



United Arab Emirates

UNITED ARAB EMIRATES

**FOURTH 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**

OCTOBER 2020

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**United Arab Emirates Fourth National Report
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Contents

List of Acronyms.....	6
Section A Introduction.....	9
Section B Policies and Practices	14
Article 32.1: Reporting	14
General Policy	14
Spent Fuel Management Policy	14
Spent Fuel Management Practices	15
Radioactive Waste Management Policy	15
Radioactive Waste Management Practices	17
Criteria used to define and categorise Radioactive Waste	18
Section C Scope of Application	19
Article 3: Scope of Application	19
Spent Fuel at Reprocessing Facilities	19
Naturally occurring Radioactive Material	19
Military or Defence Programmes	19
Discharges	19
Section D Inventories and Lists.....	20
Article 32.2: Reporting	20
Spent Fuel Management Facilities and Inventory of Spent Fuel	20
Radioactive Waste Management Facilities	20
Inventory of Radioactive Waste	21
Decommissioning of Nuclear Facilities	21
Section E Legislative and Regulatory System	23
Article 18: Implementing Measures	23
Steps to implement Obligations	23
Article 19: Legislative and Regulatory Framework	23
Establishment of Applicable National Safety Requirements and Regulations for Radiation Safety	23
System of licensing Spent Fuel and Radioactive Waste Management Activities	25
System to prohibit the Operation of a Spent Fuel or Radioactive Waste Management Facility without a Licence	27
System of Appropriate Institutional Control, Regulatory Inspection and Documentation and Reporting	27
Enforcement of Applicable Regulations and of the Terms of the Licences	28

**United Arab Emirates Fourth National Report
Under the Joint Convention**

Clear Allocation of Responsibilities of the Bodies involved in the Different Steps of Spent Fuel and Radioactive Waste Management	29
Decision to regulate Radioactive Material as Radioactive Waste	29
Article 20: Regulatory Body	30
Federal Authority for Nuclear Regulation.....	30
Status of the Regulatory Body.....	32
Organisation and Staffing: Financial Resources.....	32
Integrated Management System.....	34
Human Resources and Knowledge Management	35
Section F Other General Safety Provisions	43
Article 21: Responsibility of the Licence Holder	43
Responsibility of the Licence Holder.....	43
Article 22: Human and Financial Resources.....	43
Resources	43
Article 23: Quality Assurance	47
Quality Assurance.....	47
Article 24: Operational Radiation Protection.....	48
Article 25: Emergency Preparedness	51
Article 26: Decommissioning	54
Section G Safety of Spent Fuel Management.....	56
Article 4: General Safety Requirements.....	56
Criticality and Removal of Residual Heat	56
Minimum Generation of Radioactive Waste.....	56
Interdependencies	56
Protection of Individuals	56
Non Radiological Hazards.....	57
Future Generations.....	57
Article 5: Existing facilities	58
Article 6: Siting of proposed Facilities	58
Article 7: Design and Construction of Facilities	59
Article 8: Assessment of Safety of Facilities.....	59
Article 9: Operation of Facilities.....	61
Article 10: Disposal of Spent Fuel	61
Section H Safety of Radioactive Waste Management.....	62
Article 11: General Safety Requirements.....	62
General Obligations of the Licence Holder	62

**United Arab Emirates Fourth National Report
Under the Joint Convention**

Waste Minimisation	63
Interdependences.....	63
Protection of Individuals, Society and the Environment.....	64
Non-radiological Hazards in Waste Management	64
Avoiding impact on Future Generations.....	64
Undue Burden on Future Generations	64
Article 12: Existing Facilities and Past Practices	65
Article 13: Siting of proposed Facilities	65
Article 14: Design and Construction of Facilities.....	66
Article 15: Assessment of Safety of Facilities	67
Article 16: Operation of Facilities	68
Article 17: Institutional Measures after Closure	69
Section I Transboundary Movement.....	71
Article 27: Transboundary Movement	71
Section J Disused Sealed Sources.....	72
Article 28: Disused Sealed Sources	72
Section K General Efforts to Improve Safety	74
UAE's Report on Compliance with the Obligations of the Joint Convention in 2018	74
Outcome from the Sixth Review Meeting of the Joint Convention in 2018.....	74
Planned Efforts to improve Safety.....	77
International Review Missions.....	78
Section L Annexes.....	80
Annex A.....	81
Inventory of Orphan Sources.....	81
Annex B.....	84
References to Official National and International Reports on Safety	84

United Arab Emirates Fourth National Report Under the Joint Convention

List of Acronyms

APR	Advanced Pressurised Water Reactor
ASME	American Society of Mechanical Engineers
BOC	Barakah One Company
CEA	Atomic Energy Commission
CFSI	Counterfeit, Fraudulent and Suspect Items
CITP	Construction Inspection Test Plan
COEF	Construction and Operating Experience Feedback
CSS	Commission on Safety Standards
DAW	Dry Active Waste
DOE	Department of Energy
DTF	Decommissioning Trust Fund
EAD	Environment Agency - Abu Dhabi
EAL	Emergency Action Levels
ECL	Emergency Classification Levels
EduTA	Education and Training Appraisal
ENEC	Emirates Nuclear Energy Corporation
EPR	Emergency Preparedness and Response
EPREV	Emergency Preparedness Review
EPRI	Electric Power Research Institute
EWEC	Emirates Water and Electricity Company
FANR	Federal Authority for Nuclear Regulation
FSAR	Final Safety Analysis Report
GDF	Geological Disposal Facility
GITEX	Gulf Information Technology Exhibition
GNEII	Gulf Nuclear Energy Infrastructure Institute
HDNT	Higher Diploma of Nuclear Technology
HLW	High Level Radioactive Waste
HRD	Human Resources Development
IAEA	International Atomic Energy Agency
IAT	Institute of Applied Technology
ILW	Intermediate Level Radioactive Waste

**United Arab Emirates Fourth National Report
Under the Joint Convention**

IMS	Integrated Management System
INIR	Integrated Nuclear Infrastructure Review
INPO	Institute of Nuclear Power Operations
IPPAS	International Physical Protection Advisory Service
IRRS	Integrated Regulatory Review Service
ISFSI	Independent Spent Fuel Storage Installation
ISO	International Organization for Standardization
ISSAS	IAEA SSAC Advisory Service
ISV	Independent Safety Verification
JLOC	Joint Local Operations Centre
KEPCO	Korea Electric Power Company
KINS	Korea Institute of Nuclear Safety
KHNP	Korea Hydro and Nuclear Power
KLRA	Knowledge Loss Risk Assessment
KM	Knowledge Management
KRM	Knowledge Resource Matrix
KTP	Knowledge Transfer Plan
KUSTAR	Khalifa University of Science, Technology and Research
LLW	Low Level Radioactive Waste
MOI	Ministry of Interior
NCEMA	National Emergency Crisis and Disasters Management Authority
NEI	Nuclear Energy Institute
NOC	National Operations Centre
NORM	Naturally Occurring Radioactive Material
NPP	Nuclear Power Plant
NQA	National Qualifications Authority
NQAM	Nawah Quality Assurance Manual
NQAP	Nawah Quality Assurance Programme
NRCB	National Regulatory Capacity Building
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

**United Arab Emirates Fourth National Report
Under the Joint Convention**

NUSSC	Nuclear Safety Standards Committee
OJT	On-job-training
ORPAS	Occupational Radiation Protection Appraisal Service
OSART	Operational Safety Review Team
PJSC	Private Joint Stock Company
PSAR	Preliminary Safety Analysis Report
PWR	Pressurised Water Reactor
QA	Quality Assurance
QMS	Quality Management System
RAIS	Regulatory Authority Information System
RASSC	Radiation Safety Standards Committee
RPC	Radiation Protection Committee
RTP	Registered Training Provider
SAT	Systematic Approach to Training
SARCoN	Systematic Assessment of Regulatory Competence Needs
SCK CEN	Belgian Nuclear Research Centre
SER	Safety Evaluation Report
SME	Subject Matter Expert
SSAC	State System of Accounting for and Control of Nuclear Material
SSC	Structures, Systems and Components
SSDL	Secondary Standard Dosimetry Laboratory
TSO	Technical Support Organisation
UAE	United Arab Emirates
USNRC	United States Nuclear Regulatory Commission
VANO	World Association of Nuclear Operators
VETAC	Vocational Education and Training Awards Council
WMO	Waste Management Organisation

United Arab Emirates Fourth National Report Under the Joint Convention

Section A Introduction

A.1 This is the Fourth National Report of the United Arab Emirates (UAE) that has been prepared in accordance with the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (i.e. the Joint Convention) for review at the Seventh Review Meeting of the contracting parties to the convention scheduled in May 2021. 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 Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

The structure of the report is based on the IAEA Information Circular INFCIRC/604/Rev.3 on the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. This report is an updated version of the previous report submitted by the UAE to the Sixth Review Meeting of the Joint Convention held in May 2018, and takes into account the developments in the UAE's nuclear energy programme and within the scope of the Joint Convention that took place in the past three years.

As was the case with the UAE's Third National Report submitted to the Sixth Review Meeting in May 2018, the Fourth National Report is a collective effort of various national organisations including the Federal Authority for Nuclear Regulation (FANR), the Emirates Nuclear Energy Corporation, the Nawah Energy Company, the Environment Agency - Abu Dhabi and other leading organisations.

A.2 Executive Summary of the UAE's Nuclear Energy Generation Programme

The UAE's peaceful nuclear energy programme was established in 2009 and includes four APR1400 pressurised water reactor units at the Barakah Nuclear Power Plant in the Al Dhafra Region of the Emirate of Abu Dhabi. The four reactor units have been licensed for construction by the Federal Authority for Nuclear Regulation. One of the reactor units was licensed for operation by the Federal Authority for Nuclear Regulation on 16 February 2020 and has been in operation as of July 2020. The other three reactor units are at different stages in the process of construction. They have also been licensed by the Environment Agency - Abu Dhabi in relation to environmental construction permits.

The Federal Authority for Nuclear Regulation has issued the Emirates Nuclear Energy Corporation with two licences for construction: one in July 2012 for the construction of reactor units 1 and 2 of the Barakah Nuclear Power Plant, and the second in September 2014 for the construction of reactor units 3 and 4 of the Barakah Nuclear Power Plant. In February 2020 the Federal Authority for Nuclear Regulation issued an operation licence to the Nawah Energy Company for reactor unit 1 of the Barakah Nuclear Power Plant, and a similar receipt, handling, and storage licence for reactor unit 2 of the Barakah Nuclear Power Plant.

The Environment Agency - Abu Dhabi has also issued two licences to the Barakah Nuclear Power Plant; one of which allows the Emirates Nuclear Energy Corporation to establish four reactor units in the UAE environment, and the second is a licence allowing the Nawah Energy Company to operate in the UAE environment.

The Federal Authority for Nuclear Regulation is the independent, regulatory body responsible for the oversight of nuclear safety, security, radiation protection and safeguards, and the enforcement of international agreements entered into by the UAE. The Federal Authority for Nuclear Regulation was established in accordance with Federal Law by Decree No 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy, which was issued by H.H. Sheikh Khalifa bin Zayed Al Nahyan, President of the UAE.

The Emirates Nuclear Energy Corporation is wholly owned by the government of Abu Dhabi. The Barakah project is implemented through two distinct entities: the financing vehicle, Barakah One Company, and the operator, Nawah Energy Company. Both Barakah One and Nawah Energy Company are joint ventures between the Emirates Nuclear Energy Corporation and the Korea Electric Power Corporation being a minority shareholder.

United Arab Emirates Fourth National Report Under the Joint Convention

Nawah Energy Company was established as a subsidiary of the Emirates Nuclear Energy Corporation in 2016. As a result of the Joint Venture Agreement between the Emirates Nuclear Energy Corporation and Korea Electric Power Corporation, Nawah Energy Company is a private joint stock company with 18% owned by the Korea Electric Power Corporation and 82% owned by the Emirates Nuclear Energy Corporation. Nawah Energy Company will operate the four nuclear reactors that form the Barakah Nuclear Power Plant and will be generating up to a quarter of the electricity needs of the UAE.

On 26 March 2015 the Emirates Nuclear Energy Corporation submitted an application for a licence for operation of the Barakah Nuclear Power Plant's reactor units 1 and 2, and on 27 March 2017 an operation licence application was submitted for the Barakah Nuclear Power Plant's reactor units 3 and 4. Nawah Energy Company is the holder of the operation licence for reactor unit 1, and Nawah Energy Company is the applicant for the operation licence for the Barakah Nuclear Power Plant's reactor units 2, 3 and 4. The operation licence includes provisions for the operator such as the responsibility for pre-disposal, of radioactive waste.

As far as the radioactive waste is concerned, there was no spent fuel in the UAE at the time of writing this report and the plans for managing spent fuel are 20 years' storage in the spent fuel storage pools. After that, the Emirates Nuclear Energy Corporation and its affiliates, the Nawah Energy Company and Barakah One Company, intend to establish an independent spent fuel storage installation. The independent spent fuel storage installation will be established before the spent fuel storage pool reaches capacity. The current reference option is direct disposal of spent fuel in a geological disposal facility in the UAE.

Low and intermediate level radioactive waste from the Barakah Nuclear Power Plant will be stored at the site for 10 years until it is disposed of in a near surface disposal facility. Intermediate level radioactive waste will be disposed of in an intermediate and low level waste repository or sent for deep geological disposal.

Users of radioactive sources are required to return disused sources to the manufacturer. The Federal Authority for Nuclear Regulation will not grant an import permit for a radioactive source if there is no 'return to supplier agreement' in place between the licensee and the manufacturer.

Medical 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 Regulation on Basic Safety Standards for Facilities and Activities involving Ionizing Radiation other than in Nuclear Facilities (FANR-REG-24). Then the waste is appropriately discharged.

Management of naturally occurring radioactive material (NORM) waste is done on a case-by-case basis. Storage, treatment and disposal of NORM waste requires a licence issued by the Federal Authority for Nuclear Regulation. The Federal Authority for Nuclear Regulation has issued licences for operation of a NORM treatment facility and a NORM disposal facility for one NORM generator. Clearance of NORM contaminated material is part of the treatment.

The challenge for the UAE identified during the Sixth Review Meeting of the Contracting Parties to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management was to continue the implementation of planned measures to address the challenges identified at the Fifth Review Meeting. These challenges were to do the following:

- Establish the waste management organisation to implement the policy on the disposal of radioactive waste. A radioactive waste management working group has been established as a platform for integrating information and discussing issues and challenges with respect to radioactive waste management in the UAE.
- Ensure that the entity managing the decommissioning trust fund had been fully established by the start of the commercial operation of the Barakah Nuclear Power Plant's first reactor unit. A deposit account has been established in the interim to set aside the fees to be deposited annually in the decommissioning trust fund until an entity has been established to manage the fund.
- Recruit, train and re-train a skilled workforce in radioactive waste and spent fuel management. Various nuclear training programmes along with specific radioactive waste management training and on-job

United Arab Emirates Fourth National Report Under the Joint Convention

training programmes are ongoing with the objective to build national capabilities in the field of radioactive waste management.

- Make a decision on facilities for radioactive waste and spent fuel management prior to the disposal path being determined. In order to support ongoing operations the Emirates Nuclear Energy Corporation and its affiliates intend to establish an independent spent fuel storage installation and an interim storage facility for low and intermediate level radioactive waste at the Barakah Nuclear Power Plant.

Significant Changes since the last Review Meeting

As of the date of writing this national report, the construction of three reactor units at the Barakah Nuclear Power Plant was underway according to the Emirates Nuclear Energy Corporation's project schedule, which is under the Federal Authority for Nuclear Regulation's regulatory inspection and enforcement oversight. The construction of reactor unit 1 of the Barakah Nuclear Power Plant is complete and the reactor was licensed by the Federal Authority for Nuclear Regulation in February 2020 for operation; reactor unit 1 has been in operation since July 2020. The operation licence has an estimated duration of 60 years. As of October 2020, the construction of reactor unit 2 was complete, the construction of reactor unit 3 was approximately 95% complete, and the construction of reactor unit 4 was approximately 88% complete.

A.3 On 26 March 2019 FANR issued operation licences for the naturally occurring radioactive material (NORM) treatment and disposal facilities in the UAE. NORM facilities are the first of its kind in the UAE; they are designed to remove the NORM residues from equipment and material to make such equipment and material suitable for reuse or recycling. NORM wastes are processed and conditioned at such facilities in a form that renders such wastes suitable for disposal.

A.4 The Federal Authority for Nuclear Regulation has also continued to focus on the development of regulations and regulatory guides for the safety of waste management, and has issued FANR Regulation for the Disposal of Spent Fuel and Radioactive Waste (FANR-REG-27), and the supporting FANR Regulatory Guide on the Near Surface Disposal of Radioactive Waste (FANR-RG-027).

A.5 The UAE has continued to cooperate extensively with the International Atomic Energy Agency (IAEA) by hosting several missions and safety services since the Sixth Review Meeting. This includes:

- IAEA Expert Mission on the UAE National Dose Register, February 2018
- IAEA training course and workshop on well-logging for FANR inspectors, February 2018
- IAEA Expert Mission on Health Surveillance for Occupationally Exposed Workers in the UAE, May 2018
- IAEA Expert Mission on Radiation Safety in Non-Medical Human Imaging and Consumer Products, October 2018
- IAEA Expert Mission on Communicating Radiological Risks from Natural Sources of Radiation to the General Public in the UAE, July 2019
- IAEA Expert Mission on the Review of the Draft National Radon Action Plan, October 2019
- IAEA Expert Mission on the Review of the UAE's Regulatory Framework for Exemption, Clearance and Release, October 2019
- IAEA Expert Mission on Radiation Protection in Border Security Activities in the UAE, December 2019

**United Arab Emirates Fourth National Report
Under the Joint Convention**

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

Table A.6 Overview - UAE Programme¹

Type of Responsibility	Long-term Management	Financing	Current Practice/ Facilities	Planned Facilities
Spent fuel	'Reference Scenario' of direct disposal in a geological disposal facility in the UAE. Other options to be kept under review.	Annual contributions by the nuclear facility's operator to the decommissioning trust fund to fund the siting, construction, operation, closure and institutional control of the geological disposal facility. Pre-disposal management including storage is an operational cost.	Storage in a spent fuel pool.	On-site interim spent fuel storage installation to be constructed. The geological disposal facility is to come into operation 90 years after the start of commercial operation.
<i>See section</i>	B.1-B4, F.3, F23,	B.3, E.8, F.4-F.8, F.37-F.38,	B.4	B.4, G.8, G.18
Nuclear Fuel Cycle Radioactive Waste	Disposal in the UAE's near surface repository of low level radioactive waste from the Barakah Nuclear Power Plant. Disposal in the geological disposal facility of Intermediate radioactive waste and high level radioactive waste (i.e. spent nuclear fuel) from the Barakah	Construction of a near surface repository funded by the decommissioning trust fund. The operational costs of a near surface repository (paid by the waste producer on a unit cost basis) for the operational waste generated by the Barakah Nuclear Power Plant. The operational costs (of a near surface repository) during the decommissioning phase will be paid by the decommissioning trust fund. Annual contributions by the operator of the nuclear facility to the	On-site storage facility for low level waste (10 years of storage for all Barakah Nuclear Power Plant reactor units). Storage on-site of intermediate level radioactive waste for the life of the plant.	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. Construct additional storage building or extend existing storage building prior to storage being filled.

¹ The UAE's radioactive waste management programme for nuclear power plants commits to the Policy of the United Arab Emirates on the Evaluation and Potential Development of Peaceful Nuclear Energy.

**United Arab Emirates Fourth National Report
Under the Joint Convention**

<i>See section</i>	Nuclear Power Plant. B.3, B.5-B.6, H.30-H.31,	decommissioning trust fund. B.5, H.2, H.3	B.8	H.2, H.3
Decommissioning <i>See section</i>	Decommissioning to commence immediately after operation ceases. Decommissioning waste to be disposed of in a near surface repository and geological disposal facility, as necessary. B.5, D.4, D.6-D.7	Annual contributions by the operator of a nuclear facility to the decommissioning trust fund. The operational cost of a near surface repository (paid by the decommissioning trust fund) for the decommissioning waste generated by the Barakah Nuclear Power Plant. B.5, E.8, F4-F.6, F.8, F.38-F.39	N/A	Interim storage facility for intermediate level radioactive waste and high level radioactive waste from decommissioning (including spent nuclear fuel) prior to disposal D.7
Application waste <i>See section</i>	Naturally occurring radioactive material (NORM) treatment and disposal. Nuclear medicine, (radiotherapy and teletherapy). B.6, B.9, C.2	NORM treatment and disposal is funded by the entity generating the waste. B.5, D.4, F.1	NORM treatment and disposal facility licensed for operation for one NORM waste generator. Storage for decay to below clearance levels, and then discharge. B.9, C.2, D.2 and D.5	N/A As required
Disused Sealed Sources <i>See section</i>	Disused sealed sources to be returned to the manufacturer. Refer to the Orphan Sources Strategy for the storage of orphan sources. B.6, B.7, D.4	The licensee will bear the costs. The UAE government will bear the cost of the storage of orphan sources. J.2	Disused sealed sources to be returned to the manufacturer. Orphan sources are stored. J.2	N/A N/A

United Arab Emirates Fourth National Report Under the Joint Convention

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 the 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

General Policy

The UAE policy for the management of radioactive waste and spent fuel is still under development. However, the Policy of the United Arab Emirates on the Evaluation and Potential Development of Peaceful Nuclear Energy referenced in Annex B, and the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy constitute key elements for steering the national radioactive waste management policy effective in the UAE as discussed below in this section of the report.

