



**MISSION REPORT**

**ON**

**THE INTEGRATED NUCLEAR INFRASTRUCTURE  
REVIEW (INIR)**

**PHASE 1 MISSION**

**Counterpart:**  
**Niger High Authority for Atomic Energy (HANEA)**

**16–23 April 2018**

**Niamey, Niger**

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## EXECUTIVE SUMMARY

Niger's primary energy supply is mainly from coal, oil and biomass. The national energy potential is composed of solar, coal, oil, gas, uranium and thorium resources. Niger currently has a small electrical system with about 373 MW installed capacity and 15% of the population connected to the network. The energy demand in Niger and in the West African region is expected to increase significantly. Niger is committed to developing its energy potential to meet national energy needs.

Niger is currently the 4th largest uranium producer in the world with an identified Reasonably Assured Resources (RAR) of 325 000 tU (2014).

The Niger Renaissance Programme for 2016–2021 includes the consideration of nuclear power in Niger's energy mix. In July 2015, Niger hosted the first meeting of the West African Integrated Nuclear Power Group (WAINPG) to study the feasibility of a regional nuclear power programme.

Niger has developed a comprehensive nuclear legal framework. Law No. 2016-45 provides for the establishment, functions and structure of the Authority for Regulation and Nuclear Safety (Autorité de Régulation et de Sûreté Nucléaire (ARSN)). Niger has also adopted a new Law on Safety, Security and Peaceful Use of Nuclear Energy (Sûreté, Sécurité et Utilisation Pacifique de l'Energie Atomique (SSUPEA)), which will supersede current Law No. 2006-17. This new law was adopted by the Council of Ministers on 24 May 2017 and approved by the National Assembly on 17 April 2018.

The Nigerien High Authority for Atomic Energy (Haute Autorité Nigérienne à l'Energie Atomique (HANEA)) was established in December 2013 to supervise, coordinate and promote peaceful nuclear applications. In 2015, the Strategic Orientation Committee for the Nuclear Power Programme (Comité d'Orientation Stratégique pour le Programme Electronucléaire (COSPEN)) was established, chaired by the Prime Minister, with membership from all the relevant ministries. In September 2015, the National Technical Committee for the Nuclear Power Programme (Comité Technique National pour le Programme Electronucléaire (CTNPEN)) was also established. The CTNPEN is chaired by the President of HANEA with the Secretary General of the Ministry of Energy as Deputy Chair. Together, these committees constitute the Nuclear Energy Programme Implementing Organization (NEPIO).

CTNPEN has carried out a number of studies, including a self-evaluation report of Niger's infrastructure for nuclear power based on the International Atomic Energy Agency (IAEA) methodology. The self-evaluation report was updated by CTNPEN and sent to the IAEA in February 2018, along with 316 supporting documents.

The Integrated Nuclear Infrastructure Review (INIR) Phase 1 mission was conducted from 16 to 23 April 2018, to evaluate the status of the development of the national infrastructure to support the nuclear power programme, identify the areas needing further actions and provide recommendations and suggestions to the Government of Niger.

His Excellency, Mr Brigi Rafini, Prime Minister and Head of the Government of the Republic of Niger, Ms Mindaoudou Souley Zeinabou, President of HANEA and Mr Anthony Stott, representing Mr Mikhail Chudakov, Deputy Director General, Head of the IAEA's Department of Nuclear Energy, provided opening remarks for the INIR mission. On the

Nigerien side, the mission was coordinated by Mr Djibo Takoubakoye Daouda, Secretary General of HANEA. The INIR mission team was led by Mr Anthony Stott of the IAEA's Division of Nuclear Power, Nuclear Infrastructure Development Section, and consisted of staff from the IAEA's Departments of Nuclear Energy, Nuclear Safety and Security, Safeguards and the Office of Legal Affairs as well as international experts recruited by the IAEA.

The INIR mission and associated activities were funded through a combination of a cost-sharing contribution from the Republic of Niger, the IAEA Technical Cooperation project NER0007 Enhancing Human Resources Development in Nuclear Science and Technology and an extra budgetary contribution from Japan towards the IAEA activities to support the development of national infrastructure for nuclear power plants.

The INIR team concluded that there is a strong commitment from the Government of Niger to the work of developing the infrastructure for a nuclear power programme. Niger has established effective mechanisms to involve a wide and comprehensive range of national stakeholders in the relevant activities. Niger has already completed or initiated a significant number of studies, and has prepared a comprehensive report summarizing the results. This comprehensive report needs to be updated to take into account the results of studies that require further development in order to strengthen the rationale for moving forward.

To assist Niger in making further progress in its infrastructure development, the INIR team made 7 recommendations and 17 suggestions. The INIR team also identified 3 good practices that may benefit other countries considering the introduction of nuclear power.

Based on the recommendations and suggestions, the key areas for further action are summarized below:

- **Niger needs to develop an integrated view of the overall nuclear power plant project costs in order to strengthen the rationale for moving forward**

Niger has estimated the cost of electricity production from a nuclear power plant at 16.95 CFA francs/kWh based on international literature, which does not necessarily take into account the specificities of the national project. Niger has identified that there will be additional costs associated with its project such as securing adequate water, providing appropriate transport arrangements for construction and improving the grid. There is also a need to assess the cost of capital that will be derived from the ownership structure and the implications of developing some aspects of nuclear infrastructure using money from other national funds. All these costs need to be further assessed to develop an improved estimate of the overall cost of electricity production from the proposed nuclear power plant.

- **Niger needs to continue assessing and developing its legal and regulatory framework and ensure that all necessary elements of a national policy and strategy for safety are taken into account**

Niger has enacted a comprehensive nuclear law and prepared a plan for the development of implementing decrees and regulations. An analysis to identify relevant laws and ensure their consistency with the nuclear law and the requirements of the nuclear power programme is ongoing. Niger is encouraged to continue assessing and developing the legal and regulatory framework to ensure its overall consistency and adequacy for the nuclear power programme. Niger is also encouraged to identify all necessary elements of a national policy and strategy for safety.

- **Niger needs to strengthen the management and documentation of its activities to develop the nuclear power programme**

Niger has already completed or initiated a significant number of studies. Niger needs to strengthen the management and documentation of its activities, to ensure they are well specified, documented, reviewed and approved.

It is also important that the establishment of the key organizations in Phase 2 includes the development of sound management systems. Niger should develop guidance on establishing a management system for each of these organizations.

- **Niger needs to enhance its approach to human resource development, industrial involvement and radioactive waste management**

Niger has assessed the existing human resources, the needs for the nuclear power programme and the capability of national and foreign education and training institutions. To ensure that appropriate staff are recruited and trained by each of the key organizations on a timescale consistent with the nuclear power programme, Niger needs to revise its approach to developing human resource development plans, including a leadership development programme. Niger may also wish to consider its needs for external technical support.

Niger has conducted an analysis of the national industry capacity to participate in the nuclear power programme and is developing a National Industry Development Policy. This policy should be completed taking into account the required standards for equipment and services, the extent and timing of the nuclear power programme and potential investment requirements.

Niger has started to consider possible options for the management of radioactive waste from a nuclear power programme. Niger needs to further develop its understanding of these options.

## 1. INTRODUCTION

The Nigerien High Authority for Atomic Energy (Haute Autorité Nigérienne à l'Énergie Atomique (HANEA)) was established in December 2013 to supervise, coordinate and promote peaceful nuclear applications. In 2015, the Strategic Orientation Committee for the Nuclear Power Programme (Comité d'Orientation Stratégique pour le Programme Electronucléaire (COSPEN)) was established, chaired by the Prime Minister, with membership from all the relevant ministries. In September 2015, the National Technical Committee for the Nuclear Power Programme (Comité Technique National pour le Programme Electronucléaire (CTNPEN)) was also established. The CTNPEN is chaired by the President of HANEA with the Secretary General of the Ministry of Energy as Deputy Chair. Together, these committees constitute the Nuclear Energy Programme Implementing Organization (NEPIO).

In a letter dated 17 February 2017, HANEA requested the International Atomic Energy Agency (IAEA) to carry out an Integrated Nuclear Infrastructure Review (INIR) Phase 1 mission in Niger. CTNPEN coordinated the preparation of a self-evaluation report (SER) according to the IAEA Nuclear Energy Series publication entitled Evaluation of the Status of National Nuclear Infrastructure Development (NG-T-3.2 (Rev. 1)). The Self-Evaluation Report and supporting documents were sent to the IAEA on 22 September 2017. A SER support mission and a pre-INIR mission were conducted in Niger from 12 to 14 December 2017. The revised self-evaluation report and 316 supporting documents were submitted to the IAEA in February 2018. The INIR Phase 1 mission was conducted from 16 to 23 April 2018.

His Excellency, Mr Brigi Rafini, Prime Minister and Head of the Government of the Republic of Niger, Ms Mindaoudou Souley Zeinabou, President of HANEA and Mr Anthony Stott, representing Mr Mikhail Chudakov, Deputy Director General, Head of the IAEA's Department of Nuclear Energy, provided opening remarks for the INIR mission. On the Nigerien side, the mission was coordinated by Mr Djibo Takoubakoye Daouda, Secretary General of HANEA. The INIR mission team was led by Mr Anthony Stott of the IAEA's Division of Nuclear Power, Nuclear Infrastructure Development Section, and consisted of staff from the IAEA's Departments of Nuclear Energy, Nuclear Safety and Security, Safeguards and the Office of Legal Affairs as well as international experts recruited by the IAEA.

The INIR mission and associated activities were funded through a combination of a cost-sharing contribution from the Republic of Niger, the IAEA Technical Cooperation project NER0007 Enhancing Human Resources Development in Nuclear Science and Technology and an extra budgetary contribution from Japan towards the IAEA activities to support the development of national infrastructure for nuclear power plants.

## 2. OBJECTIVES OF THE MISSION

The main objectives of the INIR mission were to:

- Evaluate the development status of the national infrastructure to support the nuclear power programme according to the IAEA Nuclear Energy Series publication entitled Milestones in the Development of a National Infrastructure for Nuclear Power (NG-G-3.1 (Rev. 1)) and the evaluation conditions described

in the IAEA Nuclear Energy Series publication Evaluation of the Status of National Infrastructure Development (NG-T-3.2 (Rev. 1));

- Identify the areas needing further actions to reach Milestone 1: Ready to make a knowledgeable commitment to a nuclear power programme;
- Provide recommendations and suggestions which can be used by the Government of Niger and national institutions to prepare an action plan.

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

The INIR mission evaluated the status of the infrastructure in Niger covering all 19 infrastructure issues relative to the conditions identified in the above publications for Phase 1.

### **4. WORK DONE**

Prior to the mission, the INIR team reviewed the self-evaluation report and supporting documentation that included relevant national laws, regulations, studies and reports. The INIR team sought input from IAEA staff members with relevant expertise working with Niger. INIR team meetings were conducted prior to the mission, from 12 to 13 April 2018 in Vienna and on 15 April 2018 in Niamey.

The INIR Phase 1 mission was conducted from 16 to 23 April 2018. The meetings were held at the Grand Hôtel du Niger in Niamey. The main interviews were conducted over four days. Niger had prepared for the mission and managed its participation in the review effectively. During the interviews, the Nigerien counterparts provided an update on the current status of issues where progress had been made since the self-evaluation report was finalized. Niger also provided additional supporting documentation requested by the INIR team.

The preliminary draft report was prepared by the INIR team and discussed with the Nigerien counterparts. The main mission results were presented to representatives of the Government in an exit meeting on 23 April 2018. The preliminary draft report was delivered to the counterparts 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 1. Appendix 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 25 organizations involved in the nuclear power programme and corresponding infrastructure development. HANEA coordinated the mission on the Nigerien side. The full list of participants is included in the report.

The INIR team concluded that there is a strong commitment from the Government of Niger to the work of developing the infrastructure for a nuclear power programme. Niger has established effective mechanisms to involve a wide and comprehensive range of national stakeholders in the relevant activities. Niger has already completed or initiated a significant number of studies, and has prepared a comprehensive report summarizing the results. This comprehensive report needs to be updated to take into account the results of studies that require further development in order to strengthen the rationale for moving forward.

To assist Niger in making further progress in its infrastructure development, the INIR team made 7 recommendations and 17 suggestions. The INIR team also identified 3 good practices that may benefit other countries considering the introduction of nuclear power.

Based on the recommendations and suggestions, the key areas for further action are summarized below:

- **Niger needs to develop an integrated view of the overall nuclear power plant project costs in order to strengthen the rationale for moving forward**

Niger has estimated the cost of electricity production from a nuclear power plant at 16.95 CFA francs/kWh based on international literature, which does not necessarily take into account the specificities of the national project. Niger has identified that there will be additional costs associated with its project such as securing adequate water, providing appropriate transport arrangements for construction and improving the grid. There is also a need to assess the cost of capital that will be derived from the ownership structure and the implications of developing some aspects of nuclear infrastructure using money from other national funds. All these costs need to be further assessed to develop an improved estimate of the overall cost of electricity production from the proposed nuclear power plant.

- **Niger needs to continue assessing and developing its legal and regulatory framework and ensure that all necessary elements of a national policy and strategy for safety are taken into account**

Niger has enacted a comprehensive nuclear law and prepared a plan for the development of implementing decrees and regulations. An analysis to identify relevant laws and ensure their consistency with the nuclear law and the requirements of the nuclear power programme is ongoing. Niger is encouraged to continue assessing and developing the legal and regulatory framework to ensure its overall consistency and adequacy for the nuclear power programme. Niger is also encouraged to identify all necessary elements of a national policy and strategy for safety.

- **Niger needs to strengthen the management and documentation of its activities to develop the nuclear power programme**

Niger has already completed or initiated a significant number of studies. Niger needs to strengthen the management and documentation of its activities, to ensure they are well specified, documented, reviewed and approved.

It is also important that the establishment of the key organizations in Phase 2 includes the development of sound management systems. Niger should develop guidance on establishing a management system for each of these organizations.

- **Niger needs to enhance its approach to human resource development, industrial involvement and radioactive waste management**

Niger has assessed the existing human resources, the needs for the nuclear power programme and the capability of national and foreign education and training institutions. To ensure that appropriate staff are recruited and trained by each of the key organizations on a timescale consistent with the nuclear power programme, Niger needs to revise its approach to developing human resource development plans, including a leadership development programme. Niger may also wish to consider its needs for external technical support.

Niger has conducted an analysis of the national industry capacity to participate in the nuclear power programme and is developing a National Industry Development Policy. This policy should be completed taking into account the required standards for equipment and services, the extent and timing of the nuclear power programme and potential investment requirements.

Niger has started to consider possible options for the management of radioactive waste from a nuclear power programme. Niger needs to further develop its understanding of these options.

The recommendations, suggestions and good practices identified during the mission are listed below.

## **Recommendations**

**R-1.3.1** CTNPEN should update the comprehensive report to take into account the results of studies that need further development.

**R-3.1.1** CTNPEN should develop guidance on establishing a management system in each of the key organizations of the nuclear power programme.

**R-4.2.1** CTNPEN should reassess the cost of electricity from the project by building a financial model using all the financing assumptions as well as the anticipated charges and liabilities.

**R-9.1.1** CTNPEN should complete the grid studies required for Phase 1, namely the simulation of the grid when one 1000 MW unit trips, and a reliability study of the grid to minimize the loss of power to the plant.

