of any nuclear installation. Articles (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. Article (32) requires review and assessment of the licensee or applicant at every stage of the regulatory process.

Regulation FANR-REG-06, "*Application for a Licence to Construct a Nuclear Facility,*" and 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 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.

Assessment of safety through the licensing process

Article (25) of the *UAE Nuclear Law* requires that a licence be obtained prior to engaging in any *"Regulated Activity"* which include selection of a site for, preparation of a site for, construction, commissioning and operation of a nuclear facility.

Each licence application is required to meet all applicable legal and regulatory requirements. FANR is required by Law to conduct a thorough review and assessment of licence applications to verify that the relevant objectives, principles and criteria are met, and to satisfy itself that the available information demonstrates the safety of the facility or activity. Following its review and assessment, FANR is empowered to grant a licence, grant a conditional licence, or refuse a licence request. Article (28) of the Law stipulates that the FANR formally records the basis for its licensing decisions.

FANR has established in its management system a process consistent with the *UAE Nuclear Law* and the relevant IAEA safety requirements for assessing applications for licences related to the construction and operation of a nuclear facility. The main steps in the process comprise the receipt and acknowledgement of the application; review and assessment of the application; issuing requests for additional information from the applicant where necessary; preparation of a safety evaluation report; and a decision on licensing by the Board of Management. Supporting procedures and instructions detail the methods and criteria to be applied by reviewers.

A system of prohibition of the operation of a spent fuel or radioactive waste management facility without a licence

E.15 Article (23) of the *UAE Nuclear Law* prohibits any person from conducting any 'Regulated Activity' in the UAE unless licensed to do so by FANR. Regulated Activity includes the siting, construction, operation and decommissioning of Nuclear Facilities, including radioactive waste repositories, and activities with 'Regulated Material', which includes radioactive waste. Articles (60) to (62) of the *UAE Nuclear Law* establish criminal penalties for carrying out Regulated Activity without a licence.

A system of appropriate institutional control, regulatory inspection and documentation and reporting

E.16 The *UAE Nuclear Law* Articles (32-37) provides requirements on inspection and control of licensee activities. Article (35) requires FANR to establish a planned and systematic inspection programme. Article (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. Article (5.8) provides FANR with the power to enter sites and facilities to carry out inspections.

E.17 FANR has established within its Integrated Management System (IMS) a process consistent with the requirements of the *UAE Nuclear Law* and the relevant IAEA safety requirements for inspection of licensees' activities to verify compliance with the *UAE Nuclear Law*, FANR regulations, and the licence conditions. Supporting procedures and instructions detail the methods that are to be applied by inspectors in different areas including radioactive waste management.

E.18 FANR has reviewed and accepted the description of the construction inspection and test programme given in the PSAR during its review of ENEC's application for a construction licence, as noted in section F.17.

E.19 Following the issuance of the construction licence, FANR mobilised its inspection team to verify that ENEC's construction activities comply with FANR requirements and the terms and conditions of the licence. The *UAE Nuclear Law* gives FANR powers to inspect the activities of licensees and their contractors. According to Article (34) of the *UAE Nuclear Law* the licensee remains responsible to FANR even if certain activities are carried out by its contractors.

E.20 In order to effectively deliver its inspection programme, FANR has set a formal qualification standard for its inspectors. The inspector qualifications include theoretical (classroom) and practical (on-the-job) training in basic and applied nuclear technology, management systems, quality assurance and safety culture, inspection and enforcement procedures, and training in legal procedures by the UAE Ministry of Justice. FANR currently has approximately 64 qualified inspectors involved in regulatory activities, supported by other FANR subject matter experts and Technical Support Organisations (TSO). FANR has deployed five resident inspectors to a permanent site office at Barakah NPP for regulatory oversight of the construction and commissioning activities taking place at the site. Inspectors and specialists from headquarters are used to supplement the resident inspectors in specialised areas, e.g. certification of Reactor and Senior Reactor operators, when required. FANR has also engaged a specialist TSO to provide support for inspection programme planning and for conduct of field inspection.

FANR formulates an annual inspection programme covering the activities of ENEC and its prime contractor and major suppliers related to engineering, procurement and site construction. The annual inspection programme focuses on the implementation of the management system and quality assurance programme requirements to verify that the controls specified by the licensee comply with the requirements.

E.21 FANR also conducts a periodical inspection programme for the users of radiation sources. An initial or pre-operational inspection is carried out prior to commencing work with radiation sources as part of licensing process for specific practices such as radiotherapy, nuclear medicine, industrial irradiation, and predisposal Radioactive Waste Management. During the operational phase, FANR's inspection programme is planned based on the risk associated with each practice. For example, the industrial radiography and radiotherapy practices are inspected on yearly basis and twice a year during the first year of operation whereas lower-risk practices are inspected on a lower frequency.

The enforcement of applicable regulations and of the terms of the licences

E.22 Article (5.17) of the *UAE Nuclear Law* gives FANR the power to undertake enforcement actions, which are defined to include corrective actions, written warnings, revocation of a licence, and administrative penalties and fines. Article (36.2) empowers FANR to take enforcement action compelling the operator to take actions necessary to remediate any breach. Article (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. Article (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.

E.23 Chapter 10 of the UAE Nuclear Law (Articles (57, 59-64)) provides provisions for civil liability and penalties for contravention to the requirements of the UAE Nuclear Law. Article 58 of the same Chapter covers civil liability for nuclear damage which is further determined by the UAE Federal Law by Decree No. 4 of 2012 Concerning Civil Liability for Nuclear Damage.

In August 2015, the UAE Cabinet of Ministers issued Resolution No. 27 of 2015 Concerning Administrative Penalties for Violating the Conditions of the Licenses issued by the Federal Authority for Nuclear Regulation (the Cabinet Resolution). The Cabinet Resolution defines 26 violations and a range of administrative

penalties, including corresponding administrative fines, that shall be imposed on the Operator or Licensee upon committing or recommitting any of the violations set forth in the Cabinet Resolution. The administrative penalties apply on natural persons and legal persons and include administrative fines, as well as suspension or revocation of licence or any part thereof if violations cause any of the circumstances provided for in Article 31 of the UAE Nuclear Law. Pursuant to the Cabinet Resolution, in addition to the administrative fines, FANR may impose corrective actions on the Operator or the Licensee for committing any conduct or actions contrary to the provisions of the UAE Nuclear Law, regulations or resolutions issued by FANR.

In 2017, based on the UAE Nuclear Law and Cabinet Resolution, FANR drafted a regulation on "*Application of Penalties*" (FANR-REG-18), which applies to all Operators and Licensees committing or recommitting any violation. The draft regulation will be subject to review by stakeholders and subsequently to a public review.

To date, no significant enforcement actions pursuant to the above authorities have been necessary with regard to applicants for nuclear facility licences or users of Regulated Material.

A clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of radioactive waste management

E.24 As noted in section B.5 of this National Report, Chapter 8 of the *UAE Nuclear Law* (Article (40-42)) addresses issues of radioactive waste and decommissioning, where allocation of responsibilities can be found.

Other authorities concerned with environmental impact assessment, local planning, waste management and other governmental activities will be involved as appropriate to their respective mandates as the UAE's overall strategy is developed.

Whether to regulate radioactive materials as radioactive waste

E.25 The UAE is following IAEA safety standards and guidance in making these decisions.

The *UAE Nuclear Law* defines Radioactive Material as "*material designated by the Authority as being subject to Regulatory Control because of its radioactivity"*. The activity levels designated by the Authority as being subject to Regulatory Control because of its radioactivity are clarified in FANR-REG-24 Article (2) item 3 using IAEA GSR-Part 3 Schedule I. Below those levels the material do not need to be regulated.

The definition of Radioactive Waste in the *UAE Nuclear Law* is *"Waste that contains, or is contaminated with, radionuclides at concentrations or activities greater than levels as established by the Authority".* These levels are the same levels as for regulated material as described in FANR-REG-24 Article (2) item 3 using IAEA GSR-Part 3 Schedule I.

While not explicitly expressed in FANR regulations, FANR agrees with the definition in IAEA Nuclear Safety and Security Glossary, where Waste is defined as "*Material for which no further use is foreseen."*

Material which will not be used anymore and is contaminated with radionuclides in concentrations or activities above the levels cited above is designated as 'radioactive waste'.

FANR-REG-11 and FANR-REG-24 states basic requirements for radioactive waste from nuclear facilities and other facilities respectively and FANR-REG-26 addresses pre-disposal management of radioactive waste from all facilities.

Article 20: Regulatory Body

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 19, and provided with adequate authority, competence and financial and human resources to fulfill its assigned responsibilities.
2. Each Contracting Party, in accordance with its legislative and regulatory framework, shall take the appropriate steps to ensure the effective independence of the regulatory functions from other functions where organizations are involved in both spent fuel or radioactive waste management and in their regulation.

Establishment of the Regulatory Body

E.26 FANR is the federal governmental agency designated as the Regulatory Body which gets its powers from the *UAE Nuclear Law*. Chapter 2, Articles (4–9) of the *UAE Nuclear Law* establishes FANR as the regulatory body to implement the legislative and regulatory framework.

- Article (4) establishes FANR as a public, federal 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.
- Article (5) gives power to FANR to determine all matters relating to the regulation of the nuclear and radiological sectors 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 the powers of FANR in 33 sub-Articles.
- Article (6) gives FANR exclusive jurisdiction over the licensing of 'Regulated Activities' in the UAE.
- Article (7) requires FANR to co-operate with relevant government including in relation to radioactive waste.
- Article (8) authorizes FANR to investigate potential breaches of the *UAE Nuclear Law.*
- Article (9) requires FANR to maintain the highest standards of transparency in its regulatory activities while allowing it to protect confidential information.

E.27 Chapter 3, Articles (10-17) of the *UAE Nuclear Law* sets out provisions on the management of FANR.

- Article (10) establishes the FANR Board to manage the organization.
- Article (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.
- Article (12) sets forth conditions of Board membership.
- Article (13) identifies the grounds on which Board members may be replaced.
- Article (14) provides for the appointment of a Director General to manage FANR and oversee its financial, administrative and technical affairs.
- Article (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.
- Article (16) limits the grounds on which the Director General may be replaced.
- Article (17) authorizes FANR to appoint employees.

E.28 Chapter 4, Articles (18-22) of the *UAE Nuclear Law* deal with FANR's financial affairs.

- Article (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.
- Article (19) establishes the dates of the fiscal year for FANR financing.
- Article (20) makes FANR subject to UAE tender and procurement laws and applicable financial and auditing regulations.
- Article (21) grants FANR exemption from UAE taxes.
- Article (22) provides that the FANR Board will appoint an independent auditor to report on the Authority's financial affairs.

Status of the Regulatory Body

E.29 The *UAE 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 the siting, construction, and operation, and decommissioning of Nuclear Facilities as well as the regulation of radioactive materials and radiation sources used in medical, research, oil exploration, and other industries. FANR is the sole decision-maker in licensing, and its decisions are not subject to any external review. FANR is independent of ENEC and any other entity charged with promotional responsibilities.

Organisation and Staffing; Financial Resources

E.30 FANR Board Members are appointed for a renewable fixed term and can only be removed by a resolution of the Cabinet for defined reasons. Board Members are forbidden by *the Nuclear Law* from engaging directly or indirectly in the conduct of any Regulated Activity and must not have any personal interest that conflicts with the interests of FANR.

E.31 The FANR Board of Management exercises FANR's legal powers. The Board comprises up to seven Emirati citizens, including the Chairman and Deputy Chairman, who are appointed for a term of three years by resolution of the Cabinet (Article (10.1)). The Director General leads the FANR staff organisation.

E.32 FANR has created two main divisions in the organisation to fulfill its responsibilities: Administration and Operations. The Administration Division includes the Departments of Supply Chain and General Services, Finance and Control, Government Communication, Information & Communications Technology, and Human Resources; the Operations Division includes the Departments of Nuclear Safety, Radiation Safety, Nuclear Security, Safeguards, and Education and Training. Legal Affairs Department and Corporate Development Department report to the Director General. FANR currently employs over 200 employees and continue to recruit talented individuals to meet business requirements. The organisation chart is shown in Figure E.32.

