Chapter 14

Nuclear Newcomer Countries—The Path of the United Arab Emirates

Hamad AlKaabi

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Abstract Embarking on nuclear power requires high-level political decisions and commitments, considerable planning efforts, financial investments and commercial considerations, long-term sustainability for safety; as well as international and legal framework for a nuclear power programme. There are numerous challenges surrounding government decisions to introduce nuclear power into the energy mix of a country. This chapter highlights the United Arab Emirates’ (UAE) experience and accomplishments in the development and regulation of its nuclear power programme. In particular, it focuses on the milestones of the UAE path, which might be of interest to nuclear newcomer countries and to a broader international community. This chapter outlines the development of the UAE comprehensive national nuclear law and regulatory framework, which started with the so-called “nuclear policy”. It also includes an overview of a strategy that was developed and set the early path for the UAE peaceful nuclear programme, including timelines for specific targets. The international conventions and UAE’s nuclear cooperation agreements, as well as the cooperation with the IAEA are also mentioned. Particular attention has been paid to the role of the UAE nuclear regulator and its mandate and the development of the UAE

H. AlKaabi (✉)

Permanent Mission of the United Arab Emirates to the IAEA, Vienna, Austria
e-mail: Official.Mail@iaea.org

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regulations and regulatory guides. The licensing of the nuclear power programme, as well as the licensing of other activities and practices involving radiation sources have been also described in the publication. In conclusion, the publication shares some lessons the UAE learnt and on which it will base its efforts towards the continuous enhancement of its legal framework.

Keywords United Arab Emirates (UAE) · Nuclear new build · Newcomer · Legal frameworks · Economic and environmental · Electricity · Nuclear energy · Nuclear power programme

14.1 Inception of the UAE Nuclear Power Programme: Nuclear Policy

Throughout 2007, the UAE government evaluated future energy sources options and studied a potential role of nuclear energy in the UAE's future energy strategy.

The 'energy studies' concluded that nuclear energy has the potential to play a major role in meeting the growing energy needs in the UAE. Based on the studies, the UAE government developed the Policy of the United Arab Emirates on the Evaluation and Potential Development of Peaceful Nuclear Energy (the Nuclear Policy),¹ which was adopted by the UAE Cabinet of Ministers and published in April 2008. The development of the Nuclear Policy, required an in-depth study of best international practices, a broad consultation process within the UAE government, as well as with foreign and international stakeholders, such as the IAEA, determination of guiding principles for the development of the peaceful nuclear energy in the UAE.

The Nuclear Policy outlines the role of nuclear energy in the UAE's energy strategy and the UAE's approach to civilian nuclear power.

Most importantly, in the Nuclear Policy the UAE government documents the Government strategies and commitment to the highest standards of safety, security and non-proliferation and outlines six key principles for the establishment of a peaceful civilian nuclear energy programme in the UAE:

1. Complete operational transparency;
2. Highest standards of non-proliferation;
3. Highest standards of safety and security;
4. Close cooperation with the International Atomic Energy Agency (IAEA) and conformance to its standards;
5. Development of a peaceful domestic nuclear power capability in cooperation with the governments and firms of responsible nations, as well as with the assistance of appropriate expert organizations; and
6. Ensuring a long term sustainability of UAE's peaceful domestic nuclear power programme.

¹ Policy of the United Arab Emirates on the Evaluation and Potential Development of Peaceful Nuclear Energy 2008.

At that time, also several key strategic choices were reflected by the UAE government in the Nuclear Policy. Those were to forgo domestic enrichment and reprocessing of nuclear fuel should the nuclear power be one of the component of the UAE's energy mix.

14.2 From Nuclear Policy to Legal Framework

14.2.1 *International Conventions*

In order to meet the UAE's commitments to transparency, highest standards of non-proliferation, safety and security, as well as to pursue international cooperation as underpinned in the Nuclear Policy, the UAE has acceded to the relevant main international instruments, treaties, conventions, and agreements in the area of nuclear safety, nuclear security, non-proliferation and civil liability for nuclear damage.²

1. Convention on Early Notification of a Nuclear Accident, acceded by the UAE on 2 October 1987 and entered into force for the UAE on 2 November 1987.³
2. Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, acceded by the UAE on 2 October 1987 and entered into force for the UAE on 2 November 1987.⁴
3. Treaty on the Non-Proliferation of Nuclear Weapons (NPT), acceded by the UAE on 26 September 1995.⁵
4. Agreement between the United Arab Emirates and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons (Safeguards Agreement), signed on 15 December 2003 and entered into force for the UAE on 09 October 2003.⁶

²Such as the Convention on Nuclear Safety, Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, Convention on Early Notification and Assistance, the Revised Vienna Convention on Civil Liability for Nuclear Damage, the Convention on Supplementary Compensation for Nuclear Damage, the Joint Protocol, the Convention on the Physical Protection of Nuclear Material and its Amendment, the Comprehensive Safeguards Agreement (CSA) and Additional Protocol to the CSA.

³Convention on Early Notification of a Nuclear Accident, opened for signature 26 September 1986 (Vienna) and 6 October 1986 (New York), entered into force 27 October 1986 (Early Notification Convention).

⁴Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, opened for signature 26 September 1986 (Vienna) and 6 October 1986 (New York), entered into force 26 February 1987 (Convention on Assistance).

