هيئة تنظيم قطاع الطاقة والمعادن

Energy & Minerals Regulatory Commission

The Hashemite Kingdom of Jordan

Energy and Minerals Regulatory Commission

Status Report

Convention on Nuclear Safety

August 2016

In the fulfillment of Article 5 of the

Convention on Nuclear Safety

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1 INTRODUCTION

According to the fact that there are no operational Nuclear Installations in Jordan, this report aims to demonstrate Jordan's national commitment to nuclear safety through the implementation of nuclear safety requirements in nuclear facilities currently undergoing construction and/or commissioning, in radioactive facilities that are operational, and activities related to nuclear material, and the application of nuclear safety requirements during siting stage of the planned nuclear installation.

1.1 Background

This national report has been prepared by the Government of the Hashemite Kingdom of Jordan in fulfilment of Article 5 of the Convention on Nuclear Safety for submittal to the 7th Review Meeting of Contracting Parties that will be held in 2017.

Jordan became a member of the International Atomic Energy Agency (IAEA) in 1966, and has started close cooperation with the Agency to prepare for a safe and secure nuclear program.

The Hashemite Kingdom of Jordan signed the Convention on Nuclear Safety (here inafter: the Convention) in December 1994. The agreement was ratified in June 2009 and entered into force three months later in September 2009. In the ratification of the Convention, Jordan committed to a large extent on applying the safety principles and safety standards published by the IAEA.

These obligations cover legislative and regulatory frameworks, regulatory bodies and technical safety obligations. The safety obligations cover siting, design, construction, operation, adequate financial and human resources, the assessment and verification of safety, quality assurance and emergency preparedness.

1.2 Motivations for Nuclear Power Program

Jordan is currently embarking on two nuclear projects, namely the construction and operation of a research reactor and a nuclear power plant, in which there are no operating Nuclear Installation at the time this report was prepared. Energy and water demands in Jordan are pushing forward to embark on nuclear energy, where Jordan is completely dependent on imports to cover its primary energy needs. About 96% of Jordan's electricity generation is fueled by imports. Jordan's electricity generation fleet is relatively old, with most existing conventional power plants scheduled for decommissioning by 2020. Several renewable energy production projects are under operation and others are under construction, however, nuclear energy remains as one of the primary options in the planned Energy Mix. During the same timeframe, the anticipated increase in electricity consumption is substantial and will widen the gap between available electric capacity and electric demand. Projected electricity demand translates into a total electricity generation capacity need of more than 15,000 MW by 2040 (up from 2,800 MW in 2013), based on an annual average growth rate of approximately 6%.

2 NUCLEAR SAFETY POLICY AND STRATEGY IN JORDAN

2.1 International Legal Instruments

From the time Jordan decided to embark nuclear energy, Jordan has decided to become a party to relevant international legal instruments (see Table 1) for nuclear safety, civil liability, emergency preparedness and response, spent fuel and waste management, security and nonproliferation, in which Jordan established and is currently updating the necessary national legal framework to accommodate these new obligations.

Table 1: Status of International Legal Instruments

Title	In Force	Status
Agreement on the Privileges and Immunities of the IAEA.	1982-10-27	Acceptance: 1982-10-27
Vienna Convention on Civil Liability for Nuclear Damage.	2014-04-27	Accession: 2014-01-27
Convention on the Physical Protection of Nuclear Material.	2009-10-07	Accession: 2009-09-07
Amendment to the Convention on the Physical Protection of Nuclear Material.	2016-05-08	Acceptance: 2009-10-07
Convention on Early Notification of a Nuclear Accident.	1988-01-11	Signature: 1986-10-02 Ratification: 1987-12-11
Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency.	1988-01-11	Signature: 1986-10-02 Ratification: 1987-12-11
Convention on Nuclear Safety.	2009-09-10	Signature: 1994-12-06 Ratification: 2009-06-12
Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.	2016-07-14	Accession: 2016-04-15
Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage.	2014-04-27	Accession: 2014-01-27
Revised Supplementary Agreement Concerning the Provision of Technical Assistance by the IAEA (RSA).	1989-02-05	Signature: 1989-02-05
Co-operative Agreement for Arab States in Asia for Research, Development and Training Related to Nuclear Science and Technology (ARASIA) - First Extension.	2008-07-29	Acceptance: 2007-10-09
Application of safeguards in connection with the Treaty on Non-Proliferation of Nuclear Weapons. (1)	1978-02-21	Signature: 1974-12-05
Protocol Additional to the Agreement between the Hashemite Kingdom of Jordan and the IAEA for the Application of Safeguards.	1998-07-28	Signature: 1998-07-28

(1) Jordan rescinded the Small Quantity Protocol and implemented the Comprehensive Safeguards Agreement in May 2015.

2.2 Jordan Commitment to Nuclear Safety

As stated previously, Jordan became a member of the International Atomic Energy Agency (IAEA) in 1966 and has started close cooperation with the Agency to prepare for a safe and secure nuclear program.

The Government of Jordan has fully recognized the prime importance of nuclear safety and security in developing the Jordanian Nuclear Energy Program. All the steps undertaken by its involved institutions demonstrate that nuclear and radiation safety and security are fundamental aspects of the Jordanian Nuclear Safety Policy, and have the highest priority in the Jordanian nuclear program.

Jordan commitment to nuclear safety is quite apparent from the initiatives it has assumed during the past few years, where several achievements toward this trend have been accomplished, which include the following:

- Signature and ratification of the international legal instruments in the safe use of nuclear energy;
- Establishment of a clear organizational infrastructure for implementing its nuclear energy program;
- Clear division of responsibilities established by approved policies and legislations;
- Involvement of IAEA in developing Jordan's nuclear regulatory infrastructure, and receiving several IAEA missions in this regard;
- Signing several nuclear cooperation agreements and participating in several international cooperation activities;
- Jordan works in very close cooperation and in a transparent manner with the IAEA and the international community, and considers the IAEA's active participation as an assurance that all international IAEA safety and security standards will be properly reflected in Jordanian nuclear law and applicable regulations and instructions;
- Rescinding the Small Quantity Protocol (SQP) and implementing the Comprehensive Safeguards Agreement (CSA), in which it become effective in May 31st, 2015. Hence EMRC received several IAEA Safeguards Inspection and Verification mission;
- Jordan also benefits from worldwide nuclear experience through the involvement of the European Commission, US Nuclear Regulatory Commission and international consultants. Involving these and other international entities demonstrate Jordan's commitment to strictly adhere to international nuclear standards; and
- Jordan's commitment to ensure its selection, construction, and operation of Jordan's first nuclear power plant are conducted in a transparent manner.

2.3 History of Regulating Radiation and Nuclear Sectors

Prior to 2001, nuclear materials and radiological facilities and activities were regulated by the Nuclear Energy Department at the Ministry of Energy and Mineral Resources. In 2001, the Nuclear Energy and Radiation Protection Law (Law No. 29 for 2001) established the Jordan Nuclear Energy Commission (JNEC) to promote and to regulate nuclear material, radiological facilities, and radiological activities in Jordan.

In November 2006, a high-level Ministerial Committee chaired by the Prime Minister was established to develop a roadmap for implementing the nuclear energy program. The Committee established the Nuclear Energy Program Implementing Organization (NEPIO).

In July 2007, two Laws (No. 42 and No. 43) replaced Law No. 29 for 2001. Law No. 43 for 2007 established the Jordan Nuclear Regulatory Commission (JNRC); and Law No. 42 for 2007 established the Jordan Atomic Energy Commission (JAEC). Thus, the division of

responsibilities was clearly defined between the promotion and regulation of nuclear and radiological facilities and activities by these two laws. JNRC was empowered by the Parliament as a financially and administratively independent regulatory body with the authority to regulate nuclear and radiological facilities and activities, covering the nuclear safety, security, safeguards and emergency preparedness and response, and conducting the regulatory functions of safety reviews, inspections and enforcement through a systematic licensing process. In addition, JNRC was empowered to draft the regulatory legal document, and issuing legally binding instructions and regulatory decisions through its Board of Directors, where the higher levels of legally binding documents are to be issued by the Cabinet and the Parliament upon recommendations from JNRC. Moreover, JNRC was responsible for drafting the national Nuclear Safety and Security and Radiation Protection Policy.

In April 2014, the regulatory restructuring Law number (17) was issued by the Parliament. This law merged several regulatory bodies into the "Energy and Minerals Regulatory Commission - EMRC" as financially and administratively independent regulatory body in Jordan.

EMRC, as a successor to JNRC, has continued the development of the regulatory framework. EMRC has issued more than 50 instructions for the radiation and nuclear sector, with several other instructions (final drafts) are currently under the issuance process. The issuance of legal documents by EMRC follows the systematic approach outlined in the Management System of EMRC in accordance to its Quality Management Manual. Figure 1 illustrates EMRC internal approach in developing and issuance of its Legal Documents.

EMRC prepared the policy for the Safety of Radioactive Waste and Spent Fuel Management, which was issued by the Prime Ministry in 2015. In addition, EMRC has prepared the final draft of the Nuclear Safety Policy, which was reviewed by the stakeholders in Jordan, and subsequently approved by the Government in January 2016. Moreover, EMRC has received the IAEA IRRS mission and is currently implementing the developed Action Plan to ensure IAEA recommendations and suggestions are adopted. The EMRC-IRRS Action Plan and its implementation status is described in Appendix I of this report.

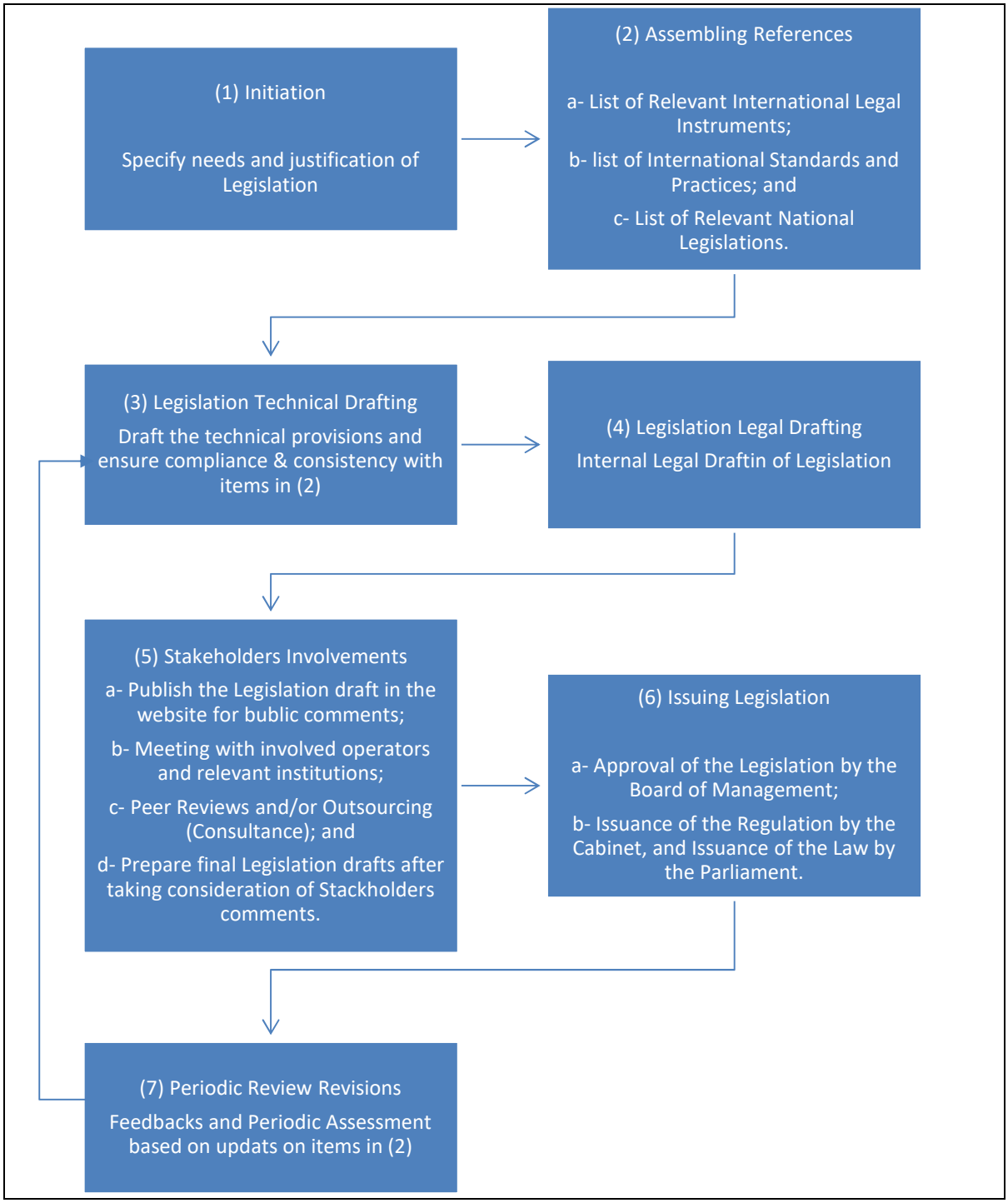

Figure 1: EMRC internal approach of the Legal Document development process

The issuance and approval of EMRC legislations was one of the major recommendations made by the IRRS mission. EMRC completed more than 50 legislations and drafted the Comprehensive Nuclear Law, which includes several recommendations documented in the IRRS report. The drafted Comprehensive Nuclear Law is now in the advanced approval stage and is expected to be issued in the 2nd Quarter of 2017. This Law was drafted and developed based on the IAEA standards, relevant international legal instruments, and good practices, as well as adopting the comments from IAEA Office of Legal Affairs on Law number (43) for the year 2007. The drafted Comprehensive Nuclear Law was sent to the Prime Ministry (Legislative and Opinion Bureau) in the 2nd Quarter of 2015, and approved by the Prime Ministry during the 4th Quarter 2015. EMRC discussed this Law with the Energy Committee

in the Parliament during the 2nd Quarter of 2016. The draft Law will be on the schedule of the upcoming Parliament that will be elected in September 2016, which is expected to be issued during the 2nd Quarter of 2017.

2.4 Jordan Atomic Energy Commission Commitment to Nuclear Safety

The Jordan Atomic Energy Commission (JAEC) is an independent body mandated to articulate a vision, strategy and roadmap to develop the use of nuclear technology for research, applications and generating electricity. JAEC acts as a member in NEPIO in Jordan, where NEPIO formed in 2014, chaired by the Minister of Energy and Minerals Resources, and has members form several ministries, and membership of EMRC CEO. JAEC represents Jordan locally and internationally in all areas related to nuclear energy, manages, and executes various projects of Jordan's Nuclear Program.

JAEC received the 2nd Phase INIR mission in 2014, and now implementing the Action Plan (Appendix II) to ensure the implementation of the IAEA recommendations and suggestions. The INIR mission defined several gaps (based on the IAEA SSG-16) in the safety infrastructure for Nuclear Power Program, and the developed action plan was reflected in the JAEC-IAEA Integrated Work Plan (IWP).

3 STATUS OF CONVENTION ON NUCLEAR SAFETY

The goal of the Convention on Nuclear Safety (CNS) was not to impose additional legal requirements nor to increase the commitments of an operating facility, but rather to provide an incentive-based instrument for nuclear plant operators, which share a common interest in sharing methods and procedures that improve nuclear operation safety.

The Convention allows a participating contracting party to submit reports that are peer reviewed at scheduled review meetings. This essentially provides a forum for exchange of ideas and methods practiced at the contracting party's facility, which contributes to the knowledge pool to enhance safe and efficient operations. The process of presenting reports at the forum and responding to questions from other parties helps each contracting party to achieve a high level of safety in its civil nuclear program.

In the next subsections, Jordan relevant institutions prepared interpretations on how fulfilling the Convention on Nuclear Security.

