



**IAEA**

International Atomic Energy Agency

**MISSION REPORT**  
**ON**  
**THE INTEGRATED NUCLEAR INFRASTRUCTURE**  
**REVIEW MISSION PHASE 2**  
**(INIR)**

**Counterpart: Government of Hashemite Kingdom of Jordan**

**4-14 August 2014**

**Amman, Jordan**

## CONTENTS

|  |    |
|--|----|
| EXECUTIVE SUMMARY .....  | 3  |
| 1. INTRODUCTION .....  | 7  |
| 2. OBJECTIVES OF THE MISSION.....  | 9  |
| 3. SCOPE OF THE MISSION.....   | 9  |
| 4. WORK DONE .....   | 10 |
| 5. MAIN CONCLUSIONS.....   | 10 |
| 6. EVALUATION RESULTS FOR PHASE 2.....   | 17 |
| ATTACHMENT 1: REVIEW OBSERVATIONS, RECOMMENDATIONS AND<br>SUGGESTIONS FOR PHASE 2..... | 24 |
| ATTACHMENT 2: LISTS OF THE INIR TEAM AND COUNTERPARTS .....                            | 86 |
| ATTACHMENT 3: REFERENCES .....   | 88 |

## EXECUTIVE SUMMARY

Jordan plans to build a nuclear power plant (NPP) to ensure security of energy supply, reduce dependence on imported oil and gas and to meet future increase in energy demand. In 2007, due to a large and growing reliance on energy imports (97%), Jordan revised its national energy strategy and included nuclear power as an option in the energy mix for the first time. The addition of nuclear power will help to alleviate a predicted energy shortage of 6.8 gigawatts by 2030. It is also anticipated to help to ensure stable pricing and to contribute to the economic growth of Jordan.

The Jordanian Cabinet confirmed in August 2013 that nuclear energy would be included in Jordan's energy mix and confirmed selection of the Amra site, located approximately 70kms from Amman and 40 kms from the waste water treatment facility that would be used as the source of cooling water. In October 2013, Jordan Atomic Energy Commission (JAEC) selected Atomstroyexport as the preferred bidder for its first NPP and Rusatom Overseas (RAOS) as its strategic investor.

The Hashemite Kingdom of Jordan requested the IAEA to carry out an Integrated Nuclear Infrastructure Review (INIR) mission in a letter dated 13 February 2013. A preparatory mission was conducted in March 2014 to provide clarification on the evaluation methodology and support the development of a Self-Evaluation Report (SER). The SER from the Government of Jordan was received by the IAEA on 13 May 2014. A previous INIR mission had been conducted in August 2009, which focused primarily on Phase 1 activities around the decision-making process. A follow-up to the August 2009 INIR mission had been conducted in January 2012, which reviewed progress toward fulfilling the recommendations made in 2009.

The INIR mission was conducted from 4-14 August 2014, in Amman and coordinated for Jordan by JAEC. The INIR mission team was led by the Director of the Division of Nuclear Power, IAEA, and consisted of staff from the Departments of Nuclear Energy, Nuclear Safety and Security, Safeguards and the Office of Legal Affairs and international experts recruited by the IAEA.

At the time of the mission, JAEC, on behalf of the Government of Jordan, was in the process of negotiating an Inter-Governmental Agreement (IGA) with the Russian Federation for the construction and operation of NPPs. It is foreseen that the Jordan Nuclear Power Plant (JNPP) will comprise two 1000 MWe Pressurized Water Reactors (PWR), based on the AES-92 design, owned and operated by the Jordan Nuclear Power Company (JNPC), with 50.1% of the shares held by Jordan and 49.9% by Rusatom Overseas.

The Cabinet approved a Project Development Agreement (PDA) between JAEC and RAOS during the mission, which identifies project-specific activities to be carried out by both sides prior to investment. For Jordan, this includes an electricity market study, grid studies, site characterization studies, an environmental impact assessment (EIA), a water supply agreement, and a power purchase agreement (PPA).

At the time of the mission, JNPC had not yet been established. This is planned to take place in two phases. During the first phase, it would be responsible for carrying out the pre-investment activities identified in the PDA. Once this phase has been completed, a final investment decision will be made, and it is expected that the Russian strategic investor RAOS will

become an equity shareholder and the Engineering, Procurement and Construction (EPC) contract will be signed.

A new regulatory structure was established in April 2014. The Energy and Minerals Regulatory Commission (EMRC) combined the previous Jordan Nuclear Regulatory Commission (JNRC) with other regulators in the energy sector.

Jordan has made notable progress in the development of its national infrastructure for nuclear power since the first INIR mission in 2009. The INIR team found that JAEC is leading the development of nuclear power and is aware of the main actions necessary to implement the programme. Though steps have been taken towards the procurement of the NPP, including the selection of a preferred bidder and strategic investor, further work is needed to develop the nuclear infrastructure required to be ready for the next significant steps in the project—the investment decision and signing of the EPC contract.

In order to assist Jordan in making further progress in its infrastructure development, the INIR team made 44 recommendations. Based on these recommendations, key areas for further actions are summarized below:

**The Government of Jordan should finalize national policies and strategies for the nuclear power programme.**

The Government of Jordan is developing national policies and strategies covering several important areas of infrastructure for nuclear power, including nuclear fuel cycle, radioactive waste management, human resource development, stakeholder involvement and industrial involvement. These policies and strategies should be completed and endorsed by the Government without delay because they will guide the work in Jordan to develop the national infrastructure as well as the negotiations with Russia for the Intergovernmental Agreement and Engineering, Procurement and Construction contract. The policies should clearly state the key principles and designate the entities responsible for their implementation. This proposal complements the results of a recent Integrated Regulatory Review Service (IRRS) mission, which recommended that Jordan develop a national policy and strategy for nuclear safety.

**The Government of Jordan should re-establish a Ministerial level coordination committee to ensure effective development of its national nuclear power infrastructure.**

The nuclear power programme involves a wide range of Government Ministries and other organizations. JAEC is the Government Commission mandated to lead the development of the nuclear power programme; however, many Government Ministries are expected to implement activities needed for the nuclear power infrastructure and fund them from their own budgets, for example the grid and transportation infrastructure. Moreover, many of the activities are inter-related and sequenced, requiring effective coordination in line with the NPP project schedule. A number of national committees have been set up covering specific nuclear infrastructure issues. Some examples are 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.

It is essential that the Government of Jordan mandates a coordinating committee dedicated solely to the nuclear power programme with Ministerial level participation from all of the relevant Ministries and organizations. This coordinating committee would review high level

policies and make recommendations to the Cabinet for approval, review the work of the committees addressing specific nuclear infrastructure issues, maintain a picture of the overall funding requirements, monitor the overall progress and implementation of the nuclear power infrastructure, and resolve any issues that may arise. JAEC would need to play a strong role as the executive arm of the Ministerial level coordination committee.

### **A comprehensive nuclear law should be enacted**

The primary legislative framework for nuclear activities in Jordan is provided by Law 43/2007 on “Radiation Protection, and Nuclear Safety and Security” and Law 42/2007 on “Nuclear Energy”. However, this framework is inadequate to support the planned nuclear power programme since it does not fully reflect the provisions of the relevant international legal instruments and does not adequately address key areas, a number of which only appear to be addressed in regulations or instructions. Furthermore, Law 43 was amended in April 2014 by Law 17, which merged the former JNRC into a new Energy and Minerals Regulatory Commission (EMRC). These changes may raise issues about the effective independence of the regulatory body, which should be provided for in the legislative framework.

Jordan recognizes the need to address these matters in a new law that will supersede Law 43/2007. It has prepared a draft “Law on Energy and Minerals”; however, the draft does not exclusively cover nuclear matters but also covers the electricity, minerals and petroleum sectors. In view of the special nature of nuclear energy, Jordan should address the legislative framework in a separate nuclear law that covers all relevant aspects in a comprehensive and coherent manner. This new nuclear law should establish: an effectively independent regulatory body; a clear delineation of roles and responsibilities; and, adequate provisions on nuclear safety, security, safeguards, and civil liability for nuclear damage, including inter alia, the licensing of nuclear facilities, import/export controls and spent fuel and radioactive waste management. This should be done as a matter of urgency.

Jordan is a party to most of the relevant international legal instruments but should join the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

### **The regulatory framework should be strengthened**

In June 2014, an IRRS mission was conducted which made a number of recommendations to strengthen the regulatory framework that are not repeated in this report. EMRC has developed an action plan to establish an effective regulatory framework for the nuclear power programme, which addresses the recommendations from the IRRS mission and other missions. The action plan includes the need to issue a comprehensive set of regulations and instructions on nuclear safety, security and safeguards, the lack of which is affecting the development of plans and procedures in other organizations.

### **The Government of Jordan should complete the development of a financing plan for its nuclear power plant.**

Financing is a major issue for all new nuclear power projects currently under consideration, affected by the viability of the projects and the cost and availability of financing. The Government of Jordan is planning to secure financing for just over half the total cost of its first NPP, with Rusatom Overseas securing the balance. Before the final stages of negotiating the Engineering, Procurement and Construction contract, the likely sources of financing need

to be identified. A comprehensive financing plan for Jordan's contribution, including contingency and cost implications, is needed. The Government of Jordan would need to provide a guarantee for the Power Purchase Agreement and give confidence to investors. The financing plan should be based on an updated feasibility study. The results of the pre-investment activities identified in the Project Development Agreement with Rusatom Overseas are major inputs to the updated feasibility study.

**Plans need to be developed and implemented to meet the human resource needs for each organisation and integrated into a national plan.**

An initial assessment of the needs of the future operating organisation has been made but recruitment and training plans are yet to be developed. The need for further development of EMRC has been recommended by a recent IRRS mission. The HR requirements for other organisations addressing areas such as: technical support, waste management, nuclear security, safeguards, and local industrial involvement need further development. A national HRD committee has been established, but it has not yet conducted a gap analysis between needs and supply. There is a draft national HRD plan but it focuses mainly on the needs of the future operating organisation and the regulatory body. Jordan should further develop its organisational level and national level HRD plan and the means to meet those needs, ensuring consistency with the project schedule.

**The operating organisation, Jordan Nuclear Power Company (JNPC), should be urgently established.**

While the Cabinet approved the establishment of JNPC in October 2013, Jordan currently does not have an operating organization. This is creating a number of issues across its nuclear infrastructure. While JAEC is currently performing this role, it intends to establish a new operating organisation, JNPC. This organisation should be established urgently to complete the pre-investment phase project development activities and in parallel establish itself as a competent operating organization. This represents a major challenge and will require the financial and human resources, competencies and systems to complete, inter alia, the following activities:

- Development and implementation of the plan for JNPC to transition from a project development organisation to one responsible for licensing, constructing and operating the NPP;
- Development of the organizational structure and culture, leadership, resources and management systems for both the pre and post-investment phases;
- Activities defined in the Project Development Agreement; and,
- Final negotiation and agreement with the relevant Russian parties.

**The Site Evaluation and Environmental Impact Assessment studies should be completed.**

The Site Evaluation and Environmental Impact Assessment studies for the preferred site have not been initiated and will require considerable resources and time. These studies are urgently needed as inputs to the financing plan and final scope requirements for the Engineering, Procurement and Construction contract.

The INIR team noted that engaging in the bidding process before completing these and other preparatory activities may impact the process of finalizing the EPC contract in the following areas:

- managing potential project risks arising from not having a finalized licensing process and associated requirements
- managing the financial implications of changes in scope and
- ensuring the consistency and completeness of the specification as a number of issues are negotiated in parallel against a challenging timescale.

As these are mainly commercial issues, the INIR team did not evaluate them in any detail.

## **1. INTRODUCTION**

Jordan's energy strategy aims to achieve a sustainable energy system through the diversification and the optimal utilization of indigenous energy resources. In 2006, a high-level Ministerial Committee chaired by the Prime Minister was established to develop a roadmap for implementing the nuclear energy programme. The motivations for the programme are security of energy supply, reduced dependence on imported oil and gas and to meet future increase in energy demand. A Royal Decree to pursue nuclear power was issued in January 2007, taking into account national goals for energy security and diversification, and a desire to reduce dependence on and uncertainty of imports. In December 2007, due to a large and growing reliance on energy imports, approximately 97% of Jordan's electricity generation is fuelled by imports, Jordan revised its national energy strategy and included nuclear power as an option for primary power sources for electrical power generation. For that, Jordan plans to build a nuclear power plant to ensure security of energy supply, reduce dependence on imported oil and gas and to meet future increase in energy demand. The addition of nuclear power will help to alleviate a predicted energy shortage of 6.8 gigawatts by 2030. It is also anticipated to help to ensure stable pricing and will contribute to the economic growth of Jordan. The addition of nuclear power to the mix of energy options follows a regional trend of seeking to diversify options in favor of a reliable and non-volatile energy source.

In 2008, the Jordan Atomic Energy Commission (JAEC) and the Jordan Nuclear Regulatory Commission (JNRC) were established. JAEC was designated as the entity responsible for the development and implementation of the nuclear power programme, together with meeting the regulatory requirements for safety, radiation protection, security and safeguards. JNRC was charged with regulatory oversight of the programme.

In August 2013, the Jordanian Cabinet confirmed the nuclear energy as one of the main components of Jordan's energy mix and confirmed selection of the Amra site, located approximately 70 km from Amman and 40 km from the waste water treatment facility that would be used as the source of cooling water. In October 2013, JAEC selected Atomstroyexport as the preferred bidder for its first NPP and Rusatom Overseas (RAOS) as its strategic investor.

In April 2014, the Energy and Mineral Regulatory Commission (EMRC), was designated as the successor to Jordan Nuclear Regulatory Commission, in accordance with Law No. 17/2014. In June 2014, an IRRS mission was conducted which made a number of recommendations to strengthen the regulatory framework.

The Hashemite Kingdom of Jordan requested the IAEA to carry out an Integrated Nuclear Infrastructure Review (INIR) mission for Phase 2 in a letter dated 13 February 2013. A mission was conducted in March 2014 which provided clarification on the evaluation methodology and supported the development of a Self-Evaluation Report (SER). The SER was provided to the IAEA on 13 May 2014. The first INIR mission which was conducted in August 2009, focused primarily on Phase 1 activities around the decision-making process. A follow-up to the August 2009 INIR mission was conducted in January 2012, which reviewed progress toward fulfilling the recommendations made in 2009.

The INIR mission was conducted from 4-14 August 2014, in Amman. The mission was coordinated for Jordan by JAEC. The INIR mission team was led by the Director of the Division Nuclear Power, IAEA, and consisted of 11 experts including staff from the Departments of Nuclear Energy, Nuclear Safety and Security, Safeguards and the Office of Legal Affairs and international experts recruited by the IAEA.

At the time of the mission, JAEC, on behalf of the Government of Jordan, was in the process of negotiating an Inter-Governmental Agreement (IGA) with the Russian Federation for the construction and operation of NPPs. The IGA, once signed, would be sent to the Jordanian Parliament for approval and serve as a high-level umbrella agreement for the project.

The Cabinet approved a Project Development Agreement (PDA) between JAEC and RAOS during the mission, which identifies project-specific activities to be carried out by both sides prior to investment. For Jordan, this includes an electricity market study, grid studies, site characterisation studies, an environmental impact assessment, water supply agreements, and a power purchase agreement.

At the time of the mission, Jordan Nuclear Power Company (JNPC) had not yet been established. This is planned in two phases. During the first phase, it would be responsible for carrying out the pre-investment activities identified in the PDA. Once this phase has been completed, a final investment decision will be made, and it is expected that the Russian strategic investor RAOS will become an equity shareholder and the Engineering Procurement and Construction (EPC) contract will be signed.

It is foreseen that the Jordan Nuclear Power Plant (JNPP) will comprise two 1000 MWe Pressurized Water Reactors (PWR), based on the AES-92 design, owned and operated by Jordan Nuclear Power Company (JNPC), with 50.1% of the shares held by Jordan and 49.9% held by Rusatom Overseas (RAOS).

For the purposes of this report, the term “JNPC Pre-Investment Phase” or “JNPC (PIPh)” refers to the project organization that will be established in the first phase, and the term “JNPC” refers to the organization with the full responsibilities of the owner-operator. This distinction is made to give emphasis to the near term activities in the pre-investment phase as well as to focus attention on the significant transition that the organization will undertake thereafter.

The pre-investment activities are expected to be completed in 2016 with start of commercial operation in 2024.

## **2. OBJECTIVES OF THE MISSION**

The main objectives of the INIR mission are:

- Evaluation of the development status of the 19 infrastructure issues described in the NE Series guide “Milestones in the Development of a National Infrastructure for Nuclear Power” (NG-G-3.1) applying the holistic approach described in NE Series technical report “Evaluation of the Status of National Infrastructure Development” (NG-T-3.2), and its Addendum 1, dated 25 January 2013.
- Identification of the areas in Phase 2 of NG-G-3.1 needing further actions to reach respective milestones in the building of national infrastructure in Jordan.
- Provision of Recommendations and Suggestions to Jordan regarding infrastructure development which can be used in preparation of an Action Plan to address areas for further improvement in its nuclear power infrastructure development.

## **3. SCOPE OF THE MISSION**

The INIR mission focused on the status of the infrastructure conditions in Jordan covering all of the 19 infrastructure issues identified in the Evaluation Methodology. Jordan prepared a SER using the Phase 2 conditions to determine its infrastructure status against Milestone 2, “Ready to invite bids.” The infrastructure conditions to meet this Milestone are effectively the same as those required to be ready to negotiate the EPC contract. This INIR mission therefore focuses on the infrastructure needed to be ready to negotiate the EPC contract and the recommendations are made in this context. As Jordan had previously issued a bid invitation specification in 2012 and is working on pre-investment activities before finalising an EPC contract, the recommendations and suggestions made in this report will assist Jordan to make further progress.

In June 2014, an IRRS mission was conducted that made a number of recommendations to strengthen the regulatory framework and the safety infrastructure to support a nuclear power programme. The INIR team considered the IRRS report as the major input to its review of regulatory infrastructure and referenced but did not duplicate recommendations made in the IRRS report.

The scope of the INIR mission included:

- Review of the current status of development of the 19 infrastructure issues concerning the Jordan nuclear power programme using the Phase 2 criteria;
- Discussion of outstanding recommendations/actions from the 2009 INIR mission and 2012 follow-up mission, as well as other recent IAEA missions related to the infrastructure issues including the IRRS;
- Recommendations to address any identified gaps in Phase 2;
- Suggestions for further improvement of the nuclear power infrastructure; and,

- Identification of good practices that were observed in the nuclear power infrastructure development.

#### **4. WORK DONE**

Prior to the mission, the INIR team reviewed the SER and supporting documentation provided by Jordan. The supporting documentation included relevant national laws, regulations, instructions, including those in draft form, as well as reports and presentations. (A full list appears in Appendix 3.) The INIR mission team also reviewed relevant reports from recent IAEA missions and workshops with Jordan, and sought input from IAEA staff members supporting Jordan's nuclear power programme. Preparatory meetings of the INIR mission team were conducted prior to the mission, in Vienna on 3-4 July, 2014 and in Amman on 2-3 August 2014.

The INIR mission was conducted from 4-14 August 2014. The meetings were held at the Regency Palace Hotel in Amman. The main interviews were conducted over six working days. The mission was coordinated for Jordan by JAEC. During the interviews, the Jordanian counterparts provided an update on the current status of issues where progress had been made since the SER was finalised.

The preliminary draft report was prepared by the INIR mission team and discussed with the counterparts. The main mission results were presented to representatives of the Government in an exit meeting on 14 August 2014. The preliminary draft report was delivered to the counterpart during the exit meeting.

The results of the mission are summarized in Section 5 and presented in tabular form in Section 6 for each of the 19 infrastructure issues in Phase 2. Attachment 1 provides the evaluation results for each issue.

#### **5. MAIN CONCLUSIONS**

The INIR mission was conducted in a cooperative and open atmosphere with participation from eight organizations in Jordan responsible for the nuclear power programme, in particular JAEC, EMRC and MEMR. The full list of participants can be found in Attachment 2.

Jordan has made notable progress in the development of its national infrastructure for nuclear power since the first INIR mission in 2009. The INIR team found that JAEC is leading the development of nuclear power and is aware of the main actions necessary to implement the programme. Though steps have been taken towards the procurement of the NPP, including the selection of a preferred bidder and strategic investor, further work is needed to develop the nuclear infrastructure required to be ready for the next significant steps in the project—the investment decision and signing of the EPC contract.

In order to assist Jordan in making further progress in its infrastructure development, the INIR team made 44 recommendations and 3 suggestions. For the benefit of other countries, the INIR team also identified 3 good practices. Based on the recommendations, key areas for further actions are summarized below:

### **The Government of Jordan should finalize national policies and strategies for the nuclear power programme.**

The Government of Jordan is developing national policies and strategies covering several important areas of infrastructure for nuclear power, including nuclear fuel cycle, radioactive waste management, human resource development, stakeholder involvement and industrial involvement. These policies and strategies should be completed and endorsed by the Government without delay because they will guide the work in Jordan to develop the national infrastructure as well as the negotiations with Russia for the Intergovernmental Agreement and Engineering, Procurement and Construction contract. The policies should clearly state the key principles and designate the entities responsible for their implementation. This proposal complements the results of a recent Integrated Regulatory Review Service (IRRS) mission, which recommended that Jordan develop a national policy and strategy for nuclear safety.

### **The Government of Jordan should re-establish a Ministerial level coordination committee to ensure effective development of its national nuclear power infrastructure.**

The nuclear power programme involves a wide range of Government Ministries and other organizations. JAEC is the Government Commission mandated to lead the development of the nuclear power programme; however, many Government Ministries are expected to implement activities needed for the nuclear power infrastructure and fund them from their own budgets, for example the grid and transportation infrastructure. Moreover, many of the activities are inter-related and sequenced, requiring effective coordination in line with the NPP project schedule. A number of national committees have been set up covering specific nuclear infrastructure issues. Some examples are 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.

It is essential that the Government of Jordan mandates a coordinating committee dedicated solely to the nuclear power programme with Ministerial level participation from all of the relevant Ministries and organizations. This coordinating committee would review high level policies and make recommendations to the Cabinet for approval, review the work of the committees addressing specific nuclear infrastructure issues, maintain a picture of the overall funding requirements, monitor the overall progress and implementation of the nuclear power infrastructure, and resolve any issues that may arise. JAEC would need to play a strong role as the executive arm of the Ministerial level coordination committee.

### **A comprehensive nuclear law should be enacted**

The primary legislative framework for nuclear activities in Jordan is provided by Law 43/2007 on “Radiation Protection, and Nuclear Safety and Security” and Law 42/2007 on “Nuclear Energy”. However, this framework is inadequate to support the planned nuclear power programme since it does not fully reflect the provisions of the relevant international legal instruments and does not adequately address key areas, a number of which only appear to be addressed in regulations or instructions. Furthermore, Law 43 was amended in April 2014 by Law 17, which merged the former JNRC into a new Energy and Minerals Regulatory Commission (EMRC). These changes may raise issues about the effective independence of the regulatory body, which should be provided for in the legislative framework.

Jordan recognizes the need to address these matters in a new law that will supersede Law 43/2007. It has prepared a draft “Law on Energy and Minerals”; however, the draft does not exclusively nuclear matters but also covers the electricity, minerals and petroleum sectors. In view of the special nature of nuclear energy, Jordan should address the legislative framework in a separate nuclear law that covers all relevant aspects in a comprehensive and coherent manner. This new nuclear law should establish: an effectively independent regulatory body; a clear delineation of roles and responsibilities; and, adequate provisions on nuclear safety, security, safeguards, and civil liability for nuclear damage, including inter alia, the licensing of nuclear facilities, import/export controls and spent fuel and radioactive waste management. This should be done as a matter of urgency.

Jordan is a party to most of the relevant international legal instruments but should join the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

### **The regulatory framework should be strengthened**

In June 2014, an IRRS mission was conducted which made a number of recommendations to strengthen the regulatory framework that are not repeated in this report. EMRC has developed an action plan to establish an effective regulatory framework for the nuclear power programme, which addresses the recommendations from the IRRS mission and other missions. The action plan includes the need to issue a comprehensive set of regulations and instructions on nuclear safety, security and safeguards, the lack of which is affecting the development of plans and procedures in other organizations.