⁵Treaty on the Non-Proliferation of Nuclear Weapons, opened for signature 1 July 1968 (Vienna, Moscow, Washington), entered into force 5 March 1970 (Non-Proliferation Treaty or NPT).

⁶Agreement between the United Arab Emirates and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear

5. Protocol Additional to the Agreement between the United Arab Emirates and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons (Additional Protocol), signed on 08 April 2009 and entered into force for the UAE on 20 December 2010.⁷
6. Convention on Nuclear Safety, acceded by the UAE on 31 July 2009 and entered into force for the UAE on 29 October 2009.⁸
7. Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, acceded by the UAE on 31 July 2009 and entered into force for the UAE on 29 October 2009.⁹
8. Convention on the Physical Protection of Nuclear Material, acceded by the UAE on 16 October 2003 and entered into force for the UAE on 15 November 2003.¹⁰
9. Amendment to the Convention on the Physical Protection of Nuclear Material, accepted by the UAE on 31 July 2009 and entered into force on 08 May 2016.¹¹
10. International Convention for the Suppression of Acts of Nuclear Terrorism (acceded, 10 January 2008).¹²

14.2.2 UAE Nuclear Cooperation Agreements

International partnerships and cooperation were recognized by the UAE as the cornerstone of a successful nuclear energy programme. Thanks to such arrangements, technologically advanced countries facilitate access of embarking countries to the peaceful uses of nuclear energy.

As per the principles set out in the Nuclear Policy, the UAE committed to develop its peaceful domestic nuclear power capability in cooperation with the governments and firms of responsible nations and to ensure a long term sustainability of UAE's peaceful domestic nuclear power program.

Weapons, signed 15 December 2002 (Abu Dhabi), entered into force 9 October 2003 (Safeguards Agreement).

⁷Protocol Additional to the Agreement between the United Arab Emirates and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons, entered into force 20 December 2010.

⁸Convention on Nuclear Safety, opened for signature 20 September 1994 (Vienna), entered into force 24 October 1996 (CNS).

⁹Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, opened for signature 29 September 1997, entered into force 18 June 2001.

¹⁰Convention on the Physical Protection of Nuclear Material, opened for signature 3 March 1980, entered into force 8 February 1987 (CPPNM).

¹¹Amendment to the Convention on the Physical Protection of Nuclear Material, entered into force 8 May 2006 (Amendment to the CPPNM).

¹²International Convention for the Suppression of Acts of Nuclear Terrorism, opened for signature 14 September 2005, entered into force 7 July 2007 (Nuclear Terrorism Convention or ICSANT).

Therefore, the UAE concluded a number of bilateral agreements to benefit from cooperation in the peaceful uses of nuclear energy (the Nuclear Cooperation Agreements (NCA)):

1. Agreement for Cooperation between the Government of the United Arab Emirates and the Government of the Republic of France in the Development of Peaceful Uses of Nuclear Energy, 15 January 2008.
2. Agreement for Cooperation between the Government of the United Arab Emirates and the Government of the United States of America Concerning Peaceful Uses of Nuclear Energy, 21 May 2009.
3. Agreement between the Government of the United Arab Emirates and the Government of the Republic of Korea for Cooperation in the Peaceful Uses of Nuclear Energy, 22 June 2009.
4. Agreement between the Government of the United Kingdom of Great Britain and Northern Ireland and the Government of the United Arab Emirates for Cooperation in the Peaceful Uses of Nuclear Energy, 2010.
5. Agreement between the Government of the United Arab Emirates and the Government of Australia on Cooperation in the Peaceful Uses of Nuclear Energy, 31 July 2012.
6. Agreement between the Government of the United Arab Emirates and the Government of Canada for Cooperation in the Peaceful Uses of Nuclear Energy, 18 September 2012.
7. Agreement between the Government of the United Arab Emirates and the Government of the Russian Federation on Cooperation in the Field of the Use of Nuclear Energy for Peaceful Purposes, 17 December 2012.
8. Agreement on Cooperation in the Peaceful Uses of Nuclear Energy between the United Arab Emirates and the Argentine Republic, 14 January 2013.
9. Agreement between the Government of the United Arab Emirates and the Government of Japan for Cooperation in the Peaceful Uses of Nuclear Energy, 2 May 2013.

Such agreements set the basis for cooperation at various levels, including at the industry level, as well as at the government level. As result, a number of bilateral agreements and memoranda of understanding were concluded by the UAE entities with the corresponding foreign counterparts to further pursue the cooperation originating from the NCAs.

14.2.3 Cooperation with the IAEA

To ensure the implementation of a successful and sustainable nuclear energy programme, the UAE was working closely with the IAEA and international partners. The UAE's resolve to work directly with the IAEA and to abide by its standards has been reflected in the ongoing technical cooperation programme covering a variety

of fields, particularly in building the scientific and technological capabilities of the IAEA Member States, including the development of human resources.

The UAE consulted the IAEA on every step taken to develop the UAE's nuclear energy programme and took advantage of the IAEA review missions.

In January 2011, the UAE received an INIR mission, the outcome of which had been very positive with no major gaps having been identified. In addition, the UAE had accumulated valuable experience in the IAEA's integrated guidance approach for the development of new nuclear energy programmes.

Also, the UAE presented its first national report to the fifth review meeting of the Contracting Parties to the Convention on Nuclear Safety, where the UAE's work on developing nuclear safety infrastructure had been praised.