3.1 Article 4: Implementing Measures

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

Discussion:

This report explains and discusses the actions, including legislative, regulatory, administrative and other actions, taken by the Jordanian relevant entities for implementing Jordan's obligations under the CNS. In addition, this report reflects the approach of taking relevant actions toward continued commitment for fulfilling Jordan's obligations to the CNS.

3.2 Article 5: Reporting

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

Discussion:
This report is intended to fulfill the requirements of and to be in accordance to this Article.

3.3 Article 6: Existing Nuclear Installations

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

Discussion:
There are no operating Nuclear Installation for time this report prepared.

3.4 Article 7: Legislative and Regulatory Framework

CNS Text:

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

Discussion:
The legislative and regulatory framework in Jordan is simple and effective, and covers all obligations mentioned in CNS Article 7 (Legislative and Regulatory Framework). The legislative and regulatory framework in Jordan consists of Law (No. 43) for the Year 2007, Radiation Protection and Nuclear Safety and Security Law, and a number of legally binding Regulations were issued pursuant to the Article (26) of the aforementioned Law. Moreover, a large number of legally binding Instructions were issued pursuant to these Regulations, given that EMRC periodically reviews and amends these legal documents upon updates in the international legal instruments, standards and good new practices.

Most of EMRC regulations and instructions were reviewed through missions, workshops, and expert reviews by the IAEA, EC, national and international consultants, parties and experts, and all Regulations and Instructions are deemed to be in compliance with IAEA requirements.

The history and status of regulatory framework in Jordan is described in the following subsections.

3.4.1 The Law

According to Jordan's Legislative framework, the law is issued after the approval of Cabinet and the Parliament upon the competent authority's recommendation, and implemented after being published in the official gazette. The status and history of laws in Jordan which establish the regulatory framework for safety can be summarized as:

a. Law (No. 14) for the year 1987, Nuclear Energy Law (Implemented from 1987 to 2001);
b. Law (No. 29) for the year 2001, Nuclear Energy and Radiation Protection Law (Implemented from 2001 to 2007);
c. Law (No. 43) for the year 2007, Radiation Protection and Nuclear Safety and Security Law (Implemented since 2007 until now); and
d. The newly drafted Comprehensive Nuclear Law is now in advanced approval process (see section 2.3) to replace Law (No. 43) for the year 2007.

3.4.2 Regulations

The regulations are issued by the Cabinet upon the competent authority's recommendation, and these regulations explain in detail the provisions of the governing law. The regulations under the previous laws (Law (No. 14) for the year 1987 and Law (No. 29) for the year 2001), were replaced by the new regulations under Law (No. 43) for the year 2007. These regulations are:

e. Regulation on the safe use of nuclear energy (Approved by the Cabinet, published in the official gazette in April 2014);
f. Regulation on the Basis and conditions for granting licenses and permits for the radiation work (issued and implemented since February 2013);
g. Regulation on the Fees for licenses and permits for the radiation work (issued and implemented since February 2013);
h. Regulation on Radiation Protection (issued and implemented since March 2015); and
i. Regulation on the Safe Transport of Radioactive Materials (issued and implemented since April 2016).

3.4.3 Instructions

According to Jordan Legislative framework, the instructions are legally binding and implemented after approval from the competent authority's Board of Directors. The current status of the EMRC instructions relevant to Nuclear Safety and Security are:

a. Instructions Issued Under the Regulation on the Safe Use of Nuclear Energy Issued by EMRC in 2015 and its main reference(s) are cited as follows:

1. Instructions on the procedures for issuing site permit for nuclear power plants. Ref.: IAEA SSG-12, IAEA SSG-9, IAEA NS-R-3 and international practices;
2. Instructions on the procedures for issuing construction permit for nuclear power plants. Ref.: IAEA SSG-12, IAEA SSR-2/1;
3. Instructions on the Safety of Radioactive Waste Management. Ref.: IAEA GSR Part 5, Joint Convention on Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (JCSSFM&SRWM);

4. Instructions on the Safety of Spent Fuel Management. Ref.: JCSSFM&SRWM;
5. Instructions on the Decommissioning of Nuclear Facilities. Ref.: IAEA GSR Part 6;
6. Instructions on the nuclear safety, security and radiation protection requirements in the organizational structure in research reactors. Ref.: International Practice;
7. Instructions on the on-site emergency preparedness in nuclear and radiological facilities. Ref.: IAEA GS-R-2 & International Practice;
8. Instructions on off-site emergency preparedness for nuclear and radiological facilities. Ref.: IAEA GS-R-2 & International Practice;
9. Instructions on Safeguards and the State System for and inventory of nuclear material, Ref.: Safeguards Agreement & Additional Protocol to the Agreement;
10. Instructions on the Safety of Research Reactors. Ref.: IAEA NS-R-4;
11. Instructions on licensing specialized training and personal licenses in research reactors. Ref.: International Practice;
12. Instructions on the Trustworthiness of the research reactors workers. Ref.: International Practice;
13. Instructions on the Radiological Environmental Impact Assessment. Ref.: USNRC 1555 & International Practice;
14. Instructions on issuing licenses and permits for Subcritical Assemblies. Ref.: International Practice; and
15. Instruction on Fund for Decommissioning. Ref.: International Practice.

b. Instructions issued under the Radiation Protection Regulation by EMRC in 2015 (Ref. the IAEA GSR Part 3):

1. Instruction of radiation protection equipment's should be available in the institutions;
2. Instruction of the bases measures that concerning in protection of radiation workers from the risks of occupational exposure;
3. Instruction of tests and periodic calibration and dosimetry and conduct quality control tests of radioactive sources and radiological practices in medicine and bases of radiation safety assessment of the radiation sources;
4. Instruction for bases control of Radiation Protection;
5. Instruction of accreditation the Radiation Protection training course;
6. Instruction of preparation the reports and records of ionizing radiation sources;
7. Instruction of controls related to the radiation protection program and safety of radiation sources and the management system and quality of radiation sources and radiological practices and accidents and monitoring for verification of compliance;
8. Instruction of exempted practices from radiation protection requirements and standards of clearance level;
9. Instruction of special radiation protection for products of general use that contain radioactive material or emitting ionized radiation;
10. Instruction of radiation protection for classification of areas within the institutions;
11. Instruction of appropriate radiation protection for pregnant women or breastfeeding;
12. Instruction of medical protection programs of radiation workers;

13. Instruction of justifying practices and conditions of medical exposure and requirements of radiation protection when imaging the individual for non-medical purposes;
14. Authorization Instruction of personal dosimetry service providers;
15. Instruction of limits the radiation doses;
16. Instruction of personal dosimetry and area monitoring system; and
17. Instruction of public protection from radiation exposure.

c. Instructions on the basis and conditions for issuing permits and licenses for Radiation Works Issued by EMRC in 2015 (Ref. International Practices and IAEA Standards):
1. Instruction for authorization requirements of dental centers and clinics;
2. Instruction for authorization requirements of centers and clinics and departments of diagnostic radiology;
3. Instruction for authorization requirements of nuclear medicine clinics and centers;
4. Instruction for authorization requirements of radiotherapy centers and departments;
5. Instruction for authorization requirements of industrial and research and medical irradiators centers and departments;
6. Instruction for authorization requirements institutions of nondestructive tests by using radiation sources;
7. Instruction for authorization requirements of nuclear gauges institutions;
8. Instruction for authorization requirements of well logging institutions;
9. Instruction for authorization requirements of luggage's inspection devices; and
10. Instruction for authorization requirements of Cyclotron.

d. Generic Instructions and Internal Roles Issued by EMRC in 2015 (Ref. International Practices and IAEA Standards):
1. Roles of EMRC Inspection on Nuclear Facilities and Activities;
2. Roles of EMRC Inspection on Radiological Facilities and Activities;
3. EMRC Enforcement Policy;
4. Instructions on the Licensing of Radiation Protection Officers;
5. Instructions on the Categorization of Radiation Facilities;
6. Roles of EMRC in Qualification of Nuclear Inspectors;
7. Roles of EMRC in Qualification of Radiation Inspectors;
8. EMRC Quality Management Manual; and
9. EMRC Inspection Manual.

e. Instructions Issued under the Regulation on the Safe Transportation of Radioactive Material:
1. Instruction on the Safe Transportation of Exempted Packages.
2. Instruction on the Documentation for Transportation Permit.
3. Instruction on the Packages Design Specifications.
4. Instruction on the Categorization of Radioactive Material for Transportation.
5. Instruction on the Packages Limitations.
6. Instruction on the Packages Means of Transportation.

7. Instruction on Package Handling.
8. Instruction on Security of Transportation.
9. Instruction on Transportation of Fissionable Material.
10. Instruction on Safe Handling of Empty Packages.
11. Instruction on the Procedures for Issuing Personal Licenses for Transportation.
12. Instruction on Record Keeping for Safe Transportation

It should be reemphasized that all of these instructions were reviewed by several IAEA experts, EU experts, consultants, and national experts, and communicated with stakeholders prior to their issuance for comments and feedback.

In addition, according to Jordan's Legislative hierarchy, international treaties, conventions and agreements are legally located above the national laws, and come into force after the ratification. Jordan is a party to a number of relevant Nuclear Safety and Security international legal instruments, as shown in Table 1.

3.5 Article 8: Regulatory Body

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

Discussion:
In Section 3.5, a discussion on CNS Article 7 about EMRC and its legal framework, and the independence of EMRC to adopt technical requirements through EMRC instructions is presented.

According to articles number (3), (4) and (5) of Law (No. 43) for the year 2007, the Radiation Protection and Nuclear Safety and Security Law, JNRC (now EMRC) shall be established in Jordan, being a legal entity, financially, and administratively independent, and as such carries out all legal actions to achieve its objectives that include possession of movable and immovable properties; enter into contracts; apply for loans; and accepts aid, donations, contributions, and grants. Moreover, EMRC shall have the right to litigation in the legislature judicial proceedings and has the right to appoint the civil attorney general as its representative in the courts or any other lawyer for such purposes. In addition, EMRC shall be linked to the Prime Minister.

The organizational structure of EMRC is shown in Figure 2, where only the sections related to the Nuclear Safety, Security and Emergency Directorate (NSSD) are illustrated.

3.5.1 EMRC Objectives

EMRC, in coordination and cooperation with relevant authorities aims to achieve the following:

a. Regulate and control the use of nuclear energy and ionizing radiation;

b. Protect the environment, human health and property from the hazards of contamination and exposure to ionizing radiation in accordance with the provisions of the law number (34) for the year 2007;

c. Ensure the fulfilment of requirements of public safety, radiation protection, and nuclear safety and security; and

d. Establish the State System for Account and Control of Nuclear Material and fulfill the obligations of Safeguards Agreement and the Additional Protocol, and other relevant international legal instruments.

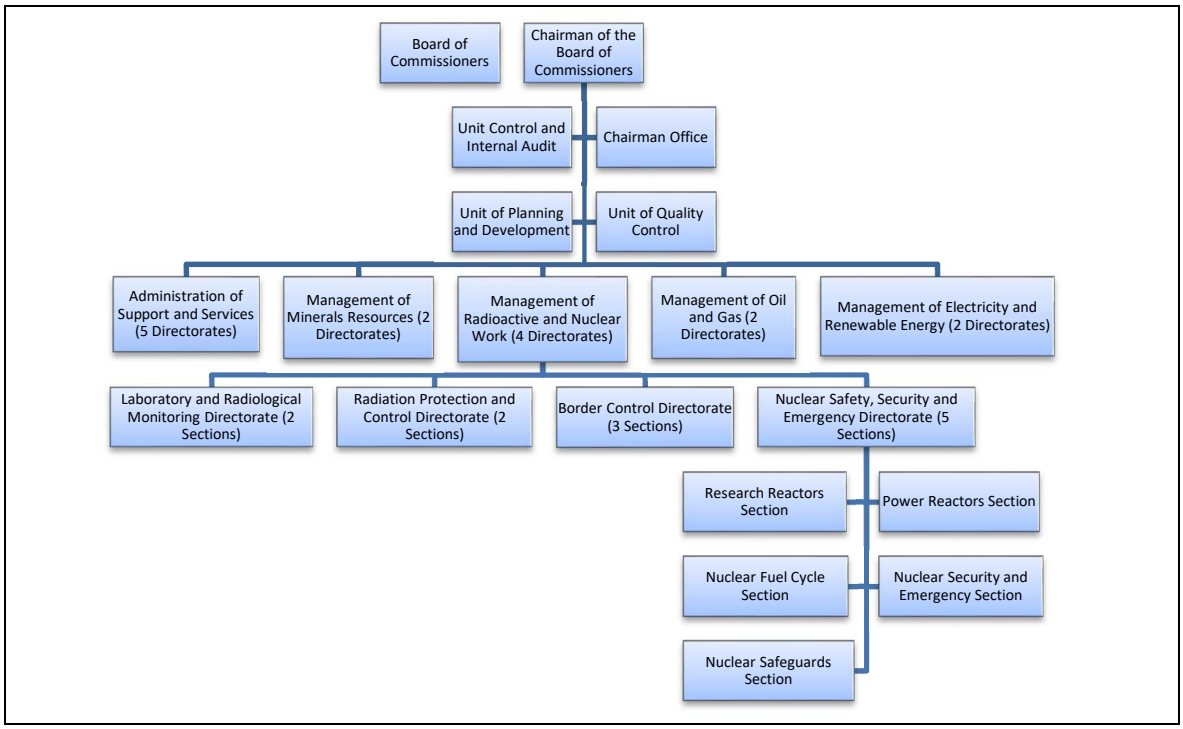

Figure 2: EMRC Organizational Structure

3.5.2 EMRC Duties and Powers

Moreover, EMRC shall undertake the following duties and powers:

a. Granting licenses and permits for radiation institutions, nuclear facilities, and workers in the radiation and nuclear fields.

b. Checkup of the commitment of the licensees to implement the terms of the law number (34) for the year 2007, and regulations and instructions issued accordingly.

c. Control on the implementation of the terms of the law number (34) for the year 2007 and conduct inspection for any installation or body for this purpose.

d. Contact institutions and commissions concerned with regulating and control of nuclear energy, radiation protection, and nuclear safety and security in the Arab and foreign countries to benefit from the expertise, scientific research, and assistance in their field of work.

e. Participate in Arab, regional and international projects concerned with nuclear energy, radiation protection, and nuclear safety and security, related to expertise or research with the consent of the cabinet.

f. Regulate relations between Jordanian entities concerned with radiation protection, and nuclear safety and security; and relevant international, regional and Arab organizations and agencies.

g. Implement comprehensive safeguards, and create a system to account for and control of all nuclear materials subject to these safeguards.

3.5.3 Capacity Building

For the authorization process of the planned Nuclear Power Plants and Research Reactors in Jordan, including the safety assessment of siting, design, commissioning, operation, decommissioning, and management of Consultant Services and Technical Support Organizations, EMRC is planning to recruit by the end of 2018, as plan shown in Figure 3, the following:

- 20 Nuclear Engineers;
- 5 Civil Engineers;
- 5 Electrical Engineers;
- 5 Mechanical Engineers;
- 5 Physicists;
- 2 Chemical Engineers;
- 2 Industrial Engineers; and
- 2 Environment Engineers.

The new recruits are deemed necessary to support ongoing and planned activities requiring EMRC oversight, support, and licensing as Jordan's competent authority for:

- JSA subcritical assembly, which is now in the operational phase;
- JRTR research reactor, and is now in the commissioning phase (> 98% completed);
- Nuclear Power Plants, which is now at the stage site survey and site selection;
- Uranium mining and milling, which is at the stage of preparing for submission of the application; and
- Waste Management Facilities (Central Storage Facility/JAEC and JRTR RTF).

