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# INTEGRATED REGULATORY REVIEW SERVICE (IRRS)

## FOLLOW UP MISSION

**TO**

## The Hashemite Kingdom of Jordan

Amman, Jordan

*14 to 22 October 2017*

DEPARTMENT OF NUCLEAR SAFETY AND SECURITY

IAEA
Integrated Regulatory Review Service
IRRS

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# INTEGRATED REGULATORY REVIEW SERVICE (IRRS) MISSION FOLLOW-UP REPORT TO JORDAN

**Mission dates:** *14 to 22 October 2017*
**Regulatory body:** *Energy and Minerals Regulatory Commission (EMRC)*
**Location:** *Amman, Jordan*
**Organized by:** *IAEA*

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IAEA 2017

**The number of recommendations, suggestions and good practices is in no way a measure of the status of the national infrastructure for nuclear and radiation safety. Comparisons of such numbers between IRRS reports from different countries should not be attempted.**

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## EXECUTIVE SUMMARY

At the request of the Government of Jordan, an international team of senior safety experts met with representatives of Jordan from 15 to 22 October 2017 to conduct an Integrated Regulatory Review Service (IRRS) follow-up mission. The purpose of the IRRS follow-up mission was to review Jordan's progress against the recommendations and suggestions identified in the initial IRRS mission (which was carried out from 14 to 25 June 2014). The mission took place at the Energy and Minerals Regulatory Commission (EMRC) Headquarters in Amman. EMRC is the national nuclear regulator for Jordan, and is responsible for all aspects of regulating radiation safety, nuclear safety and security. The scope of the IRRS-follow-up mission was the same as the scope of the 2014 mission.

The IRRS review team consisted of eight senior regulatory experts from eight IAEA Member States, two IAEA staff members and one IAEA administrative assistant.

The IRRS team carried out a review of the progress made on each recommendation and suggestion that is documented in the 2014 IRRS mission report. These recommendations and suggestions cover the following areas: responsibilities and functions of the Government; the global nuclear safety regime; responsibilities and functions of the regulatory body; the management system of the regulatory body; the activities of the regulatory body, including authorization, review and assessment, inspection, enforcement and the development and content of regulations and guides; emergency preparedness and response; occupational exposure control, patient protection and the regulatory infrastructure being developed to support the introduction of a nuclear power programme. To assess progress, the IRRS team conducted a series of interviews and discussions with EMRC staff and reviewed the advance reference material provided by EMRC.

Overall, the IRRS review team concluded that Jordan, through the EMRC, has been responsive to each recommendation and suggestion made in 2014, and continues to place appropriate focus on implementing a framework that provides for effective protection of public health and safety. The IRRS team determined that all of the 30 recommendations and all of the 26 suggestions made by the 2014 IRRS mission had been effectively addressed and therefore could be considered closed. This is a significant achievement in a period of three years. The team offered one new recommendation and three new suggestions for EMRC consideration.

The EMRC should:

- Revise its regulatory framework to include classification of exposure situations and requirements for protecting workers undertaking remedial actions.
- Consider completing its internal arrangements regarding the organization of the team acting on its premises during an emergency.
- Consider establishing the minimal duration of training of medical personnel with respect to patient radiation protection.
- Consider implementing the accreditation of radiation and nuclear safety inspectors.

Since 2014, EMRC has taken positive steps to:

- Facilitate the approval by the Government of Jordan of a national policy and strategy for safety as well as a national policy for radioactive waste and spent nuclear fuel management.
- Develop a comprehensive legislative framework that includes a law on radiation and nuclear safety and security which is awaiting final approval in Parliament, and a number of radiation and nuclear safety regulations and instructions.
- Establish arrangements to improve staffing level and competencies.
- Introduce the graded approach into its regulatory oversight of facilities and activities.
- Strengthen its core regulatory functions by developing various processes and procedures.
- Develop mechanisms for communication with the public.
- Improve emergency preparedness and response by formulating the regulatory requirements in this area and making practical arrangements.
- Strengthen the medical exposure control and the occupational exposure control.

The Government has ensured that EMRC is effectively independent in its decision making and reports directly to the Prime Minister. EMRC has made significant progress in enhancing the regulatory framework and carrying out its activities in a systematic manner. In implementing its regulatory functions, EMRC has established a clear mission and vision for the organization that is focussed on safety. EMRC has shown commitment to continuously improve its regulatory practices, including the development of an integrated management system. EMRC is fully engaged in the global nuclear safety regime, being part of the international conventions.

EMRC is further expanding its scope and programme to address the regulation of the nuclear power programme while maintaining its focus on the safety of current facilities and activities.

The development of EMRC over the next few years will be an on-going challenge. As in the case of many other regulatory bodies around the world, the EMRC also has to maintain and further develop its human and financial resources. Maintaining and expanding staff competence and knowledge will be a continuous challenge as the number of radiation facilities is growing, a research reactor is close to start up and a nuclear power plant is being considered.

The IRRS team concluded that EMRC management and staff are dedicated to continuous improvement and they clearly recognize the importance of their mission towards the safety and protection of the Jordanian public.

An IAEA press release was issued following the mission and a joint press conference organized by EMRC and the IAEA took place.

Throughout the mission, the IRRS team received full cooperation from all parties involved. In particular, EMRC staff was very open in the discussions and provided the best practicable assistance.

# I. INTRODUCTION

At the request of the Government of Jordan, an international team of senior safety experts met representatives of EMRC from 15 October to 22 October 2017 to conduct an Integrated Regulatory Review Service (IRRS) follow-up mission. The purpose of the follow-up mission was to review the implementation of the recommendations and suggestions given to the Government of Jordan during the IRRS Mission in June 2014. The follow-up mission was formally requested by the Government of Jordan in March 2016. A preparatory meeting was conducted on 5 and 6 April 2017 at the EMRC's Headquarters in Amman to discuss the purpose, objectives and detailed preparations of the review in connection with regulated facilities and activities in Jordan and their related safety aspects.

The IRRS review team consisted of eight senior regulatory experts from eight IAEA Member States, two IAEA staff members and one IAEA administrative assistant. The IRRS review team carried out the review in the areas covered by the main mission in June 2014.

Jordan prepared a national follow-up report addressing the findings of the initial mission. The follow-up report and supporting documentation were provided to the IRRS team as advance reference material (ARM) for the mission. During the mission the IRRS team performed a systematic review of all topics by reviewing the advance reference material, additional information, and by conducting interviews with management and staff of EMRC.

All through the mission the IRRS team received excellent support and cooperation from EMRC.

## II. OBJECTIVE AND SCOPE

The purpose of this IRRS follow-up mission was to conduct a review of the implementation of the recommendations and suggestions given to the Government of Jordan during the IRRS Mission in June 2014 and to exchange information and experience in the areas covered by the IRRS. The IRRS review scope included all facilities and activities regulated by EMRC. The review was carried out by comparison of existing arrangements against the IAEA safety standards.

It is expected that the IRRS mission will facilitate regulatory improvements in Jordan and other Member States from the knowledge gained and experiences shared between EMRC and IRRS reviewers and through the evaluation of the effectiveness of the EMRC regulatory framework for nuclear and radiation safety.

## III. BASIS FOR THE REVIEW

### A) PREPARATORY WORK AND IAEA REVIEW TEAM

At the request of the Government of Jordan, a preparatory meeting for the Integrated Regulatory Review Service (IRRS) follow-up mission was conducted at EMRC's Headquarters in Amman, Jordan, on 5 and 6 April 2017. The preparatory meeting was carried out by the appointed Team Leader Mr Nikolay Vlahov and IAEA representatives Mr Hilaire Mansoux and Mr Zia Hussain Shah.

The IRRS mission preparatory team had discussions regarding regulatory programmes and policy issues with the senior management of EMRC represented by Ms Al-Rabadi, EMRC Deputy Chairman, and Mr Kasht, Director of Communication and International Cooperation at EMRC. The discussions resulted in agreement that the regulatory functions covering the following facilities and activities were to be reviewed by the IRRS follow-up mission:

- Research reactor,
- Waste facilities,
- Radiation sources facilities and activities,
- Transport,
- Patient protection,
- Occupational exposure control,
- Nuclear power embarking.

Presentations were made on the national context, the current status of EMRC and the progress made by EMRC since the initial mission of June 2014.

IAEA staff presented the IRRS principles, process and methodology of conducting a follow-up IRRS mission. This was followed by a discussion on the tentative work plan for the implementation of the follow-up mission in Jordan in October 2017.

The proposed IRRS review team composition (senior regulators from Member States to be involved in the review) was discussed and the size of the IRRS review team was tentatively confirmed. Logistics including meeting and work space, counterparts and Liaison Officers' identification, lodging and transport arrangements were also addressed.

The EMRC Liaison Officer for the preparatory meeting and the IRRS follow-up mission was Mr Tamer Kasht.

EMRC provided the IAEA and the review team with the advance reference material for the review in August 2017 and additional materials in October 2017. In preparation for the mission, the IAEA review team members conducted a review of the advance reference material and provided their initial review comments to the IAEA Team Coordinator and Team Leader prior to the follow-up mission.

### B) REFERENCES FOR THE REVIEW

The relevant IAEA safety standards and the Code of Conduct on the Safety and Security of Radioactive Sources were used as review criteria. A list of IAEA publications used as the reference for this mission is given in Appendix VII.

## C) CONDUCT OF THE REVIEW

An initial IRRS review team meeting was conducted on Saturday, 14 October, in Amman by the IRRS Team Leader and the IRRS IAEA Team Coordinator to discuss the general overview, the focus areas and specific issues of the mission, to clarify the basis for the review and the background and objectives of the IRRS and to agree on the methodology for the review and the evaluation among all reviewers. They also presented the agenda for the mission.

The Liaison Officer, Mr Tamer Kasht, was present at the initial IRRS review team meeting, in accordance with the IRRS guidelines, and presented logistical arrangements planned for the mission.

The reviewers also reported their first impressions of the advance reference material. General approaches for mission conclusions drafting were agreed.

The IRRS entrance meeting was held on Sunday, 15 October 2017, with the participation of EMRC Chairman, H.E. Farouq Al-Hyari, senior management and staff. Opening remarks were made by the EMRC Deputy Chairpman, Ms Al-Rabadi, and the Team Leader, Mr Nikolay Vlahov. An overview of EMRC's activities was given and EMRC's response to the 2014 mission findings.

During the mission, a review was conducted for all the mission scope areas with the objective of reviewing the Government and EMRC's response to the recommendations and suggestions identified during the original mission. The review was conducted through meetings, interviews and discussions regarding the national practices and activities.

The IRRS review team performed its activities based on the mission programme given in Appendix II.

The IRRS exit meeting was held on Sunday 22 October 2017 where the IRRS Team Leader Mr Nikolay Vlahov presented the results of the follow-up mission highlighting the main findings. This was followed by a statement by Ms Al-Rabadi, EMRC Deputy Chairman, in response to the Team Leader's presentation. Closing remarks were made by Mr Hilaire Mansoux on behalf of the Director of the Division of Radiation, Transport and Waste Safety, Department of Nuclear Safety and Security.

An IAEA press release was issued and a press conference was held at the end of the mission.

# 1. RESPONSIBILITIES AND FUNCTIONS OF THE GOVERNMENT

## 1.1. NATIONAL POLICY AND STRATEGY FOR SAFETY

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R1** | **Recommendation: 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.** |

**Changes since the initial IRRS mission**

**Recommendation 1**: The EMRC has developed a National Policy and Strategy for Nuclear Safety. The Government approved the National Policy on 17 December 2015 following a resolution (No. 13019) of the Council of Ministers. The National Policy sets up the policy framework to implement the IAEA Fundamental Safety Principles (SF-1) and the Convention on Nuclear Safety and covers the following topics:

1. Producing and publishing national legislations regulating nuclear safety;
2. Transparency;
3. Regulatory independence;
4. Nuclear safety;
5. Adopting highest international nuclear safety standards;
6. Roles and responsibilities assigned to the regulatory authority;
7. Treaties and Conventions;
8. Civil liability;
9. Non-Proliferation of nuclear weapons
10. Nuclear security and emergency preparedness;
11. Public awareness and stakeholders' involvement;
12. Spent fuel and radioactive waste management.

Requirement 1 of GSR Part 1 is also covered by the National Policy, with the exception of paragraphs 2.3(d) and (e), which are covered by Law No. 8 of 2017 (EMRC Law) as shown below.

| | |
|---|---|
| 2.3(d) The need and provision for human and financial resources | Article 3 of the EMRC Law |
| 2.3(e) The provision and framework for research and development | Article 4A(3) and 4A(4) of the EMRC Law |

The policy and strategy for safety culture is also promulgated in Articles 9 and 25(a)(7) of the Radiation Protection Regulations (No. 108 of 2015). Safety culture is also covered in detail in the EMRC's Nuclear Safety Culture Program (December 2015).

**Status of the finding in the initial mission**

**Recommendation 1 is closed,** as the Government has approved and published a National Policy and Strategy for Nuclear Safety that meets Requirement 1 of GSR Part 1.

## 1.2. ESTABLISHMENT OF A FRAMEWORK FOR SAFETY

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R2** | **Recommendation: The Government should ensure that the proposed new law addresses the following issues in accordance with GSR Part 1:**<br>**Assigning prime responsibility for safety to the operator**<br>**Provision for appeals against decisions of the regulatory body**<br>**Provision for preparedness for, and response to, a nuclear or radiological emergency**<br>**Criteria for release from regulatory control**<br>**Clear powers for inspectors**<br>**Involvement of interested parties and for their input to decision making**<br>**Note: This Recommendation also covers issues raised in sections 1.3, 1.4, 3.6, 5.2, 7.1.3, 8.1, 11.2.3.** |
| **R3** | **Recommendation: The Government should, working with EMRC and as a matter of urgency, complete the regulations and instructions that are currently in a draft form and ensure that the remainder of the regulatory framework is established as soon as possible.**<br>**Note: This Recommendation also covers issues raised in sections 3.6, 9.1.1, 9.2, 9.3, 9.4, 9.5, 11.2.4, 11.2.19.** |

**Changes since the initial IRRS mission**

**Recommendation 2:** The EMRC has prepared the draft Radiation Protection and Nuclear Safety and Security Law, which is awaiting Parliament approval. It covers the first five issues in Recommendation 2, as follows:

| | |
|---|---|
| Assigning prime responsibility for safety to the operator | Article 34(A) |
| Provision for appeals against decisions of the regulatory body | Article 30(B) |
| Provision for preparedness for, and response to, a nuclear or radiological emergency | Articles 17 and 18 |
| Criteria for release from regulatory control | Article 6(E) |
| Clear powers for inspectors | Articles 41(b) and 41(c) |

The detailed criteria for release from regulatory control (clearance) have been published in the Instructions on Exempted Practices from Radiation Protection Requirements and the Criteria for Clearance.

Article 16 of EMRC Law makes provision for the involvement of interested parties and for their input to decision making.

**Status of the finding in the initial mission**

**Recommendation 2 is closed on the basis of progress made and confidence in effective completion**, as the draft Radiation Protection and Nuclear Safety and Security Law addresses all the issues raised in the recommendation and is awaiting Parliament's approval.