In December 2011, the UAE received its first Integrated Regulatory Review Service (IRRS) mission, at an unprecedentedly early stage in a nuclear programme. Thus, the UAE was developing into a model of transparency and responsibility for other nuclear newcomers.

By the end of 2011, before the start of the construction of Unit 1 of the Barakah nuclear power plant, the UAE approved eight new regulations for the safe, secure and peaceful use of nuclear applications and had set up licensing and inspection procedures.

The construction of the first nuclear reactor in the UAE begun in July 2012 following a detailed evaluation of the design, which had taken into consideration early lessons learned from the Fukushima Daiichi accident, making the country the first newcomer to build a nuclear power plant in 27 years. Construction of the second unit had begun in May 2013.¹³

The UAE continued to request and receive comprehensive peer reviews from the IAEA, which were essential to ensure the adequacy of safety measures and national infrastructure. The UAE was also the first country to receive an Integrated Nuclear Infrastructure Review (INIR) phase 3 mission to review the UAE's infrastructure development for a nuclear power programme. The INIR mission was carried out at the invitation of the UAE Government and was the first the IAEA has conducted for a country in the final phase of the IAEA's Milestones Approach, which provides detailed guidance for developing the infrastructure needed for a nuclear power programme.

The UAE signed an integrated work plan for 2013–2017, which defined a holistic framework of cooperation with all departments of the IAEA.

Today, the UAE continues to learn from the IAEA and benefit from its continuous support, through capacity building and the international peer review services in particular, but the UAE is also in a position to share its experience with other countries in joining the international nuclear legal instruments, developing the required legislation and regulatory framework and regulating the nuclear activities. This experience sharing is done through bilateral cooperation as well as at the international level, through inputs in international meetings, participations in nuclear law related working groups of the OECD Nuclear Energy Agency. In this context, the UAE is

¹³IAEA 2014, para 274.

also actively contributing to the development of international standards through its participation in the five Safety Standards Committees and in the Nuclear Security Guidance Committee of the IAEA.

14.2.4 Roadmap to Success

With the issuance of the Nuclear Policy, the UAE began implementation of a Nuclear Energy Program Implementation Organization as recommended by the IAEA, which was identified as the Executive Affairs Authority (EAA) of Abu Dhabi at the very early stages of the programme.

In September 2008, the EAA developed an internal strategy document called the Roadmap to Success, which built on best international practices and the IAEA Milestones covering the 19 nuclear infrastructure issues.

The Nuclear Policy states that UAE has also taken into consideration and intends to be guided by the planning recommendations expressed by the IAEA in its Milestones in the Development of a National Infrastructure for Nuclear Power (the IAEA Milestones).¹⁴

The IAEA Milestones cover three phases in the development of the infrastructure necessary to support a nuclear power programme. The completion of each phase for 19 nuclear infrastructure issues is marked by a specific milestone, at which the progress of the development effort can be assessed and a decision can be made to move on to the next phase.

The Roadmap to Success set the early path for the UAE peaceful nuclear programme by turning practices into a set of explicit recommendations, goals and objectives, responsibilities for the UAE stakeholders, and timelines for specific targets towards an estimated operation date, which was then set for 2017.

14.3 Towards a Comprehensive National Nuclear Law

The commitment of the UAE to the highest standards of nuclear safety is reflected in its legal, regulatory and institutional framework. The Nuclear Policy served as the reference for the development of legislation for the nuclear sector in the UAE. The Nuclear Policy specified that the UAE should draft a comprehensive national nuclear law, covering all aspects of nuclear law, including safety, security, non-proliferation, nuclear liability and other legislative, regulatory and commercial aspects, and, among other functions, providing legal authority for the establishment of a fully independent nuclear regulatory authority, which is needed as an institution critical to safeguard and sustain operational transparency in a nuclear energy sector. As per the Nuclear

¹⁴IAEA 2007, 2015.

Policy, the comprehensive national nuclear law was meant to enable the transposition of the UAE obligations under international instruments into the national legislation. Also, the Nuclear Policy defined that the scope of UAE nuclear legislation should include provisions concerning the establishment of a regulatory authority and licensing regime; civil liability for nuclear damage; responsibilities of licencees; management of radioactive waste and spent fuel; decommissioning of nuclear facilities; physical protection of nuclear material and facilities; and non-proliferation obligations, controls and enforcement.

As the legal structure in the UAE runs in two systems—the federal legal system and local system at the level of the seven emirates of the UAE—the government had to decide whether to set the legal and regulatory framework for the UAE at the federal or local level, in the Emirate of Abu Dhabi where a future nuclear power plant was supposed to be located. Also a decision had to be made on whether to build the legislation for the nuclear sector on the elements of existing legal infrastructure or whether to develop new legislation at the federal level. For example, the Radiation Protection Committee existed in the UAE before the ‘energy studies’ and preparation of the Nuclear Policy, and it was approved by the Cabinet of Ministers then. Also, there was the Federal Law No. 1 of 2002 Regarding the Regulation and Control of the Use of Radiation Sources and Protection Against Their Hazards.

Another challenge was to determine the scope of the mandate of a regulatory body and to ensure that is established as an independent nuclear regulator, not reporting to nor being part of any ministry in the UAE.