Spent Fuel Management Policy

B.1 The Policy of the United Arab Emirates on the Evaluation and Potential Development of Peaceful Nuclear Energy sets out several important commitments that will be covered in the UAE's spent fuel policy. These commitments include the following:

- Renouncement of the intention to develop a domestic enrichment and reprocessing capability, and committing 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, which does not include domestic reprocessing.
- Issuance of rigorous regulations on the management of spent fuel and radioactive waste management by the national nuclear regulatory authority independent of the operator, the licensee and any entity involved in spent fuel or radioactive waste in line with current international best practice methods.
- Consideration taken of the role of the stakeholders responsible for safety, security and environment.

These commitments are described in detail on pages 9 and 10 of the Policy of the United Arab Emirates on the Evaluation and Potential Development of Peaceful Nuclear Energy.

B.2 The Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy prohibits domestic enrichment and reprocessing, and has provisions related to spent fuel and radioactive waste management policy.

B.3 In considering its spent fuel management policy, 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); and

United Arab Emirates Fourth National Report Under the Joint Convention

- when activities must be initiated (as early as possible, technically optimised or delayed for economic optimisation) and its duration.

The current reference option is the direct disposal of spent fuel in a geological disposal facility in the UAE. This forms the basis for the planning carried out by the Emirates Nuclear Energy Corporation/ Nawah Energy Company and the Federal Authority for Nuclear Regulation, and the costing model for the fees to be paid into the decommissioning trust fund.

Spent Fuel Management Practices

B.4 The UAE does not yet have any spent fuel. Nonetheless, the Emirates Nuclear Energy Corporation and its affiliates have taken the following measures for the future management of spent fuel:

- The design of the Barakah Nuclear Power Plant provides sufficient capacity in the spent fuel storage pool for 20 years of operation for each reactor unit.
- The Emirates Nuclear Energy Corporation and its affiliates intend to establish an independent spent fuel storage installation to support ongoing nuclear power plant operations. The independent spent fuel storage installation 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 the 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 independent spent fuel storage installation. The requirements and the recommendations of this feasibility study have been implemented and incorporated in the current development and construction of the Barakah Nuclear Power Plant site.
- The Emirates Nuclear Energy Corporation and its affiliates are also examining long-term spent fuel management options for different scenarios.

Radioactive Waste Management Policy

B.5 In addition to the references on radioactive waste management in the Policy of the United Arab Emirates on the Evaluation and Potential Development of Peaceful Nuclear Energy as stated above, Chapter 8 of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy addresses the provisions on radioactive waste and decommissioning as follows:

- Article (40)1 affirms the responsibility of licensees to safely manage and store radioactive waste from its generation to its delivery to an entity designated by the UAE Cabinet to manage the disposal of such material.
- Article (40)2 obliges the licensee to comply with the duties and responsibilities for the safe management of radioactive waste determined by the Federal Authority for Nuclear Regulation.
- Article (40)3 states that the Board of Management of the Federal Authority for Nuclear Regulation shall 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 on the long-term management and disposal of spent fuel and nuclear waste, and identify the entity in charge of implementing the policy. It also stipulates that the spent fuel and radioactive waste will belong to the state from the time of its delivery to the state, or to the entity designated by the Cabinet.

United Arab Emirates Fourth National Report Under the Joint Convention

- Article (41)2 states that regulations shall specify terms and procedures for waste delivery to the entity designated by the Cabinet (including waste that 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 the 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 the requirements for the decommissioning of nuclear facilities including the 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, and costs of regulatory oversight and the management of the said trust fund.

The current reference option is the disposal of low level waste in a near surface disposal facility in the UAE, and disposal of high level waste in a deep geological facility. Intermediate level waste will be disposed of in an intermediate and low level waste repository or sent for deep geological disposal. This is considered in the basis for the planning carried out by the Emirates Nuclear Energy Corporation/ Nawah Energy Company and the Federal Authority for Nuclear Regulation, and the costing model for the fees to be paid into the decommissioning trust fund.

B.6 The UAE adopts an approach to the management of radioactive waste tailored to each particular application. As shown below, this is described in FANR Regulation on the Pre-disposal Management of Radioactive Waste (FANR-REG-26), and in the corresponding FANR Regulatory Guide on the Pre-disposal Management of Radioactive Waste (FANR-RG-018).

- Radioactive waste generated from nuclear facilities that is not authorised 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 as stipulated in FANR Regulation on the Basic Safety Standards for Facilities and Activities involving Ionizing Radiation other than in Nuclear Facilities (FANR-REG-24), Version 1. The clearance levels adopted by the UAE are the same as those in IAEA GSR Part 3.
- Licensees are required to send disused radioactive sources to their supplier or the manufacturer. If the 'return to manufacturer' or 'reuse' options are not viable, then the sources should be managed as radioactive waste and stored locally by the licensee (under the conditions indicated by the Federal Authority for Nuclear Regulation) until the UAE waste acceptance criteria for disposal have been developed and published.
- The UAE has developed an orphan sources strategy and action plan to manage orphan sources.
- The treatment and disposal of contaminated, naturally occurring radioactive material (NORM) and waste is assessed on a case-by-case basis.
- NORM arising from oil and gas extraction from one generator will be treated and disposed of in the NORM treatment and disposal facility, which was licensed for operation in March 2019.

For the future disposal of radioactive waste, the Federal Authority for Nuclear Regulation (FANR) has issued the FANR Regulation on the Disposal of Radioactive Waste (FANR-REG-27) and the FANR Regulatory Guide on the Near Surface Disposal of Radioactive Waste (FANR-RG-027).

For radioactive waste regulations promulgated by the Federal Authority for Nuclear Regulation, see Sections E.7 and E.8 of this national report. See Annex B of this national report for FANR regulations and regulatory guides.

United Arab Emirates Fourth National Report Under the Joint Convention

Radioactive Waste Management Practices

B.7 Management of Industrial and Medical Radioactive Waste

Users of radioactive sources are required to return disused sources to the manufacturer. However, some licensees have what is known as 'legacy radioactive sources' stored on their premises (See Section J). As an arrangement to minimise the potential for orphan sources, the Federal Authority for Nuclear Regulation will not grant an import permit for a radioactive source if there is no 'return to supplier' agreement in place between the licensee and the manufacturer.

FANR Regulation on Basic Safety Standards for Facilities and Activities involving Ionizing Radiation other than in Nuclear Facilities (FANR-REG-24), Version 1, permits the 'clearance' of radioactive material from regulatory control.

FANR Regulation on the Pre-disposal Management of Radioactive Waste (FANR-REG-26) and the corresponding FANR Regulatory Guide on Pre-disposal Management of Radioactive Waste (FANR-RG-018) systematises the process of pre-disposal management of radioactive waste by the user.

The UAE has 15 medical facilities that deal with nuclear medicine, radiotherapy and teletherapy that are generating small amounts of radioactive waste usually with very short half-lives. Around 10 prospective facilities are planning to do the same including proton-therapy. 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 Regulation on Basic Safety Standards for Facilities and Activities involving Ionizing Radiation other than in Nuclear Facilities (FANR-REG-24), Version 1. Then the waste can be appropriately discharged.

B.8 Management of Radioactive Waste from Nuclear Facilities

Activities by the Emirates Nuclear Energy Corporation and its affiliates related to radioactive waste management at the Barakah Nuclear Power Plant are outlined below.

- Reactor unit 1 attained initial criticality on 31 July 2020. Processes and procedures are in place at the Barakah Nuclear Power Plant to support the operation of reactor unit 1 to minimise the generation of radioactive waste.
- The Emirates Nuclear Energy Corporation and its affiliates have implemented the reference plant waste management systems and corresponding processes and procedures, which are under continuous improvement.
- Radioactive waste management includes principles such as:
 - Minimising the volume of waste generated from the Barakah Nuclear Power Plant through effective operations and the use of proven technology.
 - Storage of low and intermediate level radioactive waste at the Barakah Nuclear Power Plant site.
 - Evaluation of possible longer term radioactive waste storage through the construction of a separate low and intermediate level radioactive waste interim storage building at the Barakah Nuclear Power Plant.
 - Segregation of dry active waste at its source of generation

United Arab Emirates Fourth National Report Under the Joint Convention

B.9 Management of NORM Waste

The management of naturally occurring radioactive material (NORM) waste is done on a case-by-case basis. Storage, treatment and disposal of NORM waste requires a FANR licence. Clearance of NORM contaminated material is part of the treatment.

Criteria used to define and categorise Radioactive Waste

B.10 Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy defines radioactive waste as 'Waste that contains or is contaminated with radionuclides at concentrations or activities greater than levels as established by the Authority'.

Article (4) of FANR Regulatory Guide on the Pre-disposal Management of Radioactive Waste (FANR-RG-018) classifies radioactive waste based on the IAEA Safety Standards Classification of Radioactive Waste, General Safety Guide No. GSG-1. The classification is based on the safety aspects of waste management in particular the safety aspects of disposal.

United Arab Emirates Fourth National Report Under the Joint Convention

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 managed 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 According to Article (2)2 of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy the design, construction and operation of facilities for the reprocessing of spent fuel is prohibited in the UAE. The future policy on the long-term management and disposal of spent fuel and nuclear waste shall determine whether reprocessing of spent fuel outside the UAE is part of its long-term management of spent fuel.

Naturally occurring Radioactive Material

C.2 Pursuant to Article (3)2 of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (i.e. the Joint Convention), the UAE does not declare waste that contains only naturally occurring radioactive material (NORM) and that does not originate from the nuclear fuel cycle such as radioactive waste as long as the NORM is stored at the source location without treatment. However, NORM waste generated from the NORM treatment and disposal facility is declared as radioactive waste for the purpose of the Joint Convention pursuant to Article (3)2.

Military or Defence Programmes

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

Discharges

C.4 Regulatory requirements have been established to ensure that radioactive discharges are limited and consistent with international standards. This is included in Sections B.6, D.5, G.4, G.13, G.16 and H.24 of this report.

United Arab Emirates Fourth National Report Under the Joint Convention

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 practicesThis 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 management facilities in operation. Spent fuel pools are constructed at the Barakah Nuclear Power Plant.

Radioactive Waste Management Facilities

D.2 In 2019 a naturally occurring radioactive material (NORM) handling and treatment facility and a NORM disposal facility were licensed by the Federal Authority for Nuclear Regulation for operation in the UAE. The two NORM facilities belong to one NORM-generating entity. The NORM Waste Treatment Facility and the NORM Waste Disposal Facility are collectively referred to as the 'NORM facility'. The facilities are located approximately 5 kilometres from the shoreline of the Arabian Gulf and approximately 230 kilometres west of the city of Abu Dhabi.

The purpose of the NORM Waste Treatment Facility is to remove the NORM residues from equipment and material used for extraction and processing of oil and gas to render the equipment and material suitable for re-use or recycling. It also provides processing and conditioning of NORM wastes to a form suitable for disposal. The 'NORM facility' houses the structures, systems and components required for the treatment of the NORM waste. This includes:

- a high pressure water descaling system to remove scale build-up from the internal and external surfaces of tubulars and equipment;
- sludge centrifuge systems to separate the sludge waste into two different phases;
- waste water tanks;
- an incinerator that treats NORM waste products (scale, dewatered sludge, oil, contaminated or off-specification water, and burnable miscellaneous products). Through thermal decomposition, the incinerator provides significant volume reduction of organic compounds and removes hydrocarbons and complex agents; and

United Arab Emirates Fourth National Report Under the Joint Convention

- a solidification and stabilisation sub-system to prepare the NORM waste product (ash, scale, contaminated equipment, and non-burnable miscellaneous waste products) for final disposal in the landfill repository.

The NORM Waste Disposal Facility is an outdoor engineered landfill repository and consists of four cells (trenches) with a rectangular area of 25m x 91.6m each. Initially two cells were built to support the operation of the NORM Waste Treatment Facility. Two additional cells will be built when needed. The landfill includes a double liner system, a monitored leachate and leakage collection and removal systems that will be in operation until the end of the operational phase, and a final cover. The landfill repository is designed and built to prevent hazardous substances from migrating into the natural environment by means of the multi-barrier system with a performance life of up to 10,000 years.

The 'NORM facility' is not yet in operation.

NORM-generating facilities are required to store NORM waste in a condition suitable for future treatment in a NORM treatment facility or disposal.

One storage facility for orphan sources has already been identified as a national storage facility, and the sources have been moved to this facility.

Inventory of Radioactive Waste

D.3 Radioactive sources are used in the UAE in a range of industrial and medical applications. The Federal Authority for Nuclear Regulation (FANR) last conducted a waste survey in 2011, which was presented at the Fourth Review Meeting of the Joint Convention in May 2012.

D.4 During the licensing or licence renewal process, the Federal Authority for Nuclear Regulation requires its licensees to present a 'take-back' agreement with the supplier or manufacturer when the sources become disused. The Federal Authority for Nuclear Regulation replaced the software of the Regulatory Authority Information System (RAIS), which keeps an inventory of radiation sources that are in use or disused, with a module in the FANR e-Licensing System. The e-Licensing System became operational in 2016 and provides online access to services related to facilities other than nuclear facilities. Services available in the FANR e-Licensing System include an integrated approach to licensing between safeguards, security, and radiation safety inspection, import/ export, inventory-keeping, and the management of the dose records for occupationally-exposed workers. In order to further strengthen the existing regulatory framework, the Federal Authority for Nuclear Regulation is developing a specific regulation that integrates safeguards, security, and safety requirements related to siting, construction, operation, and decommissioning of facilities other than nuclear facilities.

D.5 The UAE has 15 medical facilities dealing with nuclear medicine, radiotherapy and teletherapy, and around 10 prospective facilities are planning to do the same including proton-therapy. 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 Regulation on Basic Safety Standards for Facilities and Activities involving Ionizing Radiation other than in Nuclear Facilities (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.

On 26 March 2015, the Emirates Nuclear Energy Corporation submitted an application for an operation licence for Barakah Nuclear Power Plant reactor units 1 and 2. On 27 March 2017, the Emirates Nuclear Energy Corporation submitted an operation licence application for Barakah Nuclear Power Plant reactor units 3 and 4. Nawah Energy Company is the holder of the operation licence for reactor unit 1, which was

United Arab Emirates Fourth National Report Under the Joint Convention

issued by the Federal Authority for Nuclear Regulation in February 2020. Nawah Energy Company is the applicant for the operation licences for Barakah Nuclear Power Plant reactor units 2, 3 and 4.

The operation licence applications were based on the reference nuclear power plant, which already has an operation licence from the relevant authorities in the Republic of Korea. The operation licence applications included the Final Safety Analysis Report and other supporting documents required for review by the Federal Authority for Nuclear Regulation. The Final Safety Analysis Report included complete information concerning facility operation such as the organisational structure, responsibilities and authorities, managerial and administrative controls to be used to ensure safe operation, plans for start-up testing and initial operations, plans for the conduct of normal operations including maintenance, surveillance, and periodic testing, plans for coping with emergencies, the decommissioning plan and proposed technical specifications. The Final Safety Analysis Report was the principal document upon which the Federal Authority for Nuclear Regulation based its review and assessment to support a decision to issue an operation licence. An operation licence for Barakah Nuclear Power Plant reactor Unit 1 was granted by the Federal Authority for Nuclear Regulation to Nawah Energy Company on 16 February 2020.

D.7 An initial decommissioning plan for the nuclear power plant was submitted as part of the operation licence application for Barakah Nuclear Power Plant reactor units 1 and 2, and in accordance with the requirements of FANR Regulation on the Decommissioning of Facilities (FANR-REG-21). The initial decommissioning plan includes cost estimates for the decommissioning of the Barakah Nuclear Power Plant reactor units and for disposal of the spent fuel and radioactive waste. The initial decommissioning plan strategy for the Barakah Nuclear Power Plant is based on an immediate decommissioning scenario and programme following a 60-year reactor operational lifetime. The initial decommissioning plan assumes that the fuel is used once and not reprocessed; instead, it is stored in interim storage awaiting disposal.

United Arab Emirates Fourth National Report Under the Joint Convention

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 Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy. Articles (11), (38) and (39) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy authorises the FANR Board of Management to issue regulations and regulatory guides, which are required for the Federal Authority for Nuclear Regulation's operation whilst 'taking into consideration comments from stakeholders, information made available by experts, and internationally recognised standards and recommendations such as IAEA standards'.

E.2 The Federal Authority for Nuclear Regulation has established within its integrated management system a process for establishing and revising regulations and regulatory guides that includes provisions for consultation with stakeholders and the public, and the review and incorporation of their comments.

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

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.

Establishment of Applicable National Safety Requirements and Regulations for Radiation Safety

E.4 Article (11)4 of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy gives the Board of Management of the Federal Authority for Nuclear Regulation the power to 'establish, develop or adopt regulations and guidelines upon which its regulatory actions are based' including the

United Arab Emirates Fourth National Report Under the Joint Convention

objective of protecting 'individuals, society and the environment from radiation hazards both for the present and in the future'.

E.5 Article (38) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy specifies that the Board [of Management] 'shall issue the regulations specifying the requirements which all operators must comply with and follow'.

E.6 Article (25) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy also defines the 'Regulated Activities' for which a Licence is needed.

E.7 The Federal Authority for Nuclear Regulation has issued five regulations and one is under development relating to the management of radioactive waste. The issued regulations are as follows:

- FANR Regulation on Radiation Protection and Predisposal Radioactive Waste Management for Nuclear Facilities (FANR-REG-11)
- FANR Regulation on Basic Safety Standards for Facilities and Activities involving Ionizing Radiation other than in Nuclear Facilities (FANR-REG-24), Version 1
- FANR Regulation on Decommissioning of Facilities (FANR-REG-21)
- FANR Regulation on Pre-disposal Management of Radioactive Waste (FANR-REG-26)
- FANR Regulation on Disposal of Spent Fuel and Radioactive Waste (FANR-REG-27)

For a complete list of FANR regulations and regulatory guides, see Annex B and www.fanr.gov.ae.

E.8 FANR Regulation on the Decommissioning of Facilities (FANR-REG-21) 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 financing, the requirement for emergency response arrangements during decommissioning and the management of radioactive waste generated from the decommissioning process. The FANR regulation on the decommissioning trust fund is under development and specifies the procedures to be followed in relation to the 'Decommissioning Trust Fund' such as:

- The calculation and collection of the fees to be proposed by the Federal Authority for Nuclear Regulation to the Cabinet.
- The amount to be deposited by the Licensee to the Decommissioning Trust Fund to cover the licensee's financial obligations with regard to the activities referred to in Article (42)1 of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy that are not covered by fees already paid.
- Management of the Decommissioning Trust Fund's assets by the Board of Management of the Decommissioning Trust Fund.
- Payment of the costs referred to in Article (42)1 of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy by the Board of Management of the Decommissioning Trust Fund from the Decommissioning Trust Fund .

FANR-REG-26 is a complement to FANR-REG-11 and FANR-REG-24. FANR-REG-24 was revised to give some needed clarifications in the FANR regulation, which were identified during the Integrated Regulatory Review Service mission in 2011.

FANR Regulation on Pre-disposal Management of Radioactive Waste (FANR-REG-26) is supported by the FANR Regulatory Guide on the Pre-disposal Management of Radioactive Waste (FANR-RG-018), which contains information on waste classification, the 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 regulatory guide

United Arab Emirates Fourth National Report Under the Joint Convention

will assist the Federal Authority for Nuclear Regulation's licensees to implement 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 the pre-disposal management of disused sealed sources (low and higher activity), and laboratory and medical waste and residues from industrial processing.

FANR-REG-27 establishes requirements for the disposal of radioactive waste in accordance with IAEA Safety Standards on the Disposal of Radioactive Waste, Specific Safety Requirements, No. SSR-5, which covers:

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

FANR Regulation on the Disposal of Spent Fuel and Radioactive Waste (FANR-REG-27) is supported by FANR Regulatory Guide on the Near Surface Disposal of Radioactive Waste (FANR-RG-027), which contains the guidance required for the disposal of very low level waste and low level waste in near surface radioactive waste disposal facilities. This regulatory guide covers:

- The content of the licence application.
- Safety assessment and safety case.
- Site characterisation, construction, operation, closure and institutional control of near surface radioactive waste disposal facilities.

System of licensing Spent Fuel and Radioactive Waste Management Activities

E.9 Articles (23) to (31) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy stipulates requirements for granting, revoking and suspending licences. A licence is required to carry out any 'Regulated Activity' as defined in Article (25) of the said law including activities related to spent fuel and radioactive waste management. 'Regulated Activities' include those relating to a 'Nuclear Facility' as defined in Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy (where a 'Radioactive Waste Repository' is defined as a 'Nuclear Facility'). 'Regulated Material' as defined in Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy includes radioactive waste.

E.10 Article (28) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy requires applicants for a licence to submit detailed evidence of safety that will be reviewed and assessed by the Federal Authority for Nuclear Regulation in accordance with defined procedures.

E.11 Article (6) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy grants the 'Authority' i.e. the Federal Authority for Nuclear Regulation (FANR) the exclusive responsibility for issuing a licence to practice the 'regulated activities' in the UAE, and authorises the Federal Authority for Nuclear Regulation to impose conditions in the licence.

E.12 Following the review and assessment of a licence application for a regulated activity with regulated material, the Federal Authority for Nuclear Regulation will determine whether to issue i) a licence, ii) a licence with conditions, or iii) to reject the application for a licence and record the basis for the decision.

E.13 The licensing process for spent fuel and radioactive management activities in a nuclear power plant is part of the licensing of a 'nuclear facility' as described below.