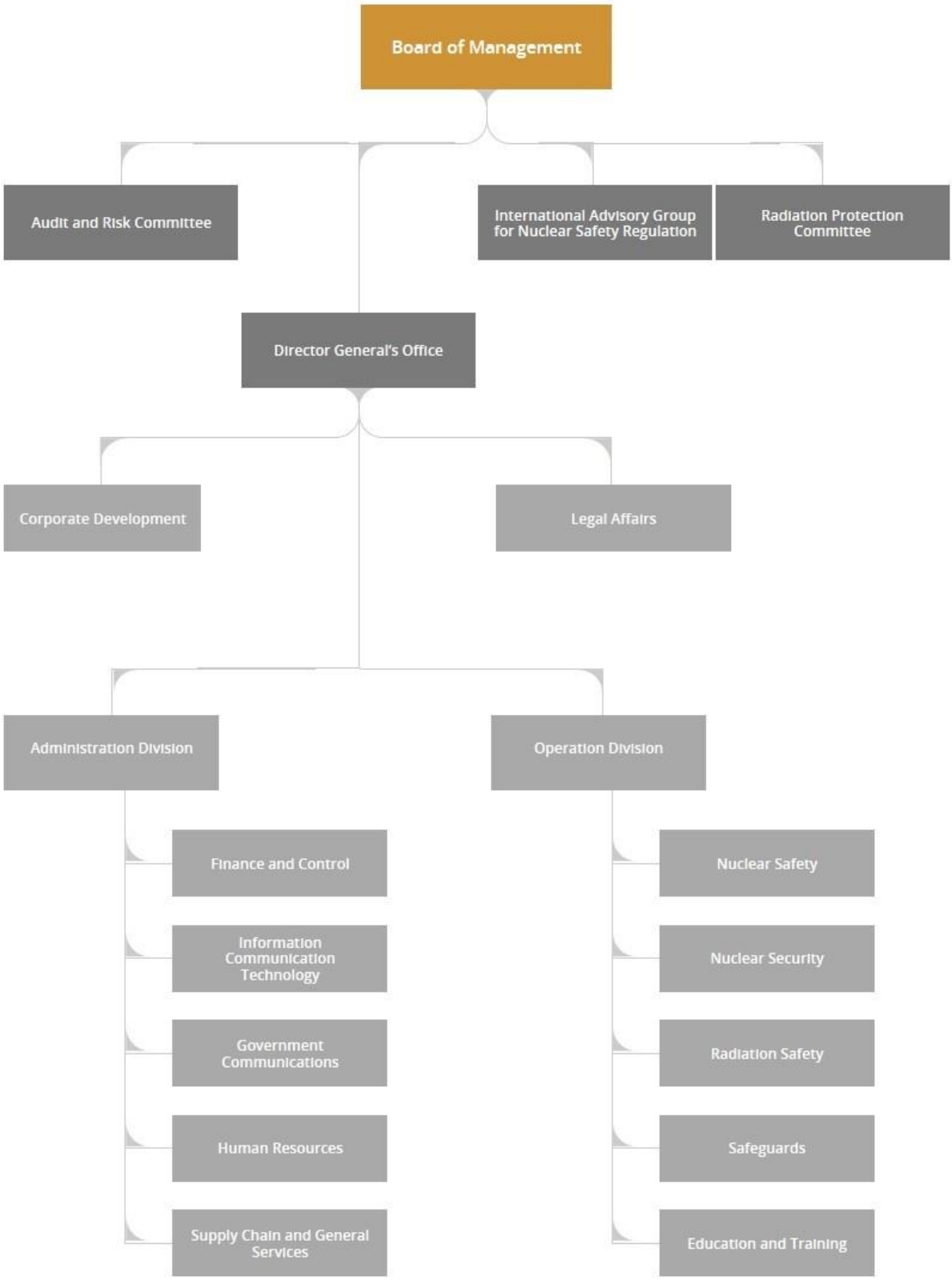

Figure E.32 – FANR Management Organisation Chart

E.33 FANR has its budget set by its Board of Management. In the past funds were made available by annual government allocation. FANR has now transitioned to having licensees pay fees in accordance with the schedule set out in a Cabinet Resolution. Licence fees constitute more than 90% of the approved budget with the balance provided by government allocation. 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. The overall budget provided has been adequate to enable FANR to carry out all of its significant regulatory responsibilities over the reporting period.

E.34 The Chairman of the Board is required by the *UAE Nuclear Law* to submit a report, at the end of each financial year, to the Minister of Presidential Affairs (Article (11)). FANR is also required by the *UAE Nuclear Law* to submit a set of audited accounts to the Cabinet for endorsement (Article (22)). As reflected in Chapter 4 of the *UAE Nuclear Law* discussed earlier, FANR has also been assured of having sufficient, predictable and autonomous financial resources to fulfill its responsibilities independently.

E.35 The reporting structure within the UAE government, its legal and financial independence, the requirement for transparency, and its technical competence are factors that demonstrate that FANR is effectively independent of other organisations concerned with the promotion or utilisation of nuclear energy.

Integrated Management System

E.36 As recommended by IAEA publications on safety requirements and guidance, FANR has developed and is implementing an Integrated Management System (IMS) that is tailored specifically to its Regulator role. 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 as corporate management and support functions. The early establishment of the integrated management system has helped FANR to deliver its functions effectively and support the development of a strong safety culture. Figure E.36 depicts the processes in the FANR IMS.

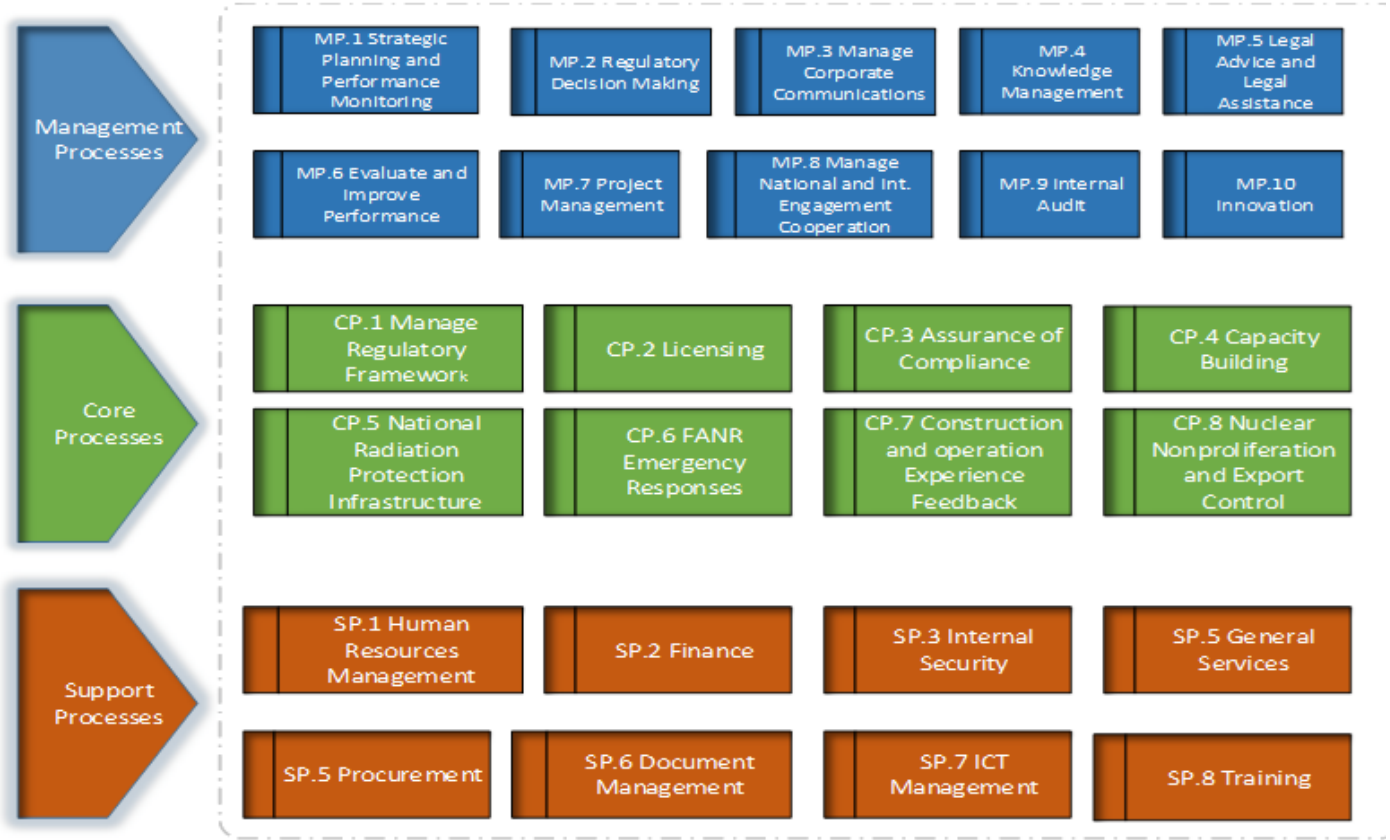

Figure E.36 – FANR Integrated Management System Process

Human Resources and Knowledge Management

E.37 FANR has made significant progress in recruiting a qualified and capable workforce over the past five years. At the time of writing, FANR employs 211 staff members with the percentage of UAE Nationals reaching sixty-four percent (64%) of the overall workforce. From 2016 to July 2017, 33 new employees joined FANR of whom 27 were UAE Nationals. The balance of the staff comprises expatriates with extensive nuclear experience recruited from 26 countries around the world. The depth and breadth of expertise embodied within this team has been instrumental in FANR's achievements to date.

E.38 Emiratisation is a key strategic objective for the UAE government, and stands at the core of FANR's corporate strategy. FANR invests significantly in capacity building strategies for UAE Nationals and this is seen through its various development programmes with the aim to build and strengthen the nuclear regulatory competencies. Long-term career opportunities for UAE Nationals at FANR are achieved through focused recruitment and training and development programmes. In 2016, progress in this field was noteworthy and demonstrated through the successful launch of a Developee Engineers Programme to ensure the long-term sustainability of the nuclear regulatory body. FANR had seventeen new graduates from various engineering disciplines on the programme, which aimed to provide the graduates an understanding of the day-to-day duties of the four technical departments in the Operations Division. In March 2017, nine engineers completed their development programme and were permanently placed in one of the four technical operations departments.

E.39 To complement its in-house expertise, FANR has contracted with several Technical Support Organisations (TSOs). The role of TSOs includes support for the preparation of regulatory documents (regulations, regulatory guides and review procedures), the conduct of expert reviews in selected areas, and

providing technical training. FANR takes ownership of all technical reviews including those where TSOs provide support.

E.40 To ensure the sustainability of competent human resources, FANR is developing its competency framework. FANR has chosen to adopt the IAEA Systematic Assessment of Regulatory Competence Needs (SARCoN) methodology to ensure its employees possess the requisite competencies to perform the functions of a nuclear regulatory body. FANR has developed formal qualification standards for safety assessors and inspectors. Currently FANR has qualified fourteen women and forty-four men as inspectors.

E.41 Having successfully recruited a workforce to meet near-term demands, FANR's human resource strategy for long-term sustainability concentrates on developing UAE nationals to take increasingly responsible positions in the regulatory body, while retaining an appropriate cadre of international experts. FANR complements its in-house training programmes through collaboration with ENEC, Khalifa University, the IAEA and other partner institutions in a national programme of capacity building which offers to citizens a range of education, training and development opportunities in the UAE and overseas. FANR has achieved the following:

Scholarships

- FANR supported with ENEC and Khalifa University a scholarship programme in Nuclear Engineering in the UAE in BSc, MSc and PhD over the years. Currently, three students are studying BSc Mechanical Engineering with Minor of Nuclear Engineering and one student is studying PhD in Nuclear.
- A total of 14 staff members graduated from Liverpool John Moores University and Risktec programme in Risk and Safety Management. Eight of them got a Master and six has got a Certificate.
- One staff member was sent by FANR to study for a Master in Science in Radiation and Environmental Protection at the University of Surrey, UK.
- Four staff members were sent to KINS Korea Advanced Institute of Science and technology (KAIST) for International Master Degree programme in Nuclear Safety.

FANR recognises the need for scholarships, where an Emirati employee with clearly identified career potential will assume the responsibility of a higher position and may be granted a scholarship for further education if any such award will be deemed necessary to enhance his or her career potential.

Internships

The aim of the internship programme is to provide university students with an exposure to the daily work of FANR, and give them the opportunity to support and learn from FANR's senior staff through a structured and objective based Internship Programme Plan. Interns accompany outstanding and inspiring career professionals and management within FANR for eight weeks. Moreover, they are encouraged to participate in meetings and contribute to analytical work. Since 2013 FANR has had 9 interns complete their internship programme in the Operations and Administration Divisions.

Employee Development Programme

This employee development programme is designed to support FANR employee's development by equipping them with the knowledge and skills needed to perform their roles and responsibilities in FANR.

FANR has established a new programme for fresh graduates called "The Developee Engineers Programme". It is designed to provide fresh UAE engineering graduates with the fundamental knowledge, skills, and attitudes necessary to understand technical concepts applicable to nuclear engineering and, specifically, nuclear regulation. This development programme runs over 53 weeks and is comprised of intensive nuclear fundamentals training, on-the-job training in each of the Operations Departments, as well as soft skills

training. The programme aims to produce UAE nuclear regulatory engineers who will be fully integrated into the Operations Departments upon completion of their programme.

A high priority for FANR is to develop the competencies of its existing and future managers and leaders, who will come to regulate the nuclear programme in the UAE. A development programme has been designed that includes management and leadership courses both internally at FANR and abroad. This programme is included as a part of our capacity-building approach to allow Emiratis to be capable of taking on leadership roles within FANR.

Both Emirati and expatriate employees have attended numerous in-house trainings and external courses covering technical skills, personal skills, and management and leadership topics. In-house training courses are delivered by staff experts and external consultants are coordinated by the Education and Training Department. Over the last five years, FANR has sent 37 of its staff members to a four-month-long Gulf Nuclear Energy Infrastructure Institute (GNEII) programme covering safety, security and safeguards, established in cooperation with Khalifa University, Sandia National Laboratories, and Texas A&M University.

Knowledge management

E.42 FANR recognizes the value of preserving critical knowledge for safety and business sustainability and 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, captured, transferred and developed to ensure the sustainability of such knowledge from in-house and TSO sources.

FANR's Knowledge Management (KM) programme address the knowledge, experience and expertise generated in the regulatory, technical, scientific, administrative, legal and managerial areas.