Nuclear safety and security reviews during the licensing process, taking into consideration accuracy, transparency and quality requirements are critical factors. Constraint factors such as a lack of staff and knowledge should be early prevented by the management system of EMRC. In addition, inspection of nuclear facilities staffing and capabilities, including staffing for the resident inspectors on site is also early considered by EMRC, as well as licensing and inspection of uranium mines and mills, and also staffing consideration given to the responsibilities of EMRC in discharging the obligation of Jordan arising from international conventions and agreement, and the necessity of increasing the staff in the coming years because of the breadth of nuclear applications in Jordan in the near future. However, the implementation of this plan is continued to the end of the calendar year 2018. In addition to the (16) staff members in the Radiation Protection Directorate, EMRC currently employs the following in its Nuclear Safety and Security Directorate:

- Nuclear Engineers (9)
- Nuclear Physics (4)
- General Physics (1)
- Medical Physics (1)
- Mechanical Engineers (4)
- Environment Engineers (1)

- Civil Engineer (1)
- Electrical Engineer (1)
- Information Technology (1)
- Chemical Geology (1)
- Industrial Engineer (1)

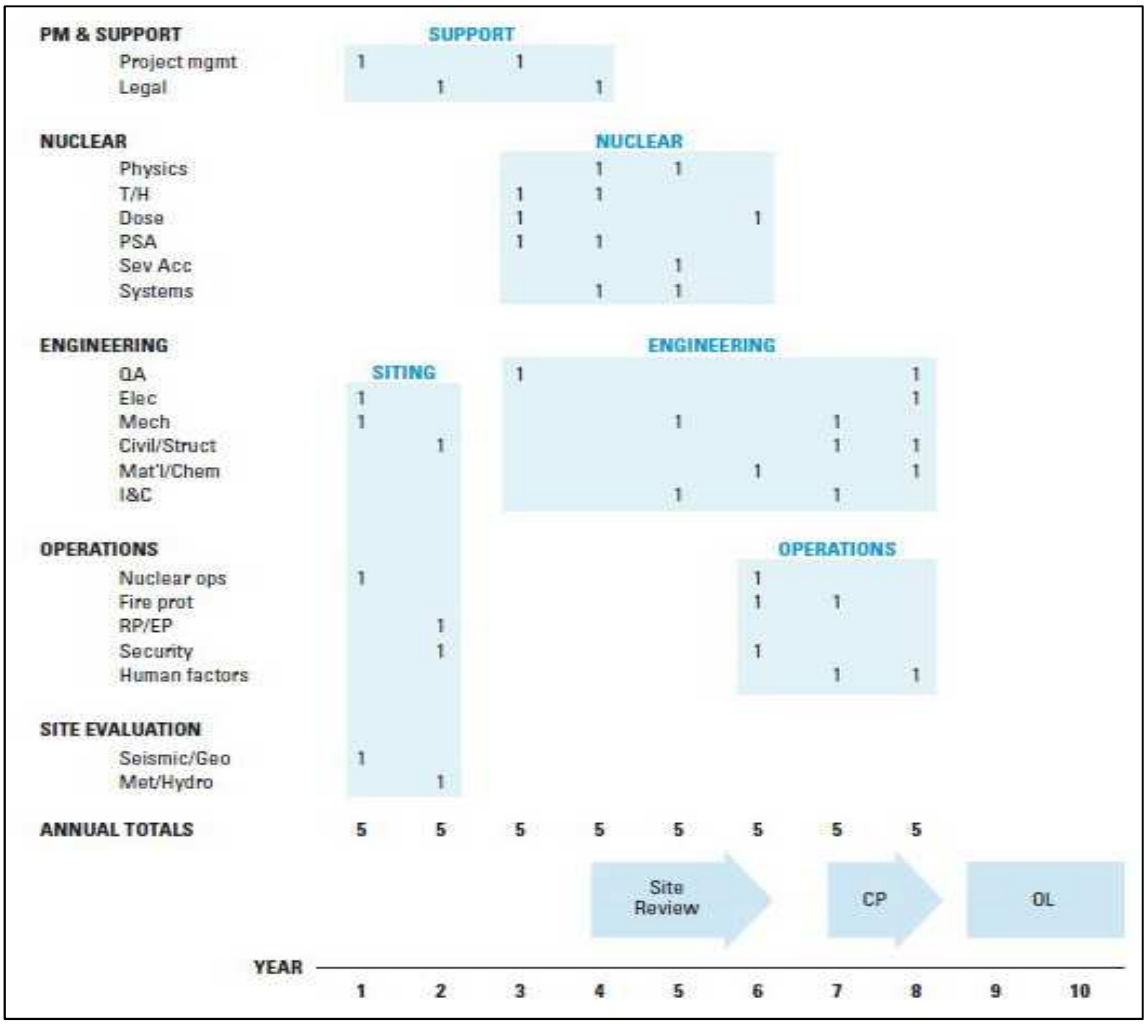

Figure 3: Adopted EMRC Nuclear Safety Staffing Plan

3.5.4 EMRC Quality Policy and Safety Culture

EMRC is committed to continually strive to meet and exceed the public expectations for service quality. EMRC establishes quality objectives to accomplish its goal in a professional and ethical manner. EMRC commits to continuous improvement of its quality management system and to develop and improve its Safety Culture Program through employee awareness and preventive actions. The Quality Policy of EMRC is based upon the following:

a. Comply with statutory and regulatory requirements applying to multi-discipline services (Radiation Protection, Radiation Licensing, Inspection, Enforcement, Nuclear safety & Security).

b. Develop and implement a systematic approach to achieve quality and reliability by driving continual improvement in all processes related to Radiation Protection, Nuclear Safety & Security and Control the Borders.

c. Cultivate and foster quality culture within EMRC.

d. Utilize EMRC resources and technical capabilities in Radiation Protection and Nuclear Safety & Security processes to the fullest extent possible in order to protect the health and safety of public and the environment.

e. Utilize communication methods and systems to ensure that EMRC requirements are fully understood by the Applicants.

f. Develop comprehensive competency and training requirements to ensure that all employees are trained to the extent necessary to deliver quality services.

g. Develop and maintain relationships with stakeholders who have the capability of consistent quality and delivery performance.

h. Identify, define and pursue continual improvement opportunities.

i. Continue to maintain a positive working environment that recognizes the importance of contribution at all levels of the commission.

j. Understand and maintain effective communications between all departments in the commission.

The Quality Policy is communicated and understood within the commission and reviewed periodically for continuing suitability. EMRC Management understands that Safety culture is an assembly of characteristics and attitudes in the organization and in individuals which establishes that, as an overriding priority, nuclear safety issues receive the attention warranted by their significant.

Safety Culture is at the heart of EMRC at the management level. Thinking about safety culture is obvious at the management level through providing the means to enhance this critical concept.

EMRC management will internally support improving the safety culture components, namely the EMRC internal framework for safety, the management hierarchy and responsibilities and the attitude of the EMRC staff at all levels in responding and benefiting from the framework for safety.

The EMRC management system, as established by the national framework for safety, shall be used to promote and support a strong safety culture by:

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

EMRC ensures that the licensee properly discharges this prime responsibility for safety, where EMRC in achieving this goal should:

- ✓ Promotes an effective safety management system in the operating organization by ensuring that there is critical self-assessment, correction and avoids acting in a manner that diminishes the responsibility for safety of the Operating organization;

- ✓ Oversight the effective self-regulating safety management system of the operating organization; and
- ✓ Monitors the performance of the organization and takes action if either the safety management system becomes ineffective or the safety performance of the organization declines.

EMRC ensures the existing of Safety Culture Programs in the operating organizations through the licensing process Further, it ensures that the safety culture requirements adopted in its relevant regulations and instructions are efficiently implemented. EMRC should ensure these requirements through regulatory inspections as the main element of EMRC oversight approach.

3.5.5 EMRC Quality Management:

EMRC has developed and is implementing Quality Management System (QMS) manual, this Quality Manual demonstrates and documents EMRC commitment to maintaining a high-level of quality and strong service within an environment that has safety as a first priority, focused on the stakeholders, and fosters continual improvement. Moreover, the quality management manual is intended to demonstrate conformance to IAEA GS-R-3.

EMRC QMS program is documented by written policies, procedures, or instructions and is carried out in accordance with those policies, procedures, or instructions. The quality assurance program provides control over activities affecting the quality of the review of applications for licenses or licensing activities to an extent consistent with their importance to safety. The program takes into account the need for reviewers to have appropriate technical skills to attain the required quality, and the need for verification of quality by in office review. The program provides for indoctrination and training of personnel performing technical review activities affecting quality as necessary to assure that suitable proficiency is achieved and maintained.

The QMS recognizes that the primary responsibility of a technical review body within the regulatory framework is to provide reasonable assurance that the public health and safety is protected. The QMS policies, procedures, and instructions reflects a collective commitment, on the part of the organization, that emphasizes safety over competing goals, such as resource expenditure and schedule, to ensure protection of people and the environment.

3.5.6 EMRC Structure:

As illustrated in Figure 2, EMRC is chaired by the Chief Executive Officer (CEO), with the consultation of Board of Commissioners (hereafter referred to as the Board). The Board comprises of:

a. The CEO of EMRC, who is also the Chairman of the Board.

b. Nuclear and Radiation Commissioner;

c. Electricity Commissioner;

d. Minerals Commissioner; and

e. Legal Commissioner.

EMRC reports directly to the Prime Minister, and it is functionally separated from any entity with responsibilities or interests that could unduly influence its decision making. It is therefore an effective independent nuclear regulatory authority. This is an evidence that the regulatory structure is established following IAEA requirements.

EMRC has about 400 staff members working in the head office in Amman, including 100 staff members working in the radiological border control offices with responsibility for controlling the trans-border transfer of nuclear and radioactive material.

3.5.7 EMRC Contracting and management of Technical Support Organizations Building Capacities

EMRC established two licensing projects with cooperation and TSO (with Korea Institute for Nuclear Safety-KINS and Advanced Systems, Technology and Management-AdSTM respectively) to conduct licensing process for nuclear facilities. The EMRC project managers were assigned from relevant staff, the competency of the Licensing Project Managers (PMs) was developed through expose to periodic Project Progress Review Meetings, in addition to that the competences of the PMs covers the main legal and technical aspects of their individual projects. Further, EMRC PMs participated in several occasions for training in Technical Cooperation Projects (such as with IAEA, EU), which includes a lot of knowledge and experience transfer and On the Job Trainings (OJT)s.

3.5.8 EMRC Future Development

EMRC will continue to develop and further improve the expertise of its staff. As with other relatively new organizations, EMRC faces the challenge of meeting high expectations regarding its staff performance with intermediate level of experience. It is very committed and ambitious in investing in its human resource capital so that its expertise meets the required international standards and its responsibilities within Jordan's nuclear energy program are fulfilled according to the IAEA's expectations.

In addition, EMRC addresses the licensing of the first Jordan nuclear research reactor, which is currently under hot commissioning and scheduled to be in operation by the end of 2016, and in the near and short-term, a key EMRC objective is to prepare its experts for the review of the first Jordan nuclear power plant licensing submission. As recommended by the IAEA, EMRC plans to establish strong relations with the NRA and the Technical Support Organization (TSO) of the vendor country providing the nuclear island. This approach will ensure the best possible transfer of experience and knowledge and will facilitate the Jordan-specific review of licensing applications.

3.6 Article 9: Responsibility of the License Holder

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

Discussion:

According to EMRC Regulation on the Safe Use of Nuclear Energy for the year 2014, the prime responsibility for safety of nuclear facilities is assigned to the operator. In addition, EMRC has the capability with number of regulatory functions which allows EMRC to ensure compliance with the regulatory requirements, includes inspections and enforcement actions. In addition, this requirement is also included in the drafted Comprehensive Nuclear Law that is expected to be enforced 3rd Quarter of 2017. On the other hand, for the Civil Liability, Jordan had joined the Vienna Convention on Civil Liability for Nuclear Damage, and ratified by National Law in 2015, in which the prime responsibility on Civil Liability for Nuclear Damage are assigned to the operator.

3.7 Article 10: Priority to Safety

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

Discussion:

Jordan Atomic Energy Commission (JAEC) is the governmental competent authority for developing Jordan's Nuclear Program; JAEC adopts high standards of safety in developing the nuclear energy program. JAEC has defined clear set of criteria for selecting the nuclear technology, and has proceeded with the bidding process on this basis. Most of these criteria have a direct or indirect impact on nuclear safety and security. This is shown by its decision to consider only Generation III and III+ advanced reactor technology, in which only a contemporary design meeting the highest safety and security standards will be implemented. The main criteria used for selecting the future designs and design providers of Jordanian nuclear technology include in particular:

- Core damage frequency (CDF);
- Consideration of beyond design basis events (severe accidents) in the design of the plants – prevention and mitigation;
- Consideration of the impact of crashing a large commercial aircraft into the plant, and the effect of external explosions, seismic and other external events in the design;
- Consideration of operator accident mitigation;
- Radiological parameters during normal operation and accidents (design basis and beyond) – the effective dose to the population, quantity of releases to the environment;
- Modern man-machine interface;
- Minimization of the exclusion zone;
- Implementation of digital instrumentation and control;
- Redundancy and diversification of safety systems;
- Introduction of passive components and systems;
- Reliability and security of fuel supply and proposed options for spent fuel management;
- Generation, quantity and treatment of radioactive waste;
- Existence and implementation of a Quality Management Program; and
- Consideration of Jordan's site-specific seismicity.

3.8 Article 11: Financial and Human Resources

CNS Text:

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

Discussion:

EMRC is administratively and financially an independent governmental body, where the recruitment process in EMRC is through the adopted governmental recruitment process. The human resources needs for a given calendar year shall be defined before the end of the preceding calendar year, then the candidates come through the Civil Service Bureau where written examination and appointment arrangements shall be arranged with the recruiting body (i.e. EMRC). The EMRC budget is given from the State Budget, in which EMRC shall prepare a request budget including its projects and justifications in the preceding calendar year. This budget shall be approved by the Parliament.

For JAEC, and as discussed in section 2 (Nuclear Safety Policy and Strategy in Jordan) regarding the independence of JAEC and its objectives; JAEC is aimed to develop a national plan for nuclear human resources, and carrying out impact assessments on various economic sectors throughout the cycle of nuclear use.

JAEC has solicited, negotiated and is currently implementing installation of a 5 MW multi-purpose research reactor and sub-critical assembly at the Jordan University of Science and Technology, for educational and research purposes. These facilities will be an integral part of a future nuclear research and development center in the country. JAEC also operates laboratories for the analytical measurement of uranium and is responsible for locating partners to explore Jordan uranium deposits.

JAEC policy is to leverage Jordan's industrial capacity, in particular construction companies, architecture and engineering firms, and the cement and steel industries, to support the construction of the nuclear power program.

JAEC has signed Nuclear Cooperation Agreements with several nuclear countries such as France, China, South Korea, Canada, Russia, United Kingdom, USA, Argentina, Spain, Japan, Ukraine and Romania For cooperation in the peaceful uses of nuclear energy. In addition, to develop the necessary qualified human resources, JAEC is constantly in pursuit of qualified and experienced staff in addition to training of new graduates to ensure that highly educated and motivated staff are available for NPP project. Moreover, JAEC is offering scholarships for continuing education in the nuclear fields.

3.9 Article 12: Human Factors

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

Discussion:

According to EMRC instructions on the safety of nuclear power plants, Article 21.b.5 and Article 31.b, and EMRC instructions on the safety of research reactors, EMRC requires that

the human factors and human–machine interfaces shall be given systematic consideration at an early stage of the design and throughout the entire design process. In addition, EMRC requires that special consideration shall be given to human factors and the application of ergonomic principles in the design of the control room and reactor systems as appropriate.

For the Jordan Research and Training Reactor, EMRC requires the organization structure and operation staff to be submitted in accordance to specific EMRC developed regulatory instructions, where the Senior Reactor Operators, Reactor Operators, Fuel Handlers, RPO, Radiation and Maintenance Staff are subject to licensing process which includes specific experience, scientific and engineering background, special training, written and practical examination. In addition, the facilities operators shall submit their Operational Organization in accordance to specific EMRC developed regulatory instructions.