United Arab Emirates Fourth National Report Under the Joint Convention

Assessment of Safety

E.14 Overview of the UAE's Arrangements and Regulatory Requirements to perform Comprehensive and Systematic Safety Assessments

Article (5) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy authorises the Federal Authority for Nuclear Regulation to establish the requirements for systematic safety assessments and periodic safety reviews. Article (28) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy stipulates that detailed evidence of safety is required at all relevant licensing stages of any nuclear facility. Articles (29) and (43) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy require the licensee to perform safety assessments over the lifetime of the nuclear facility, address any deficiencies, and provide the Federal Authority for Nuclear Regulation with any information relevant to the the Federal Authority for Nuclear Regulation's regulatory responsibilities. Article (32) requires the review and assessment of the licensee (or licence applicant) at every stage of the regulatory process.

FANR Regulation for an Application for a Licence to Construct a Nuclear Facility (FANR-REG-06) and FANR Regulation for an Application for a Licence to Operate a Nuclear Facility (FANR-REG-14) define an 'independent safety verification' 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'. Both of these regulations require that an independent safety verification report be provided as part of the licence application to describe all proposed departures from (or changes to) the reference design.

Assessment of Safety through the Licensing Process

Article (25) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy requires that a licence be obtained prior to engaging in any 'Regulated Activity', which includes the construction, commissioning, operation, and the selection and preparation of a site for a nuclear facility.

Each licence application is required to meet all applicable legal and regulatory requirements. The Federal Authority for Nuclear Regulation 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 be assured that the available information demonstrates the safety of the facility or activity. Following its review and assessment, The Federal Authority for Nuclear Regulation is empowered to i) grant a licence, ii) grant a conditional licence, or iii) reject a licence application. Article (28) of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy stipulates that the Federal Authority for Nuclear Regulation formally records the basis for its licensing decisions.

The Federal Authority for Nuclear Regulation has established in its integrated management system a process consistent with the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy and the relevant IAEA safety requirements for assessing an application for a licence related to the construction and operation of a nuclear facility. The main steps in the process include the receipt and acknowledgement of the licence application; the review and assessment of the licence application; the issuance of requests for additional information from the licence applicant, where necessary; the 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.

United Arab Emirates Fourth National Report Under the Joint Convention

System to prohibit the Operation of a Spent Fuel or Radioactive Waste Management Facility without a Licence

E.15 Article (23) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy prohibits the conduct of any 'regulated activity' in the UAE unless licensed to do so by the Federal Authority for Nuclear Regulation. Regulated activity includes the siting, construction, operation and decommissioning of a nuclear facility including a radioactive waste repository and activities using regulated material, which includes radioactive waste. Articles (60) to (62) of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy sets criminal penalties for carrying out a 'regulated activity' without a licence.

System of Appropriate Institutional Control, Regulatory Inspection and Documentation and Reporting

E.16 Articles (32) to (37) of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy stipulates requirements on the inspection and control of licensee activities. Article (35) of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy requires the Federal Authority for Nuclear Regulation to establish a planned and systematic inspection programme. Article (36) of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy requires the Federal Authority for Nuclear Regulation to conduct inspections on all areas of regulatory responsibility to ensure that the operator is in compliance with the law, regulations and licence conditions. When conducting an inspection, the Federal Authority for Nuclear Regulation is required to take account of the activities of suppliers of services and products to the operator. Article (5)8 of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy authorises the Federal Authority for Nuclear Regulation to enter sites and facilities to carry out inspections. Article (8) of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy further states that the Federal Authority for Nuclear Regulation shall examine and investigate any matter that appears to be a breach of the law, the implementing regulations, the decisions of the Federal Authority for Nuclear Regulation and any licence condition.

E.17 The Federal Authority for Nuclear Regulation has established within its integrated management system a process consistent with the requirements of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy and the relevant IAEA safety requirements for the inspection of the licensee's activities to verify compliance with the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy, and the regulations and the licence conditions established by the Federal Authority for Nuclear Regulation. Supporting procedures and instructions detail the methods that are applied by inspectors in different areas including radioactive waste management.

E.18 The Federal Authority for Nuclear Regulation has reviewed and accepted the description of the construction inspection and test programme given in the final safety analysis report during its review of the application for an operation licence submitted by the Nawah Energy Company.

E.19 Following the issuance of the licence for the construction of reactor units 1 and 2 of the Barakah Nuclear Power Plant, the Federal Authority for Nuclear Regulation mobilised its resident inspectors to be stationed at the nuclear power plant site (to complement the inspection teams based at FANR Headquarters) to verify that the Emirates Nuclear Energy Corporation's construction activities comply with and the Federal Authority for Nuclear Regulation's requirements and the terms and conditions of the licence. The Federal Authority for Nuclear Regulation's inspection programme was established to provide oversight of inspection activities important to safety, nuclear safety, nuclear security and radiation protection. The Federal Authority for Nuclear Regulation's integrated inspection plans include inspections of the licensee's and the prime contractor's design, manufacturing and construction from the initial design stage to the completion of construction and commissioning including inspections related to management systems and the quality assurance programme. The Federal Authority for Nuclear Regulation also completed an inspection of a sample of activities listed in the construction inspection test plan, which included those inspections and tests the licensee had committed to complete for reactor unit 1 of the Barakah Nuclear Power Plant. Inspections completed included the verification of the licensee's activities associated with the construction of structures

United Arab Emirates Fourth National Report Under the Joint Convention

and installation of systems and components (construction inspection test plan stages I and II respectively) followed by inspection activities associated with pre-operational testing, hot and cold functional testing (construction inspection test plan stages III and IV respectively). Inspection activities are conducted to verify organisational, operational readiness including control room staff readiness, technical training programmes, the implementation of processes, programmes and procedures, and the integrated demonstration of organisational readiness. The Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy authorises the Federal Authority for Nuclear Regulation to inspect the activities of licensees and their contractors. According to Article (34) of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy, the licensee remains responsible to the Federal Authority for Nuclear Regulation even if certain activities are carried out by the licensee's contractors. Also, pursuant to Article (57) of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy, the operator is liable for all matters relating to safety, nuclear safety, nuclear security and radiation protection.

E.20 In order to effectively deliver its inspection programme, the Federal Authority for Nuclear Regulation has set a formal qualification standard for its inspectors. The inspector qualifications include theoretical (classroom) and practical (on-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. The Federal Authority for Nuclear Regulation currently has over 80 qualified inspectors involved in regulatory activities, who are supported by other FANR subject matter experts and technical support organisations. The Federal Authority for Nuclear Regulation has deployed five resident inspectors to a permanent site office at the Barakah Nuclear Power Plant for regulatory oversight of the construction and commissioning activities taking place at the site. Inspectors and specialists from FANR's Headquarters are used to supplement the resident inspectors in specialised areas, e.g. in the certification of reactor and senior reactor operators, when required.

E.21 The Federal Authority for Nuclear Regulation 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 the licensing process for specific practices such as radiotherapy, nuclear medicine, industrial irradiation, and pre-disposal radioactive waste management. During the operational phase, the Federal Authority for Nuclear Regulation's inspection programme is planned based on the risk associated with each practice. For example, the industrial radiography and radiotherapy practices are inspected on a yearly basis and twice a year during the first year of operation whereas lower-risk practices are inspected on a lower frequency.

Enforcement of Applicable Regulations and of the Terms of the Licences

E.22 Article (5)17 of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy authorises the Federal Authority for Nuclear Regulation to take 'enforcement actions', which include corrective actions, written warnings, the revocation of a licence, and administrative penalties and fines. Article (36)2 authorises the Federal Authority for Nuclear Regulation to take enforcement action compelling the operator to take actions necessary to remediate any breach. Article (36)3 authorises the Federal Authority for Nuclear Regulation 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 the decisions of the Federal Authority for Nuclear Regulation and to remedy any breach, undertake an investigation related to the breach, and take any measures necessary to prevent a recurrence.

E.23 With the exception of Article (58), Articles (57) to (64) of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy includes provisions for civil liability and penalties for contravention of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy. Article (58) of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy covers civil liability for nuclear damage, which is further determined by the Federal Law by Decree No. 4 of 2012 Concerning Civil Liability for Nuclear Damage.

In August 2015 the UAE Cabinet issued Cabinet Resolution No. 27 of 2015 Concerning Administrative Penalties on Violating the Conditions of the Licences issued by the Federal Authority for Nuclear Regulation.

United Arab Emirates Fourth National Report Under the Joint Convention

The said cabinet resolution outlines 26 violations and a range of administrative penalties including corresponding administrative fines, which are to be imposed on the operator or the licensee upon committing or recommitting any of the violations set forth in Cabinet Resolution No. 27 of 2015 Concerning Administrative Penalties on Violating the Conditions of the Licenses issued by the Federal Authority for Nuclear Regulation. The administrative penalties apply to natural persons and legal persons, and include administrative fines as well as the suspension or revocation of a licence or any part thereof if violations result in any of the circumstances referred to in Article (31) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy. In addition to the administrative fines and pursuant to Cabinet Resolution No. 27 of 2015 Concerning Administrative Penalties on Violating the Conditions of the Licenses issued by the Federal Authority for Nuclear Regulation, the Federal Authority for Nuclear Regulation may impose corrective actions on the operator or the licensee for contravening any provision of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy, or any regulation or resolution issued by the Federal Authority for Nuclear Regulation. Cabinet Resolution No. 27 of 2015 Concerning Administrative Penalties on Violating the Conditions of the Licenses issued by the Federal Authority for Nuclear Regulation is under review.

The draft regulation on the application of penalties (FANR-REG-18) is expected to be issued by the Federal Authority for Nuclear Regulation in 2021 following a public review of the draft and amendments to Cabinet Resolution No. 27 of 2015 Concerning Administrative Penalties on Violating the Conditions of the Licenses issued by the Federal Authority for Nuclear Regulation. To date, no significant enforcement actions have been required for the holders of a licence issued by the Federal Authority for Nuclear Regulation.

Clear Allocation of Responsibilities of the Bodies involved in the Different Steps of Spent Fuel and Radioactive Waste Management

E. 24 As noted in section B.5 of this report, Articles (40) to (42) of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy outlines the responsibilities in relation to radioactive waste and decommissioning. Certain UAE government bodies will be mandated to handle the environmental impact assessment, local planning, and waste management once the UAE's strategy has been developed.

Decision to regulate Radioactive Material as Radioactive Waste

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

Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy 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 Federal Authority for Nuclear Regulation as being subject to 'regulatory control' as a result of its radioactivity are clarified in Article (2)3 of FANR Regulation on Basic Safety Standards for Facilities and Activities involving Ionizing Radiation other than in Nuclear Facilities (FANR-REG-24) using the same levels as stated in Schedule I of IAEA Safety Standards on Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, General Safety Requirements Part 3, No. GSR-Part 3. Radioactive material is exempted from regulatory control if it falls below the limits stated in FANR-REG-24.

The definition of 'radioactive waste' in Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy is, 'Waste that contains or is contaminated with radionuclides at concentrations or activities greater than [the] levels as established by the [Federal] Authority [for Nuclear Regulation]'. These levels are the same levels as for regulated material as set out in Article (2)3 of FANR Regulation on Basic Safety Standards for Facilities and Activities involving Ionizing Radiation other than in Nuclear Facilities (FANR-REG-24).

Whilst it has not been explicitly expressed in regulations established by the Federal Authority for Nuclear Regulation, the Federal Authority for Nuclear Regulation agrees with the definition in the IAEA Nuclear Safety Glossary, which states that radioactive waste is '...material for which no further use is foreseen...'

United Arab Emirates Fourth National Report Under the Joint Convention

FANR Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities (FANR-REG-11) and FANR Regulation on Basic Safety Standards for Facilities and Activities involving Ionizing Radiation other than in Nuclear Facilities (FANR-REG-24) state basic requirements for radioactive waste from nuclear facilities and other facilities respectively. FANR Regulation for Pre-disposal Management of Radioactive Waste (FANR-REG-26) addresses pre-disposal management of radioactive waste from all facilities. Spent nuclear fuel is defined as nuclear fuel removed from a reactor following irradiation, which is no longer usable in its present form. As per FANR Regulation on Disposal of Spent Fuel and Radioactive Waste Management (FANR-REG-27), spent nuclear fuel is considered as high level radioactive waste for disposal.

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 fulfil 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.

Federal Authority for Nuclear Regulation

E.26 The Federal Authority for Nuclear Regulation is the governmental agency designated as the regulatory body pursuant to Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy. Articles (4) to (9) of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy establishes the Federal Authority for Nuclear Regulation as the regulatory body to implement the legislative and regulatory framework to ensure safety, nuclear safety, nuclear security and radiation protection in the UAE.

- Article (4) establishes the Federal Authority for Nuclear Regulation as a public, federal organisation with an independent balance sheet, an independent legal status, full legal competence and financial and administrative independence. It states the mandate of the Federal Authority for Nuclear Regulation to regulate the nuclear sector for peaceful purposes only, and to ensure safety, security and radiation protection.
- Article (5) authorises the Federal Authority for Nuclear Regulation to determine all matters relating to the control and supervision of the nuclear sector with regard to safety, nuclear safety, nuclear security, radiation protection and safeguards. The Federal Authority for Nuclear Regulation must also implement obligations under relevant international instruments entered into by the UAE. This article lists the powers of the Federal Authority for Nuclear Regulation.
- Article (6) gives the Federal Authority for Nuclear Regulation exclusive jurisdiction over the licensing of 'regulated activities' in the UAE and other activities within the scope of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy (including activities related to the management of spent fuel or radioactive waste, and the decommissioning of facilities).
- Article (7) requires the Federal Authority for Nuclear Regulation to co-operate with relevant government bodies in relation to radioactive waste.
- Article (8) authorises the Federal Authority for Nuclear Regulation to investigate potential breaches of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy .

United Arab Emirates Fourth National Report Under the Joint Convention

- Article (9) requires the Federal Authority for Nuclear Regulation to maintain the highest standards of transparency in its regulatory activities while allowing it to protect confidential information.

E.27 Articles (10) to (17) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy sets out the provisions on the management of the Federal Authority for Nuclear Regulation.

- Article (10) establishes the Board of Management of the Federal Authority for Nuclear Regulation to manage the organisation.
- Article (11) establishes the authority of the Board of Management of the Federal Authority for Nuclear Regulation in relation to the approval of the organisation's policy, and its budget and organisational structure, and the issuance of regulations needed for the Federal Authority for Nuclear Regulation's operations and functions.
- Article (12) sets forth the conditions of membership to the Board of Management of the Federal Authority for Nuclear Regulation.
- Article (13) identifies the grounds on which members of the Board of Management of the Federal Authority for Nuclear Regulation may be replaced.
- Article (14) outlines the requirements for the appointment of the Director General to manage the Federal Authority for Nuclear Regulation and oversee its financial, administrative and technical affairs.
- Article (15) establishes that the Director General manages the Federal Authority for Nuclear Regulation's business and oversees its financial, administrative and technical affairs under the Board of Management's control. It sets out the duties of the Director General such as the review of licence applications and the provision of appropriate recommendations to the Board of Management of the Federal Authority for Nuclear Regulation.
- Article (16) sets out the terms on which the Director General may be replaced.
- Article (17) authorises the Federal Authority for Nuclear Regulation to appoint employees.

E.28 Articles (18) to (22) of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy deal with the Federal Authority for Nuclear Regulation's financial affairs.

- Article (18) authorises the Federal Authority for Nuclear Regulation to manage its finances and identifies its means of funding such as: funding allocated by the government; income generated from its functions (i.e. fees); and other income that is accepted and that does not conflict with the Federal Authority for Nuclear Regulation's objectives.
- Article (19) establishes the dates of the fiscal year for the Federal Authority for Nuclear Regulation's financing.
- Article (20) makes the Federal Authority for Nuclear Regulation subject to UAE tender and procurement laws, and applicable audit and financial regulations.
- Article (21) grants the Federal Authority for Nuclear Regulation exemption from UAE taxes.
- Article (22) states that the Federal Authority for Nuclear Regulation's Board of Management will appoint an independent auditor to report on the Federal Authority for Nuclear Regulation's financial affairs.

United Arab Emirates Fourth National Report Under the Joint Convention

Status of the Regulatory Body

E.29 The Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy clearly establishes the Federal Authority for Nuclear Regulation as the independent government body charged with the regulation and licensing of all regulated activities within the UAE, which includes the siting, construction, and operation, and decommissioning of nuclear facilities as well as the regulation of radioactive material and radiation sources used in the medical field, in research, oil exploration, and other industries. The Federal Authority for Nuclear Regulation is the sole decision-maker in licensing, and its decisions are not subject to any external review.

Organisation and Staffing: Financial Resources

E.30 Members of the Board of Management of the Federal Authority for Nuclear Regulation are appointed for a renewable fixed term and can only be removed with a Cabinet resolution for specified reasons. Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy prohibits members of the Board of Management from engaging directly or indirectly in the conduct of any 'regulated activity' and having any personal interest that conflicts with the interests of the Federal Authority for Nuclear Regulation.

E.31 The Board of Management of the Federal Authority for Nuclear Regulation exercises the legal powers of the Federal Authority for Nuclear Regulation. The Board of Management is made up of a maximum of seven Emirati citizens including the chairperson and deputy chairperson, who are appointed for a term of three years by Cabinet resolution. The Director General leads the Federal Authority for Nuclear Regulation's staff at the organisation.

E.32 The Federal Authority for Nuclear Regulation is split into two divisions to fulfil its responsibilities: the Administration Division and the Operations Division as shown in the organisational chart below. The Federal Authority for Nuclear Regulation currently employs over 200 employees and continues to recruit talented individuals to meet its business requirements.

United Arab Emirates Fourth National Report Under the Joint Convention

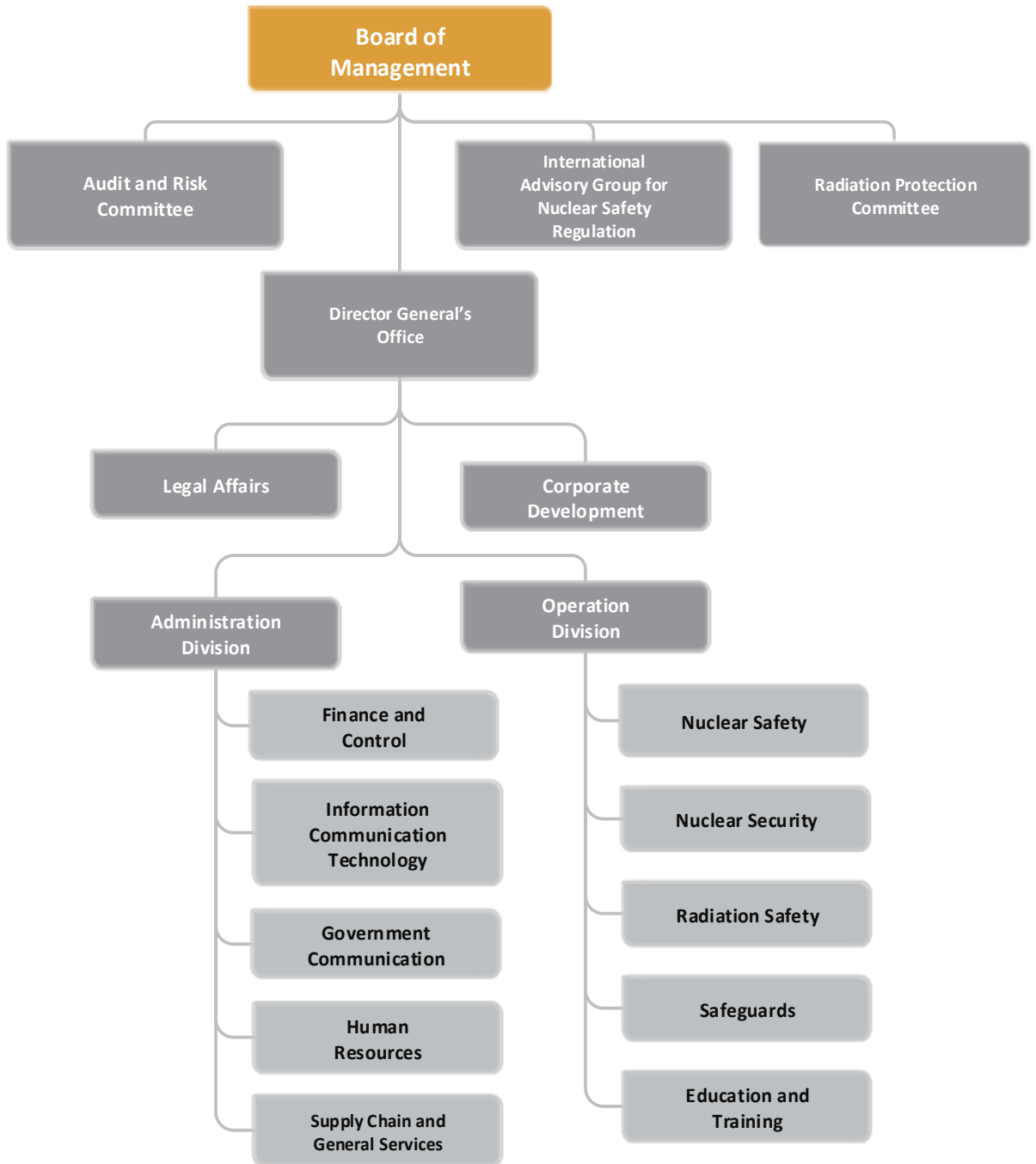


Figure E.32 – FANR Organisational Chart

United Arab Emirates Fourth National Report Under the Joint Convention

E.33 The Federal Authority for Nuclear Regulation has its budget set by its Board of Management. In the past, funds were made available through annual government allocation. The Federal Authority for Nuclear Regulation 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 the UAE government. The Federal Authority for Nuclear Regulation manages its financial resources according to the applicable financial and auditing regulations within the UAE. The the Federal Authority for Nuclear Regulation's Board of Management appoints an independent auditor registered with the appropriate UAE authorities to audit annual accounts and prepare reports on 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 Pursuant to Article (11) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy, the chair of the Board of Management is required to submit a report at the end of each financial year to the Minister of Presidential Affairs. Pursuant to Article (22) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy, the Federal Authority for Nuclear Regulation is also required to submit a set of audited accounts to the Cabinet for endorsement. As stipulated in Chapter 4 of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy, the Federal Authority for Nuclear Regulation shall receive all funds allocated to it and shall be free to deal with its funds and income.