### **The Government of Jordan should complete the development of a financing plan for its nuclear power plant.**

Financing is a major issue for all new nuclear power projects currently under consideration, affected by the viability of the projects and the cost and availability of financing. The Government of Jordan is planning to secure financing for just over half the total cost of its first NPP, with Rusatom Overseas securing the balance. Before the final stages of negotiating the Engineering, Procurement and Construction contract, the likely sources of financing need to be identified. A comprehensive financing plan for Jordan’s contribution, including contingency and cost implications, is needed. The Government of Jordan would need to provide a guarantee for the Power Purchase Agreement and give confidence to investors. The financing plan should be based on an updated feasibility study. The results of the pre-investment activities identified in the Project Development Agreement with Rusatom Overseas are major inputs to the updated feasibility study.

### **Plans need to be developed and implemented to meet the human resource needs for each organisation and integrated into a national plan.**

An initial assessment of the needs of the future operating organisation has been made but recruitment and training plans are yet to be developed. The need for further development of EMRC has been recommended by a recent IRRS mission. The HR requirements for other organisations addressing areas such as: technical support, waste management, nuclear security, safeguards, and local industrial involvement need further development. A national HRD committee has been established, but it has not yet conducted a gap analysis between needs and supply. There is a draft national HRD plan but it focuses mainly on the needs of the future operating organisation and the regulatory body. Jordan should further develop its

organisational level and national level HRD plan and the means to meet those needs, ensuring consistency with the project schedule.

**The operating organisation, Jordan Nuclear Power Company (JNPC), should be urgently established.**

While the Cabinet approved the establishment of JNPC in October 2013, Jordan currently does not have an operating organization. This is creating a number of issues across its nuclear infrastructure. While JAEC is currently performing this role, it intends to establish a new operating organisation, JNPC. This organisation should be established urgently to complete the pre-investment phase project development activities and in parallel establish itself as a competent operating organization. This represents a major challenge and will require the financial and human resources, competencies and systems to complete, inter alia, the following activities:

- Development and implementation of the plan for JNPC to transition from a project development organisation to one responsible for licensing, constructing and operating the NPP;
- Development of the organizational structure and culture, leadership, resources and management systems for both the pre and post-investment phases;
- Activities defined in the Project Development Agreement; and,
- Final negotiation and agreement with the relevant Russian parties.

**The Site Evaluation and Environmental Impact Assessment studies should be completed.**

The Site Evaluation and Environmental Impact Assessment studies for the preferred site have not been initiated and will require considerable resources and time. These studies are urgently needed as inputs to the financing plan and final scope requirements for the Engineering, Procurement and Construction contract.

The INIR team noted that engaging in the bidding process before completing these and other preparatory activities may impact the process of finalizing the EPC contract in the following areas:

- managing potential project risks arising from not having a finalized licensing process and associated requirements
- managing the financial implications of changes in scope and
- ensuring the consistency and completeness of the specification as a number of issues are negotiated in parallel against a challenging timescale.

As these are mainly commercial issues, the INIR team did not evaluate them in any detail.

### **Recommendations**

R-1.1.1 The GoJ should ensure the effective inter-ministerial coordination for nuclear power infrastructure development including pre-investment activities. This coordination mechanism should be mandated and organized to ensure effective participation by all relevant Ministries and organisations.

R-1.1.2 JAEC should finalise the national policies related to the nuclear fuel cycle and radioactive waste management to be approved by the GoJ.

R-1.3.1 JAEC should establish the owner-operator organisation with clear assignment of responsibilities.

R-2.1.1 JNPC (PIPh) and EMRC should develop and implement training and qualification programmes to ensure that staff and management are competent and authorised to prepare and review the license application, as appropriate.

R-2.1.2 JNPC (PIPh) and EMRC should develop formal safety culture programmes that are promoted by senior leadership. The programmes should include empowering staff to raise safety concerns to senior leadership.

R-2.1.3 JNPC and EMRC should develop formal programmes that gather and evaluate operating experience to improve the construction, operation, and oversight of the Jordan nuclear power programme.

R-2.1.4 JNPC (PIPh) and EMRC should establish formal communication protocols between JNPC, EMRC and the vendor to ensure the effective management of information throughout the lifecycle of the project.

R-2.2.1 JNPC (PIPh) should develop a clear strategy for the long term vendor support requirements and ensure these are addressed in the EPC contract and IGA, as appropriate.

R-3.1.1 JNPC (PIPh) should complete the pre-investment work (e.g. siting, EIA, and outstanding issues from the vendor bid) and incorporate the results into the work to finalise the EPC contract.

R-3.2.1 JNPC (PIPh) should complete the planned strengthening of the procurement team, e.g., through the possible involvement of an owner's engineer, before detailed negotiations with the EPC contractor.

R-3.3.1 JAEC should develop a clear strategy for the transition of JNPC (PIPh) to JNPC, including the necessary staffing and management systems, recognising that it will be a significantly different organisation.

R-3.4.1 JNPC (PIPh) should develop (in conjunction with the Russian partner) the integrated management system for JNPC recognising the need to manage the activities related to licensing and construction.

R-4.1.1 JNPC (PIPh) should develop a comprehensive financing plan, with options, contingencies and cost implications, to give confidence that the current financing strategy is feasible.

R-4.1.2 JNPC (PIPh) should complete the feasibility study, including a range of assumptions on key parameters, such as the electricity tariff and the cost of borrowing.

R-4.1.3 All involved organisations, at a senior level, should review the risk management plan for JNPP developed by JAEC to ensure their commitment to the plan.

R-4.2.1 All involved organisations should review the estimated costs of upgrading the off-site infrastructure for JNPP, and the Government should recognise the need for funding.

R-4.2.2 GoJ should ensure EMRC is adequately funded to perform its functions, including capacity building.

R-4.2.3 EMRC should finalise and issue the Regulation on the Fund for Decommissioning of Nuclear Facilities.

R-4.2.4 GoJ should establish the funding mechanisms for spent fuel and radioactive waste management, once the spent fuel and radioactive waste management policy has been approved.

R-5.2.1 Jordan should urgently develop and enact a comprehensive nuclear law to adequately address the need for an effectively independent regulatory body, a clear delineation of roles and responsibilities, adequate provisions on nuclear safety, security, safeguards, and civil liability for nuclear damage, including inter alia, the licensing of nuclear facilities, import/export controls and spent fuel and radioactive waste management.

R-6.1.1. EMRC should finalise its instructions for the implementation of safeguards so that JNPC (PIPh) can develop a plan to meet its requirements.

R-7.1.1 JNPC (PIPh) should discuss with EMRC the proposed owner/operator organisation early in the process to ensure that it can be licensed in accordance with the applicable laws, regulations and instructions.

R-8.1.1 EMRC should urgently finalise the radiation protection regulation and its associated instructions to be consistent with the requirements of GSR Part 3.

R-8.1.2 EMRC should include “Internal Exposure” in the drafted code of practice for occupational exposure control or develop a new one for internal exposure.

R-9.1.1 NEPCO should complete the planned detailed study of the implications of incorporating two units of 1000MW into the Amra site in order to identify the enhancements required to the Jordan grid, its interconnection to the regional grid and the operational agreements for the interconnected system.

R-10.1.1 JNPC (PIPh) should develop detailed plans, including recruitment and training plans, to address the new organisational, human resource, competence and culture requirements in preparation for operations.

R-10.1.2 The national HRD committee should further develop the national HRD plan, addressing the needs of all involved organisations ensuring consistency with the project schedule.

R-11.1.1 JAEC should finalise and issue the Public Awareness Committee’s communication strategy and plan, supported by the necessary resources, including training of spokespersons and establishment of public information centres.

R-12.1.1 EMRC should issue the “Instruction on the Site Survey and Site Selection for Nuclear Power Plants” as well as the “Instruction on the Site Evaluation for Nuclear Power Plants” to ensure that a firm basis exists for site selection and evaluation.

R-12.1.2 JNPC (PIPh) should ensure it has competent staff and an appropriate system necessary for effective management and oversight of the site evaluation activities.

R-12.1.3 JNPC (PIPh) should initiate activities for the confirmation of the site selection and site evaluation as studies and approvals are likely to take time and will require the involvement of various Ministries and stakeholders. The recommendations from the 2013 SEED mission should be addressed in the scope of these activities.

R-12.2.1 JNPC (PIPh) should complete the required site and local infrastructure studies and the GoJ should then assign responsibilities for infrastructure development to the appropriate Ministries and organisations. [See also R-4.2.1].

R-13.1.1 JNPC (PIPh) should initiate the Environmental Impact Assessment process consistent with the requirements of MoE.

R-13.2.1 JNPC should ensure that Amra site specific environmental sensitivities are fully identified during the Environmental Impact Assessment process and incorporated into the relevant vendor contracts, along with the Environmental Management Plan.

R-13.3.1 The Memorandum of Understanding between MoE and EMRC should be finalised to address the cooperation between them for the review of the radiological elements of the Environmental Impact Assessment.

R-14.1.1 GoJ should ensure that the roles of the Higher Council of Civil Defense, as the National Coordinating Authority, and the National Centre for Security and Crisis Management are defined in the case of nuclear or radiological emergencies.

R-14.1.2 The National Emergency Response Committee should conduct a gap analysis of the existing emergency communication networks and develop a plan for any identified improvements for nuclear or radiological emergencies.

R-15.1.1 The National Nuclear Security Committee should update the national threat assessment and develop the Design Basis Threat.

R-15.1.2 JNPC (PIPh) should update the requirements for nuclear security to be specified in the EPC contract and develop the needed security and physical protection measures, procedures, and plans for JNPP.

R-15.1.3 JNPC (PIPh) should develop procedures for the protection of sensitive information.

R-15.2.1 EMRC should expand the draft “Instruction on Providing Physical Protection of Nuclear Facilities” to define the licensing requirements for security for the site, construction and transport of nuclear and radioactive material, and JNPC (PIPh) should establish a plan to meet these requirements.

R-16.1.1 Based on the adopted national policy, JAEC should finalise the national strategies for the front-end of the nuclear fuel cycle as well as for spent fuel management, with well elaborated options for long term management, including the evaluation of risks.

R-17.1.2 JAEC should finalise the national strategy for radioactive waste management based on the adopted national policy.

R-18.1.1 The Localisation Committee should:

- develop a national industrial involvement policy, to be endorsed by the Government, in time to inform the various strategies and contracts;
- ensure the completion of the national and local supplier capability assessment; and,
- ensure the development, endorsement and implementation of an industrial involvement plan with progress reports to the appropriate stakeholders.

### **Suggestions**

S-1.3.1 Ensure avoidance of conflict of interest in TSOs supporting both the regulatory body and owner-operator in the future.

S-5.1.1 Although Jordan is party to the majority of relevant international legal instruments, it should continue to take steps to adhere to and implement the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, and consider joining the Convention on Supplementary Compensation for Nuclear Damage.

S-5.3.1 Jordan should complete its review of the non-nuclear laws possibly affecting the nuclear power programme and follow-up the amendment process, as appropriate.

### **Good Practices**

GP-3.1.1 JAEC agreed with the strategic partner and vendor the activities to be completed before a final investment decision is made.

GP-11.1.1 JAEC used students and nuclear graduates to communicate with the large youth population, engaging a group of stakeholders important for the future.

GP-18.1.1 Jordan established a National Localisation Committee that facilitates awareness of localisation opportunities and enhances the involvement of a wide range of national and local industry in the nuclear project.

## **6. EVALUATION RESULTS FOR PHASE 2**

For the purposes of the INIR mission results, the following definitions are used:

### **Significant actions needed:**

The “Review observations” indicates that there is considerable effort still needed to realize the stated “Condition”, and that achievement of this “Condition” is needed in order to be able to sustain overall progress in developing an effective national nuclear power infrastructure.

### **Minor actions needed:**

The “Review observations” indicates that there is some effort still needed to realize the stated “Condition”. However, the current status, supported by the on-going activities, mostly achieves the desired “Condition”.

**No actions needed:**

The available evidence indicates that the intention underlying this “Condition” has been achieved. However, as work continues on the infrastructure knowledge and implementation, care has to be taken to ensure that this status remains valid.

**Recommendations:**

Recommendations are proposed when aspects related to fulfilment of conditions of nuclear infrastructure development are discrepant, incomplete or inadequately implemented. Recommendations are specific, realistic and designed to result in tangible improvement. Recommendations are based on the *Milestones Approach* and, as applicable, state the relation with the specific issue. The recommendations are formulated so they are succinct and self-explanatory.

**Suggestions:**

Suggestions may indicate areas where concrete plans exist and are being executed, or for useful improvement of existing programmes and to point out possible better alternatives to current work. In general, suggestions stimulate the management and staff to consider new or different approaches to develop infrastructure and enhance performance. Suggestions are formulated so they are succinct and self-explanatory.

**Good practices:**

A good practice is identified in recognition of an outstanding organisation, arrangement, programme or performance, superior to those generally observed elsewhere. A good practice is more than just the fulfilment of the conditions or expectations. It is worthy of the attention of other countries involved in the development of nuclear infrastructure as a model in the drive for excellence. Good practices also reference the bases (similar to suggestions) and are clearly documented in the mission report.

**It should be noted that the results summarized in the following tables neither validate the country actions and programmes, nor certify the quality and completeness of the work done by a country.**

| 1. National Position            | Phase 2        |       |    |
|---------------------------------|----------------|-------|----|
| Condition                       | Actions needed |       |    |
|                                 | SIGNIFICANT    | MINOR | NO |
| 1.1. Government support evident | X              | X     |    |

|   |                       |              |           |
|---|-----------------------|--------------|-----------|
| 1.2. Overall strategic approach for contracting with the vendor established                                   |                       |              | X         |
| 1.3 Commitments and obligations of owner/operator organisations and regulatory body established               | X                     | X            |           |
| <b>2. Nuclear Safety</b>  | <b>Phase 2</b>        |              |           |
| <b>Condition</b>  | <b>Actions needed</b> |              |           |
|   | <b>SIGNIFICANT</b>    | <b>MINOR</b> | <b>NO</b> |
| 2.1 Safety responsibilities by all stakeholders recognised  | X                     | X            |           |
| 2.2 Long term relationship with supplier established  |                       | X            |           |
| <b>3. Management</b>  | <b>Phase 2</b>        |              |           |
| <b>Condition</b>  | <b>Actions needed</b> |              |           |
|   | <b>SIGNIFICANT</b>    | <b>MINOR</b> | <b>NO</b> |
| 3.1 Contract specifications and evaluation criteria determined  | X                     |              |           |
| 3.2 Owner/operator competence to carry out nuclear procurement evident  | X                     |              |           |
| 3.3 Project management organisation established with adequate staff to prepare for and analyse bids available | X                     |              |           |
| 3.4 Management systems established  | X                     |              |           |
| <b>4. Funding and Financing</b>   | <b>Phase 2</b>        |              |           |
| <b>Condition</b>  | <b>Actions needed</b> |              |           |
|   | <b>SIGNIFICANT</b>    | <b>MINOR</b> | <b>NO</b> |
| 4.1 Means of financing established and strategy for management of financial risks available                   | X                     |              |           |
| 4.2 Funding plan available  | X                     |              |           |
| <b>5. Legislative Framework</b>   | <b>Phase 2</b>        |              |           |
| <b>Condition</b>  | <b>Actions needed</b> |              |           |
|   | <b>SIGNIFICANT</b>    | <b>MINOR</b> | <b>NO</b> |

|  |                       |              |           |
|--|-----------------------|--------------|-----------|
| 5.1 International legal instruments governing nuclear activities in force  |                       | X            |           |
| 5.2 A comprehensive nuclear law is enacted and in force  | X                     |              |           |
| 5.3 All other legislation affected by the nuclear power programme developed, promulgated and in force                            |                       | X            |           |
| <b>6. Safeguards</b>   | <b>Phase 2</b>        |              |           |
| <b>Condition</b>   | <b>Actions needed</b> |              |           |
|  | <b>SIGNIFICANT</b>    | <b>MINOR</b> | <b>NO</b> |
| 6.1 Strengthening of the SSAC underway   |                       | X            |           |
| 6.2 Early safeguards relevant information provided to IAEA planned   |                       |              | X         |
| <b>7. Regulatory Framework</b>   | <b>Phase 2</b>        |              |           |
| <b>Condition</b>   | <b>Actions needed</b> |              |           |
|  | <b>SIGNIFICANT</b>    | <b>MINOR</b> | <b>NO</b> |
| 7.1 Independent regulatory body established and the necessary regulatory infrastructure developed                                | X                     | X            |           |
| <b>8. Radiation Protection</b>   | <b>Phase 2</b>        |              |           |
| <b>Condition</b>   | <b>Actions needed</b> |              |           |
|  | <b>SIGNIFICANT</b>    | <b>MINOR</b> | <b>NO</b> |
| 8.1 Actions to prepare adequate radiation protection programmes undertaken, and expansion of appropriate infrastructures planned | X                     |              |           |
| <b>9. Electrical Grid</b>  | <b>Phase 2</b>        |              |           |
| <b>Condition</b>   | <b>Actions needed</b> |              |           |
|  | <b>SIGNIFICANT</b>    | <b>MINOR</b> | <b>NO</b> |
| 9.1 Detailed studies to determine grid expansion, upgrade or improvement undertaken  | X                     |              |           |
| 9.2 Plans, funding and schedule for grid enhancement available   |                       |              | X         |
| <b>10. Human Resources</b>   | <b>Phase 2</b>        |              |           |

| Condition   | Actions needed |       |    |
|---|----------------|-------|----|
|   | SIGNIFICANT    | MINOR | NO |
| 10.1 Knowledge and skills needed in organisations for Phase 3 and operational phase identified and a plan to develop and maintain the human resource is developed | X              |       |    |
| <b>11. Stakeholder Involvement</b>  | <b>Phase 2</b> |       |    |
| Condition   | Actions needed |       |    |
|   | SIGNIFICANT    | MINOR | NO |
| 11.1 Public information and education programme developed   | X              |       |    |
| <b>12. Site and supporting facilities</b>   | <b>Phase 2</b> |       |    |
| Condition   | Actions needed |       |    |
|   | SIGNIFICANT    | MINOR | NO |
| 12.1 Detailed site characterisation completed   | X              |       |    |
| 12.2 Plans to prepare site for construction   | X              |       |    |
| <b>13. Environmental Protection</b>   | <b>Phase 2</b> |       |    |
| Condition   | Actions needed |       |    |
|   | SIGNIFICANT    | MINOR | NO |
| 13.1 Environmental impact assessment for selected sites performed   | X              |       |    |
| 13.2 Particular environmental sensitivities included in BIS   |                | X     |    |
| 13.3 Clear and effective regulation of environmental issues established   |                | X     |    |
| <b>14. Emergency Planning</b>   | <b>Phase 2</b> |       |    |
| Condition   | Actions needed |       |    |
|   | SIGNIFICANT    | MINOR | NO |
| 14.1 Detailed approach to emergency planning being implemented  | X              |       |    |

|   |                       |              |           |
|---|-----------------------|--------------|-----------|
| 14.2 Emergency planning for existing radiation facilities and practices in place  |                       |              | X         |
| <b>15. Security</b>   | <b>Phase 2</b>        |              |           |
| <b>Condition</b>  | <b>Actions needed</b> |              |           |
|   | <b>SIGNIFICANT</b>    | <b>MINOR</b> | <b>NO</b> |
| 15.1 Security requirements defined, plan to develop DBT established, sensitive information defined                          | X                     |              |           |
| 15.2 Planned nuclear security measures for siting, construction and transport   | X                     |              |           |
| 15.3 Programmes for selection/qualifications of staff with access to facilities are in place                                |                       |              | X         |
| 15.4 Nuclear security culture development planned   |                       |              | X         |
| <b>16. Nuclear Fuel Cycle</b>   | <b>Phase 2</b>        |              |           |
| <b>Condition</b>  | <b>Actions needed</b> |              |           |
|   | <b>SIGNIFICANT</b>    | <b>MINOR</b> | <b>NO</b> |
| 16.1 Front-end fuel cycle policy and strategy defined, and strategy for storage and ultimate disposal of spent fuel defined | X                     |              |           |
| <b>17. Radioactive Waste</b>  | <b>Phase 2</b>        |              |           |
| <b>Condition</b>  | <b>Actions needed</b> |              |           |
|   | <b>SIGNIFICANT</b>    | <b>MINOR</b> | <b>NO</b> |
| 17.1 Handling the burdens of low and intermediate radioactive waste considered  | X                     |              |           |
| 17.2 Preliminary decommissioning plan requested   |                       |              | X         |
| <b>18. Industrial Involvement</b>   | <b>Phase 2</b>        |              |           |
| <b>Condition</b>  | <b>Actions needed</b> |              |           |
|   | <b>SIGNIFICANT</b>    | <b>MINOR</b> | <b>NO</b> |

|   |                       |              |           |
|---|-----------------------|--------------|-----------|
| 18.1 Realistic assessment of the national and local capabilities carried out, ability to meet schedule and quality requirements analysed, and plans and programmes to transition to national and local suppliers in place | <b>X</b>              |              |           |
| <b>19. Procurement</b>  | <b>Phase 2</b>        |              |           |
| <b>Condition</b>  | <b>Actions needed</b> |              |           |
|   | <b>SIGNIFICANT</b>    | <b>MINOR</b> | <b>NO</b> |
| 19.1 Procurement programme consistent with national policy for industrial participation established   |                       |              | <b>X</b>  |

**ATTACHMENT 1: REVIEW OBSERVATIONS, RECOMMENDATIONS AND SUGGESTIONS FOR PHASE 2**

|  |  |                |
|--|--|----------------|
| <b>1. National Position</b>  |  | <b>Phase 2</b> |
| <b>Condition 1.1: Government support evident</b>   |  |                |
| <b>Summary of the condition to be demonstrated</b>   | <p>By the end of phase 2, regulatory and operating organisations should be in place to meet the obligations of the NPP programme. However there is still a strong government role to support the development of the programme, to ensure that a policy for long term nuclear fuel cycle liabilities is established, to ensure safety, security and safeguards responsibilities are formulated and understood by all relevant organisations, and to ensure that appropriate support with emphasis on knowledge transfer from countries with experience of a nuclear programme will be available through bilateral agreements. There also needs to be a strong commitment to ensure the state fully participates in all the activities associated with the global nuclear safety and security regime.</p> <p>This role needs to be clearly established with a government ministry.</p> |                |
| <b>Examples of how the condition may be demonstrated</b>   | <ol style="list-style-type: none"> <li>1. Evidence that an on-going government role for nuclear power programme implementation has been clearly defined and established within a government agency (e.g. energy or industry).</li> <li>2. Appropriate bilateral agreements in place with vendor countries. <i>These may not be complete or subject to review at end of Phase 2 given that the detailed contract is still to be agreed.</i></li> </ol>  |                |
| <b>Review observations</b>   |  |                |
| <p>The Government of Jordan (GoJ) has taken Cabinet decisions in August and October 2013 to proceed with its national strategy on nuclear energy as part of the energy mix, to establish a project company for construction and operation of Jordan’s first nuclear power plant, and to select the Amra site as the Preferred Site and conduct site characterisation. GoJ also approved a Russian consortium (Atomstroyexport and Rusatom Overseas) selected by JAEC as the Preferred Bidder for technology supplier and the strategic partner. JAEC has completed a Project Development Agreement (PDA) with Rosatom that defines the pre-investment activities and respective responsibilities and obligations for both parties: the Jordanian and the Russian.</p> <p>One of the main responsibilities that remains with the Government is the development of long-term policies. The INIR team was informed that JAEC is responsible for nuclear policy development and MEMR is responsible for overall energy policy. The national energy policy from 2007, updated in 2011, includes nuclear power as part of the energy mix. A national committee composed of representatives from MEMR, NEPCO and JAEC has been established to update the electricity demand study. This study is one of the pre-investment activities identified in the PDA with Rusatom Overseas as a prerequisite for investment and will explore the possibility of an export market for electricity. The mission team was informed that a national spent fuel and radioactive waste management policy has been drafted by JAEC which, once finalised and approved by the Government, will be an input to additional negotiations.</p> <p>For a successful nuclear programme, inter-governmental agency coordination among the Government Ministries and other organisations is essential to ensure all aspects of the national infrastructure are</p> |  |                |

developing on a timescale consistent with the project schedule. This has been an area of recommendations from the INIR mission in 2009 and the follow-up mission in 2012. The INIR team was informed that JAEC, functioning as the authority responsible for nuclear power promotion, has established working groups with participation of other Government Ministries to prepare draft policies, procedures and agreements. JAEC reports to the HM the King and the Prime Minister on regular basis to provide update on the progress achieved. Representatives from relevant Ministries are also involved in these meetings. Under the current Administration, there is a Megaprojects Committee overseeing mega projects in the country that are updated on regular basis on the status of the nuclear power programme. There was recognition that there will be many aspects of the pre-investment activities that will require the involvement of relevant Ministries, such as Water Supply Agreements, Environmental Impact Assessment, etc. The mission team was informed that JAEC is currently considering requesting the re-establishment of an inter-ministerial committee to monitor progress on the implementation of the pre-investment activities. The INIR team considers that full participation of Government stakeholders is essential to ensure awareness of their responsibilities for the nuclear project and should be done at the Ministerial level.