The objectives of the KM programme include:

- Mitigate the risk of knowledge loss due to employees' mobility;
- Make available knowledge and experience that enhances the quality of collaboration and increases the effectiveness and efficiency of the regulatory body; and
- Assure sustainability of the UAE nuclear programme through effective nuclear knowledge transfer from one generation to another.

Several projects and initiatives have been launched under the KM programme to facilitate sharing/transferring knowledge for the purpose of knowledge retention and operation long term sustainability. This includes conducting of knowledge loss risk assessments, enhancing the knowledge management process and procedures, integrating knowledge Management process in FANR processes and procedures.

The launch of the Knowledge Management Portal introduced new services such as mission reports page which is integrated into the KM portal to facilitate sharing knowledge and information from employees who attended business meetings, training missions or conferences. Moreover, an integration of the Construction and Operating Experience Feedback (COEF) database took place to support the recording, communication, screening and tracking of both national and international events and share experiences that will support in developing Emiratis knowledge. In addition, the implementation of exit interviews as a dual tool to identify critical knowledge that FANR might lose as well as to capture critical knowledge. Furthermore, exit interviews are used to identify the alternative resources, methods and plans for knowledge retention activities to mitigate the safety and sustainability related risks.

A latest development in the KM Programme is the capturing of FANR's perspective of the history of the UAE nuclear programme for the purpose of sharing the UAE experience and lessons learnt.

The FANR Library and Learning Centre was launched in 2016 to provide, amongst others, the latest industry periodicals, published technical literature from IAEA, NEA, USNRC and FANR employees, desktop generic PWR simulators and various technical and non-technical literature. FANR Library is a live concept of utilizing explicit knowledge for employee development through a number of initiatives such as conducting events for technical and non-technical book author discussions. The Library also facilitates awareness sessions, in coordination with all FANR departments, in different fields to enhance employee information and knowledge.

Human capacity development for the nuclear/non-nuclear industry sectors

E.43 FANR has conducted several workshops and training sessions throughout the five years for different UAE stakeholders in various areas of radiation protection, nuclear non-proliferation, nuclear security and emergency preparedness and response. In 2016, eight workshops related to safeguards were conducted for over 150 licensees, UAE customs and border control officers and law enforcement personnel. FANR hosted the sixth UAE National Workshop on Baseline Environmental Mapping, the second National Workshop on the Implementation of International Requirements for Nuclear Import-Export Control in the UAE, four workshops in collaboration with the Federal Customs Authority, and a National Workshop on Conducting Computer Security Assessments at Nuclear Facilities. Moreover, FANR organized two Meet Your Regulator events in Dubai and Abu Dhabi for over 500 licensees to build awareness on the new e-licensing service in UAE.

E.44 The IAEA requires Member States to establish education, training and competency requirements for all persons engaged in activities relating to radiation protection and safety. Therefore, FANR has also supported the development of radiation safety training for workers in non-nuclear licensed entities by presenting training for different users and positions following the guidance of IAEA Safety Report Series No. 20 and IAEA RS-G-1.4. The training requirements are posted on the FANR web site which also lists some available training entities, although these entities are not accredited by FANR.

E.45 In February 2017, FANR hosted the EduTA mission in radiation protection and safety of radiation sources. The EduTA mission was run by the IAEA in a bid to appraise the status of the provisions for education and training in radiation protection and the safety of radiation sources including the discussion of the UAE's education and training needs. During the mission, the EduTA team conducted a peer review of entities in the UAE that are engaged in activities relating to radiation protection and safety. The team commended the UAE on the progress made towards the establishment of a national framework for competence in this vitally important field.

In addition, the EduTa team concluded with sets of recommendations and suggestions on how the system, processes and procedures can be improved in order to bring the education and training provisions in the UAE in line with the IAEA safety standards and requirements for establishing education training and competency requirements for all persons engaged in activities relating to radiation protection and safety. Therefore, the UAE will create a strategy on how to develop a systematic approach on education and training in radiation protection and safety to ensure that all professionals in the field are qualified by using a UAE harmonised system to assess their competences.

The EduTa team mission report is in the process of being officially issued, the report will document the team findings and present their recommendations to the UAE on actions to be taken.

Section F. Other General Safety Provisions

Article 21: Responsibility of the License holder

1. Each Contracting Party shall ensure that prime responsibility for the safety of spent fuel or radioactive waste management rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility.
2. If there is no such licence holder or other responsible party, the responsibility rests with the Contracting Party which has jurisdiction over the spent fuel or over the radioactive waste.

Responsibility of the Licence Holder

F.1 *The UAE Nuclear Law* Article (40) states that persons holding licenses to possess Regulated Material are responsible for the safe management and storage of radioactive waste from its generation until its delivery to the entity designated by a decision of the Cabinet for the purpose of disposal. That entity would also need to be licensed by FANR to deal with the radioactive waste and to establish a radioactive waste repository (defined as a Nuclear Facility).

F.2 The *UAE Nuclear Law* Article (43) also makes clear that the licensee is responsible for all steps necessary to reduce the risk of an accident to a level that is as low as reasonably achievable, and that the licensee must ensure that there is a management system in place and adequate financial and human resources to ensure nuclear safety. This also applies to licensees who are responsible for the safety of spent fuel and radioactive waste management.

Article 22: Human and financial resources

Each Contracting Party shall take the appropriate steps to ensure that:
(i) qualified staff are available as needed for safety-related activities during the operating lifetime of a spent fuel and a radioactive waste management facility
(ii) adequate financial resources are available to support the safety of facilities for spent fuel and radioactive waste management during their operating lifetime and for decommissioning
(iii) financial provision is made which will enable the appropriate institutional controls and monitoring

Resources

F.3 The UAE does not currently have any spent fuel or radioactive waste management facilities. However, the text below discusses how UAE is complying with Joint Convention Article 22 for the planned Barakah Nuclear Power Plant. Facilities for spent fuel and radioactive waste management will be reviewed similarly.

F.4 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,"* require applicants to demonstrate projected financial and human resource requirements for the proposed nuclear project and provide details regarding their financial and technical qualifications to complete the proposed activities in accordance with nuclear safety principles and requirements. Additionally, FANR-REG-14 requires applicants to address the adequacy of decommissioning funding and the adequacy of plans for radioactive waste management. FANR also issued FANR-RG-001, *"Content of Nuclear Facility Construction and Operating Licence Applications"* to provide guidance on implementation of these regulations. ENEC submitted construction license applications through the preparation of a preliminary safety case for Barakah Units 1 & 2, and later for Units 3 & 4, both in

accordance with the requirements of FANR-REG-06 and under the guidance of FANR-RG-001 and international guidance (including from the IAEA and USNRC). ENEC and its affiliates have since prepared the final safety case which includes final design information and submitted it as part of the Operating License Applications for Units 1 & 2 and Units 3 & 4 in accordance with FANR-REG-14 and FANR-RG-001.

F.5 The *UAE Nuclear Law* Article (42) requires that the operator of a nuclear facility must pay fees into a *"Decommissioning Trust Fund"* (DTF). The fees are to cover the costs for: construction, operation and closure of a radioactive waste management facility; decommissioning the nuclear facility; regulatory oversight; and management of the trust fund. It is planned that regulations establishing the decommissioning Trust Fund will be completed by the time of commissioning of the first Barakah NPP Unit. ENEC/Nawah have developed some cost estimates for decommissioning and disposal of spent fuel in anticipation of FANR-REG-22, *"Decommissioning Trust Fund."* These estimates have been reviewed by FANR in the light of the reference scenario, which includes the construction and operation of a near-surface repository and a geological disposal facility in the UAE.

F.6 Regulation FANR-REG-21, *"Decommissioning of Facilities"* requires the application for an operating license for a facility to include reasonable assurance that funds will be available to decommission the facility. This condition is met by the commitment to fund these costs through contributions to the DTF.

F.7 The Government of Abu Dhabi, through ENEC, currently funds the costs of constructing the Barakah Nuclear Power Project and associated activities such as capacity building and planning. ENEC entered into a joint venture and established lending arrangements for the construction and development of the Barakah nuclear power project and has developed a detailed proposal for the same working with Government of Abu Dhabi stakeholders, KEPCO and a consortium of international lenders, including export credit agencies.

F.8 ENEC and its affiliates have established a power purchase agreement with the Abu Dhabi Water and Electricity Authority (ADWEA) for the purchase of electricity produced by the Barakah NPP that ensures revenue is available to the licensed operator to safely operate and maintain the facility. These revenue arrangements assure that the operator will recover costs incurred to meet its decommissioning obligations under applicable laws, including recovery of any fees that are required to be paid into a decommissioning fund under applicable regulations, and for meeting all fuel management and storage requirements.

F.9 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 other UAE Government entities and stakeholders, in order 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 nuclear workforce.

F.10 The UAE human resources policy is guided by the IAEA Document NG-G-3.1, "Milestones in the Development of National Infrastructure for Nuclear Power". The NRCB effort is being implemented by FANR, ENEC and its affiliates 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. In addition, ENEC and its affiliates have partnered with the Institute of Applied Technology to develop Emiratis at the technologist level to support the operation and maintenance of its nuclear power plants.

F.11 Finances have been provided as needed to develop staff and create the necessary opportunities for international studies. Through international agreements with several countries and their regulatory bodies, many opportunities exist and have been utilized for UAE Nationals to perform job shadowing. See section E.37- E.43 for more information.

F.12 ENEC and its affiliates have developed a Human Resources Development (HRD) Strategy to identify the capabilities needed to support the UAE nuclear energy program, assess the ability of the current market to provide those capabilities, and develop the required skills and abilities within the UAE in order to have a skilled local workforce available for the start of operations in 2018. Aligned with the Emiratization goals of the UAE, the HRD Strategy intends to build the human capacity of people in the UAE to support the nuclear industry, contributing to the work of ENEC and its affiliates, the prime contractor, and the many businesses in the UAE that will provide services to the overall program.

F.13 The strategy includes building a talent pool throughout the Emirates, starting with the educational process in grade school, and working to encompass academic, technical and vocational programs throughout the UAE and abroad. ENEC and its affiliates current strategies are:

1. Leverage UAE Educational System and Build New Infrastructure
2. Develop Partnership Opportunities
3. Leverage Business and Industry
4. Broad Outreach: Grade School to Graduate Studies

Article 23: Quality Assurance

> Each Contracting Party shall take the necessary steps to ensure that appropriate quality assurance programmes concerning the safety of spent fuel and radioactive waste management are established and implemented.

Quality Assurance

F.14 The *UAE Nuclear Law* Article (44) describes the requirements on the licensee to set up a Management System and a Quality Assurance Programme which shall be the subject of approval and inspection by the Authority. FANR-REG-01 *"Management Systems for Nuclear Facilities"* requires the licensee to establish, implement, assess and continually improve a Management System that is aligned with the goals of the organisation and contributes to its achievement (Article (3)).

F.15 From the beginning of 2009, ENEC and its affiliates have developed and maintained Quality Management Systems (QMS), in compliance with UAE Law and Regulations covering the current phase of development for the Barakah NPP, as well as the commissioning and operating phases. The Quality Management System includes a Quality Assurance Programme which is in compliance with ASME NQA-1-1994 /1995 Addendum and applicable international IAEA and ISO standards on Quality Assurance for Nuclear Facility Applications. The current ENEC QMS scope covers Siting, Design, Procurement, Engineering, Construction, and Commissioning. The ENEC QA Manual covers all four Barakah NPP units, and was approved by the regulatory authority FANR as part of the ENEC construction licenses for Units 1&2 and 3&4.

As part of its QMS, ENEC has implemented a quality surveillance and auditing programme that oversees the QA controls and measures for the Barakah NPP supply chain and construction site. ENEC conducts audits on its prime contractor KEPCO and its sub-contractors regularly to verify programme implementation and effectiveness. FANR also conducts a series of inspections of ENEC and its affiliates, KEPCO and contractors.

The results of audits and inspections are trended and continuous quality improvements are made as required.

Nawah, as an affiliate of ENEC responsible for safe operation of Barakah NPP, has developed its own Quality Assurance Programme (NQAM) which is an integral part of the Nawah Integrated Management System. Through the introduction of quality assurance requirements, Nawah integrates quality into the performance of all activities that have the potential to adversely impact the safe operation of Barakah NPP. The NQAM along with the implementing documents form the Nawah Quality Assurance Programme (NQAP). The NQAP is established and implemented to satisfy the requirements of UAE Nuclear Law, FANR regulations, ASME NQA-1 1994 with 1995 Addenda.

F.16 Extensive reviews have been performed for the Barakah NPP to strengthen Counterfeit, Fraudulent, and Suspect Items (CFSI) controls. ENEC has revised its QA programme to strengthen CFSI controls including additional reviews of certificates of compliance, enhanced audit practices, training of management and staff, and the use of handheld devices that check the elemental composition of components. The prime contractor QA programme has also been enhanced to improve CFSI controls.

ENEC has developed an overall strategy and action plan to actively monitor CFSI issues across the supply chain, which includes actions such as independent reviews of the prime contractor CFSI programs and controls. ENEC also maintains close contact with industry bodies, such as the Electric Power Research Institute (EPRI), Nuclear Energy Institute (NEI), Department of Energy (DOE), Nuclear Procurement Issues Committee (NUPIC), and the United States Nuclear Regulatory Commission (USNRC), and will continue to enhance its CFSI measures as required.