**R-10.2.1** CTNPEN should revise its approach to developing human resource development plans to take into account when competent staff need to be available for Phases 2 and 3, the recruitment process time and the training duration.

**R-17.1.1** CTNPEN should make a preliminary evaluation of the order of magnitude amounts of radioactive waste from the nuclear power programme and of the options for the management of the various waste types.

**R-18.1.1** CTNPEN should complete the National Industry Development Policy taking into account the required standards for equipment and services, the extent and timing of the nuclear power programme and potential investment requirements.

## **Suggestions**

**S-2.1.1** CTNPEN is encouraged to identify all necessary elements of a National Policy and Strategy for Safety to achieve the fundamental safety objective and to apply the fundamental safety principles.

**S-3.1.1** CTNPEN is encouraged to implement a leadership development programme to ensure that leaders in the key organizations have adequate training and experience to deliver a successful programme and to promote a safety and security culture

**S-3.1.2** HANEA is encouraged to complete the development of its management system and implement its processes and procedures.

**S-4.1.1** CTNPEN is encouraged to document the cost evaluations for each of the 19 Infrastructure Issues and the methodology used to derive them.

**S-5.2.1** Niger is encouraged to further assess certain provisions of Law No. 2016-45 and SSUPEA that may require revision to ensure the overall consistency and adequacy of the national legal framework.

**S-5.3.1** Niger is encouraged to finalize its assessment of laws that may need to be enacted or amended to meet the needs of the nuclear power programme and plan for their enactment or amendment as appropriate.

**S-6.2.1** ARSN may wish to review SSAC approaches undertaken by Member States with existing nuclear power programmes similar to that planned in Niger.

**S-6.3.1** ARSN is encouraged to address the outstanding recommendations from the 2008 ISASS mission.

**S-7.1.1** ARSN is encouraged to include the review of existing regulations in the plan on regulation development to ensure consistency.

**S-7.1.2** ARSN is encouraged to determine the external support needed to discharge its regulatory duties effectively and identify how this external support could be provided.

**S-9.1.1** CTNPEN is encouraged to evaluate the cost of the upgrades to the grid required for the nuclear power programme.

**S-10.1.1** CTNPEN is encouraged to reassess the competence and future availability of the existing staff in order to ensure a realistic evaluation of the number of staff to be recruited and trained.

**S-10.1.2** CTNPEN may wish to conduct a human resource assessment for the National Agency for Waste Management.

**S-10.2.1** CTNPEN is encouraged to implement the human resource development strategy as soon as the government has taken the decision to build the nuclear power plant.

**S-12.1.1** CTNPEN is encouraged to carry out field visits to the potential sites to confirm the validity of the data used and apply additional quantitative criteria.

**S-14.1.1** CTNPEN is encouraged to document the assessment of the existing emergency preparedness and response (EPR) capabilities and major gaps identified in accordance with the relevant IAEA EPR requirements.

**S-16.1.1** CTNPEN is encouraged to assess the required capacity for on-site and off-site spent fuel storage.

## **Good Practices**

**GP-1.2.1** Strong support for the work of the NEPIO from the highest level of government and a strong connection between the two committees that form the NEPIO, facilitated by the chair of the Technical Committee providing the secretariat for the Ministerial Committee.

**GP-4.1.1** The method used to estimate the costs for development of the nuclear infrastructure broken down by year. This involved requesting each subgroup to make an estimate for their area. Where this could not be provided, the funding subgroup made an evaluation based on international data or the cost of previous similar studies in Niger.

**GP-11.1.1** Engagement with neighbouring countries to inform them of Niger's plans and explore possibilities of cooperation and participation in the project.

## **6. EVALUATION RESULTS FOR PHASE 1**

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

### **Significant\* actions needed:**

The review observations indicate that important work still needs to be initiated or completed to meet the condition.

### **Minor\* actions needed:**

The review observations indicate that some additional work or steps are needed to meet the condition or that plans for the next phase need to be enhanced.

### **No actions needed:**

The available evidence indicates that all the work to meet the condition has been completed.

*\*The judgment whether the actions are significant or minor is based on the importance of the work to the overall programme and/or the resources needed to complete it. The classification is done through a consensus of the INIR team, and is not based solely upon the judgment of any individual team member.*

### **Recommendations:**

Recommendations are proposed when the expectations of the condition have not been met. A recommendation should:

- Emphasize 'what' needs to be done, not 'how';

- Be based on the IAEA Milestones Approach/Evaluation Methodology;
- Be succinct, self-explanatory and achievable;
- Be supported by the Review Observation text—a ‘gap’ must be identified; already planned work can still be a recommendation if it is required to reach the milestone.

**Suggestions:**

Suggestions propose the consideration of new or different approaches to develop infrastructure and enhance performance, or to point out better alternatives to current work. A suggestion:

- Should be clear and self-explanatory;
- Should be supported by the Review Observation text;
- May relate to work already under consideration for the next phase.

**Good practices:**

A good practice is identified in recognition of an outstanding practice or arrangement, superior to those generally observed elsewhere. It is more than fulfilment of the conditions or expectation, and worthy of the attention of other countries involved in the development of nuclear infrastructure as a model in the drive for excellence.

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

<b>1. National position</b>	<b>Phase 1</b>		
<b>Condition</b>	<b>Actions Needed</b>		
	<b>SIGNIFICANT</b>	<b>MINOR</b>	<b>NO</b>
1.1. Long term commitment made and importance of safety, security and non-proliferation recognized			<b>X</b>
1.2. The Nuclear Energy Programme Implementing Organization (NEPIO) established			<b>X</b>
1.3. National strategy defined	<b>X</b>		
<b>2. Nuclear safety</b>	<b>Phase 1</b>		
<b>Condition</b>	<b>Actions Needed</b>		
	<b>SIGNIFICANT</b>	<b>MINOR</b>	<b>NO</b>
2.1. Key requirements of nuclear safety understood		<b>X</b>	
2.2. Support through international cooperation initiated			<b>X</b>
<b>3. Management</b>	<b>Phase 1</b>		
<b>Condition</b>	<b>Actions Needed</b>		
	<b>SIGNIFICANT</b>	<b>MINOR</b>	<b>NO</b>
3.1. Need for appropriate leadership and management systems recognized	<b>X</b>	<b>X</b>	
<b>4. Funding and financing</b>	<b>Phase 1</b>		
<b>Condition</b>	<b>Actions Needed</b>		
	<b>SIGNIFICANT</b>	<b>MINOR</b>	<b>NO</b>
4.1. Strategies for funding established		<b>X</b>	
4.2. Potential strategies for financing identified	<b>X</b>		

<b>5. Legal framework</b>	<b>Phase 1</b>		
<b>Condition</b>	<b>Actions Needed</b>		
	<b>SIGNIFICANT</b>	<b>MINOR</b>	<b>NO</b>
5.1. Adherence to all relevant international legal instruments planned			X
5.2. Plans in place for development of comprehensive national nuclear law		X	
5.3. Plans in place to enact and/or amend other legislation affecting the nuclear power programme		X	
<b>6. Safeguards</b>	<b>Phase 1</b>		
<b>Condition</b>	<b>Actions Needed</b>		
	<b>SIGNIFICANT</b>	<b>MINOR</b>	<b>NO</b>
6.1. Terms of international safeguards agreement in place			X
6.2. Strengthening of the State System of Accounting for and Control of nuclear material (SSAC) planned		X	
6.3. Recommendations from any previous reviews or audits being addressed		X	
<b>7. Regulatory framework</b>	<b>Phase 1</b>		
<b>Condition</b>	<b>Actions Needed</b>		
	<b>SIGNIFICANT</b>	<b>MINOR</b>	<b>NO</b>
7.1. Development of an adequate regulatory framework planned		X	
<b>8. Radiation protection</b>	<b>Phase 1</b>		
<b>Condition</b>	<b>Actions Needed</b>		
	<b>SIGNIFICANT</b>	<b>MINOR</b>	<b>NO</b>
8.1. Enhancements to radiation protection programmes planned			X

<b>9. Electrical grid</b>	<b>Phase 1</b>		
<b>Condition</b>	<b>Actions Needed</b>		
	<b>SIGNIFICANT</b>	<b>MINOR</b>	<b>NO</b>
9.1. Electrical grid requirements considered	<b>X</b>	<b>X</b>	
<b>10. Human resource development</b>	<b>Phase 1</b>		
<b>Condition</b>	<b>Actions Needed</b>		
	<b>SIGNIFICANT</b>	<b>MINOR</b>	<b>NO</b>
10.1. Necessary knowledge and skills identified, and gaps in current capability assessed		<b>X</b>	
10.2. Development of human resources planned	<b>X</b>	<b>X</b>	
<b>11. Stakeholder involvement</b>	<b>Phase 1</b>		
<b>Condition</b>	<b>Actions Needed</b>		
	<b>SIGNIFICANT</b>	<b>MINOR</b>	<b>NO</b>
11.1. Open and transparent stakeholder involvement programme initiated			<b>X</b>
<b>12. Site and supporting facilities</b>	<b>Phase 1</b>		
<b>Condition</b>	<b>Actions Needed</b>		
	<b>SIGNIFICANT</b>	<b>MINOR</b>	<b>NO</b>
12.1. General survey of potential sites conducted and candidate sites identified		<b>X</b>	
<b>13. Environmental protection</b>	<b>Phase 1</b>		
<b>Condition</b>	<b>Actions Needed</b>		
	<b>SIGNIFICANT</b>	<b>MINOR</b>	<b>NO</b>
13.1. Environmental requirements considered			<b>X</b>
13.2. Framework for environment protection reviewed			<b>X</b>

<b>14. Emergency planning</b>	<b>Phase 1</b>		
<b>Condition</b>	<b>Actions Needed</b>		
	<b>SIGNIFICANT</b>	<b>MINOR</b>	<b>NO</b>
14.1. Requirements of, and resources for, developing an emergency response capability recognized		X	
14.2. Recommendations from any previous reviews or audits being addressed			X
<b>15. Nuclear security</b>	<b>Phase 1</b>		
<b>Condition</b>	<b>Actions Needed</b>		
	<b>SIGNIFICANT</b>	<b>MINOR</b>	<b>NO</b>
15.1. Nuclear security requirements recognized and the actions of all relevant organizations coordinated			X
15.2. Recommendations from any previous reviews or audits being addressed			X
<b>16. Nuclear fuel cycle</b>	<b>Phase 1</b>		
<b>Condition</b>	<b>Actions Needed</b>		
	<b>SIGNIFICANT</b>	<b>MINOR</b>	<b>NO</b>
16.1. Options for nuclear fuel cycle (front-end and back-end) considered		X	
<b>17. Radioactive waste management</b>	<b>Phase 1</b>		
<b>Condition</b>	<b>Actions Needed</b>		
	<b>SIGNIFICANT</b>	<b>MINOR</b>	<b>NO</b>
17.1. The requirements for management of radioactive waste from NPP recognized	X		
17.2. Options for disposal of all radioactive waste categories understood			X

<b>18. Industrial involvement</b>	<b>Phase 1</b>		
<b>Condition</b>	<b>Actions Needed</b>		
	<b>SIGNIFICANT</b>	<b>MINOR</b>	<b>NO</b>
18.1. National policy developed with respect to industrial involvement	<b>X</b>		
<b>19. Procurement</b>	<b>Phase 1</b>		
<b>Condition</b>	<b>Actions Needed</b>		
	<b>SIGNIFICANT</b>	<b>MINOR</b>	<b>NO</b>
19.1. Requirements for purchasing NPP services recognized			<b>X</b>

## APPENDIX 1: REVIEW OBSERVATIONS, RECOMMENDATIONS AND SUGGESTIONS

<b>1. National Position</b>		<b>Phase 1</b>
<b>Condition 1.1: Long term commitment made and importance of safety, security and non-proliferation recognized</b>		
<b>Summary of the condition to be demonstrated</b>	A clear statement adopted by the government of its intent to develop a nuclear power programme and of its commitment to safety, security and non-proliferation, with evidence that their importance is embedded in the ongoing work programme.	
<b>Examples of how the condition may be demonstrated</b>	<ol style="list-style-type: none"> <li>1. A clearly stated government commitment;</li> <li>2. Evidence of clear responsibilities for each issue, with government coordination of activities.</li> </ol>	
<b>Observations</b>		
<p>The Prime Minister, in the Déclaration de Politique Générale of 16 June 2011, stated the intention to undertake actions to promote the peaceful use of nuclear power in the context of the Economic Community of West African States (Communauté Economique des Etats de l’Afrique de l’Ouest (CEDEAO)). This was reiterated in the Déclaration de Politique Générale of 10 June 2016, which stated the intention to mobilize and invest in nuclear power and its peaceful applications.</p> <p>The Nuclear Energy Socioeconomic Impact study 2012-2015 (Plan de Développement Economique et Social 2012-2015 (PDES) indicated that all energy sources should be considered, including nuclear power in a regional context, and provided an indication of budget allocations to undertake preliminary studies on a nuclear power programme. The 2017-2021 version of the PDES also indicates that investments in the energy sector will include an analysis of the feasibility of a civil nuclear power programme.</p> <p>The INIR team was informed that a national energy policy which includes nuclear power in the energy mix has been under development for some time.</p> <p>The Government’s commitment to safety, security and non-proliferation in the implementation of all nuclear activities, including the nuclear power programme, is reflected in the new Law on Safety, Security and Peaceful Use of Atomic Energy (Sûreté, Sécurité et Utilisation Pacifique de l’Energie Atomique (SSUPEA)), approved on 17 April 2018.</p> <p>The INIR team was informed that CTNPEN includes experts with knowledge in the areas of safety, security and non-proliferation, which ensures the attention to these matters in the on-going work programme.</p> <p>Niger is a party to international legal instruments related to nuclear safety, security and non-proliferation (see Issues 5 and 6). Niger is also a party to the African Nuclear Weapons Free Zone Treaty (Pelindaba Treaty).</p> <p>Niger submitted a national report and participated in the Convention on Nuclear Safety 7th Review Meeting, Vienna, March 2017.</p>		

<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	-
<b>RECOMMENDATIONS</b>		
<b>SUGGESTIONS</b>		
<b>GOOD PRACTICES</b>		
<b>Condition 1.2: The NEPIO established</b>		<b>Phase 1</b>
<b>Summary of the condition to be demonstrated</b>	<p>The NEPIO:</p> <ul style="list-style-type: none"> <li>a) Has clear terms of reference that call for a comprehensive review of all the issues relevant to making a decision to proceed with a nuclear power programme;</li> <li>b) Is recognized by all relevant ministries as having that role;</li> <li>c) Reports to a senior minister or directly to the head of government;</li> <li>d) Has appropriate human and financial resources;</li> <li>e) Involves all relevant stakeholders, including the country's major utilities, the regulatory body for security and radiation safety, other relevant government agencies, legislative representatives and other decision makers.</li> </ul>	
<b>Examples of how the condition may be demonstrated</b>	<ol style="list-style-type: none"> <li>1. The charter establishing the NEPIO and to whom it reports;</li> <li>2. Evidence that the roles and responsibilities of the NEPIO are known by all its members and by other government ministries;</li> <li>3. A document defining objectives and timescales and an adequate scope of investigations;</li> <li>4. A clear description of how the NEPIO operates in terms of funding, planning, reporting, scope of studies and use of consultants;</li> <li>5. Evidence that the NEPIO has adequate skills to address all issues either directly or through commissioning specialist studies;</li> <li>6. Evidence of relevant interactions between the head of NEPIO and appropriate ministries, such as those responsible for energy and the environment.</li> </ol>	