The IRRS mission reviewed the development of a national policy and strategy for nuclear safety infrastructure (1.60.1) and noted that the “White Paper on Nuclear Energy in Jordan” implies a firm and long-term commitment to maintain activities that are necessary for nuclear safety. The recent IRRS mission also noted that Jordan’s participation in the global nuclear safety regime is generally satisfactory. The EMRC is participating in international and regional cooperation, and is in the process of negotiating an agreement for cooperation with the nuclear regulator in the vendor country. The IRRS report made a suggestion to consider establishing cooperation with regulatory bodies of the vendor country and countries with NPPs similar in technology and design.

The Government of Jordan has signed 13 bilateral Nuclear Cooperation Agreements (NCAs), including with countries experienced in operating nuclear power plants (France, China, Republic of Korea, Canada, Russia, UK, Argentina, Spain, Japan, Romania, Italy, Turkey and Saudi Arabia.

|                                 |                    |   |
|---------------------------------|--------------------|---|
| <b>Areas for further action</b> | <b>Significant</b> | Effective coordination of nuclear infrastructure development<br><br>National policies for nuclear fuel cycle and for radioactive waste management |
|                                 | <b>Minor</b>       | International regulatory cooperation with regulators from countries with the same NPP technology and design                                       |

## **RECOMMENDATIONS**

**R-1.1.1 The GoJ should ensure the effective inter-ministerial coordination for nuclear power infrastructure development including pre-investment activities. This coordination mechanism should be mandated and organized to ensure effective participation by all relevant Ministries and organisations.**

**R-1.1.2 JAEC should finalise the national policies related to the nuclear fuel cycle and radioactive waste management to be approved by the GoJ.**

## **SUGGESTIONS**

|   |  |
|---|--|
| None  |  |
| <b>GOOD PRACTICES</b>   |  |
| None  |  |
| <b>Condition 1.2: Overall strategic approach for contracting with the vendor established</b>  | <b>Phase 2</b>   |
| <b>Summary of the condition to be demonstrated</b>  | The state should have established how it wishes to contact for the NPP (e.g. ‘Build, Own, Operate, Transfer’ (BOOT), ‘Build, Own, Operate (BOO,) turnkey, multiple contracts) and should have a rationale supporting the decision. The strategy may include requesting bids for more than one option.  |
| <b>Examples of how the condition may be demonstrated</b>  | <ol style="list-style-type: none"> <li>1. Document reviewing contracting strategies and justifying the chosen approach with evidence that chosen strategy is consistent with national legislation.</li> <li>2. Implications recognised and plan to fulfil necessary requirements in place. Document setting out responsibilities of key national organisations and intended contracting strategy.</li> </ol> |
| <b>Review observations</b>  |  |
| <p>The September 2012 feasibility study described the contracting strategy followed by Jordan. JAEC initiated a competitive dialogue process with technology vendors in 2010, which led to a tendering process in 2011, ending by selecting three bidders. JAEC also issued a bid invitation for a strategic investor/operator in February 2011. Through this process, a preferred bidder was selected as Atomstroyexport, with Rusatom Overseas as the strategic investor. In October 2011, the Cabinet approved that a Joint Venture will be established.</p> <p>A PDA has been finalised, whereby the Rusatom Overseas investment is contingent upon the results of several pre-investment activities, including site characterisation, electricity demand studies (including for export of electricity), securing of the water source a power purchase agreement and some activities by Rusatom to address outstanding issues from the bid discussions. JAEC will form national committees to study and prepare key activities of the pre-investment phase. Through the negotiations, both Parties, Jordanian and Russian have outlined their conditions for investment:</p> <ul style="list-style-type: none"> <li>• Russian Party: site permit, readiness of the infrastructure, readiness of off-site infrastructure, and a fully approved EIA.</li> <li>• Jordanian Party: ceiling on investment costs, ceiling on electricity price to the grid, and the project’s equity rate of return.</li> </ul> <p>There was an awareness that the outcome of the pre-investment activities (e.g. site characterisation studies, water supply agreement, PPA, etc.) may affect the economics of the project. The mission team was informed that the ownership structure could be revisited by both parties, if needed.</p> <p>The Governments of both Jordan and Russian Federation are also negotiating an Inter-Governmental Agreement (IGA). The IGA provides the political umbrella on the governmental level under which the</p> |  |

|   |   |                |
|---|---|----------------|
| <p>project will be implemented. The IGA will be submitted to the Jordanian Parliament for ratification.</p> <p>In parallel with the PDA and IGA, Jordan Nuclear Power Company (JNPC Pre Investment Phase) (PIPh) will negotiate the Engineering, Procurement and Construction (EPC) contract. The INIR team was informed that the nuclear fuel cycle and radioactive waste management policies will affect negotiation of project agreements and contracts, and the draft should be finalised. (See R-1.1.2).</p> |   |                |
| <b>Areas for further action</b>   | <b>Significant</b>  | No             |
|   | <b>Minor</b>  | No             |
| <b>RECOMMENDATIONS</b>  |   |                |
| None  |   |                |
| <b>SUGGESTIONS</b>  |   |                |
| None  |   |                |
| <b>GOOD PRACTICES</b>   |   |                |
| None  |   |                |
| <b>Condition 1.3: Commitments and obligations of owner/operator organisations and regulatory body established</b>   |   | <b>Phase 2</b> |
| <b>Summary of the condition to be demonstrated</b>  | <p>Given that the main responsibilities by the end of phase 2 lie with the operator and the regulator, it is essential that the responsibilities of each are clearly defined and understood. It is also important that the role of any supporting organisation (e.g. a TSO) is clearly defined. If non-national organisations (e.g. vendor or other regulator) are expected to play a significant role, this should be clear in the contracting strategy. The safety and security responsibilities of each organisation should be clearly understood.</p>   |                |
| <b>Examples of how the condition may be demonstrated</b>  | <ol style="list-style-type: none"> <li>1. Roles and responsibilities clearly defined with respect to nuclear safety and security in the operating, regulatory and technical support organisations.</li> <li>2. Clarity of organisation that will be the authorised operator of the nuclear power plant and evidence of adequate resources to comply with license requirements. Clarity of role and responsibilities of the owner if different from the authorised operator.</li> <li>3. Where the vendor or some joint venture company is undertaking the role of authorised operator, clear principles on how and when ownership, knowledge and capability will be transferred to a national operating organisation.</li> <li>4. Clear description of any intended regulatory collaboration.</li> <li>5. Responsibility for formulating strategy for fuel cycle and waste management defined.</li> </ol> |                |

## Review observations

Laws No. 42 and 43 set out the roles and responsibilities of JAEC as the government organisation responsible for development of the nuclear power programme and JNRC/EMRC as the nuclear regulatory body responsible for nuclear safety, nuclear security and safeguards. A law merging JNRC into the recently established EMRC was approved.

As approved by the Cabinet, JNPC will be established to carry out the pre-investment activities, construct and operate the plant. The mission team was informed that JNPC will be established in the near future. The mission team was informed that the location of JNPC's offices had been identified in the King Hussein Business Centre, and some JAEC staff were transferred there. In the meantime, JAEC is performing the tasks of the future owner-operator. The mission team was informed that funding for these activities would be available from the Government's 2015 budget.

The JNPC (PIPh) would be expanded to include the Russian investment via a Shareholder Agreement (SHA) to be signed at the end of the pre-investment phase. The BIS for the strategic investor referenced support for operation, and it is envisioned that the strategic investor will provide Operation and Maintenance (O&M) support, consistent with the license requirements.

Regarding TSO support, it was noted by the IRRS mission that in the past, JAEC and JNRC have used the same consultants without requesting sufficient separation to avoid a conflict of interest. Currently, JAEC and EMRC are recruiting TSO support from different consultants. The INIR team was informed that JAEC would like to become a national TSO in the future, supporting both JNPC and EMRC with identified, dedicated and separated staff for each. The team found that all parties are aware of the importance of managing potential conflicts of interest in a TSO supporting both the regulatory body and the operating organisation. The IRRS mission made a suggestion to ensure this occurs in the future.

|                                 |                    |  |
|---------------------------------|--------------------|--|
| <b>Areas for further action</b> | <b>Significant</b> | Establishment of owner-operator organisation |
|                                 | <b>Minor</b>       | Independence of TSO support to JNPC and EMRC |

## RECOMMENDATIONS

**R-1.3.1 JAEC should establish the owner-operator organisation with clear assignment of responsibilities as a matter of urgency.**

## SUGGESTIONS

**S-1.3.1 Ensure avoidance of conflict of interest in TSOs supporting both regulatory body and owner-operator in the future.**

## GOOD PRACTICES

None

| <b>2. Nuclear Safety</b>   |   | <b>Phase 2</b> |
|--|---|----------------|
| <b>Condition 2.1: Safety responsibilities by all stakeholders recognised</b>   |   |                |
| <b>Summary of the condition to be demonstrated</b>   | <p>The government organisation responsible for the programme should have a broad understanding of fundamental safety requirements. The operator and regulatory body should understand the fundamental safety requirements and should have begun the task of understanding the safety basis of a NPP. They should also have agreed a protocol for communication between operator, regulatory body and vendor.</p> <p>Early in Phase 2, all senior positions in the operating organisation and regulatory body should have been filled and there should be evidence that the leadership of both the operating organisation and the regulatory body have initiated programmes and practices to build a safety culture in their respective organisations. By the end of Phase 2, the operating organisation, the regulatory body and external support organisations, as appropriate, should have the expertise to prepare for the conduct or the review of safety assessments of documentation to be supplied by the vendor.</p>  |                |
| <b>Examples of how the condition may be demonstrated</b>   | <ol style="list-style-type: none"> <li>1. Evidence that staff has acquired the necessary knowledge (required for Phase 2) in nuclear safety covering national and international standards, nuclear safety good practices, for example, as set out in IAEA Safety Standards. This should include: <ul style="list-style-type: none"> <li>○ Evidence that the categorization of safety importance of systems, structures and components and the implications for quality and safety assessment is understood.</li> <li>○ Evidence that the safety requirements to ensure criticality safety during handling of nuclear material are understood and that processes to ensure compliance with requirements will be in place before any nuclear material arrives on site.</li> </ul> </li> <li>2. Clear plans available to fill any knowledge gaps during phase 3.</li> <li>3. Protocol agreed for interactions between operator, regulator, vendor and technical support organisations.</li> <li>4. Process and responsibilities defined for review and understanding of information supplied by vendor during construction.</li> <li>5. Training programmes for regulators, operators and technical specialists defined including process for information exchange with design specialists.</li> <li>6. Reviews of international operating experience that is relevant to NPP designs being considered.</li> </ol> |                |
| <b>Review observations</b>   |   |                |
| <p>In June 2014 an IRRS Mission was conducted in Jordan. Therefore, to eliminate the duplication of effort, the INIR team used the draft IRRS Mission Report as supplementary information.</p> |   |                |

The IRRS mission could not find a standalone comprehensive national policy document outlining Jordan's commitment to the Fundamental Safety Principles as stated in the IAEA SF-1 and a strategy for its implementation, including a commitment to the provisions of human and financial resources, the scope of legal provisions, and the promotion of leadership and management for safety, including safety culture. This resulted in an IRRS recommendation that 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.

The INIR team found that JAEC and EMRC staff have received training in engineering and other technical areas. For example, training has been provided to the EMRC staff on deterministic and probabilistic safety analysis with the help of IAEA in order to develop competence to prepare for the conduct of the review of safety assessments. However, neither JNPC nor EMRC have in place a training and qualification programme which includes provisions to learn and understand the design of the proposed NPP that will be constructed in Jordan, but EMRC is currently developing a programme to address these areas. Such a training programme would help both organisations gain an understanding of the classification of systems, structures, and components for the NPP and prepare for the review of the PSAR. Both JAEC and EMRC realize that to develop competent and authorised staff would take at least 1-1/2 years and are in the process of developing the programmes that would need to be completed by the end of 2016 to support the license application process.

EMRC is planning to utilise services from TSOs in order to support its licensing activities. This does not relieve its responsibility for making decisions on nuclear safety issues and licensing. In order to be an intelligent customer for the services which are to be rendered by the TSO, EMRC needs to have adequate project management capabilities and technical competence on the safety assessments.

Regarding communication protocols, regular meetings are conducted between JAEC and EMRC. JAEC also holds frequent meetings with the vendor and includes EMRC when the meetings involve discussions on the licensing process. However, no formal communication protocol between these organisations, particularly for the management of licensing, has been established. The INIR team considers that protocols should be established for transmitting correspondence, conducting meetings and tracking action items.

Articles 111 and 112 of the draft Instruction on the Safety of Nuclear Power Plants requires operating organisations to give safety the highest priority and develop a safety policy which encourages a comprehensive safety culture, communication by management, and adherence by all staff. This safety policy and its implementation will be reviewed and approved by EMRC.

The INIR team learned that JAEC and EMRC have initiated a few activities to promote safety culture and may request further training from the IAEA. Safety culture is also addressed in EMRC's Quality Manual and the new law will contain a specific statement on safety culture. Notwithstanding, neither organisation has established a formal programme to promote safety culture and the INIR team considers that this will require urgent attention in JNPC as soon as it is established.

The INIR team found that some international operating experience has been considered by both JAEC and EMRC during the selection process for the nuclear technology, siting, and the regulatory review process. However, both organisations lack a comprehensive formal process to gather and evaluate relevant operating experience for applicability to Jordan's nuclear power programme. JNPC, once it is established, and EMRC should gather and evaluate operating experience from a wide variety of areas including NPPs with common technology, relevant international experience, and non-nuclear experience.

|                                 |                    |  |
|---------------------------------|--------------------|--|
| <b>Areas for further action</b> | <b>Significant</b> | Staff competence and authorization programmes for the license application process in JNPC and EMRC<br><br>Safety culture programmes for JNPC and EMRC<br><br>Operating experience programmes for JNPC and EMRC |
|                                 | <b>Minor</b>       | Communication protocols between JNPC, EMRC, and the vendor   |

## RECOMMENDATIONS

**R-2.1.1 JNPC (PIPh) and EMRC should, as a matter of urgency, develop and implement training and qualification programmes to ensure that staff and management are competent and authorised to prepare and review the license application, as appropriate.**

**R-2.1.2 JNPC (PIPh) and EMRC should develop formal safety culture programmes that are promoted by senior leadership. The programmes should include empowering staff to raise safety concerns to senior leadership.**

**R-2.1.3 JNPC and EMRC should develop formal programmes that gather and evaluate operating experience to improve the construction, operation, and oversight of the Jordan nuclear power programme.**

**R-2.1.4 JNPC (PIPh) EMRC should establish formal communication protocols between JNPC, EMRC and the vendor to ensure the effective management of information throughout the lifecycle of the project.**

## SUGGESTIONS

None

## GOOD PRACTICES

None

**Condition 2.2: Long term relationship with supplier established**

**Phase 2**

**Summary of the condition to be demonstrated**

Future role of the vendor in supporting safe operation should be defined by the owner/operator, for example any design authority role or support role in managing emergency situations. Training requirements from the vendor or other bodies should also be defined.

**Examples of how the condition may be demonstrated**

Statements in the Bid Invitation Specification (BIS) or contract specification document defining the required levels of support from the vendor and other organisations and mechanisms for information exchange, training, technical support, etc.

|  |                    |                                    |
|--|--------------------|------------------------------------|
| <b>Review observations</b>   |                    |                                    |
| JAEC is currently in the process of negotiating the EPC contract and the IGA and informed the INIR team that the future role of the vendor in supporting safe operation was under consideration to be included as appropriate. |                    |                                    |
| <b>Areas for further action</b>  | <b>Significant</b> | No                                 |
|  | <b>Minor</b>       | Long term relationship with vendor |
| <b>RECOMMENDATIONS</b>   |                    |                                    |
| <b>2.2.1 JNPC (PIPh) should develop a clear strategy for the long term vendor support requirements and ensure these are addressed in the EPC contract and IGA, as appropriate.</b>   |                    |                                    |
| <b>SUGGESTIONS</b>   |                    |                                    |
| None   |                    |                                    |
| <b>GOOD PRACTICES</b>  |                    |                                    |
| None   |                    |                                    |

|  |  |                |
|--|--|----------------|
| <b>3. Management</b>   |  | <b>Phase 2</b> |
| <b>Condition 3.1: Contract specifications and evaluation criteria determined</b>   |  |                |
| <b>Summary of the condition to be demonstrated</b>   | If competitive bidding for an NPP is being undertaken there should be a detailed BIS available with the criteria that will be used to evaluate the bids. If the vendor has already been selected (e.g. by an Inter -Governmental Agreement (IGA) the customer should have clear requirements included in the contract specification and negotiating strategy and criteria.   |                |
| <b>Examples of how the condition may be demonstrated</b>   | <ol style="list-style-type: none"> <li>1. Documented BIS or contract requirements available. Evidence that criteria include any state specific requirements, safety and security aspects, the complete fuel cycle requirements, as well as financial, legal, technical and commercial aspects.</li> <li>2. Clear description of how bids will be evaluated or the negotiating strategy defined by the NPP owner/operator.</li> </ol> |                |
| <b>Review observations</b>   |  |                |
| In January 2011, JAEC issued a BIS to three vendors. The BIS included bid evaluation criteria, scope of EPC contract, site and grid requirements, construction schedule, licensing arrangements, training and simulator requirements, operation and maintenance requirements, division of responsibilities, financial, commercial, and legal requirements. |  |                |
| A comprehensive technical and financial evaluation was carried out on the bids received, according to pre-   |  |                |

defined criteria and involving all key stakeholders in Jordan.

At the same time, JAEC also issued a bid to attract a strategic investor who would be responsible to operate the plant for an agreed time.

In August 2013, JAEC selected AtomStroyExport and Rusatom Overseas (RAOS) as the preferred Bidder (technology vendor, investor and operator).

JAEC has concluded a PDA with RAOS to cover all activities and responsibilities related to the pre-investment phase (PIPh), and is negotiating an IGA covering the principles of the project implementation, which will be ratified by the Jordanian Parliament.

During the PIPh, the EPC contract between JNPC and ASE will be negotiated. The technical specifications will be based on the BIS and Bid, and the work being carried out in the pre-investment phase. The PDA defines the work required by each party and includes the list of outstanding issues from the bid discussions.

The PIPh work is required to define a number of key parameters for the EPC contract. The INIR team was informed that there is a detailed plan to complete the activities required for the pre-investment phase. Additionally the INIR team was informed that the main work in 2014 is preparatory work so the limited funding available in 2014 should not have a significant impact on the plan.

|                                 |                    |  |
|---------------------------------|--------------------|--|
| <b>Areas for further action</b> | <b>Significant</b> | Site specific contract specifications and resolution of outstanding issues |
|                                 | <b>Minor</b>       | No   |

**RECOMMENDATIONS**

**R-3.1.1 JNPC (PIPh) should complete the pre-investment work (e.g. siting, EIA, and outstanding issues from the vendor bid) and incorporate the results into the work to finalise the EPC contract.**

**SUGGESTIONS**

None

**GP-3.1.1 JAEC agreed with the strategic partner and vendor the activities to be completed before a final investment decision is made.**

**Condition 3.2: Owner/ operator competence to carry out nuclear procurement evident**

**Phase 2**

**Summary of the condition to be demonstrated**

The owner procurement team needs to be competent to manage the procurement requirements for the type of contract. If this is not a turnkey contract (see item 19), a significantly greater level of competence will be required.

**Examples of how the condition**

1. Evidence of a suitably qualified and experienced procurement team with competence in:

|                            |  |
|----------------------------|--|
| <b>may be demonstrated</b> | <ol style="list-style-type: none"> <li>a. bid requesting and bid evaluation</li> <li>b. awarding, issue of purchase orders</li> <li>c. letter of credit</li> <li>d. quality programmes</li> <li>e. surveillance and follow up of items under manufacturing</li> <li>f. inspection, hold points and stopping work during manufacturing</li> <li>g. corrective actions to be taken when quality or schedule requirements are under risk</li> <li>h. manufacturing schedule and delivery time</li> <li>i. testing and reception</li> <li>j. non-conformance report and acceptance procedure established (accepted as is, refurbishment necessary, rejected)</li> <li>k. transportation and insurance</li> <li>l. taxes</li> <li>m. customs clearing.</li> </ol> <ol style="list-style-type: none"> <li>2. Evidence of consideration of the benefits of a procurement office sited close to the main supplier office to enhance training and learning for the procurement role in on-going operation.</li> <li>3. Plans to participate in appropriate 'owners group'.</li> </ol> |
|----------------------------|--|

**Review observations**

JNPC (PIPh) will be responsible for negotiating all commercial contracts with the Russian Party. The INIR team was informed that the EPC contract will be agreed between JNPC and ASE without direct involvement of expertise from RAOS in order to avoid a potential conflict of interest. The INIR team was also informed that the team from JAEC involved in the original bid evaluation will transfer to JNPC (PIPh). JAEC has experience with Jordanian IPP projects and other large-scale projects. JAEC is currently supplemented by hiring individual international consultants and JNPC intends to contract an owner's engineer.

Once the EPC contract is signed, JNPC will consider having a procurement office close to the vendor's office to train staff for longer term procurement of plant and services for operation.

|                                 |                    |  |
|---------------------------------|--------------------|--|
| <b>Areas for further action</b> | <b>Significant</b> | Strengthening of the procurement team. |
|                                 | <b>Minor</b>       | No                                     |

**RECOMMENDATIONS**

**R-3.2.1 JNPC (PIPh) should complete the planned strengthening of the procurement team, e.g., through the possible involvement of an owner's engineer, before detailed negotiations with the EPC contractor.**

**SUGGESTIONS**

None

**GOOD PRACTICES**

None

| <b>Condition 3.3: Project management organisation established with adequate staff to prepare for and analyse bids available</b>   |   | <b>Phase 2</b> |
|---|---|----------------|
| <b>Summary of the condition to be demonstrated</b>  | The owner/customer of the contract(s) needs a project management team to ensure the contract requirements are fully met. This will include verification of project progress and quality requirements. This may include the appointment of an owners engineer to support the owner organisation.   |                |
| <b>Examples of how the condition may be demonstrated</b>  | <ol style="list-style-type: none"> <li>1. Recognition of need to develop: <ol style="list-style-type: none"> <li>a. Project reporting mechanisms</li> <li>b. Acceptance procedures and criteria.</li> </ol> </li> <li>2. Plans to acquire/develop required commissioning skills.</li> <li>3. Interfaces with other organisations defined and agreed.</li> <li>4. Description of organisation including roles and responsibilities of departments and individuals with respect to bid assessment, supervision of construction, development of knowledge base, understanding of operating and maintenance requirements.</li> <li>5. Evidence that staff members are trained/qualified.</li> <li>6. Evidence that staff have appropriate skills and experience particularly in: <ol style="list-style-type: none"> <li>a. types of proven designs of NPP and potential suppliers</li> <li>b. main technical characteristics of potential plants</li> <li>c. nuclear and radiation safety</li> <li>d. nuclear security</li> <li>e. owner/operator technical and legal inputs (funding and financing, legal framework, site, regulations, licensing process, grid characteristics, etc.)</li> <li>f. contracting methodologies</li> <li>g. project management</li> <li>h. national and local participation capabilities and targets</li> <li>i. public information and communications.</li> </ol> </li> <li>7. Evidence that appropriate staff have visited operating plants similar to those being considered.</li> <li>8. Evidence that all the skills required to write bid specifications and evaluate submitted information are in place. This should cover technical, management and commercial issues.</li> </ol> |                |
| <p><b>Review observations</b></p> <p>Once the relevant shareholder agreements have been signed, RAOS will invest in JNPC.</p> <p>The INIR team was informed that JNPC will incorporate national engineers returning from their education/ training programs, staff from Russian organisations and staff from local power companies, and staff recruited from other international projects. It may also include staff sent by JAEC to Czech Republic to gain experience in safety analysis and licensing work. JAEC has developed an initial structure for JNPC and will discuss with RAOS the details of which partner will supply which staff into the JNPC. Once the contributions from both sides are clear, a staff recruitment and training strategy for the JNPC will be developed.</p> |   |                |

The capacity building necessary to implement and manage the licensing and construction of the NPP is recognised as a significant challenge given that JNPC (PIPh) is still being established and carrying out the pre-investment activities at the same time. The INIR team consider that a clear strategy for the development of JNPC should be developed by early 2015.