F.17 ENEC and its affiliates shall ensure that the predisposal radioactive waste management facilities are in compliance with FANR Regulations. ENEC and Nawah, as the Licensees, will ensure that its prime contractor, Korea Electric Power Company (KEPCO), which is responsible for the design, construction, commission, and initial operation of the nuclear plants, performs a Safety Assessment and develops a Safety Case for each identified waste stream.

Article 24: Operational radiation protection

1. Each Contracting Party shall take the appropriate steps to ensure that during the operating lifetime of a spent fuel or radioactive waste management facility:
   (i) the radiation exposure of the workers and the public caused by the facility shall be kept as low as reasonably achievable, economic and social factors being taken into account
   (ii) no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection and
   (iii) measures are taken to prevent unplanned and uncontrolled releases of radioactive materials into the environment
2. Each Contracting Party shall take appropriate steps to ensure that discharges shall be limited:
   (i) to keep exposure to radiation as low as reasonably achievable, economic and social factors being taken into account and
   (ii) so that no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection
3. Each Contracting Party shall take appropriate steps to ensure that during the operating lifetime of a regulated nuclear facility, in the event that an unplanned or uncontrolled release of radioactive materials into the environment occurs, appropriate corrective measures are implemented to control the release and mitigate its effects.

F.18 At this stage, there are no spent fuel or radioactive waste management facilities in the UAE. Any future facilities will be subject to FANR licensing under the provisions of the *UAE Nuclear Law.* This gives FANR the 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. See sections F.20 and F.21.

F.19 In order to ensure the utmost safety for both the Barakah NPP workforce on site and the general public, the following laws and regulations set out below in Sections F.20 and F.21 will be applied to the Barakah NPP radioactive waste and spent fuel management facilities. The details are outlined in the Final Safety Analysis Report.

F.20 *UAE Nuclear Law* Article (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."

F.21 FANR has developed the following regulations and key provisions dealing directly with radiation protection in nuclear facilities:

- **FANR-REG-04, "Regulation for Radiation Dose Limits and Optimisation of Radiation Protection for Nuclear Facilities"** covers:
  i. Dose Limits for Occupational Exposure,
  ii. Dose Limits for the Public Exposure,
  iii. Optimisation of Radiation Protection for Workers, and
  iv. Optimisation of Radiation Protection for the Public.

This regulation adopts the internationally accepted dose limits for occupational exposure during normal operation of a nuclear facility and for the public exposure. (under revision)

- **FANR-REG-11, "Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities,"** covers:
  i. Radiation Protection Programme,
  ii. Predisposal Management of Radioactive Waste,
  iii. Clearance Levels and Discharges of Radioactive Material,
  iv. Environmental Monitoring Programme, and
  v. Training.

- **FANR-REG-06 "Regulation for an Application for a Licence to Construct a Nuclear Facility"** requires an applicant for a construction licence to describe in its application preliminary information on the radiation protection programme including the design features of the facility, and preliminary information on the programme for pre-disposal management of radioactive waste.

- **FANR-REG-13, "Transportation of Radioactive Material,"** has adopted IAEA document TS-R-1 (2009 Edition), "Regulations for the Safe Transport of Radioactive Material," in its entirety. FANR is planning to update this version with the new "Regulations for the Safe Transport of Radioactive Material", 2012 Edition, SSR-6.

  FANR-REG-14 "Regulation for an Application for a Licence to Operate a Nuclear Facility" requires an applicant for an operating licence to describe in its application preliminary information on the radiation protection programme including a description of all on-site Radiation Sources, the application of the ALARA principle for the optimisation of protection and design features for Radiation Protection of personnel and the Nuclear Facility. In addition, it requires information on the programme for pre-disposal management of Radioactive Waste including arrangements for identification and control of Radioactive Waste streams, proposals for authorised discharges of Radioactive Waste, and arrangements for pre-treatment, treatment, conditioning and Storage of residual Radioactive Waste pending disposal.

F.22 Regulatory requirements have been established to ensure that radioactive discharges shall be limited consistent with international norms and standards. These requirements are described in Sections G.4, G.16 and H.24 of this report.

F.23 The UAE government is currently developing policy regarding the long term management and disposal of spent nuclear fuel and radioactive waste, and identifying the entity that will be charged with implementing such policy as provided for in Article 41 of the *UAE Nuclear Law*.

F.24 According to the *UAE Nuclear Law* Article 67, FANR's Board of Management formally established the Radiation Protection Committee (RPC) as an advisory and consultative committee to FANR on 20 July 2011. The RPC is charged with advising FANR on radiation protection. It was established to work with competent authorities; to develop radiation protection guidance as part of emergency response plans; to develop training programmes as appropriate; and to promote awareness and to improve the radiation protection infrastructure.

The RPC held thirteen (13) meetings from establishment up to July 2017. During these meetings, the RPC considered a number of issues including:

- Coordination of licensing activities, and inspection activities with health authorities;

- Radiation protection from orphan sources including establishment of centralized Storage of Orphan sources and integration of border monitoring detection and response capacities as per Orphan Source Strategy Action Plan;
- Providing service in the field of radiation safety, including FANR Secondary Standard Dosimetry Laboratory (SSDL);
- Radiological Emergency Planning and Environmental Monitoring;
- Occupational Radiation Protection;
- Management of existing exposure situation;
- Development of FANR legal framework, and
- Development and implementation of the National Strategy for Education and Training in Radiation Protection.

Article 25: Emergency Preparedness

1. Each Contracting Party shall ensure that before and during operation of a spent fuel or radioactive waste management facility there are appropriate on-site and, if necessary, off-site emergency plans. Such emergency plans should be tested at an appropriate frequency.
2. Each Contracting Party shall take the appropriate steps for the preparation and testing of emergency plans for its territory insofar as it is likely to be affected in the event of a radiological emergency at a spent fuel or radioactive waste management facility in the vicinity of its territory.

F.25 Chapter 9 of the *UAE Nuclear Law* sets out a structure for emergency preparedness. The relevant Articles include:

- Article (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)
- Article (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
- Article (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
- Article (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
- Article (53), which requires that the Licensee familiarize its employees with the Emergency Plans and conduct related training
- Article (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 control;
    - ensure continuous monitoring of radioactive releases into environment; and
    - perform any other obligations as may be established in the Emergency Plans, the Federal Law by Decree No 6 of 2009, or the applicable regulations

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

F.26 FANR-REG-12, "*Regulation for Emergency Preparedness for Nuclear Facilities*," sets out FANR requirements for an applicant or licensee for 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 licensee can perform assessment actions and implement notification procedures. It also requires the 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. FANR-REG-12 does not apply to the plans and activities of the off-site coordinating agencies or response organisations.

F.27 FANR-REG-15 *"Requirements for Off-Site Emergency Plans for Nuclear Facilities"* provides the requirements for the off-site emergency plan and was drafted in consultation with NCEMA. This regulation defines: a) terms and procedures for preparation of Off-site Emergency Plans; b) responsibilities and duties for implementation; c) measures for mitigation and remediation of consequences; d) arrangements for warning of the public; and e) measures for testing Emergency Preparedness.

F.28 FANR has drafted Regulatory Guide FANR-RG-024 "*Criteria for Protective Actions in Response to a Nuclear or Radiological Emergency*". This Regulatory Guide addresses the basic concepts, public protection strategy for nuclear and radiological emergencies, criteria for protection of emergency workers and helpers, and transition phase and criteria for terminating an emergency.

F.29 FANR regulations require comprehensive emergency plans to be prepared and periodically exercised to assure actions are taken to notify and protect citizens in the vicinity of a nuclear facility during an emergency. For radioactive waste management and spent fuel management at a nuclear power plant, the emergency preparedness programme is modified by license condition upon the facility's entry into the decommissioning phase. The revised provisions for emergency preparedness and response will be modified commensurate with the hazard of the materials remaining within the former controlled areas.

F.30 The structure and content of the Barakah NPP emergency preparedness programme has been developed consistent with the 16 planning standards outlined in USNRC NUREG-0654, "*Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants".* Nawah is also working closely with off-site agencies to facilitate their understanding of response to a radiological emergency and assist with the off-site plan as needed. Both the on-site and off-site plans have been submitted to FANR for review. The on-site and off-site plans have been tested in the fuel receipt exercise conducted on Feb 2015. A drill and exercise programme has been developed and implemented. Emergency preparedness familiarization training has been given to all plant employees.

In February 2016, the Ministry of Interior (MOI), in cooperation with the concerned entities, developed and approved the third version of the Off-site Nuclear and Radiological Emergency Response Plan for Barakah Nuclear Power Plant (hereafter referred to as the Off-site Plan) which describes the roles and responsibilities of each national and local response entity, and the support organisations. This plan has been developed in accordance with the FANR-REG-15, and includes annexes addressing responsibilities of external stakeholders; each annex is supported by implementing procedures.

F.31 The main elements of the national plan include the On-Site Emergency Plan developed and implemented by the licensee, Nawah, and the Off-Site Emergency Plan developed under the leadership of the Ministry of Interior (MOI) in coordination with other concerned entities. Planning for the national emergencies is coordinated under the "*General Framework for Emergency Response*" prepared by NCEMA in February, 2013. Notification and activation of emergency response occurs through Tariff Police Notification Point (Al Dafrah Region), Abu Dhabi Joint Local Operation Centre (JLOC), and the NCEMA National Operation Centre (NOC).

F.32 Nawah has developed and implemented a standard emergency classification scheme based on system and effluent parameters on which Federal and local response organizations may rely for determining initial off-site response measures. The scheme was developed following NEI 99-01 Revision 6. The On-site Emergency Plan provides four classes of emergencies: (1) Notification of Unusual Event, (2) Alert, (3) Site Area Emergency and (4) General Emergency.

F.33 The On-site Emergency Plan contains predefined Emergency Action Levels (EALs) based on initiating events such as abnormal conditions and system malfunctions for the nuclear facility, security related concerns, releases of radioactive material, natural events, hazards and failure of the three fission product barriers. These EALs provide indication for classifying the event as one of four Emergency Classification Levels (ECLs) in escalating severity. The On-site emergency plan developed by Nawah will be implemented by emergency procedures in the form of documents and instructions that contain details about the implementation actions and methods required to achieve the objectives of the requirements in the FANR-REG-12.

F.34 The UAE responsible entities are currently updating the Off-site Emergency Response plans which include plans/supporting plans and implementing procedures. Implementation of this plan also includes training and conduct of exercises with observation and discussion of emergency response with other nuclear facility operators and regulators.

F.35 Article (4) of FANR-REG-12, requires the Licensee to maintain an Emergency Plan and Article (7) 2.b of FANR-REG-15 requires the conduct of drills and exercises under the full Off-site Emergency Plan, together with the On-site Emergency Plan, prior to receipt of nuclear fuel.

NCEMA, FANR, ENEC and other concerned entities conducted five table-top drills, eight Integrated Facility Drills, and two drills with Off-site participation to enhance the coordination between the On-site and Off-site activities for Barakah NPP before the Pre-Fuel Receipt Exercise.

Nawah and other concerned entities in coordination with FANR and NCEMA successfully conducted a Full Scale Fuel Receipt Exercise at Barakah NPP on 23rd February 2016. The purpose of the Barakah NPP exercise was to meet FANR's regulatory requirements for a pre-fuel receipt exercise, and to evaluate On-site and Off-site plans and response entities' capabilities.

Prior to the pre-fuel receipt Barakah NPP exercise, FANR developed On-site and Off-site assessment plans that described pre-exercise review elements, processes for evaluating exercise conduct, and a post-exercise evaluation summary. Prior to the exercise, FANR reviewed Nawah's proposed Exercise Objectives and Extent of Play submittal including the scenario which identified forty-eight objectives for the exercise, of which twenty four covered elements to test the capabilities of Nawah to mobilize and perform required On-site emergency response actions. FANR verified that all critical elements were addressed and aligned with objectives.

FANR developed Exercise Evaluation Criteria based on IAEA EPR-Exercise 2005, "*Preparation, Conduct and Evaluation of Exercises to Test Preparedness for a Nuclear or Radiological Emergency,*" and trained Assessors in the use of the evaluation criteria. Nawah developed its own evaluation criteria based on NUREG 0654, "*Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants*" and included them in their process for self-critique to improve the EPR programme.

At the request of FANR, the IAEA sent an expert mission of three emergency planning counterparts to observe the preparation, conduct and evaluation of the Barakah NPP Emergency Exercise. The team participated in meetings and training sessions conducted before the exercise and observed pre-exercise planning discussions among the different On-site and Off-site organizations involved in the exercise.

Nawah has committed to conduct a full-scale exercise prior to fuel load to fully demonstrate the full response capabilities of the On-site response organisation. Nawah is coordinating with FANR and NCEMA on the development of the Fuel Load Exercise objectives, the extent of play and scenario to be conducted during the fourth quarter of 2017.

F.36 The UAE hosted an IAEA Emergency Preparedness Review (EPREV) peer review mission place in March 2015. The purpose of the EPREV Mission was to conduct a review of the United Arab Emirates (UAE) emergency preparedness and response (EPR) arrangements and capabilities associated with the Barakah NPP. The EPREV Mission also assessed progress with the previous finding of the 2011 IRRS Mission to the UAE in this area. The review was carried out by comparing existing arrangements with the current international safety standards and good practices. FANR in cooperation with NCEMA, MOI, ENEC and other concerned entities were involved in the EPREV Mission peer review.