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 the Federal Authority for Nuclear Regulation is independent of other organisations concerned with the use or promotion of nuclear energy.

Integrated Management System

E.36 As recommended in IAEA publications on safety requirements and guidance, the Federal Authority for Nuclear Regulation has developed and implemented an integrated management system that is tailored specifically to its role as regulator. The integrated management system includes a set of interacting processes that address the objectives and requirements of the organisation. Elements included in the integrated management system 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 the Federal Authority for Nuclear Regulation deliver its functions effectively and support the development of a strong safety culture. Figure E.36 depicts the processes in the Federal Authority for Nuclear Regulation's integrated management system.

The Federal Authority for Nuclear Regulation's commitment to excellence and quality, which is a necessity to achieve the organisation's vision of becoming one of the leading nuclear regulator's globally as well as ensuring the protection of the people and the environment, was demonstrated through the attainment and improvement of its management system. In this regards, the Federal Authority for Nuclear Regulation has acquired a number of ISO certifications as demonstrated below.

- ISO 22301:2012 Business Continuity Management Systems
- ISO/IEC 27001:2013 Information Security Management Systems
- ISO 9001:2015 Quality Management Systems
- ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories
- ISO 14001:2015 Environmental Management System
- ISO 45001:2018 Occupational Health and Safety Management Systems
- ISO 22320:2018 Security and Resilience – Emergency Management – Guidelines for Incident Management
- ISO 30401:2018 Knowledge Management Systems
- ISO 10015:2019 Quality Management – Guidelines for Competence Management and People Development

United Arab Emirates Fourth National Report Under the Joint Convention

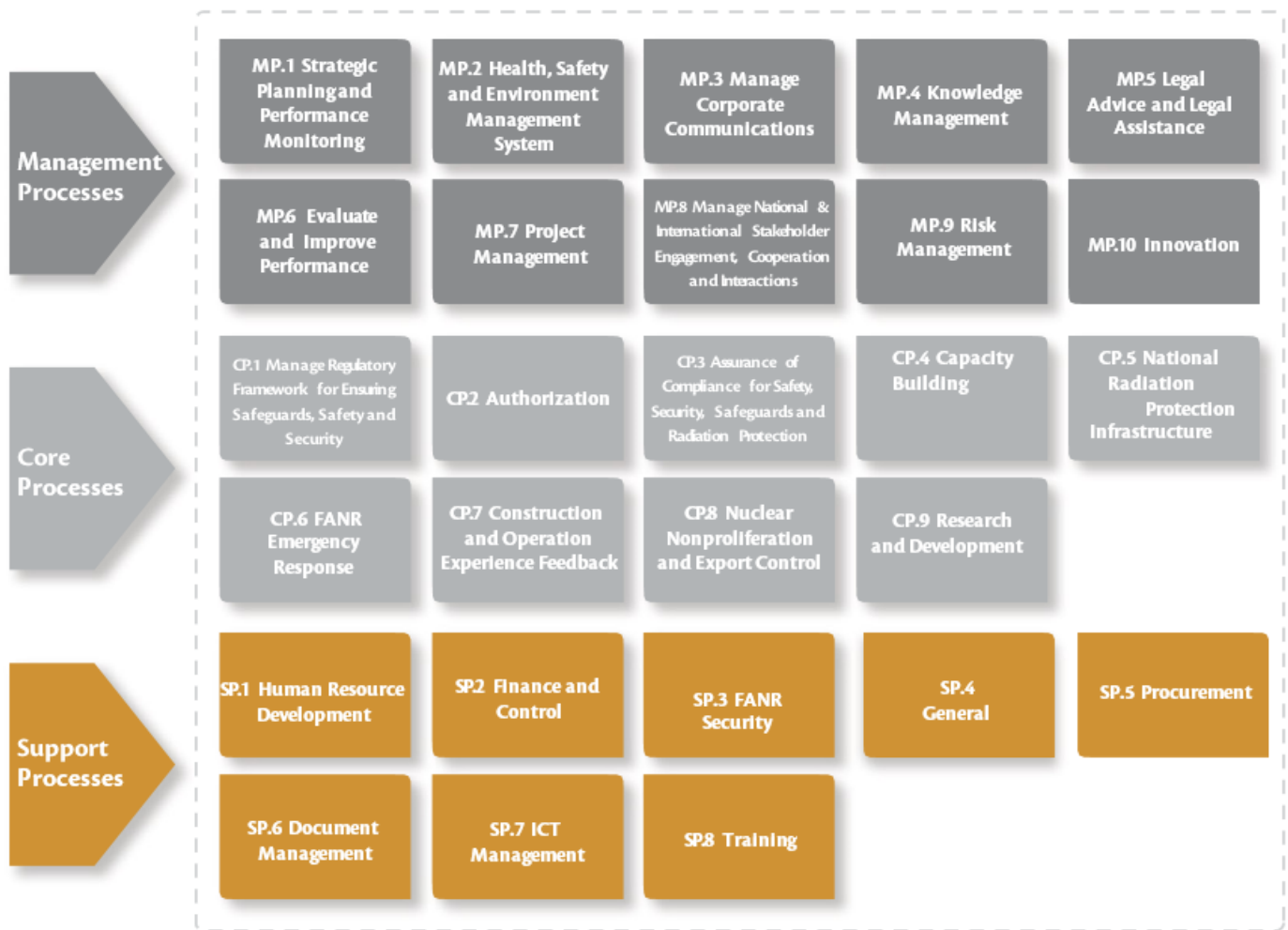


Figure E.36 – FANR Integrated Management System Process

Human Resources and Knowledge Management

E.37 The Federal Authority for Nuclear Regulation has made significant progress in recruiting a qualified and capable workforce over the past years. At the time of writing, the Federal Authority for Nuclear Regulation employed 249 staff members with Emiratis accounting for 67% of the overall workforce. From October 2018 to July 2020, there were 28 new joiners at the Federal Authority for Nuclear Regulation; 19 of whom were Emirati. The balance of the staff members are expatriates with extensive nuclear experience who were recruited from 30 different countries. The depth and breadth of expertise embodied within this team has been instrumental to the Federal Authority for Nuclear Regulation’s achievements to date.

Whilst the Covid-19 pandemic has had some impact on the recruitment process, the Federal Authority for Nuclear Regulation has overcome its challenges in recruitment by adapting its hiring processes to include virtual solutions such as video conferencing for interviews, providing the new joiners with their work laptops at home, assisting them virtually, etc.

E.38 Emiratisation is a key strategic objective for the UAE government, and stands at the core of the Federal Authority for Nuclear Regulation’s corporate strategy. The Federal Authority for Nuclear Regulation invests significantly in capacity-building strategies for Emiratis and this is seen through its various development programmes aimed at building and strengthening the nuclear regulatory competencies. Long-term career opportunities for Emiratis at the Federal Authority for Nuclear Regulation are achieved through focused

United Arab Emirates Fourth National Report Under the Joint Convention

recruitment, and training and development programmes. In January 2016 the Federal Authority for Nuclear Regulation increased its pool of competencies by launching the Developpee Engineers and Physicists Programme to ensure the long-term sustainability of the nuclear regulatory body. Seventeen trainees successfully completed various science and engineering disciplines on the programme, which aimed to help them understand the day-to-day duties of the four technical departments in the Operations Division. In August 2019 two trainee engineers and five trainee physicists completed their development programme to work as employees in one of the four technical departments in the Operations Division.

E.39 In order to complement its in-house expertise, the Federal Authority for Nuclear Regulation contracted a technical support organisation. The role of the technical support organisation includes support as needed for the regulatory oversight of operating a nuclear power plant (e.g. with inspections, review and assessment, training and preparation of regulatory documents). The Federal Authority for Nuclear Regulation assumes responsibility for all regulatory oversight activities including those where the technical support organisation provides support.

E.40 In order to ensure the sustainability of competent human resources, the Federal Authority for Nuclear Regulation has developed a competency framework for all jobs in its organisation. The Federal Authority for Nuclear Regulation has chosen to adopt elements of the IAEA's Systematic Assessment of Regulatory Competence Needs (SARCoN) methodology to ensure that its employees possess the requisite competencies to perform the functions of a nuclear regulatory body. The Federal Authority for Nuclear Regulation has developed formal qualification standards for safety assessors, inspectors and members of the FANR Emergency Response Organisation. At the time of writing this report, the Federal Authority for Nuclear Regulation had certified 27 women and 55 men as inspectors.

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

1) Scholarships

The Federal Authority for Nuclear Regulation partnered with the Emirates Nuclear Energy Corporation and Khalifa University to offer a scholarship to a degree (i.e. a BSc, MSc and PhD) in nuclear engineering in the UAE. At the time of writing this report, two students were studying a MSc Degree in Nuclear Engineering and one student was studying a PhD in the nuclear field.

A total of 14 staff members graduated from Liverpool John Moores University on Risktec's course on Risk and Safety Management. Eight of those staff members were awarded a Master's Degree and six have received a certificate.

One staff member was sent by the Federal Authority for Nuclear Regulation to study for a Master's of Science Degree on Radiation and Environmental Protection at the University of Surrey, UK.

Five staff members were sent to the Korea Advanced Institute of Science and Technology (KAIST) for a Master's Degree in Nuclear Safety.

2) Internships

The aim of the internship programme is to give university students insight into everyday work at the Federal Authority for Nuclear Regulation and grant them the opportunity to support and learn from the regulator's experienced staff members through a structured and objective based internship programme plan. Interns at the Federal Authority for Nuclear Regulation will accompany outstanding and inspiring career professionals and management within the organisation for approximately eight weeks. The interns are encouraged to participate in meetings and contribute to analytical work. Since 2013 there have been 11 interns who have

United Arab Emirates Fourth National Report Under the Joint Convention

completed their internship programme in the Operations Division and Administration Division at the Federal Authority for Nuclear Regulation.

3) Employee Development Programme

This employee development programme is designed to support the Federal Authority for Nuclear Regulation's employee's development by equipping them with the skills and knowledge needed to perform their roles and responsibilities at the Federal Authority for Nuclear Regulation.

The Federal Authority for Nuclear Regulation has established a new programme for fresh graduates called the Developpee Engineers and Physicists Programme. It is designed to provide fresh, Emirati engineering and science graduates with the fundamental skills, knowledge and attitude necessary to understand technical concepts applicable to nuclear engineering and radiation safety and in particular nuclear regulation. This development programme runs over 53 weeks and is made up of intensive training on the nuclear and radiation fundamentals, on-job training in each of the technical departments in the Operations Division as well as soft-skills training. By the end of the programme, it is expected that there will be Emirati, nuclear and radiation engineers and physicists working for the regulator in one of the technical departments in the Operations Division.

In 2019 the Federal Authority for Nuclear Regulation launched the Legal Developpee Programme, a first of its kind in the UAE. The programme was created to provide new law graduates with the fundamental knowledge necessary to understand concepts related to the national and international nuclear legal framework, and the UAE's peaceful nuclear programme.

A high priority for the Federal Authority for Nuclear Regulation 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 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 the Federal Authority for Nuclear Regulation. In 2019 the Federal Authority for Nuclear Regulation designed the leadership competencies to serve as the baseline for all future leadership programmes. The Federal Authority for Nuclear Regulation also celebrated the completion by two of its two employees of the UAE Prime Minister's Office Future Leaders Programme.

Both Emirati and expatriate employees have attended numerous in-house training sessions and external courses covering technical skills, personal skills, and management and leadership topics. In-house training courses are delivered by staff experts, and external training is delivered by external consultants. Over the last five years, the Federal Authority for Nuclear Regulation 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. In 2019 the Federal Authority for Nuclear Regulation's international collaboration efforts resulted in 10 of its employees receiving training in nuclear energy and radiation safety fundamentals, and 14 of its employees receiving 'Train-the-Trainer' training. The Federal Authority for Nuclear Regulation also sent three of its senior Emiratis to complete their senior reactor operator certification.

E.42 The Federal Authority for Nuclear Regulation recognises the value of preserving critical knowledge for safety and business sustainability and is in the process of ensuring that significant activities involving the use of knowledge unique to the nuclear sector are being systematically identified, captured, transferred and developed to ensure it is retained.

The Knowledge Management Programme run by the Federal Authority for Nuclear Regulation addresses the knowledge, experience and expertise generated in the regulatory, technical, scientific, administrative, legal and managerial areas.

The objectives of this programme includes:

- Mitigating the risk of knowledge loss due the employee's mobility

United Arab Emirates Fourth National Report Under the Joint Convention

- Making available knowledge and experience that enhances the quality of collaboration and increases the effectiveness and efficiency of the regulatory body
- Ensuring the sustainability of the UAE nuclear programme through the effective nuclear knowledge transfer from one generation to another

Several projects and initiatives have been launched under the Knowledge Management Programme to facilitate sharing/ the transfer of knowledge. This includes carrying out knowledge loss risk assessments and improving the knowledge management process and procedures.

The launch of the Knowledge Management Portal introduced new services such as the mission reports page, which is integrated into the portal to facilitate sharing knowledge and information from employees who have attended business meetings, training missions or conferences. The Construction and Operating Experience Feedback database was implemented to support the recording, communication, screening and tracking of both national and international events, and in order to share experiences that will support the development of knowledge amongst Emiratis. Exit interviews have also been used as a dual tool to identify critical knowledge to prevent its loss as well as to capture critical knowledge. Exit interviews have also been used to identify the alternative resources, methods and plans for knowledge retention activities to mitigate the safety and sustainability related risks.

The Federal Authority for Nuclear Regulation launched its Library and Learning Centre in 2016 to provide to its employees with the latest industry periodicals, published technical literature from the IAEA, the NEA and the US NRC, desktop generic pressurised water reactor simulators, and various technical and non-technical literature. The Library and Learning Centre encourages the use of explicit knowledge for employee development through a number of initiatives such as events for technical and non-technical book author discussions. The Library and Learning Centre also facilitates awareness sessions for various departments at the Federal Authority for Nuclear Regulation in order to support the development of employee information and knowledge.

Knowledge Loss Risk Assessment

The knowledge loss risk assessment is one of the most important tools to identify the individuals in the organisation who possess critical knowledge. The Federal Authority for Nuclear Regulation used this year to focus on the lessons learnt of conducting a knowledge loss risk assessment and the subsequent development of plans to enhance the assessment.

Knowledge Resource Matrix

The Federal Authority for Nuclear Regulation has developed a Knowledge Resource Matrix, which has been designed to capture all processes related to knowledge. In practice, the Knowledge Resource Matrix documents process competencies, information about references and standards as well as details about the entities and individuals required to allow a given process to function. The Knowledge Resource Matrix takes into consideration the four competency quadrants recommended by the IAEA: legal, technical, function related knowledge, and behaviour.

Knowledge Transfer Plan

The Knowledge Transfer Plan is designed to use the Knowledge Resource Matrix and the Knowledge Loss Risk Assessment to capture information, references, knowledge networks and knowledge topics to develop a know-how document. This document will facilitate the transfer of critical knowledge from the subject matter expert to the targeted employee to minimise the impact of losing critical knowledge. Each Knowledge Transfer Plan will be unique but will use the same methodologies.

Awareness Sessions

United Arab Emirates Fourth National Report Under the Joint Convention

Awareness sessions at the Federal Authority for Nuclear Regulation allow each department in the organisation to communicate information to all its employees.

Mission Reports

Capturing knowledge through the organisation's use of a 'mission report' has helped improve training and development. The contribution and commitment of the Federal Authority for Nuclear Regulation's employees to provide information that they have attained during their business missions is a key contributor to the success of the mission report, and the collation of knowledge in the organisation.

'Knowledge Day'

The second FANR Knowledge Day took place in 2019 in a bid to establish the conference's position as a prominent knowledge platform in the field of nuclear knowledge management. The Federal Authority for Nuclear Regulation received the support from the Mohammed Bin Rashid Al Maktoum Knowledge Foundation, which was represented by H.E. Jamal Bin Huwaireb, who shared the experience and contribution of the foundation in knowledge management both nationally and internationally. Additionally, the SCK CEN, the known research facility in Belgium, had been represented at the event by Dr Michele Coeck, a director, who shared experience of research and development in knowledge management, which the UAE is in need of developing. Various departments at the Federal Authority for Nuclear Regulation participated in the FANR Knowledge Day, which reflects the development of the knowledge management culture in the organisation.

FANR History Book

In accordance with the Director General's directive to collect factual and historical information about the nuclear programme and to document the history of the Federal Authority for Nuclear Regulation, the organisation's Knowledge Management Team has led experts to collect and verify documentation.

Human Capacity Development for the Nuclear/ Non-nuclear Industry Sectors

E.43 Over the last five years, the Federal Authority for Nuclear Regulation has conducted several workshops and training sessions for different UAE stakeholders in various areas of radiation protection, nuclear non-proliferation, nuclear security and emergency preparedness and response. Below is a list of events that the Federal Authority for Nuclear Regulation has conducted.

2018 Major Events

- FANR inaugurated the Secondary Standards Dosimetry Laboratory at the Khalifa University of Science and Technology so that radiation instruments can be calibrated in the UAE. The Secondary Standards Dosimetry Laboratory provides radiation metrology and calibration services to ensure that accurate doses are delivered to patients during diagnosis and treatment, and that radiation measurement instruments used throughout the UAE provide the expected degree of accuracy to support radiation protection.
- Besides the Secondary Standards Dosimetry Laboratory at Khalifa University, the Federal Authority for Nuclear Regulation inaugurated the Emergency Operations Centre at its Headquarters with state-of-the art equipment to coordinate its response in case of any nuclear or radiological event.
- The Federal Authority for Nuclear Regulation continuously monitors radioactivity levels in the UAE environment through its environmental laboratory at Zayed University in Abu Dhabi and through its 17 radioactivity monitoring stations placed at various locations across the UAE.

United Arab Emirates Fourth National Report Under the Joint Convention

- The Federal Authority for Nuclear Regulation continued to present its key regulatory activities at key international conferences including the 62nd General Conference hosted by the IAEA and the Regulatory Information Conference hosted by the US Nuclear Regulatory Commission.
- The FANR Environmental Laboratory Section of the Radiation Safety Department conducted its first training course on gamma spectroscopy.
- The Federal Authority for Nuclear Regulation participated in the Gulf Information Technology Exhibition (GITEX) Technology week.
- The Federal Authority for Nuclear Regulation hosted a national seminar in cooperation with the French Alternative Energies and Atomic Energy Commission (CEA) to present the education, research and development opportunities that can be offered to UAE stakeholders through the research centers of the CEA.
- A forum on Nuclear Export Control Practices in Dubai.
- A nuclear security workshop hosted by FANR in cooperation with King's College, University of London.
- The Federal Authority for Nuclear Regulation hosted a pre-INIR mission to the UAE and a review session phase 3 of the integrated nuclear infrastructure review mission of the IAEA.
- The Federal Authority for Nuclear Regulation participated in the International Symposium on Communicating Nuclear and Radiological Emergencies to the Public.
- The Federal Authority for Nuclear Regulation participated in the 23rd Nuclear Inter Jura 2018 organised by the International Nuclear Law Association.
- The Federal Authority for Nuclear Regulation has successfully hosted key technical workshops and forums such as:
 - The Export Control Forum in cooperation with multiple export control authorities around the world.
 - Radiation Protection Week in cooperation with the International Commission for Radiological Protection, which saw 14 countries discuss efforts to protect the public. The Federal Authority for Nuclear Regulation also launched a Radiological Environmental Monitoring Programme Report, which is the first of its kind to be published in the country, and illustrates the efforts of the regulator to protect the public and the environment.
 - Communication expert mission in cooperation with the IAEA.
 - International meeting on the Radiation Protection Computer Code Analysis and Maintenance Programme in cooperation with the US Nuclear Regulatory Commission.

2019 Events

- The Federal Authority for Nuclear Regulation hosted the Emergency Preparedness Review (EPREV) follow-up mission led by the IAEA in September 2019 in cooperation with strategic stakeholders.
- The Federal Authority for Nuclear Regulation was also actively involved in the UAE's nomination to host the largest and most complex IAEA exercise under international emergency conventions, ConvEx-3. Its nomination led to the UAE being selected to host the exercise in October 2021. In preparation for this upcoming event, FANR organised the first UAE coordination meeting in October 2019 and the first international coordination group meeting in November 2019.