The INIR team was informed that the JNPC will also contract an owner's engineer. JAEC is discussing with RAOS the selection of the owner's engineer to support JNPC (PIPh).

|                                 |                    |   |
|---------------------------------|--------------------|---|
| <b>Areas for further action</b> | <b>Significant</b> | Strategy for development of the future owner-operator for licensing and construction management |
|                                 | <b>Minor</b>       | No  |

**RECOMMENDATIONS**

**R-3.3.1 JAEC should develop a clear strategy for the transition of JNPC (PIPh) to JNPC, including the necessary staffing and management systems, recognising that it will be a significantly different organisation.**

**SUGGESTIONS**

None

**GOOD PRACTICES**

None

**Condition 3.4: Management systems established**

**Phase 2**

**Summary of the condition to be demonstrated**

Management systems should be defined and procedures for Phase 3 in place or planned to be produced before they are required. The management systems should be consistent with IAEA safety standards and security guidelines documentation [see 'relevant IAEA documents below']. They should promote strong safety, safeguards and security culture and include plans for self and independent evaluation.

**Examples of how the condition may be demonstrated**

1. Availability of quality manual, definition of key processes and responsibilities.
2. Plans to produce required detailed documentation.

**Review observations**

The INIR team was informed that the first JAEC QA Manual was issued in 2011 and JAEC now has significant experience in its application. It is based on ASME NQA-1 principles and the IAEA GS-R-3 safety standards principles.

One of the initial activities for JNPC (PIPh), once formed, will be to develop its IMS for the pre-investment activities. Current activities are carried out under the JAEC QA manual.

This includes having the QA manual, JNPC corporate procedures and the QA program and procedure for

JNPC on-going projects (Siting & EIA, and Contractual Activities with RAOS "PIPh").

Another activity is to develop the IMS for JNPC in the post-investment phase using the Russian QMS as a starting point and adapting it as necessary. As part of preparation for that activity, JAEC QA staff have carried out preliminary work on mapping the management processes for the NPP. A significant issue is the need to understand the Russian language in order to review the Russian QMS. The INIR team was informed that there is an intention to send staff to Russia to review and understand the Russian QMS. The INIR team was further informed that the JNPC QMS/IMS will be revised to incorporate RAOS IMS, the QA program for JNPP and its working procedures, and will be established and ready to be used once signing the EPC contract. As the Russian and Jordanian IMS/QMS systems should be based on ASME NQA-1, IAEA GS-R-3 Safety standards and ISO 9001, JAEC staff expect that the gap analysis to merge the two systems should be straightforward.

JAEC explained that the language of the project would be English throughout, including licensing documentation and operating procedures. JAEC did not see language as a big issue for the project.

|                                 |                    |                             |
|---------------------------------|--------------------|-----------------------------|
| <b>Areas for further action</b> | <b>Significant</b> | Development of IMS for JNPC |
|                                 | <b>Minor</b>       | No                          |

**RECOMMENDATIONS**

**R-3.4.1 JNPC (PIPh) should develop (in conjunction with the Russian partner) the integrated management system for JNPC recognising the need to manage the activities related to licensing and construction.**

**SUGGESTIONS**

None

**GOOD PRACTICES**

None

|   |   |                |
|---|---|----------------|
| <b>4. Funding and Financing</b>   |   | <b>Phase 2</b> |
| <b>Condition 4.1: Means of financing established and strategy for management of financial risks available</b> |   |                |
| <b>Summary of the condition to be demonstrated</b>  | Available means of financing the NPP exists. Owner/operator financial team established to negotiate the levels of equity, expecting borrowing, potential investors and analysis of potential returns and any price guarantees. The financial risks are clearly identified and allocated to the party who can best manage and mitigate them. |                |
| <b>Examples of how the condition may be demonstrated</b>  | 1. Document identifying how the project will be financed and demonstrating financial viability of project including implications for electricity tariffs.   |                |

2. Risk management plan identifying all the key financial risks, their owner, likelihood, consequence, how they are being controlled and mitigated, including the nature of any guarantees. These need to cover the impact of a significant event on: prolonged shutdown, public liabilities, delays in construction, regulatory delays, government/public intervention.

*Note: There is likely to be constraints on how much of this specific information will be available. May need to consider the process that has been used to develop and underwrite the plan.*

## **Review observations**

In 2012, a Bankable Feasibility Study (BFS) for the ASE 92 VVER 1000 offer was prepared with the assistance of an international consulting firm. JAEC explained that the BFS requires further development to include Site Characterisation data, EIA data, Financing Plan/Funding Scheme data, updated Grid Study data, and Offsite Infrastructure data. JAEC's current view is that the projected price for electricity and the expected cost of financing will still result in a feasible project. The INIR team considers that this needs to be demonstrated in the updated feasibility study.

The current Cabinet approved plan is that the GoJ will retain 50.1% of JNPC, while a consortium led by RAOS will hold 49.9%. Both the GoJ and RAOS will seek to finance their part based on 30% equity and 70% debt. Depending on the outcome of the financing discussions alternative distributions of equity/debt and shareholding may need to be considered. The Government is committed to providing part of the equity for the project. In addition, the Government will guarantee a PPA for the Company but will not provide loan guarantees. Whilst Jordan's credit rating might be of concern to some investors, the INIR team was informed that several Independent Power Producer (IPP) schemes (non-nuclear), the largest being 600MWe, had been built based on PPAs backed by the Government. It was recognised that a NPP is more demanding in terms of up front capital cost.

JAEC, with the assistance of international consultants, and based on discussions with the strategic investor, has begun drafting a Financing Plan for the NPP to study the viability of the financing and explore potential sources of equity and debt as well as the required returns. Over the next 18 months, this will lead to a plan for identifying and implementing the optimal financing structure.

The financing plan is being developed in conjunction with the other pre-investment phase work, including the finalisation of the updated Bankable Feasibility Study (BFS), and as such it is difficult to secure financing until much of that work has been completed. The INIR team was informed that there is interest from national and regional organisations. The INIR team considers that the completion of the revised BFS, as well as the development of a comprehensive financing plan, are key to the success of the project.

The BFS conducted in 2012 includes a thorough Risk Management Plan for the project. The objective of this plan is to identify the various risks and appropriate mitigation measures. A full spectrum of risks affecting the project have been evaluated and analysed and appropriate mitigation measures have been identified for each of these risks. The risk plan is regularly updated to reflect the events that might have an effect on the progress on the project, along with the status of the risk mitigation measures that have been proposed to limit the impact of the risks. The updates are currently carried out by the JAEC team but as soon as JNPC (PIPh) is formed, it will carry out a major review of the Risk Management Plan and will seek endorsement and commitment to the plan from all the key organisations involved. If a steering committee is established to monitor the pre-investment phase, it could be the mechanism to endorse the plan.

|   |  |   |
|---|--|---|
| <b>Areas for further action</b>   | <b>Significant</b>   | Establishment of a comprehensive financing plan<br>Completion of the feasibility study<br>Review of the risk management plan with all key organisations |
|   | <b>Minor</b>   | No  |
| <b>RECOMMENDATIONS</b>  |  |   |
| <p><b>R-4.1.1 JNPC (PIPh) should develop a comprehensive financing plan, with options, contingencies and cost implications, to give confidence that the current financing strategy is feasible.</b></p> <p><b>R-4.1.2 JNPC (PIPh) should complete the feasibility study, including a range of assumptions on key parameters, such as the electricity tariff and the cost of borrowing.</b></p> <p><b>R-4.1.3 All involved organisations, at a senior level, should review the risk management plan for JNPP developed by JAEC to ensure their commitment to the plan.</b></p> |  |   |
| <b>SUGGESTIONS</b>  |  |   |
| None  |  |   |
| <b>GOOD PRACTICES</b>   |  |   |
| None  |  |   |
| <b>Condition 4.2: Funding plan available</b>  |  | <b>Phase 2</b>  |
| <b>Summary of the condition to be demonstrated</b>  | The means by which costs which are not obviously included in the project financing needs to be defined (depending on the contracting model, this may include owner, education, training, research, regulatory body, waste management, decommissioning).  |   |
| <b>Examples of how the condition may be demonstrated</b>  | <ol style="list-style-type: none"> <li>1. Proposed Means of funding the role of regulatory body established.</li> <li>2. Proposed Means for funding spent fuel, waste management and decommissioning established.</li> <li>3. Review of funding made available for phase 2 and confirmation of adequacy and any lessons learnt.</li> <li>4. Phase 3 funding plan matched to vendors plan including all national commitments for participation in construction, for operator costs, regulator costs, other stakeholders, emergency planning.</li> </ol> |   |
| <b>Review observations</b>  |  |   |
| <i>Infrastructure</i>   |  |   |
| Grid modifications and upgrades will be required to accommodate the NPP. Grid upgrade costs for a previous site were assessed by NEPCO and presented in the SER. The INIR team was informed that the  |  |   |

current site would have significantly lower costs and that funding for grid upgrades will be secured by NEPCO. NEPCO was confident that the funding for these enhancements would be available as it has a significant ongoing programme of grid enhancements that is funded by the government.

Upgrades of existing transportation roads from the port of Aqaba to the site, port upgrades, etc. have not been assessed in detail. Preliminary estimates for these costs are in the range of \$100 – 200 million USD. The INIR team was informed that funding of transportation-related upgrades will be provided by the respective Government institutions. There may be other infrastructure costs, including the cost of providing a water supply to the site, which still need to be estimated.

Overall, JAEC was confident that the funding for these enhancements would be available, given the strategic importance of securing energy supplies to Jordan.

### *Regulation*

For regulation of radiation sources, EMRC is mainly funded directly by license fees. In 2013, JNRC's budget was just over 2 million JD.

EMRC has developed an initial estimate of the costs of authorizing the JNPP, covering capacity building and external support, and plan to recover these costs through a license fee in the region of 2 million JD per unit per year. EMRC has also developed a draft plan for capacity building but has not yet determined the detailed costs of implementing it. EMRC intends to issue a new regulation on licensee fees, which will ensure its costs are covered by all licenses from applicants including the NPP licensee. The instruction is due to be approved at the end of the year. Prior to the approval of the fees regulations for nuclear facilities, additional funds have been requested from the Government for the EMRC to cover activities during 2014-2015.

### *Decommissioning*

The INIR team was informed that EMRC will issue an instruction requiring JNPC to set up a special fund at the time of the commissioning of the plant. Funds will be paid into it on an annual basis for 55 years. The instruction requires that JNPC review the provisions and the planned decommissioning costs every 5 years and also that the fund and planned costs are subject to independent audit.

### *Spent Fuel*

JAEC is in the process of finalising the spent fuel policy. The plan currently under consideration is to store spent fuel on site for 60 years (under the JNPC's responsibility) and then return it to the Russian Federation. This plan is subject to further negotiation in the pre-investment phase. This issue will be discussed and decided on at the Governmental Level (with the development of a specific IGA). Depending on the final spent fuel policy adopted, appropriate measures will be undertaken for the allocation of funds throughout the lifetime of the plant for the disposal of spent fuel/high level waste.

Low and intermediate level waste will be stored on site. The plan is for JAEC to become the Waste Management Organisation, responsible for disposal. Once the waste management policy has been defined, JAEC will consider what fees will need to be collected from JNPC to cover the waste management costs.

### *Other*

JAEC has estimated the budget required for the set up costs of JNPC (PIPh). JAEC expects the budget to

be allocated by the Cabinet in the near future now that the PDA has been approved.

There is no requirement for the nuclear infrastructure programme to fund specific enhancements to the education and training infrastructure, since the Ministry of Labour is considering enhancements to technician education and training to support all major projects in Jordan.

|                                 |                    |  |
|---------------------------------|--------------------|--|
| <b>Areas for further action</b> | <b>Significant</b> | Review of the costs of physical infrastructure upgrades<br>Regulatory body funding for capacity building<br>Instruction on decommissioning funds<br>Requirements and means for funding of waste disposal |
|                                 | <b>Minor</b>       | No   |

#### RECOMMENDATIONS

**R-4.2.1 All involved organisations should review the estimated costs of upgrading the off-site infrastructure for JNPP, and the Government should recognise the need for funding.**

**R-4.2.2 GoJ should ensure EMRC is adequately funded to perform its functions, including capacity building.**

**R-4.2.3 EMRC should finalise and issue the Instruction on the Fund for Decommissioning of Nuclear Facilities.**

**R-4.2.4 GoJ should establish the funding mechanisms for spent fuel and radioactive waste management, once the spent fuel and radioactive waste management policy has been approved.**

#### SUGGESTIONS

None

#### GOOD PRACTICES

None

### 5. Legislative Framework

#### Condition 5.1: International Legal Instruments governing nuclear activities in force

#### Phase 2

##### Summary of the condition to be demonstrated

The state should now have adhered to the following international legal instruments and should be following an action plan for their implementation:

- a) Convention on Early Notification of a Nuclear Accident
- b) Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency.
- c) Convention on Nuclear Safety
- d) Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste management

|  |   |
|--|---|
|  | <ul style="list-style-type: none"> <li>e) Convention of Physical Protection of Nuclear Materials and its Amendment</li> <li>f) Vienna Convention on Civil Liability for Nuclear Damage, Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage and Convention on Supplementary Compensation for Nuclear Damage</li> <li>g) Comprehensive Safeguards Agreement between the State and the IAEA</li> <li>h) Revised Supplementary Agreement concerning the provision of Technical Assistance by the IAEA</li> </ul> |
| <b>Examples of how the condition may be demonstrated</b> | Evidence that the State has adhered to the relevant international legal instruments and is implementing the obligations arising from them.  |

**Review observations**

Jordan is a party to the following international legal instruments adopted under the auspices of the IAEA:

- Convention on Early Notification of a Nuclear Accident (Ratification on 1987-12-1)
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Ratification on 1987-12-11)
- Convention on Nuclear Safety (Ratification on 1987-12-11)
- Convention on Physical Protection of Nuclear Material (CPPNM) (Accession on 2009-09-07)
- Amendment to the CPPNM (Acceptance on 2009-10-07)
- 1963 Vienna Convention on Civil Liability for Nuclear Damage and 1997 Protocol to Amend the Vienna Convention (Accession on 2014-01-27)
- Comprehensive Safeguards Agreement (EIF 1978-02-21) and Additional Protocol (EIF 1998-07-28) with the IAEA
- Revised Supplementary Agreement concerning the provision of Technical Assistance by the IAEA (Signature on 1989-02-05)

The INIR team was informed that Jordan is considering joining the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive waste Management (“Joint Convention”). A national inter-institutional committee led by EMRC (JAEC, Ministries of Foreign Affairs, Interior, Environment, Security and Health, etc.) was established in March 2014 to analyze the advantages and implications of joining this Convention and a recommendation is expected from the Committee by the end of the year. It was also explained that, under the national constitutional system, the adoption of this Convention by Jordan requires only approval by the Prime Minister and not the Parliament.

The INIR team noted that Jordan had recently joined the 1963 Vienna Convention and its 1997 Protocol. In this regard, the INIR team was informed that it is taking steps to consider the possibility of joining the Convention on Supplementary Compensation for Nuclear Damage, indicating that this would require Parliamentary approval.

In connection with the Comprehensive Safeguards Agreement (CSA), the INIR team was informed that

the national committee established by the Prime Minister to consider the issue of rescinding the Small Quantities Protocol (SQP) had already adopted a positive recommendation. This recommendation will be forwarded to the Cabinet in the near future in order to proceed with the relevant arrangements with the IAEA (i.e. Exchange of Letters) for rescinding the SQP. The INIR team was also informed that steps for the implementation of the resulting obligations from CSA were already underway, such as elaborating the draft initial report that would need to be submitted to the IAEA.

|                                 |                    |   |
|---------------------------------|--------------------|---|
| <b>Areas for further action</b> | <b>Significant</b> | No  |
|                                 | <b>Minor</b>       | <p>Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management</p> <p>Convention on Supplementary Compensation for Nuclear Damage</p> |

**RECOMMENDATIONS**

None

**SUGGESTIONS**

**S-5.1.1 Although Jordan is party the majority of relevant international legal instruments, it should continue to take steps to adhere to and implement the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, and consider joining the Convention on Supplementary Compensation for Nuclear Damage.**

**GOOD PRACTICES**

None

|   |                |
|---|----------------|
| <b>Condition 5.2: A comprehensive nuclear law is enacted and in force</b> | <b>Phase 2</b> |
|---|----------------|

|  |   |
|--|---|
| <b>Summary of the condition to be demonstrated</b> | <p>The state should have promulgated the national nuclear legislation including the following main elements:</p> <ul style="list-style-type: none"> <li>a) establishing an effectively independent regulatory body or bodies with clear functions</li> <li>b) identification of responsibilities for safety, emergency response, security and safeguards</li> <li>c) formulation of safety principles , policies and rules ( nuclear installations, radioactive waste and spent fuel management, decommissioning, mining and milling, emergency preparedness, transport of radioactive material)</li> <li>d) formulation of nuclear security principles</li> <li>e) giving appropriate legal authority to and definition of the responsibilities of all competent authorities establishing a regulatory control system (authorization, inspection and enforcement, review and assessment, and development of</li> </ul> |
|--|---|

|  |   |
|--|---|
|  | <p>regulations and guides)</p> <ul style="list-style-type: none"> <li>f) implementing IAEA safeguards</li> <li>g) implementing import and export controls of nuclear and radioactive material and items</li> <li>h) establishing compensation mechanisms for nuclear damage.</li> </ul> |
| <p><b>Examples of how the condition may be demonstrated</b></p>  | <p>Evidence that a comprehensive nuclear law is enacted and promulgated.</p>  |
| <p><b>Review observations</b></p> <p>The legislative framework governing the regulatory control of radiation and nuclear activities in Jordan continues to be mainly Law No 43 (2007) on Radiation Protection, and Nuclear Safety and Security.</p> <p>Law 43 was amended by Law 17 (31 March 2014), which restructures and merges State regulatory agencies in different fields, including the JNRC, which has been merged with other agencies into the “Energy and Minerals Regulatory Commission” (EMRC). Law 17 thus provides a new institutional framework for the regulatory body but Law 43 continues to apply to substantive requirements for nuclear safety, security and safeguards.</p> <p>Since 2009, the IAEA has provided legislative assistance to Jordan, at its request, in order to support Jordan in establishing a comprehensive legislative framework for nuclear activities that would supersede Law 43. The INIR team noted that, as referred to in previous INIR missions, Law 43 does not contain adequate provisions on all the basic elements of a nuclear law associated with a nuclear power programme, such as the delineation of responsibilities for safety, security and safeguards, licensing of nuclear facilities, fundamental principles of nuclear security, implementation of safeguards, import/export controls, spent fuel and radioactive waste management, and others. These matters will need to be addressed in the nuclear law that will supersede Law 43. In this regard, the INIR team noted that some regulations and instructions had been issued or were being drafted which covered elements of nuclear safety, security and safeguards (i.e. Regulation on the Safe Use of Nuclear Energy) which should be covered in the nuclear law rather than in regulations or instructions.</p> <p>Furthermore, the new institutional structure may raise issues about the independence of the regulatory body (the separation of regulatory functions from development or promotional functions. In particular, it was noted that under Law 17 the current EMRC is attached to the Ministry of Energy and Mineral Resources which has policy and development functions for energy sector in Jordan, while under Law 43 the former JNRC was attached to the Prime Minister. It was noted that this issue was also discussed during the IRRS mission conducted in June 2014. The INIR team stressed that the legislative framework should provide for the establishment of an effectively independent regulatory body and that potential conflicts of interest should be avoided.</p> <p>The latest draft “Law on Regulating of Energy and Minerals” was submitted to the IAEA for review in June 2014. The INIR Team informed that comments would be provided to Jordan by the end of August 2014 but conveyed some general preliminary remarks in this respect.</p> <p>In particular, it was noted that the scope of the draft law not only covers the regulation of radiation and nuclear matters but also concerns the regulation of the electricity, minerals and petroleum sectors. In this context, it was highlighted that radiation and nuclear activities justify a special legal regime, and it would be advisable to have a law dealing only with radiation and nuclear matters. Jordan explained that the reason for merging regulators of different sectors into a single institution and covering them in a single law was to improve administrative and financial efficiency and to reduce the number of organisations</p> |   |

|   |   |  |
|---|---|--|
| reporting to the Prime Minister's office.   |   |  |
| The INIR team considers that Jordan should revisit this approach and stressed the importance of addressing all relevant aspects in the new nuclear law in a comprehensive and coherent manner. The INIR team was informed that there was an action plan for the elaboration and adoption of the new law, expecting that the revised draft law would be submitted this year for Parliament approval.   |   |  |
| <b>Areas for further action</b>   | <b>Significant</b>  | Review and adoption of a comprehensive nuclear law |
|   | <b>Minor</b>  | No   |
| <b>RECOMMENDATIONS</b>  |   |  |
| <b>R-5.2.1 Jordan should urgently develop and enact a comprehensive nuclear law to adequately address the need for an effectively independent regulatory body, a clear delineation of roles and responsibilities, adequate provisions on nuclear safety, security, safeguards, and civil liability for nuclear damage, including inter alia, the licensing of nuclear facilities, import/export controls and spent fuel and radioactive waste management.</b> |   |  |
| <b>SUGGESTIONS</b>  |   |  |
| None  |   |  |
| <b>GOOD PRACTICES</b>   |   |  |
| None  |   |  |
| <b>Condition 5.3: All other legislation affected by the nuclear power programme developed, promulgated and in force</b>   |   | <b>Phase 2</b>                                     |
| <b>Summary of the condition to be demonstrated</b>  | Laws need to be enacted and/or amended to cover: <ul style="list-style-type: none"> <li>i. environmental protection</li> <li>ii. emergency management</li> <li>iii. occupational health and safety of workers</li> <li>iv. protection of intellectual property</li> <li>v. local land use controls</li> <li>vi. foreign Investment</li> <li>vii. taxation, fees, electricity tariffs, incentives (including long-term liabilities related to SF, radioactive waste and decommissioning)</li> <li>viii. roles of national government, local government,</li> <li>ix. stakeholders and public involvement</li> <li>x. international trade and customers</li> <li>xi. financial guarantees and any other required financial legislation</li> <li>xii. research and development.</li> </ul> |  |
| <b>Examples of how the condition may be demonstrated</b>  | Presentation of a review identifying relevant laws and evidence that they have been enacted or there is a clear plan to enact them at the appropriate time.   |  |

|  |                    |                            |
|--|--------------------|----------------------------|
| <b>Review observations</b>   |                    |                            |
| <p>The INIR team was informed that Jordan was in the process of identifying the laws that might affect the nuclear power programme and the stakeholders that will be consulted for the review. However, it was noted that the review process of these laws had yet to be pursued. It was suggested that the NEPIO or other competent government body could be tasked with coordinating this matter. In this context, Jordan also explained that the consistency of other laws with the current and the new nuclear laws was already being assessed as part of the legislative process.</p> |                    |                            |
| <b>Areas for further action</b>  | <b>Significant</b> | No                         |
|  | <b>Minor</b>       | Review of non-nuclear laws |
| <b>RECOMMENDATIONS</b>   |                    |                            |
| None   |                    |                            |
| <b>SUGGESTIONS</b>   |                    |                            |
| <b>S-5.3.1 Jordan should complete its review of the non-nuclear laws possibly affecting the nuclear power programme and follow-up the amendment process, as appropriate.</b>   |                    |                            |
| <b>GOOD PRACTICES</b>  |                    |                            |
| None   |                    |                            |

|  |  |                |
|--|--|----------------|
| <b>6. Safeguards</b>   |  | <b>Phase 2</b> |
| <b>Condition 6.1: Strengthening of the SSAC underway</b>   |  |                |
| <b>Summary of the condition to be demonstrated</b>   | An established and technically competent State System on Accounting for and Control of Nuclear Materials (SSAC) including designation of the organisation acting as the regulator, and definition of role, responsibilities and reporting methods.   |                |
| <b>Examples of how the condition may be demonstrated</b>   | <ol style="list-style-type: none"> <li>1. Description of the SSAC roles and responsibilities.</li> <li>2. Operation-relevant safeguards procedures being developed.</li> <li>3. Plans to maintain the technical competence and provision of necessary resources to the SSAC to match the development of the nuclear power programme.</li> <li>4. Evidence through information exchange with the IAEA that the SSAC has a good understanding of the principles of safeguarding a NPP including the type of equipment the IAEA may install in the facility.</li> </ol> |                |
| <p>Jordan has an established State System of Accounting and Control (SSAC) consisting of EMRC, which acts as the State Authority responsible for safeguards implementation and JAEC, which controls and accounts for nuclear materials that are part of the Commission's projects subject to comprehensive safeguards, and other Locations Outside Facilities. The INIR team considers that there are several factors, however, which may hinder the effectiveness of the SSAC as it assumes new responsibilities with the</p> |  |                |

nuclear power program. The first factor is that the rights and responsibilities of the State Authority and provisions for export and import of nuclear material are not explicitly defined by Law 43, but only in regulations. [See Issue 5- Legislative Framework]. The second factor that may affect the performance of the SSAC is the lack of clear delineation of responsibilities and procedures for implementing safeguards at JNPP. The INIR mission team was informed that JNPC, as the license holder, will assume safeguards responsibilities for JNPP and will be responsible for providing information and access for IAEA verification early in the construction phase.