3.10 Article 13: Quality Assurance

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

Discussion:

According to EMRC regulatory framework, namely EMRC regulation on the Safe Use of Nuclear Energy, Article 7.r, the applicant should submit QAP for all the stages of the nuclear facility and activities. For instance, JRTR operation organization has submitted its QAP, which is applied to all design, procurement, and construction activities, such as procurement, manufacturing, installation, inspection and test. This organization was subject to several EMRC QA inspections (see discussion in 11- Article 14. Assessment and Verification of Safety).

Throughout the licensing process of the research reactor, EMRC has performed daily inspections on various activities. Further, several QA inspections were conducted covering the operating organization, suppliers of the main reactor components (POSCO PANTEC in South Korea) and fuel (CERCA in France).

Table 2 shows the list of QA inspections conducted by EMRC with KINS, as well as EMRC with its TSO (AdSTM):

Table 2: List of QA Inspection Missions on JRTR Research Reactor Project

Mission Number	Inspection Subject	Start Date	End Date
1.	E&T: QA Inspection	04/29/2012	05/03/2012
2.	QA: Inspection (JAEC and KDC)	03/03/2013	03/12/2013
3.	QA: Inspection (POSCO Plantec)	10/14/2013	10/17/2013
4.	QA: Inspection (KDC)	06/29/2014	07/02/2014
5.	QA: Follow Up Inspection (POSCO Plantec)	09/29/2014	10/02/2014
6.	QA: Inspection (CERCA)	20/10/2014	20/10/2014
7.	E&T: Follow Up QA Inspection	6/1/2014	10/1/2014
8.	QA: Follow Up Inspection (JAEC)	14/2/2016	17/2/2016
9.	QA inspection on commissioning procedures	3/4/2016	7/4/2016

3.11 Article 14: Assessment and Verification of Safety

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

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

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

Discussion:

According to the law number (43), Radiation Protection and Nuclear Safety and Security Law, Articles 10.a.3 and 21.a, EMRC has the legal authority to conduct safety reviews and inspections to verify transport organization management system compliance with regulatory requirements.

In addition to that and according to EMRC Regulation on the Safe Use of Nuclear Energy number (43) for the year 2014, Article 6, EMRC empowered to issue, amend, suspend or revoke licenses and permits in accordance with the regulations and instructions in force by EMRC, based on the principles of fairness and transparency and the recommendations of the EMRC Board of Commissioners, including:

a. Operation of Nuclear Installations and Facilities.

b. Siting for Nuclear Facilities and Installations.

c. Safety and Security of Nuclear Power Plants.

d. Safety and Security of Research Reactors.

e. Radioactive Waste Management.

f. Spent Fuel Management.

g. Decommissioning of Nuclear Facilities.

h. Transportation of Nuclear Material.

i. Operation of the nuclear facility or installation

j. Specialized training in the nuclear field.k. Personal licenses for radiation and nuclear workers.

L. Siting of a nuclear facility.M. Construction of a nuclear facility.

n. Commissioning of a nuclear facility.

O. Decommissioning of a nuclear facility.

P. Transportation of nuclear materials.

Q. Commercial transactions involving nuclear facilities or nuclear material.

R. Import of nuclear materials or export of nuclear materials, radioactive waste, nuclear spent fuel.

S. Transit of nuclear materials, radioactive waste, spent fuel.

t. The activities that lead to the amendment of:

1. The structures, systems and components important to nuclear safety, nuclear security and radiation protection at nuclear facilities.
2. Limits and requirements for the safe operation of the nuclear facility or installation, which was the basis of the operation license of the nuclear facility or installation.
3. Internal procedures and rules related to nuclear safety, security and radiation protection in the nuclear facility or installation, including the instructions, programs, technical specifications, and conditions that are included in the operation license of the nuclear facility or installation.

U. Nuclear personal licenses.

EMRC applied its regulatory review licensing requirements on Jordan Research and Training Reactor (JRTR) and Jordan Subcritical Assembly (JSA), in addition to EMRC local safety review capabilities, EMRC also has formal agreements in place for multinational cooperation that enhances safety, particularly through harmonized approaches and increased quality and effectiveness of safety reviews and inspections with KINS and AdSTM TSO.

Licensing of JRTR is an example of EMRC approach for authorization of nuclear facilities. Several safety review rounds, Request for Additional Information third Party Opinions and Witness activities were performed. Figure 4 illustrates the flow charts of the adopted Safety Review Approach during the licensing process for JRTR research reactor for the two stages of license (namely Construction Permit and Operation License). Further Progress Review Meetings with Korea Institute of Nuclear Safety and with TSO, inspections and witness have been conducted since 2010. Table 3 list the major inspection mission conducted on the JRTR project, where the inspection extends to the operator, designer, constructor and subcontractors, in addition to the daily and reaction inspections conducted by EMRC and its resident inspectors in the JRTR research reactor site.

Table 3: List of Major Inspection Missions on JRTR Research Reactor Project

Mission Number	Inspection Subject	Start Date	End Date
1.	E&T: QA Inspection	04/29/2012	05/03/2012
2.	POI: Structural Area - 1st	01/28/2013	02/13/2013
3.	QA: Inspection (JAEC and KDC)	03/03/2013	03/12/2013
4.	Audit for EQ Testing of Electrical and I&C Equipment	05/06/2013	05/16/2013
5.	QA: Inspection (POSCO Plantec)	10/14/2013	10/17/2013
6.	POI: Structural Area - 2nd	01/23/2014	04/07/2014
7.	E&T: Welding and Facility Installation Inspection	04/27/2014	05/01/2014
8.	POI: Structural Area - 3rd	05/20/2014	06/05/2014
9.	POI: Facility installation (Mechanical Area) - 1st	10/05/2014	11/21/2014
10.	POI: Meteorological and Environmental Radiation Monitoring Area - 1st	12/01/2014	12/31/2014
11.	Flap Valve EQ test (Samshin)	06/23/2014	06/27/2014
12.	Performance Test of CRDM/SSDM (POSCO Plantec)	09/02/2014	09/02/2014
13.	QA: Inspection (KDC)	06/29/2014	07/02/2014
14.	Audit for EQ/SQ Test of Electrical and I&C Equipment	09/15/2014	09/24/2014
15.	QA: Inspection (POSCO Plantec)	09/29/2014	10/02/2014
16.	QA: Inspection (CERCA)	20/10/2014	20/10/2014
17.	E&T: QA Inspection	6/1/2014	10/1/2014
18.	POI: Structural Area - 4th	04/19/2015	04/23/2015
19.	POI: Facility installation (Mechanical Area) - 2nd	12/7/2015	15/7/2015
20.	POI: 2nd Pre-Operational Inspection of JRTR on Mechanical Area	15/7/2015	16/7/2015
21.	POI : 1st POI on electrical Area of the JRTR	29/11/2015	3/12/2015
22.	POI: 3rd POI on Mechanical Area of the JRTR	29/11/2015	3/12/2015
23.	1st Pre-Operational Inspection of JRTR on Radiation Protection Area	29/11/2015	3/12/2015
24.	1st Pre-Operational Inspection of JRTR On the Fire Protection System	10/1/2016	14/1/2016
25.	First Pre-Operational EMRC-KINS Team Inspection of the System Performance Tests (Commissioning Test Stage A2) for the Primary Cooling System and Connected Systems	10/1/2016	14/1/2016
26.	Second Pre-Operational EMRC-KINS Joint Team Inspection of the SPTs (System Performance Tests) (Commissioning Test Stage (A2)) &ISTs (Integrated System Tests) for the Primary Cooling System and Connected Systems	10/1/2016	14/1/2016
27.	Commissioning Inspection for I&C and HSI	13/3/2016	17/3/2016
28.	QA: Follow Up Inspection (JAEC)	14/2/2016	17/2/2016
29.	QA inspection on commissioning procedures	3/4/2016	7/4/2016

Moreover, EMRC prepared its planned chart for issuance of Operation License for the JRTR, it consists of five licensing steps, defined as (see Figure 4):

Step 1: JAEC should submit the FSAR, Commissioning program, Accident Analysis Report, Operating procedures and Training & Qualification program; to be reviewed by EMRC.

Step 2: EMRC will review the submitted document in order to give JAEC the hot commissioning authorization to start fuel loading and power accession to full power commissioning test. EMRC should make sure that CP conditions are completely fulfilled by JAEC.

Step 3: JAEC should submit the final commissioning report showing the results for commissioning tests; to be reviewed by EMRC.

Step 4: EMRC will review the final Commissioning Report submitted by JAEC for OL issuance.

Step 5: EMRC will issue the operation license.

Notes:

- Application for Construction of Radioactive Waste Treatment (RWT) Facility was submitted, reviewed and licensed before issuance of the OL.
- Emergency and Security Plans was approved by EMRC before fuel loading.

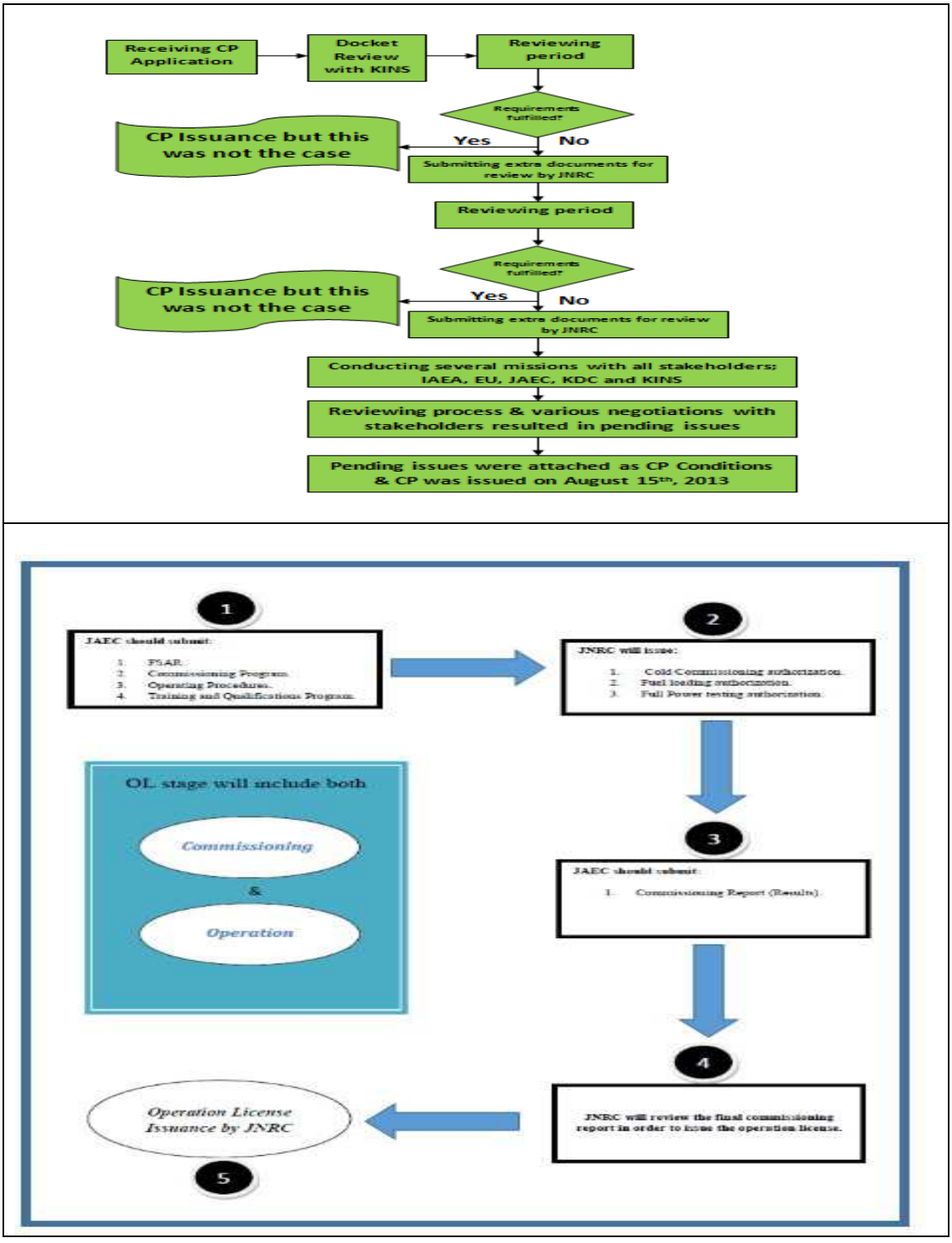

Figure 4: EMRC Licensing Flow Charts for JRTR Research Reactor

In September, 2015, JAEC hosted IAEA Expert Review Mission on the JRTR research reactor, and based on the mission recommendations, JAEC developed and implemented Action Plan to ensure consistency with the IAEA safety standards (NSR-4). The main recommendations was the request of establishing and activate the Safety Committee. Hence JAEC established and involved this committee in the commissioning of JRTR, and it will pursue its work during the Operation Stage of JRTR research reactor. On the other hand, EMRC inspections are considering in its objectives the implementation of this Action Plan. In January, 2016, EMRC hosted IAEA Expert Mission to assess EMRC licensing process for the

JRTR research reactor, and adopted the IAEA mission recommendations in EMRC licensing process.

3.12 Article 15: Radiation Protection

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

Discussion:

In 2015, the government of Jordan issued the Radiation Protection Regulation and its implementing Instructions, based on the IAEA GSR Part 3, after more than 2 years of technical and legal drafting. This regulation shall be applicable for nuclear facilities and activities.

In the JRTR research reactor project, the EMRC Radiation Protection Directorate staff conducted safety review on the Radiation Protection Program (RPP) jointly with Radiation Protection Experts from Korea Institute for Nuclear Safety, as well as they conducted several radiation protection inspections which covers the implementation of the RPP. In addition, EMRC Radiation Protection Directorate is issuing radiation protection personal licenses based on regulatory requirements set forth in the regulation on the Bases for Issuing License and Permits for Radiation Facilities and Activities number (8) for the year 2013. According to EMRC Regulation on Radiation Protection for the year 2016, all radioactive practices and the use and circulation of radioactive sources in any way shall be deemed to meet the requirements if the following conditions are satisfied:

a. Such practices and use are justified.
b. The resulting radiation exposures do not exceed the allowable dose limit.
c. Radiation protection is optimized.

Moreover, and according to EMRC Regulation on the Safe Use of Nuclear Energy number (43) for the year 2014, Article 5, the occupational radiation exposure and public exposure shall always be As Low As Reasonably Achievable (ALARA) taking into account the economic and social factors, and not to exceed dose limits set by the Commission.

In addition and according to the law number (34) for the year 2007, Radiation Protection and Nuclear Safety and security Law, Article 15.g, the licensee should notify EMRC and the Civil Defense Directorate by any possible means immediately in case of an accident that caused or may cause an environmental contamination, or exposure of any person to a radiation dose exceeding the dose limits, or in case of loss, damage or loss of control of any source of ionizing radiation. Clarification of the details of the accident and the reasons that led to the accident, must immediately be followed by a written documentation of the notification.

All these requirements are considered in the licensing process through EMRC dose assessment analysis, for instance, the design safety reviews of JRTR, JSA and SESAME Synchrotron Facility, conducted by EMRC ensures the dose optimization and limitation.

3.13 Article 16: Emergency Preparedness

CNS Text:

1. Each Contracting Party shall take the appropriate steps to ensure that there are on-site and off-site emergency plans that are routinely tested for nuclear installations and cover the activities to be carried out in the event of an emergency. For any new nuclear installation, such plans shall be prepared and tested before it commences operation above a low power level agreed by the regulatory body.
2. Each Contracting Party shall take the appropriate steps to ensure that, insofar as they are likely to be affected by a radiological emergency, its own population and the competent authorities of the States in the vicinity of the nuclear installation arc provided with appropriate information for emergency planning and response.
3. Contracting Parties which do not have a nuclear installation on their territory, insofar as they are likely to be affected in the event of a radiological emergency at a nuclear installation in the vicinity, shall take the appropriate steps for the preparation and testing of emergency plans for their territory that cover the activities to be carried out in the event of such an emergency.