The institutional characteristics ensuring the independence of a nuclear regulator were reflected in the Nuclear Policy, which specified that an independent nuclear regulator “would be endowed with the following IAEA recommended powers to: (1) establish requirements and regulations; (2) issue licences; (3) inspect and assess facilities and structures connected to facilities; (4) monitor and enforce compliance with regulations; and (5) establish a State System for Accounting and Control (SSAC) of nuclear material (including spent fuel and radioactive waste) in accordance with IAEA Safeguards obligations.”¹⁵ Also, the Nuclear Policy specifies that the regulatory body would be tasked with communicating with the IAEA on an ongoing basis to provide, for example, reports required by international agreements to which the UAE is a party. Another challenging aspect was to ensure that the legislation would guarantee the independence of the nuclear regulator in its decision making, particularly with regard to safety related decisions.

A number of foreign experts from the US, Europe, and Asia as well as the IAEA contributed to the development of the comprehensive national nuclear law. They took into account lessons learned from various legal systems, international standards and offered numerous ideas aiming at putting into practice the lessons learned so far. The IAEA provided support through its legislative assistance programme. The IAEA revised the draft law and also provided comments and advice on selected provisions of the future comprehensive nuclear legislation of the UAE.

¹⁵ Policy of the United Arab Emirates on the Evaluation and Potential Development of Peaceful Nuclear Energy 2008, p. 6.

The challenge that the UAE faced then was to choose the right approach to the development of a comprehensive technical legislation that would indeed reflect the best practices gathered around the world, international standards, as well as the lessons learned. The UAE had a limited experience in the drafting and processing through the UAE's legislative process such a complex legislation. The external expertise provided numerous inputs and options. However, the responsibility for evaluation and choosing the most appropriate option always rested with the UAE.

On 23 September 2009, the UAE passed the comprehensive Federal Law by Decree No. 6 of 2009 Concerning Peaceful Uses of Nuclear Energy (the Nuclear Law) providing for the development of a comprehensive system for licensing and control of nuclear material, as well as the establishment of the Federal Authority for Nuclear Regulation (FANR) to oversee the UAE's nuclear energy sector in the area of safety, security, and safeguards. The Nuclear Law defines the responsibilities of the operator and functions and responsibilities of the regulatory body—FANR.

Following the establishment of FANR, the Emirates Nuclear Energy Corporation (ENEC) was established on 23 December 2009, by Law No. 12 of 2009 issued by the President of the UAE in his capacity as the Ruler of Abu Dhabi. ENEC was established as the organization charged with implementing the UAE nuclear energy programme and carried out the non-regulatory work of the Nuclear Energy Program Implementation Organization (NEPIO). As per the Law no. 12 of 2009, ENEC is responsible to develop, build, finance, operate, maintain, manage and possess nuclear reactors to be used for peaceful purposes for energy generation, water desalination, subject to the Nuclear Law. Consistent with the Nuclear Policy objectives, ENEC retains the NEPIO function, which is important for the sustainability of the programme in the long term as ENEC reinforces a mechanism of coordination involving all relevant stakeholders.

Soon after, on 27 December 2009, ENEC announced that it had selected a team led by the Korea Electric Power Corporation (KEPCO) to design, build and assist in operation and maintenance of four, 1400 MWe civil nuclear power units. The announcement came after a year long extensive tendering process.

In order to achieve a comprehensive nuclear legal framework and as required by the international nuclear liability instruments to which the UAE became a party, the UAE issued the Federal Law by Decree No. 4 of 2012 Concerning Civil Liability for Nuclear Damage (the Nuclear Liability Law) in August 2012, which came into effect in October 2012. The Nuclear Liability Law aims to implement the nuclear liability principles such as the channelling of the liability to the nuclear operator, limitation of the nuclear operator's liability in amount and in time, the obligation for a financial security, the principle of non-discrimination, etc., which would apply should an nuclear incident occur within a nuclear installation in the UAE and trigger nuclear damage. The provisions of the Nuclear Liability Law are in line with UAE obligations under the 1997 Vienna Convention on Civil Liability for Nuclear Damage, to which the UAE acceded in May 2012, and takes into account the best international practices. It is also worth noticing that in line with the recommendations formulated by the International Expert Group on Nuclear Liability (INLEX), in order to contribute to the achievement of a global nuclear liability regime the UAE also joined the Joint

Protocol relating to the Application of the Vienna Convention and the Paris Convention in August 2012 and joined the Convention on Supplementary Compensation for Nuclear Damage in July 2014.

14.3.1 International Advisory Board

Further development of the UAE nuclear power programme, including its legislation and regulatory framework, benefitted from the advice and recommendations of the International Advisory Board (IAB). The IAB was established with a view to ensure operational transparency of the programme and to provide the UAE peaceful nuclear energy program with the benefit of the expertise and knowledge of a highly select group of internationally recognized experts in the fields of nuclear safety and security, non-proliferation and the development of human resources. The IAB first met on 22 February 2010 at Abu Dhabi and continued meeting on a semi-annual basis for eight years, until holding its final meeting in October 2017. Throughout its term, the IAB reviewed the progress of the UAE in achieving and maintaining the highest standards of safety, security, non-proliferation, transparency and sustainability and the IAB members provided their valuable insights into optimization of the nuclear power program towards achieving these targets.¹⁶ The recommendations of the IAB are recorded in the 16 semi-annual reports of the IAB which is publicly available.¹⁷

14.3.2 UAE Nuclear Regulator

The UAE nuclear regulator—FANR—was established by the UAE President His Highness Sheikh Khalifa Bin Zayed Al Nahyan in September 2009. Article 4(1) of the Nuclear Law sets out that “A public organization under the name of “Federal Authority for Nuclear Regulation” shall hereby be established with independent balance sheet and it shall have an independent legal personality, full legal competence and financial and administrative independence in all its matters.”