**Changes since the initial IRRS mission**

**Recommendation 3**: The following regulations described in the initial IRRS mission report as being in draft form have been issued:

- Draft Regulation of Radiation Protection has been issued as Radiation Protection Regulations (No. 108 of 2015) (Published in Official Gazette No. 5367);
- Draft Regulation on the Management and Treatment of Radioactive Waste and Spent Fuel has been issued as two instructions, namely, Instruction on the Safety of Radioactive Waste Management and Instruction on the Safety of Spent Fuel Management, both of which were issued on 17 Nov 2015;
- Draft Regulation on the Transport of Radioactive Materials has been issued as Regulation on the Transport of Radioactive Materials (No. 32/2016) (Published in Official Gazette No. 5387).

The draft Regulation on Extracting, Mining and Processing of Nuclear Materials has not been finalized. This is because uranium mining and milling is still at the feasibility study stage and the draft regulation may be finalized in the longer term only if it is necessary to do so.

Recommendation 3 also covered issues raised in sections 9.3, 9.4, 9.5, 11.2.4 and 11.2.19 of the initial IRRS mission report. The draft regulations and instructions referred to in these sections are listed below with the current status described against each:

- Draft Instruction on Safety of Research Reactors has been issued as Research Reactor Safety Instructions (1 December 2015).
- Draft Instruction for site evaluation for nuclear facilities is now covered in the Instruction on Procedure for Issuing Site Permits for Nuclear Power Plants (15 December 2015).
- Draft guidance on the application of graded approach regarding safety assessment of research reactors and preparation of the safety analysis report is covered by the Research Reactor Safety Instructions (1 December 2015), which embeds the IAEA's NS-R-4 and which will be updated by the middle of 2018 to take into account IAEA SSR-3, which has replaced NS-R-4. The EMRC has agreed that it will be useful to include relevant parts of IAEA's Specific Safety Guide: Use of Graded Approach in the Application of Safety Requirements for Research Reactors (SSG-22).
- Draft guidance document on commissioning of research reactors was never completed and has since been overtaken by events as the commissioning of JRTR has been completed.
- Draft Instruction on Licensing of Radioactive Waste Management and Spent Fuel Management Facilities has been issued as the Instruction on the Safety of Radioactive Waste Management and Instruction on the Safety of Spent Fuel Management on 17 November 2015.

- Draft Instructions for the safe transport of radioactive materials has been issued as Regulation on the Transport of Radioactive Materials No. 32/2016 (Published in Official Gazette No. 5387).
- Draft Instruction on the Safety of Nuclear Power Plants has not been issued yet. A draft regulation on the subject dated 2011 will be updated by an IAEA expert mission that is expected to complete the work by the end of 2018.
- Draft Instruction on the Procedure for Issuing Licences and Permits for Nuclear Facilities and Associated Activities has been overtaken by a decision of the EMRC to divide this draft instruction into five instructions as follows:
    - Instruction on Procedure for Issuing Site Permits for Nuclear Power Plants, which was issued on 15 December 2015;
    - Instruction on Procedure for Issuing Construction Permits for Nuclear Power Plants, which was issued on 15 December 2015;
    - Three proposed instructions on procedures for issuing commissioning permits, operation licence, and decommissioning licence for Nuclear Power Plants. (Issue date to be determined based on the progress of Jordan's nuclear power programme.)
- Draft Instruction on the Provision of Physical Protection and Security of Nuclear Facilities, Nuclear Material and Radioactive Substances has been overtaken by a decision to issue the following three instructions under Regulation for the Safe Use of Nuclear Energy (No. 43 of 2014):
    - Instruction on Information Security and Computers (issued on 12 June 2016);
    - Instruction on Nuclear Security for Nuclear Facilities and Related Activities (issued on 12 June 2016) ;
    - Instruction on Trustworthiness of Employee in Research Reactors (issued on 22 December 2015, and amended and updated on 16 March 2016).

**Status of the finding in the initial mission**

**Recommendation 3 is closed on the basis of progress made and confidence in effective completion**, as almost all the draft regulations and instructions identified by this recommendation have been finalized, with only the proposed instructions for the nuclear power programme and the draft Regulation on Extracting, Mining and Processing of Nuclear Materials remaining to be completed when required.

## 1.3. ESTABLISHMENT OF A REGULATORY BODY AND ITS INDEPENDENCE

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R4** | **Recommendation: 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.**<br><br>**Note: This Recommendation also covers issues raised in sections 3.1, 3.2, 11.2.3.** |

**Changes since the initial IRRS mission**

**Recommendation 4:** The Government has, through Article 3 of the EMRC Law, established the Commission as a separate legal entity with financial and administrative independence. The Government

has ensured the EMRC's regulatory independence by moving it out of the Ministry of Energy and bringing it under the Prime Minister.

The Government has, in the National Policy and Strategy for Safety and Article (7)A2 of the EMRC Law, expressed that safety is paramount and the making of regulatory judgements and decisions should be on sound technical basis.

The EMRC has drafted four laws, each specifying one of the regulatory functions of EMRC. Thus separate laws apply within the EMRC to the regulation of energy and minerals, electricity production, oil products and other natural resources, and radiation protection and nuclear safety.

For radiation protection and nuclear safety, the law is the draft Radiation Protection and Nuclear Safety and Security Law. Article 5(h) of this draft Law requires the EMRC to set standards, determine procedures, and review decisions without prejudice to the requirements of nuclear safety and radiation protection. Article 14(D) of the draft Law requires licensees and authorized persons to give priority to nuclear safety and radiation protection in activities related to nuclear facilities and radiological installations.

At the procedural level, the Radiation Protection Directorate (RPCD) and Nuclear Safety Directorate (NSD) ensure that a document called "Task Guidelines" is established for each section within the Directorate. This document specifies the roles and responsibilities of the sections for each task assigned to the Directorates. The roles and responsibilities that are specified must comply with the above-mentioned requirements of the EMRC Law and the National Policy.

**Status of the finding in the initial mission**

**Recommendation 4 is closed on the basis of progress made and confidence in effective completion**, as the Government has laws to ensure regulatory independence and the EMRC has the necessary internal procedures to ensure that the requirements of the laws are applied. However, the draft Radiation Protection and Nuclear Safety and Security Law is awaiting approval from the Parliament.

## 1.4. RESPONSIBILITY FOR SAFETY AND COMPLIANCE WITH REGULATIONS

**There were no findings in this area in the initial IRRS mission.**

## 1.5. COORDINATION OF AUTHORITIES WITH RESPONSIBILITIES FOR SAFETY WITHIN THE REGULATORY FRAMEWORK

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R5** | **Recommendation: 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.**<br><br>**Note: This Recommendation also covers issues raised in sections 7.1.1, 12.1.** |

**Changes since the initial IRRS mission**

**Recommendation 5:** The EMRC has analyzed its regulatory functions and activities and has identified the authorities with which it has to coordinate. Based on the results, the EMRC has established a strategy for coordination arrangements. A Memorandum of Understanding (MoU) has been signed with the EMRC's main stakeholder, the Ministry of Environment in 2015. The MoU with the Ministry of Environment includes coordination arrangements on the environmental impact assessment for the Jordanian nuclear power project. The MoU also describes the role of the Ministry of Environment in, among others, radioactive waste management, nuclear power plant siting, and mining and milling.

A MoU with the Ministry of Health was signed in mid-2017. However, the Ministry of Health has recently withdrawn it to propose certain amendments and it is expected to be finalised in 2017.

A MoU has also been prepared and discussed with the Public Security Department and is awaiting official signature.

The EMRC also has formal coordination arrangements with other government agencies to cooperate in the field of safety and security of radioactive sources. Such arrangements include exchange of formal correspondence as well as formulations of joint committees. For example, EMRC and Jordan Armed Forces have a joint committee to coordinate arrangements to deal with orphan sources. There are also coordination committees for nuclear emergencies, and nuclear security.

Other formal arrangements have been initiated with the Ministry of Interior, General Intelligence Department, Civil Defence, General Directorate of Gendarmerie, Jordan Customs, Jordan Atomic Energy Commission (JAEC), and the National Centre for Security and Crises Management.

**Status of the finding in the initial mission**

**Recommendation 5 is closed on the basis of progress made and confidence in effective completion**, as EMRC has established the strategy for coordination and is proactive in seeking formal coordination arrangements as appropriate.

## 1.6. SYSTEM FOR PROTECTIVE ACTIONS TO REDUCE EXISTING OR UNREGULATED RADIATION RISKS

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **S1** | **Suggestion: The Government should consider establishing national processes and guidance for protective actions to reduce the risk from unregulated sources.** |

**Changes since the initial IRRS mission**

**Suggestion 1:** EMRC has established procedures and guidance listed below:

- **Border crossing:** Standard Operating Procedures (SOP) for radiation detection and initial response by EMRC Front Line Officers working at border crossings to deal with contaminated

material, and other nuclear material or radioactive sources. The SOP was made by the Board of Commissioners on 28 December 2015 (Decision No. 166).

- **Orphan Sources***:* Jordanian National Strategy for Regaining Control over Orphan Sources (2017).

Other risks from unregulated sources may arise from an accident, a discontinued practice or from inadequate control of contaminated material or natural radioactivity. The EMRC intends to deal with such risks as they arise.

**Status of the finding in the initial mission**

**Suggestion 1 is closed on the basis of progress made and confidence in effective completion**, as the EMRC has initiated a strategy of making processes and guidelines to reduce the risk from unregulated sources. However, further efforts are needed to effectively cover all likely risks.

## 1.7. PROVISIONS FOR THE MANAGEMENT OF RADIOACTIVE WASTE

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **S2** | **Suggestion: 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.**<br><br>**Note: This Suggestion also covers issues raised in section 11.2.13.** |

**Changes since the initial IRRS mission**

**Suggestion 2:** At the time of the initial mission, the National Policy for Radioactive Waste and Spent Nuclear Fuel Management was awaiting approval by the Government. This policy was developed by a committee chaired by the JAEC and approved by the Prime Minister following consideration by the Council of Ministers. The approved policy document was published in Official Gazette number 5351 on 2 August 2015. The EMRC has also taken steps to adopt and implement the policy. To this end the EMRC has issued the Instruction on Management of Radioactive Waste for the practical application of the policy.

**Status of the finding in the initial mission**

**Suggestion 2 is closed**, as the National Policy for Radioactive Waste and Spent Nuclear Fuel Management has been published.

## 1.8. COMPETENCE FOR SAFETY

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R6** | **Recommendation: 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.** |

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| | **Note: This Recommendation also covers issues raised in sections 6.1.2, 11.2.9.** |

**Changes since the initial IRRS mission**

**Recommendation 6:** The EMRC has outlined the processes in place to maintain an appropriate level of staffing and to train staff. These include:

- The formation of a higher national human resources committee to establish a strategy and a national work plan for developing the human resources necessary for the Jordanian nuclear programme.
- The formation of a Personnel Affairs Committee headed by the Secretary General of EMRC to study job requirements, identify shortfalls and surpluses, draw up job descriptions, and review jobs and numbers according to the changes that may affect the organizational requirements.
- Annual financial appropriation in EMRC's budget to hire consulting firms to assist in implementing regulatory processes and to train staff.
- Actively using training opportunities offered by the donor organizations, such as the IAEA.
- Facilitating a regional radiation training center for the benefit of EMRC staff and countries in the region.

Staff levels in the RPCD and NSD have increased from 39 in 2014 to 53 in 2017. The EMRC is planning to further increase staff numbers in the RPCD and NSD by 17 in 2018 and 11 in 2019.

**Status of the finding in the initial mission**

**Recommendation 6 is closed**, as there has been progress in increasing the number of staff and there are systems and processes in place to recruit staff based on projected operational needs.

## 1.9. PROVISION OF TECHNICAL SERVICES

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **S3** | **Suggestion: The Government should consider establishing internal dosimetry arrangements in a timely manner.**<br><br>**Note: This Suggestion also covers issues raised in section 12.2.** |

**Changes since the initial IRRS mission**

**Suggestion 3:** The Government, through JAEC, has established a direct measurement system for internal exposure. The FASTSCAN whole body counter was bought, and placed in King Abdullah University Hospital. It is designed to monitor people quickly and accurately for internal contamination of radionuclides with energies between 300 keV to 1.8 MeV. Category A employees are monitored once every six months, category B employees once every year. An indirect method is under arrangement

between Jordan and the IAEA in establishing a laboratory for measuring internal intake of radioactive materials.

**Status of the finding in the initial mission**

**Suggestion 3 is closed,** as internal dosimetry arrangements have been made.

# 2. THE GLOBAL SAFETY REGIME

## 2.1. INTERNATIONAL OBLIGATIONS AND ARRANGEMENTS FOR INTERNATIONAL COOPERATION

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R7** | **Recommendation: 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.**<br><br>**Note: This Recommendation also covers issues raised in section 11.2.2.** |

**Changes since the initial IRRS mission**

**Recommendation 7:** On 4 January 2016, Jordan received Royal assent to become a contracting party to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. Jordan acceded to the Joint Convention on 15 April 2016. It entered into force in Jordan on 14 July 2016. Jordan is in the process of ratification. Jordan will be submitting a national report to the next review meeting of the Joint Convention in April 2018. Jordan submitted a national report to the 2017 review meeting of the Convention on Nuclear Safety and also participated in the meeting.

**Status of the finding in the initial mission**

**Recommendation 7 is closed,** as Jordan has become a contracting party to the Joint Convention and is fulfilling its obligation to participate in the relevant international arrangements.

## 2.2. SHARING OF OPERATING EXPERIENCE AND REGULATORY EXPERIENCE

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **S4** | **Suggestion: EMRC should consider establishing processes for identifying and sharing lessons learnt from operating experience and regulatory experience.** |

**Changes since the initial IRRS mission**

**Suggestion 4:** The EMRC has established processes to identify and share lessons learnt from operating and regulatory experience. These include:

- A portal for sharing information and knowledge, into which training materials and any other information regarding the regulatory role of EMRC are uploaded;
- Access to the Incident Reporting System for Research Reactors (IRSRR) to share operating experience and knowledge and learn from those reported by other members;
- Attendance at International Nuclear and Radiological Event Scale (INES) technical meetings;
- Participation in the Arab Network of Nuclear Regulators (ANNuR).

**Status of the finding in the initial mission**

**Suggestion 4 is closed**, as the EMRC has established processes to identify and share lessons learnt from operating and regulatory experience.

## 3. RESPONSIBILITIES AND FUNCTIONS OF THE REGULATORY BODY

### 3.1. ORGANIZATIONAL STRUCTURE OF THE REGULATORY BODY AND ALLOCATION OF RESOURCES

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **S5** | **Suggestion: EMRC should consider finalizing the 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.**<br><br>**Note: This Suggestion also covers issues raised in section 10.1.** |

**Changes since the initial IRRS mission**

**Suggestion 5:** The EMRC has, under Articles (7) A5 of the EMRC Law, the mandate to restructure its administrative organization and structure. This is done in coordination with the Ministry of Public Sector and any change is subject to approval of the Cabinet.

The EMRC has a unit that is tasked with looking for opportunities to rationalize its administrative and organizational structure and arrangements. This unit also executes any instruction to review administrative and organizational structure and arrangements. Since 2014 the EMRC has reviewed its administrative organization through a systematic process as follows:

- Analyze the current role and functions implemented by a Directorate;
- Prepare proposals and recommendations for restructuring and submit the proposals to the Planning Committee (chaired by the CEO and comprising the Secretary General, the directors of Directorates and the heads of units);
- Following approval by the Planning Committee, proceed as mentioned in the first paragraph above.