## Observations

The NEPIO is comprised of two main committees:

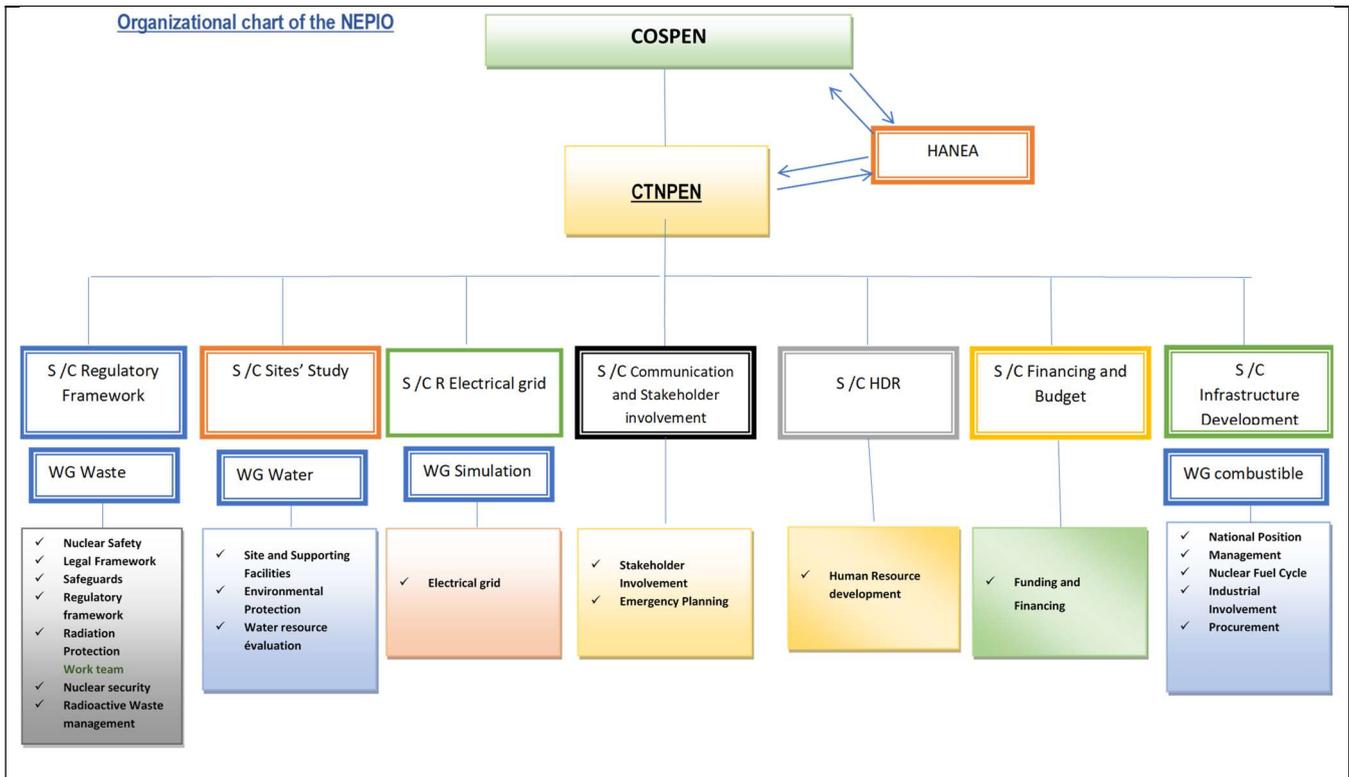
- The Strategic Orientation Committee for the Nuclear Power Programme (Comité d'Orientations Stratégiques pour le Programme Electronucléaire (COSPEN)) established by Arrêté No 0204/PM of 23 November 2015 and modified by Arrêté No 00196/PM of 5 December 2016;
- The National Technical Committee for the Nuclear Power Programme (Comité Technique National pour le Programme Electronucléaire (CTNPEN)) established by Arrêté No 00028/PRN/DIRCAB of 3 September 2015.

COSPEN is chaired by the Prime Minister and composed of 13 ministers and the President of HANEA. The Committee's responsibility is to review, guide and approve policies and strategies for the efficient implementation of the nuclear power programme in line with the Government's vision. COSPEN is reporting to the President of the Republic of Niger. The operation of COSPEN is co-financed by HANEA and the Prime Minister's Office. The President of HANEA is the Secretary of COSPEN, who recommends agendas for meetings to the Chair of COSPEN. COSPEN had its inaugural meeting in January 2017. The second meeting of COSPEN was held in April 2018.

CTNPEN is composed of 51 representatives from key governmental institutions, civil society, non-governmental organizations, public and private companies. CTNPEN is responsible for defining, developing and implementing the activities required, taking into account the possibility of the development of a regional nuclear power programme. The President of HANEA is the Chair of the CTNPEN. CTNPEN's reports and recommendations are tabled for COSPEN's approval. The operation of the CTNPEN is covered by the HANEA budget.

CTNPEN has established sub-committees and working groups to address the 19 infrastructure issues for the development of a nuclear power programme.

Organizational chart of the NEPIO



<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	-

**RECOMMENDATIONS**

**SUGGESTIONS**

**GOOD PRACTICES**

**GP-1.2.1** Strong support for the work of the NEPIO from the highest level of government and a strong connection between the two committees that form the NEPIO, facilitated by the chair of the Technical Committee providing the secretariat for the Ministerial Committee.

<b>Condition 1.3: National strategy defined</b>	<b>Phase 1</b>
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<b>Summary of the condition to be demonstrated</b>	A comprehensive report, defining and justifying the national strategy for nuclear power, including: <ol style="list-style-type: none"> <li>An analysis of energy demand and energy alternatives;</li> <li>An evaluation of the impacts of nuclear power on the national economy, for example gross domestic product and employment;</li> <li>A preliminary technology assessment to identify technologies that are consistent with national expectations;</li> </ol>
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	<p>d) Consideration of siting possibilities and grid capacity;</p> <p>e) Consideration of financing options, ownership options and operator responsibilities;</p> <p>f) Consideration of long term costs and obligations relating to spent fuel, radioactive waste and decommissioning;</p> <p>g) Consideration of the human resource needs and external support needs of the regulatory body and the owner/operator;</p> <p>h) Recognition that there remains a non-zero possibility of a severe accident and the need to deal with the consequences of such an accident will need to be addressed;</p> <p>i) Consideration of the demands of each of the infrastructure issues and a plan for how they will be met in the next phase of development.</p> <p><b>Note:</b> Any prefeasibility study conducted during Phase 1 can provide significant input to the comprehensive report, although it is important that the report fully address all 19 infrastructure issues.</p>
<p><b>Examples of how the condition may be demonstrated</b></p>	<ol style="list-style-type: none"> <li>1. List of the studies that are feeding into the report(s);</li> <li>2. Current status and conclusions;</li> <li>3. Contents list for the report(s);</li> <li>4. Executive summary of the report(s);</li> <li>5. Evidence of ministerial review of the report(s).</li> </ol>
<p><b>Observations</b></p> <p>The CTNPEN has developed a National Strategy to implement a nuclear power programme (Stratégie Nationale de Mise en Oeuvre du Programme Electronucléaire) that summarizes the context and justification for a nuclear power programme, with the following specific objectives:</p> <ul style="list-style-type: none"> <li>— To establish, within the required deadlines, a legal and institutional framework in line with IAEA requirements;</li> <li>— To establish a progressive empowerment plan for all institutions to ensure sustainability;</li> <li>— To set up a training and maintenance plan for competent human resources;</li> <li>— To set up an industrial development plan;</li> <li>— To put in place an effective communication plan for all phases of the programme;</li> <li>— To establish a plan for the supply of materials, materials and services including nuclear fuel;</li> <li>— To set up a financing plan for the programme activities;</li> <li>— To develop a roadmap for the implementation of the nuclear power programme.</li> </ul> <p>The National Strategy was developed taking into account (i) the objectives of the West African Power Pool System (WAPP); (ii) an IAEA analysis of energy supply and demand for sustainable electricity supply for West African countries; and (iii) a nuclear energy socioeconomic impact study conducted by CTNPEN.</p> <p>The National Strategy includes a ‘roadmap’ in the form of a table of activities with start and end dates and the responsible key organization (Government, NEPIO, HANEA,</p>	

Regulatory Body, Operating Organization, Waste Management Organization or Vendor). The activities are categorized into five blocks. Typical Phase 1 activities are included in Block 1: the infrastructure evaluation activities in the period 2015–2018, including the topical studies, the pre-feasibility study, the self-assessment report, and the monitoring and evaluation manual.

Blocks 2 and 3 cover the planning and implementation of work in Phase 2.

The NEPIO has conducted studies related to nuclear infrastructure issues. Discussions on the individual infrastructure issues have identified that some studies, such as studies on electrical grid, financing and siting, need further development.

The NEPIO prepared a comprehensive report (Résumé non-technique du Programme Electronucléaire pour la décision du Gouvernement) based on the National Strategy, the Self-Evaluation Report and the Pre-Feasibility Study for the Government’s decision on the nuclear power programme. The INIR team considers that this report will need to be updated to take into account the results of the studies that need further development.

<b>Areas for further action</b>	<b>Significant</b>	Updating the comprehensive report
	<b>Minor</b>	-

**RECOMMENDATIONS**

**R-1.3.1** CTNPEN should update the comprehensive report to take into account the results of studies that need further development.

**SUGGESTIONS**

**GOOD PRACTICES**

<b>2. Nuclear Safety</b>		<b>Phase 1</b>
<b>Condition 2.1: Key elements of nuclear safety understood</b>		
<b>Summary of the condition to be demonstrated</b>	The key requirements for nuclear safety, specified in the IAEA safety standards, are understood by the NEPIO and other relevant stakeholders, and their implications are recognized.	
<b>Examples of how the condition may be demonstrated</b>	<ol style="list-style-type: none"> <li>1. Evidence that the NEPIO has an understanding of, and commitment to, nuclear safety and the principles described in IAEA Safety Standards Series No. SF-1, Fundamental Safety Principles [8], and is aware of how nuclear safety requirements are taken into account in various designs of nuclear power plants (NPPs);</li> <li>2. Evidence that the responsibility for nuclear safety is recognized, for example in consideration of leadership, funding and expertise;</li> <li>3. Evidence that the need to develop adequate capability and skills in nuclear safety is recognized;</li> <li>4. Evidence of familiarity with IAEA safety standards and other States' practices, and recognition of the need for, and commitment to, the development of national safety standards.</li> </ol>	
<b>Observations</b>		
<p>A number of activities (e.g. training courses, including IAEA on-line training courses, workshops and scientific visits) have been conducted for CTNPEN members to develop understanding of and knowledge on nuclear safety and the IAEA safety standards.</p> <p>The INIR team was informed that HANEA emphasizes regularly the importance of safety during meetings organized in the framework of the nuclear power programme. In this respect, the INIR team was informed that the fundamental safety objectives and principles have been presented during a number of meetings, including meetings at high governmental level.</p> <p>The INIR team noted the conclusion of the regulatory framework subcommittee of CTNPEN in the Radiation Protection Infrastructure Analysis Report (Rapport d'analyse de l'infrastructure nationale de radioprotection) that a National Policy and Strategy for Safety has not been formally developed, however there is a clear perception about its importance.</p>		
<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	National Policy and Strategy for Safety.
<b>RECOMMENDATIONS</b>		

<b>SUGGESTIONS</b>		
<p><b>S-2.1.1</b> CTNPEN is encouraged to identify all necessary elements of a National Policy and Strategy for Safety to achieve the fundamental safety objective and to apply the fundamental safety principles.</p>		
<b>GOOD PRACTICES</b>		
<b>Condition 2.2: Support through international cooperation initiated</b>		<b>Phase 1</b>
<b>Summary of the condition to be demonstrated</b>	The need for international cooperation and open exchange of information related to nuclear safety as an essential element is recognized and demonstrated.	
<b>Examples of how the condition may be demonstrated</b>	<ol style="list-style-type: none"> <li>1. Evidence of review of options for bilateral or regional cooperation and specific actions for selected cooperation started, especially with countries with an established nuclear power programme;</li> <li>2. Implementation of a national technical cooperation programme with the IAEA and evidence of government financial support including nuclear safety aspects.</li> </ol>	
<b>Observations</b>		
<p>Niger has a number of bilateral cooperation agreements with several countries operating nuclear power plants, including France, Japan, South Africa and South Korea. Discussions have been initiated with the European Union. The INIR team was informed that Niger met with US Nuclear Regulatory Commission in 2016. Additional cooperation agreements are expected.</p> <p>Contacts have been established with foreign nuclear power plant vendors: Niger has signed a memorandum of understanding with Westinghouse and the INIR team was informed that there are on-going discussions with Korea Electric Power Corporation (KEPCO) and China National Nuclear Corporation (CNNC).</p> <p>The Authority for Regulation and Nuclear Safety (Autorité de Régulation et de Sûreté Nucléaire (ARSN)) is a member of the Forum of Nuclear Regulatory Bodies in Africa (FNRBA) and participates in events organized by the Forum. The INIR team was informed that ARSN plans to become a member of the Regulatory Cooperation Forum (RCF).</p> <p>Niger has signed with the IAEA a Country Programme Framework (CPF) and Niger's Government supports the programme through participation in national and regional Technical Cooperation (TC) projects which include considerations on nuclear safety.</p>		
<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	-

<b>RECOMMENDATIONS</b>
<b>SUGGESTIONS</b>
<b>GOOD PRACTICES</b>

<b>3. Management</b>		<b>Phase 1</b>
<b>Condition 3.1: Need for appropriate leadership and management systems recognized</b>		
<b>Summary of the condition to be demonstrated</b>	There is a commitment to leadership and management systems that will ensure success and promote a safety and security culture as well as the peaceful use of nuclear technologies. There are plans to ensure the knowledge gained by the NEPIO is transferred to the future regulatory body and the owner/operator of the programme.	
<b>Examples of how the condition may be demonstrated</b>	<ol style="list-style-type: none"> <li>1. Plans to ensure appointment of leaders with the appropriate training and experience to plan, procure, construct and operate an NPP as well as to ensure the leadership and management of nuclear safety, security and safeguards;</li> <li>2. Evidence that the importance of nuclear safety and security culture in each of the organizations to be established is recognized;</li> <li>3. Evidence that the importance of ensuring the peaceful use of nuclear technology is recognized;</li> <li>4. Evidence of a clear understanding of management system requirements;</li> <li>5. A plan to implement management systems in future key organizations is consistent with the appropriate standards and guidance.</li> </ol>	
<b>Observations</b>		
<p>Over more than twenty years, Niger has trained a number of civil servants and private companies' staff in the field of safety and security of ionizing radiation sources. The INIR team noted that while this addresses some of the technical competences required in the areas of safety and security, it does not address other required leadership competences such as major project management, strategic decision making, contract negotiation as well as leadership for safety.</p> <p>For the regulatory body, the INIR team was informed that Niger is selecting the Director General (3 candidates have been short-listed). Once the Director General is selected and nominated, Directors of the individual departments will be selected through a competitive recruitment process, and the need for training will be considered. Law No. 2016-45 establishing the ARSN identifies competence requirements for the Director General and the Directors.</p> <p>As part of the Human Resources (HR) development plan, Niger has identified the leadership roles in the key organizations but has not detailed the competences required nor developed specific plans to acquire the competences and experience required. The INIR team was informed that these are intended to be developed as part of the specific training plans for each organization. Leadership training is expected to include training abroad, on the job training with the vendor country, and training on leadership for safety and security in a national institute to be created. The INIR team was also informed that agreements with foreign partners foresee assistance in training.</p>		

HANEA is developing an Integrated Management System (IMS). The manual has been prepared but is still to be approved. The INIR team was informed that three procedures have been developed but are not yet implemented. The remaining procedures and processes are still to be developed.