In line with international recommendations, FANR was established as an independent entity which is separated from the entities in charge of the development or the promotion of nuclear energy and nuclear applications and from the users. The members of FANR’s Board Management are prohibited from carrying out a regulated activity under the Nuclear Law, either direct or indirect (Article 10(2) of the Nuclear Law) and the reporting of FANR to the government is done through an Annual Report to the Minister for Presidential Affairs (Article 11 of the Nuclear Law). Another important element is the financial independence of FANR addressed in Article 18 of the Nuclear Law which specifies, inter alia, that the Authority’s funds

¹⁶<http://www.uaeiab.ae>. Accessed 15 October 2021. (Information on the work of the IAB.)

¹⁷<http://www.uaeiab.ae/en/publications.html>. Accessed 15 October 2021. (All reports of the IAB.)

consist of the funds allocated to it by the government and income generated by the conduct of its functions.

The responsibilities of FANR are explicitly enumerated in the Articles 4 and 5 of the Nuclear Law, as well as in other provisions, and include the power to regulate, control and supervise the nuclear sector in the UAE toward the peaceful purposes only, and to ensure safety, nuclear safety, nuclear security, radiation protection and safeguards. FANR has also the responsibility to ensure the fulfilments of obligations under international treaties, conventions, agreements related to its mandate and entered into by the UAE.

For the purposes of implementing its responsibilities under the Nuclear Law, FANR undertakes a number of activities which are listed in the Nuclear Law and can be regrouped into four core regulatory functions:

1. The development and issuance of regulations and regulatory guides to support the implementation of the Nuclear Law. Such regulations aim to specify the requirements applicable to specific regulated activities and related facilities, including on safety, physical protection, emergency preparedness, nuclear material accounting and control, transport of radioactive material, import, export, radiation protection or decommissioning. The regulations shall also specify the exclusions and exemptions from all or parts of the regulatory control;
2. The licensing, including the review and assessment of licence applications, the issuance of licences, along with the identification of licence conditions and their amendment, renewal, suspension or revocation:

These two first core activities are further detailed below in this paper.

3. The inspection and assessment of all regulated activities, including the development of a systematic inspection programme within FANR;
4. The identification and implementation of enforcement actions, including fines and other administrative penalties up to criminal penalties, following a graded approach.

These core activities also require FANR to coordinate with the other competent authorities in the UAE in various area such as emergency preparedness, nuclear security, non-proliferation and the transport of hazardous goods. In addition, FANR cooperates and provides advice to the government entities on matters related to nuclear safety, radiation protection, security and also environment protection, public and occupational health, radioactive waste, etc.

At the international level, FANR has established cooperation with a number of foreign nuclear regulators to exchange regulatory experience and also with foreign research centres, institutes and international organizations to support its activities in various areas, such as nuclear safety, radiation safety or research and development. As per the UAE international commitments and the Nuclear Law, FANR is finally responsible for liaising, providing required information, notifications and reports to the relevant international organisations.

14.3.3 Development of Regulatory Framework: Regulations and Regulatory Guides

Developing the nuclear legislation is an essential step that sets the framework allowing for the conduct of all activities in the nuclear and radiation sectors in the country while at the same time ensuring an adequate protection of the people and the environment from the harmful effects of ionizing radiation. However, it is only the first step of a country in the development of a comprehensive nuclear legal framework.

By nature, the UAE Federal Law by Decree No. 6 of 2009 Concerning Peaceful Uses of Nuclear Energy (the Nuclear Law), though meant to be a “comprehensive” legislative instrument on nuclear and radiation matters, can’t prescribe all the conditions and requirements governing the conduct of all activities in nuclear and radiation sectors in the country. The detailed regulatory requirements applicable to each specific activity and related facilities are to be included in a comprehensive set of regulations, complemented by regulatory guides. As mentioned above, the power to develop and issue regulations has been granted to FANR in the Nuclear Law, which specifies in its Article 11(4)(j), that the Board of Management of FANR shall have the functions and authorities to issue implementing technical regulations required for the FANR’s operation, including “to establish, develop or adopt regulations and guidelines upon which its regulatory actions are based”. The same elements are reiterated in the provisions of Article 38 of the Nuclear Law.

The work on the development of regulations was launched immediately after the establishment of FANR, taking into account that the availability of some of the regulations was critical for the development of the nuclear sector in the UAE. The Regulation for Radiation Dose Limits and Optimization of Radiation Protection for Nuclear Facilities (FANR-REG-04), the Regulation on Application of Probabilistic Risk Assessment at Nuclear Facilities (FANR-REG-05), the Regulation for Management Systems for Nuclear Facilities (FANR-REG-01), the Regulation for an Application for a Licence to Construct a Nuclear Facility (FANR-REG-06) and the Regulation for Transport of Radioactive Materials (FANR-REG-13) were approved as early as 2010. Subsequently, the Regulation for Emergency Preparedness for Nuclear Facilities (FANR-REG-12), the Regulation for Radiation Protection and Predisposal Radioactive Waste Management in Nuclear Facilities (FANR-REG-11), and the Regulation for System of Accounting for and Control of Nuclear Material and Application of Additional Protocol (FANR-REG-10), were approved in 2011. Later, the Regulation for the Siting of Nuclear Facilities (FANR-REG-02), the Regulation for Basic Safety Standards for Facilities and Activities involving Ionising Radiation other than in Nuclear Facilities (FANR-REG-24), the Regulation for Certification of Operations Personnel in Nuclear Facilities (FANR-REG-17), and the Regulation for the Design of Nuclear Power Plants (FANR-REG-03) were approved in 2013. Importantly, the Regulations for Requirements for Off-site Emergency Plans for Nuclear Facilities (FANR-REG-15), the Regulation for an Application for a Licence

to Operate a Nuclear Facility (FANR-REG-14) and the Regulation on Operational Safety including Commissioning (FANR-REG-16) were approved by FANR in 2014.