Discussion:

According to the law number (34) for the year 2007, Radiation Protection and Nuclear Safety and security Law, Article 15.a, every licensed establishment shall provide the necessary precautions for radiation protection, and nuclear safety and security consistent with the nature of the radiation source and the expected hazard and it's extent, and appoint a radiation protection and nuclear safety and security officer, setting of an emergency plan proportionate with the nature of the work of the establishment according to the regulations issued in accordance to the terms of this law.

Besides that, EMRC Regulation on the Safe Use of Nuclear Energy, Articles (15,16, 17, 18 and 19), the licensee implementing activities related to design, construction, commissioning, operation and decommissioning of nuclear facilities and to manufacturing, transportation and storage of nuclear material shall establish measures for emergency planning and emergency preparedness, and emergency planning measures shall be established by the emergency plans:

a. For protection of the population (off-site emergency plan), which regulates the emergency planning areas and determines the actions to be taken by the competent authorities to protect the population, property and environment in the case of an accident;
b. For the nuclear facility (on-site emergency plan), which determines the actions to be taken by the licensee for accident mitigation and remediation of consequences in co-ordination with the off-site emergency plan.

Moreover, EMRC had issued Instructions on the Emergency Preparedness and Response for Nuclear Facilities, and EMRC National Rules for Emergency Preparedness and Response. These Instructions and Rules were established for the implementation of EPR, and was applicable for the JRTR research reactor, where the facility Emergency Plan was subject to review, inspections and drills.

Jordan National Committee for Nuclear Emergency was established in January, 2014 by a Prime ministry Decree, to be under EMRC coordination The Committee shall work on the preparation, drafting, review and coordinate the off-site National Emergency Plan, in addition to review the facility level (on-site) Emergency Plan, six months prior to the commissioning of a nuclear facility, this review is the basis of EMRC approval of the plan in accordance to the licensing process.

A national Emergency Exercise was conducted in March 2016 on the site of the JRTR research reactor, where the national competent authorities participated in this exercise, prior to JRTR research reactor fuel loading and hot commissioning.

EMRC has received IAEA EPREV mission in 2013, and developed Action Plan to cope with the recommendation of the mission. This Action Plan was implemented and completed by the end of April 2016.

In May 2016, IAEA and EMRC organized Regional workshop to develop the national EPR Self-Assessment Emergency Preparedness and Response Information Management System (EPRIMS) for the regional countries including Jordan where Jordan completed the National EPR Self-Assessment report (IAEA EPRIMS website).

3.14 Siting

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

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

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

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

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

Discussion:

According to EMRC Instructions on the procedures for issuing site permit for nuclear power plants, the site selection process is divided into two stages (Figure 5 and Figure 6). The first stage "site survey" considers potential sites based on existing data. The second stage is the actual selection of the site and may be considered part of the "site evaluation" which aims to confirm the acceptability of the final site and to establish the parameters needed for the design of the nuclear power plant. Site evaluation continues throughout the entire life of the nuclear installation to take into account the changes of the site characteristics, evaluation methodologies and safety standards. After the site selection stage, the confirmation of site acceptability and a complete site characterization are performed during the site assessment stage. This process eventually leads to the preparation of the Site Evaluation Report as a basis to the Site Chapter of the PSAR. All the site related activities after the approval of the SER by the Commission and which involve confirmatory and monitoring work are in the pre-operational stage. With the approval of the FSAR the open-ended operational stage for site evaluation starts. This includes all confirmatory, monitoring and re-evaluation work throughout operation and especially during periodic safety reviews.

In the site survey studies, consideration should be given to Specific Screening Criteria, including:

- Population
- Feasibility of Emergency Plans

- Capable faults
- Foundation hazards
- Airplane crash hazard
- Other human-induced hazards
- UHS Safety

The details of these regulatory requirements are explained in the EMRC instruction on the Site Survey and Site Selection for NPPs, and in EMRC instruction on the Site Evaluation for NPPs.

In addition, EMRC requires different databases are needed to undertake the site selection process. The following databases should be established:

- Fault displacement database
- Volcanological database
- Coastal flooding database
- River flooding database
- Meteorological extreme events database
- Human induced events database
- Geological database
- Seismological database

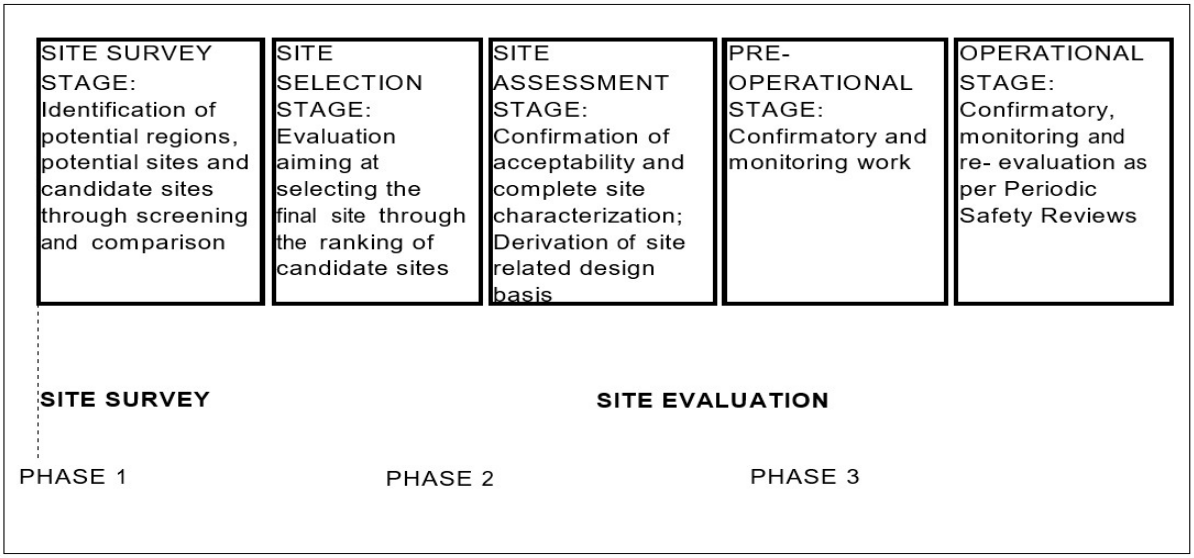

Figure 5: EMRC Siting Process Chart.

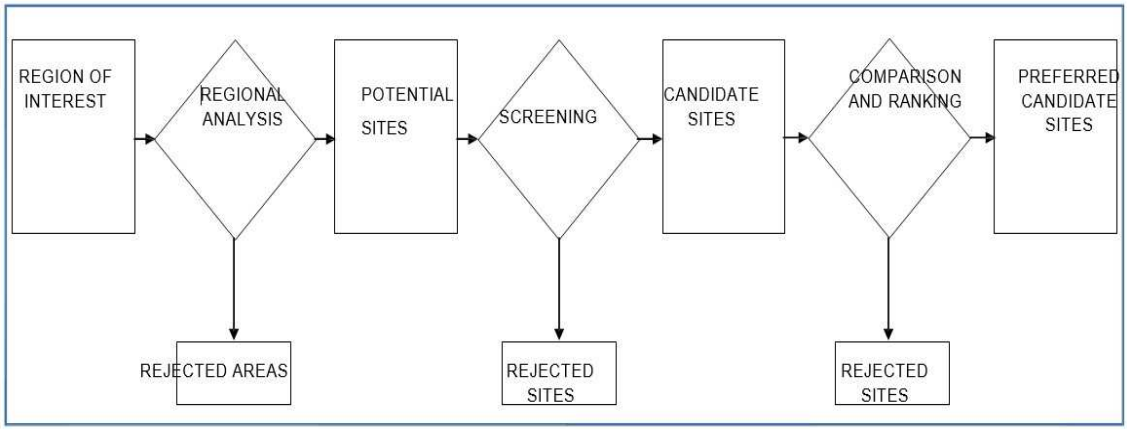

Figure 6: Site Selection Decision Tree Process

In 2015, JAEC contracted KEPCO from South Korea to conduct the siting studies for the planned Jordan Nuclear Power Plants. KEPCO conducted geologic investigations to check site suitability and acceptability by confirming the absence of geological hazards as defined in the exclusivity criteria set out by EMRC, where the presence of a capable fault within the near region of the site is a defined exclusion criteria. The evaluation of such faults is commonly based on estimation of the time of the last movement. Until now, the siting studies is not officially submitted to the regulatory body (EMRC).

EMRC applied these criteria in JRTR research reactor in a graded approach, where further studies (such as Probabilistic Seismic Hazard Analysis, 1 km fault analysis) was requested by EMRC to the siting studies for the Jordanian research reactor (JRTR) based on the IAEA Guide (SSG-9, the Seismic Hazards in Site Evaluation for Nuclear Installations). These additional site studies was reviewed by EMRC, IAEA, KINS and EU. Also Radiological Environmental Report was required by EMRC as a part of the Environmental Impact Assessment, and reviewed by EMRC, IAEA, KINS and EU, the site evaluation studies for JRTR are listed in Table.4.

Table 4: Siting Submittals for JRTR Research Reactor Project

Submittal	Reviewers (in addition to EMRC)	Notes
Site Characteristics (PSAR, Ch-3)	IAEA, KINS, NucAdvisors, EU	N/A
PSHA & DSHA	IAEA, KINS, NucAdvisors, EU, National Expert (Prof. Najeeb Abu Karaki)	EMRC contracted the seismic national Expert (Prof. Najeeb Abu Karaki), because of the KINS recommendation that a seismic national expert should review seismic studies, since the subject of seismicity depends mainly on the experiences and the cumulative seismic history of the region under study.
1 km fault study	IAEA, KINS, NucAdvisors, EU, National Expert (Prof. Najeeb Abu Karaki)	N/A
Site survey studies and QA of the site selection process.	KINS	N/A
Soil Liquefaction and Rocks Studies	KINS	N/A
EIA	Ministry of Environment	National EIA Committee
RER	IAEA, KINS	Part of EIA

3.15 Article 18: Design and Construction

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

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

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

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

Discussion:

According to EMRC instruction on the safety of research reactors, Article 24, the EMRC criteria for assessing the acceptability of the design of research reactors is that the design shall ensure that the nuclear installation is suited for reliable, stable and easily manageable operation, and ensure that the design of SSCs complies with the requirements adopted by EMRC. The prime goal shall be the prevention of accidents. In addition, the design shall include the appropriate application of the defense in depth principle, and ensure that failures or combinations of failures that might lead to significant radiological consequences are of very low probability. Further, the design shall comprise features to minimize the possibility of failures due to a common cause by means of the independence, physical separation and diversity of equipment.

According to EMRC instruction on the safety of research reactors, Article 27, EMRC require that the defense in depth concept being applied in the design to provide graded protection against various reactor transients, including transients resulting from equipment failure and human error and from internal or external events that could lead to a Design Basis Accidents (DBA).

In JRTR, the defense-in-depth strategy applied to design the facility against potential human errors and unexpected mechanical failures. A defense-in-depth principle adopted to ensure that the reactor design and operation incorporates multiple levels of protection against the release of radioactive materials. The successive level of defense- in-depth is the prevention of deviations from normal operation, and the mitigation of the radiological consequences of significant releases of radioactive materials.

The criteria of the JRTR design is an adoption of conservative design factors, completeness of quality assurance activities, and the completeness of test and monitoring activities. They strengthen the prevention of an abnormal radioactive material release. A prompt response and measure for an abnormal condition during an operation is reliable and prompt directions and measures against a system in line is provided in order to ensure a regulating capability of an operation.

An initial accident shall be prevented from spreading into a serious one with a reactor protection system and engineered safety features. Emergency and protective measures to the reactor auxiliary facilities shall be applied to prevent environmental contamination and dispersion of radioactive materials.

EMRC require three basic safety functions to have multi barriers defense in-depth precautions, namely: i) a reactor shutdown, ii) a decay heat removal, and III) confinement of

radioactive materials shall be satisfied by implementing appropriate inherent and passive safety features, safety systems and engineered safety features.

Concerning the technologies incorporated in the design and construction of a nuclear installation, EMRC has several requirements and regulatory instruments to ensure the quality of Structures, Systems and Component (SSCs), services and activities relevant to nuclear facilities and activities, these requirements and regulatory instruments includes:

- QA Inspection on applicant (during construction, commissioning and operation), manufacturer and vendors (as the evidence in the discussion to 3.11- Article 14. Assessment and Verification of Safety).
- Witnessing test activities (as the evidence in the discussion to 3.11- Article 14.
- Assessment and Verification of Safety).
- Witnessing installation activities.
- Requesting acceptance reports and internal audit reports.
- Requesting of certificates of service providers and chain suppliers in nuclear projects.

Moreover, JAEC dispatched 40 nuclear engineers and scientific staff for Master Degrees academic program and long-term training programs to JRTR research reactor country of origin, South Korea (KAERI and KAIST university), to study nuclear safety and nuclear design.

JAEC nuclear engineers and the scientific staff are now involved in the hot commissioning of the JRTR research reactor.

3.16 Article 19: Operation

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

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

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

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

(iv) procedures are established for responding to anticipated operational occurrences and to accidents;

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

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

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

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

Discussion:

There is no operational nuclear installations in Jordan until now, but EMRC has provided the applicant (JAEC) with the regulatory requirements for the operational stage of nuclear installations, set forth in EMRC instruction on Safety of NPPs and EMRC instruction on Safety of Research Reactors, where all safety requirements listed in CNS Article (19) are included in the mentioned EMRC instructions.

In addition, several JAEC nuclear engineers acquired long-term training programs on research reactor operation in the JRTR designing institution (KAERI), the engineers were subject to EMRC-KINS written and practical examination to be Senior Reactor Operators and Reactor Operators for the JRTR research reactor.

4 CONCLUSIONS

As a conclusion to the discussion contained in the status report of CNS, Jordan has made many actions toward fulfilling its obligations to the CNS, including enforcing the necessary legislative regulatory framework, and building capacities and infrastructure for nuclear energy, continues support from the Government of Jordan, commitment on cooperation and fulfilling obligations of the International Legal Instruments.

This CNS status report emphasizes the commitment to safety in all EMRC and JAEC activities, decisions and considerations to protect public, properties and environment from harms of radiation, and despite of shortage in financial resources of EMRC, the capacity building and development of competencies is constantly progressing, and EMRC has succeeded in acquiring funds for contracting AdSTM company as a TSO for licensing JRTR,

and has a Special Agreement with KINS for the same purpose, in addition, EMRC started the TSO bidding process for siting and EIA for the planned NPPs.

EMRC has developed capabilities for establishing Quality Management System to ensure the compliance with the provisions of CNS. In addition, EMRC built capabilities to conduct safety reviews on nuclear safety and radiation protection. Concerning Emergency Planning and Preparedness, EMRC completed the implementation of a Corrective Action Plan to the IAEA EPREV mission since 2013, in which adequate EPR requirements are included in EMRC regulatory requirements, and in compliance with the IAEA EPR relevant requirements and international legal instruments. Regarding Siting, Design, Construction and Operation of nuclear installations, EMRC has developed, and partially implemented to the extent of the progression in Jordan Nuclear Projects, all safety and safety related requirements, which are in compliance with the IAEA requirements, where EMRC hosted several IAEA Expert Missions to review siting, design, construction, commissioning, operation and decommissioning EMRC instructions are against the relevant IAEA safety requirements for NPPs.