The EPREV mission identified six recommendations, five suggestions and two good practices. FANR in cooperation with NCEMA, MOI, ENEC and other concerned entities prepared an action plan to address the EPREV Mission's recommendations and suggestions. The action plan was submitted to the IAEA for future follow up by an EPREV Mission. The UAE is planning to have a follow-up mission in the near future.
For more information, please click on the link below:
http://fanr.gov.ae/en/Lists/Reports/Attachments/2/2015EPREV-UAE-Final.pdf

F.37 For radioactive waste treatment facilities that are not affiliated with nuclear facilities, FANR-REG-24 Article (16) applies. The licensee is required to prepare and maintain an Emergency Plan for protection of people, commensurate with the nature and magnitude of the risk involved. The Emergency plan shall be subject to the approval of the Authority.

Article 26: Decommissioning

Each Contracting Party shall take the appropriate steps to ensure the safety of decommissioning of a nuclear facility. Such steps shall ensure that:

(i) qualified staff and adequate financial resources are available
(ii) the provisions of Article 24 with respect to operational radiation protection, discharges and unplanned and uncontrolled releases are applied
(iii) the provisions of Article 25 with respect to emergency preparedness are applied and
(iv) records of information important to decommissioning are kept

F.38 *UAE Nuclear Law* Article 42 states that *"A juridical Person that is licensed to operate a Nuclear Facility that generates or will generate Radioactive Waste shall pay fee into a trust fund called "Decommissioning Trust Fund" established by a decision of the Cabinet according to the Board's recommendation."* The Article also describes what the fee shall cover.

F.39 FANR has issued FANR-REG-21 *"Decommissioning of Facilities"* addressing decommissioning activities including the decommissioning license termination criteria; and is drafting FANR-REG-22, *"Decommissioning Trust Fund."* Regulation 21 and 22 cover the requirements in Article 26 in the Joint Convention:

- Ensuring that adequate financial resources are available during decommissioning is addressed in F.4-F.8. FANR-REG-21, Article (5) includes the responsibilities of the licensee during the decommissioning phase of the facility. One of these responsibilities is ensuring that properly trained, qualified and competent staff are available for the decommissioning project.

- The provisions of Joint Convention Article 24 with respect to operational radiation protection, discharges and unplanned and uncontrolled releases are applied during decommissioning as addressed in FANR-REG-21 Article (3) which requires that radiation protection of persons who are exposed as a result of decommissioning actions shall be optimized with due regard to the relevant dose constraints

- FANR-REG-21, Article (5) requires that the licensee shall be responsible for all aspects of safety, radiation protection and environmental protection during decommissioning

- The provisions of Joint Convention Article 25 with respect to emergency preparedness applied during decommissioning are addressed in Section F.29.

- The maintenance of records important to decommissioning are addressed in FANR-REG-21, Article 18.

F.40 FANR-REG-14, "*Regulation for an Application for a Licence to Operate a Nuclear Facility*", requires information on decommissioning and end-of-life aspects to be included in the operating license application. Nawah has developed a preliminary decommissioning plan and submitted it with the Barakah NPP operating license application.

Section G. Safety of Spent Fuel Management

Article 4: General Safety Requirements

Each Contracting Party shall take the appropriate steps to ensure that at all stages of spent fuel management; individuals, society and the environment are adequately protected against radiological hazards. In so doing, each Contracting Party shall take the appropriate steps to:

(i) ensure that criticality and removal of residual heat generated during spent fuel management are adequately addressed
(ii) ensure that the generation of radioactive waste associated with spent fuel management is kept to the minimum practicable, consistent with the type of fuel cycle policy adopted
(iii) take into account interdependencies among the different steps in spent fuel management
(iv) provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards
(v) take into account the biological, chemical and other hazards that may be associated with spent fuel management
(vi) strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation
(vii) aim to avoid imposing undue burdens on future generations

Criticality and Removal of Residual Heat

G.1 FANR-REG-03 Article (87) provides requirements for spent fuel handling and for spent fuel storage in water pools.

Minimum Generation of Radioactive Waste

G.2 FANR-REG-11 Article (15.1) and FANR-REG-24 Article (30.2) require that the generation of radioactive waste including waste associated with spent fuel management, be kept to the minimum practicable.

Interdependencies

G.3 The UAE policy on long-term management of spent fuel will take into account interdependencies among the different steps in spent fuel management. Addressed in B.1-B.3.

Protection of Individuals

G.4 FANR-REG-11, Articles (3) through (13) require a radiation protection programme to be put in place commensurate with the radiological hazards to ensure that doses to workers during normal operations are controlled and that the radiation dose limits of FANR-REG-04 are met. In addition, FANR-REG-11 Article 23 states that:

"*1. The Licensee shall ensure that the Safety Case for gases and effluents shall describe:*

a) the characteristics and activity of the material to be discharged, and the potential points and methods of discharge;

b) all significant exposure pathways by which discharged radionuclides can deliver Public Exposure;

c) the total amount of various radionuclides expected to be discharged per year; and

*d) the Doses to the Representative Person due to the planned discharges.*2. The Licensee shall ensure that Doses arising from discharges meet the requirements of FANR-REG-04, "*Dose Limits and Optimisation for Nuclear Facilities*".

Non Radiological Hazards

G.5 The UAE policy on long-term management of spent fuel will take into account biological, chemical and other hazards that may be associated with spent fuel management.

Future Generations

G.6 While steps to *"strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation"* is not explicitly covered in FANR regulations, this IAEA Safety Fundamental (SF-1) principle No. 7 will be applied by FANR. See section H.14.

G.7 While steps to *"aim to avoid imposing undue burdens on future generations"* are not explicitly covered in FANR regulations, this IAEA Safety Fundamental (SF-1) Principle No. 7 will be applied by FANR. See section H.15.

G.8 ENEC and its affiliates have taken the following measures for the management of spent fuel:

- The design of Barakah NPP has sufficient capacity in the spent fuel storage pool for 20 years of operation for each unit.
- Completed a dry storage feasibility study to ensure sufficient allocation of space in the Barakah NPP site layout plan for the construction of a spent fuel dry storage facility if needed in the future. The study also evaluated the existing and planned site infrastructure to ensure spent fuel dry storage requirements are implemented early in the nuclear programme development.
- Formed a designated department to develop a long-term waste management programme with realistic milestones and flexibility to take into account potential technical developments that may influence spent fuel and radioactive waste management.

Article 5: Existing facilities

Each Contracting Party shall take the appropriate steps to review the safety of any spent fuel management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility.

G.9 Currently, there are no spent fuel management facilities existing in the UAE, and the UAE does not have an inventory of spent fuel to report. The UAE has no spent fuel management past practices to report.

Article 6: Siting of proposed facilities

1. Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed spent fuel management facility:
   (i) to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime
   (ii) to evaluate the likely safety impact of such a facility on individuals, society and the environment
   (iii) to make information on the safety of such a facility available to members of the public
   (iv) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory
2. In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 4.

G.10 In accordance with Article (28) (1) of the *UAE Nuclear Law*, an applicant for a licence to construct or operate a spent fuel management facility will be required to submit detailed evidence of safety that will be reviewed and assessed by FANR. Consistent with the approach described in FANR-REG-11, any proposal for a spent fuel management facility will need to establish a Safety Case (see definition in section G.15.) The characteristics of the siting of the facility will be a part of the Safety Case. It is expected that the relevant requirements of FANR-REG-02, "*Siting of Nuclear Facilities*" would apply.

G.11 Spent fuel pool storage is currently considered in the design of Barakah NPP and FANR requirements have been addressed in the Final Safety Analysis Report (FSAR). ENEC also envisions that capability may be required for the dry storage of spent fuel. ENEC and its affiliates will comply with FANR requirements in the siting and design of the dry spent fuel storage facility.

Article 7: Design and construction of facilities

Each Contracting Party shall take the appropriate steps to ensure that:
(i) the design and construction of a spent fuel management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;
(ii) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a spent fuel management facility are taken into account;
(iii) the technologies incorporated in the design and construction of a spent fuel management facility are supported by experience, testing or analysis.

G.12 In accordance with Article (28) (1) of the *UAE Nuclear Law*, an applicant for a licence to construct or operate a spent fuel management facility would be required to submit a detailed evidence of safety that would be reviewed and assessed by FANR. Consistent with the approach described in FANR-REG-11, any proposal for a spent fuel management facility would need to establish a Safety Case. The approach to the design and construction of the facility would be a part of the safety case. It would be expected that the relevant requirements of FANR-REG-03 "*Design of Nuclear Power Plants*" and FANR-REG-14 "*Construction of a Nuclear Facility*" would apply.

G.13 FANR-REG-03 "*Regulation for the Design of Nuclear Power Plants*" Article (82) states:
"*Adequate systems shall be provided to treat radioactive liquid and gaseous effluents in order to keep Doses arising from Discharge of Radioactive Material within the Dose limits established by REG-04, Regulation for*

Radiation Dose Limits and Optimisation of Radiation Protection for Nuclear Facilities and subject to optimisation of protection as defined in that Regulation".

To ensure that spent fuel and radioactive waste management facilities are designed and constructed to limit possible radiological impacts and discharges throughout their life cycle, reviews of the proposed design and operation of the facilities will be conducted against well-established design and construction criteria in the regulations. Subsequent monitoring and inspection during the construction process will provide confidence that the facilities will operate safely.

G.14 ENEC and its affiliates have ensured sufficient capacity in the spent fuel storage pool for 20 years of operation for each unit at Barakah NPP. ENEC and its affiliates have also reserved sufficient space in the Barakah NPP site layout plan for the construction of a spent fuel dry storage facility in the future.

Article 8: Assessment of safety of facilities

Each Contracting Party shall take the appropriate steps to ensure that: (i) before construction of a spent fuel management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out (ii) before the operation of a spent fuel management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i)

G.15 In accordance with Article (28) (1) of the *UAE Nuclear Law*, an applicant for a licence to construct or operate a spent fuel management facility will be required to submit detailed evidence of safety that would be reviewed and assessed by FANR. Environmental assessment will be carried out by the relevant competent authority (e.g. the Environment Agency of Abu Dhabi). Consistent with the approach described in FANR-REG-11, the proponent of a spent fuel management facility will need to establish a Safety Case.

G.16 Consistent with the approach taken in FANR regulations of Nuclear Facilities to date, FANR reviews and assesses a preliminary safety case at the stage of seeking a construction licence followed by a final safety case at the stage of the operating licence. FANR-REG-11, Article (23) states ":

1. "*The Licensee shall ensure that the Safety Case for gases and effluents shall describe:*
    a) *the characteristics and activity of the material to be discharged, and the potential points and methods of discharge;*
    b) *all significant exposure pathways by which discharged radionuclides can deliver Public Exposure;*
    c) *the total amount of various radionuclides expected to be discharged per year; and*
    d) *the Doses to the Representative Person due to the planned discharges.*
2. *The Licensee shall ensure that Doses arising from discharges meet the requirements of FANR-REG-04 Dose Limits and Optimisation for Nuclear Facilities.*
3. *The Licensee shall, review and adjust the discharge control measures taking into account:*
    a) *Operating experience*
    b) *Any changes in exposure pathways and the characteristics of the critical group that could affect the assessment of Doses due to the discharges.*
4. *The Licensee shall record the details of all gaseous and liquid discharges, including estimates of any unmonitored discharges, in the source monitoring programme. "*

G.17 Consistent with the approach taken in FANR regulation of Nuclear Facilities to date, ENEC submitted an application to FANR on 27 December 2010 for the construction of the first two units of the nuclear facility

at the Barakah NPP site (Barakah Units 1 and 2). The application requested authorisation to conduct all regulated activities required to construct the plant, including management of spent fuel and radioactive waste. On 28 February 2013, ENEC submitted to FANR a further application for authorisation to construct the third and fourth APR-1400 units at the Barakah NPP site. In July 2012 FANR issued Construction Licences for Barakah Units 1 and 2 and in September 2014 FANR issued Construction Licences for Barakah Units 3 and 4.

On 26 March 2015, an Operating License Application was submitted for Barakah Units 1 and 2. The Licences to Operate the Barakah Nuclear Energy Plant Units are under consideration by FANR, with a decision expected to be made on the Operating Licence for Unit 1 by the time of the 6th Review Meeting. Fresh nuclear fuel assemblies intended for Unit 1 have been received and are stored at the Barakah NPP site, subject to regulatory oversight by FANR. On 27 March 2017, an Operating License Application was submitted for Barakah Units 3 and 4. Nawah is the Applicant for the Operating Licenses for Barakah units 1, 2, 3 and 4. Nawah has the contractual authority and responsibility for pre-disposal radioactive waste management.

In addition, ENEC prepared a Non-Nuclear-Environmental Impact Assessment (NN-EIA) and a Nuclear-Environmental Impact Assessment (N-EIA) for Barakah NPP Units 1, 2, 3 and 4 that was submitted to the Environment Agency of Abu Dhabi (EAD). Based on the EAD review of the NN-EIA and the N-EIA, a *"No Objection Certificate"* was granted for the non-nuclear and nuclear construction activities for Barakah Units 1 and 2 according to the technical details and plans included in the project environmental impact assessment report (number S439) and the project environmental management plan (number S433). EAD issued "No Objection Certificate" for nuclear construction activities for Barakah units 1, 2, 3, and 4 according to approval EIA report (S943) and its Ref. (EMS/14/ESRF816).