These processes were followed recently in the creation of the Nuclear Security Directorate on 3 August 2017 through the merger of the Border Control Directorate with the security elements of the Nuclear Safety Directorate.

**Status of the finding in the initial mission**

**Suggestion 5 is closed,** as the EMRC has a system to assess its current and future organizational needs and establish new administrative and organizational structures, as required.

## 3.2. EFFECTIVE INDEPENDENCE IN THE PERFORMANCE OF REGULATORY FUNCTIONS

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **S6** | **Suggestion: 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.** |

**Changes since the initial IRRS mission**

**Suggestion 6:** The EMRC has a list of core values, which it has promulgated. These are transparency, integrity and justice, maintaining competitiveness, teamwork spirit, performance, motivation, quality control and assurance, and community responsibility. Transparency, integrity and justice as well as quality control and assurance are particularly relevant to regulatory independence.

The EMRC has published an internal document in the form of a table showing its staff how each value, when applied on the job, would be reflected in the EMRC's activities, documents, programmes or committees and what the final outcome would look like.

EMRC staff has been trained on the core values and their importance. A questionnaire survey in 2016 showed that 73 percent of EMRC staff understood the core values and their application.

**Status of the finding in the initial mission**

**Suggestion 6 is closed,** as the EMRC has developed a statement describing its regulatory values, including regulatory independence.

## 3.3. STAFFING AND COMPETENCE OF THE REGULATORY BODY

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R8** | **Recommendation: 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.**<br><br>**Note: This Recommendation also covers issues raised in sections 7.1.1, 7.1.3, 11.2.9, 11.2.12.** |
| **R9** | **Recommendation: The Government and EMRC should identify and implement innovative approaches to attract and retain highly qualified staff at EMRC to support its nuclear and radiation safety regulatory functions.** |

**Changes since the initial IRRS mission**

**Recommendation 8:** The EMRC is undertaking the following activities in relation to human resources and training for its current and new regulatory staff:

- Annual assessment of training and professional needs and yearly training;

- Attendance at conferences, seminars, colloquiums and scientific meetings;
- Ensuring staff get training opportunities from international organisations, e.g., the IAEA;
- Annual allocation of money to hire consulting firms to assist in regulation and to train staff;
- Initiation of a regional training centre;
- Assistance from the EU to EMRC and the Ministry of Environment to improve regulatory capability.

The Staffing Plan and Training Programme for the RPCD and the Human Resource Plan for the NSD were provided to the IRRS team to substantiate the progress. Although the training plans and programme are still being developed, the activities described in the above list and the planning process in place demonstrate that a system is in place to deal with human resource development and training issues as the EMRC progresses.

**Recommendation 9:** the EMRC:

- has issued an instruction on granting incentives for employees based on achievement, and
- sends its employees to international training courses and workshops.

EMRC provided the IRRS team a copy of its instructions on granting incentives. Briefly, the instruction provides for the following:

- Every employee receives, according to his or her level, a monthly financial incentive based on several factors, including the employee's length of service, examinations passed successfully and other performance-based achievements.
- Employees undertaking field trips (for example, inspections) away from home receive an allowance that is worked out based on the employee's base salary.
- Incentives are provided as a percentage of the employee's salary based on professional conduct and achievement, such as, timeliness, achievement of tasks, efficiency, and exercise of initiative and innovation.

**Status of the finding in the initial mission**

**Recommendation 8 is closed on the basis of progress made and confidence in effective completion,** as a system is in place to deal with human resource and training issues as the EMRC progresses, although training programmes are still being developed.

**Recommendation 9 is closed**, as the EMRC has implemented innovative ways to attract and retain staff.

## 3.4. LIAISON WITH ADVISORY BODIES AND SUPPORT ORGANIZATIONS

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **S7** | **Suggestion: 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.**<br><br>**Note: This Suggestion also covers issues raised in section 11.2.7.** |

**Changes since the initial IRRS mission**

**Suggestion 7:** The EMRC Board of Commissioners decided in June 2017 (Decision No. 519/2017) to establish an external consultation committee called 'Consultation Technical Committee for Nuclear and Radiation Safety Issues'. The Committee will provide technical advice and support the decision making process to ensure nuclear safety and radiation protection. This committee comprises members from:

- Royal Scientific Society
- Chairman of the University of Jordan
- Chairman of the Jordan University for Science and Technology
- Chairman of the Al Hussain University
- Jordan Engineers Association
- Jordan Industry Chamber
- Chairman of Al-Azraq Municipality
- Electrical Employees Association
- Jordan Geological Association
- Jordan Contractors Association

The EMRC has noted that the basis of Suggestion 7 is GSR Part 1, Requirement 20, para 4.18, which requires advisory bodies to provide independent advice. The EMRC informed the team that the first meeting of this committee is expected to be by the end of 2017 and this meeting will decide on the detailed terms of reference, taking into account the need to ensure that the committee provides independent advice.

**Status of the finding in the initial mission**

**Suggestion 7 is closed**, as the EMRC has established a technical advisory committee.

## 3.5. LIAISON BETWEEN THE REGULATORY BODY AND AUTHORIZED PARTIES

**There were no findings in this area in the initial IRRS mission.**

## 3.6. STABILITY AND CONSISTENCY OF REGULATORY CONTROL

**There were no findings in this area in the initial IRRS mission.**

## 3.7. SAFETY RELATED RECORDS

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R10** | **Recommendation: EMRC should take prompt actions to establish effective arrangements to manage safety-related documents and records, so as to ensure that they are available, identifiable and easily retrievable.**<br><br>**Note: This Recommendation also covers issues raised in sections 4.4, 5.2, 7.1.2.** |

**Changes since the initial IRRS mission**

**Recommendation 10:** The EMRC is using the following to maintain its safety-related records:

(1) Regulatory Authority Information System (RAIS) for managing the inventory of radiation sources. RAIS is fully implemented in the RPCD and helps in controlling the radiation sources inventory in Jordan. It includes:

a. registers of sealed radioactive sources and radiation generators,
b. records of occupational doses (annual dose records),
c. inventories of radioactive wastes (disused sources).

(2) A new software called *E-captured* implemented in 2016 for managing all the documents in the NSD and the RPCD. This software enables the scanning and electronic filing of records. It is being applied in both Directorates for reading, completeness-checking, identifying and retrieving documents. The software enables management according to specific categories and directories, for example, safety documents, inspection results, and licensing documents. The EMRC Board decided on 16 April 2016 that the records kept by licence holder must be maintained for the life of a facility and 15 years after the decommissioning.

(3) EMRC has also been using the administrative software called *Zajel*; this software is for the formal correspondence arriving to and leaving EMRC. Each formal correspondence is maintained by this software on a timely basis and can be easily retrieved and identified.

The EMRC would further benefit from establishing internal procedures on managing archives of records related to safety.

**Status of the finding in the initial mission**

**Recommendation 10 is closed on the basis of progress made and confidence in effective completion**, as the EMRC has a system of electronic record keeping for safety-related records. However, further efforts are required for EMRC's internal management of safety related records.

## 3.8. COMMUNICATION AND CONSULTATION WITH INTERESTED PARTIES

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **S8** | **Suggestion: EMRC should consider developing further, and formalizing in a policy, its information and consultation strategy with interested parties.** |

**Changes since the initial IRRS mission**

**Suggestion 8:** The EMRC has a Communication Plan for 2015 to 2017, which is updated annually. The plan covers print and broadcast media, electronic and social media, workshops and awareness sessions and the distribution of pamphlets and brochures to the public and schools. The aim of the communications activities is to help the public understand the roles of EMRC and how they benefit from the EMRC's regulatory activities for nuclear safety and radiation protection.

The EMRC reported that it has had information sessions with the public, schools and local communities on radiation protection. In 2016 the EMRC organized three public events in each of the 12 governorates, including events in schools and in 2017, the EMRC organized four media conferences at its offices. In addition, in 2016 and 2017, the EMRC issued 104 press releases, and organized 107 radio interviews and five television interviews. The EMRC also makes extensive use of electronic and social media, including Facebook, its Internet website and text messages.

In the area of nuclear safety, EMRC conducted about 20 formal meetings in 2016 and 15 meetings so far in 2017 with the Jordan Research and Training Reactor (JRTR). Meetings were also held with the Jordan Nuclear Power Company (JNPC) to exchange information on the NPP site permit application.

**Status of the finding in the initial mission**

**Suggestion 8 is closed,** as the EMRC has a strategy and communication plan in place and has also demonstrated that it has undertaken extensive communication activities.

# 4. MANAGEMENT SYSTEM OF THE REGULATORY BODY

## 4.1. IMPLEMENTATION AND DOCUMENTATION OF THE MANAGEMENT SYSTEM

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R11** | **Recommendation: 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:**<br>- **defining, documenting, and implementing the core regulatory processes;**<br>- **bringing all the requirements for managing the organization together in a coherent way;**<br>- **assigning authority and responsibility for the regulatory processes to designated individuals;**<br>- **assessing and continually improving the processes of the management system.**<br>**Note: This Recommendation also covers issues raised in sections 4.5, 10.4.** |

**Changes since the in the initial IRRS mission**

**Recommendation 11:** An integrated management system (IMS) is in the process of development. The EMRC has recently - on 7 August 2017 - established an internal unit called Quality Control Unit to spearhead the development of an IMS for the EMRC. At the time of the formation of the QC Unit, the EMRC also approved the hiring of a consultant to help in the development of the documented procedures needed for the IMS. The RPCD and NSD are well placed to contribute to and link into the IMS for the following reasons:

- Each of the RPCD and NSD has an overarching Operations Manual that describes the core regulatory processes of licensing, review and assessment and inspection.
- The RPCD has a Service Manual describing its licensing process. The NSD is now drafting its licencing procedures for approval early in 2018 in order to be ready for an IAEA expert mission that is expected in 2018.
- Both RPCD and NSD have Inspection Manuals.
- The RPCD and NSD are participating in two IAEA projects that will support the development and implementation of the IMS. The projects aim to assist Arab regulators in the regulation of radiation sources and Arab countries (regulators and operators) aiming to embark on NPP programmes. The target completion date is 2020.
- The RPCD and NSD have in place management system manuals which were used by the (then) JNRC. Although these manuals are not formal EMRC documents, they will be useful references for RPCD's and NSD's contribution to the development of EMRC's IMS.

In relation to the specifics in Recommendation 11:

- The core regulatory processes are described in the Operations Manuals.
- The IMS, when established, will bring all requirements for managing the EMRC together.

- Individuals who lead the development of manuals or procedures for each core regulatory process will take ownership of the maintenance and review of those regulatory processes.

The assessment and continuous improvement of the management system will be done after the IMS is established.

**Status of the finding in the initial mission**

**Recommendation 11 is closed on the basis of progress made and confidence in effective completion**, as the RPCD and NSD are well placed to contribute to the development of the IMS, which is in its development phase.

## 4.2. MANAGEMENT RESPONSIBILITY

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R12** | **Recommendation: 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.** |

**Changes since the initial IRRS mission**

**Recommendation 12:** The EMRC has established an internal unit called the Quality Control Unit and has appointed a manager to lead this unit. This unit, which has a total of five staff, has been given the responsibility to develop the management system. The Manager of the QC Unit will be the individual responsible for developing, maintaining, assessing, improving and implementing the IMS. The Manager reports directly to the Chairman and senior management of EMRC on any issue related to the management system. The QC Unit is now undertaking a gap analysis in every directorate of the EMRC in order to determine the scope of work to develop an IMS.

**Status of the finding in the initial mission**

**Recommendation 12 is closed,** as the EMRC has appointed an individual reporting directly to senior management with the responsibility and authority to coordinate the development and implementation of the IMS.

## 4.3. RESOURCE MANAGEMENT

**There were no findings in this area in the initial IRRS mission.**

## 4.4. PROCESS IMPLEMENTATION

**There were no findings in this area in the initial IRRS mission.**

## 4.5. MEASUREMENT, ASSESSMENT AND IMPROVEMENT

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **S9** | **Suggestion: EMRC should consider extending the authority and capacity of the internal audit unit to cover the responsibility of independent assessments of regulatory processes and technical matters related to safety.** |

### Changes since the initial IRRS mission

**Suggestion 9:** The EMRC has extended the authority of the Internal Audit Unit to undertake technical audits, in addition to the administrative and financial audits for which it previously had responsibility. Technical audits include the independent assessment of regulatory processes and technical matters related to safety.

The Internal Audit Unit reports directly to the Chairman and senior EMRC management and receives its mandate and priorities from the Government. The Unit has a Manager and three full time staff. Each EMRC directorate has a staff member that directly coordinates and communicates with the Unit.

The Unit undertook an audit of the NSD in the first quarter of 2017. It audited the NSD's core regulatory procedures and processes.

### Status of the finding in the initial mission

**Suggestion 9 is closed,** as the EMRC has extended the authority and capacity of the Internal Audit Unit to cover the audit of regulatory processes and technical matters related to safety.

# 5. AUTHORIZATION

## 5.1. GENERIC ISSUES

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R13** | **Recommendation: EMRC should further formalize the application of a graded approach in the authorization process based on the radiation risks associated with facilities and activities.**<br><br>**Note: This Recommendation also covers issues raised in section 5.3.** |
| **R14** | **Recommendation: EMRC should develop adequate guidance on the format and content of the documents to be submitted by the applicant in support of its licence application.**<br><br>**Note: This Recommendation also covers issues raised in section 5.3.** |

**Changes since the initial IRRS mission**

**Recommendation 13:** According to Article 14 of the law No. 43/2007 any operation involving the possession or the use of a radioactive source has to be authorized and EMRC has been delegated the responsibility for granting licenses and permits for radiation and nuclear facilities, and workers in the radiation and nuclear fields.

EMRC has developed and issued a number of specific instructions on licensing requirements for various facilities and activities commensurate with the radiation risks associated with the facilities and activities and in accordance with a graded approach. In addition, EMRC has prepared a draft amendment to Regulation No. 8 of 2013 on the "Basis and Conditions for Granting Licences and Permits for Radiation Work" which includes a proposal to change the period of license validity for radiation practices and personal licences in accordance with the graded approach. This amendment is awaiting signature by the Prime Minister.

**Recommendation 14:** The EMRC website has a dedicated page which provides application forms and sets out the list of documents that must be submitted by the applicant in support of different licence application types. In November 2015, EMRC issued a licensing service manual for applicants which gives instructions and guidance on the steps to be taken, and the required format and content of documents to be submitted. The guidance covers all applicable radiation practices in Jordan.

**Status of the finding in the initial mission**

**Recommendation 13 is closed on the basis of progress made and confidence in effective completion**, as EMRC has developed and issued specific instructions on licensing requirements for various facilities and activities commensurate with a graded approach, and has drafted an amendment to Regulation No. 8 of 2013, awaiting approval, which includes a proposal to change the period of license validity for radiation practices and personal licenses in facilities and activities in accordance with a graded approach.