The INIR team was informed that Niger plans to develop and implement integrated management systems in each of the major organizations namely, the regulatory body, the owner/operator, the NEPIO. However, no specific plans or guidance for their development have been prepared. The INIR team considers there are benefits of developing the IMS early in the life of the organization and hence the need for plans to be developed during Phase 1.

HANEA has developed a process to identify and transfer the knowledge gained by the staff of CTNPEN to the staff of the new organizations. In addition, for the regulatory body, several staff of the National Centre for Radiological Protection (Centre National de Radioprotection (CNRP)) (some of whom have been involved in the work of CTNPEN) will be transferred to ARSN in the near future.

<b>Areas for further action</b>	<b>Significant</b>	Plans and guidance for integrated management systems
	<b>Minor</b>	Leadership development HANEA Management System

**RECOMMENDATIONS**

**R-3.1.1** CTNPEN should develop guidance on establishing a management system in each of the key organizations of the nuclear power programme.

**SUGGESTIONS**

**S-3.1.1** CTNPEN is encouraged to implement a leadership development programme to ensure that leaders in the key organizations have adequate training and experience to deliver a successful programme and to promote a safety and security culture.

**S-3.1.2** HANEA is encouraged to complete the development of its management system and implement its processes and procedures.

**GOOD PRACTICES**

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4. Funding and Financing		Phase 1
Condition 4.1: Strategies for funding established		
<b>Summary of the condition to be demonstrated</b>	<p>Mechanisms have been defined for funding a range of key activities that are specific to a nuclear power programme but may not be the fiscal responsibility of the owner/operator.</p> <p>The activities include:</p> <ol style="list-style-type: none"> <li>a) Establishing the legal framework;</li> <li>b) Activities of the regulatory body for safety, security and safeguards;</li> <li>c) The government’s stakeholder involvement programme;</li> <li>d) Siting and environmental protection activities that are the responsibility of the government;</li> <li>e) Emergency preparedness and response (EPR);</li> <li>f) Education, training and research;</li> <li>g) Any required improvements to the electrical grid, if such improvements are the government’s responsibility;</li> <li>h) Any proposed incentives and direct government support to promote localization;</li> <li>i) Storage and disposal of radioactive waste, including spent fuel;</li> <li>j) Decommissioning of the NPP.</li> </ol>	
<b>Examples of how the condition may be demonstrated</b>	<ol style="list-style-type: none"> <li>1. Clear statements of how the above areas will be funded, based on a consideration of options</li> <li>2. Evidence that the scale of the costs of each of these activities has been recognized</li> </ol>	
<b>Observations</b>		
<p>The INIR team was informed that the CTNPEN’s Funding and Financing subcommittee has estimated the cost of developing the national infrastructure for nuclear power by requesting cost estimates for each of the 19 issues from the other CTNPEN’s subcommittees. When no such information was available, the Funding and Financing subcommittee made an evaluation based on international data or the cost of similar studies conducted in Niger.</p> <p>The aggregated cost for the period 2015–2030 has been estimated as follows:</p> <ul style="list-style-type: none"> <li>— 300–400 million CFA francs for conducting 15 to 16 Issue-specific studies in Phase 1;</li> <li>— 600–700 million CFA francs for human resource development;</li> <li>— 1500–2100 billion CFA francs for developing the infrastructure in Phases 2 and 3, including upgrade of the roads and the power grid;</li> <li>— 800 million to one billion CFA francs for site selection and characterization.</li> </ul> <p>The INIR team considers that documenting the cost breakdown of developing the 19 infrastructure issues and the methodology used to evaluate them would provide a basis for monitoring and review of funding needs in Phases 2 and 3.</p> <p>The INIR team was informed that funding for spent fuel and radioactive waste management, as well as funding for decommissioning, will be provided by the establishment of a fund, to be managed by a financial institution to be designated. Contributions to this fund will be from the operating organization.</p>		

Apart from investment in roads and grid which may be financed through a private funding model, all other funding needs for the nuclear power programme are expected to come from the public budget.

Between 2015 and 2018, Phase 1 activities have been financed by a direct allocation to the budget of HANEA. The direct funding of the infrastructure development is expected to continue from 2019 to 2025 with an annual budget of 500 million CFA francs until 2020, one billion CFA francs until 2024 and 3 billion in 2025.

Additional funding needed after 2025 is expected to be obtained by introducing taxes on some energy products (coal, wood and fuel) and using existing funds (mining site rehabilitation funds, energy access funds and training funds paid by exploration companies). The INIR team was informed that CTNPEN has verified that it is possible to use these funds for this purpose with a decree signed jointly by the Ministry in charge of these funds and the Ministry of Energy.

<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	Document analysis of the costs

## RECOMMENDATIONS

## SUGGESTIONS

**S-4.1.1** CTNPEN is encouraged to document the cost evaluations for each of the 19 Infrastructure Issues and the methodology used to derive them.

## GOOD PRACTICES

**GP-4.1.1** The method used to estimate the costs for development of the nuclear infrastructure broken down by year. This involved requesting each subgroup to make an estimate for their area. Where this could not be provided, the funding subgroup made an evaluation based on international data or the cost of previous similar studies in Niger.

## Condition 4.2: Potential strategies for financing identified

### Phase 1

#### Summary of the condition to be demonstrated

Potential options have been identified with financial and risk management strategies, which together:

- Create sufficient confidence for lenders and investors to support an NPP project;
- Ensure the long-term viability of the owner/operator to fulfil all its responsibilities.

**Note:** A large part of the government's role in nuclear power financing, if the government is not directly a sponsor of the project, relates to financial risk reduction.

<b>Examples of how the condition may be demonstrated</b>	A review of financing options and risk management strategies, considering the long-term economics and risks associated with the NPP and including the extent of government funding, equity partners and borrowing, among other things.	
<p><b>Observations</b></p> <p>The Funding and Financing subcommittee has considered several financing mechanisms for the nuclear power plant and has analyzed the pros and the cons of each solution. The preferred option is to create a regional consortium. As an alternative, Niger has identified a build-own-operate (BOO) option, with Niger buying all the electricity production at an agreed price (power purchase agreement).</p> <p>The subcommittee recommends a three-stage approach. Stage 1 would involve investment by several large private Nigerien companies such as Orano Niger, Sopamin, Sonichar, Nigelec and Sonidep. For Stage 2, the plan is to invite investments from utilities in the WAPP region such as SBEE (Benin), Sonabel (Burkina Faso) and CIE (Côte d’Ivoire). At Stage 3, the vendor selected to build the nuclear power plant would be invited to invest in the project, with other potential international investors. The subcommittee considers that this pool of investors would show confidence in the project and facilitate obtaining loans.</p> <p>The INIR team was informed that the expected cost of production (16.95 CFA francs/kWh) has been estimated based on cost data from international literature and that no financial model has been built to reflect the assumptions of the project. There is therefore no guarantee that 16.95 CFA francs/kWh will ensure sufficient income to attract the investments, or the long-term viability of the operating organization to fulfil all its responsibilities.</p> <p>The INIR team was informed that contact with potential investors, including the Stage 1 investors, will be carried out once the decision has been taken.</p>		
<b>Areas for further action</b>	<b>Significant</b>	Assessment of the levelized cost of electricity
	<b>Minor</b>	-
<b>RECOMMENDATIONS</b>		
<b>R-4.2.1</b> CTNPEN should reassess the cost of electricity from the project by building a financial model using all the financing assumptions as well as the anticipated charges and liabilities.		
<b>SUGGESTIONS</b>		
<b>GOOD PRACTICES</b>		

<b>5. Legal Framework</b>  <b>Condition 5.1: Adherence to all relevant international legal instruments planned</b>		<b>Phase 1</b>
<b>Summary of the condition to be demonstrated</b>	<p>There is an understanding of the requirements of the relevant international legal instruments, their implications and a commitment to adhere to them. The following instruments are covered:</p> <ul style="list-style-type: none"> <li>a) Convention on Early Notification of a Nuclear Accident (INFCIRC/335);</li> <li>b) Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (INFCIRC/336);</li> <li>c) Convention on Nuclear Safety (INFCIRC/449);</li> <li>d) Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (the ‘Joint Convention’) (INFCIRC/546);</li> <li>e) Convention on the Physical Protection of Nuclear Material (INFCIRC/274/Rev.1) and Amendment thereto (INFCIRC/274/Rev.1/Mod.1);</li> <li>f) Vienna Convention on Civil Liability for Nuclear Damage (INFCIRC/500);</li> <li>g) Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage (INFCIRC/566);</li> <li>h) Convention on Supplementary Compensation for Nuclear Damage (INFCIRC/567);</li> <li>i) Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (INFCIRC/402);</li> <li>j) Comprehensive safeguards agreement — based on The Structure and Content of Agreements Between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons (INFCIRC/153 (Corrected));</li> <li>k) Additional protocol — following the provisions of Model Protocol Additional to the Agreement(s) Between States(s) and the International Atomic Energy Agency for the Application of Safeguards (INFCIRC/540 (Corrected));</li> <li>l) Revised Supplementary Agreement Concerning the Provision of Technical Assistance by the IAEA.</li> </ul>	
<b>Examples of how the condition may be demonstrated</b>	<ol style="list-style-type: none"> <li>1. Plans for when each of the instruments will be adhered to;</li> <li>2. Identification of the actions that will need to be undertaken and the required timescales;</li> <li>3. Evidence that the resources required are understood and have been defined.</li> </ol>	

## Observations

Niger is a party to the following international legal instruments:

- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency;
- Convention on Nuclear Safety;
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management;
- Convention on the Physical Protection of Nuclear Material and Amendment;
- Vienna Convention on Civil Liability for Nuclear Damage;
- Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage;
- Comprehensive safeguards agreement and additional protocol thereto;
- Revised Supplementary Agreement Concerning the Provision of Technical Assistance by the IAEA.

The INIR Team was informed that the Convention on Early Notification of a Nuclear Accident was approved by the National Assembly on 28 March 2018.

The INIR Team was also informed that Niger will take steps to adhere to the Convention on Supplementary Compensation for Nuclear Damage and the Joint Protocol Relating to the Application of the Paris Convention and the Vienna Convention during Phase 2.

<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	-

## RECOMMENDATIONS

## SUGGESTIONS

## GOOD PRACTICES

**Condition 5.2: Plan in place for development of a comprehensive national nuclear law**

**Phase 1**

**Summary of the condition to be demonstrated**

There is an understanding of the requirements of the comprehensive national nuclear law that needs to be enacted, a plan with the actions and timescales for development and enactment, together with a commitment from the government to achieve the stated plan.

The plan includes the need for the law to:

- a) Establish an independent nuclear regulatory body with adequate human and financial resources, and a clear and comprehensive set of functions;

	<ul style="list-style-type: none"> <li>b) Identify responsibilities for safety, security and safeguards;</li> <li>c) Formulate safety principles and rules (radiation protection, nuclear installations, radioactive waste and spent fuel management, decommissioning, mining and milling, EPR and the transport of radioactive material);</li> <li>d) Formulate nuclear security principles;</li> <li>e) Give appropriate legal authority to, and define the responsibilities of, the regulatory body and all competent authorities establishing a regulatory control system (authorization, inspection and enforcement, review and assessment, and development of regulations and guides);</li> <li>f) Implement IAEA safeguards, including a State system of accounting for and control of nuclear material (SSAC);</li> <li>g) Implement import and export control measures for nuclear and radioactive material and items;</li> <li>h) Establish compensation mechanisms for nuclear damage.</li> </ul>
<p><b>Examples of how the condition may be demonstrated</b></p>	<ol style="list-style-type: none"> <li>1. A plan on how the law will be developed and approved;</li> <li>2. A summary of how each of the areas listed above will be addressed within the law;</li> <li>3. Interactions with the IAEA and the other relevant organizations.</li> </ol>

**Observations**

Niger has developed a comprehensive nuclear legal framework. Law No. 2016-45 of 6 December 2016 provides for the establishment, functions and structure of ARSN. A draft decree to implement this law is currently being prepared.

Niger has also elaborated a new Law on 'Safety, Security and Peaceful Uses of Nuclear Energy (SSUPEA)', which will supersede current Law No. 2006-17 of 21 June 2006. This new Law was adopted by the Council of Ministers on 24 May 2017. The INIR Team was informed that the Law was approved by the National Assembly on 17 April 2018. The SSUPEA Law provides for the creation of an independent regulatory authority and designates ARSN established under Law No. 2016-45 as such (Article 7 of the SSUPEA Law).

The SSUPEA Law contains provisions on radiation protection, radiation sources, safety of nuclear installations and decommissioning, emergency preparedness and response, exploration, extraction and processing of uranium and thorium, transport of radioactive material, radioactive waste/spent fuel management, civil liability for nuclear damage, export and import controls, safeguards and nuclear security. The INIR Team was informed that a Decree will be elaborated to implement this law.

The INIR team noted that some elements of the above legal framework may need further clarification and assessment, such as the process leading to the Government's decision to approve an NPP project (Article 36 of the SSUPEA Law), the national process for the selection of potential sites for an NPP (Article 38 of the SSUPEA Law), as well as mechanisms to prevent undue influence in regulatory decision-making in connection with donations that may be received by ARSN (Article 30 of Law No. 2016-45).

The INIR team was informed that these matters would be addressed through the implementing decrees planned to be adopted under the respective laws. The INIR Team noted that Niger, while developing these decrees, may also need to assess the relevant provisions of the above laws to ensure the overall consistency and adequacy of the national legal framework.

<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	Further assessment of legal provisions

**RECOMMENDATIONS**

**SUGGESTIONS**

**S-5.2.1** Niger is encouraged to further assess certain provisions of Law No. 2016-45 and SSUPEA that may require revision to ensure the overall consistency and adequacy of the national legal framework.