G.18 ENEC has ensured sufficient capacity in the spent fuel storage pool for 20 years of operation for each unit at Barakah NPP. ENEC and its affiliates have reserved sufficient space in the Barakah NPP site layout plan for the construction of a spent fuel dry storage facility if needed in the future.

Article 9: Operation of facilities

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

(i) the licence to operate a spent fuel management facility is based upon appropriate assessments as specified in Article 8 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements

(ii) operational limits and conditions derived from tests, operational experience and the assessments, as specified in Article 8, are defined and revised as necessary

(iii) operation, maintenance, monitoring, inspection and testing of a spent fuel management facility are conducted in accordance with established procedures

(iv) engineering and technical support in all safety-related fields are available throughout the operating lifetime of a spent fuel management facility

(v) incidents significant to safety are reported in a timely manner by the holder of the licence to the regulatory body

(vi) programmes to collect and analyse relevant operating experience are established and that the results are acted upon, where appropriate

(vii) decommissioning plans for a spent fuel management facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body

G.19 All the above requirements are included in the FANR regulations dealing with Nuclear Facilities (including spent fuel management facilities) and would be appropriately applied to any proposed spent fuel management facility.

Article 10: Disposal of spent fuel

> If, pursuant to its own legislative and regulatory framework, a Contracting Party has designated spent fuel for disposal, the disposal of such spent fuel shall be in accordance with the obligations of Chapter 3 relating to the disposal of radioactive waste.

G.20 Should the UAE designate spent fuel for disposal as part of its spent fuel and radioactive waste management strategy, the provisions of the Nuclear Law and previously-mentioned FANR Regulations would apply in conformance with the requirements of the Convention.

Section H. Safety of Radioactive Waste Management

Article 11: General Safety Requirements

Each Contracting Party shall take the appropriate steps to ensure that at all stages of radioactive waste management individuals, society and the environment are adequately protected against radiological and other hazards.
In so doing, each Contracting Party shall take the appropriate steps to:

(i) ensure that criticality and removal of residual heat generated during radioactive waste management are adequately addressed,
(ii) ensure that the generation of radioactive waste is kept to the minimum practicable
(iii) take into account interdependencies among the different steps in radioactive waste management
(iv) provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards
(v) take into account the biological, chemical and other hazards that may be associated with radioactive waste management
(vi) strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation
(vii) aim to avoid imposing undue burdens on future generations

H.1 FANR-REG-11 *"Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities"* contains a chapter about Predisposal Management of Radioactive Waste. FANR-REG-24, *"Basic Safety Standards for Facilities and Activities involving Ionizing Radiation other than in Nuclear Facilities"* contains paragraphs on radioactive waste management. Both regulations are complemented by FANR-REG-26 *"Predisposal Management of Radioactive Waste"* and FANR-RG-018 *"Predisposal Radioactive Waste Management"* which contains more requirements on pre-disposal management of radioactive waste.

General Obligations of license holder

H.2 Article (14) of FANR-REG-11 requires the licensee to be responsible for the waste until its delivery to the entity designated by the Cabinet of Ministers for the purpose of disposal. It also requires the licensee to carry out a Safety Assessment and develop a Safety Case for each identified waste stream including all phases of a radioactive waste management facility's life span. The Licensee is required to implement measures to ensure an integrated approach to safety and security.

H.3 ENEC and its affiliates are responsible for the safe management and storage of Radioactive Waste generated from Barakah NPP until its delivery to the WMO or operator of a waste management facility. This includes the following responsibilities:

- The safety of predisposal radioactive waste management for Barakah NPP and its activities.
- Carrying out safety assessments and developing a safety case for each identified waste stream.
- Ensuring that the siting, design, construction, commissioning, operation, shut down and decommissioning of the Barakah NPP are carried out in compliance with FANR regulations.

- Implementing measures to ensure an integrated approach to safety in the predisposal management of Radioactive Waste in accordance with FANR-REG-11.
- Applying the management system established in accordance with FANR-REG-01 for all steps and elements of the Predisposal Management of Radioactive Waste.

Waste minimization

H.4 Article (15) of FANR-REG-11 requires the Licensee to identify all radioactive waste and keep radioactive waste to a minimum. It also states that the Licensee shall consider the authorized discharge of effluent and the clearance of material from Regulatory control after processing and/or storage, together with reuse and recycling of material in order to reduce the amount of waste that needs further processing or storage.

H.5 Article (5) of FANR-RG-018 provides useful strategies for waste minimization. This guidance provides considerations that should be given to the design of the facility and to operational features for waste minimization.

H.6 ENEC has committed to complying with the USNRC Regulatory Guide 4.21, "*Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning",* which provides additional information on minimization of waste throughout all stages of the nuclear fuel cycle, including disposal. This guidance provides examples of measures, which can be combined to support a contaminant management philosophy. This philosophy includes prevention of unintended release, early detection of potential releases, and proper cleanup when releases happen.

H.7 Barakah NPP has been designed, constructed and will be operated in a manner that keeps radioactive waste volume to a minimum practicable with proven technologies.

Furthermore, ENEC and its affiliates are committed to adopting appropriate processes for the responsible discharge of effluents, in addition to the clearance of material from regulatory control. These processes include the reuse, recycling and storage of material.

Interdependences among different steps

H.8 Article (14.4) of FANR-REG-11 states that the licensee shall take into account interdependencies among all steps in the predisposal waste management of radioactive waste, as well as the impact of the anticipated disposal option as this becomes known to be able to consider the radioactive waste management in an integrated manner.

H.9 The steps adopted for predisposal waste management at Barakah NPP are widely accepted amongst the nuclear industry worldwide. Because each step and technology has interdependencies with other steps, predisposal waste management will be executed in an integrated manner to minimize the waste volume and radiation exposure to workers and general public.

Protection of individuals, society and the environment

H.10 Article (24) of FANR-REG-11 describes the Licensee's obligations with regard to establishing an environmental monitoring programme to ensure that public exposure is adequately assessed and is sufficient to demonstrate compliance with the regulations. The article also describes minimum requirements on what the programme shall include.

H. 11 ENEC and its affiliates have implemented an environmental monitoring programme which complies with governmental regulations. As a part of this program, environmental samples are being collected, analyzed and documented in advance of operations, in order to collect baseline environmental data.

Non radiological hazards in waste management

H.12 Article (16) of FANR-REG-11 requires the Licensee to characterize waste in terms of its physical, mechanical, chemical, radiological and biological properties at various steps and classify it appropriately, including from the perspective of its future disposal.

H.13 ENEC and its affiliates characterize waste according to the UAE regulatory requirements. According to physical properties, waste will be classified into gaseous, liquid and solid wastes.

Based on these detailed classifications, appropriate technologies will be applied to treat waste. Furthermore, there will be an effort to identify non-radioactive waste, which will be separated from radioactive waste and disposed of accordingly, in order to minimize the radioactive waste volume and to optimize doses to workers and the general public in accordance with the governmental regulations.

Strive to avoid actions that impose impacts on future generations

H.14 While not explicitly covered in the Regulation, this IAEA Safety Fundamental (SF-1) principle No. 7 is included in the *UAE Nuclear Law* Article (11.4.a) where the FANR Board is authorized "*to protect the individuals, society and the environment from radiation hazards, both for the present and in the future".*

Aim to avoid to impose undue burden on future generations

H.15 While not explicitly covered in the Regulation, this IAEA Safety Fundamental (SF-1) principle No. 7 is included in the *UAE Nuclear Law* Article (11.4.a) where the FANR Board is authorized "*to protect the individuals, society and the environment from radiation hazards, both for the present and in the future".*

H.16 The overriding priority of ENEC and its affiliates is ensuring the safety of the UAE community, its employees and the environment. ENEC and its affiliates understand their obligation to future generations and strive to conduct their activities with long-term sustainability in mind, avoiding any undue impacts. ENEC and its affiliates will process radioactive waste to the minimum waste volume achievable, maintaining high quality waste form, which will reduce the burden on ultimate disposal and ensure long term protection of the environment and the nation's future generations.

Article 12: Existing facilities and past practices

Each Contracting Party shall in due course take the appropriate steps to review:

(i) the safety of any radioactive waste management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility

(ii) the results of past practices in order to determine whether any intervention is needed for reasons of radiation protection bearing in mind that the reduction in detriment resulting from the reduction in dose should be sufficient to justify the harm and the costs, including the social costs, of the intervention

H.17 Currently, there are no radioactive waste management facilities in the UAE.

Article 13: Siting of proposed facilities.

1. Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed radioactive waste management facility:
   (i) to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime as well as that of a disposal facility after closure
   (ii) to evaluate the likely safety impact of such a facility on individuals, society and the environment, taking into account possible evolution of the site conditions of disposal facilities after closure
   (iii) to make information on the safety of such a facility available to members of the public
   (iv) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory
2. In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects

H.18 In accordance with Article (28) (1) of the *UAE Nuclear Law*, an applicant for a licence to construct or operate a radioactive waste management facility will be required to submit detailed evidence of safety that will be reviewed and assessed by FANR. Consistent with the approach described in FANR-REG-11, a Safety Case and supporting Safety Assessment for a radioactive waste management facility would need to be reviewed and assessed by FANR. The characteristics of the siting of the facility would be a part of the Safety Case. It is expected that the relevant requirements of FANR-REG-02 "*Siting of Nuclear Facilities*" would apply.

H.19 ENEC and its affiliates, as the owner and operator of Barakah NPP, will be responsible for the safe operation and maintenance of the plant, including minimizing the generation of radioactive waste and overseeing the safe storage of any waste within the site boundary.

In order to optimize doses to plant workers and the general public, the international standards and FANR regulations have been applied to the design, construction, and operation of Barakah NPP radioactive waste and spent fuel management. The details are described in the Preliminary Safety Analysis Reports and further discussed in the Final Safety Analysis Report.

Once plans for the UAE's radioactive waste management facilities are finalized, and the WMO who will operate these facilities is in place, ENEC and its affiliates will cooperate with the appointed WMO to ensure radiation safety for both workers and general public.

Article 14: Design and construction of facilities.

Each Contracting Party shall take the appropriate steps to ensure that:
(i) the design and construction of a radioactive waste management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases
(ii) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a radioactive waste management facility other than a disposal facility are taken into account
(iii) at the design stage, technical provisions for the closure of a disposal facility are prepared
(iv) the technologies incorporated in the design and construction of a radioactive waste management facility are supported by experience, testing or analysis

H.20 In accordance with Article (28) (1) of the *UAE Nuclear Law*, an applicant for a licence to construct or operate a radioactive waste management facility will be required to submit detailed evidence of safety that will be reviewed and assessed by FANR. Consistent with the approach described in FANR-REG-11, any proposal for a radioactive waste management facility would need to establish a Safety Case. The approach to the design and construction of the facility would be a part of the Safety Case. It is expected that the relevant requirements of FANR-REG-03 "*Design of Nuclear Power Plants*" and FANR-REG-14 '*Construction of a Nuclear Facility*" would apply.

H.21 FANR-REG-03 "*Regulation for the Design of Nuclear Power Plants*" Article (82) states:
"*Adequate systems shall be provided to treat radioactive liquid and gaseous effluents in order to keep Doses arising from Discharge of Radioactive Material within the Dose limits established by REG-04, Regulation for Radiation Dose Limits and Optimisation of Radiation Protection for Nuclear Facilities and subject to optimisation of protection as defined in that Regulation*".

To ensure that the spent fuel and radioactive waste management facilities are designed and constructed to limit possible radiological impacts and discharges throughout their life cycle, FANR will review the proposed design and operation of the facilities against well-established design and construction criteria in the regulations. Subsequent monitoring and inspection during the construction process, by FANR will provide confidence that the facilities will operate safely.

H 22 When plans for the UAE's radioactive waste management facilities are finalized, and the WMO who will operate these facilities is in place, ENEC and its affiliates will cooperate with the appointed WMO to ensure radiation safety for both workers and general public.

Article 15: Assessment of safety of facilities

Each Contracting Party shall take the appropriate steps to ensure that: (i) before construction of a radioactive waste management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out (ii) in addition, before construction of a disposal facility, a systematic safety assessment and an environmental assessment for the period following closure shall be carried out and the results evaluated against the criteria established by the regulatory body (iii) before the operation of a radioactive waste management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i)

H.23 In accordance with Article (28) (1) of the *UAE Nuclear Law*, an applicant for a licence to construct or operate a spent fuel management facility would be required to submit detailed evidence of safety that would be reviewed and assessed by FANR. Environmental assessment would be carried out by the relevant competent authority (e.g. the Environment Agency of Abu Dhabi see section G.17). Consistent with the approach described in FANR-REG-11, a Safety Case and supporting Safety Assessment for a spent fuel management facility would need to be reviewed and assessed by FANR. This is defined as: "*A collection of arguments and evidence in support of the Safety of a Facility or Activity including the findings of a Safety assessment and a statement of confidence in these findings."*

H.24 Consistent with the approach taken in its regulation of Nuclear Facilities to date, FANR would expect a preliminary safety case at the stage of seeking a construction licence followed by a final safety case at the stage of the operating licence. FANR-REG-11, Article (23) states:

1. "*The Licensee shall ensure that the Safety Case for gases and effluents shall describe:*

a) *the characteristics and activity of the material to be discharged, and the potential points and methods of discharge;*
b) *all significant exposure pathways by which discharged radionuclides can deliver Public Exposure;*
c) *the total amount of various radionuclides expected to be discharged per year; and*
d) *the Doses to the Representative Person due to the planned discharges.*

2. *The Licensee shall ensure that Doses arising from discharges meet the requirements of FANR REG 04 Dose Limits and Optimisation for Nuclear Facilities.*
3. *The Licensee shall, review and adjust the discharge control measures taking into account:*
   a) *Operating experience*
   b) *Any changes in exposure pathways and the characteristics of the critical group that could affect the assessment of Doses due to the discharges.*
4. *The Licensee shall record the details of all gaseous and liquid discharges, including estimates of any unmonitored discharges, in the source monitoring programme. "*

H.25 When plans for the UAE's radioactive waste management facilities are finalized, and the WMO who will operate these facilities is in place, ENEC and its affiliates will cooperate with the appointed WMO to ensure radiation safety for both workers and general public.