**Recommendation 14 is closed,** as EMRC has issued a licensing service manual in 2015 giving instructions and guidance on the steps to be taken by applicants, and the required format and content of documents to be submitted for all radiation facilities and practices in Jordan.

## 5.2. AUTHORIZATION OF RADIATION SOURCES FACILITIES AND ACTIVITIES

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R15** | **Recommendation: EMRC should ensure that all facilities and activities that require a licence 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.**<br><br>**Note: This Recommendation also covers issues raised in section 7.1.1.** |
| **S10** | **Suggestion: 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.** |
| **S11** | **Suggestion: 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.** |

**Changes since the initial IRRS mission**

**Recommendation 15:** EMRC has developed and issued instructions on licensing veterinary facilities and has issued official letters to all veterinary facilities advising them of the requirement to be in compliance with the relevant legislation. Since the initial IRRS Mission, EMRC has licensed veterinary facilities and has conducted inspections of such facilities as part of its annual inspection programme.

A computerised process comprising the IAEA database RAIS version 3.3 and the administrative software Zajel has been put into operation for recording and tracking facilities and activities requiring licences, and for tracking the license validity or expiry date. Based on this computerized system, facilities and activities approaching the end of their licensed period are notified in advance and requested to submit applications in order to renew their licence.

**Suggestion 10:** According to Law No. 43 of 2007 any person performing a practice or work that has nuclear or radiation safety relevance needs a license for such activities. The IRRS team was advised that this requirement is also contained in the draft Radiation Protection and Nuclear Safety and Security Law and accordingly the issuing of personal licenses cannot be waived.

EMRC has approved a draft amendment to Regulation No. 8 of 2013 on the Basis and Conditions for Granting Licenses and Permits for the Radiation Work which proposes to introduce:

- changing the validity period of licences for radiation practices and for personal licences to be commensurate with the radiation risks associated with facilities and activities, and in accordance with a graded approach;

- developing new criteria for licensing radiation sources and devices such that these will be issued as an attachment to the radiation practice license instead of being issued as individual licenses;

- requiring exempted sources to be subject to notification only rather than registration.

This amendment is awaiting signature by the Prime Minister.

**Suggestion 11:** EMRC is using the Regulatory Authority Information System (RAIS) developed by IAEA. Data previously stored in other databases held by EMRC have been transferred into RAIS, and RAIS is now the single official database used in EMRC for managing the national register of radiation sources.

**Status of the finding in the initial mission**

**Recommendation 15 is closed,** as EMRC is using the IAEA database RAIS version 3.3 and the administrative software Zajel for recording and tracking all facilities and activities requiring licences, and for tracking the license validity or expiry date.

**Suggestion 10 is closed on the basis of progress made and confidence in effective completion**, as EMRC has approved a draft amendment to Regulation No. 8 of 2013, awaiting approval, which proposes to extend the validity period of licences for radiation practices and for personal licences; to issue licences for radiation sources and devices as attachments to the radiation practice licence; to require exempted sources to be subject to notification.

**Suggestion 11 is closed,** as EMRC is using the IAEA database RAIS as the single official national register of radiation sources.

## 5.3. AUTHORIZATION RESEARCH REACTORS

**There were no findings in this area in the initial IRRS mission.**

## 5.4. AUTHORIZATION OF RADIOACTIVE WASTE MANAGEMENT FACILITIES

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R16** | **Recommendation: EMRC should immediately rectify the licensing status of the radioactive waste facility at JAEC.** |
| **S12** | **Suggestion: 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.** |

**Changes since the initial IRRS mission**

**Recommendation 16:** At the time of the initial IRRS mission in 2014, EMRC had limited experience in the authorization and inspection of radioactive waste facilities. Following the IRRS Mission, the Regulation on the Safe Use of Nuclear Energy which covers the regulatory issues regarding the safe use of nuclear energy and the management of the radioactive waste facilities was issued in 2014 and EMRC issued specific instructions to regulate and control the management of radioactive waste.

During the period 2014-2017, EMRC inspectors conducted several site visits to the radioactive waste storage facility operated by JAEC (JAEC-Central Storage Facility-CSF) in order to ensure that radiation protection requirements were in place.

EMRC organized a regional workshop and invited IAEA experts in the area of radioactive waste facility authorization and licence renewal. In addition, IAEA conducted an expert mission in December 2015. This mission was aimed at providing the EMRC staff with the requirements for authorization of radioactive waste management facilities including inspection checklists.

The radioactive waste facility JAEC-Central Storage Facility-CSF had its licence renewed in June 2017 for a period of two years.

**Suggestion 12:** EMRC has attached specific conditions to the JAEC-CSF licence requiring JAEC to provide it with:

- information on new sources transferred to the radioactive waste facility within one week at latest after receiving the sources;
- the inventory of the radioactive sources every three months and with the full inventory yearly.

EMRC has entered all data related to the inventory of the radioactive waste facility into their electronic database (RAIS).

**Status of the finding in the initial mission**

**Recommendation 16 is closed,** as the radioactive waste Facility at JAEC is currently licensed until June 2019.

**Suggestion 12 is closed,** as EMRC has attached specific conditions to the JAEC-CSF licence requiring JAEC to provide it promptly with information in relation to new sources that arrive on-site and to provide quarterly and annual inventories of all sources on-site.

## 5.5. AUTHORIZATION OF TRANSPORT

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **S13** | **Suggestion: EMRC should consider revising its requirements related to transport licence application so that they include all the relevant information mentioned in TS-G-1.3.** |

**Changes since the initial IRRS mission**

**Suggestion 13:** EMRC has issued a specific instruction for licensing the transport activities based on the Law No. 43/2007. According to this instruction, EMRC requires the applicant to forward to them the relevant information mentioned in the IAEA Safety Guide TS-G-1.3 such as:

- the amount of radioactive material that can be loaded in a single shipment,
- the types of radionuclides that will be transported.

EMRC has also developed and issued transport regulations No. 32/2016 in accordance with the IAEA Safety Requirement SSR 6.

**Status of the finding in the initial mission**

**Suggestion 13 is closed,** as EMRC has issued a specific instruction for licensing the transport activities which encompass requirements in line with IAEA Safety Guide TS-G-1.3 and has also developed and issued transport regulations in accordance with the IAEA SSR 6.

# 6. REVIEW AND ASSESSMENT

## 6.1. GENERIC ISSUES

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R17** | **Recommendation: EMRC should develop a formal process for review and assessment of safety related applications, taking into account a graded approach.** |

**Changes since the initial IRRS mission**

**Recommendation 17:** EMRC has developed an operations manual for their staff which sets out in detail the formal review and assessment processes to be followed by staff of EMRC together with guidance for staff on how to conduct the review and assessment and with the timeframes for completion of these tasks in accordance with the graded approach. All licence applications and the conduct of review and assessments are tracked by the administrative software Zajel.

The head of the relevant department is responsible for ensuring that EMRC staff adheres to the timeframes for review and assessment set down in the operations manual. The EMRC Internal Audit Unit monitors the progress of all applications and reports to the CEO of EMRC in the event of delays.

**Status of the finding in the initial mission**

**Recommendation 17 is closed**, as the operations manual details the formal review and assessment process for licence applications.

### 6.1.1. MANAGEMENT OF REVIEW AND ASSESSMENT

**There were no findings in this area in the initial IRRS mission.**

### 6.1.2. ORGANIZATION AND TECHNICAL RESOURCES FOR REVIEW AND ASSESSMENT

**There were no findings in this area in the initial IRRS mission.**

### 6.1.3. BASES FOR REVIEW AND ASSESSMENT

**There were no findings in this area in the initial IRRS mission.**

### 6.1.4. PERFORMANCE OF REVIEW AND ASSESSMENT

**There were no findings in this area in the initial IRRS mission.**

## 6.2. REVIEW AND ASSESSMENT FOR RESEARCH REACTORS

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R18** | **Recommendation: EMRC should establish requirements for qualification and certification of the** |

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| | **personnel of research reactors.** |
| **R19** | **Recommendation: EMRC should develop safety acceptance criteria for the research reactors.** |

**Changes since the initial IRRS mission**

**Recommendation 18:** EMRC has issued an instruction in June 2015 on the required qualification, training and licensing of the research reactor personnel.

The instructions define the high-level requirements for licensing, training and qualifications for:

1. Senior Reactor Operators
2. Reactor Operators
3. Fuel Handlers
4. Radiation Protection workers
5. Maintenance staff

The instructions also define generic training requirements for other support staff, as well as responsibilities for administering the training programme.

The Instructions document was verified to be formally approved and issued. It provides an adequate level of requirements to ensure that the international guidance and standards on research reactor personnel licensing are followed, such as requirements defined in GSR Part 3 and 4, SSR-3 and NS-G-4.5.

The IRRS Team reviewed the authorizations currently in effect for personnel of the JRTR, as well as the existing qualification and examination records. EMRC also clarified the arrangements between JAEC and KAERI with regards to initial training and certification of JRTR personnel ensuring that the initial crew of reactor personnel is trained and certified appropriately. EMRC also demonstrated arrangements made between EMRC and KINS with regards to examination of JRTR personnel before licensing by EMRC.

EMRC demonstrated adequate understanding and implementation of personnel training, qualification and certification process.

**Recommendation 19:** EMRC demonstrated that the licensing process for the JRTR is based on the Policy Statement on the Licensing Scheme for the JRTR, signed by JNRC and JAEC in 2010. In accordance with this Policy, the review and assessment of a license submittal on the research reactor is performed on the basis of applicable standards and guidelines as set in USNRC NUREG 1537 Part 1, which includes a formal process of review and assessment of safety related documents in a license application, IAEA NS-R-4 and vendor country regulations and guidelines. The Research Reactor Safety Instructions document is being updated to reflect these criteria, scheduled for completion in 2018.

**Status of the finding in the initial mission**

**Recommendation 18 is closed,** as EMRC has established requirements for qualification and certification of the personnel of research reactors**.**

**Recommendation 19 is closed on the basis of progress made and confidence in effective completion**, as EMRC is in the process of updating its Research Reactor Safety Instructions to formalize the acceptance criteria in accordance with NUREG 1537 Part 1, SSR-3 (formerly NS-R-4) and vendor country requirements.

## 6.3. REVIEW AND ASSESSMENT FOR TRANSPORT

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **S14** | **Suggestion**: **EMRC should consider establishing processes for review, assessment and approval of package designs, taking into account existing internationally approved designs**. |

**Changes since the initial IRRS mission**

**Suggestion 14**: EMRC has issued a specific instruction, based on the Law No. 43/2007, which sets out requirements for package design. This instruction takes into account the existing internationally approved designs.

Processes for review, assessment and approval of package designs are contained in the EMRC operations manual "Issuing license for import, transport, export and transit". This manual also identifies the required documents needed for review assessment and approval of package designs which include compliance certificates issued by the manufacturer or the regulatory body of the country of origin.

**Status of the finding in the initial mission**

**Suggestion 14 is closed,** as EMRC has established processes for review, assessment and approval of package designs, taking into account existing internationally approved designs.

# 7. INSPECTION

## 7.1. GENERIC ISSUES

### 7.1.1. INSPECTION APPROACHES, METHODS AND PLANS

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R20** | **Recommendation: EMRC should reduce the influence of the current licence renewal process on its inspection programme and instead develop the programme on the basis of the radiation risks associated with facilities and activities.** |

**Changes since the initial IRRS mission**

**Recommendation 20:** EMRC has approved a draft amendment to the Regulation No. 8 of 2013 on the *Basis and Conditions for Granting Licenses and Permits for the Radiation Work* which proposes to introduce changes to the validity period of licences for radiation practices and for personal licences in order to be commensurate with the radiation risks associated with the facilities and activities, and in accordance with the graded approach; to develop criteria for licensing radiation sources and devices such that these will be issued as an attachment to the radiation practice license; and to require exempted sources to be subject to notification. This amendment is awaiting signing by the Prime Minister.

In addition, EMRC has issued an inspection manual which defines the expected frequencies of periodic inspections of the various radiation applications and practices in Jordan. The frequencies have been determined using a graded approach by taking into account the radiation risk represented by the respective radiation applications and practices.

The annual inspection programme is developed in December every year for the following year and comprises:

- routine inspections,
- inspections due to new license applications,
- inspections due to license renewal programme,
- follow-up inspections.

Based on inspection data for 2017 presented to the IRRS team it is evident that, in the interim period while awaiting the signing into law of the draft amendment to Regulation No. 8 of 2013, the annual inspection programme is still being unduly influenced by inspections due to the licence renewal programme.

**Status of the finding in the initial mission**

**Recommendation 20 is closed on the basis of progress made and confidence in effective completion,** as the EMRC inspection manual defines the expected frequencies of periodic inspections of the various radiation applications in accordance with a graded approach. However, the draft amendment to Regulation No. 8 of 2013 is awaiting approval by the Government.

### 7.1.2. INSPECTION PROCESSES AND PRACTICES

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R21** | **Recommendation: EMRC should conduct inspections and develop the associated inspection procedures to cover all facilities and activities in Jordan, including transport.**<br><br>**Note: This Recommendation also covers issues raised in section 7.5.** |

**Changes since the initial IRRS mission**

**Recommendation 21:** EMRC is conducting inspections of radiation facilities and practices including veterinary and transport practice as part of its annual inspection programme. In support of the inspection programme, EMRC has issued an inspection manual for all radiation facilities and practices in Jordan. The manual contains the relevant inspection procedure and checklists to be followed for each type of practice including transport.

EMRC demonstrated the "Approach for Inspection and Enforcement for Research Reactors and the Sub-Critical Assembly", which provides the general guidance on the conduct of inspections by nuclear inspectors, including the planning phase, execution, reporting, issuing the report and requirement on the licensee to respond.

EMRC has two resident inspectors at the JRTR who have been conducting inspections during the commissioning activities of the reactor.

**Status of the finding in the initial mission**

**Recommendation 21 is closed,** as EMRC is conducting inspections of all types of radiation facilities and practices in Jordan including veterinary and transport practices and has issued an inspection manual which contains the relevant inspection procedure and checklists to be followed for each type of facility and activity.

### 7.1.3. INSPECTORS

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R22** | **Recommendation: 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.** |

**Changes since the initial IRRS mission**

**Recommendation 22:** EMRC has established and issued instructions on the accreditation of radiation inspectors *"*Basis for the Accreditation of the Radiation Inspectors*"*. These instructions specify the criteria for determining when a new staff member is deemed competent to be appointed as an inspector. These criteria relate to the qualification, training, time of experience, number of inspections attended under supervision of senior inspectors, and passing of a theoretical examination.

The nuclear safety inspectors certification programme is summarized in Accreditation of Nuclear Inspectors (approved by Board of Commissioners 2015), and includes a requirement for 60 hours of training and successful completion of five inspections. However, the training content and other details are not entirely defined yet. There are two EMRC resident inspectors at the JRTR who receive OJT and mentoring by the consultants from KINS and Advanced Systems Technology and Management.

All radiation inspectors are provided with documented evidence of their appointment from the Chairman of EMRC which gives them the right to enter and inspect any place suspected of containing unlicensed sources, materials, equipment or radiation devices, or that any activities are practiced in violation of the law No. 43 of 2007, or of regulations or instruction issued accordingly.

**Status of the finding in the initial mission**

**Recommendation 22 is closed,** as EMRC has issued instructions specifying the criteria for determining when a new staff member is deemed competent to be appointed as an inspector and for providing documented evidence of appointment.