**GOOD PRACTICES**

<b>Condition 5.3: Plans in place to enact and/or amend other legislation affecting the nuclear power programme</b>	<b>Phase 1</b>
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<b>Summary of the condition to be demonstrated</b>	<p>There is an understanding of which legislation that affects the nuclear power programme needs to be enacted and/or amended, the timescales for its development and approval, together with a commitment from the government to achieve the stated plan.</p> <p>The legislation to be considered includes that on:</p> <ul style="list-style-type: none"> <li>a) Environmental protection;</li> <li>b) EPR;</li> <li>c) Occupational health and safety of workers;</li> <li>d) Protection of intellectual property;</li> <li>e) Local land use controls;</li> <li>f) Foreign investment;</li> <li>g) Taxation, fees, electricity tariffs and incentives;</li> <li>h) Roles of national and local governments;</li> <li>i) Stakeholders and public involvement;</li> <li>j) International trade and customs;</li> <li>k) Financial guarantees and any other required financial legislation;</li> <li>l) R&amp;D.</li> </ul>
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<b>Examples of how the condition may be demonstrated</b>	<ol style="list-style-type: none"> <li>1. A plan on how the legislation will be developed and approved;</li> <li>2. A summary of how each of the areas listed above will be addressed within the proposed legislation;</li> <li>3. Interactions with the IAEA and the other relevant organization.</li> </ol>	
<p><b>Observations</b></p> <p>An analysis to identify relevant laws and ensure their consistency with the nuclear law and the requirements of the nuclear power programme is ongoing. The analysis has identified relevant laws in areas such as civil protection, environment, territorial organization, expropriation, labor code, tax code, customs, investment and copyright, and has also identified some of the laws that will need to be revised.</p> <p>In addition, the INIR team was informed that there have been some discussions identifying the possible need for a law on financial and other incentives to support industrial development and for specific legislation in connection with the implementation of the nuclear power programme.</p>		
<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	Assessment and amendment of laws
<b>RECOMMENDATIONS</b>		
<b>SUGGESTIONS</b>		
<p><b>S-5.3.1</b> Niger is encouraged to finalize its assessment of laws that may need to be enacted or amended to meet the needs of the nuclear power programme and plan for their enactment or amendment as appropriate.</p>		
<b>GOOD PRACTICES</b>		

6. Safeguards		Phase 1
Condition 6.1: Terms of international safeguards agreement in place		
<b>Summary of the condition to be demonstrated</b>	<ol style="list-style-type: none"> <li>1. The Member State has a comprehensive safeguards agreement with associated subsidiary arrangements in force with the IAEA;</li> <li>2. If the Member State currently has concluded a small quantities protocol to its comprehensive safeguards agreement, a plan needs to be developed setting out the necessary steps to rescind the small quantities protocol in a timely manner;</li> <li>3. The Member State is aware of the requirements of the additional protocol; if the Member State has made the decision to ratify the additional protocol but has not already done so, a plan is in place for the timely ratification.</li> </ol>	
<b>Examples of how the condition may be demonstrated</b>	<ol style="list-style-type: none"> <li>1. Plans for rescinding the small quantities protocol and/or for ratification of the additional protocol, including the actions that need to be taken, clear assignment of responsibilities and understanding of the resources and the required timescales;</li> <li>2. Evidence that the need for outreach activities is recognized to ensure that all existing and future entities having to report to the State authority for safeguards are aware of their roles and obligations.</li> </ol>	
<b>Observations</b>		
<p>Niger has concluded a Comprehensive Safeguards Agreement (without small quantity protocol) with the IAEA that entered into force on 16 February 2005 (INFCIRC/664) and an Additional Protocol to the Comprehensive Safeguards Agreement that entered into force on 2 May 2007 (INFCIRC/664/Add 1). The Subsidiary Arrangements for the Comprehensive Safeguards Agreement and the Additional Protocol are also in force.</p>		
<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	-
<b>RECOMMENDATIONS</b>		
<b>SUGGESTIONS</b>		
<b>GOOD PRACTICES</b>		

<b>Condition 6.2: Strengthening of the SSAC planned</b>		<b>Phase 1</b>
<b>Summary of the condition to be demonstrated</b>	The Member State has a plan describing how the existing SSAC will be strengthened or adjusted to deal with the increase of activities and resources, as well as the need for enhancement of capabilities.	
<b>Examples of how the condition may be demonstrated</b>	<ol style="list-style-type: none"> <li>1. Evidence that the NEPIO includes a representative knowledgeable in the requirements of the comprehensive safeguards agreement;</li> <li>2. A plan produced by the NEPIO covering the enforcement of national legislation, policies and procedures relevant to safeguards; the development of the legislation itself is covered under infrastructure issue No. 5, legal framework;</li> <li>3. Evidence that approaches undertaken by one or more States with existing nuclear power programmes have been reviewed and the information gained has been adapted for the national context.</li> </ol>	
<b>Observations</b>		
<p>Law No. 2006-18 designated CNRP as the authority responsible for establishing the State System of Accounting for and Control of Nuclear Material (SSAC). These functions were delegated to the Ministry of Mines and Energy (Ministère des Mines et de l'Énergie (MME)). Following a reorganization within the MME in June 2011, these functions were assigned to the Directorate for Nuclear Application and Energy (Direction de l'Utilisation Pacifique des Techniques Nucléaires) and later transferred to HANEA upon its establishment in 2013.</p> <p>Law No. 2016-45, provides for the establishment of ARSN as the nuclear regulatory authority dealing with nuclear safety, security and safeguards.</p> <p>Additional Protocol declarations are updated annually and physical inventory verification inspections are performed by the IAEA inspectors. Niger submits nuclear material accounting reports to the IAEA in a timely and correct manner.</p> <p>Current staff dealing with safeguards have received training in Niger and participated in the IAEA training courses.</p> <p>For the nuclear power programme, a plan on the equipment, staff and training needed to perform safeguards activities has been prepared. The INIR team was also informed that costs for equipment and for hiring and training ARSN staff involved in safeguards activities have been assessed. ARSN will receive staff from HANEA and MME, and additional staff will be recruited.</p> <p>The INIR team was informed that Niger reviewed safeguards approaches in the Republic of Korea. The INIR team noted that Niger may also wish to review safeguards approaches in countries implementing nuclear power programmes similar to that being planned in Niger in order to gain relevant information that may be adapted for the national context.</p>		

<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	Review SSAC approaches in other countries
<b>RECOMMENDATIONS</b>		
<b>SUGGESTIONS</b>		
S-6.2.1 ARSN may wish to review SSAC approaches undertaken by Member States with existing nuclear power programmes similar to that planned in Niger.		
<b>GOOD PRACTICES</b>		
<b>Condition 6.3: Recommendations from any previous reviews or audits being addressed</b>		<b>Phase 1</b>
<b>Summary of the condition to be demonstrated</b>	If any reviews or audits have been conducted on the existing safeguards provisions, there is evidence that the actions resulting from it are progressing.	
<b>Examples of how the condition may be demonstrated</b>	Action plans resulting from a review or audit with progress identified indicating the required timescales, responsibilities and resources required.	
<b>Observations</b>		
<p>In February 2008, an IAEA SSAC Advisory Service (ISSAS) mission was conducted in Niger and a number of recommendations were made.</p> <p>The INIR team was informed that some of the recommendations arising from the ISSAS mission have been addressed. In particular, in connection with the recommendation related to strengthening the SSAC, including human, financial and technical resources for verification activities at the State level, it was highlighted that under Law No. 2016-45 there will be a department in ARSN on safeguards. This will ensure that the funds and staff needed for ARSN safeguards activities will be provided.</p> <p>Work on other recommendations from the ISASS mission is still ongoing.</p>		
<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	Recommendations from ISASS mission
<b>RECOMMENDATIONS</b>		

<b>SUGGESTIONS</b>
<b>S-6.3.1</b> ARSN is encouraged to address the outstanding recommendations from the 2008 ISASS mission.
<b>GOOD PRACTICES</b>

7. Regulatory Framework		Phase 1
Condition 7.1: Development of an adequate regulatory framework planned		
<p><b>Summary of the condition to be demonstrated</b></p>	<p>The prospective senior managers of the regulatory body have been identified. There are plans to develop a regulatory framework for nuclear safety, nuclear security and safeguards that matches the overall plan for the NPP, and includes:</p> <ul style="list-style-type: none"> <li>a) Designation of an effectively independent competent regulatory body with clear authority, adequate human and financial resources, and strong government support;</li> <li>b) Assignment of core safety, security and safeguards regulatory functions for developing regulations, review and assessment, authorization, inspection, enforcement and public information;</li> <li>c) Authority and resources to obtain technical support as needed;</li> <li>d) A clear definition of the relationship of the regulatory body to other organizations (e.g. technical support organizations and environmental agency);</li> <li>e) Clearly defined responsibilities of licensees;</li> <li>f) Authority to implement international obligations, including IAEA safeguards;</li> <li>g) Authority to engage in international cooperation;</li> <li>h) Provisions to protect proprietary, confidential and sensitive information;</li> <li>i) Provisions for stakeholder involvement and communication with the public.</li> </ul> <p>There are agreed terms of reference for each regulator and a clear definition of roles of, and interfaces with, other regulators. There is recognition of the need for integrating existing security and radiation safety regulations with new regulations for NPPs.</p> <p><b>Note:</b> Plans to develop competence are addressed under infrastructure issue No. 10, human resource development.</p>	
<p><b>Examples of how the condition may be demonstrated</b></p>	<ol style="list-style-type: none"> <li>1. Evidence of what has been done, or is planned, to develop the experience of the senior regulators;</li> <li>2. Proposals on the overall approach to assessment, licensing, inspection and enforcement, among other things;</li> <li>3. Plans to develop the regulatory body for safety, security and safeguards;</li> <li>4. Plans to develop the required regulations;</li> <li>5. Evidence of interaction and cooperation with established regulatory organizations;</li> <li>6. Plans to enhance or develop appropriate technical support</li> </ol>	

	<p>organizations (see also infrastructure issue No. 10, human resource development) to support the regulatory body;</p> <p>7. Plans to secure support from international regulatory organizations.</p>
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**Observations**

ARSN has been established by Law No. 2016-45 as an independent regulatory body. ARSN reports directly to the Prime Minister and has been assigned with the core safety, security and safeguards regulatory functions. These include developing regulations and guides, review and assessment, authorization, inspection and enforcement. ARSN has been also assigned to inform and consult with the public on activities and practices related to safety, security, health and environment. ARSN will supersede CNRP taking over all its functions with the exception of technical services provided by CNRP, i.e.: individual dosimetry, radiation occupational exposure monitoring, spectrometry and testing and analysis activities. Further provisions regarding the role and responsibilities of ARSN, including during the licensing process of nuclear installations, are provided by the SSUPEA Law.

A Draft Decree to implement the Law No. 2016-45 has been prepared. The INIR team was informed that this Draft Decree will be revised to cover all areas of responsibility of the ARSN, and not only the regulatory activities conducted so far by CNRP.

ARSN will have a Regulatory Board, a General Directorate, and five Departments. Nineteen staff from CNRP, of which 8 have a technical background in radiation protection, will be transferred to ARSN. The need for human resources for ARSN has been estimated at 58 staff as an intermediate step to conduct Phase 2 activities. The INIR team was informed that the recruitment of a Director General of ARSN is on-going; a short list of three candidates had already been established at the time of the mission.

Article 2 of the Decree No. 2013-490 provides that HANEA is responsible to initiate legal and regulatory draft documents related to the application of nuclear technologies. The INIR team was informed that this Decree will be revised to clarify that HANEA is not responsible for developing regulations in the areas of responsibility of ARSN.

CNTPEN has prepared a plan on regulation development. This plan establishes a list of regulations to be developed with associated timeline, responsibilities and resources. However, the INIR team noted that it does not cover the need to review the existing regulations, such as Decree No. 2013-490, which may need to be revised to ensure consistency with new legislation and regulations.

Law No. 2016-45 provides that ARSN can obtain advice as appropriate including hiring advisers, subcontracting specific projects or establishing standing or specific advisory bodies. The INIR team was informed that organizations to provide external support to ARSN have not yet been identified.

<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	<p>Plan on regulation development.</p> <p>Need for advisory bodies and support organizations.</p>

<b>RECOMMENDATIONS</b>
<b>SUGGESTIONS</b>
<p><b>S-7.1.1</b> ARSN is encouraged to include the review of existing regulations in the plan on regulation development to ensure consistency.</p> <p><b>S-7.1.2</b> ARSN is encouraged to determine the external support needed to discharge its regulatory duties effectively and identify how this external support could be provided.</p>
<b>GOOD PRACTICES</b>

<b>8. Radiation Protection</b>		<b>Phase 1</b>
<b>Condition 8.1: Enhancements to radiation protection programmes planned</b>		
<b>Summary of the condition to be demonstrated</b>	<p>The needed enhancements to the existing radiation protection programme to address NPP operation have been identified, including consideration of transport of radioactive materials and radioactive waste management. They consider both the increase in scale and the need to cover new technical issues.</p> <p><b>Note:</b> This issue is closely linked to infrastructure issue No. 7, regulatory framework. In particular, the development of regulations and whether the existing regulatory body will expand its role or whether the infrastructure issues will be addressed by a separate organization.</p>	
<b>Examples of how the condition may be demonstrated</b>	<ol style="list-style-type: none"> <li>1. Evidence of discussions with specialists from other countries;</li> <li>2. Identification of the main areas requiring enhancement;</li> <li>3. Recognition that additional competences will be required to review proposed designs against the requirement to control contamination and to reduce exposures to as low as reasonably achievable, also known as ALARA;</li> <li>4. Recognition that the programme for dose assessment will need to be significantly expanded;</li> <li>5. Plans for who will be responsible for the main elements of a radiation protection programme.</li> </ol>	
<b>Observations</b>		
<p>Initially, radiation protection activities were conducted by the Ministry of Mines through the Institute of Radioisotopes (University of Niamey) established in January 1984 and acting as promotor.</p> <p>In 1998, Niger established the CNRP, a public institution under the Office of the Prime Minister. CNRP mission and functions were to act as regulator, promotor and technical service provider. This allowed CNRP to develop practical experience in the radiological safety of activities involving radiation sources.</p> <p>Law No. 2016-45 revoked the previous law on CNRP and all regulatory functions initially carried out by CNRP are now the responsibility of ARSN. However, the technical support services were not transferred to ARSN.</p> <p>The INIR team was informed that the mission and responsibilities for developing and providing radiation protection technical services and associated human and technical resources will be transferred to HANEA. Consequently, Decree No. 2013-490 establishing HANEA will be reviewed and updated to reflect this change. Presently, these services are mainly related to external dosimetry and gamma spectrometry. It is foreseen to strengthen these services, considering the nuclear power plant project needs and to extend them to include internal exposure dosimetry, radiation protection equipment calibration and additional radiation analysis systems, such as alpha spectrometry.</p>		

The SSUPEA Law contains provisions relating to radiation protection during the development of a nuclear power programme (principles, licensing process, requirements), and identifies responsibilities.

Under CTNPEN, the Subcommittee for Regulatory Framework developed in 2017 a report entitled Analysis Report of the Radiation Protection Infrastructure. This report highlights the existing national radiation protection system, the developments under consideration (legal, regulatory, institutional, managerial and technical). This report also provides a broad assessment of the needed enhancements to the existing radiation protection programme. It also makes recommendations on further work still to be accomplished in terms of policy, strategy, development of technical services, quality policy and reinforcement of competences

The HR development plan (July 2017) identifies the existing resources in radiation protection, nuclear chemistry, nuclear engineering, etc. Radiation protection training and education needs and associated planning are provided for 2018–2021. The existing and the needed resources in radiation protection for each of the key organizations are provided. Various means of education and training in radiation protection both in Niger and abroad are identified.

The INIR team was informed that the NEPIO and key organizations will continue to deepen and update their assessment of gaps, taking into account the nuclear power plant needs.