Article 16: Operation of facilities

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

(i) the licence to operate a radioactive waste management facility is based upon appropriate assessments as specified in Article 15 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements

(ii) operational limits and conditions, derived from tests, operational experience and the assessments as specified in Article 15 are defined and revised as necessary

(iii) operation, maintenance, monitoring, inspection and testing of a radioactive waste management facility are conducted in accordance with established procedures. For a disposal facility the results thus obtained shall be used to verify and to review the validity of assumptions made and to update the assessments as specified in Article 15 for the period after closure

(iv) engineering and technical support in all safety-related fields are available throughout the operating lifetime of a radioactive waste management facility

(v) procedures for characterization and segregation of radioactive waste are applied

(vi) incidents significant to safety are reported in a timely manner by the holder of the licence to the regulatory body;

(vii) programmes to collect and analyse relevant operating experience are established and that the results are acted upon, where appropriate

(viii) decommissioning plans for a radioactive waste management facility other than a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body

(ix) plans for the closure of a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility and are reviewed by the regulatory body

H.26 All the above requirements are included in the FANR regulations dealing with Nuclear Facilities (including radioactive waste management facilities) and would be appropriately applied to any proposed radioactive waste management facility.

H.27 The operation of the radioactive waste management facility at an operating nuclear power plant will be addressed within the context of the safety case associated with the operating facility.

H.28 When plans for the UAE's radioactive waste management facilities are finalized, and the WMO who will operate these facilities is in place, ENEC and its affiliates will cooperate with the appointed WMO to ensure radiation safety for both workers and general public.

Article 17: Institutional measures after closure

Each Contracting Party shall take the appropriate steps to ensure that after closure of a disposal facility:

(i) records of the location, design and inventory of that facility required by the regulatory body are preserved

(ii) active or passive institutional controls such as monitoring or access restrictions are carried out, if required and

(iii) if, during any period of active institutional control, an unplanned release of radioactive materials into the environment is detected, intervention measures are implemented, if necessary

H.29 These obligations of the Joint Convention are included in the draft FANR-REG-27 concerning radioactive waste disposal facilities. This regulation is based on IAEA Safety Standards Requirement No. SSR-5, *"Disposal of Radioactive Waste"* where all the obligations are included.

H.30 FANR-REG-27 applies to the disposal of radioactive waste of all types by means of emplacement in designed disposal facilities, subject to the necessary limitations and controls being placed on the disposal of the waste and on the siting, design, construction, operation and closure of facilities. The classification of radioactive waste is discussed in FANR-REG-26, FANR-RG-018 and draft FANR-RG-027.

This regulation will establish the safety requirements to provide assurance of the radiation safety of the disposal of radioactive waste, in the operation of a disposal facility and especially after its closure. The fundamental safety objective is to protect people and the environment from harmful effects of ionizing radiation. This is achieved by setting requirements on the site selection and evaluation and design of a disposal facility, its construction, operation and closure, including organizational and regulatory requirements.

The draft FANR-REG-27 addresses the following disposal options, corresponding to recognized classes of radioactive waste:

(a) Specific landfill disposal facility for the disposal of very low level radioactive waste (VLLW) with low concentrations or quantities of radioactive content. Typical waste disposed of in a facility of this type may include soil and rubble arising from decommissioning activities.

(b) Near-surface disposal facility for the disposal of low level radioactive waste (LLW).

(c) Intermediate level waste disposal facility for the disposal of intermediate level radioactive waste (ILW)

(d) Geological disposal facility for the disposal of high level radioactive waste (HLW), including spent fuel if it is to be treated as waste.

(e) Borehole disposal facility for the disposal of only relatively small volumes of waste, in particular disused sealed radioactive sources.

The regulation addresses the safety requirements during three periods associated with the development, operation and closure of a disposal facility:

(i) the pre-operational period
(ii) the operational period and
(iii) the post-closure period.

Section I Transboundary Movement

Article 27: Transboundary Movement

1. Each Contracting Party involved in transboundary movement shall take the appropriate steps to ensure that such movement is undertaken in a manner consistent with the provisions of this Convention and relevant binding international instruments. In so doing:
   (i) a Contracting Party which is a State of origin shall take the appropriate steps to ensure that transboundary movement is authorized and takes place only with the prior notification and consent of the State of destination
   (ii) transboundary movement through States of transit shall be subject to those international obligations which are relevant to the particular modes of transport utilized
   (iii) a Contracting Party which is a State of destination shall consent to a transboundary movement only if it has the administrative and technical capacity, as well as the regulatory structure, needed to manage the spent fuel or the radioactive waste in a manner consistent with this Convention
   (iv) a Contracting Party which is a State of origin shall authorize a transboundary movement only if it can satisfy itself in accordance with the consent of the State of destination that the requirements of subparagraph (iii) are met prior to transboundary movement
   (v) a Contracting Party which is a State of origin shall take the appropriate steps to permit re-entry into its territory, if a transboundary movement is not or cannot be completed in conformity with this Article, unless an alternative safe arrangement can be made
2. A Contracting Party shall not licence the shipment of its spent fuel or radioactive waste to a destination south of latitude 60 degrees south for storage or disposal.
3. Nothing in this Convention prejudices or affects:
   (i) the exercise, by ships and aircraft of all States, of maritime, river and air navigation rights and freedoms, as provided for in international law
   (ii) rights of a Contracting Party to which radioactive waste is exported for processing to return, or provide for the return of, the radioactive waste and other products after treatment to the State of origin
   (iii) the right of a Contracting Party to export its spent fuel for reprocessing
   (iv) rights of a Contracting Party to which spent fuel is exported for reprocessing to return, or provide for the return of, radioactive waste and other products resulting from reprocessing operations to the State of origin

I.1 As a Contracting Party to the Joint Convention, the UAE adopts and supports the objectives of Article 27 without exception. Import of spent fuel and nuclear waste into the UAE for the purpose of long term storage or disposal is prohibited under the *UAE Nuclear Law*, Article (41.3).

Section J. Disused Sealed Sources

Article 28: Disused sealed sources

1. Each Contracting Party shall, in the framework of its national law, take the appropriate steps to ensure that the possession, remanufacturing or disposal of disused sealed sources takes place in a safe manner.
2. A Contracting Party shall allow for reentry into its territory of disused sealed sources if, in the framework of its national law, it has accepted that they be returned to a manufacturer qualified to receive and possess the disused sealed sources.

J.1 The 'possession, use, manufacture or handling' and the 'storage' and 'disposal' of Regulated Material are Regulated Activities under Article (25) of the *UAE Nuclear Law.* The definition of Regulated Material clearly includes sealed radioactive sources (with activity above the UAE exemption levels). Therefore, the 'possession, remanufacturing or disposal' of disused sources is subject to licensing by FANR with the associated need for safety to be demonstrated.

J.2 In general, UAE users of sealed sources shall have contractual arrangements to return disused sealed sources to the manufacturer. The verification of these arrangements is an important part of FANR's review and assessment and regulatory oversight of these licensees. Article (18.8.e) of FANR-REG-24 requires that licensees ensure that arrangements are made for the safe management and disposition of radioactive sources, including financial provisions where appropriate, once they have become disused.

J.3 FANR also has power under Article (5.32) of the *UAE Nuclear Law* to develop a strategy to ensure radiation protection from orphan sources. Such a strategy is in force now as adopted by the FANR Board of Management. The strategy objective is to assure radiation protection from orphan sources. The Action Plan comprises of Governance for Safety, Search and Recovery activities, arrangements for End-of Life Management, and Awareness activities.

The national Radiation Protection Committee established an Orphan Source Strategy Working Group in 2016. The Working Group is responsible for implementing the Strategy and the Action Plan. This Working Group is an inter-agency working group comprising of authorities in the country being stakeholders in implementation of the Action Plan. The working group started with implementation of the Action Plan, and is currently focusing on the following:

- Streamlining communication between authorities in order to assure timely and appropriate response to orphan source events,
- Integration of response in the case orphan source event is identified on the borders,
- Establishment of formal arrangements to operate existing centralized orphan source storage facility, and
- Conduct of search and recovery campaigns.

J.4 Part of the orphan source strategy was to find a central storage facility for the sources. This is now accomplished and the sources have been moved to this facility. The planned strategy for locating orphan sources will proceed.

J.5 At the fourth review meeting FANR reported 12 orphan sources. Four of these sources were not orphan but disused and has been exported for reuse. The UAE still has 8 orphan sources registered in the Orphan Source Register. Sources in use and disused sources are registered in the FANR E-Licensing System. See Annex A.

Section K. General Efforts to Improve Safety

K.1 The discussion contained in this third UAE Joint Convention *National Report* of actions taken by the UAE, as a Contracting Party, regarding the obligations under relevant Articles of the Joint Convention confirms the continuous 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.

At an early stage in the programme, the UAE government recognized the need to put into place the necessary legislative, regulatory, and organisational framework to ensure the safety, security and environmental acceptability of its spent fuel management and radioactive waste management. This *National Report* is the third Joint Convention 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 organisations are fully committed to meeting the obligations of this Joint Convention and actively participating in the peer review process established under the Joint Convention. The UAE has adopted a policy of transparency regarding its nuclear programme, including spent fuel and radioactive waste, 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 Joint Convention 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 May 2018 Joint Convention review meeting.

UAE's report on compliance with the obligation of the Joint Convention in 2015

K.2 During the period before the meeting in May 2015, UAE received 43 questions to be answered on UAE's second report. The questions concerned several articles of the Joint Convention and were mostly requests for clarifications and related to matters of the longer term strategy of the UAE for storage and disposal of spent fuel and radioactive waste, the management of orphan sources, and regulatory independence and sustainability of radiation safety knowledge in non-nuclear fields of radiation safety and security. All questions were answered on the Joint Convention website and commented on in a general sense at the meeting.

Outcome from the fifth Joint Convention Review Meeting in 2015

K.3 During the discussion at the Joint Convention Review Meeting in 2015 it was concluded that the UAE made particular progress within the following areas:

- A Knowledge Management (KM) programme introduced.
- Plans and considerations on waste and Spent Fuel in place and consistent with the timelines for operating a Nuclear Programme.
- Storage for orphan sources in place.
- Safety improvements for Spent Fuel pools in response to Fukushima Daiichi Accident.
- Use of international peer review services.
- Integration of international experience into domestic programme.
- Reporting of the management of NORM outside of the nuclear fuel cycle as part of the Joint Convention.

The UAE continues to develop its radioactive waste and spent fuel management programme.

K.4 Highlights from the UAE's Second report were as follows:

- Starting construction of two NPPs Units 3 and 4.
- Continued use of international experts to assist in regulatory development and oversight.
- Development of an Orphan Source strategy and an Action Plan.
- Conducting and commencing to implement a comprehensive national RWM/SFM strategy in a timely manner in progress.
- Sustainable human capacity development both for regulatory and nuclear/non-nuclear sectors in line with the time frame of the strategy.
    - Radiation safety training requirements for radiation workers is ongoing.
    - In-house training programme and national programme of capacity building is ongoing.
- Continued development and implementation of comprehensive regulations and regulatory guides to support the National Strategy.
    - Regulations of predisposal waste management and existing exposure situations Completed.
    - Regulations on waste disposal and decommissioning in progress.