**New observations from the follow-up mission**

**Observation:** During interviews with the counterparts the IRRS Team was informed that the accreditation system set down in instructions on the accreditation of radiation and nuclear safety inspectors are not being implemented.

| FU Mission | RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES |
|---|---|
| | **Observation**: The processes of accreditation of radiation and nuclear safety inspectors are not being implemented. |
| **(1)** | **BASIS: GSR Part 1 Req.18 states that** *"The regulatory body shall employ a sufficient number of qualified and competent staff, commensurate with the nature and the number of facilities and activities to be regulated, to perform its functions and to discharge its responsibilities."* |
| **(2)** | **BASIS: GS-G-1.3 Para 2.10 states that "…***The degree of authority of the regulatory inspectors should be clearly specified and clear administrative procedures should be adopted and implemented***."** |
| SF1 | **Suggestion: EMRC should consider implementing the accreditation of radiation and nuclear safety inspectors as per the relevant EMRC instructions.** |

## 7.2. INSPECTION OF RADIATION SOURCES FACILITIES AND ACTIVITIES

### 7.2.1. INSPECTION OF GAMMA IRRADIATION FACILITY

**There were no findings in this area in the initial IRRS mission.**

### 7.2.2. INSPECTION OF KING HUSSEIN CANCER HOSPITAL

**There were no findings in this area in the initial IRRS mission.**

## 7.3. INSPECTION OF RESEARCH REACTORS

**There were no findings in this area in the initial IRRS mission. GP**

## 7.4. INSPECTION OF WASTE MANAGEMENT FACILITIES

**There were no findings in this area in the initial IRRS mission.**

## 7.5. INSPECTION OF TRANSPORT

**There were no findings in this area in the initial IRRS mission.**

# 8. ENFORCEMENT

## 8.1. ENFORCEMENT POLICY AND PROCESS

**There were no findings in this area in the initial IRRS mission.**

## 8.2. ENFORCEMENT IMPLEMENTATIONS

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R23** | **Recommendation: 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.** |

**Changes since the initial IRRS mission**

**Recommendation 23:** EMRC has issued an Enforcement Policy as an Instruction in accordance with Law No. 43 of 2007. The Enforcement Policy encompasses a graded approach to enforcement actions and comprises verbal warnings, written warnings, the imposition of fines and penalties, and legal prosecutions.

All staff in the Radiation Protection Directorate undergo training in implementing the Enforcement Policy. This training forms part of the annual training programme developed by EMRC Human Resources Department. The training comprises both on-the-job and in-house training from the Legal Services Department of EMRC. Training records are maintained.

It was noted during the interviews with EMRC staff that the Enforcement Policy instruction made no reference to an appeals process in relation to decisions taken by EMRC. However, there is an internal procedure for dealing with complaints from licensees in relation to inspection findings in the Inspection Manual developed by EMRC.

However, the draft Radiation Protection and Nuclear Safety and Security Law contains an appeals mechanism whereby a decision of EMRC can be taken before the competent administrative court. See Section 1.2.

**Status of the finding in the initial mission**

**Recommendation 23 is closed,** as EMRC has established and implemented an Enforcement Policy taking into account a graded approach to enforcement actions and that all staff in the Radiation Protection Directorate undergo training in implementing the Enforcement Policy.

# 9. REGULATIONS AND GUIDES

## 9.1. GENERIC ISSUES

### 9.1.1. EXISTING REGULATIONS AND GUIDES

**There were no findings in this area in the initial IRRS mission.**

### 9.1.2. PROCESS FOR DEVELOPING REGULATIONS AND GUIDES

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R24** | **Recommendation: EMRC should establish and implement a process to develop and update regulations, instructions and guides.**<br><br>**Note: This Recommendation also covers issues raised in section 7.4.** |

**Changes since the initial IRRS mission**

**Recommendation 24:** EMRC has established and implemented an internal systematic process to develop and update laws, regulations, instructions and guides based on a decision of the CEO of the EMRC (No. 647/2017) based on the EMRC Law.

This process specifies the criteria and the procedures to develop and update regulations, instructions and guides taking into account consultation with interested parties in the development of the regulations and guides.

Laws and Regulations are reviewed every five years and three years, respectively, or more frequently if the Legal Department and the concerned departments in EMRC consider amendments are urgently required in the case of new international guidance or recommendations or national requirements. The draft amendments are discussed with the Board of the Commission and then processed in accordance with Jordanian constitutional procedures.

Instructions and Guides are reviewed yearly or more frequently if the Legal Department and the concerned departments in EMRC consider there is a need to make a draft amendment on the instructions or the guides. The approval of the Board of the Commission is required in order to proceed.

**Status of the findings in the initial mission**

**Recommendation 24 is closed,** as EMRC has established and implemented an internal systematic process to develop and update laws, regulations, instructions and guides.

## 9.2. REGULATIONS AND GUIDES FOR RADIATION SOURCES FACILITIES AND ACTIVITIES

**There were no findings in this area in the initial IRRS mission.**

## 9.3. REGULATIONS AND GUIDES FOR RESEARCH REACTORS

**There were no findings in this area in the initial IRRS mission.**

## 9.4. REGULATIONS AND GUIDES FOR WASTE MANAGEMENT FACILITIES

**There were no findings in this area in the initial IRRS mission.**

## 9.5. REGULATIONS AND GUIDES FOR TRANSPORT

**There were no findings in this area in the initial IRRS mission.**

# 10. EMERGENCY PREPAREDNESS AND RESPONSE – REGULATORY ASPECTS

## 10.1. GENERAL EPR REGULATORY REQUIREMENTS

### Basic responsibilities

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R25** | **Recommendation: EMRC should complete the regulatory framework for EPR and ensure that licensees have adequate arrangements in place to respond to nuclear and radiological emergencies.**<br><br>**Note: This Recommendation also covers issues raised in sections 10.2, 10.3, 11.2.14.** |

**Changes since the initial IRRS mission**

**Recommendation 25:** The EMRC has made significant progress in formulating the regulatory requirements in the area of emergency preparedness and response. Instructions on emergency preparedness for nuclear and radiological facilities were issued in December 2015. The Instructions cover all sources and contain the requirements for licensees, e.g. to have an emergency plan, hazard assessment, emergency classification, capabilities of assessing initial phase and mitigation of emergencies, reference level of residual dose, guidance for restricting exposure of emergency workers. Elements of the licensee emergency response plan are included in Appendix 1 of the instructions.

Before the license is issued, the EMRC Section for Facilities Security and Emergencies verifies if the EPR requirements are met.

EMRC Inspection Manual contains checklists guiding inspectors to inspect licensees' emergency procedures and adequacy of training for emergency response.

Verification of licensee's EPR arrangements is also carried out by the implementation of exercises and drills. The EMRC takes part in annual exercises to test emergency response arrangements of the research reactor.

The operational intervention levels (OILs) are prescribed by the EMRC and are contained in the Annex to National Emergency Response Plan. These OILs need to be revised and to be aligned with the OILs and methodology required by the IAEA GSG-2 "Criteria for Use in Preparedness and Response in a Nuclear or Radiological Emergency".

The IAEA GSR Part 7, published after the initial mission, has been applied partially. For example, Requirement 5 about protective strategies is not addressed in the instructions. Other requirements, such as managing of radioactive waste, requesting and providing international assistance, analyzing the emergency response, as well as concepts of keeping informed the international community, leadership, interface between security and emergency planning have not been addressed. The instructions, mentioned in the first paragraph, need to be updated to address all the requirements of the IAEA GSR Part 7 in order to maintain the emergency management system up-to-date.

**Status of the findings in the initial mission**

**Recommendation 25 is closed on the basis of progress made and confidence in effective completion**, as the instructions on emergency preparedness for nuclear and radiological facilities contain emergency preparedness and response requirements for the licensees and need to be updated with the latest international standard.

### Assessment of threats

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **S15** | **Suggestion: EMRC should consider continuing the cooperation with other relevant organizations to develop a comprehensive national threat (hazard) assessment.** |

**Changes since the initial IRRS mission**

**Suggestion 15:** The national hazard assessment, performed by the EMRC, was done in line with the Table I, Emergency Preparedness Categories, of the GSR Part 7, but not all sources and practices (e.g. transport, scrap metal collection) were included in this assessment; therefore, it needs to address also missing sources and practices.

In order to provide emergency planners with needed information, this hazard assessment should contain also the hazard descriptions including potential consequences for sources, practices and facilities within relevant emergency preparedness categories.

**Status of the findings in the initial mission**

**Suggestion 15 is closed on the basis of progress made and confidence in effective completion**, as the national hazard assessment has been prepared. However, it needs to address all sources and practices and it needs to be expanded with the descriptions of hazards and their consequences.

## 10.2. FUNCTIONAL REGULATORY REQUIREMENTS

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **S16** | **Suggestion: EMRC should consider defining its role in public communication on emergency preparedness and response, in cooperation with relevant governmental organizations.** |
| **S17** | **Suggestion: 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.** |

**Changes since the initial IRRS mission**

**Suggestion 16:** In the Appendix to the National Emergency Response Plan the roles and responsibilities of all organizations involved in EPR are described. The organization responsible to communicate with the media is the Ministry of Interior. EMRC provides input for the media through the Ministry of Interior. In addition, EMRC cooperates with the Ministry of Interior in announcing protective actions and other instructions.

This year EMRC issued a plan on communication and interaction with the public in the event of accidents and radiological and nuclear emergencies. This plan provides practical guidance to media officials to facilitate communication with the public and the media. It defines communication channels, splits communication process in phases, requires establishment of more detailed communication plans for different facilities in line with the emergency preparedness categories, and sets many other requirements, e.g. contact lists, feedback (monitoring rumours), communication trainings and exercises.

**Suggestion 17:** EMRC issued two instructions for the emergency preparedness in the nuclear and radiological facilities, one for on-site and the other one for off-site. The off-site instruction is more comprehensive in terms of requirements for emergency workers. It contains guidance values for restricting exposure of emergency workers, and it contains also other requirements, such as fitness for duty, designation of emergency workers, training, management of personal dosimetry and records, medical examination, issuance of protective equipment, etc. The helpers are also addressed in the off-site instruction.

EMRC implements two types of training for emergency workers, in particular they train emergency workers of the Civil Protection. One type of training is in the area of general radiation protection and the other is more focused on their duties during emergencies.

**Status of the findings in the initial mission**

**Suggestion 16 is closed,** as EMRC defined its role in public communication on emergency preparedness and response, in cooperation with other government organizations.

**Suggestion 17 is closed,** as the EMRC issued the requirements for emergency workers in line with international standards.

## 10.3. REGULATORY REQUIREMENTS FOR INFRASTRUCTURE

**There were no findings in this area in the initial IRRS mission.**

## 10.4. ROLE OF REGULATORY BODY DURING RESPONSE

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R26** | **Recommendation: EMRC should develop its own emergency response arrangements including plans, procedures, training and drills.** |

**Changes since the initial IRRS mission**

**Recommendation 26:** EMRC issued the internal procedure for nuclear and radiological emergency response, which describes EMRC response to nuclear and radiological emergencies. However, this document focuses on the EMRC role as response organization on scene.

EMRC has its own emergency response team equipped with measuring instruments, protective equipment and source container to act in case of an emergency. EMRC has done several drills for emergency preparedness and response for the Jordan Research and Training Reactor and for several radiation

facilities. EMRC developed and updated a training programme for refreshing and upgrading the readiness of its staff. The EMRC emergency response team takes part also in the off-site drills for the JRTR, which are planned to be organized every three years. The first such drill was in 2016 and the next is scheduled for 2019.

**Status of the findings in the initial mission**

**Recommendation 26 is closed,** as the EMRC has the procedure defining internal response arrangements.

## New observations from the follow-up mission

**Observation:** The current EMRC procedure for nuclear and radiological emergency response needs improvements with respect to the organization of the team that should act on the premises during the emergency. At least, the information about the following items should be developed:

- the individual emergency team members' positions,
- the necessary data from the external organizations and systems,
- the list of tasks for each position, information flow between them, specifying input/output products.

In addition, maintenance of EMRC preparedness needs to comprise regular testing of equipment including communications, as well as regular training, drills and exercises of the EMRC emergency response team. The future emergency and training center, which is under construction right now, will be used for this purpose.

| FU Mission | RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES |
|---|---|
| | **Observation**: The organization of the team that should act on the premises during the emergency is not well described in the current procedure for nuclear and radiological emergency response. |
| **(1)** | **BASIS**: GS-R-2, para. 5.10 states that ***"****In planning for, and in the event of [a nuclear or radiological emergency], the regulatory body shall act as an adviser to the government and [response organizations] in respect of nuclear safety and radiation protection." (Ref. [10], para. 6.6.)* |
| **(2)** | **BASIS**: GS-R-2, para 3.2. states that *"The arrangements for emergency response actions both within and outside facilities, if applicable, or elsewhere under the control of the operator, are dealt with through the regulatory process. [The State] shall ensure that [the regulatory body and response organizations] have the necessary resources and that they make preparations and arrangements to deal with any consequences of [a nuclear or radiological emergency] in the public domain, whether the [nuclear or radiological emergency] occurs within or beyond national [borders]. These preparations shall include the actions to be taken both in and after an emergency."* |
| SF2 | **Suggestion:** EMRC should consider completing its internal arrangements regarding the organization of the team acting on its premises during an emergency. |

# 11. TAILORED MODULE FOR COUNTRIES EMBARKING ON NUCLEAR POWER (SSG-16)

## 11.1. INTRODUCTION TO TAILORED MODULE FOR COUNTRIES EMBARKING ON NUCLEAR POWER

**There were no findings in this area in the initial IRRS mission.**

## 11.2. CONSIDERATION OF ELEMENTS OF SSG-16

**There were no findings in this area in the initial IRRS mission.**

### 11.2.1. SSG-16 Element 01 National Policy and Strategy

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **S18** | **Suggestion: 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.** |

**Changes since the initial IRRS mission**

**Suggestion 18:** The Government of Jordan approved the National Policy and Strategy for Nuclear Safety in December 2015. The document establishes a policy framework to implement the IAEA Fundamental Safety Principles (SF-1) and the Convention on Nuclear Safety in order to, among others, maintain a high level of nuclear safety through effective defence in depth in nuclear installations.

The Government of Jordan has taken various steps to support implementation of the nuclear power programme. This includes, forming an independent regulatory body and assigning prime responsibility for safety to the operating organization.

JAEC is the government body mandated to lead the development of the nuclear power programme. Other government ministries are expected to implement activities needed for the nuclear power infrastructure, for example, the Ministry of Environment. A number of national committees have been set up covering specific nuclear infrastructure issues, such as the Mega-projects Committee, national Human Resource Development (HRD) committee, the localization committee and the public awareness committee. Some committees report directly to the Prime Minister; others report to JAEC or EMRC. The Government has also set up a coordinating committee dedicated solely to the nuclear power programme with Ministerial level participation from all relevant Ministries and organizations. This coordinating committee reviews high level policies and makes recommendations to the Cabinet for approval. It also reviews the work of other committees addressing specific nuclear infrastructure issues, maintains a picture of the overall funding requirements, and monitors the overall progress and implementation of the nuclear power infrastructure to resolve any issues that may arise.