<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	-
<b>RECOMMENDATIONS</b>		
<b>SUGGESTIONS</b>		
<b>GOOD PRACTICES</b>		

<b>9. Electrical Grid</b>		<b>Phase 1</b>
<b>Condition 9.1: Electrical grid requirements considered</b>		
<b>Summary of the condition to be demonstrated</b>	<p>A preliminary study of the grid system has been conducted covering:</p> <ol style="list-style-type: none"> <li>a) Capability and reliability to take the output from the NPP;</li> <li>b) Ability to withstand loss of the output;</li> <li>c) Reliability to minimize the risk of loss of power to the NPP from the grid.</li> </ol>	
<b>Examples of how the condition may be demonstrated</b>	<ol style="list-style-type: none"> <li>1. An analysis of the grid covering: <ol style="list-style-type: none"> <li>a) The expected grid capacity;</li> <li>b) The historical stability and reliability of the electrical grid;</li> <li>c) The historical and projected variation in energy demand.</li> </ol> </li> <li>2. Evidence of consideration of: <ol style="list-style-type: none"> <li>a) Available NPP designs to identify those with output consistent with required grid performance and reliability ('grid code'), with due consideration taken for safety aspects;</li> <li>b) Potential NPP sites and their impact on grid operation;</li> <li>c) The anticipated growth of grid capacity;</li> <li>d) The potential for local or regional interconnectors to improve grid characteristics.</li> </ol> </li> <li>3. Preliminary plans to enhance the grid to meet NPP requirements.</li> </ol>	
<b>Observations</b>		
<p>Niger's national network is composed of 12 transmission lines (eight 66 kV lines and four 132 kV lines) and 21 transformers. This national network is divided into 5 zones (Niger River; Center-East; North; East; Gaya-Malanville). Niger River zone accounts for 70% of the consumption and the Center-East zone for 20%.</p> <p>The installed capacity in Niger is 373 MW with an annual generation of around 0.6 TWh. The Niger River zone depends mainly on the imports from Nigeria.</p> <p>Niger is part of the WAPP, created in 1999 and bringing together 14 of the 15 members of CEDEAO. The objective of the WAPP is to integrate the operation of the national power grids into a unified regional electricity market, with an information and communication center established in Benin. Today, Niger is connected to Nigeria with two 132 kV lines.</p> <p>According to a CEDEAO study, the electricity demand is anticipated to grow in the region with an estimated installed capacity of 32 GW in 2030. To accommodate this growth a number of additional lines are planned including a 330 kV backbone through CEDEAO countries. No 400 kV lines are planned at this stage.</p> <p>Normal operation of the WAPP network is set at 220 V (<math>\pm 5\%</math>) at 50 Hz (<math>\pm 0.4\%</math>) but the stability of the Nigerien network is much less than that, resulting in frequent power cuts.</p>		

The CTNPEN subcommittee in charge of the grid has carried out a simulation of the Nigerian grid interconnected to the WAPP. For this purpose, it has modelled the local network with the new lines and power plants as they are planned by 2030 in the high demand scenario. This include 2 conventional power plants (200 and 100 MW), 3 hydro power plants (90, 122.5 and 130 MW), an interconnection with the Nigeria (75 MVA), the 330 kV backbone (175 MVA) and connection of the Niger River zone with the Center-East zone.

This configuration is stable in normal conditions. However, after inserting a 2 x 1000 MW nuclear power plant located in the Niger River zone, the simulation shows that the network is unstable.

The sub-committee has run another simulation with the plant located in the Center East zone with 11 double circuit 330 kV lines, 7 double circuits 132 kV lines, one 132 kV line and of additional transformers. This additional grid equipment allows the network to take the output of a 2 x 1000 MW nuclear power plant under normal conditions.

The subcommittee recognizes that further studies are needed. The INIR team was informed that these studies will cover the ability to withstand a loss of output or a loss of load such as the interconnection with Nigeria. An additional study will cover the reliability to minimize the risk of loss of power to the nuclear plant from the grid. Further studies may be necessary if the nuclear power plant is to be located in the Niger River zone.

The INIR team was also informed that the cost of upgrades to the grid required for the nuclear power programme need to be evaluated.

<b>Areas for further action</b>	<b>Significant</b>	Grid studies
	<b>Minor</b>	Cost evaluation of grid upgrades

**RECOMMENDATIONS**

**R-9.1.1** CTNPEN should complete the grid studies required for Phase 1, namely the simulation of the grid when one 1000 MW unit trips, and a reliability study of the grid to minimize the loss of power to the plant.

**SUGGESTIONS**

**S-9.1.1** CTNPEN is encouraged to evaluate the cost of the upgrades to the grid required for the nuclear power programme.

**GOOD PRACTICES**

<b>10. Human Resources</b>		<b>Phase 1</b>
<b>Condition 10.1: Necessary knowledge and skills identified, and gaps in current capability assessed</b>		
<b>Summary of the condition to be demonstrated</b>	<p>A broad assessment of the typical staffing needs of each of the key organizations and their technical support has been completed together with an assessment of improvements required in the current capability of the country to meet the projected need. The assessment covers the full range of scientific, technical, managerial and administrative disciplines and considers:</p> <ol style="list-style-type: none"> <li>a) Current human resource competences and capabilities;</li> <li>b) Estimated required competence and capability;</li> <li>c) Availability of domestic and foreign capacity for education and training;</li> <li>d) Additional education, recruitment, training and experience that will be required (gap analysis), including specialist training in nuclear safety, nuclear security, safeguards, radiation protection, spent fuel and radioactive waste management, management systems and EPR;</li> <li>e) Which facilities and programmes need to be established for education, training and experience building;</li> <li>f) Which research capability needs to be developed;</li> <li>g) A senior leaders' development programme.</li> </ol>	
<b>Examples of how the condition may be demonstrated</b>	<ol style="list-style-type: none"> <li>1. An analysis identifying the competences and number of staff needed, covering all the future organizations. The analysis needs to include: <ol style="list-style-type: none"> <li>a) Bulk workforce needs per phase;</li> <li>b) A breakdown by knowledge, skills and discipline per phase;</li> <li>c) The flow of workforce to other projects (e.g. future NPPs).</li> </ol> </li> <li>2. An analysis of existing human resource capabilities and the ability to attract experienced staff from other countries.</li> <li>3. An assessment of the capability of existing education and training facilities.</li> </ol>	
<b>Observations</b>		
<p>The HR Development Subcommittee distributed two questionnaires among the national institutions, public and private organizations in order to assess the current human resources in the country and assign them to a category related to their knowledge in the nuclear field ('nucléarisé', 'nucléarisable' or 'sensibilisé'). The INIR team noted that such a categorization does not fully describe the competence or experience of the human resources as their competence may not be directly applicable to the nuclear programme's needs. In most cases a complementary training for such staff will be necessary which is not considered in the HR Development Strategic Plan.</p> <p>The HR Development Subcommittee assessed the human resource requirement for three key organizations (NEPIO, ARSN and operating organization) for the three phases of the nuclear power programme. The INIR team noted that a human resource assessment for the</p>		

National Agency for Waste Management established by the Article 73 of the SSUPEA Law was not considered.

The INIR team was also informed that the numbers assessed for ARSN only cover Phase 2.

The HR Development Subcommittee estimated the recruitment needs (new staff) to be: 15 staff for the NEPIO, 47 for the ARSN and 354 for the operating organization, for the period 2018–2021.

The INIR team noted that the assessment of additional training required for existing staff has only been performed for the NEPIO (13 staff). The INIR team also noted that a specific 'Senior Leaders Development Programme' for the key organizations has not been considered (see Suggestion S-3.1.1).

An assessment of existing national education and public and private training institutions capacity has been performed. The training and education capacity is estimated at 1200 person a year. International education and training opportunities in countries such as France, Russia, South Africa, and Ghana were identified. It is expected that the vendor will provide training support including on-job training, a training center, training equipment as well as a control room full scope simulator specific to the supplier technology. The INIR team was informed that the national facilities and programmes to be established for education, and training will be addressed after the government has made a decision to build the nuclear power plant.

The INIR team was informed that an assessment of the availability of young professionals is planned to address the future human resource needs of the nuclear power programme.

<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	Competence and future availability of the existing staff Human resource assessment for the National Agency for Waste Management

**RECOMMENDATIONS**

**SUGGESTIONS**

**S-10.1.1** CTNPEN is encouraged to reassess the competence and future availability of the existing staff in order to ensure a realistic evaluation of the number of staff to be recruited and trained.

**S-10.1.2** CTNPEN may wish to conduct a human resource assessment for the National Agency for Waste Management.

**GOOD PRACTICES**

<b>Condition 10.2: Development of human resources planned</b>		<b>Phase 1</b>
<b>Summary of the condition to be demonstrated</b>	<p>Outline plans have been agreed to:</p> <ul style="list-style-type: none"> <li>a) Enhance national education and training;</li> <li>b) Develop a detailed human resource development plan for each key organization;</li> <li>c) Integrate the plans to develop a national strategy including the development of an initial core leadership group.</li> </ul>	
<b>Examples of how the condition may be demonstrated</b>	<ul style="list-style-type: none"> <li>1. Plans to develop human resources required including: <ul style="list-style-type: none"> <li>a) Identification of national organizations that could support human resource development;</li> <li>b) Enhancement of education and training infrastructure;</li> <li>c) Development of national competences (through schools, universities, institutes and industry);</li> <li>d) Non-national human resources that are needed to augment national resources and how they will be secured;</li> <li>e) International cooperation and vendor support;</li> <li>f) Leadership development.</li> </ul> </li> <li>2. Strategies for the recruitment and retention of staff.</li> <li>3. Recognition of the need for qualification and certification programmes for personnel.</li> <li>4. Evidence that key stakeholder organizations have participated in the development and review of the plans.</li> </ul>	
<b>Observations</b>		
<p>The INIR team was informed that Niger has considered the enhancements of the existing education system of universities, high level and professional schools that will be required to address the competence needs for a nuclear power programme. Niger has considered the need to establish a new institute, the Institute of Science and Nuclear Technologies, to develop and implement training programmes in nuclear science and engineering. The establishment of memoranda of understanding with national and international institutions for the training of students and researchers will be performed after the Government has taken the decision to build the nuclear power plant.</p>		
<p>The INIR team was informed that launching a train-the-trainers programme to convert experienced conventional teachers in fundamental fields to nuclear science and engineering teachers will be performed after the Government has taken the decision to build a nuclear power plant.</p>		
<p>The INIR team was informed that a research reactor is being considered at the Université de Niamey and could be used as a complementary training tool for the nuclear power programme.</p>		
<p>The training costs for each key organization (for all phases except construction) have been evaluated as 398 million CFA francs for the NEPIO, 739 million CFA francs for ARSN and 8800 million CFA francs for the operating organization.</p>		

The INIR team considers that the approach to developing human resource development plans does not take into account when competent staff need to be available, the recruitment process time and does not fully consider the training duration.

<b>Areas for further action</b>	<b>Significant</b>	Approach to human resource development plans
	<b>Minor</b>	Implementation of human resource development strategy

**RECOMMENDATIONS**

**R-10.2.1** CTNPEN should revise its approach to developing human resource development plans to take into account when competent staff need to be available for Phases 2 and 3, the recruitment process time and the training duration.

**SUGGESTIONS**

**S-10.2.1** CTNPEN is encouraged to implement the human resource development strategy as soon as the government has taken the decision to build the nuclear power plant.

**GOOD PRACTICES**

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<b>11. Stakeholder Involvement</b>		<b>Phase 1</b>
<b>Condition 11.1: Open and transparent stakeholder involvement programme initiated</b>		
<b>Summary of the condition to be demonstrated</b>	Stakeholder involvement strategy and plan, with the required resources and competence, implemented by the NEPIO based on transparency and openness. The public, and other relevant interested parties, receive information about the benefits and risks of nuclear power, including the non-zero potential for severe accidents.	
<b>Examples of how the condition may be demonstrated</b>	<ol style="list-style-type: none"> <li>1. A clear mandate for the NEPIO to engage with stakeholders;</li> <li>2. Actions to disseminate information in the context of the national energy outlook, policy and needs, and pros and cons of all sources of energy, using a range of effective tools;</li> <li>3. Evidence of a professional communication team available to the NEPIO, with appropriate financial resources;</li> <li>4. Results of surveys to determine the public's knowledge and receptiveness to nuclear power;</li> <li>5. Approaches to address public concerns, including waste management and severe accidents;</li> <li>6. Evidence of activities at the local, regional and national level;</li> <li>7. A plan for ongoing interaction with the public, in particular, opinion leaders, media, local and national governmental officials and neighbouring countries;</li> <li>8. Plans for regular opinion polls managed by specialist companies;</li> <li>9. A training programme to enable identified spokespersons to interact with stakeholders.</li> </ol>	
<b>Observations</b>		
<p>CTNPEN has created a subcommittee on communication and stakeholder involvement with the mandate to propose a communication plan and to cooperate with other subcommittees for building a national position in favor of the programme. The subcommittee has already developed a communication plan and a strategy to implement the plan, including a definition of the objectives and identification of relevant stakeholders.</p> <p>The INIR team was informed that the subcommittee on communication and stakeholder involvement acts as the interface with all stakeholders for matters relating to the nuclear power programme. HANEA and CTNPEN work in close collaboration and coordinate their respective stakeholder involvement activities.</p> <p>The subcommittee has developed a training programme to build team capacity and the programme implementation has already begun.</p> <p>Awareness days on the peaceful uses of nuclear energy and on the advantages and disadvantages of nuclear power have been organized. Surveys on the acceptability of nuclear power are planned. CTNPEN has requested the Laboratory for Studies and</p>		

Research on Social Dynamics and Development (Laboratoire d'Etudes et de Recherche sur les Dynamiques Sociales et le Développement (LASDEL)) to conduct an analysis of the behavior and concerns of populations facing modern energy options. CTNPEN has also requested the National Institute of Statistics to conduct a survey on the level of knowledge and acceptability for nuclear science and techniques in general and for nuclear power in particular.

HANEA has conducted awareness days with participation of all the members of the Parliament regarding the importance of adhering to the conventions. It also organized a national awareness seminar for ministers, to explain what is nuclear, what are the benefits and risks, including also explanations on other uses of nuclear technologies.

The INIR team was informed that Niger presented its plans for a nuclear power programme during the first meeting of the West African Integrated Nuclear Power Group (WAINPG) held in Niamey in July 2015. In addition, Niger conducted a sub-regional tour to inform other countries of its plans and explore possibilities of cooperation, including the possibility to join it if they so wish.