K.5 The following challenges were identified for the future development with regard to management of spent fuel and radioactive waste;

Table K.5

Challenges for the UAE from the fifth Review Meeting	**Current status**	**See section**
Establishing the waste management organization (WMO) to implement the policy on disposal of radioactive waste.	The waste management organisation has yet to be established as of October 2017.	WMO: B.5, H.3, K.9 SNF policy: B.1-B.3 RW policy: B.5
Ensuring that the DTF entity is fully established by the time of operation of the first NPP unit.	The regulation setting out the arrangements for the DTF is in advanced draft. A 'reference scenario' for decommissioning and disposal facilities and timing has been agreed between FANR and ENEC and its affiliates, which enables an agreed fee to be set for contributions to the DTF. These moneys will be set aside even if the DTF is not formally established by the time operation commences.	Table A-6 F.5
Recruiting, training and retaining skilled workforce in radioactive waste and spent fuel management.	This is a continuing challenge	E.37 and E.43
Decision on facilities for radioactive waste and spent fuel management prior to the disposal path being determined.	To support on-going operations ENEC and its affiliates intend to establish an independent spent fuel storage installation (ISFSI) and an interim storage facility for low and intermediate level radioactive waste at the Barakah NPP site. The reference scenario adopted for the UAE by FANR and ENEC envisages disposal of ILW and direct disposal of spent fuel in a GDF to be constructed in the UAE, along with disposal of LLW in a near-surface repository in the UAE.	ISFSI; B.4 RW Storage; B.8 Reference scenario; B.3

K.6 The following UAE planned measures to improve safety were identified;

Table K.6

UAE planned measures to improve safety	Current status	See section
Completing regulations and regulatory guides for radioactive waste disposal and for decommissioning.	• FANR-REG-21 "*Decommissioning of Facilities*" completed. • FANR-REG-22 "*Decommissioning Trust Fund*" under development. • FANR-REG-26 "*Predisposal Management of Radioactive Waste*" and its guide FANR-RG-018 completed. • FANR-REG-27 "*Disposal of Radioactive Waste*" and its supporting guide FANR-RG-027 "*Near-Surface Disposal of Radioactive Waste*" both under development.	E.8-E.9 and Annex B
Establishing the decommissioning trust fund (DTF).	In progress	F.5
Implementing the arrangements for radioactive waste and spent fuel management as the Barakah NPP comes into operation.	• The capacity of the spent fuel storage pool is 20 years of operation for each plant. • storage of low and intermediate level radioactive waste at the Barakah NPP site • an independent spent fuel storage installation (ISFSI) to support on-going operations will be established before the spent fuel storage pool reaches capacity.	B.4 and B.8

Outcome from the fifth Joint Convention Review Meeting in 2015

K.7 International review missions performed and planned

Since 2011 the UAE has received 11 international review missions:

- Integrated Nuclear Infrastructure Review (INIR) Mission in 2011.
- A Site Review Mission in 2011.
- IAEA Integrated Regulatory Review Service (IRRS) Mission in 2011.
- IRRS follow-up Mission in 2014.
- IAEA SSAC Advisory Service (ISSAS) Mission in 2014.
- Review mission on Integrated Management Systems in 2014.
- Expert mission on knowledge management in 2014.
- Occupational Radiation Protection Appraisal (ORPAS) in 2014.
- Emergency Preparedness Review (EPREV) in 2015.
- International Physical Protection Advisory Service (IPPAS) Mission in 2016.
- Education and Training Appraisal (EduTA) Mission in 2017.

Annex C Lists references to official national and international reports related to safety.

The following review missions are planned before Barakah enters into operation:

- Operational Safety Review Team for pre operational phase – Pre-OSART (September 2017)

Planned Efforts to Improve Safety

K.8 Decommissioning Trust Fund Established

Contributions to the DTF will be sufficient to meet the costs of the decommissioning of the Barakah NPP units and the construction, operation and decommissioning of a GDF and a near-surface repository and associated facilities as and when these cost fall due.

K.9 Waste Management Organisation appointed

The UAE government will appoint a Waste Management Organisation (WMO) for the managing of the disposal of spent fuel and radioactive waste in the UAE.

K.10 Continued development of regulations and guides

Continue to develop regulations and guides according to the FANR Regulation and Guide development plan as approved by the FANR Board in June 2017

K.11 NORM Facility and disposal licensing

The application for a NORM treatment and disposal facility is still under review by FANR. An operating licence is expected to be granted by FANR prior to the Sixth Joint Convention Review Meeting. This planned NORM treatment and disposal facility will be the first of its kind in the UAE.

K.13 International cooperation

The UAE will continue to participate in peer reviews, international meeting and events, such as the Meeting on the Convention of Nuclear Safety and Joint Convention on Spent Fuel management and on the Safety of Radioactive Waste Management and also continue to participate in development of IAEA Safety Standards through membership on the Standards Committees like the Commission on Safety Standards (CSS), the Radiation Safety Standards Committee (RASSC), the Nuclear Safety Standards Committee (NUSSC), and the Nuclear Security Guidance Committee (NSGC).

Section L. Annexes

Annex A Inventory of orphan sources
Annex B References to national laws, regulations, requirements, guides, etc.
Annex C References to official national and international reports related to safety

Annex A – Inventory of radioactive waste

No	Radio-nuclide	Activity	Application	Found in	Remarks
1	Sr-90	55 mCi	Eye plaque (BRACHYTHERAPY)	Collected from Scrap of governmental department	Found pre FANR
2	Cs-137	20 mCi	Crawler Control Source	Brought in Scrap from Italy to free zone	Found pre FANR
3	unknown probably Ra-226	unknown	Lightening Preventing Device	Brought in Scrap from Republic of Ivory Coast to free zone	Found pre FANR
4	Am-241/Be	50 mCi	Soil Moisture Probe	Collected from Scrap of governmental department	Found pre FANR
5	Cs-137	100 mCi	Cement, mud Densitometer	Received from government company.	Found pre FANR
6	Cs-137	Unknown	Unknown	NDT company	
7	Cs-137	Unknown	Unknown	NDT company	
8	Ir-192	Unknown	Unknown	NDT company	

Note: Orphan sources is stored in a central storage facility 2011-2017

Annex B - References to national laws, regulations, requirements, guides, etc.

UAE Policy Paper, Policy of the United Arab Emirates on the Evaluation and Potential Development of Peaceful Nuclear Energy, (can be found on FANR website, www.fanr.gov.ae under 'Open data' and 'Nuclear Law')
Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy (can be found on FANR website, www.fanr.gov.ae under 'Open data' and 'Nuclear Law')and
Federal Law by Decree No. 4 of 2012 Concerning Civil Liability for Nuclear Damage.

All issued documents below (not the drafts) can be found on the FANR website, www.fanr.gov.ae under 'Regulations and Guides'.

The FANR Regulation and Guide development plan is being updated for the period of 2017 to 2021 and will be accessible on FANR website.

FANR Regulations

FANR now has 21 Regulations (4 more drafted) and 28 Regulatory Guides of which 11 are drafts.

- FANR-REG-01 "Regulation for Management Systems for Nuclear Facilities"
- FANR-REG-02 "Regulation for the Siting of Nuclear Facilities"
- FANR-REG-03 "Regulation for the Design of Nuclear Power Plants"
- FANR-REG-04 "Regulation for Radiation Dose Limits and Optimisation of Radiation Protection for Nuclear Facilities" (under revision)
- FANR-REG-05 "Regulation for the Application of Probabilistic Risk Assessment (PRA) at Nuclear Facilities"
- FANR-REG-06 "Regulation for an Application for a Licence to Construct a Nuclear Facility"
- FANR-REG-08, (Version 1) "Physical Protection of Nuclear Material and Nuclear Facilities"
- FANR-REG-09 "Regulation on the Export and Import Control of Nuclear Material, Nuclear Related Items and Nuclear Related Dual-Use Items"
- FANR-REG-10 "Regulation for the System of Accounting for and Control of Nuclear Material and Application of Additional Protocol"
- FANR-REG-11 "Regulation for Radiation Protection and Predisposal Radioactive Waste Management for Nuclear Facilities"
- FANR-REG-12 "Regulation for Emergency Preparedness for Nuclear Facilities"
- FANR-REG-13 "Regulation for the Safe Transport of Radioactive Materials"
- FANR-REG-14 "Regulation for Application for a License to Operate a Nuclear Facility"
- FANR-REG-15 "Requirements for Off-Site Emergency Plans for Nuclear Facilities"
- FANR-REG-16 "Operational Safety including Commissioning"
- FANR-REG-17 "Regulation for the Certification of Operating Personnel at Nuclear Facilities"
- FANR-REG-19 "Regulation for Existing Exposure Situations"
- FANR-REG-21 "Decommissioning of Facilities"
- FANR-REG-23 (Restricted) "Regulation for Security of Radioactive Sources"
- FANR-REG-24, (Version 1) "Basic Safety Standards for Facilities and Activities involving Ionizing Radiation other than in Nuclear Facilities"
- FANR-REG-26 "Regulation for Predisposal Management of Radioactive Waste"

The following regulations are under development:

- FANR-REG-18 “Application of Penalties’”
- FANR-REG-22 “Decommissioning Trust Fund”
- FANR-REG-27 “Disposal of Radioactive Waste”
- FANR-REG-29 “Authorization of Regulated Activities in Facilities other than Nuclear Facilities”

FANR Regulatory Guides

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. The following table shows the regulatory guides that have been approved and issued together with draft guides:

- FANR-RG-001, (Version 1) “Content of Nuclear Facility Construction and Operating Licence Applications “
- FANR-RG-002 “Application of Management Systems for Nuclear Facilities”
- FANR-RG-003 “Probabilistic Risk Assessment: Scope, Quality and Application”
- FANR-RG-004 “Evaluation Criteria for Probabilistic Safety Targets and Design Requirements” (under revision)
- FANR-RG-005 “Guidelines for the Design, Construction and Operation of Nuclear Power Plants” (under revision)
- FANR-RG-006 “Transportation Safety Guide”
- FANR-RG-007 “Radiation Safety”
- FANR-RG-008 “Reporting of Events” (Draft)
- FANR-RG-010 (Restricted) “Identification and Maintenance of Target Sets and Timeline Analysis”
- FANR-RG-011 (Restricted) “Guidance on Cyber Security at Nuclear Facilities”
- FANR-RG-013 “Implementation of the System of Accounting for and Control of Nuclear Material at Locations outside Facilities (LOF)” (Draft)
- FANR-RG-014 “Implementation of the System of Accounting for and Control of Nuclear Material at Nuclear Facilities” (Draft)
- FANR-RG-015 “Implementation of the Obligations and Requirements of the Additional Protocol to the UAE Comprehensive Safeguards Agreement”
- FANR-RG-017 “Certification of Reactor Operators and Senior Reactor Operators at Nuclear Facilities”
- FANR-RG -018 “Pre-disposal Management of Radioactive Waste”
- FANR-RG-019 “Radiation Safety in Industrial Radiography”
- FANR-RG-020 “Security of Radioactive Sources in Use and Storage” (Draft)
- FANR-RG-021 “Security of Radioactive Sources during Transport” (Draft)
- FANR-RG-023 “Safety Significance Evaluations for Modifications for Nuclear Facilities during Construction”
- FANR-RG-024 “Criteria for Protective Actions in Response to a Nuclear or Radiological Emergency” (Draft)
- FANR-RG-025 (Restricted) “Physical Protection for Transportation of Nuclear Material”
- FANR-RG-026 (Restricted) “Response and Contingency Plans of Nuclear Facilities”
- FANR-RG-027 “Near-Surface Disposal of Radioactive Waste” (Draft)
- FANR-RG-028 “Routine Reporting” (Draft)
- FANR-RG-029 “Modification During Operation” (Draft)

- FANR-RG-030 “RG to Support Requirements of FANR-REG-16” (Draft)
- FANR-RG-031 “Implementation of the Regulation on the Export and Import Control of Nuclear Material, Nuclear Related Items and Nuclear Related Dual Use item” (Draft)
- FANR-RG-032 “Establishment and Modifications of Physical Protection Plan for Operation of Nuclear Facilities” (Draft)

Annex C - References to official national and international reports related to safety

The following UAE Reports are publically available and can be found on FANR webpage or IAEA webpage, as applicable.

- National Report for 5th Review Meeting of the Convention on Nuclear Safety, 2011.
- National Report for 6th Review Meeting of the Convention on Nuclear Safety, 2014.
- National Report for 7th Review Meeting of the Convention on Nuclear Safety, 2017.
- National Report for the 4th Review Meeting of the Joint Convention on the safety of spent fuel management and on the safety of radioactive waste management, 2012.
- National Report for the 5th Review Meeting of the Joint Convention on the safety of spent fuel management and on the safety of radioactive waste management, 2015.
- IAEA Report for the Integrated Regulatory Review Service (IRRS) Mission to the UAE in 2011.
- IAEA Report for the Integrated Regulatory Review Service (IRRS) follow-up Mission to the UAE in 2014.
- IAEA Report for the Emergency Preparedness Review (EPREV) Mission to the UAE in 2015.
- IAEA Report for Integrated Nuclear Infrastructure Review (INIR) Mission to the UAE in 2011.
- Safety Evaluation Report of an Application for a license to construct Barakah Units 1 and 2.
- Safety Evaluation Report of an Application for a license to construct Barakah Units 3 and 4.
- Executive summary of Safety Evaluation Report of ENEC's Application for an amendment to a Limited Construction License for Stage 1.
- National Report to the Ex-Ordinary Meeting August, May 2012.
- Federal Law by Decree No. 4 of 2012 Concerning Civil Liability for Nuclear Damage.
- IAEA Site Safety Review Mission in 2011.
- IAEA Report for the IAEA SSAC Advisory Service (ISSAS) Mission in 2014.
- IAEA Report for the Review mission on Integrated Management Systems in 2014.
- IAEA Report of the Expert Mission on knowledge Management in 2014.
- IAEA Report for the Occupational Radiation Protection Appraisal (ORPAS) Mission in 2014.
- IAEA Report for the International Physical Protection Advisory Service (IPPAS) Mission in 2016.

International Advisory Board reports

The International Advisory Board (IAB) is established to provide the UAE peaceful nuclear energy programme with the benefit of the expertise and knowledge of a highly select group of internationally recognized experts in the fields of nuclear safety and security, non-proliferation and the development of human resources.

On at least a semi-annual basis the Board reviews the progress the UAE is making in achieving and maintaining the highest standards of safety, security, non-proliferation, transparency and sustainability.

Board members provide their invaluable insights into how the programme can be optimized against these targets.

The semi-annual reports can be found on http://www.uaeiab.ae/en/publications.html