United Arab Emirates Fourth National Report Under the Joint Convention

- As part of ongoing efforts to raise public awareness of the Federal Authority for Nuclear Regulation and the nuclear industry in the UAE, the Federal Authority for Nuclear Regulation conducted several community outreach activities in 2019 to inform the public of its roles and responsibilities. Its public outreach campaigns aim to engage with different segments of the community and raise awareness about the Federal Authority for Nuclear Regulation as the UAE's nuclear regulator. The campaigns also aim to increase the understanding of the Federal Authority for Nuclear Regulation's role in ensuring a safe, secure and peaceful nuclear energy programme in the UAE. This campaign targeted students in schools and universities, members of the public, government entities and the Federal Authority for Nuclear Regulation's licensees who are authorised to use regulated items. The Federal Authority for Nuclear Regulation held seven student outreach sessions, and reached over 500 students in schools and universities in Al Ain, Dubai and Abu Dhabi. Each session featured a presentation on the basic facts about radiation in everyday life and the nuclear sector in the UAE.
- The Federal Authority for Nuclear Regulation also conducted various public outreach sessions in the community, visited community centres and presented an open forum for the public on its role as regulator.
- The Federal Authority for Nuclear Regulation hosts 'Meet Your Regulator' events on an annual basis for its licensees in both the medical and non-medical sectors. The events reflect the Federal Authority for Nuclear Regulation's commitment to transparency as it openly shares its regulatory experience with its licensees. During the 'Meet Your Regulator' events, the Federal Authority for Nuclear Regulation discusses documents that its licensees should use as guidance to comply with the Federal Authority for Nuclear Regulation's requirements. Updates are also provided to licensees on any changes to such requirements. The Federal Authority for Nuclear Regulation also discussed the new FANR e-Licensing System, which was launched in July 2019. The new system provides enhancements to the old system. The Federal Authority for Nuclear Regulation used the 2019 'Meet Your Regulator' event to seek first-hand feedback through open discussion in a bid to further strengthen the safety and security culture. Almost 900 participants attended the event in 2019.

FANR hosted key technical workshops such as the following:

- Emergency Preparedness Review follow-up mission in cooperation with the IAEA.
- Halden Programme Group Meeting in cooperation with the Institute for Energy Technology.
- Student competition on Nuclear Science for Development in cooperation with the UAE Permanent Mission to the IAEA, and UAE entities.
- Spent Fuel Management Workshop in cooperation with the Nuclear Threat Initiative.
- Nine construction and operating experience feedback screening meetings that collectively reviewed 20 of Nawah Energy Company's reports and 73 international reports in order to assess and then distribute them internally for review or action as appropriate.
- A Safety Evaluation Report and an operational readiness inspection report were prepared to support the issuance of operation licences for naturally occurring radioactive material (NORM) treatment disposal facilities. The Federal Authority for Nuclear Regulation's Board of Management subsequently issued operation licences to the NORM treatment and disposal facilities in March 2019.
- The Federal Authority for Nuclear Regulation's staff actively participated in the cost estimation methodologies for spent fuel management at the IAEA's Headquarters in November.
- The Federal Authority for Nuclear Regulation held an awareness session of UAE-based business councils to shed light on the Federal Authority for Nuclear Regulation's role as the nuclear regulator in the UAE and its mission to ensure the safe, secure and peaceful use of nuclear and radioactive activities in the country.

United Arab Emirates Fourth National Report Under the Joint Convention

E.24 The IAEA requires Member States to establish education, training and competency requirements for all persons engaged in activities relating to radiation protection and safety. The Federal Authority for Nuclear Regulation 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 Federal Authority for Nuclear Regulation's website, which also lists some available training entities.

E.25 In February 2017, the Federal Authority for Nuclear Regulation hosted the IAEA education and training appraisal (EduTA) service mission. The EduTA team conducted a peer review of entities in the UAE that are engaged in activities relating to radiation protection and safety, and concluded its report (https://www.iaea.org/sites/default/files/documents/review-missions/eduta_2017-uae.pdf) containing recommendations and suggestions on how the system, processes and procedures should be improved in order to bring the education and training provisions in the UAE in line with the IAEA's safety standards and requirements.

In April 2017 a Working Group including all the relevant UAE Stakeholders was created under the Radiation Protection Committee to implement the EduTA Mission's suggestions and recommendations.

In September 2019 the UAE National Strategy for Education, Training and Qualifications in Radiation Protection was endorsed by the Radiation Protection Committee, and its implementation was set in motion.

In July 2019 a call for candidatures to create a pool of temporary 'Qualified Experts' in the UAE was published by the Federal Authority for Nuclear Regulation (<https://www.fanr.gov.ae/en/services/others/temporary-list-of-uae-qualified-experts>). Candidatures are being assessed in line with the requirements set by the Radiation Protection Committee.

Work to establish UAE national qualifications for professionals in radiation protection began in December 2017 in collaboration with the UAE National Qualifications Authority.

A Master's Degree of Engineering in Radiological Protection was established in 2020 at Khalifa University, in Abu Dhabi, and a Master's Degree of Science in Medical Physics is expected to be established at the same University.

United Arab Emirates Fourth National Report Under the Joint Convention

Section F Other General Safety Provisions

Article 21: Responsibility of the Licence 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 Article (40) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy stipulates that a person with a licence to possess 'regulated material' is responsible for the safe management and storage of radioactive waste until it has been sent for disposal to the entity designated by a decision of the Cabinet. That entity would also need to be licensed by the Federal Authority for Nuclear Regulation to deal with the radioactive waste and to establish a radioactive waste repository.

F.2 Article (43) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy also stipulates 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 At the time of writing this report, the UAE did not have any spent fuel or radioactive waste management facilities. However, as the UAE now has its first nuclear power plant in commercial operation, capacity development plans for radioactive waste and spent fuel disposal are being developed. Legislative and regulatory provisions ensure the timely development of required skills and competencies for the safe and secure management of radioactive waste and spent fuel.

F.4 FANR Regulation for an Application for a Licence to Construct a Nuclear Facility (FANR-REG-06) and FANR Regulation for an Application for a Licence to Operate a Nuclear Facility (FANR-REG-14) require licence applicants to demonstrate projected financial and human resource requirements for the proposed nuclear project, and provide details on their financial and technical qualifications to complete the proposed activities in accordance with nuclear safety principles and requirements. FANR-REG-14 requires licence applicants to address the adequacy of decommissioning funding and the adequacy of plans for radioactive waste management. The Federal Authority for Nuclear Regulation also issued FANR Regulatory Guide on the Content of Nuclear Facility Construction and Operating Licence Applications (FANR-RG-001) to provide guidance on the implementation of those regulations. The Emirates Nuclear Energy Corporation submitted a construction licence application during the preparation of a preliminary safety case for reactor units 1 and 2

United Arab Emirates Fourth National Report Under the Joint Convention

of the Barakah Nuclear Power Plant, and another construction licence application was submitted for reactor units 3 and 4 of the Barakah Nuclear Power Plant. Both construction licence applications were submitted in accordance with the requirements of FANR-REG-06 and as per the regulatory guidance of FANR-RG-001 whilst taking into account guidance from the IAEA and the US Nuclear Regulatory Commission.

Subsequently on 26 March 2015 the Emirates Nuclear Energy Corporation submitted an application for an operation licence for reactor units 1 and 2 of the Barakah Nuclear Power Plant. On 27 March 2017 an operation licence application was submitted for reactor units 3 and 4 of the Barakah Nuclear Power Plant. Nawah Energy Company holds an operation licence for reactor unit 1 and is the licence applicant for the operation licences for units 2, 3 and 4 of the Barakah Nuclear Power Plant.

A final safety case, which included final design information, supported each operation licence application in accordance with FANR Regulation for an Application for a Licence to Operate a Nuclear Facility (FANR-REG-14) and FANR Regulatory Guide on the Content of Nuclear Facility Construction and Operating Licence Applications (FANR-RG-001).

F.5 Article (42) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy requires the operator of a nuclear facility to pay fees into a 'Decommissioning Trust Fund'. 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.

The Emirates Nuclear Energy Corporation and the Nawah Energy Company have developed initial cost estimates for decommissioning and disposal of spent fuel as part of the documentation for the operation licence application ahead of the issuance of the draft FANR regulation on the decommissioning trust fund. These estimates have been reviewed by the Federal Authority for Nuclear Regulation in light of the reference scenario, which includes the construction and operation of a near surface repository and a geological disposal facility in the UAE.

The Federal Authority for Nuclear Regulation, and the Emirates Nuclear Energy Corporation and its affiliates have agreed on a 'reference scenario' for decommissioning and disposal facilities, and the timing, which allows for a fee to be set for contributions to be made to the decommissioning trust fund. An interim arrangement in the form of a deposit account has been established to set aside these moneys until the entity managing the decommissioning trust fund has been established.

F.6 FANR Regulation for the Decommissioning of Facilities (FANR-REG-21) requires the application for an operation licence for a facility to provide 'reasonable assurance' that funds will be available to decommission the facility. For nuclear facilities this condition is met by the commitment to fund these costs through contributions to the decommissioning trust fund.

F.7 The Emirates Nuclear Energy Corporation receives funding from the Abu Dhabi government for the costs of constructing the Barakah Nuclear Power Plant and associated activities such as capacity-building. The Emirates Nuclear Energy Corporation entered into a joint venture and established lending arrangements for the construction and development of the Barakah Nuclear Power Plant, and has developed a detailed proposal for the same working with the Abu Dhabi government's stakeholders, the Korea Electric Power Corporation and a consortium of international lenders such as export credit agencies.

F.8 The Emirates Nuclear Energy Corporation and its affiliates, Nawah Energy Company and Barakah One Company, have established a power purchase agreement with the Emirates Water and Electricity Company for the purchase of electricity produced by the Barakah Nuclear Power Plant, which will ensure revenue is available to the licensed operator to safely operate and maintain the facility. These revenue arrangements ensure that the operator will recover costs incurred to meet its decommissioning obligations under applicable laws such as the recovery of any fees that are required to be paid into a decommissioning fund under applicable regulations.

United Arab Emirates Fourth National Report Under the Joint Convention

F.9 The UAE has adopted the following two strategic goals associated with the national regulatory capacity-building programme:

- To support the national capacity-building approach through effective coordination with certain UAE government entities and stakeholders in order to develop human resources in the nuclear sector.
- To establish and maintain a national regulatory capacity-building programme in order to develop and sustain an Emirati nuclear workforce to an international standard.

F.10 The UAE human resources policy is guided by the IAEA document NG-G-3.1 entitled, Milestones in the Development of National Infrastructure for Nuclear Power. The Federal Authority for Nuclear Regulation, the Emirates Nuclear Energy Corporation and its affiliates, and Khalifa University are working together on the national regulatory capacity-building programme across education, training and recruitment lines to ensure that the nuclear programme's human resource needs are met at every stage of its development. The Emirates Nuclear Energy Corporation and its affiliates have partnered with the Institute of Applied Technology to train Emiratis to the technologist level to support the operation and maintenance of its nuclear power plants.

The Emirates Nuclear Energy Corporation and its affiliates, Nawah Energy Company and Barakah One Company, work with local universities to ensure that Emiratis are qualified for jobs in the nuclear energy sector including senior technical and management positions. The Energy Pioneers Programme offers a variety of scholarships and training opportunities to the most talented science students and experienced professionals. There is also an outreach programme to encourage students to study science and advise them of career possibilities at the Emirates Nuclear Energy Corporation. This includes study at the Institute of Applied Technology, whose vision is to 'produce the scientists, engineers, and technicians needed for the UAE to build a knowledge-based economy'. In order to accomplish its vision, the Institute of Applied Technology has included the academic requirements of the Nuclear Technician Programme within their curriculum. Emiratis who want to become a part of the emerging nuclear energy sector can apply for a scholarship for a higher diploma in Nuclear Technology at the Abu Dhabi Polytechnic.

The higher diploma in Nuclear Technology is jointly run between Abu Dhabi Polytechnic and Nawah Energy Company. During the three-year course, the students learnt various subjects such as mathematics, physics, chemistry, mechanical science, electrical science, heat transfer and fluid flow, nuclear physics, plant systems, nuclear safety, radiation measurement, radiation protection and nuclear material. The course includes on-the-job training for 23 weeks to allow the students to have insight into various disciplines on offer and introduce them to the nuclear power plant.

The Emirates Nuclear Energy Corporation and Nawah Energy Company partnered with the IAEA, Khalifa University and the Federal Authority for Nuclear Regulation to establish the UAE-IAEA Nuclear Energy Management School to build the future leadership to manage the UAE's nuclear energy programme and to bring together a network of people interested in nuclear energy.

The Emirates Nuclear Energy Corporation has established the Radioactive Waste Management Division to provide solutions to manage and ultimately dispose of spent fuel and radioactive waste in a safe, secure and sustainable manner that protects workers, the public and the environment now and in the future without imposing an undue burden on future generations.

Capacity-building in radioactive waste management is the primary focus of the Radioactive Waste Management Division, which aims to build upon the competency of Emiratis in the field of spent fuel and radioactive waste management. There are various ongoing nuclear training programmes along with specific radioactive waste management training and on-the-job training programmes, which have been designed for this purpose. Such training programmes will enable Emiratis to be specialise in fields associated with the radioactive waste management.

The Emirates Nuclear Energy Corporation also has schemes in place for trainees and interns in addition to summer training programmes to train and develop the capabilities of Emirati students and fresh graduates. These schemes will contribute to the sustainability of the radioactive waste management programme. The

United Arab Emirates Fourth National Report Under the Joint Convention

Emirates Nuclear Energy Corporation is also considering having its Emirati engineers seconded into a fully functioning radioactive waste management organisation in another country for a set period of time to allow them to gain the skills necessary for the UAE's radioactive waste management organisation. This approach is designed to create alliances with international organisations.

In addition to the capacity-building endeavours of the Emirates Nuclear Energy Corporation, the Nawah Energy Company has been officially approved to be a national registered training provider following a comprehensive audit by the Vocational Education and Training Awards Council and the National Qualifications Authority. As a national registered training provider, the Nawah Energy Company is authorised to issue nationally-endorsed qualifications. This makes the Nawah Energy Company the first UAE industry-led organisation (whose primary role is not training) to achieve national recognition. It also highlights the Nawah Energy Company's commitment to the development of its employees in line with the UAE's Emiratisation plans.

Nationally-endorsed qualifications can be obtained for the following positions at the Nawah Energy Company for those who can demonstrate competence against the national standards:

- Chemical/ radiation protection technicians
- Electrical/ mechanical/ instrumentation and control technicians
- Reactor operators
- Senior reactor operators
- Other applicable operators

Such nationally-endorsed qualifications are recognised by other UAE institutions for credit transfer and career advancement.

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 used for Emiratis to do job-shadowing. See section E.37- E.43 for more information.

F.12 The Emirates Nuclear Energy Corporation and its affiliates have developed a human resources development strategy to identify the capabilities needed to support the UAE nuclear energy programme, 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, Emirati workforce.

The Emirates Nuclear Energy Corporation and its affiliates have partnered with schools and universities to offer and promote opportunities to graduates to join its Energy Pioneers Scholarship Programme.

F.13 The human resources development strategy aims to build a pool of talented Emiratis from school to university. The Emirates Nuclear Energy Corporation and its affiliates plan to do this by doing the following:

- Leveraging the UAE's educational system and building new infrastructure
- Developing partnership opportunities
- Leveraging business and industry

United Arab Emirates Fourth National Report Under the Joint Convention

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 Article (44) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy describes the requirements that the licensee must meet to set up a management system and a quality assurance programme; both of which are subject to inspection and approval by the Federal Authority for Nuclear Regulation. FANR Regulation on Management Systems for Nuclear Facilities (FANR-REG-01) requires the licensee to establish, implement, assess and continually improve a management system that is in line with the goals of the organisation and contributes to its achievement. FANR Regulation on Operational Safety including Commissioning (FANR-REG-16) requires the licensee to establish implement, assess goals of the operating organisation, and continually improve the management system.

F.15 The Emirates Nuclear Energy Corporation and its affiliates have developed and maintained a quality management system in compliance with Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy and FANR regulations. The quality management system includes a Quality Assurance Programme, which adheres to ASME NQA-1-1994 /1995 Addendum and applicable international IAEA and ISO standards on quality assurance for nuclear facility applications. The scope of the quality management system covers siting, design, procurement, engineering, construction and commissioning. Emirates Nuclear Energy Corporation's Quality Assurance Manual covers all four reactor units of the Barakah Nuclear Power Plant, and was approved by the Federal Authority for Nuclear Regulation as part of the Emirates Nuclear Energy Corporation's construction licences for reactor units 1 and 2, and 3 and 4.

As part of its quality management system, the Emirates Nuclear Energy Corporation has implemented a quality surveillance and auditing programme that oversees the quality assurance controls and measures for the Barakah Nuclear Power Plant's supply chain and construction site. The Emirates Nuclear Energy Corporation conducts audits regularly on its prime contractor, the Korea Electric Power Company, and its sub-contractors to verify its programme implementation and effectiveness. The Federal Authority for Nuclear Regulation also conducts regular inspections on the Emirates Nuclear Energy Corporation and its affiliates, and on the Korea Electric Power Company and its contractors. The results of audits and inspections are reviewed and quality improvements are made as required.

The Nawah Energy Company has developed its own quality assurance manual, which forms part of its integrated management system. Through the introduction of quality assurance requirements, the Nawah Energy Company integrates quality into the performance of all activities that have the potential to adversely impact the safe operation of the Barakah Nuclear Power Plant. The Nawah Quality Assurance Manual along with the implementing documents form the Nawah Quality Assurance Programme. The Nawah Quality Assurance Programme was established and is implemented to satisfy the requirements of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy, FANR regulations, ASME NQA-1 1994 with 1995 Addenda, and ANSI/ANS-3.2,2012 Managerial, Administrative and Quality Assurance Controls for the Operational Phase of Nuclear Power Plant .

As a part of its quality assurance manual, the Nawah Energy Company has implemented a quality surveillance and auditing programme that oversees the quality assurance controls and measures for the Barakah Nuclear Power Plant's construction inspection test plan stages III and IV, and its operations stage V. The Nawah Energy Company regularly conducts audits on the prime contractor, the Korea Electric Power Company/ Korea Hydro and Nuclear Power and its sub-contractors to verify its programme implementation and effectiveness. The Nawah Energy Company conducts third-party audits on its operating organisation to check for its readiness. The Federal Authority for Nuclear Regulation also conducts a series of operation readiness inspections to ensure that the implementing procedures are useable, published and technically

United Arab Emirates Fourth National Report Under the Joint Convention

correct, that technical training has been completed, and resources are in place to support the operation of Barakah Nuclear Power Plant.

F.16 Extensive reviews have been carried out at the Barakah Nuclear Power Plant to strengthen controls on counterfeit, fraudulent, and suspect items. The Emirates Nuclear Energy Corporation and the Nawah Energy Company have revised their quality assurance programme to strengthen controls on counterfeit, fraudulent, and suspect items 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's quality assurance programme has also been enhanced to improve controls on counterfeit, fraudulent, and suspect items.

The Emirates Nuclear Energy Corporation and the Nawah Energy Company have developed an overall strategy and action plan to actively monitor controls over counterfeit, fraudulent, and suspect items across the supply chain, which includes independent reviews of the prime contractor, and of the Nawah Energy Company's supplier's programmes and control measures. The Emirates Nuclear Energy Corporation and the Nawah Energy Company also maintains close contact with industry bodies such as the Electric Power Research Institute, the Nuclear Energy Institute, the US Department of Energy, the Nuclear Procurement Issues Committee, and the US Nuclear Regulatory Commission, and will continue to enhance its control measures, as required.

F.17 The Emirates Nuclear Energy Corporation and its affiliates will ensure that the pre-disposal radioactive waste management facilities are in compliance with FANR regulations. The Emirates Nuclear Energy Corporation and the Nawah Energy Company as licensees will ensure that its prime contractor, the Korea Electric Power Company, which is responsible for the design, construction, commission, and initial operation of the nuclear power plant, performs a safety assessment and develops a safety case for each identified waste stream. The pre-disposal management of radioactive waste will be managed in accordance with the approved safety analysis performed by the licensee addressing the pre-treatment, treatment, conditioning and storage of radioactive waste that is anticipated to be generated from the Barakah Nuclear Power Plant.

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.

United Arab Emirates Fourth National Report Under the Joint Convention

F.18 At the time of writing this report, there were no spent fuel or radioactive waste management facilities in the UAE. Any future facilities will be subject to licensing by the Federal Authority for Nuclear Regulation in accordance with the provisions of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy. This authorises the Federal Authority for Nuclear Regulation to regulate radiation protection in the nuclear sector in the UAE, which includes the medical and industrial application of radioactive material. See sections F.20 and F.21 in this report.

F.19 In order to ensure the utmost safety of both the workforce on-site at the Barakah Nuclear Power Plant and the general public, the requirements outlined in sections F.20 and F.21 in this report will be applied to the Barakah Nuclear Power Plant's radioactive waste and spent fuel management facilities. Details can be found in the final safety analysis report.

F.20 Article (43) of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy 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 ionising 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 [Federal] Authority [for Nuclear Regulation] as specified in the applicable regulations'.

F.21 The Federal Authority for Nuclear Regulation has developed the following regulations, which relate to radiation protection in nuclear facilities:

- **FANR Regulation for Radiation Dose Limits and Optimisation of Radiation Protection for Nuclear Facilities (FANR-REG-04), Version 1**
 - i. Dose Limits for Occupational Exposure
 - ii. Dose Limits for the Public Exposure
 - iii. Optimisation of Radiation Protection for Workers
 - iv. Optimisation of Radiation Protection for the Public

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

- **FANR Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities (FANR-REG-11)**
 - i. Radiation Protection Programme
 - ii. Predisposal Management of Radioactive Waste
 - iii. Clearance Levels and Discharges of Radioactive Material
 - iv. Environmental Monitoring Programme
 - v. Training
- **FANR Regulation for an Application for a Licence to Construct a Nuclear Facility (FANR-REG-06)** requires the 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 Regulation on the Transportation of Radioactive Material (FANR-REG-13)** has adopted IAEA document TS-R-1 (2009 Edition) on Regulations for the Safe Transport of Radioactive Material. The Federal Authority for Nuclear Regulation is planning to update this version with the IAEA's latest 2018 Edition, SSR-6, entitled Regulations for the Safe Transport of Radioactive Material.
- **FANR Regulation for an Application for a Licence to Operate a Nuclear Facility (FANR-REG-14)** requires the applicant for an operation licence to describe in its application preliminary information

United Arab Emirates Fourth National Report Under the Joint Convention

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 the radiation protection of personnel and the nuclear facility. This FANR regulation 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.