Regulatory requirements for control and accounting of nuclear materials are set forth in the regulation on the Safe Use of Nuclear Energy. These requirements cover, at a high level, the provision of information and access to the IAEA under Jordan’s Comprehensive Safeguards Agreement and Additional Protocol. The INIR team was informed that two instructions are under review now which will provide further detail on provision of information and requirements of the SSAC. These instructions were sent to the EMRC Board of Commissioners for approval. The approval of the two instructions is expected by the end of 2014. These instructions were not reviewed by the INIR team but Jordan indicated that it may ask for an IAEA review prior to finalization. Such a review would allow the IAEA to provide feedback on the completeness of the regulatory framework for safeguards, as laid forth by the regulation and instructions.

With respect to human resource development and staff training, the INIR team was informed that both JAEC and EMRC are training new staff on safeguards in readiness for the commissioning of JRTR. Safeguards implementation at JRTR will provide valuable experience in advance of commissioning of JNPP. The INIR team was also informed that both organizations recognize the need for further staff development to meet the demands of safeguards implementation at both JRTR and JNPP and are planning accordingly.

|                                 |                    |                                   |
|---------------------------------|--------------------|-----------------------------------|
| <b>Areas for further action</b> | <b>Significant</b> | No                                |
|                                 | <b>Minor</b>       | Safeguards implementation at JNPP |

**RECOMMENDATIONS**

**R-6.1.1. EMRC should finalize its instructions for the implementation of safeguards so that JNPC (PIPh) can develop a plan to meet its requirements.**

**SUGGESTIONS**

**None**

**GOOD PRACTICES**

**None**

|  |                |
|--|----------------|
| <b>Condition 6.2: Early safeguards relevant information provided to IAEA planned</b> | <b>Phase 2</b> |
|--|----------------|

|  |   |
|--|---|
| <b>Summary of the condition to be demonstrated</b> | The contract specification should require early information on design to be given to IAEA for ability to suggest any design changes for safeguards reasons. |
|--|---|

|                                      |  |
|--------------------------------------|--|
| <b>Examples of how the condition</b> | 1. Information on technology and list of designs being included in the BIS |
|--------------------------------------|--|

|  |   |    |
|--|---|----|
| <b>may be demonstrated</b>   | <p>or contract specifications, provided to IAEA. If a design has already been chosen, design information submitted to IAEA with any specific national variations.</p> <p>2. Additional Protocol declaration provides updates on plans for reactor under the 10-year plan.</p> |    |
| <b>Review observations</b>   |   |    |
| <p>Plans for JNPP have been provided to the IAEA via Jordan's Additional Protocol declaration (2.a.x). Jordan may wish to specify the specific design and reference plant, so that the IAEA can inform Jordan of the anticipated equipment needs for safeguards equipment at JNPP. These specifications could be relayed to the vendor as design specifications are developed.</p> |   |    |
| <b>Areas for further action</b>  | <b>Significant</b>  | No |
|  | <b>Minor</b>  | No |
| <b>RECOMMENDATIONS</b>   |   |    |
| None   |   |    |
| <b>SUGGESTIONS</b>   |   |    |
| None   |   |    |
| <b>GOOD PRACTICES</b>  |   |    |
| None   |   |    |

|   |  |                |
|---|--|----------------|
| <b>7. Regulatory Framework</b>  |  | <b>Phase 2</b> |
| <b>Condition 7.1: Independent nuclear regulatory body established and the necessary regulatory infrastructure developed</b> |  |                |
| <b>Summary of the condition to be demonstrated</b>  | <p>The Regulatory Framework should address all the relevant of aspects for safety, security and safeguards related to the proposed nuclear programme. The framework will ultimately need to cover all the phases of the programme (siting, design, construction, commissioning, operation, decommissioning, spent fuel and waste management, and transport) but at this stage, some aspects may be covered by future work plans.</p> <p>The regulatory body should have the legal authority, technical competence and resources to fulfil the statutory obligations, ready to licence and inspect the construction of the NPP against a clearly defined set of regulations and licensing framework. Its regulatory decisions should be free from undue political and economic influence.</p> |                |
| <b>Examples of how the condition may be demonstrated</b>  | <p>1. Effective independent and Competent Regulatory body (ies) established and the necessary infrastructure (e.g. regulations) developed. The following may be considered:</p>  |                |

|  |   |
|--|---|
|  | <ul style="list-style-type: none"> <li>a) aspects of effective independence include political, legislative, technical and managerial competence, and human and financial resources, communications with public and ability to liaise with international community</li> <li>b) capability requirements and training plans including evidence of leadership capabilities</li> <li>c) documented formal managements system including roles, responsibilities and organisational structure, record keeping</li> <li>d) defined requirements for nuclear safety and security as well as the process for licensing and inspections: <ul style="list-style-type: none"> <li>i. For nuclear safety, such requirements should include Regulatory criteria for acceptance and approval of design, and licensing process</li> <li>ii. For nuclear security, such requirements should include those for nuclear security measures applied by the operator, procedure for protection of sensitive information and trustworthiness checks of personal</li> </ul> </li> <li>e) Technical Support Organisations (TSO) and advisory experts available to support the regulatory function</li> <li>f) interface with operating organisations, other regulatory bodies, transport organisations and international forums.</li> </ul> <p>2. For nuclear safety a report evaluating the regulatory framework against the actions described in SSG-16, would address these conditions.</p> <p><i>Note; If an IAEA Integrated Regulatory Review Service (tailored for embarking countries mission had been conducted, the results of this mission would be used as evidence of the issue. However, subsequent work on any identified recommendations would be noted, but not reviewed in details as that would occur during an IRRS follow-up mission.</i></p> |
|--|---|

**Review observations**

In June 2014 an IRRS Mission was conducted in Jordan. The tailored module for countries embarking on nuclear power was included in the scope of the IRRS, specifically for countries in Phase 2 of the Milestones Approach – Safety infrastructure preparatory work for construction of a nuclear power plant (NPP) after a policy decision has been taken. To eliminate the duplication of effort, the INIR team used the draft IRRS Mission Report as supplementary information.

*Legal Authority and Independence*

The Government of Jordan has recently made significant changes to the former radiation and nuclear regulator (JNRC) by merging it into EMRC and is preparing a new energy and minerals law that will, inter alia, cover the regulation of radiation and nuclear safety. While the IRRS team found the new regulatory structure to be novel and requiring further definition to ensure technically sound and independent regulatory decision-making, its formation and the development of the new law offers the opportunity to strengthen the role of the regulatory body and establish an improved regulatory framework.

The INIR team was informed that the Minster for Energy and Mineral Resources (MEMR) had no role in regulatory decision-making and that the reporting line was only to improve administrative efficiency. It was also pointed out in the IRRS report that MEMR did not own or operate projects in the energy sector and that promotion of nuclear energy was the role of JAEC. While accepting these assurances, the IRRS team was of the view that the issue of the potential for undue influence that might compromise safety

needs to be clarified further. As Jordan proceeds with the development of nuclear energy, this issue is likely to rise in significance in the international perspective of the Jordan nuclear programme. The IRRS report also recommended that 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 judgments and decisions have sound technical basis and are free from undue influences on its regulatory decision-making. Regulatory independence is also addressed in Issue 5-Legislative Framework.

#### *Management Systems*

Regarding the implementation of management systems, the IRRS report determined that EMRC recently developed an integrated management system, which is documented in the Quality Management System Manual. The IRRS report recommended that 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.

#### *Requirements and Licensing*

Law 43/ 2007 includes the list of regulations to be developed in order to support the execution of the law. The “Regulation on the Safe Use of Nuclear Energy,” issued in April 2014, provides a framework for the oversight of nuclear safety, security, emergency and safeguards. Based on this regulation, EMRC drafted a number of instructions, including “Instruction on the Safety of Nuclear Power Plants”, and “Instruction on the Procedure for Issuing Licenses and Permits for Nuclear Facilities and Associated Activities,” in order to setup the practical and technical requirements for the implementation of the licensing and inspection activities covering safety, safeguards and security for the nuclear power programme. The INIR team was informed that JAEC will send an official request to EMRC to review and comment on the licensing instruction in order to ensure that considered options for the owner/operator organisational structures and licensing approaches are applicable and licensable without any compromise to the safety. The INIR team was informed that EMRC is also developing new draft regulations related to radiation protection, uranium mining, and other relevant issues. EMRC is planning to issue these instructions by the end of 2014. JAEC and EMRC are currently utilising the draft instructions for the nuclear power programme. The INIR team was informed that no major modifications will be made to them during the issuing process, as agreed between JAEC and EMRC, to reduce any potential risk in the future at the implementation stage of the project. The INIR team notes that utilising the draft documents during the early stages of the project could potentially create issues and problems during the implementation of the project. The IRRS report recommended that the Government should, working with EMRC and as a matter of urgency, complete the new law, 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.

#### *Technical Competence*

EMRC has identified the need for an additional 25 staff and associated competence requirements and training plans to fulfil its responsibilities. The IRRS report recommended that EMRC should develop, as a matter of urgency, a human resource development plan to support its nuclear and radiological regulatory decision-making and establish its internal systematic training programme for current and new inspectors and assessors.

#### *Technical Support Organisations*

Jordan plans to utilise a variety of external support organisations and contractors to support the nuclear power programme, for both the operating organisation and EMRC. Though no formal plans have been established yet, EMRC plans to use an external TSO to provide support for licensing activities associated

with the NPP. The IRRS report noted that in past activities, EMRC utilised the same contractors as JAEC. While these examples did not pose an actual conflict of interest, it is important to take measures to address conflicts of interest, whether it is actual or perceived. The IRRS report suggested that EMRC should develop arrangements to address actual, potential, or perceived conflicts of interests. The IRRS report also suggested that 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.

*Interface with Operating Organisation*

JAEC (and ultimately JNPC) is considering different owner/operator organisational structures. The final structure may include contracting the operations of the NPP to an external organisation, including potentially a foreign contractor. The INIR team noted that, since all of the laws, regulations and instructions have not been approved, the potential exists for an organisational structure to be proposed that cannot be licensed in accordance within the final legal and regulatory framework. Therefore, JAEC (and ultimately JNPC) and EMRC should communicate early regarding the arrangement of the operating license for the NPP and the proposed licensing approach and requirements mentioned in the draft instruction on the licensing of the NPP.

*Action Plan*

EMRC has developed an action plan to address the recommendations and suggestions that resulted from the IRRS mission. The plan will be a living document that will also incorporate recommendations and suggestions from the INIR mission and other items identified by both EMRC and international organisations that must be addressed to complete various stages of the project. The action plan is currently under review by the Commission. The EMRC Commissioner for Nuclear Safety has the overall responsibility for ensuring the implementation of the action plan. EMRC has already begun addressing some of the short term/high priority action items including the adoption of regulations and instructions.

The INIR team has identified areas for further action associated with this condition. All but one, are covered by IRRS recommendations as noted above. As a result, the INIR team has not duplicated them in this report.

|                                 |                    |  |
|---------------------------------|--------------------|--|
| <b>Areas for further action</b> | <b>Significant</b> | Regulatory independence<br>Technical competence<br>Management systems<br>Regulations and instructions<br>Interface with operating organisation |
|                                 | <b>Minor</b>       | Conflict of interest for TSO   |

**RECOMMENDATIONS**

**R-7.1.1 JNPC (PIPh) should discuss with EMRC the proposed owner/operator organisation early in the process to ensure that it can be licensed in accordance with the applicable laws, regulations and instructions.**

**SUGGESTIONS**

**None**

|                       |
|-----------------------|
| <b>GOOD PRACTICES</b> |
| None                  |

|   |  |                |
|---|--|----------------|
| <b>8. Radiation Protection</b>  |  | <b>Phase 2</b> |
| <b>Condition 8.1: Actions to prepare adequate radiation protection programs undertaken, and expansion of appropriate infrastructures planned</b>  |  |                |
| <b>Summary of the condition to be demonstrated</b>  | Plans need to be in place to develop programmes to control and monitor exposure of individuals on-site before any radioactive material arrives on the site. They should include staff training, procurement of equipment and services, design requirements. They need to be able to cope with the increased requirements during construction and commissioning.  |                |
| <b>Examples of how the condition may be demonstrated</b>  | <ol style="list-style-type: none"> <li>1. Clear plans to implement radiation monitoring and protection programmes for occupational exposure of workers and the public on-site, before any radioactive material arrives on site.</li> <li>2. The appropriate equipment and systems for radiation monitoring are included in the BIS or contract specifications.</li> <li>3. The owner/operator plan for radiation protection has been submitted to the regulator for review.</li> </ol> |                |
| <b>Review observations</b>  |  |                |
| <p>EMRC has drafted a new Radiation Protection Regulation according with IAEA GSR-Part3. This regulation will follow a process of review (translation, stakeholder’s comments, etc.) and will be approved by the Board of Commissioners of EMRC and, finally, by the Cabinet.</p> <p>EMRC has also drafted a Code of Practice for Occupational Exposure Control-External Exposure, which will be approved and issued as an Instruction (Note: Instructions are approved and issued by the Board of Commissioners of EMRC).</p> <p>JAEC is developing a Radiation Protection Programme that considers both radiation and nuclear activities. It includes monitoring programmes for occupational personnel, workplace, and environmental.</p> <p>JAEC personnel monitoring capabilities are limited to external dosimetry. Workplace monitoring capabilities are limited to the monitoring inside radiation facilities.</p> <p>JNPC and in coordination and cooperation with JAEC, will perform an assessment of gaps in the monitoring programmes to be prepared to monitor and control any radioactive material before it arrives to the Amra site.</p> <p>The INIR team was informed that the BIS requested that the bidder provide a description of the proposed RP measures and a justification of how the radiation doses will be maintained below the IAEA’s prescribed limits.</p> <p>The INIR team was also informed that training for the NPP personnel is foreseen through the EPC contract.</p> |  |                |

|   |                    |   |
|---|--------------------|---|
| <b>Areas for further action</b>   | <b>Significant</b> | Radiation protection regulation and its associated instructions |
|   | <b>Minor</b>       | No  |
| <b>RECOMMENDATIONS</b>  |                    |   |
| <p><b>R-8.1.1 EMRC should urgently finalise the radiation protection regulation and its associated instructions to be consistent with the requirements of GSR Part 3.</b></p> <p><b>R-8.1.2 EMRC should include “Internal Exposure” in the drafted code of practice for occupational exposure control or develop a new one for internal exposure.</b></p> |                    |   |
| <b>SUGGESTIONS</b>  |                    |   |
| None  |                    |   |
| <b>GOOD PRACTICES</b>   |                    |   |
| None  |                    |   |

|   |   |                |
|---|---|----------------|
| <b>9. Electrical Grid</b>   |   | <b>Phase 2</b> |
| <b>Condition 9.1: Detailed studies to determine grid expansion, upgrade or improvement undertaken</b> |   |                |
| <b>Summary of the condition to be demonstrated</b>  | <p>An analysis of the grid system should have been completed to identify any enhancements needed to:</p> <ul style="list-style-type: none"> <li>• cope with the enhanced generating capacity</li> <li>• achieve grid stability and reliability requirements to allow safe operation (ability to reliably take the load and provide supplies to safety equipment).</li> </ul> <p>The performance characteristics of the planned NPP have been agreed with the transmission system operator and they are compatible with the capability of NPP designs being considered.</p>  |                |
| <b>Examples of how the condition may be demonstrated</b>  | <p>Plans to address the grid requirements associated with the inclusion of the NPP. The plans should include:</p> <ol style="list-style-type: none"> <li>a) enhancement and/or expansion compatible with the increased generating capacity</li> <li>b) achieving the overall grid stability and reliability requirements for safe operation</li> <li>c) justification of the reliability/capacity of the ‘off-site power’ for the NPP; multiple grid connections to the NPP site, including provisions for their robustness, diversity, physical security and cyber security</li> <li>d) grid characteristics and reliability requirements included in the BIS or contract specifications.</li> </ol> |                |
| <b>Review observations</b>  |   |                |

Jordan's grid is part of an interconnected fully synchronised regional grid system. The necessary legal/commercial agreements and operating procedures are in place and cover the required response to control system frequency in case of any emergency situation (reserve sharing). Egypt (the largest grid) operates as the primary system controller for the interconnected system. Some relevant characteristics of the interconnected grid are:

| <b>Country</b> | <b>Peak Load [GWe]</b> | <b>Technical Limit of Interconnected Capacity [MWe]</b> |
|----------------|------------------------|---|
| Egypt          | 22.8                   | 450   |
| Syria          | 8.2                    | 350   |
| West Bank      | 1                      | 500 (Future)  |

In addition, the Egyptian grid is connected to Libya and the Syrian grid to Turkey. The latter is not included in the current studies as it is not a fully integrated grid and does not affect the technical study. The current required reserve in Jordan based on the interconnection agreement is only 40MWe, and, before the crisis, the system reserve came primarily from Egypt (400MWe) and also from Syria (150MWe); at present they have very little reserve capacity. The operation of the integrated system has been affected by the recent crises and this will clearly need to be considered in the future studies.

Currently, countries do not pay for reserve capacity located outside of the national grid but it is recognised that this may need to be considered in the future if the required reserve exceeds the agreed in the interconnection agreements.

The INIR team was informed that the minimum load is about 45% of the peak load and NEPCO had requested that the requirements for the NPP should include an ability to operate at 60%. There was some discussion as to whether this had been specified as a regular requirement or only in unlikely low load or emergency conditions.

The INIR team was also informed that there are additional opportunities to strengthen the interconnected system. For example, connections to the northern part of Saudi Arabia (which currently has an independent grid of 3000MWe) are under consideration, although this would have to be a DC link as Saudi Arabia has a 60Hz frequency. In addition, 2 more single cables could be added between Jordan and Egypt, which would give the capability of doubling the size of the current AC connection. These considerations are not purely for the NPP project but are part of Jordan's more general considerations of how to strengthen the grid system.

In 2010, a comprehensive Grid Study was carried out by the NEPCO (Grid System Operator and Transmission Network Owner) in cooperation with an international firm in order to assess the capability of the Jordanian electrical system to integrate an NPP unit with capacity of 1000 MWe. The technical requirements of the grid for the NPP design were studied primarily for a 1000 MWe NPP at the Aqaba site, but additionally, one of the situations covered was the installation of 2 x 1000 MWe units at the current site. The study identified the necessary changes to the grid including consideration of interconnections with neighbouring countries. The study was based on a system peak load (year 2020) of

5011 MWe and considered various import and export scenarios.

NEPCO recognises that the inclusion of 2 x 1000 MWe units is a major challenge for the grid system. There are also plans to implement some renewable projects, mainly solar, which will make the management of the system more difficult. The main recommendation of the first study was to conduct a detailed operational study after selection of the final site and the NPP technology considering the following tasks:

- The analysis of main grid connection and the auxiliary power supply for the safe start-up, shutdown, and operation;
- The analysis for the primary, secondary and tertiary reserves;
- The analysis for the load following;
- Load flow, stability and short circuit analysis;
- The analysis for frequency response capability;
- Communication systems and operation procedures; and,
- The environmental impact analysis for main grid connection and the secondary connection.

An IAEA expert mission was conducted in September 2013, during which the Grid Study was reviewed, and the detailed operational study for the preferred Amra site was discussed. A number of recommendations were made related to the work to be done and the INIR team was informed that they have been addressed in the scope of the detailed operational study. JAEC has developed a ToR for this detailed study, which was reviewed by the preferred vendor. Once JNPC (PIPh) is established, the study will be implemented by NEPCO. The cost is expected to be around 2M USD and the budget is available. The study will provide the detailed information required to analyse options for ensuring the grid can accommodate the proposed NPP and will make some recommendations on the actions that need to be taken. The study will also include a market survey.

|                                 |                    |                       |
|---------------------------------|--------------------|-----------------------|
| <b>Areas for further action</b> | <b>Significant</b> | Detailed grid studies |
|                                 | <b>Minor</b>       | No                    |

**RECOMMENDATIONS**

**R-9.1.1 NEPCO should complete the planned detailed study of the implications of incorporating two units of 1000MW into the Amra site in order to identify the enhancements required to the Jordan grid, its interconnection to the regional grid and the operational agreements for the interconnected system.**

**SUGGESTIONS**

**None**

**GOOD PRACTICES**

**None**

| Condition 9.2: Plans, funding and schedule for grid enhancement available   |   | Phase 2 |
|---|---|---------|
| <b>Summary of the condition to be demonstrated</b>  | The plans for and funding of the identified enhancements should be available and the enhancement programme should be consistent with NPP construction programme.  |         |
| <b>Examples of how the condition may be demonstrated</b>  | <ol style="list-style-type: none"> <li>1. Evidence that funding and schedules for grid enhancements, compatible with the foreseen construction, testing and commissioning have been approved and that delivery times of towers, lines and components, substations and switch yards are consistent with the construction schedule.</li> <li>2. If the grid system will be interconnected to other countries, plans for appropriate legal and commercial agreements and operating procedures in place for proper control of system frequency after a NPP trip and for grid emergency situations.</li> <li>3. If the required performance of the future grid is a significant improvement over the current performance, firm and realistic plans exist to ensure this performance will be achieved in time for the NPP commissioning.</li> </ol> |         |
| <b>Review observations</b>  |   |         |
| <p>NEPCO is responsible for the grid upgrade and the costs of the required enhancements to accommodate the NPP are considered in NEPCO's investment plan.</p> <p>NEPCO is part of the NPP implementation team to ensure that all connection requirements are consistent with the NPP construction schedule.</p> <p>The operational study will allow the detailed costs of upgrading the grid system to be estimated. Based on the previous study, NEPCO expects the cost to be around 200M USD and sees no difficulties in funding the enhancements identified.</p> |   |         |
| <b>Areas for further action</b>   | <b>Significant</b>  | No      |
|   | <b>Minor</b>  | No      |
| <b>RECOMMENDATIONS</b>  |   |         |
| None  |   |         |
| <b>SUGGESTIONS</b>  |   |         |
| None  |   |         |
| <b>GOOD PRACTICES</b>   |   |         |
| None  |   |         |

|   |   |                |
|---|---|----------------|
| <b>10. Human Resources</b>  |   | <b>Phase 2</b> |
| <b>Condition 10.1: Knowledge and skills needed in organisations for Phase 3 and operational phase are identified and a plan to develop and maintain the human resource is developed</b> |   |                |
| <b>Summary of the condition to be demonstrated</b>  | All relevant organisations should have identified an organisational structure and the staff requirements for Phase 3 and the operational phase. The intended senior staff should be in place or identified. A gap analysis should have been completed and recruitment and training plans developed. The plans of the different organisations (including research organisations and TSO's) should be considered in an integrated way so as to optimise the development programme. The programme should cover education, training and experience requirements and should also include consideration of bilateral and international training activities.   |                |
| <b>Examples of how the condition may be demonstrated</b>  | <ol style="list-style-type: none"> <li>1. Evidence that senior executives have had appropriate training in managing a nuclear programme.</li> <li>2. An analysis of the competences needed for Phase 3 and the initial operational phase, in all relevant organisations. The analysis should: <ol style="list-style-type: none"> <li>a) include contributions from each of the organisations</li> <li>b) reflect realistic expectations regarding the owner's scope of supply and that of other organisations</li> <li>c) ensure an appropriate balance of skills between operating organisation, regulator and specialist organisations with adequate training in each</li> <li>d) address the needs of support organisations (e.g. for maintenance, refurbishment, replacement) including appropriate training programmes.</li> </ol> </li> <li>3. Recruitment, training and development programmes covering: <ol style="list-style-type: none"> <li>a) technical requirements (including nuclear specific technical capabilities)</li> <li>b) business requirements (e.g legal, finance)</li> <li>c) public relations requirements</li> <li>d) fuel procurement</li> <li>e) construction management and commissioning</li> <li>f) operation and maintenance</li> <li>g) spent fuel and waste management.</li> </ol> </li> <li>4. Requirements for changes to national education infrastructure (at secondary and tertiary level).</li> <li>5. Evidence that key stakeholder organisations have participated in the development and review of the above plan.</li> <li>6. The BIS or contract specifications address what is required from the supplier with respect to the training and development of resources to carry out the owner and support responsibilities during commissioning, and initial plant operations and the provision of simulator training requirements as well as the training of national Trainers to ensure long-term sustainability.</li> </ol> |                |

These should include:

1. Consideration of a long term strategy to ensure sustainable capable resource for each organisation including consideration of a remuneration structure that will ensure that all organisations are adequately staffed.
2. Evaluation of the need for training abroad at operating plant similar to those being considered. Any necessary language training started or planned.
3. Programmes in place for involvement of future operation and maintenance personnel with the construction and commissioning groups.
4. Licensing requirements, in order to remove the risk of start up delays due to lack of licensed personnel.