APPENDIX I: STATUS OF IMPLEMENTATION OF THE ACTION PLAN FOR THE INTEGRATED REGULATORY REVIEW SERVICE (IRRS) MISSION

Area		R: recommendation S: Suggestion G: Good Practice	Action	Overall Status
Responsibilities and Functions of the Government				
National Policy and Strategy for Safety	R1	The Government should establish and publish a national policy and strategy for safety on the basis of consideration of a formulation of the policy prepared by EMRC.	Done	The Cabinet has approved the Nuclear Safety Policy issued by EMRC on December 13th, 2015. The Nuclear Safety Policy has been published on EMRC official website.
Establishment of a Framework for Safety	R2	The Government should ensure that the proposed new law addresses the following issues in accordance with GSR Part 1: Assigning prime responsibility for safety to the operator Provision for appeals against decisions of the regulatory body Provision for preparedness for, and response to, a nuclear or radiological emergency Criteria for release from regulatory control Clear powers for inspectors Involvement of interested parties and for their input to decision making	Done	All the points under this recommendation have been addressed in the regulations and instructions issued recently by EMRC.
	R3	The Government should work with EMRC and as a matter of urgency, complete the regulations and instructions that are currently in a draft form and ensure that the reminder of the regulatory framework is established as soon as possible.	Ongoing	Ongoing Many regulations and instructions have been issued officially by EMRC in 2015. New law was prepared. 6 Regulations were approved and published. More than 70 instructions were approved.

Area		R: recommendation S: Suggestion G: Good Practice	Action	Overall Status
Establishment of a Regulatory Body and its Independence	R4	The Government, in the law and in its policy and strategy for safety, and EMRC, in its internal procedures, should clarify the role and authority of each separate regulatory function of EMRC so that all regulatory judgements and decisions have sound technical basis and are free from undue influences on its regulatory decision-making.	Ongoing	Ongoing with draft laws. The board of Commissioners of EMRC has issued five laws. Each law is specified of one of EMRC regulatory functions.
Compliance with Regulations and Responsibility for Safety Coordination of Authorities with Responsibilities for Safety within the Regulatory Framework	R5	The Government should ensure that formal coordination arrangements are established between EMRC and other Government agencies including the Ministries of Health, Interior, Environment, and Labour.	Ongoing	Ongoing Memorandum of Understanding with the environmental ministry has been signed. Draft memorandum of understanding with the ministry of health has been sent to the ministry for the comments and discussion. Comments and discussions with the public Security Department on the memorandum of understanding between EMRC and them has been finished and waiting for the official signature.
System for Protective Actions to Reduce Unregulated Radiation Risks	S1	The Government should consider establishing national processes and guidance for protective actions to reduce the risk from unregulated sources.	Done	EMRC has established requirements for controlling the radiation and nuclear materials which is out of the regulatory control.
Provisions for Decommissioning and Management of Radioactive Waste and Spent Fuel	S2	The Government should consider timely adoption of the draft national policy on management of spent fuel and radioactive waste and support for its effective implementation.	Done	The policy on management of spent fuel and radioactive waste has been issued by the cabinet.
	R6	The Government should ensure that EMRC is provided with adequate human resources with the necessary competence to effectively regulate nuclear and radiation risks in the country.	Ongoing	Ongoing A national committee has been established according to a prime ministry decision to develop human resources capabilities for the Jordanian nuclear program.

Area		R: recommendation S: Suggestion G: Good Practice	Action	Overall Status
				The recommendations which will be done by this committee will be considered in the future employment and to train the current staff in the issues needed.
Provision of Technical Services	S3	The Government should consider establishing internal dosimetry arrangements in a timely manner.	Done	A formal letter has been sent to JAEC to inform them to consider establishing dosimetry arrangements in a timely manner and they response and provide us with the dosimetry. EMRC has issued the instruction on provisions for protecting workers from occupational exposure risks.
Global Nuclear Safety Regime				
International Obligations and Arrangements for International Cooperation	GP1	Jordan is participating in several international forums and actively using various international cooperation programs to strengthen its nuclear and radiation safety infrastructure	Ongoing	Ongoing
	R7	The Government should become a contracting party to the Joint Convention and should demonstrate that respective international obligations are fulfilled by participation in its relevant international arrangements.	Done	A formal letter (8/11/7952) dated Nov. 8, 2015 has been sent to the Prime Ministry indicating the importance of being part of the Joint Convention. A formal letter (58/11/1/50311) dated Nov. 17, 2015 has been sent to the Ministry of Foreign Affairs by the Prime Ministry for a statement of opinion. A formal letter (58/11/1/399) dated Jan. 4th, 2016 has been received from the Prime Ministry indicating the approval for being part of this convention.
Sharing of Operating Experience and Regulatory Experience	S4	EMRC should consider establishing processes for identifying and sharing lessons learnt from operating and regulatory experience.	Done	Ongoing EMRC has established a portal for sharing information and knowledge. The training department in the administrative directorate has assigned this responsibility. All the training materials taken by the staff is uploaded on the portal. In addition, any other information or issues regarding the regulatory role of EMRC is also shared in the portal.

Area		R: recommendation S: Suggestion G: Good Practice	Action	Overall Status
				Jordan has an access to the Incident Reporting System for Research Reactors (IRSRR). In this system, all the member can report any event or incident that happened in the operational research reactor all around the world. By this, all the related experience could be shared and lessons learnt could be identified. Jordan is participating in International Nuclear and Radiological Event Scale (INES) technical meetings and participate in discussions and decisions on the application of the scale. This gives an opportunity to EMRC staff to share the regulatory experience and learn all the lessons learnt from the nuclear events.
Responsivities and Functions of the Regulatory Body				
Organizational Structure of the Regulatory Body and Allocate of Resources	S5	EMRC should consider finalizing its systematic assessment of its organizational needs for its current and future nuclear and radiation safety regulatory functions and establish its new organization and resources accordingly.	Done	Ongoing The organizational chart of EMRC has been established according to its regulatory functions. A review and assessment for the organization is conducted yearly according to the civil service bureau law. Accordingly, changes can be made if there is any need.
Effective in the Performance of Regulatory Activities	S6	EMRC should consider developing a statement describing its regulatory values, emphasizing its independence in regulatory decision-making and promulgating a statement of expectations for its employees.	Done	EMRC has received a decision from the prime ministry ensuring the financial and administrative independence.
Staffing and Competence of the Regulatory Body	R8	EMRC should develop, as a matter of urgency, a human resources plan to support its nuclear and radiological regulatory decision-making and establish its internal systematic training programme for current and new inspectors and assessors.	Done	The board of commissioners of EMRC has issued the general framework for the training plan for EMRC personnel in the radiation and nuclear regulatory field. The cabinet has issued a formal decision on establishing national committee for development of human resource capabilities for the Jordanian nuclear programme.
	R9	The Government and EMRC should identify and implement innovative approaches to attract and retain	Ongoing	Ongoing

Area		R: recommendation S: Suggestion G: Good Practice	Action	Overall Status
		highly qualified staff at EMRC to support its nuclear and radiation safety regulatory functions.		EMRC has trained its staff in specialized training courses and to get higher qualification in the field of nuclear and radiation. There are internal policies on how to grant incentives and overtime for EMRC staff.
Liaison with Advisory Bodies and Support Organization	S7	EMRC should consider the use of one or more technical advisory bodies of experts to support its decision-making on important nuclear and radiation safety issues.	Ongoing	Ongoing EMRC has decided to establish an advisory committee to support its decision making process in the nuclear and radiation safety issues. The work is progressing in specifying the members of this committee.
Liaison Between the Regulatory Body and Authorized Parties Stability and Consistency of Regulatory Control Safety Related Records	R10	EMRC should take prompt actions to establish effective arrangements to manage safety-related documents and records, to ensure that they are available, identifiable and easily retrievable.	Done	All the documents and records have been archived in the nuclear safety and security directorate and the radiation protection directorate.
Communication and Consultation with Interested Parties	S8	EMRC should consider developing further, and formalizing in a policy, its information and consultation strategy with interested parties.	Done	EMRC has issued the policy and requirements for hiring the consultants and interested parties.
Management System of the Regulatory Body				
Implementation and Documentation of the Management System	R11	EMRC should proceed further with the establishment and implementation of the integrated management system according to the requirements in GS-R-3 with the aim to achieve and enhance safety. Special attention should be paid to: defining, documenting, and implementing the core regulatory processes	Ongoing	Ongoing The quality manual for the nuclear and radiation sector has been established. The inspection manual for the radiation protection is issued in November, 2015. The inspection procedures for the nuclear facilities have been issued in the radiation protection directorate in November, 2015. The quality manual will be updated and implemented step by step.

Area		R: recommendation S: Suggestion G: Good Practice	Action	Overall Status
		bringing all the requirements for managing the organization together in a coherent way assigning authority and responsibility for the regulatory processes to designated individuals assessing and continually improving the processes of the management system		
	GP2	The regulatory body is promoting safety culture in an inventive and constructive way by sending daily safety messages to all staff. Training sessions are held on safety culture and a survey is planned. This contributes to a common understanding of the key aspects of safety culture across the organization.	Ongoing	Ongoing
Management Responsibility	R12	EMRC should appoint an individual reporting directly to senior management with the responsibility and authority to coordinate the development and implementation of the management system.	Ongoing	Ongoing An internal unit department has been established in EMRC. This unit will assign the responsibility of monitoring the implementation of the management system. This personnel of this unit must receive the required training to be capable for performing their tasks effectively.
Resources Management Process Implementation Measurement, Assessment and Improvement	S9	EMRC should consider extending the authority and capacity of the internal audit unit to also cover the responsibility of independent assessments of regulatory processes and technical matters related to safety.	Ongoing	Ongoing The unit of internal audit has the responsibility of independent assessments of regulatory processes and technical matters related to safety. The personnel of this unit has to be capable for performing their tasks effectively.
Authorization				
Generic Issues	R13	EMRC should further formalize the application of graded approach in the authorization process based on the radiation risks associated with facilities and activities.	Done	EMRC has issued several instructions specifies the licensing requirements for each facility or nuclear activity according to their radiation risk. (Sub critical licensing instruction, safety instruction for research reactors)

Area		R: recommendation S: Suggestion G: Good Practice	Action	Overall Status
				EMRC has issued instruction on licensing requirements for radiation activities according to their radiation risk.
	R14	EMRC should develop adequate guidance on the format and content of the documents to be submitted by the applicant in support of its license application.	Done	EMRC has issued the licensing service manual in November, 2015. EMRC has issued the instruction on format and content of the safety analysis report for the nuclear power plant in November, 2015. EMRC has issued the requirements on the site notification for the sitting process of the nuclear power plant and the approved form.
Authorization of Radiation Sources Facilities and Activities	R15	EMRC should ensure that all facilities and activities that require a license according to Law No (43) of 2007 are licensed and that the licensing renewal process is revised and formalized so that it does not result in facilities operating without a valid license.	Done	EMRC has established a mechanism to use computerized program for controlling all the licensed facilities. EMRC will contact the organization whose license is approaching to finish. EMRC is cooperating with various departments in Jordan to ensure that the radiation protection is controlled. Conducting inspections on organization that perform radiation activities to ensure the existence of radiation protection requirements and they are licensed from the commission.
	S10	In order to free resources to be directed to higher priority activities, EMRC should consider amending its practices of issuing personal licenses to all workers and individual licenses to each device and source, as well as the registration of exempted sources.	Ongoing	Outstanding EMRC opinion is: It is not practical to cancel the personal license as it is required in the laws which requires issuing the personal license in order to practice the nuclear and radiation work
	S11	EMRC should consider rationalizing the number of databases for sources to ensure that there is a single official comprehensive register of sources and devices in Jordan.	Done	EMRC has been provided by the RAIS program from the IAEA. EMRC has operated this program by entering and updating all the information required from the radiation organizations and its radiation sources. The RAIS program is a web based program and it enables all the staff of the radiation protection directorate to know the details of the radiation practices, sources and personnel in the radiation field and their licensing status.

Area		R: recommendation S: Suggestion G: Good Practice	Action	Overall Status
Authorization of Research Reactors Authorization of Radioactive Waste Management	R16	EMRC should immediately rectify the licensing status of the radioactive waste facility at JAEC.	Ongoing	Ongoing EMRC has conducted workshop with expert mission from the IAEA to inspect the central storage and reviewing the renewal license application and for fiving the technical advice on granting the renewal license. The work is in progress for licensing the radioactive facility at JAEC.
	GP3	Orphan sources and disused sources are transferred for safe storage to a radioactive waste storage facility.	Ongoing	Ongoing
	S12	EMRC should consider ensuring that the radioactive waste facility at JAEC promptly notifies it of new sources transferred to it and that these records should be appropriately stored	Done	EMRC has notified JAEC in the necessity of updating the radioactive waste record in the radioactive facility at JAEC. JAEC has provided EMRC the updated record and it will be delivered to EMRC periodically and upon request.
Authorization of Transport	S13	EMRC should consider revising its requirements related to transport license application so that they include all the relevant information mentioned in TS-G-1.3.	Done	EMRC has issued the instruction on safety transport for radiation materials taking into account the requirements mentioned in TS-G-1.3.
Review and Assessment				
Generic Issues	R17	EMRC should develop a formal process for review and assessment of safety related applications, taking into account a graded approach.	Done	Formal process for review and assessment: For the research reactor: There is a policy statement on the licensing scheme for the JRTR which has been signed by the applicant and JNRC (At that time) on March 24th, 2010. This policy statement includes the legal basis for licensing the research reactor. There is an adoption to US NRC NUREG 1537 part 1 which includes a formal process for review and assessment of the safety related documents in the licensing application. For the Nuclear Power Plant (NPP): EMRC will adopt the IAEA Safety Guide GS-G-1.2 (and the latest updates): Review and Assessment of Nuclear Facilities by the Regulatory Body. In addition to that, EMRC will adopt the relevant vendor regulations

Area		R: recommendation S: Suggestion G: Good Practice	Action	Overall Status
				and guides to support the review and assessment process of the application safety documents.
Management of Review and Assessment Organization and Technical Resources for Review and Assessment Bases for review and Assessment Performance of Review and Assessment Review and Assessment for Research Reactors	R18	EMRC should establish requirements for qualification and certification of the personnel of research reactors	Done	EMRC has issues the instruction on qualification, training and licensing of the personnel of research reactors in June, 2015.
	R19	EMRC should develop safety acceptance criteria for the Research Reactors.	Done	There is a policy statement on the licensing scheme for the JRTR which has been signed by the applicant and JNRC (At that time) on March 24th, 2010. This policy statement includes the legal basis for licensing the research reactor. There is an adoption to US NRC NUREG 1537 part 2 to be the acceptance criteria for the content of the PSAR and to refer to the US Regulatory Guides for any details.
Review and Assessment for Transport	S14	EMRC should consider establishing processes for review, assessment and approval of package designs, taking into account existing internationally approved designs.	Done	EMRC has issued the instruction on requirements for the package designs for transportation of radiation materials and the methods for testing these packages according to the IAEA requirements.
Inspection				
Generic issues Inspection Approaches, Methods and Plans	R20	EMRC should reduce the influence of the current license renewal process on its inspection programme and instead develop the programme on the basis of the radiation risks associated with facilities and activities	Done	EMRC has issued the inspection manual which identifies the period required for the periodic inspection on various applications according to their radiation risks.
Inspection Processes and Practices	R21	EMRC should conduct inspections and develop the associated inspection procedures to cover all facilities and activities in Jordan, including transport.	Done	EMRC has issued the inspection manual which identifies the period required for the periodic inspection on various applications according to their radiation risks.