However, the IRRS team observed that an integrated strategy including identification of specific goals, milestones, interconnection between stakeholders has not been established yet. This is expected to be done after the signing of the contract for the construction of a NPP.

**Status of the findings in the initial mission**

**Suggestion 18 is closed on the basis of progress made and confidence in effective completion,** as the Government has established various elements of the strategy for the nuclear power programme. However, a comprehensive integrated strategy is expected to be made only after the signing of the contract for the construction of a NPP.

### 11.2.2. SSG-16 Element 02 Global nuclear safety regime

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **S19** | **Suggestion: The regulatory body should consider establishing cooperation with regulatory bodies of the vendor country and countries with NPPs of the same type.**<br><br>**Note: This Suggestion also covers issues raised in section 11.2.4.** |

**Changes since the initial IRRS mission**

**Suggestion 19:** EMRC signed a general agreement in March 2016 with ROSTECHNADZOR - the regulatory body of the Russian Federation - on cooperation in the field of nuclear and radiation safety regulation. The agreement includes cooperation in the development of legislation; quality control of nuclear safety equipment; emergency preparedness and response; exchange of experience in licensing, regulatory oversight, management of radioactive waste and spent fuel, physical protection and training of EMRC personnel. However, EMRC has not made a specific agreement of cooperation in safety with ROSTECHNADZOR to provide support during the licensing phase of the nuclear power plant as a formal contract has not yet been signed by the JNPC.

In addition to the general agreement of sharing information on safety and personnel training with ROSTECHNADZOR, EMRC has also started communication with the regulatory body of Belarus for bilateral cooperation in the regulation of NPPs of similar design.

**Status of the findings in the initial mission**

**Suggestion 19 is closed on the basis of progress made and confidence in effective completion,** as EMRC has signed a general agreement with ROSTECHNADZOR. However, EMRC will extend bilateral cooperation agreements with ROSTECHNADZOR only after a formal contract is signed for the construction of the nuclear power plant.

### 11.2.3. SSG-16 Element 03 Legal framework

**There were no findings in this area in the initial IRRS mission.**

### 11.2.4. SSG-16 Element 04 Regulatory framework

**There were no findings in this area in the initial IRRS mission.**

### 11.2.5 SSG-16 Element 05 Transparency and openness

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **S20** | **Suggestion: EMRC should consider developing means to inform interested parties on how they can raise safety concerns to EMRC.** |

**Changes since the initial IRRS mission**

**Suggestion 20:** The EMRC has initiated activities on the education of interested parties to improve their understanding of the nature of the nuclear power programme and radiation protection. EMRC is engaging in regular dialogues and discussions with local communities and encourages communication of safety related matters and issues to EMRC. EMRC is also in regular contact with the media to communicate and receive feedback on safety related issues.

Furthermore, EMRC has established an email system and 24/7 communication system (telephone), and prepared forms to get feedback on any kind of issues from interested parties and the general public. EMRC departments initiate actions on the concerns raised for their resolution.

**Status of the findings in the initial mission**

**Suggestion 20 is closed,** as EMRC has established systems to inform interested parties and to get feedback on safety concerns.

### 11.2.6 SSG-16 Element 06 Funding and financing

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **S21** | **Suggestion: The Government should consider removing from EMRC's source of funding the fines levied in respect of enforcement actions on the licensees.** |

**Changes since the initial IRRS mission**

**Suggestion 21:** Under the EMRC Law, EMRC shall have its independent annual budget for each fiscal year (Article (20)A).

Under Article (21), the Commission's financial resources shall consist of:

a. funds allocated to it in general budget;
b. funds earned by it from permits and licenses fees in respect of grant of licenses and their renewal;
c. fee charges by the Commission for administrative services;
d. aids, grants, donations and contributions subject to the approval of the cabinet if from non-Jordanian sources;.
e. charges of fines imposed according to the terms of this law and the by-laws related to the regulatory of the sector.

Under Article (20)B, any surplus at the end of the fiscal year must be returned to the State Treasury.
In practice, the EMRC treats all funds collected under Article (21)(b) to (21)(e) as surplus and these are returned to the State Treasury. EMRC therefore does not use any funds collected under Article (21)(e).

**Status of the findings in the initial mission**

**Suggestion 21 is closed,** as fines levied in respect of enforcement actions on the licensees are returned to the State Treasury.

### 11.2.7 SSG-16 Element 07 External support organizations and contractors

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R27** | **Recommendation: EMRC should develop arrangements to avoid actual, potential, or perceived conflicts of interest when employing external support organizations.** |

**Changes since the initial IRRS mission**

**Recommendation 27:** EMRC has developed a procedure in November 2015 to award contracts to any national and international technical support organization for the activities of the nuclear power programme especially for siting and preliminary safety analysis report assessment. According to this procedure, the contractor or its personnel are bound not to provide any consultancy to the licensee, its vendor/contractor/subcontractor. Further, EMRC has also developed provisions in the same procedure to abide by the contractors to maintain confidentiality and propriety nature of the outcome of any consultancy.

EMRC contracted a Spanish company for assessment of site evaluation application. A Finnish company in association with a national company for support in review of environmental impact assessment was also contracted. In both tenders EMRC evaluated the bidding documents to verify that these firms and their experts have not been involved in related activities for the applicant.

**Status of the findings in the initial mission**

**Recommendation 27 is closed,** as EMRC has developed arrangements to avoid actual, potential, or perceived conflicts of interest when employing external support organizations.

### 11.2.8 SSG-16 Element 08 Leadership and management for safety

**There were no findings in this area in the initial IRRS mission.**

### 11.2.9 SSG-16 Element 09 Human resources development

**There were no findings in this area in the initial IRRS mission.**

### 11.2.10 SSG-16 Element 10 Research for safety and regulatory purposes

**There were no findings in this area in the initial IRRS mission.**

### 11.2.11 SSG-16 Element 11 Radiation protection

**There were no findings in this area in the initial IRRS mission.**

### 11.2.12 SSG-16 Element 12 Safety assessment

**There were no findings in this area in the initial IRRS mission.**

### 11.2.13 SSG-16 Element 13 Safety of radioactive waste, spent fuel management and decommissioning

**There were no findings in this area in the initial IRRS mission.**

### 11.2.14 SSG-16 Element 14 Emergency preparedness and response (regulatory aspects)

**There were no findings in this area in the initial IRRS mission.**

### 11.2.15 SSG-16 Element 15 Operating Organization

**There were no findings in this area in the initial IRRS mission.**

### 11.2.16 SSG-16 Element 16 Site survey, site selection and evaluation

**There were no findings in this area in the initial IRRS mission.**

### 11.2.17 SSG-16 Element 17 Design safety

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **S22** | **Suggestion: EMRC should consider adopting the provisions of IAEA SSR-2/1 as the basis of its requirements for NPP design.** |

**Changes since the initial IRRS mission**

**Suggestion 22:** The EMRC has issued an instruction to adopt IAEA SSR-2/1 (Rev.1) as its general requirements for the design of nuclear facilities in December 2015. According to Article 3 of these instructions, the applicant shall submit generic design review report showing that its proposed design fulfils the EMRC requirements which are in accordance with IAEA SSR-2/1 (Rev.1).

**Status of the findings in the initial mission**

**Suggestion 22 is closed,** as EMRC has issued instructions to adopt IAEA SSR-2/1 (Rev.1).

### 11.2.18 SSG-16 Element 19 Transport Safety

**There were no findings in this area in the initial IRRS mission.**

### 11.2.19 SSG-16 Element 20 Interfaces with nuclear security

**There were no findings in this area in the initial IRRS mission.**

# 12. ADDITIONAL AREAS

## 12.1. CONTROL OF MEDICAL EXPOSURES

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R28** | **Recommendation: EMRC should without delay 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.** |
| **R29** | **Recommendation: EMRC should develop training requirements regarding patient protection.** |

**Changes since the initial IRRS mission**

**Recommendation 28:** In relation to medical exposure control, the Regulation No. 108/2015 ("Radiation Protection Regulations") was published, together with an extensive set of instructions, including: "Instructions on justification of radiation practices, medical exposure conditions and requirements of radiation protection for non-medical imaging of the individual"; "Instructions on controls of the radiation protection Programme, safety of radiation sources, the management system, quality of radiation sources and radiological practices, accidents and verification of compliance"; "Instructions on the basis and procedures for the tests, periodic calibration, dosimetry, quality control tests for radiation sources and medical radiation practices and basis of radiation safety assessment of the radiation sources"; "Instructions on radiation protection requirements for the pregnant or breast-feeding female"; "Instructions on establishment of reports and records of ionising radiation sources"; "Instructions on radiation dose constraints" and "Instructions on release of patients". Part of these instructions has been published recently and hence evidence of actual implementation was not available to the IRRS team.

Regulatory requirements have been introduced in relation to defining the responsibilities of licensees and registrants for protection of the patients, the justification and optimization of medical exposure, the use of diagnostic reference levels (DRL's) for optimization purposes, dose constraints for carers and comforters, criteria for patient release, the use of referral criteria for medical procedures involving exposure to ionising radiation, quality assurance and quality control (QA/QC) of medical radiation sources and devices, including reviews and records keeping, unintended medical exposures and protection of pregnancy during medical exposures.

With respect to the actual use of DRL's and setting the national DRL's, EMRC has assembled a set of DRL's from different countries and brought these together in a "Fact sheet on DRL's". This fact sheet was sent in July 2017 to a set of larger hospitals with the request to evaluate the feasibility of using these values as national DRL's. EMRC is currently waiting for the hospitals' feedback. As part of a long-term strategy, EMRC is planning to set up a nationwide registration system of patient dose parameters in order to evaluate the actual patient exposure in the country and to compare it to the set DRL's in order to further optimize the radiation protection of patients.

Three documents have been established by EMRC on QA/QC programmes for radiology, for nuclear medicine and for radiotherapy. Although these documents tend to focus on the QC aspects, they contain a

good basis for establishing the national requirements on QA programmes in the medical field. The hospitals contacted for evaluating the DRL's have also been requested to implement the proposed QA/QC programmes and EMRC is awaiting their feedback.

With respect to establishing referral guidelines, a MoU with the Ministry of Health was proposed, covering i.e. collaboration in implementing the existing regulations, which clearly includes individual justification of the medical exposures, of which referral guidelines are an important part. As the MoU has not been finalized yet, no actions have been taken so far in establishing referral guidelines for radiological procedures, nor for their periodic review.

With respect to unintended and accidental medical exposure, article 3.b of the "Instructions on establishment of reports and records of ionising radiation sources" provides for the notification to EMRC within 24h after the discovery of any unintended medical exposure. Additionally a detailed report indicating the cause of the event, the dose received and the corrective actions taken is to be sent to EMRC within a 30 days period.

**Recommendation 29:** The "Instructions on training requirements regarding patient protection" has been issued in July 2017, covering the requirement for all relevant personnel in the medical sector to be trained in respect to radiation protection of the patient. For the different types of medical practices, relevant training elements are identified.

**Status of the findings in the initial mission**

**Recommendation 28 is closed based on progress made and confidence in effective completion,** as the necessary requirements related to medical exposure have been provided for in the regulatory framework. Some requirements are however still awaiting regulatory actions before their effective implementation will be possible. These include at least the establishment of referral guidelines for radiological procedures, the setting of national DRL's and establishing national QA/QC programmes for medical radiation sources.

**Recommendation 29 is closed,** as EMRC has published Instructions on training requirements regarding patient protection.

**New observations from the follow-up mission**

**Observation:** In relation to the training requirements of medical personnel with respect to the radiation protection of the patient, the instruction issued by EMRC does not establish the required duration of such training. Additionally, the identified training elements do not seem to have been defined in a systematic way, e.g. the role of audits and QA in maintaining or improving patient dose is only recommended for the personnel working in radiology departments.

| FU Mission | RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES |
|---|---|
| | **Observation**: The instruction on training of medical personnel on patient protection does not specify the minimal required duration of this training. |
| **(1)** | **BASIS: GSR Part 3 Para. 3.150 states that** *"The regulatory body shall ensure that the authorization for medical exposures to be performed at a particular medical radiation* |

| FU Mission | RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES |
|---|---|
| | *facility allows personnel (radiological medical practitioners, medical physicists, medical radiation technologists and any other health professionals with specific duties in relation to the radiation protection of patients) to assume the responsibilities specified in these Standards only if they:*<br>*(b) Meet the respective requirements for education, training and competence in radiation protection, in accordance with para. 2.32;"* |
| **(2)** | **BASIS: RS-G-1.4 Para 2.8 States that :…** *"However, whenever appropriate, the regulatory body should provide guidance in respect of the types of training required, the course content, the duration and level of training, and the assessment of trainees*." |
| SF3 | **Suggestion: EMRC should consider establishing the minimal duration of the training of medical personnel with respect to radiation protection of the patient and should consider revising the training elements adopting a more systematic approach.** |

## 12.2. OCCUPATIONAL RADIATION PROTECTION

**Legal and regulatory framework, general responsibilities of registrants, licensees, employers and workers.**

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **R30** | **Recommendation: 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.** |

### Changes since the initial IRRS mission

**Recommendation 30:** In relation to occupational exposure control, the Regulation No. 108/2015 ("Radiation Protection Regulations") was published, together with an extensive set of instructions in the area of occupational exposure to ionising radiation. Additionally, the "Code of practice on personal monitoring during activities resulting of external and internal exposure" was finalized and published containing guidance in the field of personal monitoring. These publications align the requirements for occupational exposure in Jordan to a large extent with the relevant requirements of GSR Part 3: the annual dose limits have been fully aligned, the regulations have been made consistent with respect to exposure of trainees of ages between 16 and 18 years old, the definitions of controlled and supervised areas have been reviewed, the requirements on workplace monitoring have been included, the exposure control of emergency workers has been updated, requirements on dose constraints have been incorporated, employers, registrants and licensees are required to facilitate compliance by workers with the requirements, while workers are required to follow all applicable rules and procedures for protection and safety, employers are required to record any report from workers identifying incompliances and they have to take appropriate actions, while workers have the obligation to report as soon as possible all circumstances that could adversely affect protection and safety and workers are required to cooperate with the employer, registrant or licensee with respect to protection and safety.

### Status of the findings in the initial mission

**Recommendation 30 is closed,** as EMRC has aligned the regulatory framework for occupational exposure in Jordan to a large extent with the relevant requirements of GSR Part 3.