<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	-

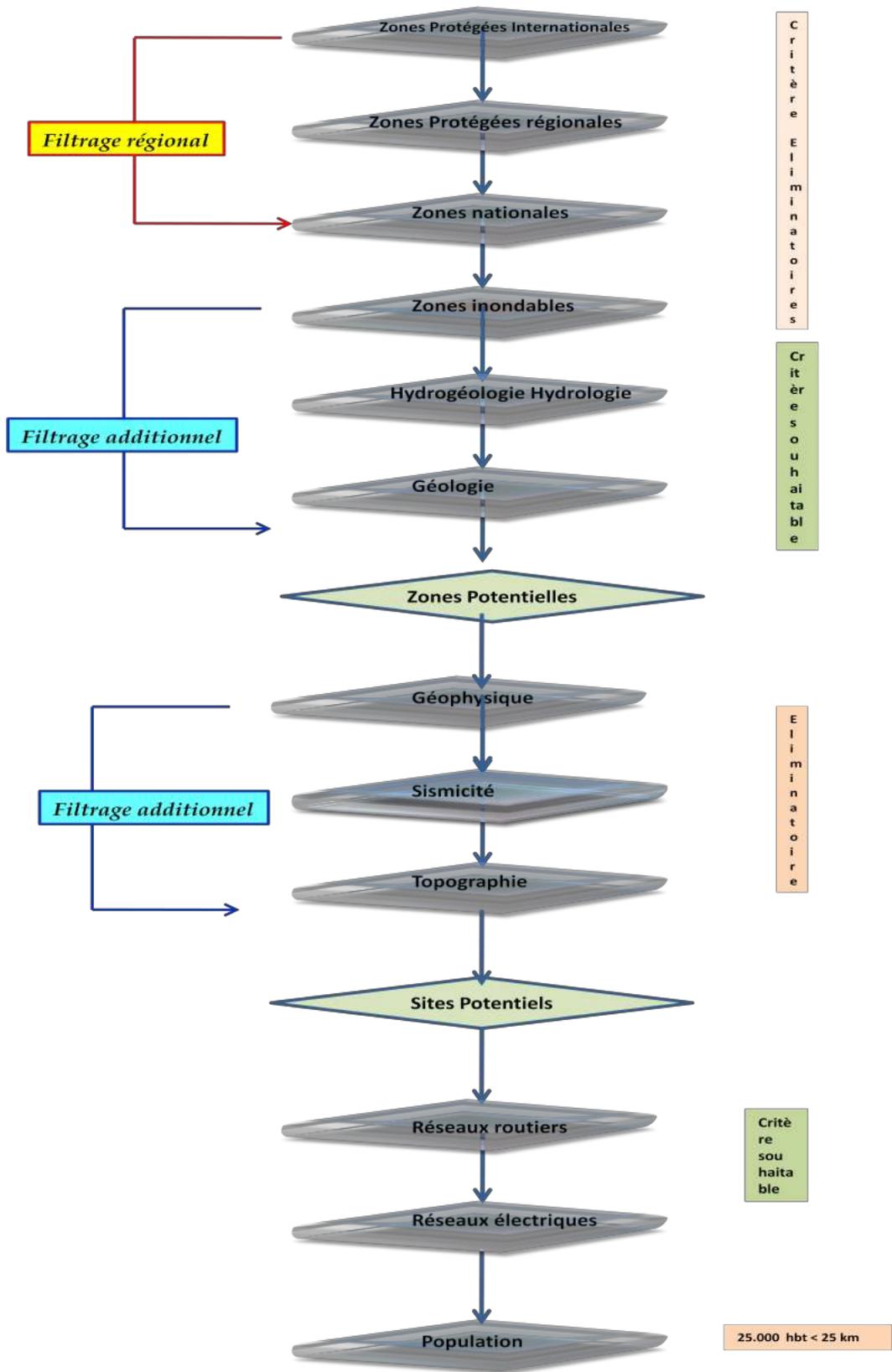
**RECOMMENDATIONS**

**SUGGESTIONS**

**GOOD PRACTICES**

**GP-11.1.1** Engagement with neighbouring countries to inform them of Niger's plans and explore possibilities of cooperation and participation in the project.

<b>12. Site and supporting facilities</b>		<b>Phase 1</b>
<b>Condition 12.1: General survey of potential sites conducted and candidate sites identified</b>		
<b>Summary of the condition to be demonstrated</b>	Exclusion and avoidance criteria (covering safety, security, cost, socioeconomic issues, engineering and the environment) have been identified and regional analysis to identify candidate sites has been conducted. The analysis includes the impact of external hazards on security and emergency response capability. Consultations with stakeholders have been part of the process.	
<b>Examples of how the condition may be demonstrated</b>	<ol style="list-style-type: none"> <li>1. A report covering: <ol style="list-style-type: none"> <li>a) Safety and security criteria for initial NPP site selection;</li> <li>b) National criteria (e.g. socioeconomic and environmental);</li> <li>c) Engineering and cost criteria.</li> </ol> </li> <li>2. An assessment report issued and approved identifying: <ol style="list-style-type: none"> <li>a) Regional analysis and identification of potential sites;</li> <li>b) Screening of potential sites and selection of candidate sites.</li> </ol> </li> <li>3. Evidence that the resources that were used for NPP site selection are competent and have experience with NPP site selection.</li> <li>4. Plans for the work that will be required in Phase 2 to select and justify the site.</li> <li>5. Evidence that safety and security related activities conducted (e.g. site evaluation and environmental impact studies) are included within the framework of an effective management system.</li> </ol>	
<b>Observations</b>		
<p>The subcommittee for siting developed a methodology for regional analysis using exclusion and avoidance criteria.</p> <p>The process used is summarized in the figure below:</p>		



Based on a review of the provisions of the SSUPEA Law and the guides of the IAEA, the following criteria were identified:

- Exclusion of areas protected by national or international laws and agreements, identified by the Ministry of the Environment;
- Exclusion of areas subject to flooding. These were identified from maps showing the main flood plains of the country;
- Exclusion of desert areas;
- Exclusion of security-sensitive areas;
- Exclusion of areas more than 5km from water sources, either surface or underground water. A series of studies had been carried out to identify the availability of significant quantities of underground water;
- Exclusion of areas without suitable bedrock close to the surface based on expert judgement of national experts;
- Exclusion of areas within a defined distance of a seismically active fault. (The distance being dependent on the length of the fault);
- Exclusion of areas with unsuitable topography based on expert judgement of national experts.

Using a Geographical Information System, the criteria were used in a desktop study to identify 4 potential areas for a nuclear power plant. Within those areas 18 potential sites were defined.

These sites were then plotted on the road network and the electrical network and the experts concluded that all the potential sites were sufficiently close to the road and electrical networks. The INIR team was informed that all the potential sites are within the areas covered by the grid study.

In order to give greater confidence that suitable sites are available at a cost that will make the project viable, field visits to the potential sites to confirm the validity of the data used (some of the maps were from 1971) are planned and more quantitative criteria will be applied.

Following this initial screening, a set of criteria with weightings will be used to identify the preferred candidate sites. The subgroup has already identified parameters for which criteria will be defined.

As part of developing their competence, the siting team has had discussions with experts in South Africa and Morocco, and participated in IAEA workshops. A visit to learn from the siting of an inland project in China is under discussion. Niger is also keen to learn from the experience of Palo Verde (USA).

With respect to water resources a specific working group has reviewed several studies and has identified renewable groundwater at potential sites at depths ranging from 7 m to 85 m below ground. The INIR team was informed that the preference is to use surface water in order to reduce the cost but at this stage the NEPIO wish to keep a wider range of potential sites available.

A plan is available for the next stage of the work that identifies 15 months to complete the site selection process.

<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	Additional review of potential sites
<b>RECOMMENDATIONS</b>		
<b>SUGGESTIONS</b>		
S-12.1.1 CTNPEN is encouraged to carry out field visits to the potential sites to confirm the validity of the data used and apply additional quantitative criteria.		
<b>GOOD PRACTICES</b>		

<b>13. Environmental Protection</b>		<b>Phase 1</b>
<b>Condition 13.1: Environmental requirements considered</b>		
<b>Summary of the condition to be demonstrated</b>	The NEPIO has considered the main environmental requirements related to the siting of an NPP, including land use, water use, water quality and the impacts of low level radioactive effluents.	
<b>Examples of how the condition may be demonstrated</b>	<ol style="list-style-type: none"> <li>1. Identification of key requirements for siting and during construction;</li> <li>2. Evidence of discussions by specialists with States operating nuclear power;</li> <li>3. Evidence that the non-radiological environmental issues, such as water use, transport of materials, disposal of hazardous waste, additional environmental monitoring requirements and construction impact, have been considered and taken into account by the NEPIO.</li> </ol>	
<b>Observations</b>		
<p>Members of the Ministry of Environment are part of the CTNPEN siting subcommittee. The exclusion criteria have taken into account the many environmentally protected zones. The importance of securing cooling water and drinking water during the construction as well as operation phase was also recognized.</p> <p>In addition, the subcommittee has prepared a document summarizing all the environmental requirements included in legal documents (laws, ordonnances, décrets and arrêtés). This contains over 40 specific references to environmental requirements, in particular the Law No. 98-56 provides for the need to protect the atmosphere, the water resources and the soil.</p> <p>The INIR team was informed that environmental experts from Niger visited South Africa in 2017 and discussed the environmental issues to be addressed in a nuclear power programme, particularly for inland and river sites.</p> <p>The subcommittee has also reviewed relevant documents by the IAEA, the European Union and the USA.</p>		
<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	-
<b>RECOMMENDATIONS</b>		
<b>SUGGESTIONS</b>		

<b>GOOD PRACTICES</b>		
<b>Condition 13.2: Framework for environmental protection reviewed</b>		<b>Phase 1</b>
<b>Summary of the condition to be demonstrated</b>	The NEPIO has reviewed the suitability of the State's existing framework for environmental protection and for meeting its international obligations.	
<b>Examples of how the condition may be demonstrated</b>	<ol style="list-style-type: none"> <li>1. Procedures developed for the elaboration, reporting and assessment of environmental studies for nuclear and other related facilities;</li> <li>2. Evidence of interactions by specialists with States operating nuclear power.</li> </ol>	
<b>Observations</b>		
<p>A procedure for the development and review of an Environmental Impact Assessment (EIA) is already in place. As Niger has a large uranium mining industry, this procedure already includes consideration of radiological impact. The procedure was developed on the basis of the Decree No. 2000-398 issued in 2000, which includes considerations related to nuclear power plant activities. The INIR team was informed that no changes are required to carry out an EIA for a nuclear power plant.</p> <p>The terms of reference for the EIA have already been prepared, taking into account all the legal documents identified (see Condition 13.1).</p>		
<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	-
<b>RECOMMENDATIONS</b>		
<b>SUGGESTIONS</b>		
<b>GOOD PRACTICES</b>		

<b>14. Emergency Planning</b>		<b>Phase 1</b>
<b>Condition 14.1: Requirements of, and resources for, developing an emergency response capability recognized</b>		
<b>Summary of the condition to be demonstrated</b>	<ol style="list-style-type: none"> <li>1. The NEPIO is aware of the EPR arrangements and capabilities that will be required for the nuclear power programme. It has evaluated existing EPR arrangements and capabilities in the country and is aware of the major gaps that will need to be addressed.</li> <li>2. The NEPIO has identified the main organizations and resources that will need to be involved in the establishment of adequate national EPR capabilities.</li> <li>3. The lead for the execution of the action plan and the action plan coordination framework has been identified.</li> </ol> <p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>a) The process of developing adequate EPR will be initiated in Phase 2 and will be largely carried out in Phase 3;</li> <li>b) The requirements of the conventions on early notification and assistance are covered under infrastructure issue No. 5, legal framework.</li> </ol>	
<b>Examples of how the condition may be demonstrated</b>	Report summarizing existing EPR arrangements and capabilities and identifying those to be enhanced and/or developed as well as identifying the main organizations and resources that will need to be involved in the establishment of adequate national EPR capabilities.	
<b>Observations</b>		
<p>Niger has various documents defining the governmental organization and responsibilities to respond to emergencies and disasters at different levels (national, local), including a Law on the Organization of Civil Protection (Organisation de la Réponse de Sécurité Civile (ORSEC)) and an implementing decree for developing ORSEC plans. These documents identify the roles and responsibilities of responding organizations, their capabilities and the coordination mechanisms.</p> <p>The national context is characterized by a concern regarding the general security environment in the Sahel, large quantities of radioactive tailings stored at uranium mine sites, radioactive waste resulting from current activities using radioactive sources and the interest of Niger for a nuclear power programme.</p> <p>Niger recognizes the necessity to enhance its capabilities to respond to nuclear or radiological emergencies considering the national context and the need to comply with international obligations.</p> <p>The SSUPEA Law contains provisions in Chapter IV for emergency response, including the requirement for the submission of emergency plans to ARSN during the licensing process for approval. The SSUPEA Law provides also for the development of a national plan for nuclear or radiological emergencies and for public information and notification to the IAEA in the case of an emergency with transboundary radiological consequences.</p>		

The CTNPEN Emergency Response working group has developed a draft document addressing the national policy, the national strategy and the national response plan. This document proposes the establishment of two national committees: the Inter-Ministerial Committee, chaired by the Prime Minister, co-chaired by the Ministry of Interior; and the National Technical Committee, chaired by the Direction Générale de la Protection Civile. The expert organizations, such as ARSN and HANEA, are part of these committees.

The INIR team was informed that Niger will issue a new decree pursuant to Law No. 2017-06 on the Organization of the Civil Protection and the SSUPEA Law. This Decree will provide for the establishment of the National Response Plan, the Inter-Ministerial Committee and the National Technical Committee.

Niger has identified actions to enhance EPR capabilities and resources arising from the nuclear security instruments such as the Integrated Nuclear Security Support Plan (INSSP) with the IAEA and the Chemical Biological Radiological and Nuclear Risk Mitigation Center of Excellence with the European Union. These address planning, training, response actions, equipment and exercises. The INIR team was informed that the development of EPR capabilities considers among others the acquisition of a decontamination unit by the Civil Protection and the medical response capability to handle radiation injuries.

However, the INIR team considers that the evaluation of existing EPR capabilities in the country and the identification of major gaps required for the nuclear power programme needs to be documented considering the relevant IAEA EPR Requirements.

<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	Document assessment of EPR capabilities

**RECOMMENDATIONS**

**SUGGESTIONS**

**S-14.1.1** CTNPEN is encouraged to document the assessment of the existing emergency preparedness and response (EPR) capabilities and major gaps identified in accordance with the relevant IAEA EPR requirements.

**GOOD PRACTICES**

<b>Condition 14.2: Recommendations from any previous reviews or audits being addressed</b>		<b>Phase 1</b>
<b>Summary of the condition to be demonstrated</b>	If any reviews or audits have been undertaken of the existing framework, there is evidence that the actions resulting from it are progressing.	
<b>Examples of how the condition may be demonstrated</b>	Presentation of any action plans resulting from a review or audit with progress identified.	

**Observations**

An IAEA International Nuclear Safety and Security Advisory Service (INSServ) mission was conducted in Niger in December 2008. The main recommendation was related to developing, implementing and exercising Niger's nuclear or radiological emergency response plan and procedures.

Niger has made significant progress in addressing this recommendation.

**Areas for further action****Significant**

-

**Minor**

-

**RECOMMENDATIONS****SUGGESTIONS****GOOD PRACTICES**

<b>15. Nuclear Security</b>		<b>Phase 1</b>
<b>Condition 15.1: Nuclear security requirements recognized and the actions of all relevant organizations coordinated</b>		
<b>Summary of the condition to be demonstrated</b>	<p>The NEPIO recognizes the importance of nuclear security, based on a national threat assessment and principles of prevention, detection and response. All competent authorities that are involved in nuclear security have been identified and there is a coordinating body or mechanism established that brings together all of the organizations that have responsibility for nuclear security.</p> <p><b>Note:</b> The need to establish legislation and a regulatory framework is addressed under infrastructure issues Nos 5 and 7, legal framework and regulatory framework, respectively.</p>	
<b>Examples of how the condition may be demonstrated</b>	<ol style="list-style-type: none"> <li>1. Evidence of familiarity with IAEA Nuclear Security Series publications and other States' practices;</li> <li>2. Clear identification of all organizations that have roles and responsibilities for nuclear security and of the work that will need to be carried out in the subsequent phases;</li> <li>3. Evidence that nuclear security considerations for siting have been defined and have been considered as part of the siting assessment (see infrastructure issue No. 12, site and supporting facilities);</li> <li>4. Evidence that international cooperation and assistance is being used;</li> <li>5. Evidence that the need to address the interface with safety and safeguards is recognized.</li> </ol>	
<b>Observations</b>		
<p>Niger has a well-established national security structure.</p> <p>Niger is party to the Convention on the Physical Protection of Nuclear Material and its Amendment and has expressed its support for the Code of Conduct on the Safety and Security of Radioactive Sources and for the Guidelines for the Import and Export of Radioactive Sources.</p> <p>The SSUPEA Law contains provisions on the physical protection of nuclear and other radioactive material, including provisions on the categorization of material and the establishment of physical protection requirements, the obligations of authorized persons, and arrangements for international cooperation and assistance.</p> <p>The INIR team was informed that Niger is preparing a decree to list the competent authorities and their respective functions in the area nuclear security. This decree will also identify the coordinating organization.</p> <p>CTNPEN has created a sub-committee on nuclear security to propose the elements of a nuclear security regime for Niger.</p>		

Niger adopted the INSSP in 2010. The last review of the INSSP took place in 2017. A roadmap has been drafted for the development of the national nuclear security policy and strategy, including the design basis threat. Also, regarding intervention, a plan is being prepared with the identification of the responsibilities of each organization, which would be put in place in cases of terrorist or criminal events.