Area		R: recommendation S: Suggestion G: Good Practice	Action	Overall Status
Inspection of Waste Management Facilities Inspection of Transport				This inspection manual explains all the inspection procedures for all radiation practices including transport of radiation materials.
Inspectors	R22	EMRC should establish formal criteria for determining when a new staff member is deemed competent to be appointed as an inspector and provide the inspector with documented evidence of that appointment.	Ongoing	EMRC has issued the acceptance criteria for qualification of the radiation inspectors and the nuclear inspectors in separate documents.
Inspection of Radiation Sources Facilities and Activities Inspection of Research Reactors	GP4	EMRC has a resident inspector at JRTR construction site.	Ongoing	Ongoing
Enforcement				
Enforcement Policy and Processes Enforcement Implementation	R23	EMRC should establish and implement an enforcement policy in accordance with a graded approach and ensure that all relevant staff are appropriately trained on enforcement actions	Done	EMRC has issued the enforcement policy and the staff is aware of it.
Regulations and Guides				
Generic Issues Existing Regulations and Guides Process for Development and Guides	R24	EMRC should establish and implement a process to develop and update regulations, instructions and guides.	Ongoing	Ongoing EMRC is in the process for developing a process for updating regulations, instructions and guides.
Emergency Preparedness and Response				

Area		R: recommendation S: Suggestion G: Good Practice	Action	Overall Status
General Regulatory Requirement	R25	EMRC should complete the regulatory framework for EPR and ensure that licensees have adequate arrangements in place to respond to nuclear and radiological emergencies.	Done	EMRC has established instructions for emergency preparedness in the nuclear and radiation facilities. The requirements for this instruction has to be applied by the applicant. On the other hand, EMRC will conduct an inspection to ensure that the applicant activities are in compliance with these requirements. Instruction title: Instruction on emergency preparedness in the nuclear and radiological facilities. Issued in accordance with article 25/n from regulation no: 43 for the year 2014: Safe use of nuclear energy. Used reference: GSR part-7
	S15	EMRC should consider continuing the cooperation with other relevant organizations to develop a comprehensive national threat (hazard) assessment.	Done	EMRC has established “Threat Assessment Document” in 2014 with cooperation with the national committee for nuclear security. According to the “Threat Assessment Document”, the Design Basic Threat (DBT) has been established for the JRTR. In 2016, a review and update for the “Threat Assessment Document” will be conducted. Use the word hazard instead of threat.
Functional Regulatory Requirements	S16	EMRC should consider defining its role in public communication on emergency preparedness and response, in cooperation with relevant Governmental organizations,	Done	EMRC has issued an Appendix to the National Plan for Emergency Response which contains the means of communication in case of emergencies. Page 16 of this appendix demonstrates the responsibilities and duties for other related organizations for implementing radiation emergency plan defined by EMRC.
	S17	EMRC should consider clarifying the allocation of responsibilities for the protection of emergency workers (on-site and off-site) and issuing guidance on the management, control and recording of emergency workers exposure.	Done	EMRC has issued the instruction on Emergency preparedness in the nuclear and radiation facilities. The instruction specifies the responsibilities to protect workers and emergency workers exposure in case of emergencies. Use GSR part 3 and GSR part 7
Regulatory Requirements for Infrastructure	R26	EMRC should develop its own emergency response arrangements including plans, procedures, training and drills.	Done	EMRC has established Principles for offsite emergency preparedness in the nuclear and radiological facilities.

Area		R: recommendation S: Suggestion G: Good Practice	Action	Overall Status
Role of Regulatory Body During Response				Document title: Principles on offsite emergency preparedness in the nuclear and radiological facilities. Issued in accordance with article 25/ن from regulation no: 43 for the year 2014: Safe use of nuclear energy.
SSG-16 Elements	S18	The Government should consider developing an integrated national strategy for the nuclear power programme going forward that identifies and addresses potential challenges to safety, involves all interested parties, and is periodically updated.	Ongoing	Ongoing The integrated national strategy for the nuclear power programme is the responsibility of JAEC. A formal letter has been sent to JAEC to provide us with this strategy.
	S19	The regulatory body should consider establishing cooperation with regulatory bodies of the vendor country and countries with NPPs of the same type.	Done	An agreement between the Federal Environmental, Industrial and Nuclear Supervision Service (the Russian Federation) and The Energy & Minerals Regulatory Commission has been signed and approved. Agreement Title: "Agreement Between the Federal Environmental, Industrial and Nuclear Supervision Service (The Russian Federation) and the Energy & Minerals Regulatory Commission on Cooperation in the Field of Nuclear and Radiation Safety Regulation in the Peaceful Use of Atomic Energy"
	S20	EMRC should consider developing means to inform interested parties on how they can raise safety concerns to EMRC.	Done	Ongoing EMRC has established "Crisis Management and Emergency Center". The duties of this center is to receive any kind of safety concerns in all EMRC sectors. EMRC has published the emergencies numbers and the duties of the center in all media means in Jordan.
	S21	The Government should consider removing from EMRC's source of funding the fines levied in respect of enforcement actions on the licensees.	Done	All the funds that EMRC gain according to the regulations and instructions are directed to the government. The budget of EMRC does not depend on the gained funds. Miscommunicated to IRRS team member

Area		R: recommendation S: Suggestion G: Good Practice	Action	Overall Status
	R27	EMRC should develop arrangements to avoid actual, potential, or perceived conflicts of interest when employing external support organizations.	Done	Internal policy has been issued in this regard.
	S22	EMRC should consider adopting the provisions of IAEA SSR-2/1 as the basis of its requirements for NPP design.	Done	EMRC has issued the instruction of construction permit for nuclear power plant in the board meeting no: 156. Decision no: 612/2015. Article 3 from the instruction mentioned above states that the requirements of SSR-2/1 and the latest update shall be applied in the design of NPP.
Additional Area				
Control of Medical Exposure	R28	EMRC should immediately finalize the regulatory requirements on medical exposure, making sure that they are compliant with GSR Part 3, and prepare the instructions required for their application. Some of this framework should be developed in consultation with the Ministry of Health and relevant professional bodies. Guidance should also be developed.	Done	EMRC has issued the regulation on radiation protection which includes the requirements on medical and occupational exposure.
	R29	EMRC should develop training requirements regarding patient protection.	Done	EMRC has issued the regulation on radiation protection which includes the requirements on medical and occupational exposure and to educate workers to protect patients from radiation exposures.
Occupational Radiation Protection	R30	EMRC should review and revise the regulatory framework for occupational exposure control, including regulations, instructions and guidance, for consistency and completeness with respect to GSR part 3 and approve the draft regulations and instructions as quickly as possible.	Done	EMRC has issued the regulation on radiation protection which includes the requirements on medical and occupational exposure.
	S23	EMRC should consider implementing a monthly dosimeter exchange for Category I workers.	Done	EMRC has notified all the related organizations in the necessity of providing it with monthly dosimeter exchange for category I workers instead of providing it quarterly.

Area		R: recommendation S: Suggestion G: Good Practice	Action	Overall Status
	S24	EMRC should consider establishing a computerized national register of occupational dose records.	Done	EMRC has established the national register for the nuclear and radiation application which includes a database for the occupational dose records for the nuclear and radiation workers.
	S25	EMRC should consider including in the radiation protection regulatory framework specific requirements for calibration of portable and fixed dose rate and surface contamination measuring equipment.	Done	EMRC has issued the regulation on radiation protection in October, 2015 which includes requirements for the calibration of portable and fixed dose rate and surface contamination measuring equipment.
	S26	EMRC should consider, in consultation with the relevant training course providers, establishing arrangements to support the availability of authorized radiation protection training courses for RPOs. The radiation protection framework should include provisions for the re-training of occupationally exposed workers by the RPO.	Ongoing	Ongoing EMRC is motivating the licensees to develop radiation protection training courses for internal training for those who are working in the radiation field and the RPOs including periodic training courses and training courses upon request.

APPENDIX II: JAEC-EMRC-JNPC ACTION PLAN INIR MISSION IN 2014

1. NATIONAL POSITION		**Phase 2**				
1.1. Government support evident						
Rec. No.	**Recommendation**	**Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
R-1.1.1	**The GoJ should ensure the effective inter-ministerial coordination for nuclear power infrastructure development including pre-investment activities. This coordination mechanism should be mandated and organized to ensure effective participation by all relevant ministries and organisations**	Establish a Higher Ministerial Committee for the Nuclear Power Plant Project chaired by the Minister of Energy and Mineral Resources	JAEC	Done	Oct., 29, 2014	Done
R-1.1.2	**JAEC should finalise the national policies related to radioactive waste management and nuclear fuel cycle to be approved by the GoJ**	1. Approve the Policy for Radioactive Waste Management and Spent Fuel	GoJ	Done	Jul., 2015	
		2.1 Develop NFC policy	JAEC	Started	Dec., 2015	
		2.2 Approve NFC policy	GoJ		Mar., 2016	
1.2. Overall Strategic Approach for Contracting With the Vendor Established						

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1.3. Commitments and obligations of owner/operator organizations and regulatory body established						
Rec. No.	**Recommendation**	**Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
R-1.3.1	**JAEC should establish the owner-operator organisation with clear assignment of responsibilities as a matter of urgency.**	1.1 Establish JNPC 1.2 Clarify JNPC's clear responsibilities	JAEC JNPC	Done	Oct., 2015 Jan., 2016	
2. NUCLEAR SAFETY		**Phase 2**				
2.1. Safety responsibilities by all stakeholders recognized						
Rec. No.	**Recommendation**	**Action/Activity**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
R-2.1.1	**EMRC &JNPC (PIPh) should, as a matter of urgency, develop and implement training and qualification programmes to ensure that staff and**	1. 1 Draft JNPC's training and qualification programme 1.2 Approve the programme 2.1 Draft staffing plan	JNPC JNPC BoD EMRC	Started Started	May, 2015 Q2/2016 May, 2015	

	management are competent and authorised to prepare and review the license application, as appropriate	2.2 Approve the staffing plan	EMRC BoC		Q1/2016	
		2.3 Draft training and qualification programme	EMRC	Done	May, 2015	
		2.4 Approve the programme	EMRC BoC	Done	Dec. 2015	
R-2.1.2	**EMRC and JNPC (PIPh) should develop formal safety culture programmes that are promoted by senior leadership. The programmes should include empowering staff to raise safety concerns to senior leadership**	1.1 Develop a separate safety culture programme partly based on its updated its QM manual	EMRC	Started	Jul., 2015	
		1.2 Review the programme	IAEA	Done	Aug., 2015	
		1.3 Approve the programme	EMRC BoC	Done	Dec. 13, 2015	
		2.1 Draft JNPC's safety culture programmes	JNPC	Done	Jun., 2015	
		2.2 Review the programme	IAEA	Done	Aug., 2015	
		2.3 Revise the programme	JNPC		Q1/2016	
		2.4 Approve the programme	JNPC BoD		Q2/2016	
R-2.1.3	**JNPC and EMRC should develop formal programmes that gather and evaluate operating experience to improve the construction, operation, and oversight of the Jordan nuclear power programme**	1.1 Draft operating experience programme	JNPC	Done	Jun., 2015	
		1.2 Review operating experience programme	IAEA	Done	Aug., 2015	
		1.3 Revise the programme	JNPC		Q1/2016	
		1.4 Approve the programme	JNPC BoD		Q2/2016	

		2.1 Draft operating experience programme 2.2 Review the programme 2.3 Revise the programme 2.4 Approve the programme	EMRC IAEA EMRC EMRC BoC	Done Done	Jun., 2015 Aug., 2015 Q1/2016 Q2/2016	
R-2.1.4	**EMRC and JNPC (PIPh) should establish formal communication protocols between JNPC, EMRC and the vendor to ensure the effective management of information throughout the lifecycle of the project**	1.1 Develop the communication protocol 1.2 Revise the protocol 1.3 Send the protocol for the Russian side for comments 1.4 Approve the protocol	JNPC/ EMRC JNPC/ EMRC JNPC JNPC BoD and EMRC BoC	Done	Aug., 2015 Q2/2016 Q2/2016 Q3/2016	
2.2. Long term relationship with supplier established						
Rec. No.	**Recommendation**	**Action/Activity**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
2.2.1	**JNPC (PIPh) should develop a clear strategy for the long term vendor support requirements**	1.1 Develop draft strategy 1.2 Revise the strategy	JNPC JNPC	Done	Aug., 2015 Q2/2016	

	and ensure these are addressed in the EPC contract and IGA, as appropriate	1.3 Approve the strategy	JNPC BoD		Q3/2016	
3. MANAGEMENT		**Phase 2**				
3.1. Contract specifications and evaluation criteria determined						
Rec. No.	**Recommendation**	**Action/Activity**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
R-3.1.1	**JNPC (PIPh) should complete the pre-investment work (e.g. siting, EIA, and outstanding issues from the vendor bid) and incorporate the results into the work to finalise the EPC contract**	1.1 Sign PDA with RAOS	JAEC	Done	Sep., 2014	
		1.2 Sign contracts with ASE to preform water optimization study and site supervisory activities	JAEC	Done	Jun., 2015	
		1.3 Procure consultant for grid study and electricity market research	JAEC		Jan., 2016	
		1.4 Procure consultant for project development services	JAEC	Started	Jan., 2016	

		(Technical, Legal, and Financial)				
		2.1 Review of PPA	NEPCO		Mar., 2016	
		2.1 Review of WSA	MWI		Mar., 2016	
		2.2 Review of EPC	JNPC		Oct., 2016	
		2.3 Complete site characterization and EIA	JNPC	Started	Dec., 2016	
3.2. Owner/ operator competence to carry out nuclear procurement evident						
Rec. No.	**Recommendation**	**Action/Activity**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
R-3.2.1	**JNPC (PIPh) should complete the planned strengthening of the procurement team, e.g., through the possible involvement of an owner's engineer, before detailed negotiations with the EPC contractor.**	1.1 Procure technical consultant to assist prior to EPC negotiations	JNPC	Started	Mar., 2016	
		1.2 Hire procurement staff	JNPC		Q4/2016	
3.3. Project management organization established with adequate staff to prepare for and analyze bids available						

Rec. No.	Recommendation	Action/Activity	Responsibility	Action Status	Timeline	Overall Status
R-3.3.1	**JAEC should develop a clear strategy for the transition of JNPC (PIPh) to JNPC, including the necessary staffing and management systems, recognising that it will be a significantly different organization**	Develop a strategy for transition to O/O	JNPC		Q4/2016	
3.4. Management systems established						
Rec. No.	**Recommendation**	**Action/Activity**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
R-3.4.1	**JNPC (PIPh) should develop (in conjunction with the Russian partner) the integrated management system for JNPC recognising the need to manage the activities related to licensing and construction**	1.1 Develop and review the integrated management system 1.2 Finalize the integrated management system	JNPC JNPC		Q3/2016 Q2/2017	
4. FUNDING AND FINANCING		**Phase 2**				
4.1. Means of financing established and strategy for management of financial risks available						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
R-4.1.1	**JNPC (PIPh) should develop a comprehensive financing plan, with options, contingencies and cost**	1.1 Prepare financing resources 1.2 Identify supplier and financing scenarios	JNPC JNPC	Started	2015/2016 Q1/2016	

	implications, to give confidence that the current financing strategy is feasible	1.3 Prepare draft financing plan with suppliers, strategic investors, along with financing resources	JNPC		Q2/2016	
		1.4 Finalize indicative financing plan to include detailed financing strategy, alternatives, sources, cost associated etc	JNPC		Q3/ 2016	
R-4.1.2	**JNPC (PIPh) should complete the feasibility study, including a range of assumptions on key parameters, such as the electricity tariff and the cost of borrowing**	1.1 Recruit a consultant to assist in the update of the financial model and the BFS	JNPC	Started	Q2/ 2016	
		1.2 Revise Financial/economic models for BFS	JNPC	Started	Q2/ 2016	
		1.3 Prepare draft BFS	JNPC		Q4/2016	
		1.4 Finalize the BFS	JNPC		Q1/2017	
R-4.1.3	**All involved organisations, at a senior level, should review the risk management plan for JNPP developed by JAEC to ensure their commitment to the plan**	1.1 Draft detailed risk analysis report –preliminary risk study and matrix for the project with a risk management plan	JAEC	Done	Sep., 2015	
		2.1 Prepare comprehensive risk analysis report	JNPC		Q3/2016	