Eventually, FANR has developed a set of 23 regulations which cover a broad spectrum of activities conducted in the UAE and their associated facilities, from the siting, design, construction, operation and decommissioning of nuclear facilities, emergency preparedness and response, the predisposal and disposal of radioactive waste, radiation protection, physical protection of nuclear material and related facilities, the security of radioactive sources and also address issues such as nuclear material accounting and control, import and export controls, existing exposure situations and the certifications of operating personnel.

All these regulations have been developed taking into account the relevant IAEA safety standards and security guidance documents as well as regulations developed by foreign regulators which also have served as reference. The regulations are available in Arabic and English on FANR website.

FANR has established a specific process supported by procedures for the development and revision of regulations. Such process ensures a systematic approach to the development of regulations, with the collection of the required inputs at the internal level and from external entities through public and stakeholders consultations. The comments provided through these consultations are assessed and taken into consideration for the development of the final draft regulation. Once approved and issued the regulations are available in both languages on the FANR website and are also published in the UAE Official Gazette. FANR also organizes specific events targeting the users of these regulations to raise their awareness and understanding of the new or revised requirements.

The nuclear regulator has also developed a systematic approach which provides for the regular review and revision, if found necessary, of regulations and the identification of the need for new regulations. The regular review of regulations shall be done at the latest five years after the date of issuance of the regulation. A review may be also triggered earlier to take into account a specific need or circumstance. The review needs to address the continued adequacy of the regulation, taking into account factors such as updates to the IAEA Safety Standards, or Security Guidance documents, operational, regulatory and implementation experience, response to international events or research and development findings.

As an example, following the Fukushima Daiichi accident in March 2011, FANR reviewed its relevant regulations relating to nuclear facilities to assess the need for their immediate revision. Further to this exercise FANR has identified no need for immediate changes to the existing regulations, but listed a number of items to be taken into account during the course of update of the regulatory framework.

FANR regulations are complemented by a set of regulatory guides that are issued to describe methods and/or criteria acceptable for meeting and implementing specific requirements contained in FANR regulations. Similarly to the regulations, the regulatory guides also extensively take into account the IAEA Safety Standards and Security Guidance documents and also adopted many of the guides issued by the regulatory body of the country of origin of the nuclear technology.

To date, 22 regulatory guides have been issued by FANR to support the implementation of the regulations and four more are currently being developed. The development and revision of the regulatory guides also follows a systematic process embedded in the integrated management system of FANR, involving the technical departments in FANR and external stakeholders. The regulatory guides are available in English on FANR website.

14.3.4 System of Licensing

All activities and practices involving the peaceful uses of nuclear energy and ionizing radiation, including the related equipment, information and technology in the UAE, i.e. the regulated activities, are subject to FANR licensing. The exclusive authority of FANR to grant licences for the conduct of those regulated activities is established in Article 6 of the Nuclear Law, while Article 23 of the Nuclear Law prohibits any person from conducting any Regulated Activity in the UAE without a licence.

The Nuclear Law provides in its Article 25 a list of regulated activities subject to a licence which include, inter alia, the siting, construction, operation, commissioning and decommissioning of nuclear facilities. The Nuclear Law further develops specific provisions relating to the licensing including some specific criteria for the granting, revocation, and suspension of licences.

Article 28 of the Nuclear Law requires the applicant for a licence to submit detailed evidence of safety that shall be reviewed and assessed by FANR in accordance with established procedures. Following a review and assessment of a licence application, FANR, through its Board of Management, determines whether to grant the licence, grant the licence with conditions, or to refuse the licence and records the basis for these decisions. As provided by the Nuclear Law, FANR has established a set of regulations which specify, for example, the licensing requirements relating to an application for a licence to construct a nuclear facility (FANR-REG-06) or the requirements for an application for a licence to operate a nuclear facility (FANR-REG-14). More recently, FANR has also issued a specific regulation on the registration and licensing of radiation sources (FANR-REG-29).

These regulations aim to specify the requirements to be complied by the applicant to obtain a FANR licence and have to be read in conjunction with the supporting regulatory guides developed by FANR (see for example FANR regulatory guide on the content of a nuclear facility construction and operating licence applications, FANR-RG-001-V1).

As required by Article 32(3) of Federal Law by Decree No. 6 of 2009:

FANR is obligated to conduct a thorough review of the applicant's submission to satisfy itself that: a) available information demonstrates the safety of the facility or proposed activity; b) information ... in the submissions is accurate and sufficient to enable confirmation of compliance with regulatory requirements; and that c) technical solutions, and in particular any novel ones, have been proven or qualified either by competent authorities, experience or testing, and are capable of achieving the required level of safety.