### New observations from the follow-up mission

**Observation:** The regulatory framework on radiation protection in Jordan does not use the GSR Part 3 terminology of exposure situations in terms of 'planned, emergency and existing'. Additionally, there are no specific requirements addressing the protection of workers undertaking remedial actions in existing exposure situations, which have to be controlled in accordance with the relevant requirements for occupational exposure in planned exposure situations.

| FU Mission | RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES |
|---|---|
| | **Observation**: The regulatory framework in Jordan does not explicitly classify the exposure situations in terms of planned, existing and emergency exposure situations. Additionally, the requirements for protecting workers undertaking remedial actions under the requirements for planned exposure situations are missing from the current regulations in Jordan. |
| **(1)** | **BASIS: GSR Part 3 Para. 1.20 states that** *"For the purpose of establishing practical requirements for protection and safety, these Standards distinguish between three different types of exposure situation: planned exposure situations, emergency exposure situations and existing exposure situations. Together, these three types of exposure situation cover all situations of exposure for which these Standards apply:…"* |
| **(2)** | **BASIS: GSR Part 3 Para. 5.3 states that** *"The government shall include in the legal and regulatory framework for protection and safety (see Section 2) provision for the management of existing exposure situations. The government, in the legal and regulatory framework, as appropriate:*<br>*(b) Shall specify the general principles underlying the protection strategies developed to reduce exposure when remedial actions and protective actions have been determined to be justified;"* |
| **(3)** | **BASIS: GSR Part 3 Para. 5.26 states that** *"Employers shall ensure that the exposure of workers undertaking remedial actions is controlled in accordance with the relevant requirements on occupational exposure in planned exposure situations as established in Section 3."* |
| RF1 | **Recommendation: EMRC should revise the regulatory framework in order to take into account the classification of exposure situations and to include the requirements for protecting workers undertaking remedial actions under the requirements for planned exposure situations.** |

**Outside workers**

**Requirements for radiation protection programmes**

**There were no findings in this area in the initial IRRS mission.**

**Monitoring programmes and technical services**

External dosimetry

| RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES | |
|---|---|
| **S23** | **Suggestion: EMRC should consider implementing a monthly dosimeter exchange for Category I workers.** |

**Changes since the initial IRRS mission**

**Suggestion 23:** Article 9.f.1 of the "Instructions on radiation protection requirements against occupational exposure" provides explicitly for a monthly dosimeter exchange in nuclear medicine, brachytherapy, interventional radiology, and NDT practices. Additionally, the "Code of practice on personal monitoring

during activities resulting of external and internal exposure" gives clear guidance on how this requirement can be implemented. Dosimetry data from workers in the fields of NDT, nuclear medicine and interventional radiology produced by two different dosimetry service providers were presented, delivering clear evidence of the implementation of this requirement.

**Status of the findings in the initial mission**

**Suggestion 23 is closed,** as a monthly dosimeter exchange for category I workers is being implemented.

Individual internal dosimetry

Suggestion 3 to the Government of Jordan to implement plans for internal exposure monitoring is given in section 1.9.

National Dose Register

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **S24** | **Suggestion: EMRC should consider establishing a computerized national register of occupational dose records.** |

**Changes since the initial IRRS mission**

**Suggestion 24:** EMRC is currently using RAIS for registering the doses of occupationally exposed workers. The data is manually entered in the database once a year. Clear evidence of the computerized national register was observed by the IRRS team. Currently EMRC is investigating the possibility for a more automated input of the data into the database.

**Status of the findings in the initial mission**

**Suggestion 24 is closed,** as EMRC has implemented a computerized national dose registry.

Calibration services

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **S25** | **Suggestion: 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.** |

**Changes since the initial IRRS mission**

**Suggestion 25:** EMRC has published the "Radiation protection regulation" containing requirements for the calibration of portable and fixed dose rate and surface contamination measuring equipment. Additionally, both the "Instructions on controls of the radiation protection program, safety of radiation sources, the management system, quality of radiation sources and radiological practices, accidents and

verification of compliance" and the "Instructions on the basis and procedures for the tests, periodic calibration, dosimetry, quality control tests for radiation sources and medical radiation practices and basis of radiation safety assessment of the radiation sources" contain further requirements on the calibration and verification of portable and fixed measurement equipment.

As a general rule, the recommendations given by the device manufacturers are being used by EMRC for setting the required periodicity of these calibrations. These are rendered mandatory through the Licensing Requirements Instructions for the different types of applications. Verification of some calibration certificates for the devices used by EMRC during inspection indicated a yearly calibration period for both the dose rate and the contamination measurement equipment. The "Instructions on nuclear medicine departments, centres and clinics licensing requirements" provides for an annual calibration of the activity meter, the contamination meters and the area monitors (article 4). A similar requirement is also provided for in the article 5 of the "Instructions on cyclotron facilities licensing requirements".

**Status of the findings in the initial mission**

**Suggestion 25 is closed,** as EMRC has published requirements for periodic calibrations of fixed and portable radiation measuring equipment.

Training services and staff training and re-training

| 2014 MISSION RECOMMENDATIONS AND SUGGESTIONS | |
|---|---|
| **S26** | **Suggestion: 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.** |

**Changes since the initial IRRS mission**

**Suggestion 26:** To implement the requirement of article 4.f of the Regulation No. 8 for the year 2013 ("Basis and conditions regulation for granting licenses and permits for the radiation work"), EMRC published in 2016 the "Instructions on requirements for granting licenses for radiation protection officers". It contains clear training requirements and other licensing requirements for RPO's. At the time of the IRRS Follow-up mission, a total of 315 RPO's are licensed.

Periodic retraining of workers is provided for by the articles 4.h and 6 of the "Instructions on radiation protection requirements against occupational exposure". The "Instructions on requirements for granting licenses for radiation protection officers" attributes the responsibility for supervising the training and retraining of workers to the RPO.

**Status of the findings in the initial mission**

**Suggestion 26 is closed,** as EMRC has published the requirements for licensing RPO's and implemented the requirement for periodic retraining of workers by the RPO.

## APPENDIX I - LIST OF PARTICIPANTS

| | | | |
|---|---|---|---|
| **INTERNATIONAL EXPERTS** | | | |
| 1. | VLAHOV Nikolay | Bulgarian Nuclear Regulatory Agency<br>BULGARIA | n.vlahov@bnra.bg |
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| 1. | MANSOUX Hilaire | Division of Radiation, Transport and Waste Safety | H.Mansoux@iaea.org |
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| **LIAISON OFFICER** | | | |
| 1. | KASHT Tamer | Director, Communication and International Cooperaton<br>Energy and Minerals Regulatory Commission | Tamer.Kasht@emrc.gov.jo |

**APPENDIX II - MISSION PROGRAMME**

| **Schedule of the IRRS Follow-up Mission to Jordan 14-22 October 2017** | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| **14 October, Saturday** | | | | | | |
| *14:00 – 20:00* | Initial Team Meeting at the Hotel (Signature – 13th Floor / Landmark Amman Hotel) | | | | | |
| **15 October, Sunday** | | | | | | |
| *09:00 – 11:00* | Entrance Meeting (EMRC, Auditorium G-Floor)<br>• **Opening of the meeting, EMRC CEO/ Chairman of the Board of Directors**<br>• **Opening remarks, Team Leader Nick Vlahov, introduction of the team**<br>• **Overview of EMRC activities,**<br>• **Introduction of counterparts**<br>• **Remarks by the IAEA Team Coordinator** | | | | | |
| | ***Group A***<br>Room TBD | ***Group B, D***<br>Room TBD | ***Group C***<br>Room TBD | ***Group E***<br>Room TBD | ***Group F***<br>Room TBD | ***Group G*** |
| *11:00 – 12:00* | Interviews<br>Modules 1,2,3,4 | Interviews<br>Modules 5, 6, 7, 8, 9 for sources, waste store, transport | Interviews<br>Modules 5, 6, 7, 8, 9 for research reactor | Interviews<br>Module 10 | Interviews<br>Modules 12 | Interviews<br>Module 11 on SSG 16 |
| *12:00 – 13:00* | Lunch | | | | | |
| *13:00 – 17:00* | Interviews<br>Modules 1,2,3,4 | Interviews<br>Modules 5, 6, 7, 8, 9 for sources, waste store, transport | Interviews<br>Modules 5, 6, 7, 8, 9 for research reactor | Interviews<br>Module 10 | Interviews<br>Modules 12 | Interviews<br>Module 11 on SSG 16 |
| *17:00 – 18:00* | Daily Team Meeting (Signature – 13th Floor / Landmark Amman Hotel) | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| *18:30 – 20:00* | Dinner (no-host) | | | | | |
| *20:00 -* | Writing of the report (Signature – 13th Floor / Landmark Amman Hotel) | | | | | |
| **16 October, Monday** | | | | | | |
| | ***Group A*** | ***Group B,D*** | ***Group C*** | ***Group E*** | ***Group F*** | ***Group G*** |
| *09:00 – 10:15* | | Interviews Modules 5, 6, 7, 8, 9 for sources, waste store, transport | Interviews Modules 5, 6, 7, 8, 9 for research reactor | Interviews Module 10 | Interviews Modules 12 | Interviews Module 11 on SSG 16 |
| *10:30 - 12:00* | Interviews Modules 1,2,3,4 | | | | | |
| *12:00 – 13:00* | Lunch | | | | | |
| *13:00 – 16:00* | Interviews Modules 1,2,3,4 | Interviews Modules 5, 6, 7, 8, 9 for sources, waste store, transport | Interviews Modules 5, 6, 7, 8, 9 for research reactor | Interviews Module 10 | Interviews Modules 12 | Interviews Module 11 on SSG 16 |
| *16:00 - 16:30* | Team Members (TM) formulate findings (Main Meeting Room 1st Floor / EMRC) | | | | | |
| *16:30 – 17:00* | Written preliminary findings delivered (Main Meeting Room 1st Floor / EMRC) | | | | | |
| *17:00 – 18:00* | Daily Team Meeting: Discussion of findings, Submission to IRRS Admin (Main Meeting Room 1st Floor / EMRC) | | | | | |
| *18:30 – 20:00* | Dinner | | | | | |
| *20:00 -* | IRRS Admin compiles/distributes Report (Signature – 13th Floor / Landmark Amman Hotel) | | | | | |
| **17 October, Tuesday** | | | | | | |
| | ***Group A*** | ***Group B,D*** | ***Group C*** | ***Group E*** | ***Group F*** | ***Group G*** |

| | | | | | | |
|---|---|---|---|---|---|---|
| *09:00 – 12:00* | Interviews Modules 1,2,3,4 (as necessary)<br><br>TM write report | Interviews Modules 5, 6, 7, 8, 9 for sources, waste store, transport (as necessary)<br><br>TM write report | Interviews Modules 5, 6, 7, 8, 9 for research reactor<br><br>TM write report | Interviews Module 10<br><br>TM write report | Interviews Modules 12<br><br>TM write report | Interviews Module 11 on SSG 16<br><br>TM write report |
| *12:00 – 13:00* | Lunch | | | | | |
| *13:00 – 17:00* | Final findings with texts delivered (Main Meeting Room 1st Floor / EMRC) | | | | | |
| *17:00 – 18:00* | Daily Team Meeting: Discussion of findings, Submission to IRRS Admin (Main Meeting Room 1st Floor / EMRC) | | | | | |
| *18:30 – 20:00* | Dinner (no-host) | | | | | |
| *20:00 -* | IRRS Admin compiles/distributes Report (Signature – 13th Floor / Landmark Amman Hotel) | | | | | |
| **18 October, Wednesday** | | | | | | |
| *09:00 – 12:00* | Discussion of findings by the Team / Team writes report (Auditorium Terrace G-Floor / EMRC) | | | | | |
| *12:00 – 13:00* | Lunch | | | | | |
| | ***Group A*** | ***Group B,D*** | ***Group C*** | ***Group E*** | ***Group F*** | ***Group G*** |
| *13:00 – 15:00* | Discussion of findings with counterpart Modules 1, 2, 3, 4 | Discussion of findings with counterpart Modules 5, 6, 7, 8, 9 for sources, waste store, transport | Discussion of findings with counterpart Modules 5, 6, 7, 8, 9 for research reactor | Discussion of findings with counterpart Module 10 | Discussion of findings with counterpart Modules 12 | Discussion of findings with counterpart Module 11 on SSG 16 |
| *15:00 - 16:30* | Team writes report (Auditorium Terrace G-Floor / EMRC) | | | | | |
| *16:30 - 17:00* | Draft report text to TL (Auditorium Terrace G-Floor / EMRC) | | | | | |
| *17:00 – 18:00* | Daily Team Meeting: outcomes of discussion with counterparts, Submission to IRRS Admin (Main Meeting Room 1st Floor / EMRC) | | | | | |

| | |
|---|---|
| *18:30 – 20:00* | Dinner (no-host) |
| *20:00 -* | IRRS Admin compiles/distributes Report (Signature – 13th Floor / Landmark Amman Hotel) |
| **19 October, Thursday** | |
| *09:00 – 10:00* | Individual Team Review (Auditorium Terrace G-Floor / EMRC) |
| *10:00 - 12:00* | Detailed Group Review (Auditorium Terrace G-Floor / EMRC) |
| *12:00 – 13:00* | Lunch |
| *13:00 – 14:00* | Detailed Group Review (Auditorium Terrace G-Floor / EMRC) |
| *14:00 - 16:00* | TC drafts Executive Summary, TM finalize the Draft Report |
| *16:00 – 17:00* | Discussion of Executive Summary. Submission of Report to IRRS Admin (Main Meeting Room 1st Floor / EMRC) |
| *18:00 – 20:00* | Dinner (no-host) |
| *20:00 -* | IRRS Admin finalizes Draft Report and submission of the Draft to the Host (Signature – 13th Floor / Landmark Amman Hotel) |

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| **20 October, Friday** | |
| *09:00 – 12:00* | Host reads report, TL prepares presentation |
| *13:00 – 16:00* | Social event (Tour in Amman) |
| *13:00 – 16:00* | Host reads report |
| *16:30 – 17:00* | Written comments presented by the Host |
| *17:00 – 18:00* | Daily Team Meeting: Host's comments (Signature – 13th Floor / Landmark Amman Hotel) |
| *18:00 – 20:00* | Dinner (no-host) |
| *20:00 -* | IRRS Admin finalizes Draft Report (Signature – 13th Floor / Landmark Amman Hotel) |

| **21 October, Saturday** | |
|---|---|
| *09:00 – 12:00* | Discussion on some of the comments not agreed, if needed/IAEA Admin prepares Final Draft Report to Host (Auditorium Terrace G-Floor / EMRC) |
| *12:00 – 13:00* | Lunch |
| *13:00 – 15:00* | Presenting and handling over Final Draft to the Host (Auditorium Terrace G-Floor / EMRC) |
| *15:00 – 17:00* | Finalization of press release |
| *17:00 –* | Free |

| **22 October, Sunday** | |
|---|---|
| *10:00 – 11:00* | Exit meeting (Auditorium Terrace G-Floor / EMRC) |
| *11:00 – 12:00* | Press Conference (Auditorium Terrace G-Floor / EMRC) |
| *12:30 – 13:30* | Lunch |
| *14:00 -* | Departure of the Team Members |