## **Review observations**

### ***Operating Organisation***

Jordan is in the process of creating an operating organisation, JNPC, which will initially manage the pre-investment activities identified in the PDA. Although an initial organisational structure has been developed, the company has not yet been established and the senior staff have yet to be appointed, or even identified. It is expected that a number of the key staff for JNPC (PIPh) will be transferred from JAEC. Plans for initial resources and competence requirements are focused on the PDA activities and it is planned that only Jordanian staff will be recruited initially. However, once the investment decision is made, Rusatom Overseas will make its investment and become a 49.9% shareholder in JNPC. At the same time the EPC contract will be signed, and JNPC must quickly transition into the Project Company, with a much larger and more complex structure needed for an operating organisation. The organisational structure, resources, competences and culture will need to be adapted accordingly. The INIR team was informed that a number of Russian and expatriate staff will be recruited as soon as the investment decision is made, but the details of the arrangements for JNPC post-investment have yet to be agreed. Given the limited time for this transition, the INIR team considers that planning for this transition, including discussions with RAOS, should commence as soon as JNPC is established.

### ***Regulatory Body***

The regulatory body has recently been merged into a larger body, the EMRC. The INIR team was informed that EMRC faces specific challenges on recruiting and retaining suitably qualified and trained staff due to limited funding and inadequate salary levels. A recent (June 2014) IRRS mission has made a number of recommendations concerning EMRC, including a specific recommendation to urgently develop plans to improve HRD for its staff. The INIR team noted that the IRRS mission focuses on safety aspects and that similar issues exist for the regulation of Security and Safeguards. EMRC has already begun to implement actions to respond to these challenges and these actions will be included in the national plan. Since these issues are largely addressed in the IRRS report and recommendations, no additional recommendations are made in this report.

### ***Other Organisations***

Within the directives of Law 42, JAEC retains responsibility for a number of key areas, including: development of national policy, management of various nuclear projects, developing research facilities, control and accounting of all nuclear materials and management and disposal of spent fuel and radioactive waste. The INIR team was informed that JAEC intends to replace any staff that might be transferred to JNPC. If the role of JAEC is changed, a new organisation structure will be established with a new HRD

plan.

The INIR team was also informed that a number of other organisations need training for their roles in support of the nuclear programme. For example, JAF, Civil Defence and Ministry of the Interior need training for their roles in EPR and Nuclear Security. All of these needs should be reflected in the national HRD plan.

***National HRD analysis and plan***

A gap analysis has yet to be conducted for national HR needs. A national HRD committee, based on a previously existing ‘mega-projects’ HR steering committee but with wider membership, has recently been established to undertake this work. This committee will build on the work that was undertaken as part of the mega-projects needs analysis conducted in 2010, but it has yet to meet and has not set a clear plan or timeline for the work to be done.

Jordan has a draft national HRD plan for the nuclear programme. It has recently been updated to include more detail on the staffing requirements for the first NPP. It currently focuses mainly on EMRC and the operating organisation requirements. The INIR team considers that inclusion of other organisations related to the nuclear power programme would strengthen the plan. Other organisations include national TSOs, the waste management organisation, key education and training institutions, and organisations, such as those responsible for security and public information/stakeholder involvement. Further, the INIR team considers that the organisational plans and the national plan should be clearly linked to the project schedule to enable the relevant organisations to develop detailed and timely recruitment and training plans.

Some curricula changes are needed in the education of non-nuclear specialists and technician education and training needs to be further developed. The INIR team was informed that these activities relate to Jordan’s mega projects in general and that this work was already in hand with the Ministry of Labour, Ministry of Higher Education, and other relevant organisations.

Training and training infrastructure support requirements were included in the original BIS and there have been extensive discussions with the vendor in this regard. The INIR team was informed that detailed training requirements are under discussion as part of the EPC contract.

The INIR team considers that Jordan should ensure that it has the resources required to support the development and implementation of its HRD plans and that the national plan should include the necessary mechanisms, including effective recruitment and retention strategies, for the sustainability of its human resources.

|                                 |                    |  |
|---------------------------------|--------------------|--|
| <b>Areas for further action</b> | <b>Significant</b> | Staffing of JNPC for operations<br>Integrated HRD plan |
|                                 | <b>Minor</b>       | No   |

**RECOMMENDATIONS**

**R-10.1.1 JNPC (PIPh) should develop detailed plans, including recruitment and training plans, to address the new organisational, human resource, competence and culture requirements in preparation for operations.**

**R-10.1.2 The national HRD committee should further develop the national HRD plan, addressing**

|  |
|--|
| <b>the needs of all involved organisations ensuring consistency with the project schedule.</b> |
| <b>SUGGESTIONS</b>   |
| None   |
| <b>GOOD PRACTICES</b>  |
| None   |

|   |   |                |
|---|---|----------------|
| <b>11. Stakeholder Involvement</b>  |   | <b>Phase 2</b> |
| <b>Condition 11.1: Public information and education programme developed</b> |   |                |
| <b>Summary of the condition to be demonstrated</b>                          | An integrated stakeholder involvement strategy and plan should be in use and updated. For each of the main organisations (government, regulator, and operator), there should be a clear statement of the role and responsibilities in proactive stakeholder involvement and each organisation should have a plan covering: public, local government, industry, media, NGOs (Non-government organisations), opposition groups, and neighboring countries.  |                |
| <b>Examples of how the condition may be demonstrated</b>                    | <ol style="list-style-type: none"> <li>1. Developed stakeholder involvement strategy and plan for each of the main organisations (government, regulator, and operator), with the commitment to share and understand all plans and ensure consistency of messages, efficiency in resources and avoid duplication of efforts.</li> <li>2. For each of the main organisations (government, regulator, and operator), a clear statement of the role and responsibilities in proactive stakeholder involvement and examples of communications with: public, local government, industry, media, NGOs (Non-government organisations), opposition groups, educational institutions and neighboring countries.</li> <li>3. Evidence of training and experience of spokespersons.</li> <li>4. Material produced in a range of media formats addressing all key stakeholder groups.</li> <li>5. Records of stakeholder meetings held and follow up actions taken.</li> <li>6. Educational press-events to give journalists basic knowledge of nuclear energy, radiation and plans for NPP construction.</li> <li>7. Availability of experts, who are trusted by the public, to support development of nuclear energy Evidence that local issues have been identified and addressed as part of a local public information plan that ensures local communities have been engaged.</li> <li>8. Consultative Committee (or Citizens Advisory Panel) representing local interests established.</li> <li>9. Statement of regulator policy regarding availability of information to the public.</li> <li>10. Evidence that the role of the regulator is understood by stakeholders and that they are perceived as competent and independent.</li> <li>11. Evidence of ongoing government communications regarding energy policy and energy needs, the role of nuclear power in the energy mix, the</li> </ol> |                |

|  |  |
|--|--|
|  | <p>benefits and risks of nuclear power, the “non-zero” potential for severe accidents, and response to issues raised.</p> <p>12. Review of public acceptance through means such as opinion polls or meetings.</p> <p>13. Evidence of communications from both the operator and regulator on technology choice, safety, security, waste management, severe accidents, health and environmental impact etc.</p> <p>14. Effective public information centres, including required budgets and facility design.</p> |
|--|--|

**Review observations**

JAEC is currently responsible for the development of the national strategy for stakeholder involvement. JAEC would prefer that the implementation of the strategy should be led by one of the relevant Ministries, such as the Ministry of Energy and Mineral Resources or Ministry of State for Media Affairs, but so far, this has not happened. JAEC has established a Public Awareness Committee (PAC), which includes representation from these Ministries, as well as EMRC, JAEC, MEMR, NEPCO, local community, JUST, Media, activists and nuclear engineers etc.

A Draft communication strategy has been developed by PAC which will be submitted to the Board of Commissioners of JAEC for approval, which includes 3 phases:

1. Build awareness, inform and educate
2. Engage different stakeholders
3. Empower them to advocate the project.

A hard copy of the draft strategy was handed to the experts

JAEC has conducted a number of public information activities including a high-level seminar facilitated by the IAEA. Up to now these have been focused mainly on key stakeholders such as parliamentarians and journalists, but they are now focusing more on the ‘neutral’ general public and, in particular, young people.

JAEC has recruited a part time media consultant and is recruiting three young nuclear graduates who will focus on social media, such as Facebook, Twitter and JAEC’s website and using short hashtag facts on social media, websites, TV and radio. Since 50% of the population is under 20.

JAEC recognises the importance of social media. They are also using nuclear graduates, who have been provided post graduate scholarships and specialized training supported by JAEC in nuclear engineering and nuclear sciences in France, Republic of Korea, China, Russia in morning TV shows, interviews, etc., to give a young, personal perspective about nuclear power and global experience.

TV, radio and newspapers interviews have been held with Jordanian nuclear experts who are working abroad.

Nuclear engineering students in the Jordan University of Science and Technology have also initiated several activities such as open days, Q&A sessions, interviews, their own Facebook pages, etc., and they currently lead an initiative supported by JAEC called “Our energy is our responsibility” and a plan is being developed to roll this model out to other universities.

Visits to JAEC by school students have been organized to introduce them to the commission and its responsibilities and role in the Jordanian energy sector.

JAEC has held meetings with media representatives, where the nuclear project's details were presented and their concerns and questions were addressed. A visit to the IAEA has been arranged for 12 media representatives to give them a broader understanding of nuclear energy and related issues.

EMRC is a member of PAC and will support the PAC strategy but, at present, do not have a specific communication plan. As with JAEC, EMRC does not have trained spokespersons. Currently, most of EMRC public communication is undertaken by the EMRC Commissioner for Nuclear Regulation. The INIR team was informed that the public is aware of EMRC's role and it is frequently asked technical questions.

Both JAEC and EMRC have regular meetings with key stakeholders in the local communities but these activities appear to be ad-hoc. JAEC and EMRC need to focus more on tracking issues raised in public meetings and the responses provided. JAEC indicated that similar questions are frequently raised mainly by Parliamentarians and have been used to develop appropriate messages for various stakeholders. More than 250 frequent questions and their answers are posted at JAEC's website in Arabic and English translation will start soon. Local stakeholder involvement, consultation and communication activities have been initiated but a plan has yet to be established. JAEC has identified the main associations and groups around the Amra site and has arranged visits to overseas NPP facilities for local community leaders, and a BSc scholarships program will be sponsored by JAEC for students from the local community to study nuclear engineering at JUST. JAEC indicated that JNPC (PIPh) would establish a local community advisory committee in the future, probably by mid-2015. The INIR team pointed out that since JNPC (PIPh) will soon begin activities 'on the ground', such as site characterisation and EIA, a well-defined plan for engagement with the local community is urgently needed.

Several independent polls have been conducted by different national and international organisations indicating overall support for nuclear power in Jordan. JAEC recognises the need to commission its own polls, which will assist in measuring the success of the communications strategy.

JAEC recognises that a public information centre should be established. JAEC has started informal contacts with the Children's Museum in Amman but there is currently no plan for the main information centre. JAEC is also considering a mobile information centre following some countries' practices

The INIR team pointed out that any planned information centre should be in a location that is easily accessible to the public and that consideration should be given to establishing some kind of presence at the Amra site as soon as on site activities commence.

|                                 |                    |                              |
|---------------------------------|--------------------|------------------------------|
| <b>Areas for further action</b> | <b>Significant</b> | Integrated strategy and plan |
|                                 | <b>Minor</b>       | No                           |

**RECOMMENDATIONS**

**R-11.1.1 JAEC should finalise and issue the Public Awareness Committee's communication strategy and plan, supported by the necessary resources, including training of spokespersons and establishment of public information centres.**

**SUGGESTIONS**

|  |
|--|
| None   |
| <b>GOOD PRACTICES</b>  |
| <b>GP-11.1.1 JAEC used students and nuclear graduates to communicate with the large youth population, engaging a group of stakeholders important for the future.</b> |

|   |   |                |
|---|---|----------------|
| <b>12. Site and supporting facilities</b>   |   | <b>Phase 2</b> |
| <b>Condition 12.1: Detailed site characterisation completed</b>   |   |                |
| <b>Summary of the condition to be demonstrated</b>  | The basis for the site selection from the candidate sites available from Phase 1 should be justified against clearly defined siting criteria. These should cover safety, engineering, security, environment, social and economic aspects. The site characterisation should be completed and an evaluation by the regulatory body should confirm that the site meets their siting requirements depending on the specific authorization stages defined in the Member State. Site related design basis information should be available and included in the NPP requirements.   |                |
| <b>Examples of how the condition may be demonstrated</b>  | <ol style="list-style-type: none"> <li>1. Report demonstrating ranking of possible sites and basis of the chosen site or sites.</li> <li>2. Evidence that the site(s) meets all siting requirements and the necessary characterisation studies have been completed. These should cover: <ol style="list-style-type: none"> <li>a) integration into the grid</li> <li>b) geology and tectonic</li> <li>c) seismology</li> <li>d) heat removal capability</li> <li>e) hydrology</li> <li>f) demography</li> <li>g) meteorology</li> <li>h) environmental issues</li> <li>i) external Hazards</li> <li>j) local Infrastructure</li> <li>k) access</li> <li>l) legal issues</li> <li>m) nuclear security.</li> </ol> </li> <li>3. Evidence that local legal, political and public acceptance issues have been identified and resolved or their resolution planned.</li> <li>4. Analysis of sites required for fuel interim storage, and for waste conditioning, storage and, where appropriate, disposal.</li> <li>5. Evidence that where appropriate, transport between the NPP and any waste storage/disposal sites has been considered.</li> </ol> |                |
| <b>Review observations</b>  |   |                |
| Various site selection studies have been conducted between 2008 and 2014. While the sites identified in the Aqaba region are more preferable from a plant cooling perspective extensive design measures are |   |                |

likely necessary to ensure the plant is not challenged from natural external events especially from earthquake hazards considering that Aqaba region is the collision zone of two tectonic plates (the Rift region). For this reason site survey and selection studies, initiated in 2009, identified preferred sites in the Majdal region more than 20km north of Amman on the basis of defined siting criteria. The INIR team was informed that preliminary seismic studies indicate the necessity to design for a Peak Ground Acceleration (PGA) in the region of 0.3-0.4g. The Majdal site 3B was used as a basis for the NPP bidding process. An IAEA siting mission was held in September 2011 reviewing the site survey and selection reports as well as the Preliminary Probabilistic Seismic Hazard Analysis (PPSHA).

Following the Fukushima accident, updated studies were conducted looking for sites in less seismically active regions with alternative cooling water solutions. A key stakeholder review committee, consisting of 35 agencies, participated in the endorsement of the site selection criteria and their associated weightings. These studies identified candidate sites at Amra more than 40km east of Amman which seem to indicate the necessity to design for a PGA in the region of 0.13g. This is to be confirmed during the site evaluation studies. Previously identified sites may be considered for future use. It is also expected that the Amra site will be utilised for the low and intermediate waste storage facility.

A Site and External Events Design (SEED) follow-up review mission was conducted in July 2013. This mission confirmed that the recommendations from the 2011 siting mission were completed, but additional recommendations were made on the updated site selection preferring the Amra site including the following:

- For record purpose, the report on PPSHA should be revised in order to be more consistent with the site selection phase of studies, the quality of the present database and the implications for the Seismic Hazard Assessment at the site. An ad hoc meeting with the Experts that have performed the study would be beneficial to solve the above comment.
- A revised version of the PPSHA, if required, should be issued after the meeting.
- An appropriate CWS was conducted to select the candidate site; however some aspects are not fully reported in the given document. In particular: volcanic hazard, feasibility of emergency management plan implementation, meteorology radiological and non-radiological aspects.

The INIR team considers that issues highlighted during this SEED review mission need to be taken into account in the planned work for the confirmation of the site selection with specific emphasis on the recommendations from the mission. EMRC is in the process of reviewing the site selection reports and anticipate completing this activity by the end of 2014.

EMRC instructions for Site Survey and Site Selection for NPP's and Site Evaluation for NPPs are in a final draft status. Comments have been requested from key stakeholders and the instructions have been sent to the commissioners for approval, which is expected by the end of August 2014. JAEC considers its approach to the site selection to be conservative in meeting the EMRC requirements. The INIR team considers it important that these instructions are finalised so that they can form a firm basis for the planned work for confirmation of site selection and evaluation.

JNPC (PIPh) will manage the site evaluation studies. The INIR team considers it important that JNPC (PIPh) is established with sufficient staff and systems to manage and have adequate oversight of these activities which are considered significant to nuclear safety. These studies need to generate information that will be preserved and maintained over the life of the facility. The ToR for the studies has been compiled and it is expected to appoint a consultant by the end of 2014. Plans for the site evaluation are expected to be submitted to EMRC for review in mid-2015. Studies will be conducted in two phases. Phase 1, lasting 6 months, deals with the confirmation of site selection. Phase 2 deals with the site

evaluation and characterisation. Critical path Phase 2 activities, such as meteorological monitoring and the installation of 10 additional seismic monitoring stations, are expected to start in parallel with Phase 1.

Once site evaluation and characterisation studies have been completed, the site design basis will be given to the vendor for inclusion in the design considerations.

|                                 |                    |   |
|---------------------------------|--------------------|---|
| <b>Areas for further action</b> | <b>Significant</b> | EMRC siting instructions.<br>Competence and management systems of JNPC<br>Site selection and evaluation |
|                                 | <b>Minor</b>       | No  |

**RECOMMENDATIONS**

**R-12.1.1 EMRC should issue the “Instruction on the Site Survey and Site Selection for Nuclear Power Plants” as well as the “Instruction on the Site Evaluation for Nuclear Power Plants” to ensure that a firm basis exists for site selection and evaluation.**

**R-12.1.2 JNPC (PIPh) should ensure it has competent staff and an appropriate system necessary for effective management and oversight of the site evaluation activities.**

**R-12.1.3 JNPC (PIPh) should initiate activities for the confirmation of the site selection and site evaluation as studies and approvals are likely to take time and will require the involvement of various Ministries and stakeholders. The recommendations from the 2013 SEED mission should be addressed in the scope of these activities.**

**SUGGESTIONS**

None

**GOOD PRACTICES**

None

|   |                |
|---|----------------|
| <b>Condition 12.2: Plans to prepare site for construction</b> | <b>Phase 2</b> |
|---|----------------|

|  |   |
|--|---|
| <b>Summary of the condition to be demonstrated</b> | Infrastructure either exists or is planned to support construction, e.g. access, workforce housing, water and construction materials. Any outstanding work is planned in accordance with the construction requirements or included in the BIS or contract specifications. |
|--|---|

|  |   |
|--|---|
| <b>Examples of how the condition may be demonstrated</b> | <ol style="list-style-type: none"> <li>1. A review of current infrastructure and plans to implement any enhancements required.</li> <li>2. Existing and planned site facilities are clearly described in the BIS or contract specifications.</li> </ol> |
|--|---|

**Review observations**  
Site and regional infrastructure requirements have not yet been assessed for the Amra site. The scope for

this assessment is included in the scope of work for the consultant to be contracted for the siting studies. The vendor infrastructure requirements have already been received and JAEC reported that it also intends for the vendor to review the terms of reference for the site contract before it is issued. Responsibilities for the delivery of the necessary off-site infrastructure (e.g. grid and transportation upgrades) will lie with the relevant Ministries and organisations and will require due monitoring and coordination.

The INIR team considers it necessary to complete the appropriate planning and assignment of responsibilities for the delivery of the required site infrastructure so as to ensure timely site readiness. Moreover, the INIR team considers that a high level inter-ministerial committee (such as the re-constituted NEPIO under consideration) would play a key role in enabling this function.

|                                 |                    |  |
|---------------------------------|--------------------|--|
| <b>Areas for further action</b> | <b>Significant</b> | Off-site physical infrastructure development plans |
|                                 | <b>Minor</b>       | No   |

### RECOMMENDATIONS

**R-12.2.1 JNPC (PIPh) should complete the required site and local infrastructure studies and the GoJ should then assign responsibilities for infrastructure development to the appropriate Ministries and organisations. [See also R-4.2.1].**

### SUGGESTIONS

None

### GOOD PRACTICES

None

|   |   |                |
|---|---|----------------|
| <b>13. Environmental Protection</b>   |   | <b>Phase 2</b> |
| <b>Condition 13.1: Environmental Impact Assessment for selected sites performed</b>   |   |                |
| <b>Summary of the condition to be demonstrated</b>  | A complete assessment of the environmental impact of the proposed NPP should be carried out in accordance with National Requirements and an environmental impact assessment report submitted to the appropriate authority.  |                |
| <b>Examples of how the condition may be demonstrated</b>  | <ol style="list-style-type: none"> <li>1. Availability of the Environmental Impact Assessment (EIA) report and the status of approval by all relevant regulators and agencies.</li> <li>2. Mitigation measures evaluated.</li> <li>3. Plans to develop systems and facilities for the necessary environmental monitoring (including radiation monitoring), with clearly assigned roles for the operating organization and the Environmental Regulator.</li> </ol> |                |
| <b>Review observations</b>  |   |                |
| As noted in the SER, Jordan's EIA process is defined by EIA Regulation No. 37 from the year 2005, as well as instructions that will be issued by EMRC, such as the Instructions on the Licensing Procedures for |   |                |

Nuclear Facilities and Associated Activities. EMRC requires that the EIA report of the nuclear facility must be available as a prerequisite for the issuance of the Site Permit.

The process is initiated by submitting a special environmental clearance form prepared by JNPC or its representative(s) (proponent) to the MoE notifying them of the intent to construct and operate the NPP. Following this, a draft ToR for the EIA must be submitted by the applicant and reviewed in a scoping session by a formal EIA committee including fifteen members from relevant government agencies, academia and NGOs coordinated by the MoE. The MoE will then organize a public hearing involving a wide range of stakeholders. Feedback (comments, questions, suggestions and concerns) of the public will be used by the proponent to modify the TOR and it is then reviewed and approved by MoE. Once the ToR is approved, the work on the EIA can be initiated.

The INIR team was informed that JAEC is in the final process of selecting the consultant who will prepare the scope of the EIA and has prepared a draft ToR (for the Majidal site) for the selected consultant to revise and submit to the MoE to initiate the approval process for the Amra site. The MoE noted its requirement to approve the selection of the consultant that will be contracted to conduct the EIA. The INIR team considers that it is urgent for JNPC (PIPh) to initiate the EIA process in accordance with MoE requirements.

With respect to environmental monitoring, the INIR team was informed that plans to develop an environmental monitoring system would be finalized after the EIA is completed and the potential impacts have been defined.