Therefore, in 2010, FANR developed in its Integrated Management System (IMS) dedicated internal processes consistent with the Nuclear Law and the relevant IAEA safety requirements for the licensing of the regulated activities related to nuclear facilities on one side, and for the licensing of all other regulated activities on the other side. Each process specifies the respective responsibilities within the regulatory authority for the receipt of licence application, issuance of an internal plan with responsibilities and schedule for review of the licence application, initial evaluation and requests for additional information, final evaluation and licence recommendation, licensing decision and issuance of a licence. The process is complemented by a set of procedures and instructions, which detail the methods and criteria to be applied by FANR during its review of a licence application.

As regards the licensing of regulated activities related to nuclear facilities, major milestones have been reached by the UAE over these past twelve years with seven key licences issued to date:

1. The Licence for Selection of a Site for the Construction of a Nuclear Facility, granted to ENEC in February 2010;

As there were no regulations in place at that time yet, the licensing of the site selection was based on guidance from the IAEA and references from the US NRC. The licence was approved by FANR's Board of Management, the highest decision making body at FANR, following FANR's review of the application submitted by ENEC. The issuance of the licence to ENEC marked the formal start of FANR's important role as the independent safety regulator for the UAE's nuclear power programme.

2. The Licence for the Preparation of the Construction of a Nuclear Facility, granted to ENEC in July 2010;

This licence and the 'site selection' licence mentioned previously provide authorization to ENEC to conduct site investigation and preparation activities at the Barakah site, such as the installation of site infrastructure, and construction of parts of the facility not related to nuclear safety.

3. The Limited Construction Licence, granted to ENEC in July 2010;

The licence authorizes the manufacturing, assembly, and testing of certain components as specifically delineated in the licence, including reactor vessels, steam generators, and other primary reactor system components. The licence authorize ENEC and its Prime Contractor, KEPCO, to manufacture and assemble structures, systems and components, such as reactor pressure vessel, steam generators, coolant pumps and other components important to safety of the nuclear power plant. Due to the long lead time for these processes, ENEC has decided to apply for this licence at this early stage.

As stated in the licence itself, the licence was granted at the applicant's risk and without prejudice to any subsequent decision by FANR about the suitability of the siting, design and construction of the nuclear facility or its systems, structures and components. Importantly, the licence is valid until the completion of the construction

work of the nuclear facility or until it is earlier suspended or revoked by FANR or surrendered by the licensee.

Three subsequent amendments to the licence were issued in March 2011, in March 2012 and in May 2012 to cover a number of civil works at the site.

4. The Licence for the Construction of Unit one and Unit two of Barakah Nuclear Power Plant, granted to ENEC in July 2012;

It is worth noting that for the issuance of this construction licence, FANR took into consideration all the early lessons learned from the Fukushima Daiichi accident as FANR actively participated in the IAEA Nuclear Safety Standards Committee meetings and associated working groups to discuss the implications of the Fukushima Daiichi accident findings on IAEA Safety Standards. A thorough review of the reactor design and of the areas of the licence application associated with protection against external events and severe accident mitigation was made and FANR requested the licence applicant to undertake an assessment to determine application of lessons learned from the Fukushima Daiichi accident to the proposed Baraka NPP Units 1 and 2 and to provide a supplement to licence application.

5. The Licence for the Construction of Unit three and Unit four of Barakah Nuclear Power Plant and related regulated activities, granted to ENEC in July 2014;
6. The Licence for the Handling and Storage of Unirradiated Nuclear Fuel, granted to Nawah Energy Company PJSC (Nawah) in December 2016;
7. The Licence for the Operation of Unit One of the Barakah Nuclear Power Plant issued to Nawah, the nuclear operator, on 17 February 2020.

The issuance of the first licence to operate a nuclear power plant in the UAE was a significant achievement for the country and the result of extensive investment both from the side of the industry and the nuclear regulator. A thorough review of the 14,000 pages of the application documents submitted by the applicant has been undertaken by FANR, with additional 2000 requests for additional information issued, complemented by the conduct of over 180 inspections prior to the issuance of the licence.

The review and assessment of the licence application has involved all FANR departments of the operations division with the support of the legal affairs department and is documented in the Safety Evaluation Report (SER) of the Operating Licence Application which describes the framework, the methodology and conclusions of the regulatory review and assessment of the licence application for the operation of Unit 1 of the Barakah Nuclear Power Plant. The SER follows a systematic approach and considers 22 overarching topics (such as corporate governance, site characteristics, reactor, instrumentation and control, electrical power, radioactive waste management, radiation protection, accident analysis, quality assurance programme, physical protection, safeguards or decommissioning). It is complemented by the Constructed in Accordance with Requirements report, which provides information and supporting evidence that Unit 1 of the Barakah nuclear power plant has been constructed in accordance with the regulatory requirements and the Ready to Operate report, which summarizes the process and supporting evidence used to reach the

regulatory findings that the operating licence applicant is organizationally ready to operate.

The licence for the operation of Unit 2 of the Barakah Nuclear Power Plant was granted to Nawah on 8 March 2021 together with an Amendment to the licence for the operation of Unit 1 of the Barakah Nuclear Power Plant. The licences authorize Nawah to operate the relevant unit of the Barakah nuclear power plant for a period of 60 years and to conduct related regulated activities directly associated with the operation of the concerned unit.¹⁸ The construction of Units 3 and 4 of the Barakah Nuclear Power Plant is close to completion and FANR is currently reviewing the licence application for the application of Unit 3 of the Barakah Nuclear Power Plant.