- **FANR Regulation on Disposal of Spent Fuel and Radioactive Waste (FANR-REG-27)**

This regulation designates 'Regulated Activities' in relation to the radioactive waste repository and establishes the safety requirements for the disposal of radioactive waste during the siting, design, construction, operation, closure and the post-closure control period, and the institutional control of a radioactive waste repository.

F.22 Regulatory requirements have been established to ensure that radioactive discharges are limited in line with international norms and standards. These requirements are described in sections B.6, D.5, G.4, G.13, G.16 and H.24 of this report.

F.23 The UAE government is developing a policy on 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 Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy.

F.24 According to Article (67) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy, the Federal Authority for Nuclear Regulation's Board of Management formally established the Radiation Protection Committee on 20 July 2011 as an advisory and consultative committee to the Federal Authority for Nuclear Regulation. The Radiation Protection Committee is charged with advising the Federal Authority for Nuclear Regulation 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 Radiation Protection Committee has held 23 meetings from its establishment until August 2020. During these meetings, the Radiation Protection Committee considered the following:

- Coordinating licensing activities, and inspection activities with health authorities
- Public radiation protection from unjustified exposure
- Radiation exposure of the space crew
- Radiation protection from orphan sources including the establishment of centralised storage of orphan sources and the integration of border monitoring detection and response capacities in accordance with the Orphan Source Strategy Action Plan
- National internal dosimetry infrastructure requirements
- Providing services in radiation safety such as the FANR Secondary Standards Dosimetry Laboratory
- Radiological emergency planning and environmental monitoring
- Occupational radiation protection
- Management of existing exposure situations
- Development of the FANR legal framework
- Development and implementation of the National Strategy for Education and Training in Radiation Protection

United Arab Emirates Fourth National Report Under the Joint Convention

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 Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy sets out a structure for emergency preparedness. The provisions are shown below for the relevant articles in Chapter 9.

- Article (49) stipulates that the licensee and the competent authorities shall establish measures for emergency preparedness and emergency response for the protection of the population, property and environment (off-site Emergency plan) and for each nuclear facility and any facility that contains sources of ionising radiation (on-site Emergency Plan).
- Article (50) stipulates that the preparation, maintenance and coordination of the off-site Emergency Plan will be carried out by the competent authorities and licensees in order to provide protection to the public.
- Article (51) 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) stipulates that the licensee shall provide its emergency plan to the Federal Authority for Nuclear Regulation for approval and other UAE competent authorities before the commissioning of a nuclear facility, and that the emergency plan shall be tested before nuclear facility commissioning and during the course of operation.
- Article (53) stipulates that the licensee is required to familiarise its employees with the emergency plans and to conduct related training.
- Article (54) stipulates that in case of an accident, licensees must do the following:
 - notify the Federal Authority for Nuclear Regulation 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
 - perform any other obligations as may be established in the emergency plans, the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy, or the applicable regulations
- Article (55) stipulates that the terms and procedures for preparation of the emergency plan, the duties and responsibilities for implementation, the measures for mitigation and remediation of the consequences, and the arrangements for warning of the public be established with regulations.

United Arab Emirates Fourth National Report Under the Joint Convention

- Article (7) stipulates that the Federal Authority for Nuclear Regulation will cooperate with and advise relevant UAE government entities concerned with emergency preparedness and response.

F.26 FANR Regulation for Emergency Preparedness for Nuclear Facilities (FANR-REG-12) sets out the Federal Authority for Nuclear Regulation's requirements for a licence applicant or licensee for preparation and planning for and response to emergencies at nuclear facilities.

The purpose of FANR-REG-12 is to ensure that the licence 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.

Based on the lessons learnt, feedback from different missions and with the aim of continuous improvement, a new version of FANR-REG-12 was prepared by the Federal Authority for Nuclear Regulation and submitted for review by the its stakeholders.

F.27 FANR Regulation on the Requirements for Off-Site Emergency Plans for Nuclear Facilities (FANR-REG-15) provides the requirements for the off-site emergency plan and was drafted in consultation with the National Emergency Crisis and Disaster Management Authority. This regulation defines a) terms and procedures for preparation of the off-site emergency plan, b) responsibilities and duties for implementation, c) measures for mitigation and remediation of consequences, d) arrangements for warning the public, and e) measures for testing emergency preparedness.

F.28 The Federal Authority for Nuclear Regulation is developing three regulatory guides on emergency preparedness: the first, Criteria for Protective Actions in Response to a Nuclear or Radiological Emergency; the second, Preparation, Conduct and Evaluation of Drills and Exercises; and the third, Emergency Preparedness for Nuclear Facilities. The draft regulatory guide on the Criteria for Protective Actions in Response to a Nuclear or Radiological Emergency addresses the basic concepts, public protection strategy for nuclear and radiological emergencies, criteria for protection of emergency workers and helpers, and the transition phase and criteria to end an emergency. The draft regulatory guide on the Preparation, Conduct and Evaluation of Drills and Exercises provides acceptable methods and guidance for activities involving emergency preparedness drills and exercises. The draft regulatory guide on the Emergency Preparedness for Nuclear Facilities provides acceptable methods and guidance for activities involving the preparation, planning for and response to an emergency at a nuclear facility.

F.29 Regulations issued by the Federal Authority for Nuclear Regulation require comprehensive emergency plans to be prepared and periodic exercises to be organised to ensure that actions are taken to notify and protect people 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 licence 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 Nuclear Power Plant's emergency preparedness programme has been developed in line with the 16 planning standards outlined in the US Nuclear Regulatory Commission's NUREG-0654 report entitled Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants. The Nawah Energy Company is also working closely with off-site agencies to facilitate their understanding of the 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 the Federal Authority for Nuclear Regulation for review. The on-site and off-site emergency plans have been successfully tested in three exercises evaluated by the Federal Authority for Nuclear Regulation. A drill and exercise programme has been developed and implemented since 2015 to periodically

United Arab Emirates Fourth National Report Under the Joint Convention

test the on-site and off-site plans. Emergency preparedness familiarisation training is provided to all plant personnel to take the required actions during a declared emergency.

In 2019 the Abu Dhabi Police and other applicable entities approved the fourth version of the Off-site Nuclear and Radiological Emergency Response Plan for the Barakah Nuclear Power Plant, which describes the roles and responsibilities of each national response entity and the support organisations. This off-site plan has been developed in accordance with FANR Regulation on the Requirements for Off-site Emergency Plans for Nuclear Facilities (FANR-REG-15). The off-site plan includes annexes, which address the responsibilities of external stakeholders; each of which 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, the Nawah Energy Company, and the Off-Site Emergency Plan developed under the leadership of the Ministry of Interior in coordination with other concerned entities. Planning for the national emergencies is coordinated in line with the General Framework for Emergency Response, which was prepared by the National Emergency Crisis and Disasters Management Authority in February 2013. Notifications and the activation of an emergency response occurs through the Tariff Police Notification Point in Al Dafrah (i.e. in the region where the Barakah Nuclear Power Plant is located), the Abu Dhabi Joint Local Operations Centre, and the National Operations Centre operated by the National Emergency Crisis and Disasters Management Authority.

F.32 Nawah Energy Company has developed and implemented a standard emergency classification scheme, which takes into account the facility's system and effluent parameters that response organisations may rely on to determine initial off-site response measures. The classification scheme was developed in line with the Nuclear Energy Institute's document, NEI 99-01, Revision 6. The On-site Emergency Plan outlines 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 pre-defined emergency action levels based on initiating events such as abnormal conditions and system malfunctions of the nuclear facility, security-related concerns, releases of radioactive material, natural events, hazards and the failure of the three fission product barriers. These emergency action levels help to classify the incident as one of four emergency classification levels in escalating severity. The On-site Emergency Plan developed by the Nawah Energy Company will be implemented with emergency procedures in the form of documents and instructions that contain details about the implementation actions and methods required to meet FANR Regulation for Emergency Preparedness for Nuclear Facilities (FANR-REG-12).

F.34 Article (4) of FANR Regulation for Emergency Preparedness for Nuclear Facilities (FANR-REG-12) requires the licensee to maintain an emergency plan, and Article (7)2(b) of FANR Regulation for Off-site Emergency Plans for Nuclear Facilities (FANR-REG-15) requires the conduct of drills and exercises as per the full Off-site Emergency Plan and the On-site Emergency Plan prior to the receipt of nuclear fuel.

During the reporting period between October 2018 and August 2020 the Nawah Energy Company conducted eight drills and the Federal Authority for Nuclear Regulation participated in most of them to also test its emergency response organisations. Other exercises were conducted at the off-site level. As part of the bi-annual exercise requirement, a full-scale exercise was implemented in 2019, which was preceded by a rehearsal. The Federal Authority for Nuclear Regulation evaluated this exercise to fully demonstrate the full response capabilities of the on-site emergency response organisation. As with the pre-fuel receipt for the Barakah Nuclear Power Plant exercise, the Nawah Energy Company submitted the exercise packages to the Federal Authority for Nuclear Regulation for review and verification. The Barakah Emergency Response Organisation demonstrated a satisfactory performance during the said exercises.

The Nawah Energy Company uses its own evaluation criteria based on the NUREG-0654 report entitled Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants, and it included the criteria in their process for self-evaluation to improve the emergency response and preparedness programme.

United Arab Emirates Fourth National Report Under the Joint Convention

Prior to fuel receipt at unit 1 of the Barakah Nuclear Power Plant, the IAEA sent an expert mission made up of three emergency planning counterparts at the request of the Federal Authority for Nuclear Regulation to observe the preparation, conduct and evaluation of the Barakah Nuclear Power Plant emergency exercise in 2016. The IAEA's expert mission participated in meetings and training sessions before the exercise and observed pre-exercise planning discussions among the different on-site and off-site organisations involved in the exercise.

F.35 The UAE hosted an IAEA Emergency Preparedness Review mission in March 2015. The purpose of this mission was to conduct a review of the UAE's emergency preparedness and response arrangements and capabilities associated with the Barakah Nuclear Power Plant. The Emergency Preparedness Review mission also assessed the progress of the previous finding in the Integrated Regulatory Review Service to the UAE in 2011. The review service was carried out by comparing existing arrangements with the current international safety standards and good practices. The Federal Authority for Nuclear Regulation was involved with the National Emergency Crisis and Disasters Management Authority, the Ministry of Interior, the Emirates Nuclear Energy Corporation, and other concerned entities in the IAEA's Emergency Preparedness Review mission.

The IAEA Emergency Preparedness Review mission made six recommendations, five suggestions, and identified two good practices. The Federal Authority for Nuclear Regulation was involved with the National Emergency Crisis and Disasters Management Authority, the Ministry of Interior, the Emirates Nuclear Energy Corporation, and other concerned entities to address the recommendations and suggestions. For more information, please click on the link below.

<http://fanr.gov.ae/en/Lists/Reports/Attachments/2/2015EPREV-UAE-Final.pdf>.

The UAE hosted an IAEA Emergency Preparedness Review follow-up mission in September 2019. The purpose of the Emergency Preparedness Review follow-up mission was to review the actions undertaken to address the recommendations and suggestions made during the Emergency Preparedness Review mission that was conducted in 2015. The review involved the comparison of the UAE's emergency arrangements relating to the findings from the previous mission against the IAEA's safety standards for preparedness and response to a nuclear or radiological emergency.

The follow-up mission made two recommendations, and gave three suggestions, and identified two good practices.

For more information please click on the link below.

<https://www.iaea.org/sites/default/files/documents/review-missions/eprev-uae-120919.pdf>

F.36 Article (16) of FANR Regulation on Basic Safety Standards for Facilities and Activities involving Ionizing Radiation other than in Nuclear Facilities (FANR-REG-24) applies to radioactive waste treatment facilities that are not affiliated to nuclear power plants. The licensee is required to prepare and maintain an emergency plan for the protection of people commensurate with the nature and magnitude of the risk involved. The emergency plan is subject to the approval of the Federal Authority for Nuclear Regulation.

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

United Arab Emirates Fourth National Report Under the Joint Convention

F.37 Article (42) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy 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 the 'Decommissioning Trust Fund' established by a decision of the Cabinet according to the Board's recommendation. Article (42) also describes what the fee shall cover.

F.38 The Federal Authority for Nuclear Regulation issued FANR Regulation on the Decommissioning of Facilities (FANR-REG-21), which addresses decommissioning and the criteria to terminate a licence. The Federal Authority for Nuclear Regulation is also developing another regulation on the decommissioning trust fund. Both these regulations will cover the requirements of Article (26) in the Joint Convention as demonstrated below.

- Article (5) of FANR-REG-21 states the responsibilities of the licensee during the decommissioning phase of the facility. One of these responsibilities is to ensure that properly trained, qualified and competent staff are available for the decommissioning project.
- Article (3) 1 of FANR Regulation on Decommissioning Trust Fund (FANR-REG-22) which is under development states "the fees to be paid by the Operating Licensee in accordance with Article (42)(1) of the Nuclear Law are established as the annual charges that are to be paid over the period of the validity of the Licence to Operate a Nuclear Facility that, together with fund growth in the DTF through investment, generate sufficient funds to meet the Decommissioning Costs as and when payment(s) for such costs fall due".
- Article (3) of FANR-REG-21 requires that the radiation protection of persons who are exposed as a result of decommissioning actions shall be optimised with due regard to the relevant dose constraints in accordance with the provisions of Article (24) on operational radiation protection, discharges and unplanned and uncontrolled releases.
- Article (5) of FANR-REG-21 stipulates that the licensee is responsible for all aspects of safety, radiation protection and environmental protection during decommissioning.
- Article (18) of FANR-REG-21 addresses the maintenance of records important to decommissioning.

F.39 FANR Regulation for an Application for a Licence to Operate a Nuclear Facility (FANR-REG-14) requires information on the decommissioning and end-of-life aspects to be included in the operation licence application. The Nawah Energy Company has developed a preliminary decommissioning plan and submitted it to the Federal Authority for Nuclear Regulation with the operation licence application for the Barakah Nuclear Power Plant.

United Arab Emirates Fourth National Report Under the Joint Convention

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 Article (87) of FANR Regulation on the Design of Nuclear Power Plant (FANR-REG-03) outlines the requirements for spent fuel handling and for spent fuel storage in water pools.

Minimum Generation of Radioactive Waste

G.2 Article (15)1 of FANR Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities (FANR-REG-11) and Article (30)2 of FANR Regulation on Basic Safety Standards for Facilities and Activities involving Ionizing Radiation other than in Nuclear Facilities (FANR-REG-24) 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 the long-term management of spent fuel will take into account interdependencies in the different steps in spent fuel management as mentioned in sections B.1 to B.3 of this report.

Protection of Individuals

G.4 Articles (3) to (13) of FANR Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities (FANR-REG-11) 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 are met in accordance with FANR Regulation for Radiation Dose Limits and Optimisation of Radiation Protection for Nuclear Facilities (FANR-REG-04), Version 1. Furthermore, Article (23)1 and 2 of FANR Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities (FANR-REG-11) stipulates the following:

'The Licensee shall ensure that the safety Case for gases and effluents shall describe the characteristics and activity of the material to be discharged, and the potential points and methods of discharge; all significant

United Arab Emirates Fourth National Report Under the Joint Convention

exposure pathways by which discharged radionuclides can deliver public exposure; the total amount of various radionuclides expected to be discharged per year; and the doses to the representative person due to the planned discharges. The licensee shall ensure that doses arising from discharges meet the requirements of FANR-REG-04'.

FANR Regulation on the Disposal of Spent Fuel and Radioactive Waste Management (FANR-REG-27) requires the licensee of a radioactive waste repository to do the following:

- a) site, design, operate, close and control the repository (even after its 'closure') so that there is reasonable assurance that occupational exposures and public exposures will be within the limits set in FANR Regulation for Radiation Dose Limits and Optimisation of Radiation Protection for Nuclear Facilities (FANR-REG-04)
- b) ensure the protection (including the radiation protection) of any individual who inadvertently intrudes into or occupies the disposal site or comes into contact with the radioactive waste at any time during institutional control
- c) ensure that exposures to ionising radiation are optimised and in compliance with the requirements for radiation protection in FANR Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities (FANR-REG-11)
- d) carry out a monitoring programme prior to and during the construction and operation of a radioactive waste repository and post-closure control period. These programme(s) shall be designed to collect and update information necessary for the purpose of radiation protection and safety
- e) establish a radiation protection programme commensurate with the radiological hazards to ensure that doses to workers and the public during normal operations of the radioactive waste repository are controlled, and that the requirements on dose limits are met in accordance with FANR Regulation for Radiation Dose Limits and Optimisation of Radiation Protection for Nuclear Facilities (FANR-REG-04)
- f) optimise radiation protection after closure with social and economic factors taken into account so that doses and risks to members of the public in the long-term will not exceed the dose constraints or risk constraints that were used as design criteria to meet the performance objectives.

Non Radiological Hazards

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

Future Generations

G.6 Whilst taking 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 is applied by the Federal Authority for Nuclear Regulation in accordance with the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy. See section H.14 of this report.

G.7 Whilst taking steps to avoid imposing undue burdens on future generations is not explicitly covered in FANR regulations, this IAEA Safety Fundamental (SF-1) Principle No. 7 is applied by the Federal Authority for Nuclear Regulation in accordance with the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy. See section H.15.

G.8 The Emirates Nuclear Energy Corporation and its affiliates have taken the following measures for the management of spent fuel:

United Arab Emirates Fourth National Report Under the Joint Convention

- The design of the Barakah Nuclear Power Plant has sufficient capacity in the spent fuel storage pool for 20 years of operation for each reactor unit at the nuclear power plant.
- The entities have carried out a dry storage feasibility study to ensure the sufficient allocation of space at the Barakah Nuclear Power Plant 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.
- The entities have also formed a division, which they have designated to develop a long-term radioactive waste management programme with realistic milestones and flexibility to take into account potential technical developments that may influence spent fuel and radioactive waste management and disposal.

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 At the time of writing this report, there were no spent fuel management facilities in the UAE, and the UAE does not have an inventory of spent fuel to report on.

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 It is expected that the relevant requirements of FANR Regulation on the Siting of Nuclear Facilities (FANR-REG-02) will apply to the siting of a spent fuel management facility.

G.11 Spent fuel pool storage is incorporated into the design of the Barakah Nuclear Power Plant and the Federal Authority for Nuclear Regulation's requirements have been addressed in the final safety analysis report. The Emirates Nuclear Energy Corporation envisages that capability may be required for the dry storage of spent fuel. The Emirates Nuclear Energy Corporation and its affiliates will comply with the Federal Authority for Nuclear Regulation's requirements in the siting and design of the dry spent fuel storage facility.

United Arab Emirates Fourth National Report Under the Joint Convention

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 Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy, 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 the Federal Authority for Nuclear Regulation. Any proposal for a spent fuel management facility would require the licence applicant to establish a safety case in accordance with FANR Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities (FANR-REG-11). It is expected that the design and construction of the facility would form part of the safety case. FANR Regulation on the Design of Nuclear Power Plants (FANR-REG-03) and FANR Regulation on the Construction of a Nuclear Facility (FANR-REG-14) are also expected to apply to a spent fuel management facility.

G.13 Article (82) of FANR Regulation on the Design of Nuclear Power Plants (FANR-REG-03) states that adequate systems shall be provided to treat radioactive liquid and gaseous effluents in order to keep doses arising from the discharge of radioactive material within the dose limits established by FANR-REG-04 and subject to the optimisation of protection as defined in that regulation.

In order 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, a review 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 The Emirates Nuclear Energy Corporation and its affiliates have ensured sufficient capacity in the spent fuel storage pool for 20 years of operation for each reactor unit at the Barakah Nuclear Power Plant. The Emirates Nuclear Energy Corporation and its affiliates have also reserved sufficient space in the Barakah Nuclear Power Plant 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 Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy, 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 the Federal Authority for Nuclear Regulation. An environmental assessment will be carried out by the Environment Agency of Abu Dhabi. The licence applicant of a spent fuel management facility will need to establish a safety case in accordance with FANR Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities (FANR-REG-11).

United Arab Emirates Fourth National Report Under the Joint Convention

G.16 In line with the approach taken in FANR regulations on nuclear facilities, the Federal Authority for Nuclear Regulation reviews and assesses the preliminary safety case during the construction licence application stage followed by a final safety case at the operation licence stage. Article (23) of FANR Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities (FANR-REG-11) states:

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.

The licensee shall ensure that doses arising from discharges meet the requirements of FANR-REG-04 Dose Limits and Optimisation for Nuclear Facilities.

The licensee shall review and adjust the discharge control measures taking into account:

- a) operating experience; and
- b) any changes in exposure pathways and the characteristics of the critical group that could affect the assessment of doses due to the discharges.

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 In line with the approach taken in FANR regulations on nuclear facilities, the Emirates Nuclear Energy Corporation submitted an application to the Federal Authority for Nuclear Regulation on 27 December 2010 for the construction of the first two reactor units of the Barakah Nuclear Power Plant. The application requested authorisation to conduct all regulated activities required to construct the nuclear power plant including the management of spent fuel and radioactive waste. On 28 February 2013 the Emirates Nuclear Energy Corporation submitted to the Federal Authority for Nuclear Regulation a further application for authorisation to construct the third and fourth reactor units of the Barakah Nuclear Power Plant. In July 2012 the Federal Authority for Nuclear Regulation issued construction licences for reactor units 1 and 2 of the Barakah Nuclear Power Plant, and in September 2014 the Federal Authority for Nuclear Regulation issued construction licences for units 3 and 4 of the Barakah Nuclear Power Plant.