The EIA process will culminate with the development and approval of an Environmental Management Plan (EMP), which will be implemented throughout the lifecycle of the NPP.

|                                 |                    |             |
|---------------------------------|--------------------|-------------|
| <b>Areas for further action</b> | <b>Significant</b> | EIA process |
|                                 | <b>Minor</b>       | No          |

**RECOMMENDATIONS**

**R-13.1.1 JNPC (PIPh) should initiate the Environmental Impact Assessment process consistent with the requirements of MoE.**

**SUGGESTIONS**

**None**

**GOOD PRACTICES**

**None**

|   |                |
|---|----------------|
| <b>Condition 13.2: Particular environmental sensitivities included in BIS</b> | <b>Phase 2</b> |
|---|----------------|

|   |   |  |
|---|---|--|
| <b>Summary of the condition to be demonstrated</b>  | Comprehensive specification of environmental site conditions, factors, characteristics and data, should be provided in the BIS or contract specifications in as much detail as possible.  |  |
| <b>Examples of how the condition may be demonstrated</b>  | <ol style="list-style-type: none"> <li>1. BIS or Contract specifications identifying local environmental factors.<br/>Areas to consider include: <ol style="list-style-type: none"> <li>a) pathways for transport of effluent into the environment</li> <li>b) local population demographics and trends</li> <li>c) predominant plant and animal life and relevant radio-ecological sensitivities</li> <li>d) predominant land use</li> <li>e) data relevant to justifying heat removal capability</li> <li>f) sites and means for disposal of hazardous waste</li> <li>g) local environment issues affecting construction.</li> </ol> </li> <li>2. Bidders have free access to all detailed site studies including EIA documents and collected site data, with the environmental limitations, commitments and conditions.</li> <li>3. Established procedure for resolution of vendors' questions regarding the interpretation of the site data.</li> </ol> |  |
| <b>Review observations</b><br><br>The INIR team was informed that Jordan carried out a country wide survey that included the Amra site and made some initial identification of the environmental considerations. Additionally, JAEC noted that the draft ToR for the EIA includes the identification of the site specific environmental considerations in and around the Amra site. Once the EIA and the subsequent EMP are finalized, they will be provided to the vendor. |   |  |
| <b>Areas for further action</b>   | <b>Significant</b>  | No   |
|   | <b>Minor</b>  | Site specific environmental considerations |
| <b>RECOMMENDATIONS</b>  |   |  |
| <b>R-13.2.1 JNPC should ensure that Amra site specific environmental sensitivities are fully identified during the Environmental Impact Assessment process and incorporated into the relevant vendor contracts, along with the Environmental Management Plan.</b>   |   |  |
| <b>SUGGESTIONS</b>  |   |  |
| None  |   |  |
| <b>GOOD PRACTICES</b>   |   |  |
| None  |   |  |
| <b>Condition 13.3: Clear and effective regulation of environmental issues established</b>   | <b>Phase 2</b>  |  |

|  |   |   |
|--|---|---|
| <b>Summary of the condition to be demonstrated</b>   | The role and responsibilities of the environmental regulator for the nuclear programme should be assigned and the interface between this organisation and the nuclear regulator should be defined.  |   |
| <b>Examples of how the condition may be demonstrated</b>   | <ol style="list-style-type: none"> <li>1. Roles and responsibilities of the environmental regulator for the NPP defined.</li> <li>2. Memoranda of understanding between the Environmental and Nuclear regulatory bodies.</li> <li>3. Adequate skills and resources to evaluate the EIA, assess acceptability of design information, inspect/audit activities during construction and evaluation of monitoring results.</li> </ol> |   |
| <p><b>Review observations</b></p> <p>By law, MoE is the Jordanian agency responsible for protecting the environment. The INIR team was informed that MoE and EMRC are currently finalizing the development of an MOU to outline their respective roles and responsibilities related to the review of the EIA. The MoE has identified a lack of skilled resources within their ministry to oversee matters dealing with radiological impacts and is discussing with EMRC its assistance in this area through the proposed MOU. The INIR team was also informed that MoE would rely on both EMRC as well as external consultants to ensure that it has the necessary expertise to review the EIA and monitor the environment during the construction and operation of the NPP.</p> |   |   |
| <b>Areas for further action</b>  | <b>Significant</b>  | No  |
|  | <b>Minor</b>  | Framework of cooperation between MoE and EMRC |
| <b>RECOMMENDATIONS</b>   |   |   |
| <b>R-13.3.1 The Memorandum of Understanding between MoE and EMRC should be finalized to address the cooperation between them for the review of the radiological elements of the Environmental Impact Assessment.</b>   |   |   |
| <b>SUGGESTIONS</b>   |   |   |
| None   |   |   |
| <b>GOOD PRACTICES</b>  |   |   |
| None   |   |   |

|   |                |
|---|----------------|
| <b>14. Emergency Planning</b><br><br><b>Condition 14.1: Detailed approach to emergency planning being implemented</b> | <b>Phase 2</b> |
|---|----------------|

|  |   |
|--|---|
| <p><b>Summary of the condition to be demonstrated</b></p>  | <p>The responsibilities of each of the national institutions involved should have been defined. There should be a clearly defined lead organisation responsible for the national plan. The operating organisation should be aware of its responsibilities and should have a plan to develop full capability in Phase 3. For milestone 2, implementation details do not need to be in place, but implementation of the general approach for emergency planning should have started. The gaps in existing national institutions and communication networks should have been identified and filled or included in an action plan to be implemented later in Phase 3.</p>   |
| <p><b>Examples of how the condition may be demonstrated</b></p>  | <ol style="list-style-type: none"> <li>1. Basic regulations developed.</li> <li>2. National coordinating authority for emergency preparedness and response established.</li> <li>3. Clear roles and responsibilities for each organisation involved.</li> <li>4. Clear chain of command for emergency response management established.</li> <li>5. Identification of the size and type of accident to be covered by the plan (i.e. threat assessments performed, concept of operations developed).</li> <li>6. Relevant demographic information has been collated and studied by appropriate organisations.</li> <li>7. Plan showing development, approval and testing of emergency plan and procedures completed before the first nuclear fuel arrives on site.</li> <li>8. Evidence showing plans for relations and communications with neighbouring countries and the IAEA.</li> </ol> |
| <p><b>Review observations</b></p> <p>The National Nuclear and Radiological Emergency Committee (NNREC), established by EMRC in January 2014, is reviewing the National Nuclear Emergency and Response Plan (NNREP), which will be included in the draft National Emergency and Response Plan (NERP) where the levels of emergency response are defined, in general terms. The NNREP is expected to be approved 3 years before the JNPP is commissioned. The NERP is a classified document but is released to stakeholders involved in EPR. General parts could be open to the public, but some information is confidential. Signed confidentiality agreements are in place.</p> <p>In addition, NNREC has drafted an Annex to the NERP entitled “Members of Nuclear Emergency Centre for Radiological Accidents (NECRA) of the Government of Jordan for Radiation Accidents” where responsibilities of all involved organisations are defined (MoI, NoH, MoE, HCCD, JAF, JAEC and, EMRC).</p> <p>The INIR team was informed that the Higher Council of Civil Defence (HCCD) is considered to be the National Coordinating Authority (NCA), but this is not formally specified in the regulation (as required in GS-R part 2, #3.4).</p> <p>During the interview, the INIR team was informed that the National Centre for Security and Crisis Management (NCSCM) participates in the NNREC and in the future would be in a good position to cooperate with HCCD to support emergency response, but the draft regulation must be finalised for its role to be formalised.</p> <p>The Minister of the Interior designates the local governor as a key coordinator to be responsible for the</p> |   |

determination of the necessary manpower and equipment requirements to deal with incidents and radiological and nuclear emergencies within their province.

EMRC expects to issue the draft “Instruction on Nuclear Emergency and Preparedness and Planning” before the end of 2014. This instruction establishes the overall regulations for EPR. The INIR team was informed that EMRC had followed IAEA guidance in development of this instruction. The instruction will be approved by NNREC and is expected to be issued within one to two years.

EMRC is designated as the notification point for nuclear and radiological emergencies to the IAEA.

JAEC has started working on the identification and assessment of areas and population around the JNPP site that may be potentially affected in case of an emergency.

JAEC and EMRC have initiated studies to identify the size and type of accident which need to be mitigated. Twenty have been identified so far.

JAEC and EMRC will develop emergency operation procedures and emergency action levels for the planned JNPP.

An analysis of the communication network has not yet been conducted, and no Emergency Communication Network Plan has been developed. The INIR team considers that this issue should be discussed at the government level.

|                                 |                    |  |
|---------------------------------|--------------------|--|
| <b>Areas for further action</b> | <b>Significant</b> | National EPR strategy and coordination |
|                                 | <b>Minor</b>       | No                                     |

**RECOMMENDATIONS**

**R-14.1.1 GoJ should ensure that the roles of the Higher Council of Civil Defense, as the National Coordinating Authority, and the National Centre for Security and Crisis Management are defined in the case of nuclear or radiological emergencies.**

**R-14.1.2 The National Emergency Response Committee should conduct a gap analysis of the existing emergency communication networks and develop a plan for any identified improvements for nuclear or radiological emergencies.**

**SUGGESTIONS**

None

**GOOD PRACTICES**

None

|  |                |
|--|----------------|
| <b>Condition 14.2: Emergency planning for existing radiation facilities and practices in place</b> | <b>Phase 2</b> |
|--|----------------|

|  |   |    |
|--|---|----|
| <b>Summary of the condition to be demonstrated</b>   | Most countries embarking on a nuclear power programme will have emergency arrangements for radiation sources and possibly for a research reactor. Such arrangements should be demonstrated, evaluated and updated as required.  |    |
| <b>Examples of how the condition may be demonstrated</b>   | <ol style="list-style-type: none"> <li>1. Evidence that current the national radiation emergency plan and facility plans are regularly demonstrated and evaluated.</li> <li>2. Evidence of an action plan arising from the evaluations.</li> <li>3. Peer or international review of emergency response arrangements.</li> </ol> |    |
| <b>Review observations</b>   |   |    |
| <p>The draft regulation on the Safe Use of Nuclear Energy covers the general requirements for EPR (on-site &amp; off-site). The EMRC states that the NERP already includes a plan for radioactive source emergencies. The INIR team considers that a detailed instruction is required.</p> <p>An EPREV mission was conducted by an IAEA team in May 2013, which produced 40 recommendations. The INIR team was informed that an action plan was developed to address all of the recommendations therefore this area was not covered in detail during this mission.</p> |   |    |
| <b>Areas for further action</b>  | <b>Significant</b>  | No |
|  | <b>Minor</b>  | No |
| <b>RECOMMENDATIONS</b>   |   |    |
| None   |   |    |
| <b>SUGGESTIONS</b>   |   |    |
| None   |   |    |
| <b>GOOD PRACTICES</b>  |   |    |
| None   |   |    |

|  |   |                |
|--|---|----------------|
| <b>15. Nuclear Security</b>  |   | <b>Phase 2</b> |
| <b>Condition 15.1: Security requirements defined, plan to develop DBT established, sensitive information defined</b> |   |                |
| <b>Summary of the condition to be demonstrated</b>   | The national security requirements for the design and the site should be defined. They should be included in the BIS or contract specifications. National plans to develop the nuclear security systems and measures should be defined with clear roles, responsibilities and requirements. |                |
| <b>Examples of how the condition may be demonstrated</b>   | <ol style="list-style-type: none"> <li>1. The national threat assessment is up to date and the design basis threat has been defined for the facility. Outline of security requirements included in the BIS or contract specifications.</li> </ol>   |                |

|  |  |                           |   |
|--|--|---------------------------|---|
|  | <ol style="list-style-type: none"> <li>2. Security requirements and desirable features planned for the site.</li> <li>3. Evidence that best practise for security at the nuclear power plant is understood.</li> <li>4. Arrangement for bilateral, multi-lateral and international cooperation has been initiated</li> <li>5. Procedures are in place for the definition and protection of sensitive information and trustworthiness checks of personnel. Penalties for violation exist and supported by legislation.</li> </ol> |                           |   |
| <p><b>Review observations</b></p> <p>Jordan’s national security requirements are set out in the regulation on the “Safe Use of Nuclear Energy”. Article 15 of this regulation states that the physical protection of nuclear material, nuclear facilities and installations will be implemented according to the requirements of the Convention on Physical Protection of Nuclear Material. Article 16 provides more detailed technical requirements. The INIR team was informed that the EMRC has the regulatory responsibility for nuclear security in Jordan. However, the responsibility for nuclear security should be assigned by law, including respective roles and responsibilities. In addition, the law should address criminalization and related enforcement, as well as assignment of responsibility for the development and future maintenance of the Design Basis Threat (DBT). [See Issue 5- Legislative Framework].</p> <p>The INIR team was informed that the National Nuclear Security Committee (NNSC) was established by the Prime Minister and is chaired by EMRC. NNSC is responsible for developing the national threat assessment and DBT, assessment and evaluation of the physical protection system at nuclear facilities, and review of regulations and instructions for nuclear security and implementation of relevant international legal instruments. NNSC is currently in the process of carrying out the national threat assessment and will start developing the DBT for JNPP in 2015. The NNSC will submit it to EMRC who will provide it to JAEC &amp; JNPC (PIPh).</p> <p>EMRC is developing a nuclear security instruction based on INFCIRC 225/Rev5 that will define the security requirements for nuclear material and facilities and provides regulatory requirements of the nuclear security regime in Jordan. This instruction will also define requirements for sensitive information and trustworthiness. The INIR team considers that this instruction should also include recommendations set out in the IAEA Nuclear Security Series No 14 and No 15 (security for radioactive material and associated facilities and security for nuclear material and other radioactive material out of regulatory control.) This will ensure the establishment of a comprehensive nuclear security regime.</p> <p>The INIR team was informed that once the DBT and the EMRC instruction have been finalised, JNPC will use them to update the requirements for nuclear security specified in the EPC contract and to develop the needed security and physical protection measures, systems, and plans for JNPP.</p> <p>The INIR team was informed that JAEC has established procedures for the trustworthiness checks of personnel. These procedures are currently applied in JAEC, and similar arrangements will be developed in JNPC. The INIR team was further informed that procedures for ensuring the confidentiality of information still need to be developed. They are not yet in place for JRTR, but the INIR team was informed that all information and documents related to JNPP will be protected according to national requirements.</p> |  |                           |   |
| <p><b>Areas for further action</b></p>   | <table border="1"> <tr> <td data-bbox="550 1825 746 1964"> <p><b>Significant</b></p> </td> <td data-bbox="746 1825 1497 1964"> <p>Roles and responsibilities of security organizations [See Issue 5- Legislative Framework]</p> <p>Development of DBT and instruction on nuclear</p> </td> </tr> </table>  | <p><b>Significant</b></p> | <p>Roles and responsibilities of security organizations [See Issue 5- Legislative Framework]</p> <p>Development of DBT and instruction on nuclear</p> |
| <p><b>Significant</b></p>  | <p>Roles and responsibilities of security organizations [See Issue 5- Legislative Framework]</p> <p>Development of DBT and instruction on nuclear</p>  |                           |   |

|  |  |   |
|--|--|---|
|  |  | security<br>Nuclear security requirements for JNPP<br>Protection of sensitive information |
|  | <b>Minor</b>   | No  |
| <b>RECOMMENDATIONS</b>   |  |   |
| <p><b>R.15.1.1 The National Nuclear Security Committee should update the national threat assessment and develop the Design Basis Threat.</b></p> <p><b>R 15.1.2 JNPC (PIPh) should update the requirements for nuclear security to be specified in the EPC contract and develop the needed security and physical protection measures, procedures, and plans for JNPP.</b></p> <p><b>R 15.1.3 JNPC (PIPh) should develop procedures for the protection of sensitive information.</b></p>  |  |   |
| <b>SUGGESTIONS</b>   |  |   |
| None   |  |   |
| <b>GOOD PRACTICES</b>  |  |   |
| None   |  |   |
| <b>Condition 15.2: Planned nuclear security measures for siting, construction and transport</b>  |  | <b>Phase 2</b>  |
| <b>Summary of the condition to be demonstrated</b>   | Appropriate nuclear security systems and measures will need to be defined for the design, siting, construction and transport of nuclear and other radioactive material.    |   |
| <b>Examples of how the condition may be demonstrated</b>   | Nuclear security requirements during construction defined (including on site civil security personnel and a policy on whether armed), and a plan for their implementation. |   |
| <b>Review observations</b>   |  |   |
| <p>The draft “Instruction on Providing Physical Protection of Nuclear Facilities” sets out general nuclear security requirements during siting, construction and transportation of nuclear material, but the INIR team considers that it needs further development to address licensing requirements. The INIR team was informed that the national security agencies are involved in the development of the nuclear security requirements and that a plan to meet these requirements will be provided by JNPC prior to obtaining a site license.</p> <p>The SER states that JAEC has discussed arrangements with the concerned security agencies in Jordan and with the Jordan Armed Forces (JAF). JAF will be responsible for offsite protection of JNPP.</p> |  |   |

|   |  |   |
|---|--|---|
| <b>Areas for further action</b>   | <b>Significant</b>   | Implementation of security requirements during siting, construction and transport |
|   | <b>Minor</b>   | No  |
| <b>RECOMMENDATIONS</b>  |  |   |
| R-15.2.1 EMRC should expand the draft “Instruction on Providing Physical Protection of Nuclear Facilities” to define the licensing requirements for security for the site, construction and transport of nuclear and radioactive material, and JNPC (PIPh) should establish a plan to meet these requirements.  |  |   |
| <b>SUGGESTIONS</b>  |  |   |
| None  |  |   |
| <b>GOOD PRACTICES</b>   |  |   |
| None  |  |   |
| <b>Condition 15.3: Programs for selection/ qualifications of staff with access to facilities are in place</b>   |  | <b>Phase 2</b>  |
| <b>Summary of the condition to be demonstrated</b>  | Adequate screening programs for recruitment and selection of personnel with access to facilities and classified information. The programme should be graded so that persons with greater access undergo a more rigorous screening process. |   |
| <b>Examples of how the condition may be demonstrated</b>  | Screening programme for recruitment and selection of personnel defined.  |   |
| <b>Review observations</b>  |  |   |
| <p>A screening programme for recruitment and selection of personnel already exists and is currently used by JAEC and EMRC. The screening programme is regulated by the Civil Service by law, and is technically supported by the Ministry of Health, Public Security Department and the General Intelligence Department of the Ministry of Interior.</p> <p>The INIR team was informed that procedures for selection/qualifications of JAEC staff are in place and require security clearance from national security agencies. This also includes medical checks and criminal checks. In the future, a graded approach will be applied according to the sensitivity of the place and the material, so that individuals with greater access undergo a more rigorous screening process. In the future, periodical checks will be established (yearly or every second year).</p> <p>JNPC will develop a screening program based on the experience derived from the applied procedures in the JRTR. The INIR team was informed that a comprehensive Human Reliability Programme will be designed in 2014 and will commence in 2015.</p> |  |   |
| <b>Areas for further action</b>   | <b>Significant</b>   | No  |

|   |  |                |
|---|--|----------------|
|   | <b>Minor</b>   | No             |
| <b>RECOMMENDATIONS</b>  |  |                |
| None  |  |                |
| <b>SUGGESTIONS</b>  |  |                |
| None  |  |                |
| <b>GOOD PRACTICES</b>   |  |                |
| None  |  |                |
| <b>Condition 15.4: Nuclear security culture development planned</b>   |  | <b>Phase 2</b> |
| <b>Summary of the condition to be demonstrated</b>  | Evidence that all relevant organisations understand the importance of a nuclear security culture and have plans to develop a security culture among their staff.       |                |
| <b>Examples of how the condition may be demonstrated</b>  | Evidence of the promotion of a security culture, recognizing the importance of nuclear material, within all key organizations involved in the nuclear power programme. |                |
| <b>Review observations</b>  |  |                |
| <p>JAEC and EMRC currently apply nuclear security culture in their organizations and the INIR team was informed that JNPC (PIPh) will establish a nuclear security culture program for their personnel. A plan has been designed to strengthen nuclear security culture among staff at JAEC and EMRC, and in particular, among staff assigned to the NPP project. This will be achieved through the establishment of a nuclear security culture programme (2014-2015), based on surveys and interview results. The INIR team was informed that IAEA assistance is needed in this field.</p> <p>The INIR team was informed that a routine assessment of nuclear security culture would be performed by JAEC, JNPC, and EMRC would evaluate the assessment results.</p> |  |                |
| <b>Areas for further action</b>   | <b>Significant</b>   | No             |
|   | <b>Minor</b>   | No             |
| <b>RECOMMENDATIONS</b>  |  |                |
| None  |  |                |
| <b>SUGGESTIONS</b>  |  |                |
| None  |  |                |

|                       |
|-----------------------|
| <b>GOOD PRACTICES</b> |
| None                  |

|  |   |                |
|--|---|----------------|
| <b>16. Nuclear Fuel Cycle</b>  |   | <b>Phase 2</b> |
| <b>Condition 16.1: Front-end fuel cycle policy and strategy defined, and strategy for storage and ultimate disposal of spent fuel defined</b>  |   |                |
| <b>Summary of the condition to be demonstrated</b>   | Based on the national policy, a clear front-end fuel cycle strategy should be defined identifying how new fuel will be available in the short and long term, or which options are being pursued. A back-end fuel cycle strategy should also be defined, including plans /options for storage (at reactor and away from reactor) and for ultimate disposal. Actions and timescales should be consistent with the planned NPP construction programme. If reprocessing is considered, then the strategy should include high level waste.   |                |
| <b>Examples of how the condition may be demonstrated</b>   | <ol style="list-style-type: none"> <li>1. Policy document on nuclear fuel cycle developed.</li> <li>2. A completed front-end nuclear fuel cycle planning document applying the NEPIO knowledge of the steps and approaches, defining a realistic nuclear fuel cycle strategy at a level of detail appropriate for milestone 2.</li> <li>3. Spent fuel management strategy developed including identification of facilities needed, actions, resources and timescales.</li> <li>4. Evidence that basic decisions needed for milestone 2 have been made for both front and back ends of the nuclear fuel cycle. These include a decision on the number of reloads to be requested with the first core and a short and long term purchasing strategy for the fuel services (natural uranium, conversion, enrichment, fuel manufacturing, fuel take back), spent fuel storage capacity at reactor and a strategy for purchasing/building this capacity (e.g. capacity of reactor pools).</li> <li>5. An integrated plan for bidding and construction of any intended front-end fuel cycle facilities consistent with the power plant construction programme and the national non-proliferation commitment.</li> </ol> |                |
| <b>Review observations</b>   |   |                |
| <i>Front End Fuel Cycle</i>  |   |                |
| <p>A policy for the NFC front-end has not yet been formally developed and is anticipated to be completed by mid-2015. The policy for the NFC front-end is expected to cover the utilisation of domestic uranium deposits as a possible source for fuelling the JNPP. Studies are in progress investigating the commercial viability of uranium production, enrichment and fuel manufacturing. The INIR team was informed that Jordan would like to keep these options open to be developed depending on economic feasibility and regional market conditions.</p> <p>JAEC has formulated a multi-layered approach for ensuring short term (3-5 years) fuel supply from the NPP vendor with the option to extend this into the long term (60 years). The INIR team was informed that this will be covered in the IGA, currently being negotiated with Russia, and the PDA.</p> |   |                |

After 10 years of operation, JNPC may seek alternate suppliers of fuel. The vendor will be contracted to supply JNPC with all the required technical specifications and drawings for the fuel assembly to allow procurement of fuel from other suppliers in a competitive process. This will, of course, have an impact on the long-term SFM options, particularly on the spent fuel take back option.

If indigenous uranium resources are used to provide fuel for the JNPP, it is anticipated that foreign services for conversion, enrichment and fuel manufacturing will initially be used. At a later stage, the development of local capabilities for further fuel production could also be considered.

*Back End Fuel Cycle*

A draft policy for the NFC back-end has been developed. SNF will be stored in the SF pool for a minimum of 10 years. The INIR team was informed that the draft policy allows for 15 years. It will then be moved to an onsite interim storage facility utilising dry storage in casks. The INIR team was also informed that an interim dry storage facility for 20 years is included in the draft EPC contract but that this capacity can still be increased if required. Interim storage facilities will be licensed as a separate facility and JNPC will be the license holder.

The draft national policy on SFM and RWM includes several options for long-term SFM including:

- Repatriation of SNF to the country of origin (fuel take-back);
- Reprocessing of SNF abroad with return of HLW for local disposal;
- Reprocessing of SNF and HLW disposal in Jordan; and,
- Direct disposal of SNF within Jordan (initiated 50 years after start-up of JNPP).

The analysis of advantages, disadvantages, risks and financial implications for different options has not yet been performed. A political decision with regard to the disposal of SNF has not yet been made. Stakeholder and public involvement have also not yet been addressed. The INIR team was informed that the policy is expected to be approved by the government in late 2014.

According to the Law 42 from 2007, JAEC will be responsible for spent fuel and waste management (including disposal) on a national level. JNPC is responsible for SFM up to the end of interim dry storage at which stage the responsibility is transferred to the JAEC.