In addition to the licences related to the nuclear power programme, FANR is assessing, reviewing and issuing a large number of licences for all other activities and practices involving radiation sources, as well as for import and export of nuclear material and dual use items. As an example, in 2020, FANR issued 1097 licences to conduct activities involving radiation sources, including 301 new licences, 304 renewals and 469 amendments of existing licences. To support the processing and evaluation of the applications by FANR and the exchange of documents and information between the applicant for a licence and the regulatory authority, and in line with the national initiative for a smart government, FANR has put into place an ‘e-licensing platform’, which allows an applicant for a FANR licence to provide all relevant information as required by FANR and supporting documentation. This is an integrated system which will reflect all the regulatory requirements relating to the licensing of activities and integrates safety, security and non-proliferation into one single portal. This e-licensing system is constantly updated to reflect the latest requirements developed by FANR and enables FANR to consider licensee requests and reports more rapidly and accurately.

14.3.5 Enhancing the UAE Legal Framework

Looking back over the past ten years, so much has been accomplished. A comprehensive nuclear legal framework has been developed almost from scratch in the UAE, with a Nuclear Law addressing safety, nuclear security and safeguards, complemented by a nuclear liability legislation. FANR has been established as a strong independent nuclear regulator. A full set of regulations supporting the development of the nuclear power programme, as well as all the other activities involving ionizing radiation in the country has been built and has been complemented by a number of regulatory guides. Hundreds of applications for licences have been assessed, licences issued, including huge milestone licences, such as the construction licences for the 4 units and operating licences for the 2 units of the Barakha Nuclear Power Plant. Last but not least, the UAE has diligently fulfilled its international commitments

¹⁸<https://www.fanr.gov.ae/en/rules-regulations/licenses-regulatory-approval>. Accessed 15 October 2021.

and has built a strong network at the international level. This could not have been done without a solid legal framework in place, a strong nuclear regulator and solid expertise available in the country.

However, that does not mean that the work is finished. Complacency is not a word acceptable in the nuclear world and the lessons have to be drawn from these years of experience in developing this ambitious nuclear power programme and implementing the nuclear legal framework. Also, new best practices are constantly identified, regulatory approaches are evolving and new technologies are being developed. Having that in mind and in line with the IAEA recommendations, the UAE nuclear legal framework has to be kept under continuous review.

In this context two different sets of documents have to be considered. On one side, the nuclear regulatory framework needs to be constantly updated. Indeed, it is essential to ensure that our regulations and guides are up-to-date, aligned with the latest international standards, drawing the lessons from the experience from their implementation. As mentioned previously, FANR has put in place a systematic mechanism to review the adequacy of regulations at regular intervals, but it is also essential to scrutinize and monitor developments, progresses in other countries and within international organizations which may require earlier reviews.

It also implies strengthening the internal process and procedures for the development of such regulatory framework. FANR is working towards continuously improving the process of development and review of regulations, to ensure the highest quality in the drafting and the content is strengthened based on the national needs and circumstances to ensure that all activities are conducted in a manner offering the best protection to the workers, the population and the environment of the UAE. In this context, the process for the development and revision of regulations has been recently strengthened to enhance the early involvement and cooperation between the FANR operational departments with a systematic contribution from the legal affairs department. The UAE through its regulator is striving to establish an agile albeit solid regulatory framework.

On the other side, another very important exercise is the regular review of the nuclear legislation. The development of a nuclear power programme cannot take place without a solid and sustainable nuclear legal framework, as highlighted previously. Certain stability was required to ensure the smooth launch and development of the nuclear power programme. However, it is also essential to keep the founding nuclear legislation under scrutiny, identify the gaps, draw the lessons from the implementation of the legal provisions, identify the potential issues and finally establish some actions plans to address them.

The Nuclear Law was adopted in 2009, more than 12 years ago. At the international and at the national level a number of developments took place. New international nuclear legal instruments were joined by the UAE, the UAE nuclear regulatory framework has matured, lessons and recommendations have been identified by international peer reviews missions, the Fukushima accident happened. Also, the world had to face in the past two years a pandemic which obliged the nuclear world, industry and regulators, to perform their work in a different manner. Challenges arose and solutions were developed. Such global crises demonstrated the need to have in place

frameworks which also allow flexible, innovative and prompt response to unforeseen situations and circumstances, while at the same time preserving the fundamental safety objective which is to ensure the best protection to the population and the environment against the harmful effects of ionizing radiation. All these factors have to be considered and the UAE is now working towards the review of its founding nuclear legislation to ensure that it continues to serve the country's objectives for the next 50 years.

The strengthening of the nuclear legal framework requires experienced people and a combination of technical inputs supported by legal experts. To this end, the UAE needed to develop and maintain the appropriate nuclear legal expertise with lawyers trained and experienced in developing, revising and implementing nuclear legislation and regulations. The UAE has benefited from the extensive support from the IAEA and other international organisations, such as the OECD Nuclear Energy Agency, which provide highly recognized intensive trainings for nuclear lawyers. In addition, FANR has also been proactive in developing a tailored nuclear legal developpee programme, in partnership with a renowned law firms to train young Emirati graduates into nuclear law issues, combining theoretical sessions and on the job training.

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