## APPENDIX III - MISSION COUNTERPARTS

| | IRRS Experts | EMRC Lead Counterpart | EMRC Support Staff |
|---|---|---|---|
| **1.** | RESPONSIBILITIES AND FUNCTIONS OF THE GOVERNMENT | | |
| | Selva Kumar<br>Nikolay Vlahov | Samer Quran | R1, R2, R3, R4, R5, R6, S1, S2, S3:<br><br>Wijdan Al Rabadi<br>Tamer Kasht<br>Dr. Tahreer Al-Qaq<br>Salah Khazaaleh<br>Zahera Tubaishat<br>Dahouk Khair<br>Serene Mukattash<br>Malak Melhem<br>: |
| **2.** | **GLOBAL NUCLEAR SAFETY REGIME** | | |
| | Selva Kumar<br>Nikolay Vlahov | Samer Quran | R7, S4:<br><br>Wijdan Al Rabadi<br>Tamer Kasht<br>Dr. Tahreer Al-Qaq<br>Salah Khazaaleh<br>Zahera Tubaishat<br>Dahouk Khair<br>Serene Mukattash<br>Malak Melhem<br>Remah Nsour |

| | IRRS Experts | EMRC Lead Counterpart | EMRC Support Staff |
|---|---|---|---|
| **3.** | **RESPONSIBILITIES AND FUNCTIONS OF THE REGULATORY BODY** | | |
| | Selva Kumar<br>Nikolay Vlahov | Samer Quran | R8, R9, R10, S5, S6, S7, S8:<br><br>Wijdan Al Rabadi<br>Tamer Kasht<br>Dr. Tahreer Al-Qaq<br>Salah Khazaaleh<br>Zahera Tubaishat<br>Dahouk Khair<br>Serene Mukattash<br>Malak Melhem<br>Remah Nsour |
| **4.** | **MANAGEMENT SYSTEM OF THE REGULATORY BODY** | | |
| | Selva Kumar<br>Nikolay Vlahov | Samer Quran | R11, R12, S9:<br><br>Wijdan Al Rabadi<br>Tamer Kasht<br>Dr. Tahreer Al-Qaq<br>Salah Khazaaleh<br>Zahera Tubaishat<br>Dahouk Khair<br>Serene Mukattash<br>Malak Melhem |
| **5.** | **AUTHORIZATION** | | |

| | IRRS Experts | EMRC Lead Counterpart | EMRC Support Staff |
|---|---|---|---|
| | Jack Madden | Essa Khalaylah | R13: Gaydaa Tbaileh / Huthaifa alomari<br><br>R14: Gaydaa Tbaileh / Huthaifa alomari / Ahmad AbuNadi<br><br>R15: Gaydaa Tbaileh / Ali Adayleh<br><br>R16: Omar Kloub/Arwa Qudah/Amani Mahmoud<br><br>S10: Ali Adieleh / Gaydaa tbaileh /Huthaifa alomari/Ahmad AbuNadi<br><br>S11: Essa Khalaylah<br><br>S12: Essa Khalaylah |
| | Hassan Bsat | Essa Khalaylah | S13: Ali Adieleh |
| **6.** | **REVIEW AND ASSESSMENT** | | |
| | Pierre Tanguay | Raed Almajali | R18, R19:<br><br>Mohammed Atiyat<br>Sireen Owais<br>Musab Alshboul<br>Rahaf Ababneh<br>Mohammad Ihsan<br>Nida Faraheed<br>Nisreen Al demiri |

| | IRRS Experts | EMRC Lead Counterpart | EMRC Support Staff |
|---|---|---|---|
| | Hassan Bsat | Essa Khalaylah | R17: Ali Adieleh / Gaydaa Tbaileh /Huthaifa alomari<br>S14: Ali Adieleh |
| **7.** | **INSPECTION** | | |
| | Hassan Bsat | Essa Khalaylah | R20: Ali Adieleh / Gaydaa Tbaileh / Huthaifa alomari<br>R21: Ali Adieleh / Gaydaa Tbaileh<br>R22: Ali Adieleh/Gaydaa Tbaileh/Huthaifa alomari |
| **8.** | ENFORCEMENT | | |
| | Hassan Bsat | Essa Khalaylah | R23: Ali Adieleh |
| **9.** | REGULATIONS AND GUIDES | | |
| | Hassan Bsat | Essa Khalaylah | R24: Ali Adieleh / Gaydaa Tbaileh / Huthaifa alomari |
| **10.** | EMERGENCY PREPAREDNESS AND RESPONSE – REGULATORY ASPECTS | | |
| | Igor Grlicarev | Ahmad Alsalman | R25, R26, S15, S16, S17:<br>Ahmad Alsalman<br>Emad Ead<br>Abdalbasit Alzyoud |

| | IRRS Experts | EMRC Lead Counterpart | EMRC Support Staff |
|---|---|---|---|
| **11.** | TAILORED MODULE FOR COUNTRIES EMBARKING ON NUCLEAR POWER | | |
| | Muhammad Naeem Arshad | Ahmad Shanan | R27, S18, S19, S20, S21, S22:<br><br>Muhannad Abu-Hamdeh<br>Khaled Al-Momani<br>Mohamad Amro |
| 12. | ADDITIONAL AREAS, CONTROL OF MEDICAL EXPOSURES, OCCUPATIONAL RADIATION PROTECTION | | |
| | Michel Sonck | Ahmad Hamdan | R28, R29, R30, S23, S24, S25, S26:<br><br>Shrooq Shawabka<br>shaden Alsayyed<br>osama alatawneh<br>haneen abu akkaz<br>Mohamad AboMharib |

## APPENDIX IV - RECOMMENDATIONS (R) AND SUGGESTIONS (S) FROM THE PREVIOUS IRRS MISSION THAT REMAIN OPEN

None

## APPENDIX V - RECOMMENDATIONS (RF), SUGGESTIONS (SF) AND GOOD PRACTICES (GPF) FROM THE 2017 IRRS FOLLOW-UP MISSION

| Section | Module | RF/SF/GPF | Recommendations, Suggestions or Good Practices |
|---|---|---|---|
| **7.1.3** | **INSPECTORS** | **SF1** | **Suggestion: EMRC should consider implementing the accreditation of radiation and nuclear safety inspectors as per the relevant EMRC instructions.** |
| **10.4** | **ROLE OF REGULATORY BODY DURING RESPONSE** | **SF2** | **Suggestion: EMRC should consider completing its internal arrangements regarding the organization of the team acting on its premises during an emergency**. |
| **12.1** | **CONTROL OF MEDICAL EXPOSURES** | **SF3** | **Suggestion: EMRC should consider establishing the minimal duration of the training of medical personnel with respect to radiation protection of the patient and should consider revising the training elements adopting a more systematic approach.** |
| **12.2** | **OCCUPATIONAL RADIATION PROTECTION** | **RF1** | **Recommendation: EMRC should revise the regulatory framework in order to take into account the classification of exposure situations and to include the requirements for protecting workers undertaking remedial actions under the requirements for planned exposure situations.** |

## APPENDIX VI - REFERENCE MATERIAL PROVIDED BY EMRC

[1-1] National Policy and Strategy for Nuclear Safety
[1-2] Radiation Protection and Nuclear Safety and Security Law
[1-3] Energy and Minerals Regulatory Commission Law
[1-4] Radiation detection and initial response procedures for EMRC Front Line Officers working at border crossings
[1-5] National Strategy of Orphan Sources in Jordan
[1-6] Mechanism of dealing with contaminated materials
[1-7] National Policy for Radioactive Waste and Spent Nuclear Fuel Management
[1-8] Instruction on the Management of Radioactive Waste
[1-9] Radiation Protection Regulations and Instructions
[5-1] Instructions for licensing diagnostic centres, sections and clinics
[5-2] Instructions for licensing veterinary centres, sections and clinics
[5-3] Nuclear medicine departments, centres, and clinics licensing requirements Instructions
[5-4] Instructions for the requirements of licensing the centres and departments of radiation therapy
[5-5] Requirements for licensing cyclotron facilities
[5-6] Instructions for requirements for licensing industrial, research and medical irradiation centres and departments
[5-7] Instructions for licensing requirements of industrial radiography facilities
[5-8] Instructions for the licensing of nuclear gauges' facilities
[5-9] Instructions of well logging license
[5-10] Instructions and Conditions for luggage inspection licenses
[5-11] Instruction of licensing requirements for persons dealing with transported radioactive material
[5-12] Guidance on diagnostic radiology
[5-13] Instructions on licensing requirements for facilities of transport of radioactive materials
[6-1] Instructions for licensing specialized training, qualification and personal licenses in research reactors
[6-2] Transport of Radioactive Materials Regulations No. 32 for the year 2016
[6-3] Instructions on the basis and conditions for classification of radioactive materials
[6-4] Conditions and technical specifications of the conveyance, inspection and maintenance
[6-5] Instructions for radioactive materials not subject to the provisions of the radioactive materials transportation regulation
[6-6] Instructions for records and reports to be provided when transporting radioactive materials
[6-7] Instructions of documentation and data required for transport permit applications
[6-8] Instructions for safe handling of empty packages
[6-9] Instructions on marking & labelling & placards of packaging
[6-10] Instructions of the special limits of transported radioactive materials
[6-11] Instructions on technical specifications and conditions of each packages type and category
[6-12] Instructions on loading packages
[7-1] Radiation Inspection Manual
[7-2] Draft Generic Inspection Guidance
[7-3] Instructions on accreditation of radiation inspectors
[8-1] Enforcement Policy
[8-2] List of enforcement actions
[10-1] Instructions for emergency preparedness in for nuclear and radiological facilities
[11-1] Updated Master Strategy of Energy Sector in Jordan for the period (2007-2020)

[11-2] White Paper on Nuclear Energy in Jordan
[12-1] Code of Practice – Personal Monitoring during Activities Resulting in External and Internal Exposures

## APPENDIX VII - IAEA REFERENCE MATERIAL USED FOR THE REVIEW

1. No. SF-1 - Fundamental Safety Principles
2. INTERNATIONAL ATOMIC ENERGY AGENCY - Governmental, Legal and Regulatory Framework for Safety General Safety Requirement Part 1(Rev 1) (Vienna2016)
3. INTERNATIONAL ATOMIC ENERGY AGENCY- Leadership and Management for Safety Requirement GSR Part 2 IAEA, Vienna (2016)
4. INTERNATIONAL ATOMIC ENERGY AGENCY – Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, General Safety Requirements Part 3, (2014)
5. INTERNATIONAL ATOMIC ENERGY AGENCY – Safety assessment for facilities and activities, General Safety Requirements Part 4, No. GSR Part 4 (Rev 1), IAEA, Vienna (2016)
6. INTERNATIONAL ATOMIC ENERGY AGENCY – Predisposal Management of Radioactive Waste General Safety Requirement Part 5, No. GSR Part 5, IAEA, Vienna (2009)
7. INTERNATIONAL ATOMIC ENERGY AGENCY – Decommissioning of Facilities General Safety Requirement Part 6, No. GSR Part 6, IAEA, Vienna (2014)
8. INTERNATIONAL ATOMIC ENERGY AGENCY – Preparedness and Response for a Nuclear or Radiological Emergency General Safety Requirement Part 7, No. GSR Part 7, IAEA, Vienna (2015)
9. INTERNATIONAL ATOMIC ENERGY AGENCY - Regulations for the Safe Transport of Radioactive Material Specific Safety Requirements 6, No. SSR 6, IAEA, Vienna (2012)8.
10. INTERNATIONAL ATOMIC ENERGY AGENCY - Organization and Staffing of the Regulatory Body for Nuclear Facilities, Safety Guide Series No. GS-G-1.1, IAEA, Vienna (2002)
11. INTERNATIONAL ATOMIC ENERGY AGENCY - Review and Assessment of Nuclear Facilities by the Regulatory Body, Safety Guide Series No. GS-G-1.2, IAEA, Vienna (2002)
12. INTERNATIONAL ATOMIC ENERGY AGENCY - Regulatory Inspection of Nuclear Facilities and Enforcement by the Regulatory Body, Safety Guide Series No. GS-G-1.3, IAEA, Vienna (2002)
13. INTERNATIONAL ATOMIC ENERGY AGENCY - Documentation for Use in Regulatory Nuclear Facilities, Safety Guide Series No. GS-G-1.4, IAEA, Vienna (2002)
14. INTERNATIONAL ATOMIC ENERGY AGENCY- - Arrangements for Preparedness for a Nuclear or Radiological Emergency, Safety Guide Series No. GS-G-2.1, IAEA, Vienna (2007)

15. INTERNATIONAL ATOMIC ENERGY AGENCY – Criteria for use in Preparedness and Response for a Nuclear or Radiological Emergency, General Safety Guide Series No. GSG-2, IAEA, Vienna (2011)

16. INTERNATIONAL ATOMIC ENERGY AGENCY– Assessment of Occupational Exposure Due to Intake of Radionuclides Safety Guide Series No. RS-G-1.2, IAEA, Vienna (1999)

17. INTERNATIONAL ATOMIC ENERGY AGENCY - Assessment of Occupational Exposure Due to External Sources of Radiation Safety Guide Series No. RS-G-1.3, IAEA, Vienna (1999)

18. INTERNATIONAL ATOMIC ENERGY AGENCY - Building Competence in Radiation Protection and the Safe Use of Radiation Sources, Safety Guide Series No. RS-G-1.4, IAEA, Vienna (2001)

19. INTERNATIONAL ATOMIC ENERGY AGENCY – Classification of Radioactive Waste, General Safety Guide No. GSG-1, IAEA, Vienna (2009)

20. INTERNATIONAL ATOMIC ENERGY AGENCY – Regulatory Control of Radioactive Discharge to the Environment, Safety Guide Series No. WS-G-2.3, IAEA, Vienna (2000)

21. INTERNATIONAL ATOMIC ENERGY AGENCY – Safety Assessment for the Decommissioning of Facilities Using Radioactive Material, Safety Guide Series No. WS-G.5.2, IAEA, Vienna (2009)

22. INTERNATIONAL ATOMIC ENERGY AGENCY – Establishing the Safety Infrastructure for a Nuclear Power Programme Specific Safety Guide No SSG-16, IAEA, Vienna (2011)

23. INTERNATIONAL ATOMIC ENERGY AGENCY - Disposal of Radioactive Waste Specific Safety Requirements 5, No. SSR 5, IAEA, Vienna (2011)

24. INTERNATIONAL ATOMIC ENERGY AGENCY – Review and Assessment of Nuclear Facilities by the Regulatory Body, Safety Guide Series No. GS-G-1.2, IAEA, Vienna (2002)

25. INTERNATIONAL ATOMIC ENERGY AGENCY – Regulatory Inspection of Nuclear Facilities and Enforcement by the Regulatory Body, Safety Guide Series No. GS-G-1.3, IAEA, Vienna (2002)

26. INTERNATIONAL ATOMIC ENERGY AGENCY – Documentation for Use in Regulatory Nuclear Facilities, Safety Guide Series No. GS-G-1.4, IAEA, Vienna (2002)

27. INTERNATIONAL ATOMIC ENERGY AGENCY – Safety of Nuclear Power Plants: Design, Specific Safety Requirement Series SSR-2/1 IAEA, Vienna (2012)

28. INTERNATIONAL ATOMIC ENERGY AGENCY – Safety of Nuclear Power Plants: Operation, Safety Requirement Series No. NS-R-2, IAEA, Vienna (2000)

29. INTERNATIONAL ATOMIC ENERGY AGENCY – Safety of Research Reactors, Safety Requirement Series No. NS-R-4, IAEA, Vienna (2005.)

30. INTERNATIONAL ATOMIC ENERGY AGENCY – Periodic Safety Review of Nuclear Power Plants Specific Safety Guide SSG-25, IAEA, Vienna (2013)

31. INTERNATIONAL ATOMIC ENERGY AGENCY – A System for the Feedback of Experience from Events in Nuclear Installations Safety Guide No. NS-G-2.11, IAEA, Vienna (2006)

# APPENDIX VIII - EMRC ORGANIZATIONAL CHART