On 26 March 2015 an operation licence application was submitted for reactor units 1 and 2 of the Barakah Nuclear Power Plant. On 27 March 2017 an operation licence application was submitted for reactor units 1 and 2 of the Barakah Nuclear Power Plant. On 16 February 2020 the Federal Authority for Nuclear Regulation issued a licence to operate reactor unit 1 of the Barakah Nuclear Power Plant. The Federal Authority for Nuclear Regulation also issued the fuel handling and storage licence for reactor unit 2 of the Barakah Nuclear Power Plant on the same date. There are now fresh nuclear fuel assemblies for reactor unit 2 of the Barakah Nuclear Power Plant, which are stored at the site and are subject to regulatory oversight by the Federal Authority for Nuclear Regulation.

The Nawah Energy Company is the applicant for the operation licences for reactor units 1, 2 and 3 of the Barakah Nuclear Power Plant, and has the contractual authority and responsibility for pre-disposal radioactive waste management for all four reactor units.

The Emirates Nuclear Energy Corporation prepared a non-nuclear environmental impact assessment and a nuclear environmental impact assessment for the Barakah Nuclear Power Plant, which was submitted to the Environment Agency Abu Dhabi. Based on the review of the nuclear assessment by the Federal Authority for Nuclear Regulation and the non-nuclear assessment by the Environment Agency Abu Dhabi, a 'no objection certificate' was issued for both the nuclear and non-nuclear construction activities for reactor unit 2 of the Barakah Nuclear Power Plant according to the technical details and plans included in impact assessment

United Arab Emirates Fourth National Report Under the Joint Convention

report and the environmental management plan). The Environment Agency Abu Dhabi issued a 'no objection certificate' for nuclear construction activities for the Barakah Nuclear Power Plant according to report and its reference EMS/14/ESRF816.

G.18 The Emirates Nuclear Energy Corporation has ensured that there is sufficient capacity in the spent fuel storage pool for 20 years of operation for each reactor unit of the Barakah Nuclear Power Plant. The Emirates Nuclear Energy Corporation and its affiliates have reserved sufficient space at the Barakah Nuclear Power Plant for the construction of a spent fuel dry storage facility (i.e. an independent spent fuel storage installation), 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 requirements above are included in the FANR regulations on nuclear facilities (including spent fuel management facilities) and they 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 Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy and FANR Regulation on the Disposal of Spent Fuel and Radioactive Waste Management (FANR-REG-27) will apply in conformance with the requirements of the convention.

FANR Regulation on the Disposal of Spent Fuel and Radioactive Waste Management (FANR-REG-27) establishes the requirements that must be satisfied during the siting, design, construction, operation, closure and post-closure control period, and during the institutional control period for the radioactive waste repository. Article (4) of FANR Regulation on the Disposal of Spent Fuel and Radioactive Waste Management (FANR-REG-27) defines the performance objectives that a radioactive waste repository shall meet.

United Arab Emirates Fourth National Report Under the Joint 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 Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities (FANR-REG-11) includes a chapter on the predisposal management of radioactive waste. FANR Regulation on Basic Safety Standards for Facilities and Activities involving Ionizing Radiation other than in Nuclear Facilities (FANR-REG-24) includes paragraphs on radioactive waste management. Both regulations are complemented by FANR Regulation for Pre-disposal Management of Radioactive Waste (FANR-REG-26) and FANR Regulatory Guide on Pre-disposal Management of Radioactive Waste (FANR-RG-018), which contains more requirements and regulatory guides on pre-disposal management of radioactive waste. Furthermore, FANR Regulation on the Disposal of Spent Fuel and Radioactive Waste Management (FANR-REG-27) and FANR Regulatory Guide on Near Surface Disposal of Radioactive Waste (FANR-RG-27) includes requirements and guidance respectively on the disposal of radioactive waste.

General Obligations of the Licence Holder

H.2 According to Article (40) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy, persons holding licences to possess regulated material are responsible for the safe management and storage of radioactive waste from its generation until its delivery to the waste management organisation designated by the UAE Cabinet for the purpose of disposal. Article (14) of FANR Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities (FANR-REG-11) reiterates the same obligation. 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 The Emirates Nuclear Energy Corporation and its affiliates are responsible for the safe management and storage of radioactive waste generated from the Barakah Nuclear Power Plant until its delivery to the waste management organisation or operator of a waste disposal facility. This includes the following responsibilities:

United Arab Emirates Fourth National Report Under the Joint Convention

- The safety of pre-disposal radioactive waste management for the Barakah Nuclear Power Plant 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 Nuclear Power Plant are carried out in compliance with FANR regulations.
- Implementing measures to ensure an integrated approach to safety in the pre-disposal management of radioactive waste in accordance with FANR Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities (FANR-REG-11).
- Applying the management system established in accordance with FANR Regulation for Management Systems Nuclear Facilities (FANR-REG-01) for all steps and elements of the pre-disposal management of radioactive waste.

Waste Minimisation

H.4 Article (15) of FANR Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities (FANR-REG-11), and Article (4) in FANR Regulation for Pre-disposal Management of Radioactive Waste (FANR-REG-26) require the licensee to identify all radioactive waste and keep radioactive waste to a minimum. It also states that the licensee shall consider the authorised discharge of effluents and the clearance of material from regulatory control after processing and/ or storage together with the reuse and recycling of material in order to reduce the amount of waste that needs further processing or storage. Minimising the generation of radioactive waste also means less waste for disposal.

H.5 Article (5) of FANR Regulatory Guide on Pre-disposal Management of Radioactive Waste (FANR-RG-018) provides useful strategies to minimise waste. This regulatory guide outlines considerations that should be given to the design of the facility and to operational features to minimise waste.

H.6 In addition to the regulatory requirements of the Federal Authority for Nuclear Regulation, the Emirates Nuclear Energy Corporation has committed to complying with the US Nuclear Regulatory Commission's Regulatory Guide 4.21 on Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning, which provides additional information on minimising waste throughout all stages of the nuclear fuel cycle including disposal. This regulatory guide 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 clean-up when releases happen.

H.7 The Barakah Nuclear Power Plant has been designed, constructed and will be operated in a manner that keeps the volume of radioactive waste to a minimum practicable with proven technologies.

Furthermore, the Emirates Nuclear Energy Corporation 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

H.8 Article (14)4 of FANR Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities (FANR-REG-11), and Article (3)4 in FANR Regulation for Pre-disposal Management of Radioactive Waste (FANR-REG-26) 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 the Barakah Nuclear Power Plant are widely accepted amongst the nuclear industry worldwide. As each step and technology has interdependencies with

United Arab Emirates Fourth National Report Under the Joint Convention

other steps, predisposal waste management will be executed in an integrated manner to minimise the volume of waste and radiation exposure to workers and the general public.

Protection of Individuals, Society and the Environment

H.10 Article (24) of FANR Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities (FANR-REG-11), Article (31) of FANR Regulation on Basic Safety Standards for Facilities and Activities involving Ionizing Radiation other than in Nuclear Facilities (FANR-REG-24), and Article (8) of FANR Regulation on the Disposal of Spent Fuel and Radioactive Waste Management (FANR-REG-27) 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 articles in those regulations also describe the minimum requirements for what is to be included in the programme.

H.11 The Emirates Nuclear Energy Corporation and its affiliates have implemented an environmental monitoring programme, which complies with governmental regulations. As a part of this programme, environmental samples are being collected, analysed 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 Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities (FANR-REG-11) and Article (5) of FANR Regulation for Pre-disposal Management of Radioactive Waste (FANR-REG-26) require the licensee to characterise waste in terms of its physical, mechanical, chemical, radiological and biological properties at various steps, and classify the waste appropriately from the perspective of its future disposal.

H.13 The Emirates Nuclear Energy Corporation and its affiliates characterise waste according to the UAE's regulatory requirements. The radioactive waste treatment systems within the Barakah Nuclear Power Plant's design will appropriately treat gaseous, liquid and solid radioactive waste. Non-radiological hazards such as physical, mechanical, chemical and biological properties are considered during all stages of conditioning, packaging and storage of radioactive 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 minimise the volume of waste for disposal as radioactive waste, and to optimise doses to workers and the general public in accordance with the governmental regulations.

Avoiding impact on Future Generations

H.14 This IAEA Safety Fundamental (SF-1) principle No. 7 is included in Article (11)4(a) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy, which stipulates that the Federal Authority for Nuclear Regulation's Board of Management will issue implementing regulations and the requirements to protect society and the environment from radiation hazards both for the present and in the future.

Undue Burden on Future Generations

H.15 Article (15) of FANR Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities (FANR-REG-11) and Article (4) FANR Regulation for Pre-disposal Management of Radioactive Waste (FANR-REG-26) require the licensee to keep radioactive waste to the minimum practicable.

H.16 The overriding priority of the Emirates Nuclear Energy Corporation and its affiliates is to ensure the safety of its employees, the UAE and its environment. The Emirates Nuclear Energy Corporation and its affiliates understand their obligation to future generations and strive to conduct their activities with long-term

United Arab Emirates Fourth National Report Under the Joint Convention

sustainability in mind whilst avoiding any undue impact. The Emirates Nuclear Energy Corporation and its affiliates will process radioactive waste to the minimum waste volume achievable whilst maintaining a high quality waste form, which will reduce the burden on the final disposal and ensure the 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 A reference plant was used at the Barakah Nuclear Power Plant for the radioactive waste management facilities.

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 It is expected that the relevant requirements of the FANR Regulation for the Siting of Nuclear Facilities (FANR-REG-02) would apply to the siting of a radioactive waste management facility.

FANR Regulation on the Disposal of Spent Fuel and Radioactive Waste Management (FANR-REG-27) establishes the requirements that must be satisfied during the siting, design, construction, operation, closure and post-closure control period, and during the institutional control period for the radioactive waste repository. Article (4) of FANR Regulation on the Disposal of Spent Fuel and Radioactive Waste Management (FANR-REG-27) defines the performance objectives that a radioactive waste repository must meet.

Article (5) of FANR Regulation on the Disposal of Spent Fuel and Radioactive Waste Management (FANR-REG-27) requires the application for a licence for the siting of a radioactive waste repository to include conceptual design and planning, a description of the site selection, an area survey, a site characterisation plan and site confirmation. The licence application must include a description of the natural and demographic disposal site characteristics as determined by disposal site selection and characterisation activities.

United Arab Emirates Fourth National Report Under the Joint Convention

H.19 The Emirates Nuclear Energy Corporation and its affiliates are responsible for the safe operation and maintenance of the Barakah Nuclear Power Plant, which includes minimising the generation of radioactive waste and overseeing the safe storage of any waste within the site boundary.

In order to optimise doses to plant workers and the general public, international standards and the Federal Authority for Nuclear Regulation's regulations have been applied to the design, construction and operation of the Barakah Nuclear Power Plant. 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 disposal facilities have been finalised and the waste management organisation that will operate these facilities is in place, the Emirates Nuclear Energy Corporation and its affiliates will cooperate with the appointed waste management organisation to ensure safe disposal and radiation safety for both workers and the 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 Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy, the 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 the Federal Authority for Nuclear Regulation. In line with the approach described in FANR Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities (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 Regulation for the Design of Nuclear Power Plants (FANR-REG-03) would apply.

FANR Regulation on the Disposal of Spent Fuel and Radioactive Waste Management (FANR-REG-27) establishes the requirements for the radioactive waste repository that must be satisfied during the siting, design, construction, operation, closure and post-closure control period, and during the institutional control period. Article (4) of FANR Regulation on the Disposal of Spent Fuel and Radioactive Waste Management (FANR-REG-27) defines the performance objectives that a radioactive waste repository must meet.

H.21 Article (82) of FANR Regulation for the Design of Nuclear Power Plants (FANR-REG-03) states that adequate systems shall be provided to treat radioactive liquid and gaseous effluents in order to keep doses arising from the discharge of radioactive material within the dose limits established in FANR-REG-04 and subject to the optimisation of protection as defined in that regulation.

In order to ensure that the radioactive waste management facilities are designed and constructed to limit possible radiological impacts and discharges throughout their life cycle, the Federal Authority for Nuclear Regulation 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 the Federal Authority for Nuclear Regulation will boost confidence that the facilities will operate safely.

United Arab Emirates Fourth National Report Under the Joint Convention

H.22 Once plans for the UAE's radioactive waste disposal facilities have been finalised, and the waste management organisation that will operate these facilities is in place, the Emirates Nuclear Energy Corporation and its affiliates will cooperate with the appointed waste management organisation to ensure the safe disposal of radioactive waste and radiation safety for both workers and the 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 Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy, the applicant for a licence to construct or operate a radioactive waste management facility would be required to submit detailed evidence of safety to be reviewed and assessed by the Federal Authority for Nuclear Regulation. An environmental assessment would be carried out by the Environment Agency Abu Dhabi (see section G.15). A safety case and supporting safety assessment for a radioactive waste management facility would need to be reviewed and assessed by the Federal Authority for Nuclear Regulation in line with FANR Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities (FANR-REG-11). 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'.

H.24 In line with the approach taken in FANR regulations on nuclear facilities, the Federal Authority for Nuclear Regulation reviews and assesses the preliminary safety case during the construction licence application stage followed by a final safety case at the operation licence stage. Article (23) of FANR Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities (FANR-REG-11) states:

The licensee shall ensure that the safety case for gases and effluents shall describe:

- e) the characteristics and activity of the material to be discharged, and the potential points and methods of discharge;
- f) all significant exposure pathways by which discharged radionuclides can deliver public exposure;
- g) the total amount of various radionuclides expected to be discharged per year; and
- h) the doses to the representative person due to the planned discharges.

The licensee shall ensure that doses arising from discharges meet the requirements of FANR-REG-04 Dose Limits and Optimisation for Nuclear Facilities.

The licensee shall review and adjust the discharge control measures taking into account:

- c) operating experience; and
- d) any changes in exposure pathways and the characteristics of the critical group that could affect the assessment of doses due to the discharges.

United Arab Emirates Fourth National Report Under the Joint Convention

The licensee shall record the details of all gaseous and liquid discharges including estimates of any unmonitored discharges in the source monitoring programme.

Article (6) of FANR Regulation on the Disposal of Spent Fuel and Radioactive Waste Management (FANR-REG-27) stipulates the safety requirement for a radioactive waste repository. Article (6)2 states that a safety case and supporting safety assessment including environmental impact assessments shall be prepared by the licence applicant and updated by the licensee (as necessary) at each step in the phases of design, construction, commissioning, operation, closure, and the post-closure control and institutional control of a radioactive waste repository. The safety case and supporting safety assessment shall be submitted to the Federal Authority for Nuclear Regulation for approval. The safety case and supporting safety assessment shall be sufficiently detailed and comprehensive to provide the necessary technical input to the Federal Authority for Nuclear Regulation.

H.25 Once plans for the UAE's radioactive waste disposal facilities have been finalised, and the waste management organisation that will operate these facilities is in place, the Emirates Nuclear Energy Corporation and its affiliates will cooperate with the appointed waste management organisation to ensure the safe disposal of radioactive waste and radiation safety for both workers and the 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 requirements above are included in the FANR regulations on nuclear facilities (including spent fuel management facilities) and they would be appropriately applied to any proposed spent fuel 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 Once plans for the UAE's radioactive waste disposal facilities have been finalised, and the waste management organisation that will operate these facilities is in place, the Emirates Nuclear Energy

United Arab Emirates Fourth National Report Under the Joint Convention

Corporation and its affiliates will cooperate with the appointed waste management organisation to ensure the safe disposal of radioactive waste and radiation safety for both workers and the 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 FANR Regulation on the Disposal of Spent Fuel and Radioactive Waste Management (FANR-REG-27). This regulation is based on the IAEA Safety Standards Requirement No. SSR-5 on the Disposal of Radioactive Waste. In this regulation, spent nuclear fuel is considered as high level radioactive waste.

H.30 FANR Regulation on the Disposal of Spent Fuel and Radioactive Waste Management (FANR-REG-27) applies to the disposal of all types of radioactive waste by means of emplacement in designed disposal facilities subject to the necessary limits and controls being placed on the disposal of the waste and on the siting, design, construction, operation, closure and post-closure of facilities. The classification of radioactive waste is discussed in FANR Regulation for Pre-disposal Management of Radioactive Waste (FANR-REG-26), FANR Regulatory Guide on Pre-disposal Management of Radioactive Waste (FANR-RG-018), and in FANR Regulatory Guide on Near Surface Disposal of Radioactive Waste (FANR-RG-27).

FANR Regulation on the Disposal of Spent Fuel and Radioactive Waste Management (FANR-REG-27) establishes 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 the harmful effects of ionising radiation. This is achieved by setting requirements on the site selection, evaluation and design of a disposal facility, its construction, operation and closure, and the organisational and regulatory requirements.

The FANR Regulation on the Disposal of Spent Fuel and Radioactive Waste Management (FANR-REG-27) addresses the following disposal options, which correspond to recognised classes of radioactive waste:

- (a) A specific landfill disposal facility for the disposal of very low level radioactive waste 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) A near surface disposal facility for the disposal of low level radioactive waste.
- (c) An intermediate level waste disposal facility for the disposal of intermediate level radioactive waste.
- (d) A geological disposal facility for the disposal of high level radioactive waste including spent fuel if it is to be treated as waste.
- (e) A borehole disposal facility for the disposal of only relatively small volumes of waste in particular disused sealed radioactive sources.

The FANR Regulation on the Disposal of Spent Fuel and Radioactive Waste Management (FANR-REG-27) addresses the safety requirements during three periods associated with the development, operation and closure of a disposal facility:

- (i) the pre-operational period

**United Arab Emirates Fourth National Report
Under the Joint Convention**

- (ii) the operational period
- (iii) the post-closure period

H.31 FANR Regulatory Guide on Near Surface Disposal of Radioactive Waste (FANR-RG-27) addresses selected requirements in FANR Regulation on the Disposal of Spent Fuel and Radioactive Waste Management (FANR-REG-27). The regulatory guide relates to the disposal in a near surface radioactive waste disposal facility of very low level waste and low level waste. FANR Regulatory Guide on Near Surface Disposal of Radioactive Waste (FANR-RG-27) does not apply to geological disposal facilities.

**United Arab Emirates Fourth National Report
Under the Joint Convention**

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) of the Joint Convention without exception. The import of spent fuel and nuclear waste into the UAE for the purpose of long-term storage or disposal is prohibited as per Article (41)3 of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy.

United Arab Emirates Fourth National Report Under the Joint Convention

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 re-entry 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 considered regulated activities as per Article (25) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy. The definition of 'regulated material' includes sealed radioactive sources (with activity above the UAE's exemption levels). Therefore, the possession, remanufacturing or disposal of disused sources is subject to licensing by the Federal Authority for Nuclear Regulation with the associated need for safety to be demonstrated.

J.2 UAE users of sealed sources must have contractual arrangements in place to return disused sealed sources to the manufacturer. The verification of these arrangements is an important part of the Federal Authority for Nuclear Regulation's review, assessment and regulatory oversight of these licensees. Article (18)8(e) of FANR Regulation on Basic Safety Standards for Facilities and Activities involving Ionizing Radiation other than in Nuclear Facilities (FANR-REG-24) requires licensees to ensure that arrangements are made for the safe management of radioactive sources including financial provisions where appropriate once they have become disused.

J.3 The Federal Authority for Nuclear Regulation also has the authority under Article (5)32 of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy to develop a strategy to ensure radiation protection from orphan sources. Such a strategy is in force now as adopted by the Federal Authority for Nuclear Regulation's Board of Management. The strategy has been developed into an orphan sources action plan, which includes governance for safety, search and recovery activities, arrangements for end-of life management, and awareness activities.

The national Radiation Protection Committee established an Orphan Sources Strategy Working Group in 2016. The working group is responsible for implementing the strategy with the creation of an orphan sources action plan. This working group is a working group with members from different government entities in the UAE. The working group started with the implementation of the orphan sources action plan, and is currently focusing on the following:

- Streamlining communication between government authorities in order to ensure the timely and appropriate response to events involving orphan sources.
- Integrating a response to an event at the borders involving an orphan source.
- Establishing formal arrangements to operate existing centralised orphan sources storage facilities.
- Carrying out routine search and recovery campaigns to provide assurance that no additional unknown sources exist.
- Training and developing Emiratis in research and detection, and the disposal of orphan sources.
- Disseminating information for licensees and the public about possible events concerning radioactive sources that are not subject to regulatory control.
- Establishing a legal framework to handle orphan sources.

J.4 A central storage facility for orphan sources has now been established and the sources have been moved to this facility. The planned strategy for locating orphan sources is to continue the search and recovery campaigns as necessary.

United Arab Emirates Fourth National Report Under the Joint Convention

J.5 At the Fourth Review Meeting, the Federal Authority for Nuclear Regulation reported that there were 12 orphan sources in the UAE. Four of these sources were not orphan but disused and had been exported for reuse. The UAE still has eight orphan sources registered in the Orphan Sources Register (see Annex A of this report). Sources in use and disused sources are registered in the FANR e-Licensing System.

J.6 Part of the orphan sources strategy was to establish mechanisms to cover the financial costs of the disposal of disused sources that are not returned to the suppliers. The Federal Authority for Nuclear Regulation initiated discussions with the insurance authorities in the UAE to that effect.