The regulation on safety of SFM has been drafted and has yet to be issued. The INIR team considers that funding of long term SFM will need to be addressed and main principles and responsibilities defined in the legislation to assure availability of funds when needed. [See Issue 5- Legislative Framework]. It is expected that EMRC will further detail funding arrangements and develop instructions on fees to be collected for SFM.

|  |                           |  |
|--|---------------------------|--|
| <p><b>Areas for further action</b></p> | <p><b>Significant</b></p> | <p>Policy on NFC front-end and back end [See Issue 1- National Position]</p> <p>Regulations/instructions on SFM [See Issue 7- Regulatory Framework]</p> <p>Funding of long-term SFM [See Issue 4- Funding and Financing]</p> |
|--|---------------------------|--|

|  |              |  |
|--|--------------|--|
|  |              | National strategies for nuclear fuel cycle |
|  | <b>Minor</b> | No   |
| <b>RECOMMENDATIONS</b>   |              |  |
| <b>R-16.1.1 Based on the adopted national policy, JAEC should finalise the national strategies for the front-end of the nuclear fuel cycle as well as for spent fuel management, with well elaborated options for long term management, including the evaluation of risks.</b> |              |  |
| <b>SUGGESTIONS</b>   |              |  |
| None   |              |  |
| <b>GOOD PRACTICES</b>  |              |  |
| None   |              |  |

|   |   |                |
|---|---|----------------|
| <b>17. Radioactive Waste</b>  |   | <b>Phase 2</b> |
| <b>Condition 17.1: Handling the burdens of low and intermediate radioactive waste considered</b>  |   |                |
| <b>Summary of the condition to be demonstrated</b>  | Based on the national policy, there should be a clear strategy for the processing, storage and disposal of low and intermediate radioactive waste. Requirements for facilities to be provided by the vendor should be included in the BIS or contract specifications. Plans for any national facilities or waste management organisations should be clear and consistent with the construction programme.   |                |
| <b>Examples of how the condition may be demonstrated</b>  | <ol style="list-style-type: none"> <li>1. A defined national waste management organisation.</li> <li>2. A strategy document prepared by the waste management organisation to implement the national policy for the management of all kinds of radioactive waste, considering regulatory and implementation infrastructures, allocation of responsibilities, technical approaches and capabilities, financing schemes, etc.</li> <li>3. A completed radioactive waste planning document applying the NEPIO understanding of the significant implications of radioactive waste at a level of detail appropriate for milestone 2.</li> <li>4. An integrated plan for bidding and construction of waste facilities consistent with the power plant construction programme.</li> </ol> |                |
| <b>Review observations</b>  |   |                |
| <p>A national policy on SNF and RWM has been drafted and is under the review by JAEC Board of Commissioners and EMRC Commissioners. JAEC has also drafted a national strategy for SNF and RWM.</p> <p>According to the draft policy, JAEC has the responsibility for implementation, including for predisposal and disposal of RW. The management of RW, as long as it remains on the premises of the facility, is the responsibility of the waste generator. Establishment of a specific Waste Management Organisation</p> |   |                |

(WMO) is not foreseen, as JAEC will act as WMO. For this purpose, a special department for SFM and RWM will be established and new staff will be recruited. Currently four staff members are working on this issue.

Until final disposal, LILW will be managed on the site of the NPP. The BIS included requirements for processing of and storage facilities for operational waste to be provided by the vendor. The INIR team was informed that the vendor is offering a comprehensive system for processing liquid, gaseous and solid radioactive waste, as well as a storage facility for 10 years of NPP operation and expandable to accommodate waste for up to 50 years of operation. JAEC is currently reviewing the vendor's offer so that adequate requirements could be included in the EPC contract. The responsibility for storage and processing of LILW on the site of the NPP will be assigned to JNPC.

The national policy on SNF and RWM includes a recommendation on early siting of a near surface repository (to be initiated 5-10 years after the start-up of JNPP). The INIR team was informed that there are two options for the site of the repository - at the reactor site or at another site. It will be a national repository for LIL short lived waste, operated by JAEC.

A regulation on RWM is drafted and awaiting approval which is expected at the end of 2014 or early 2015. The INIR team noted that provisions for funding radioactive waste management are not currently in the legislation or in regulations. [See Issue 4- Funding and Financing, and Issue 5- Legislative Framework].

|                                 |                    |  |
|---------------------------------|--------------------|--|
| <b>Areas for further action</b> | <b>Significant</b> | National policy for RWM [See Issue 1- National Position]<br><br>Funding arrangements for RWM [See Issue 4- Funding and Financing]<br><br>National strategy for RWM |
|                                 | <b>Minor</b>       | No   |

**RECOMMENDATIONS**

**R-17.1.1 JAEC should finalise the national strategy for radioactive waste management based on the adopted national policy.**

**SUGGESTIONS**

None

**GOOD PRACTICES**

None

|   |                |
|---|----------------|
| <b>Condition 17.2: Preliminary decommissioning plan requested</b> | <b>Phase 2</b> |
|---|----------------|

|  |   |    |
|--|---|----|
| <b>Summary of the condition to be demonstrated</b>   | A request for a preliminary decommissioning plan from the vendor should be included in the BIS or contract specifications. Specific national criteria should be included. |    |
| <b>Examples of how the condition may be demonstrated</b>   | Document discussing national requirements for decommissioning. Requirements for a decommissioning plan included in the BIS or contract specifications.                    |    |
| <b>Review observations</b>   |   |    |
| The Instruction on Decommissioning of Nuclear Facilities and Instruction on the Fund for Decommissioning of Nuclear Facilities were drafted by JNRC. The INIR team was informed that according to this draft regulation the preliminary (initial) decommissioning plan has been requested and delivered by the vendor. |   |    |
| <b>Areas for further action</b>  | <b>Significant</b>  | No |
|  | <b>Minor</b>  | No |
| <b>RECOMMENDATIONS</b>   |   |    |
| None   |   |    |
| <b>SUGGESTIONS</b>   |   |    |
| None   |   |    |
| <b>GOOD PRACTICES</b>  |   |    |
| None   |   |    |

|   |  |                |
|---|--|----------------|
| <b>18. Industrial Involvement</b>   |  | <b>Phase 2</b> |
| <b>Condition 18.1: Realistic assessment of the national and local capabilities carried out, Ability to meet schedule and quality requirements analysed, and Plans and programmes to transition to national and local suppliers in place</b> |  |                |
| <b>Summary of the condition to be demonstrated</b>  | A review of national capability identifying areas where national supply is available or can be developed. Based on this volume targets, or specific areas, for local or national involvement should be developed. Any plans for upgrading national capability should be defined and funded.  |                |
| <b>Examples of how the condition may be demonstrated</b>  | <ol style="list-style-type: none"> <li>1. A realistic assessment of the national and local supplier capabilities for either nuclear or non-nuclear safety related activities based on the national policy recommended by the NEPIO.</li> <li>2. Recognition of the training and funding requirements to upgrade quality.</li> <li>3. Extent of national industrial participation agreed and established and desired targets for local and national industrial involvement included in</li> </ol> |                |

|  |  |
|--|--|
|  | <p>the BIS or contract specifications.</p> <ol style="list-style-type: none"> <li>4. Requirements for industries to be added to the approved vendor/service supplier list together with procedures for audits of the management systems (including quality control and assurance) of the approved vendor/supplier.</li> <li>5. Clear plans and programmes identifying: <ol style="list-style-type: none"> <li>a. specific industrial involvement in future construction, maintenance or operational support services</li> <li>b. audits of the progress of industrial preparation and ability to meet the requirements for addition to the approved supplier</li> <li>c. short term and long term programme (including future projects) to develop the ability to produce items initially being supplied by foreign suppliers</li> <li>d. Recognition of the training and funding requirements to meet the proposed level of industrial involvement.</li> </ol> </li> <li>6. Consideration of mechanisms to be agreed with the awarded main supplier to convert national items into foreign supplied items and vice versa, in case of supply problems having major impact on the construction schedule.</li> </ol> |
|--|--|

**Review observations**

Various localisation activities have been undertaken including the specification of the target of 20% of the total budget to the vendor. A national Localisation Committee was established in January 2014 with representation from relevant Ministries and institutions, industry regulators, professional societies and R&D institutions. The committee is mandated to develop a policy and direct localisation efforts. A draft policy is expected to be developed after the completion of the national industrial survey and capability assessments in Q4 2015. The INIR team considers that such a policy should include the identification of areas of expected localisation during different phases of the project and endorsed by the Government.

A macro-economic study has been conducted that could assist in establishing policy criteria. The study indicates a threefold benefit to the local economy in terms of the localisation expenditure.

A realistic assessment of the national and local-to-site supplier capability has not yet been conducted. This is likely to be conducted by the committee with the full participation of the Jordan Chambers of Industry, which are members of the Localisation Committee. The INIR team considers the study to be a prerequisite to the creation of any industrial development plans. Jordan plans to consult with the communities near to the site and assess their capabilities to promote local economic involvement in the programme during its various phases.

A localisation workshop was conducted with local industrial representatives in September 2013. The INIR team was informed that more workshops, with involvement of the Russian vendor, are needed to provide more detailed focus on the required codes, standards and contracting processes.

The BIS targeted 20% localisation and the preferred vendor has confirmed its interest to involve Jordanian companies in the construction programme. Once developed it is expected that the national industrial involvement policy would have a role in informing the various contract negotiations including the IGA and EPC contract.

The mission team was informed that good opportunities exist for Jordan to become an exporter to the gulf region for the supply of nuclear power related products and services. Localisation opportunities should

consider all applicable phases of the NPP lifecycle, local infrastructure development, manufacturing, construction, operations and maintenance.

It is planned that a department or unit will be established within JNPC to promote, monitor and assist with the achievement of localisation targets. The INIR team considers that it may be advisable for the established Localisation Committee to play an oversight role to ensure continued policy implementation.

|                                 |                    |   |
|---------------------------------|--------------------|---|
| <b>Areas for further action</b> | <b>Significant</b> | Finalisation of the national industrial involvement policy<br>Completion of the capability assessments<br>Development, endorsement and monitoring of a localisation implementation plan |
|                                 | <b>Minor</b>       | No  |

### RECOMMENDATIONS

#### R-18.1.1 The Localisation Committee should:

- develop a national industrial involvement policy, to be endorsed by the Government, in time to inform the various strategies and contracts;
- ensure the completion of the national and local supplier capability assessment; and,
- ensure the development, endorsement and implementation of an industrial involvement plan with progress reports to the appropriate stakeholders.

### SUGGESTIONS

None

### GOOD PRACTICES

**GP-18.1.1 Jordan established a National Localisation Committee that facilitates awareness of localisation opportunities and enhances the involvement of a wide range of national and local industry in the nuclear project.**

|   |   |                |
|---|---|----------------|
| <b>19. Procurement</b>  |   | <b>Phase 2</b> |
| <b>Condition 19.1: Procurement programme consistent with national policy for industrial participation established</b> |   |                |
| <b>Summary of the condition to be demonstrated</b>  | Clear procurement programme included in the BIS or contract specifications that delineate the scope of supply for specific equipment and services, consistent with the national policy for national industrial involvement. |                |
| <b>Examples of how the condition may be demonstrated</b>  | 1. A procurement programme clearly described in the BIS or contract specifications that delineate the scope of supply for specific equipment and services.  |                |

|  |  |
|--|--|
|  | <ol style="list-style-type: none"> <li>2. If the national policy for industrial involvement supports local involvement in construction or support services, evidence of a procurement team competent in: <ol style="list-style-type: none"> <li>a) filing of: design descriptions, technical specifications, drawings of items to be procured</li> <li>b) quality levels to be assigned, depending the relevance of the item</li> <li>c) standards and codes ruling the item</li> <li>d) environmental qualification of the item (including storage conditions on the shelf, expiry dates, etc.)</li> <li>e) stock policy to be adopted (max/min levels).</li> <li>f) urgent procurement procedures.</li> </ol> </li> <li>3. Formal equipment and services specifications have been developed by the owner/operator.</li> <li>4. Approved supplier list has been developed and a routine auditing program is in place.</li> <li>5. A schedule identifying purchase orders placement dates and site arrival dates.</li> </ol> |
|--|--|

**Review observations**

A BIS was released in January 2011 in four parts: 1) Administrative Instructions 2) Technical Requirements 3) Financial Requirements 4) Attachments (Siting data, Grid requirements etc.). Bids were received in two parts with technical submissions received in June 2011 shortly followed by the financial submissions in August. A two year evaluation was led in five streams 1) Key Factors 2) Evaluation Matrix 3) Exclusion Topics 4) Best in Class and 5) Price Normalisation. A preferred bidder was announced in August 2013.

An IGA is expected to be finalised before the end of 2014. A PDA was finalised and approved by Cabinet during the course of the INIR mission dealing with the pre-investment phase activities, investment prerequisites and the basis for conclusion of the EPC negotiations. The strategic partner requires the completion of: the site permit, the national infrastructural readiness, the local infrastructure readiness and an environmental approval. The Jordan state requires the establishment of ceilings for the: investment cost, tariff and internal rate of return.

A Final Investment Decision is expected in mid-2016.

The INIR team was informed that relevant EMRC instructions, most of which are currently in draft, will be formally issued before the final approval of the EPC contract. Where national nuclear regulations or instructions are not in place, and there are no relevant IAEA safety standards, EMRC indicated that the vendor country regulations will be applied. Were this to occur, the vendor country regulations and established vendor practices would need to be reviewed by EMRC for applicability to Jordan.

The INIR team considers it necessary to finalise all key regulations and instructions before the signing of the EPC contract to provide a firm regulatory framework for the project.

The EMRC process for amending regulations and instructions includes steps for consulting key stakeholders, including the licensee. A process for managing scope change control will be included in the EPC contract.

Studies for the establishment of the required local infrastructure have not yet been concluded. The INIR team was informed that procurement for this infrastructure would be conducted through the appropriate Ministries and organisations which have adequate resources to manage the procurement and construction oversight. Refer to Issue 12- Siting and Supporting Facilities, for recommendations on how this work should be managed.

|                                 |                    |    |
|---------------------------------|--------------------|----|
| <b>Areas for further action</b> | <b>Significant</b> | No |
|                                 | <b>Minor</b>       | No |

**RECOMMENDATIONS**

**None**

**SUGGESTIONS**

**None**

**GOOD PRACTICES**

**None**

## ATTACHMENT 2: LISTS OF THE INIR TEAM AND COUNTERPARTS

| <b>INIR REVIEW TEAM</b>          |                     |
|----------------------------------|---------------------|
| Jong Kyun <b>PARK</b>            | Team Leader, IAEA   |
| Anne <b>STARZ</b>                | Coordinator, IAEA   |
| Stephen <b>MORTIN</b>            | External Consultant |
| Julio <b>BARCELO</b>             | External Consultant |
| Rod <b>SPEEDY</b>                | External Consultant |
| Fanny <b>TONOS PANIAGUA</b>      | IAEA                |
| Rebecca <b>STEVENS</b>           | IAEA                |
| Andrea <b>BRAUNEGGER-GUELICH</b> | IAEA                |
| Brian <b>MOLLOY</b>              | IAEA                |
| Tim <b>KOBETZ</b>                | IAEA                |
| Irena <b>MELE</b>                | IAEA                |
| Matthew <b>VAN SICKLE</b>        | IAEA                |
| Yusuf <b>ZAFAR</b>               | IAEA                |

### Participants from Jordan

| <b>Organization</b> | <b>Name</b>  |
|---------------------|--|
| <b>JAEC</b>         | H.E. Dr. Khaled Toukan<br>Dr. Kamal Araj<br>Mr. Yazan Bakhit<br>Mr. Bahjat Aulimat<br>Mr. Eyad Qutishat<br>Ms. Duaa Jilalni<br>Mr. Rakan Ayoub<br>Mr. Nooraldeen Abutaleb<br>Mr. Mutasem Abughazal<br>Mr. Mohammad Alutoom<br>Ms. Dala' Amawi<br>Ms. Anoud Zoubi<br>Mr. Mahmoud Assaf<br>Ms. Randa Alqudah |

|   |   |
|---|---|
|   | Ms. Yasmin Majali<br>Dr. Tawfiq Yazjeen<br>Dr. Wail Abuelshar<br>Mr. Abd Rababah<br>Mr. Khalil Awad<br>Mr. Osama Netsheh<br>Mr. Ahmad Malkawi<br>Ms. Sajeda Nsour |
| <b>EMRC</b>                                     | Dr. Mohammad Bqoor<br>Mr. Ahmad Hamdan<br>Mr. Ahmad Alsalman  |
| <b>NEPCO</b>                                    | Mr. Khaled Waleedi  |
| <b>JUST</b>                                     | Dr. Salaheddin Malkawi  |
| <b>JAF</b>                                      | Mr. Saleh Sheyyab   |
| <b>Ministry of Interior</b>                     | Mr. Ahmad Aljboor   |
| <b>Ministry of Environment</b>                  | Dr. Abdelkarim Shalabi  |
| <b>Ministry of Energy and Mineral Resources</b> | H.E. Mr. Mohammad Hamed   |

## ATTACHMENT 3: REFERENCES

### Documents provided by Jordan

|   |
|---|
| Law 42  |
| Law 43  |
| Regulation on the "Safe Use of Nuclear Energy" for the year 2014.   |
| Regulation number (8) for the year 2013 on the Bases and Conditions for Granting Radiation Licenses and Permits.  |
| Instruction on Licensing of Nuclear Facilities and Associated Activities (Final Draft).   |
| Instruction on the provision of Physical Protection and Security of Nuclear Facilities, Nuclear Material and Radioactive Substance (Final Draft).       |
| Instruction on the Conditions and Procedure for Notification about events in nuclear facilities and sites with sources of ionizing radiation (Drafted). |
| Instruction on Issuing Licenses for Specialized Training Qualification and Individual Licenses for use of Nuclear Power (Drafted).                      |
| Instruction on the Fund for Decommissioning of Nuclear Facilities (Drafted).  |
| Instruction for Decommissioning of Nuclear Facilities (Final Draft).  |
| Instruction on the Safety of NPPs (Final Draft).  |
| Instruction for Safety of Spent Nuclear Fuel Management (Final Draft).  |
| Instruction on Site Survey and Site Selection for NPPs (Final Draft).   |
| Instruction on Site Evaluation for NPPs (Final Draft).  |
| Instruction on Licensing of Radioactive Waste Management Spent Fuel Management Facilities (Final Draft).  |
| Instruction on Emergency Preparedness (Drafted).  |
| Instruction on Design Envelope for Nuclear Power Plants (Drafted).  |
| Instruction on the Format and Content of Safety Analysis Report for Nuclear (Drafted).  |
| Regulation (Instruction) on Special Statutory Areas (Drafted).  |
| Instruction on Radiation Protection Officer Requirements (Drafted).   |
| Convention on Nuclear Safety National Report.   |
| JNRC Inspection Manual  |
| JNRC Quality Management Manual  |
| JAEC Quality Assurance Manual   |
| JNPC Structure and Overview   |
| JNPC Timeline   |
| Jordan BFS  |
| Law 17  |
| List of Counterparts  |
| Nuclear Security Org Chart  |
| Emergency Response Section of SER   |

### IAEA Documents

1. Considerations to Launch a Nuclear Power Programme, GOV/INF/2007/2, Vienna (2007)

2. Milestones in the Development of a National Infrastructure for Nuclear Power, IAEA Nuclear Energy Series No. NG-G-3.1, Vienna (2007)
3. Evaluation of the Status of National Infrastructure Development, IAEA Nuclear Energy Series No. NG-T-3.2, Vienna (2008)
4. Addendum to: Evaluation of the Status of National Infrastructure Development (Working Paper) NG-T-3.2 Addendum 1 Draft 25 Jan 2013
5. INIR, Integrated Nuclear Infrastructure Review Missions – Guidance on Preparing and Conducting INIR Missions (Rev.1), Vienna (2011)
6. Establishing the Safety Infrastructure for a Nuclear Power Programme, Safety Standards Series No. SSG-16, Vienna (2012)
7. Fundamental Safety Principles, Safety Standards No. SF-1, Vienna (2006) and applicable IAEA Safety Standards
8. Other publications as appropriate from the bibliography included in Reference 2 above
9. The IAEA expert Mission reports, as appropriate

## ABBREVIATIONS

|              |   |
|--------------|---|
| <b>ASE</b>   | <b>AtomStroyExport</b>  |
| <b>AP</b>    | <b>Additional Protocol</b>                                    |
| <b>BAU</b>   | <b>Al-Balqa Applied University</b>                            |
| <b>BIS</b>   | <b>Bid Invitation Specifications</b>                          |
| <b>BOO</b>   | <b>Build Own Operate</b>                                      |
| <b>CD</b>    | <b>Competitive Dialogue</b>                                   |
| <b>CSA</b>   | <b>Comprehensive Safeguards Agreement</b>                     |
| <b>CPPNM</b> | <b>Convention of Physical Protection of Nuclear Materials</b> |
| <b>CWS</b>   | <b>Country Wide Survey</b>                                    |
| <b>DBT</b>   | <b>Design Basis Threat</b>                                    |
| <b>EIA</b>   | <b>Environmental Impact Assessment</b>                        |
| <b>EC</b>    | <b>European Commission</b>                                    |
| <b>EMRC</b>  | <b>Energy and Minerals Regulatory Commission</b>              |
| <b>ECAs</b>  | <b>Export Credit Agencies</b>                                 |
| <b>GCC</b>   | <b>Gulf Corporation Council</b>                               |
| <b>GoJ</b>   | <b>Government of Jordan</b>                                   |
| <b>HCCD</b>  | <b>The Higher Council of Civil Defence</b>                    |
| <b>IAEA</b>  | <b>International Atomic Energy Agency</b>                     |
| <b>IA</b>    | <b>Integrated Approach</b>                                    |
| <b>IGA</b>   | <b>Inter-Governmental Agreement</b>                           |
| <b>INIR</b>  | <b>Integrated Nuclear Infrastructure Review</b>               |
| <b>IMS</b>   | <b>Integrated Management System</b>                           |
| <b>JAEC</b>  | <b>Jordan Atomic Energy Commission</b>                        |
| <b>JAF</b>   | <b>Jordan Armed Forces</b>                                    |
| <b>JERI</b>  | <b>Jordan Energy Resources Inc.</b>                           |

|              |  |
|--------------|--|
| <b>JNRC</b>  | <b>Jordan Nuclear Regulatory Commission</b>                  |
| <b>JSA</b>   | <b>Jordan Sub-critical Assembly</b>                          |
| <b>JUMCO</b> | <b>Jordan Uranium Mining Company</b>                         |
| <b>JUST</b>  | <b>Jordan University for Science and Technology</b>          |
| <b>JV</b>    | <b>Joint Venture</b>   |
| <b>LILW</b>  | <b>Low and Intermediate Level of Radioactive Waste</b>       |
| <b>MEMR</b>  | <b>Ministry of Energy and Mineral Resources</b>              |
| <b>MOFA</b>  | <b>Ministry of Foreign Affairs</b>                           |
| <b>NEPCO</b> | <b>National Electric Power Company</b>                       |
| <b>NPC</b>   | <b>Nuclear Power Company</b>                                 |
| <b>NPP</b>   | <b>Nuclear Power Plant</b>                                   |
| <b>NEPIO</b> | <b>Nuclear Energy Programme Implementing Organisation</b>    |
| <b>NERP</b>  | <b>National Emergency and Response Plan</b>                  |
| <b>NNREP</b> | <b>National Nuclear Emergency and Response Plan</b>          |
| <b>NCA</b>   | <b>National Coordinating Authority</b>                       |
| <b>NCSCM</b> | <b>National Centre for Security and Crisis Management</b>    |
| <b>NRA</b>   | <b>Natural Resources Authority</b>                           |
| <b>NNREC</b> | <b>National Nuclear and Radiological Emergency Committee</b> |
| <b>NNSC</b>  | <b>National Nuclear Security Committee</b>                   |
| <b>NFC</b>   | <b>Nuclear Fuel Cycle</b>                                    |
| <b>OJT</b>   | <b>On the Job Training</b>                                   |
| <b>PDA</b>   | <b>Project Development Agreement</b>                         |
| <b>PIPh</b>  | <b>Pre-Investment Phase</b>                                  |
| <b>PPA</b>   | <b>Power Purchase Agreement</b>                              |
| <b>PPP</b>   | <b>Public Private Partnership</b>                            |

|             |  |
|-------------|--|
| <b>PWR</b>  | <b>Pressurized Water Reactor</b>       |
| <b>QMS</b>  | <b>Quality Management System</b>       |
| <b>RAOS</b> | <b>Rusatom Overseas</b>                |
| <b>SEED</b> | <b>Site and External Events Design</b> |
| <b>SER</b>  | <b>Self Evaluation Report</b>          |
| <b>SHA</b>  | <b>Shareholder Agreement</b>           |
| <b>SSC</b>  | <b>Social Security Corporation</b>     |
| <b>SPA</b>  | <b>Share Purchase Agreement</b>        |
| <b>SSC</b>  | <b>Social Security Corporation</b>     |
| <b>TOR</b>  | <b>Terms of Reference</b>              |
| <b>UJ</b>   | <b>University of Jordan</b>            |
| <b>VEC</b>  | <b>Valued Environmental Components</b> |