4.2. Funding plan available

Rec. No.	Recommendation	Agreed Action	Responsibility	Action Status	Timeline	Overall Status
R-4.2.1	**All involved organisations should review the estimated**	1.1 Define and complete cost of offsite infrastructure through the studies	JNPC/MoHPW/ MoT/MoWI/ NEPCO/ JEPCO	Started	Q4/2016	

	costs of upgrading the off-site infrastructure for JNPP, and the Government should recognise the need for funding	1.2 Allocate funding	GoJ	Started	Q4/2016	
R-4.2.2	**GoJ should ensure EMRC is adequately funded to perform its functions, including capacity building.**	1.1 EMRC to defend its budget to the GoJ 1.2 Approve the budget	EMRC Parliament	Done	Dec., 2015 Mar.,2016	Done
R-4.2.3	**EMRC should finalise and issue the Instruction on the Fund for Decommissioning of Nuclear Facilities**	1.1 Include several provisions for the Fund for Decommissioning of Nuclear Facilities in the draft EMRC Law 1.2 Approve the Instruction on the Fund for Decommissioning of Nuclear Facilities	EMRC EMRC BoC	Done Done	Aug.,2015 Nov.,2015	Done
R-4.2.4	**GoJ should establish the funding mechanisms for spent fuel and radioactive waste management, once the spent fuel and radioactive waste management policy has been approved**	1.1 Propose options for funding mechanisms for spent fuel and radioactive waste management 2.1 Approve funding mechanisms	JAEC GOJ		Q1/2017 Q2/2017	
5. LEGISLATIVE FRAMEWORK		**Phase 2**				

5.1. International legal Instruments governing nuclear activities in force						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
	-	-	-	-	-	-
5.2. A comprehensive nuclear law is enacted and in force						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
R-5.2.1	**Jordan should urgently develop and enact a comprehensive nuclear law to adequately address the need for an effectively independent regulatory body, a clear delineation of roles and responsibilities, adequate provisions on nuclear safety, security, safeguards, and civil liability for nuclear damage, including inter alia, the licensing of nuclear facilities, import/export controls and spent fuel and radioactive waste management**	1.1 Send draft Law on Energy and Mineral Regulatory Commission to the Prime Ministry for approval 1.2 Approve final Law	EMRC EMRC/ Parliament	Done	Aug., 2015 Q3/2016	

5.3. All other legislation affected by the nuclear power programme developed, promulgated and in force.						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
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6.SAFEGUARDS		**Phase 2**				
6.1. Strengthening of the SSAC underway						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
R-6.1.1.	**EMRC should finalize its instructions for the implementation of safeguards so that JNPC (PIPh) can develop a plan to meet its requirements**	1.1 Approve the instruction and publish it in the Official Gazette 2.1 Develop safeguards plan to be included in the EPC contract	EMRC BoC JNPC	Done	Jul., 2015 Nov., 2016	
6.2. Early safeguards relevant information provided to IAEA planned						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
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7. REGULATORY FRAMEWORK		**Phase 2**				
7.1. Independent nuclear regulatory body established and the necessary regulatory infrastructure developed						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
R-7.1.1	**JNPC (PIPh) should discuss with EMRC the proposed owner/operator organisation early in the process to ensure that it can be licensed in accordance with the applicable laws, regulations and instructions.**	JNPC (w/RAOS) to discuss the licensability of O/O with EMRC	JNPC		Q2/2016	
8. RADIATION PROTECTION		**Phase 2**				
8.1. Actions to prepare adequate radiation protection programs undertaken, and expansion of appropriate infrastructures planned						

Rec. No.	Recommendation	Agreed Action	Responsibility	Action Status	Timeline	Overall Status
R-8.1.1	**EMRC should urgently finalise the radiation protection regulation and its associated instructions to be consistent with the requirements of GSR Part 3**	Issue radiation protection regulation in compliance with the IAEA GSR Part 3	EMRC/GoJ	Done	Oct., 2015	Done
R-8.1.2	**EMRC should include "Internal Exposure" in the drafted code of practice for occupational exposure control or develop a new one for internal exposure**	Internal exposure included in the radiation protection regulation	EMRC	Done	May, 2015	Done
9. ELECTRICAL GRID		**Phase 2**				
9.1. Detailed studies to determine grid expansion, upgrade or improvement undertaken						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
R-9.1.1	**NEPCO should complete the planned detailed study of the implications of incorporating two units of 1000MW into the Amra site in order to identify the enhancements required to the Jordan grid, its interconnection to the regional grid and the operational agreements for the interconnected system**	1.1 Procure a consultant to perform the Study 1.2 Identify the enhancements	NEPCO NEPCO/JNPC	Started	Jan., 2016 Q1/2017	

9.2. Plans, funding and schedule for grid enhancement available						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
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10 HUMAN RESOURCES		**Phase 2**				
10.1. Knowledge and skills needed in organizations for Phase 3 and operational phase are identified and a plan to develop and maintain the human resource is developed						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
R-10.1.1	**JNPC (PIPh) should develop detailed plans, including recruitment and training plans, to address the new**	1.1 Draft the organizational structure of JNPC	JNPC		Mar., 2016	
		1.2 Approve the structure	JNPC BoD	Started	Apr., 2016	

	organisational, human resource, competence and culture requirements in preparation for operations	1.3 Prepare recruitment plan	JNPC	Started	Ma., 2016	
		1.4 prepare training plan	JNPC	Started	Jun., 2016	
R-10.1.2	**The national HRD committee should further develop the national HRD plan, addressing the needs of all involved organisations ensuring consistency with the project schedule**	1.1 Identify detailed HR requirements of all involved organizations (JNPC, EMRC, JRTR, Uranium extraction)	JAEC		Feb., 2016	
		1.2 Identify training needs of support organizations (e.g. security, civil defense, etc.)	JAEC		Feb., 2016	
		1.3 Review existing national education and training capabilities	JAEC		Mar., 2016	
		1.4 Gap analysis of the education and training needs	JAEC		Apr., 2016	
		1.5 Identify plans to mitigate gap in education and training	JAEC		Jun., 2016	
11. STAKEHOLDER INVOLVEMENT		**Phase 2**				
11.1. Public information and education programme developed						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**

R-11.1.1	**JAEC should finalise and issue the Public Awareness Committee's communication strategy and plan, supported by the necessary resources, including training of spokespersons and establishment of public information centres**	1.1 Conduct a poll	JAEC		Jan., 2016	
		1.2 Develop public communication plan	JAEC		Q1/2016	
		1.3 Review of public communication plan	JAEC/IAEA		Q2/2016	
		1.4 Approve strategy and plan	JAEC BoC		Q2/2016	
		1.4 Submit strategy and plan to NEPIO for support and coordination.	JAEC		Q2/2016	
		1.5 Coordinate the establishment of public information centre	JAEC/JNPC		Q3/ 2016	
12. SITE AND SUPPORTING FACILITIES		**Phase 2**				

12.1. Detailed site characterization completed						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
R-12.1.1	**EMRC should issue the "Instruction on the Site Survey and Site Selection for Nuclear Power Plants" as well as the "Instruction on the Site Evaluation for Nuclear Power Plants" to ensure that a firm basis exists for site selection and evaluation**	1.1 Revise the instructions 1.2 Approve the instructions	EMRC EMRC BoC	Started Done on Dec.2015	Nov.,2015 Q1/2016	Done
R-12.1.2	**JNPC (PIPh) should ensure it has competent staff and an appropriate system necessary for effective management and oversight of the site evaluation activities**	Recruit support team	JNPC		Feb., 2016	
R-12.1.3	**JNPC (PIPh) should initiate activities for the confirmation of the site selection and site evaluation as studies and approvals are likely to take time and will require the involvement of various Ministries and stakeholders. The recommendations from the 2013 SEED mission should be**	1.1 Initiate activities for confirmation 1.2 Confirm site suitability 1.3 Complete the studies	JNPC JNPC JNPC	Started	Dec., 2014 Feb., 2016 Dec., 2016	

	addressed in the scope of these activities					
12.2. Plans to prepare site for construction						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
R-12.2.1	**JNPC (PIPh) should complete the required site and local infrastructure studies and the GoJ should then assign responsibilities for infrastructure development to the appropriate Ministries and organisations. [See also R-4.2.1].**	Complete local infrastructure studies	JNPC/JAEC MoWI / NEPCO	Started	Feb., 2017	
13. ENVIRONMENTAL PROTECTION		**Phase 2**				
13.1. Environmental Impact Assessment for selected sites performed						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
R-13.1.1	**JNPC (PIPh) should initiate the Environmental Impact**	1.1 Submit application for environmental clearance to the MoEnv	JNPC	Done	Jun., 2015	
		1.2 Submit preliminary TOR for the EIA	JNPC	Done	Dec., 2015	

	Assessment process consistent with the requirements of MoEnv	1.3 Conduct scoping session 1.4 Draft scoping report 1.5 Finalize EIA	JNPC JNPC JNPC		Apr., 2016 Jul., 2016 Dec., 2016	
13.2. Particular environmental sensitivities included in BIS						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
R-13.2.1	**JNPC should ensure that Amra site specific environmental sensitivities are fully identified during the Environmental Impact Assessment process and incorporated into the relevant vendor contracts, along with the Environmental Management Plan**	1.1 Identify environmental sensitivities during the scoping process of the EIA and include in the TOR for the EIA for the NPP 1.2 Include the environmental sensitivities in the Environmental Management plan	JNPC JNPC	Done	May, 2015 Dec., 2016	
13.3. Clear and effective regulation of environmental issues established						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
R-13.3.1	**The Memorandum of Understanding between MoE**	1.1 Prepare and discuss draft MOU	EMRC/ MoEnv.	Done	May, 2014	Done

	and EMRC should be finalized to address the cooperation between them for the review of the radiological elements of the Environmental Impact Assessment	1.2 Sign MOU	EMRC/MoEnv.		Jan., 2016	
14. EMERGENCY PLANNING		**Phase 2**				
14.1. Framework for emergency planning being developed						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
R-14.1.1	**GoJ should ensure that the roles of the Higher Council of Civil Defense, as the National Coordinating Authority, and the National Centre for Security and Crisis Management are defined in the case of nuclear or radiological emergencies**	1.1 Publish the instruction on EPR for public comments	EMRC	Done	Sep., 2015	Done
		1.2 Issue the EPR instruction	EMRC	Done	Dec., 2015	
		1.4 Define and agree on roles of all parties (the Higher Council of Civil Defense is responsible for dealing with all types of accidents, Civil Defense (Current Law 18/99)	EMRC	Done	Dec., 2015	

R-14.1.2	**The National Emergency Response Committee should conduct a gap analysis of the existing emergency communication networks and develop a plan for any identified improvements for nuclear or radiological emergencies**	1.1 Prepare for the national EPR exercise in which the gap analysis will be one of the outcomes. 1.2 Develop a plan for improvements for nuclear or radiological emergencies	EPR national committee EPR national committee		Feb., 2016 Mar. 2016	
14.2. Emergency planning for existing radiation facilities and practices in place						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
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15. NUCLEAR SECURITY		**Phase 2**				
15.1. Security requirements defined						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
R.15.1.1	**The National Nuclear Security Committee should update the national threat assessment and develop the Design Basis Threat**	Update the national threat assessment under coordination of EMRC	EMRC/JNPC/ NNSC		Q2/2016	

R 15.1.2	**JNPC (PIPh) should update the requirements for nuclear security to be specified in the EPC contract and develop the needed security and physical protection measures, procedures and plans for JNPP**	1.1 Review draft instructions on nuclear security in consistency with the IAEA documents. 1.2 Develop the requirements, based on the instructions, for nuclear security to be included in the EPC contract. IAEA nuclear security series shall be used as needed	EMRC JNPC	Done	Feb., 2015 Q4/2016	
R 15.1.3	**JNPC (PIPh) should develop procedures for the protection of sensitive information**	1.1 Develop information security instructions 1.2 Approve the instructions 2.1 Develop the procedures	EMRC EMRC BoC JNPC	Started	Jun., 2015 Jan., 2016 Mar. 2016	
15.2. Planned nuclear security measures for siting, construction and transport						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**

R-15.2.1	**EMRC should expand the draft "Instruction on Providing Physical Protection of Nuclear Facilities" to define the licensing requirements for security for the site, construction and transport of nuclear and radioactive material, and JNPC (PIPh) should establish a plan to meet these requirements**	1.1 Include licensing requirements for security for the site, construction and transport of nuclear and radioactive material in the instructions on security of facilities and nuclear materials	EMRC	Started	Q1/2016	
		2.1 Conduct national workshop on Physical Protection for design and evaluation	JNPC		Q1/2016	
		2.2 Develop a plan to meet the requirements	JNPC		Q3/ 2016	

15.3. Programs for selection/qualifications of staff with access to facilities are in place

Rec. No.	Recommendation	Agreed Action	Responsibility	Action Status	Timeline	Overall Status
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15.4 Nuclear security culture development planned

Rec. No.	Recommendation	Agreed Action	Responsibility	Action Status	Timeline	Overall Status
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16. NUCLEAR FUEL CYCLE		Phase 2				
16.1. Front-end fuel cycle policy and strategy defined, and strategy for storage and ultimate disposal of spent fuel defined						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
R-16.1.1	**Based on the adopted national policy, JAEC should finalise the national strategies for the front-end of the nuclear fuel cycle as well as for spent fuel management, with well elaborated options for long term management, including the evaluation of risks**	1.1 Develop strategy for the front-end of the nuclear fuel cycle 1.2 Review strategy 2.3Approve strategy 2.1 Draft strategy for spent fuel management 2.2 Review draft strategy 2.3 Approve strategy	JAEC JAEC JAEC BoC JAEC JAEC JAEC BoC	Started Started	Oct.,2015. Q1/2016 May, 2016 Aug. 2015 Q2/2016 Q3/2016	
17. RADIOACTIVE WASTE		**Phase 2**				
17.1. Handling the burdens of radioactive waste considered						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
R-17.1.1	**JAEC should finalise the national strategy for radioactive waste**	1.1 Draft the national strategy for RWM 1.2 Review final draft strategy for RWM	JAEC JAEC/IAEA JAEC/EMRC	Started	Aug., 2015 Q1/2016 Q1/2016	

	management based on the adopted national policy	1.3 Submit to the EMRC for review and comments 1.4 Approve the strategy	JAEC's BoC		Q2/2016	
17.2. Preliminary decommissioning plan requested						
Ref. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
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18. INDUSTRIAL INVOLVEMENT		**Phase 2**				
18.1. Realistic assessment of the national and local capabilities carried out, ability to meet schedule and quality requirements analyzed, and plans and programmes to transition to national and local suppliers in place						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**
R-18.1.1	**The Localization Committee should:** **• develop a national industrial involvement policy, to be endorsed by the Government, in time to inform the various strategies and contracts;** **• ensure the completion of the national and local supplier capability assessment; and;**	1.1 Make contractors qualification form & supplier qualification form available at the website of JAEC, Amman Chamber of Industry, and Jordan Construction Contractor Association 1.2 Conduct a survey of industry, trade, construction, service and commerce sectors	JAEC JAEC	Done Started	Oct. 2015 Dec. 2015	

	• ensure the development, endorsement and implementation of an industrial involvement plan with progress reports to the appropriate stakeholders	1.3 Review and analysis of collected information 1.4 Establish national industrial involvement policy after the completion of the survey for local industries and suppliers	JAEC JAEC		Jul., 2016 Sep., 2016	
19. PROCUREMENT		**Phase 2**				
19.1. Procurement programme consistent with national policy for industrial participation established						
Rec. No.	**Recommendation**	**Agreed Action**	**Responsibility**	**Action Status**	**Timeline**	**Overall Status**