United Arab Emirates Fourth National Report Under the Joint Convention

Section K General Efforts to Improve Safety

K.1 This report includes actions taken by the UAE as a Contracting Party to meet its obligations under relevant articles of the Joint Convention. It confirms the continuous, conscientious and systematic effort by relevant bodies in the UAE to fully implement these provisions in the UAE's nuclear energy programme for peaceful uses.

At an early stage in the programme, the UAE government recognised 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. The relevant UAE organisations are fully committed to meeting the obligations of this Joint Convention and actively participate in the peer review process established under the Joint Convention. The UAE has adopted a policy of transparency in its nuclear programme as well as in relation to spent fuel and radioactive waste, and the country 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 any questions and comments from other 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 Joint Convention Review Meeting in May 2021.

UAE's Report on Compliance with the Obligations of the Joint Convention in 2018

K.2 During the period before the meeting in May 2018, the UAE received 29 questions on its Third National Report. The questions related to several articles of the Joint Convention and were mostly requests for clarifications and related to matters of the UAE's practices on the storage and disposal of spent fuel and radioactive waste, the management of orphan and disused sources, decommissioning and public involvement. All questions were answered on the Joint Convention's website and commented on in a general sense at the meeting.

Outcome from the Sixth Review Meeting of the Joint Convention in 2018

K.3 During the discussion at the Joint Convention Review Meeting in 2018, it was concluded that the UAE made progress within the following areas:

- Continued development of the regulatory framework for radioactive waste:
 - FANR Regulation on the Decommissioning of Facilities (FANR-REG 21)
 - FANR Disposal of Spent Fuel and Radioactive Waste (FANR-REG-27)
 - Draft FANR regulation on the decommissioning trust fund
- Peer review missions conducted:
 - Integrated Regulatory Review Service Mission in December 2011 and follow-up mission in February 2015
 - Emergency Preparedness Review Mission in March 2015
 - International Physical Protection Advisory Service in 2016
 - Education and Training Appraisal Mission in 2017
 - Pre-operational Safety Assessment Review Team Mission in October 2017

K.4 Highlights from the UAE's Third Report presented at the Sixth Review Meeting of the Joint Convention were as follows:

- The waste management organisation had yet to be established as of October 2017.

United Arab Emirates Fourth National Report Under the Joint Convention

- The draft regulation setting out the arrangements for the decommissioning trust fund was in the advanced stage. A reference scenario for decommissioning and disposal facilities, and the timing has been agreed between the Federal Authority for Nuclear Regulation and the Emirates Nuclear Energy Corporation and its affiliates, which enables an agreed fee to be set for contributions to the decommissioning trust fund. These monies will be set aside until the decommissioning trust fund has been established.
- The establishment of the decommissioning trust fund is in progress.
- The capacity of the spent fuel storage pool is 20 years of operation for each reactor unit. The storage of low and intermediate level radioactive waste will be at the Barakah Nuclear Power Plant. An independent spent fuel storage installation to support ongoing operations will be established before the spent fuel storage pool reaches capacity.
- A decision is being reached on facilities for radioactive waste and spent fuel management prior to disposal.
- In order to support ongoing operations, the Emirates Nuclear Energy Corporation and its affiliates intend to establish an independent spent fuel storage installation and an interim storage facility for low and intermediate level radioactive waste at the Barakah Nuclear Power Plant. The reference scenario was adopted for the UAE by the Federal Authority for Nuclear Regulation, and the Emirates Nuclear Energy Corporation envisages the direct disposal of spent fuel in a geological disposal facility to be constructed in the UAE along with the disposal of low level waste in a near surface repository in the UAE. Intermediate level waste will be disposed of in an intermediate and low level waste repository or sent for deep geological disposal.
- The completion of regulations and regulatory guides for radioactive waste disposal and for decommissioning.

K.5 The following challenges were identified at the Sixth Review Meeting of the Joint Convention for the future development with regard to the management of spent fuel and radioactive waste:

Table K.5

Challenges	Current Status	Section of this Report
Establishing the waste management organisation to implement the policy on the disposal of radioactive waste.	As of the time of writing this report, the waste management organisation had yet to be established. However, a radioactive waste management working group has been established as a platform for integrating information, tracking progress and discussing issues and challenges with respect to radioactive waste management in the UAE.	Waste management organisation: B.5, H.3, K.9 Spent nuclear fuel policy: B.1 to B.3 Radioactive waste policy: B.5
Ensuring that the entity managing the decommissioning trust fund has been fully established by the time of operation of the first reactor unit.	Contributions are to be made to the decommissioning trust fund. An interim arrangement in the form of a deposit account has been established to set aside these monies until an entity managing the decommissioning trust fund has been fully established.	Table A-6 Sections E.8, F.5, K.4
Recruiting, training and retaining a skilled workforce in	Radioactive waste management capacity development is a primary focus of the Radioactive Waste Management Division at the Emirates Nuclear	F.10

**United Arab Emirates Fourth National Report
Under the Joint Convention**

Challenges	Current Status	Section of this Report
radioactive waste and spent fuel management.	<p>Energy Corporation. Various nuclear training programmes along with specific radioactive waste management training and on-job training programmes are ongoing with the objective to build national capabilities in the field of radioactive waste management. This will enable those individuals to be specialised in specific fields associated with the management of radioactive waste and provide them with a long-term career as the Radioactive Waste Management Programme develops.</p> <p>One training path that is being considered is the secondment of Emirati engineers into a fully functioning radioactive waste management organisation abroad for a specific time to allow the Emiratis to gain the skills necessary for the UAE's own radioactive waste management organisation. This approach will allow for working relationships to be built with international organisations.</p>	
Decision on facilities for radioactive waste and spent fuel management prior to the disposal path being determined.	In order to support ongoing operations, the Emirates Nuclear Energy Corporation and its affiliates intend to establish an independent spent fuel storage installation and an interim storage facility for low and intermediate level radioactive waste at the Barakah Nuclear Power Plant. The reference scenario was adopted for the UAE by the Federal Authority for Nuclear Regulation, and the Emirates Nuclear Energy Corporation envisages the direct disposal of spent fuel in a geological disposal facility to be constructed in the UAE along with the disposal of low level waste in a near surface repository in the UAE. Intermediate level waste will be disposed of in an intermediate and low level waste repository or sent for deep geological disposal.	<p>Independent spent fuel storage installation: B.4</p> <p>Radioactive waste storage: B.8</p> <p>Reference scenario: B.3, B.5</p>

K.6 The following measures to improve safety were identified at the Sixth Review Meeting of the Joint Convention:

Table K.6

Planned Measures in the UAE	Current Status	Section of this Report
Issuing regulations and publishing regulatory guides on radioactive waste management and the decommissioning trust fund.	<ul style="list-style-type: none"> FANR Regulation on the Decommissioning of Facilities (FANR-REG 21) has been issued. 	E.7 and E.8 Annex B

**United Arab Emirates Fourth National Report
Under the Joint Convention**

Planned Measures in the UAE	Current Status	Section of this Report
	<ul style="list-style-type: none"> • The FANR regulation on the decommissioning trust fund is under development. • FANR Regulation for Pre-disposal Management of Radioactive Waste (FANR-REG-26) has been issued. • FANR Regulatory Guide on Pre-disposal Management of Radioactive Waste (FANR-RG-018) has been published. • FANR Regulation on the Disposal of Spent Fuel and Radioactive Waste Management (FANR-REG-27) has been issued. • FANR Regulatory Guide on Near Surface Disposal of Radioactive Waste (FANR-RG-27) has been published. 	F.5
<p>Implementing the arrangements for radioactive waste and spent fuel management as the Barakah Nuclear Power Plant comes into operation.</p>	<ul style="list-style-type: none"> • The capacity of the spent fuel storage pool is 20 years of operation for each reactor unit. • Provisions are to be made for an interim storage facility for low and intermediate level radioactive waste at the Barakah Nuclear Power Plant. • An independent spent fuel storage installation is to be established to support ongoing operations before the spent fuel storage pool reaches capacity. 	B.4 and B.8
<p>Issuance of the UAE policy on the long-term management and disposal of spent nuclear fuel and radioactive waste.</p>	<p>The draft policy is being restructured and updated to meet the revised requirements of the UAE Cabinet as set forth in the UAE Cabinet's Policy Manual.</p>	F.23

Planned Efforts to improve Safety

K.7 Decommissioning Trust Fund

Contributions to the decommissioning trust fund will be sufficient to meet the costs of the decommissioning of the Barakah Nuclear Power Plant, and the construction, operation and decommissioning of a geological disposal facility and a near surface repository and associated facilities as and when these costs are due. A 'reference scenario' for decommissioning and disposal facilities (and the timing) has been agreed between

United Arab Emirates Fourth National Report Under the Joint Convention

the Federal Authority for Nuclear Regulation and Emirates Nuclear Energy Corporation and its affiliates, which enables an agreed fee to be set for contributions to the decommissioning trust fund. An interim arrangement in the form of a deposit account has been established by the Nawah Energy Company to set aside these monies until an entity has been established to manage the decommissioning trust fund.

K.8 Waste Management Organisation

As stipulated in Article (40) of Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy, the UAE government will designate a waste management organisation to manage the disposal of spent fuel and radioactive waste in the UAE. Meanwhile the Federal Authority for Nuclear Regulation, the Emirates Nuclear Energy Corporation and the Nawah Energy Company have established a radioactive waste management working group where information and developments within the respective entities are shared.

K.9 Continued Development of Regulations and Regulatory Guides

The Federal Authority for Nuclear Regulation will continue to develop regulations and regulatory guides in accordance with its five-year development plan as approved by the Federal Authority for Nuclear Regulation's Board of Management in June 2017.

K.10 NORM Facility

The treatment and disposal facilities for naturally occurring radioactive material (NORM) received their operation licence in March 2019 but the facilities were not in operation at the time of writing this report due to unforeseen delays with the transportation of the waste from the NORM waste generators to the treatment and disposal facilities.

K.11 International Cooperation

The UAE will continue to participate in peer reviews, and international events and meetings 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. The UAE will also continue to participate in the development of IAEA Safety Standards through its membership and participation in committees such as the Commission on Safety Standards, the Radiation Safety Standards Committee, the Nuclear Safety Standards Committee, and the Nuclear Security Guidance Committee.

In March 2020 the UAE responded to the IAEA's call for the establishment of the Consolidated Plan for Nuclear and Radiation Safety developed by the IAEA Secretariat in consultation with Member States, which will contain all of the IAEA's planned activities on nuclear safety, radiation, transport and waste safety as well as emergency preparedness and response.

The UAE has a long-standing collaboration agreement with the International Commission for Radiological Protection, which involves a series of coordinated actions including regular bilateral meetings and the organisation of workshops, training courses and congresses in order to strengthen and further develop radiation protection in the UAE in collaboration and consultation with its most authoritative international organisation.

International Review Missions

K.12

Since 2011 the UAE has received 13 international review missions as mentioned below.

- Integrated Nuclear Infrastructure Review in 2011
- Site Review in 2011
- IAEA Integrated Regulatory Review Service in 2011

United Arab Emirates Fourth National Report Under the Joint Convention

- Integrated Nuclear Infrastructure Review follow-up Mission in 2014
- IAEA International SSAC Advisory Service Mission in 2014
- Review on Integrated Management Systems in 2014
- Expert Mission on Knowledge Management in 2014
- Occupational Radiation Protection Appraisal in 2014
- Emergency Preparedness Review in 2015
- International Physical Protection Advisory Service Mission in 2016
- Education and Training Appraisal Mission in 2017
- Integrated Nuclear Infrastructure Review Mission Phase 3 in 2018
- IAEA Emergency Preparedness Review Follow-up Mission in 2019

The following review missions were conducted by the World Association of Nuclear Operators (WANO) before the Barakah Nuclear Power Plant entered into operation:

- WANO's pre-start-up review in November 2019 assessed the readiness of the nuclear power plant
- WANO's crew performance observation focused on the readiness of the operations' staff

The IAEA CONVEX-3 emergency exercise on the Convention on the Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency is scheduled for October 2021.

Annex C of this report lists references to official national and international reports related to safety.

**United Arab Emirates Fourth National Report
Under the Joint Convention**

Section L Annexes

- Annex A Inventory of Orphan Sources
Annex B References to National Laws, Regulations, Regulatory Guides *et al*
Annex C References to Official National and International Reports on Safety

**United Arab Emirates Fourth National Report
Under the Joint Convention**

**Annex A
Inventory of Orphan Sources**

No	Radionuclide	Activity	Application	Found in	Remarks
1	Sr-90	55 mCi	Eye plaque (BRACHYTHERAPY)	Collected from scrap of governmental department	Found before FANR's establishment
2	Cs-137	20 mCi	Crawler Control Source	Brought in scrap from Italy to a Free Zone in the UAE	Found before FANR's establishment
3	Unknown probably Ra-226	Unknown	Lightening Prevention Device	Brought in scrap from the Republic of the Ivory Coast to a Free Zone in the UAE	Found before FANR's establishment
4	Am-241/Be	50 mCi	Soil Moisture Probe	Collected from scrap of governmental department	Found before FANR's establishment
5	Cs-137	100 mCi	Cement, mud Densitometer	Received from government company	Found before FANR's establishment
6	Cs-137	Unknown	Unknown	NDT Company	
7	Cs-137	Unknown	Unknown	NDT Company	
8	Ir-192	Unknown	Unknown	NDT Company	

NB: These orphan sources are stored in the central storage facility.

United Arab Emirates Fourth National Report Under the Joint Convention

Annex B

References to National Laws, Regulations, Regulatory Guides *et al*

The Policy of the United Arab Emirates on the Evaluation and Potential Development of Peaceful Nuclear Energy can be found on the FANR website www.fanr.gov.ae under 'Open data' and 'Nuclear Law'.

The Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy can be found on the FANR website www.fanr.gov.ae under 'Open data' and 'Nuclear Law'.

The Federal Law by Decree No. 4 of 2012 Concerning Civil Liability for Nuclear Damage can be found on the FANR website www.fanr.gov.ae under 'Open data' and 'Nuclear Law'.

All issued regulations can be found on the FANR website www.fanr.gov.ae under 'Regulations and Guides'.

FANR Regulations

- FANR Regulation for Management Systems for Nuclear Facilities (FANR-REG-01)
- FANR Regulation for the Siting of Nuclear Facilities (FANR-REG-02)
- FANR Regulation for the Design of Nuclear Power Plants (FANR-REG-03)
- FANR Regulation for Radiation Dose Limits and Optimisation of Radiation Protection for Nuclear Facilities (FANR-REG-04), Version 1
- FANR Regulation for the Application of Probabilistic Risk Assessment (PRA) at Nuclear Facilities (FANR-REG-05)
- FANR Regulation for an Application for a Licence to Construct a Nuclear Facility (FANR-REG-06)
- FANR Regulation for Physical Protection of Nuclear Material and Nuclear Facilities (FANR-REG-08), Version 1 [this regulation is for official use only]
- FANR Regulation on the Export and Import Control of Nuclear Material, Nuclear Related Items and Nuclear Related Dual-Use Items (FANR-REG-09)
- FANR Regulation for the System of Accounting for and Control of Nuclear Material and Application of Additional Protocol (FANR-REG-10)
- FANR Regulation for Radiation Protection and Predisposal Radioactive Waste Management for Nuclear Facilities (FANR-REG-11)
- FANR Regulation for Emergency Preparedness for Nuclear Facilities (FANR-REG-12)
- FANR Regulation for the Safe Transport of Radioactive Materials (FANR-REG-13)
- FANR Regulation for Application for a License to Operate a Nuclear Facility (FANR-REG-14)
- FANR Regulation on the Requirements for Off-Site Emergency Plans for Nuclear Facilities (FANR-REG-15)
- FANR Regulation on Operational Safety including Commissioning (FANR-REG-16)
- FANR Regulation for the Certification of Operating Personnel at Nuclear Facilities (FANR-REG-17)
- FANR Regulation for Existing Exposure Situations (FANR-REG-19)
- FANR Regulation on the Decommissioning of Facilities (FANR-REG-21)
- FANR Regulation for the Security of Radioactive Sources (FANR-REG-23) - [this regulation is restricted]
- FANR Regulation on Basic Safety Standards for Facilities and Activities involving Ionizing Radiation other than in Nuclear Facilities (FANR-REG-24), Version 1
- FANR Regulation for Pre-disposal Management of Radioactive Waste (FANR-REG-26)
- FANR Regulation on the Disposal of Spent Fuel and Radioactive Waste (FANR-REG-27)

United Arab Emirates Fourth National Report Under the Joint Convention

The following regulations are under development:

- Application of Penalties
- Decommissioning Trust Fund
- Licencing of Regulated Activities outside the Nuclear Fuel Cycle

FANR Regulatory Guides

Guidance that describes methods acceptable to the Federal Authority for Nuclear Regulation for the implementation of regulatory requirements can be found in the FANR regulatory guides. The following regulatory guides are those that have been approved and published:

- FANR Regulatory Guide on the Content of Nuclear Facility Construction and Operating Licence Applications (FANR-RG-001), Version 1
- FANR Regulatory Guide on the Application of Management Systems for Nuclear Facilities (FANR-RG-002)
- FANR Regulatory Guide on the Probabilistic Risk Assessment: Scope, Quality and Application (FANR-RG-003)
- FANR Regulatory Guide on the Evaluation Criteria for Probabilistic Safety Targets and Design Requirements (FANR-RG-004)
- FANR Regulatory Guide on the Transportation Safety Guide (FANR-RG-006)
- FANR Regulatory Guide on the Radiation Safety (FANR-RG-007)
- FANR Regulatory Guide on the Implementation of the Obligations and Requirements of the Additional Protocol to the UAE Comprehensive Safeguards Agreement (FANR-RG-015)
- FANR Regulatory Guide on the Certification of Reactor Operators and Senior Reactor Operators at Nuclear Facilities (FANR-RG-017)
- FANR Regulatory Guide on the Pre-disposal Management of Radioactive Waste (FANR-RG-018)
- FANR Regulatory Guide on the Radiation Safety in Industrial Radiography (FANR-RG-019)
- FANR Regulatory Guide on the Safety Significance Evaluations for Modifications for Nuclear Facilities during Construction (FANR-RG-023)
- FANR Regulatory Guide on the Physical Protection for Transportation of Nuclear Material (FANR-RG-025) - [this regulatory guide is restricted]
- FANR Regulatory Guide on the Response and Contingency Plans of Nuclear Facilities (FANR-RG-026) - [this regulatory guide is restricted]
- FANR Regulatory Guide on the Near Surface Disposal of Radioactive Waste (FANR-RG-027)
- FANR Regulatory Guide on the Development and Modifications of Physical Protection for Nuclear Power Plants (FANR-RG-032) - [this regulatory guide is restricted]

The following regulatory guides are under development:

- Criteria for Protective Actions in Response to a Nuclear or Radiological Emergency
- Routine Reporting
- Significance Evaluations for Modifications of Nuclear Facilities during Operation
- Operational Safety for Nuclear Facilities
- Radiation Protection for Nuclear Power Plants.
- Preparation, Conduct, and Evaluation of Drills and Exercises for Nuclear Facilities
- Emergency Preparedness for Nuclear Facilities

United Arab Emirates Fourth National Report Under the Joint Convention

Annex B References to Official National and International Reports on Safety

The following UAE reports can be found on the FANR website or on the IAEA website, as applicable:

- National Report for Fifth Review Meeting of the Convention on Nuclear Safety, 2011
- National Report to the Extraordinary Meeting of the Convention on Nuclear Safety, 2012
- National Report for Sixth Review Meeting of the Convention on Nuclear Safety, 2014
- National Report for Seventh Review Meeting of the Convention on Nuclear Safety, 2017
- National Report for the Eight Review Meeting of the Convention on Nuclear Safety, 2020 [the report was submitted but the review meeting has been postponed due to the COVID-19 pandemic]
- National Report for the Fourth 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 Fifth Review Meeting of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, 2015
- National Report for the Sixth Review Meeting of the Joint Convention Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, 2018
- IAEA Report for the Integrated Regulatory Review Service Mission to the UAE in 2011
- IAEA Report for the Integrated Regulatory Review Service follow-up Mission to the UAE in 2015
- IAEA Report for the Emergency Preparedness Review Mission to the UAE in 2015
- IAEA Report for the Emergency Preparedness Review Mission to the UAE in 2019
- IAEA Report for Integrated Nuclear Infrastructure Review Mission to the UAE in 2011
- IAEA Report for Integrated Nuclear Infrastructure Review Mission Phase 3 Mission to the UAE in 2018
- Safety Evaluation Report of the Application for a Licence to construct Barakah Nuclear Power Plant Reactor Units 1 and 2
- Safety Evaluation Report of the Application for a Licence to construct Barakah Nuclear Power Plant Reactor Units 3 and 4
- Executive Summary of the Safety Evaluation Report of the Emirates Nuclear Energy Corporation's Application for an Amendment to a Limited Construction Licence for Stage 1
- National Report to the Extraordinary Meeting in 2012
- IAEA Site Safety Review Mission in 2011
- IAEA Report for the IAEA's International SSAC Advisory Service 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 Mission in 2014
- IAEA Report for the International Physical Protection Advisory Service Mission in 2016

International Advisory Board Reports

The International Advisory Board was established in 2010 to provide the UAE peaceful nuclear energy programme with the benefit of the expertise and knowledge of a highly select group of internationally recognised experts in the fields of nuclear safety and security, and non-proliferation, and in the development of human resources. On at least a semi-annual basis, the board reviewed the progress the UAE was making in achieving and maintaining the highest standards of safety, security, non-proliferation, transparency and sustainability. Board members provided their invaluable insight into how the programme could be optimised against these targets. The semi-annual reports can be found on <http://www.uaeiab.ae/en/publications.html>