The Technical and Scientific Advisory Board (Conseil Technique et Scientifique Consultatif (CTSC)) is an advisory committee to CTNPEN. The Article 4 of the order creating the CTSC provides that CTSC is the National Nuclear Security Committee (Comité National de Sécurité Nucléaire).

CTSC is working on developing and adapting the national security regime to the requirements of a nuclear power programme.

In 2014, Niger became a member of the International Network for Nuclear Security Training and Support Centers. Niger intends to establish a National Nuclear Security Support Center.

<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	-

**RECOMMENDATIONS**

**SUGGESTIONS**

**GOOD PRACTICES**

<b>Condition 15.2: Recommendations from any previous reviews or audits being addressed</b>	<b>Phase 1</b>
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<b>Summary of the condition to be demonstrated</b>	If any reviews or audits have been undertaken of the existing framework, there is evidence that the actions resulting from it are progressing.
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<b>Examples of how the condition may be demonstrated</b>	Presentation of any action plans resulting from a review or audit with progress identified.
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**Observations**

Niger received an IAEA INSServ mission, held from 1 to 5 December 2008, in Niamey.

The INIR team was informed that the recommendations of the mission have been implemented.

<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	-
<b>RECOMMENDATIONS</b>		
<b>SUGGESTIONS</b>		
<b>GOOD PRACTICES</b>		

<b>16. Nuclear Fuel Cycle</b>		<b>Phase 1</b>
<b>Condition 16.1: Options for nuclear fuel cycle (front end and back end) considered</b>		
<b>Summary of the condition to be demonstrated</b>	At a strategic level, options have been considered for the front end and back end of the fuel cycle. For the front end, options for uranium sourcing and fuel manufacture and supply have been addressed. For the back end of the fuel cycle, spent fuel storage needs and capacities (on-site and off-site) and possible reprocessing have been considered.	
<b>Examples of how the condition may be demonstrated</b>	<ol style="list-style-type: none"> <li>1. A document: <ol style="list-style-type: none"> <li>a) Identifying available national natural resources and capacities for individual steps in the nuclear fuel cycle;</li> <li>b) Identifying potential sources of supply and services;</li> <li>c) Assessing available options for a national fuel cycle strategy, taking into account non-proliferation issues.</li> </ol> </li> <li>2. A document clearly demonstrating that the NEPIO understands the long-term commitments related to the back end of the nuclear fuel cycle and has considered the options and their implications. The document needs to address the need for adequate capacity for spent fuel storage at the reactor site, the possibility of interim storage of spent fuel at a dedicated facility and any plans for reprocessing;</li> <li>3. Clear allocation of responsibilities for development of the fuel cycle policy and strategy (front end and back end) to be undertaken during Phase 2.</li> </ol>	
<b>Observations</b>		
<p>CTNPEN's analysis of the fuel procurement options concluded that Niger would procure fuel from the vendor, while requiring it to use uranium from Niger. The INIR team was informed that using the national resource is a key consideration in launching the nuclear power programme, and that the use of uranium from Niger would ensure cost stability.</p> <p>Niger intends to conclude a 10-year renewable contract for fuels supplies and to keep on-site inventories of fresh fuel for up to 6 operating cycles.</p> <p>The INIR team was informed that the NEPIO intends to hold discussions with Hitachi and Westinghouse on fuel supply.</p> <p>Based on considerations of the options for the back-end of the fuel cycle, the NEPIO proposed to opt for an open cycle for the first plant with long term management for spent fuel in Niger. The NEPIO considered that return to the supplier country is almost impossible to implement. The INIR team was informed that a two-step management strategy is considered with long-term storage followed by final deep underground disposal. The INIR team noted that the on-site and off-site storage capacities have not been assessed.</p>		

<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	Capacity for on-site and off-site spent fuel storage
<b>RECOMMENDATIONS</b>		
<b>SUGGESTIONS</b>		
<p><b>S-16.1.1</b> CTNPEN is encouraged to assess the required capacity for on-site and off-site spent fuel storage.</p>		
<b>GOOD PRACTICES</b>		

<b>17. Radioactive Waste</b>		<b>Phase 1</b>
<b>Condition 17.1: The requirements for management of radioactive waste from NPPs recognized</b>		
<b>Summary of the condition to be demonstrated</b>	The NEPIO understands the significantly increased requirements for the processing, storage and disposal of high, intermediate and low level radioactive waste from a nuclear power programme, and has developed options for the management of radioactive waste, taking into account existing arrangements.	
<b>Examples of how the condition may be demonstrated</b>	A document addressing possible approaches to the management of radioactive waste arising from NPP operation and decommissioning, the capabilities and resources needed, and the options and technologies for its processing, handling, storage and disposal. If reprocessing is being considered, this needs to include the management of high level waste. Regulatory framework and financing schemes are addressed under infrastructure issues Nos 7 and 4, regulatory framework, and funding and financing, respectively.	
<b>Observations</b>		
<p>The CTNPEN waste management working group is developing a draft policy and strategy (Document de Politique et de Stratégie Nationale en Matière de Gestion des Déchets Radioactifs).</p> <p>The draft document prepared by this working group mentions five types of radioactive waste: nuclear radioactive waste, contaminated materials from the scrap industry, sealed radioactive sources, spent nuclear fuel, naturally occurring radioactive material (NORM). Among various elements to be addressed in the strategy, it introduces the concepts of classification and characterization of waste but it does not include considerations of any corresponding approach.</p> <p>The INIR team noted that the working group has not considered the order of magnitude amounts of radioactive waste from the nuclear power programme to be stored, processed or disposed of, in the various categories of waste. The INIR team was informed that CTNPEN has not yet considered options for the processing, conditioning and storage of the various categories of waste streams arising from the operation of the nuclear power plant. A strategy will be developed on waste processing, based on requirements to be set by ARSN. CTNPEN is considering a two-stage management strategy for radioactive waste, comprising first on-site storage, followed by transfer to the national waste management facility.</p> <p>The INIR team was informed that Niger has arrangements for exchanges with the IAEA and countries such as South Africa, Korea, France, USA and Morocco in the area of waste management.</p>		
<b>Areas for further action</b>	<b>Significant</b>	Evaluation of amounts of waste and options
	<b>Minor</b>	-

<b>RECOMMENDATIONS</b>		
<p><b>R-17.1.1</b> CTNPEN should make a preliminary evaluation of the order of magnitude amounts of radioactive waste from the nuclear power programme and of the options for the management of the various waste types.</p>		
<b>SUGGESTIONS</b>		
<b>GOOD PRACTICES</b>		
<b>Condition 17.2: Options for disposal of all radioactive waste categories understood</b>		<b>Phase 1</b>
<b>Summary of the condition to be demonstrated</b>	The NEPIO understands the options for disposal of each of the different waste categories. Although the specific routes for disposal of the different waste categories (including spent fuel if considered as waste) can be decided later, the need to select and plan for adequate options is recognized.	
<b>Examples of how the condition may be demonstrated</b>	A document indicating that the NEPIO understands options for disposal of different radioactive waste categories and options for funding these activities.	
<b>Observations</b>		
<p>As part of the two-stage management strategy for radioactive waste, it is envisioned that the final disposal of high-level waste will be deep underground disposal, in a site to be identified later.</p> <p>The INIR team noted that there are no considerations on the disposal options for low and medium level waste.</p>		
<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	-
<b>RECOMMENDATIONS</b>		
See recommendation R-17.1.1		
<b>SUGGESTIONS</b>		
<b>GOOD PRACTICES</b>		

<b>18. Industrial Involvement</b>		<b>Phase 1</b>
<b>Condition 18.1: National policy with respect to industrial involvement developed</b>		
<b>Summary of the condition to be demonstrated</b>	A policy for national involvement in the nuclear power programme has been developed, taking into account current industrial capacity and technical services, current and required quality standards, and potential investment requirements. The policy may include short term and long-term targets for industrial involvement.	
<b>Examples of how the condition may be demonstrated</b>	<ol style="list-style-type: none"> <li>1. A survey of companies with the potential to participate in the nuclear power programme for construction, equipment provision or support services, with a review of their ability to satisfy the requirements of a nuclear power programme.</li> <li>2. Meetings with, or training of, potential suppliers to explain standards and qualifications required, review feasibility of involvement, and identify required actions and funding requirements.</li> </ol>	
<b>Observations</b>		
<p>The CTNPEN industrial development subcommittee is developing a draft National Industry Development Policy document.</p> <p>The subcommittee has conducted an analysis of the national industry capacity to participate in the nuclear power programme which shows that the national industry is not ready to provide equipment and services related to safety. The analysis has identified 139 potential companies, which all need to be upgraded to meet the nuclear requirements. Twelve companies are ISO 9001 certified.</p> <p>The INIR team was informed that Niger is aware of the rigorous requirements needed for a national industry to be qualified to provide equipment or services to the nuclear programme.</p> <p>The subcommittee has developed a strategy for the development and upgrading of the national Industry. This document outlines some incentives, such as tax rebate, that the Government may grant companies to upgrade to nuclear standards.</p> <p>Niger plans to support national industries that fulfil some criteria (human resources qualification, economical solvency, entrepreneurs' attitude, etc.) and turn them into national champions through training, introduction of quality system etc., which should lead to the required change in culture.</p> <p>The INIR team was informed that a seminar with potential national industry 'champions' took place in HANEA premises to inform them on nuclear requirements. The Government will encourage national industries to form consortia.</p> <p>The INIR team was informed that the existing Bureau de Restructuration et de Mise à Niveau at the Ministry of Industry will play an important role in the process of upgrading the national industry to nuclear standards.</p>		

The INIR team was informed that discussions with two potential vendors were held to highlight the great interest of Niger in involving national industries in the nuclear power programme.

The INIR team noted that the National Industrial Development Policy still needs to be completed to cover in more detail the Development and Upgrading of the national industry.

<b>Areas for further action</b>	<b>Significant</b>	National Industry Development Policy
	<b>Minor</b>	-

**RECOMMENDATIONS**

**R-18.1.1** CTNPEN should complete the National Industry Development Policy taking into account the required standards for equipment and services, the extent and timing of the nuclear power programme and potential investment requirements.

**SUGGESTIONS**

**GOOD PRACTICES**

<b>19. Procurement</b>		<b>Phase 1</b>
<b>Condition 19.1: Requirements for purchasing NPP services recognized</b>		
<b>Summary of the condition to be demonstrated</b>	Recognition of the requirements associated with purchasing services.	
<b>Examples of how the condition may be demonstrated</b>	<ol style="list-style-type: none"> <li>1. Appropriate procurement of consulting services in Phase 1;</li> <li>2. Evidence that the issues related to services for Phase 2 activities are recognized, allowing for both national and foreign suppliers.</li> </ol>	
<b>Observations</b>		
<p>Niger has a set of legal instruments to regulate public procurement: the public procurement code established by the Law No. 2011-37 of 28 October 2011 (Loi portant principes généraux, contrôle et régulation des marchés publics et des délégations de service public au Niger) and its implementing regulations including the Decree No. 2013/569/PRN/PM of 20 December 2013.</p> <p>The public contract code sets the thresholds for non-competitive contracts, restricted consultations, national competitive bidding and international competitive bidding. It determines the specifications required for each type of contract and the necessary checks and assessments before, during and after the receipt of goods and services.</p> <p>The INIR team was informed that HANEA refers to Law No. 2011-37 for the procurement of services.</p> <p>The INIR team was informed that HANEA is developing an accounting procedure manual considering the quality requirements for purchases of goods and services in Phase 1 and 2, based on the IAEA publications, including the IAEA Nuclear Energy Series No. NG-T-3.9 and No. NP-T-3.21, as well as accounting procedures manuals from Nigelec, SONICHAR and the Gorou Banda power plant. The manual has set a threshold for restricted consultations, specialized tenders, national competitive bidding and international competitive bidding.</p> <p>The INIR team was informed that HANEA has a process of purchasing services (including studies, plans and strategies), (Procedure for the Purchase of Goods and Services 02/P MGT/21), which includes the definition of the objectives of the studies and services, the quality requirements for the service and the supplier, the system for monitoring the performance and progress, the system for the approval or rejection of the services and the means and methods of settlement of the services. This procedure has been used to purchase some studies such as the public opinion survey on the nuclear power programme.</p> <p>The INIR team was informed that the purchase of products or services that have an impact on safety, security, quality of services and the environment is evaluated based on the robustness of the references provided by the service provider(s), the quality of the proposals and the value for money. In addition, checks and verifications of compliance with standard specifications or safety requirements are carried out.</p>		

The INIR team was informed that the service level of the approved suppliers is monitored by the HANEA quality manager who compiles the ‘supplier anomalies’ in the supplier database.

The evaluation process, the choice of the supplier and the monitoring of supplier performance are described in the supplier evaluation procedure, (Procédure d’Evaluation des Fournisseurs Référence 03/P RH/29).

The INIR team was informed that the NEPIO is considering training or hiring experts in procurement to take care of specific nuclear issues (control of nonconformities, supplier’s technical capability, etc.).

<b>Areas for further action</b>	<b>Significant</b>	-
	<b>Minor</b>	-

**RECOMMENDATIONS**

**SUGGESTIONS**

**GOOD PRACTICES**

## APPENDIX 2: LISTS OF THE INIR TEAM MEMBERS AND COUNTERPARTS

INIR MISSION REVIEW TEAM	
Anthony STOTT	Team Leader, IAEA
Thibaud REYSSET	Mission Coordinator, IAEA
Abdellah CHAHID	IAEA
Jean-René JUBIN	IAEA
Benoît LEPOUZE	IAEA
Fanny TONOS PANIAGUA	IAEA
Marc-Gérard ALBERT	International Expert
Julio BARCELO	International Expert
Alain CARDOSO	International Expert
Stephen MORTIN	International Expert
Itimad SOUFI	International Expert
François FOULON	IAEA (Observer)

<b>PARTICIPANTS FROM NIGER</b>			
	<b>INFRASTRUCTURE ISSUE</b>	<b>REPRESENTATIVE</b>	<b>RESPONSIBLE ORGANIZATION(S)</b>
<b>1</b>	<b>National position</b>	MINDAOUDOU SOULEY Zeinabou KAMBÉIDOU Abdelnasser DJIBO TAKOUBAKOYE Daouda	HANEA-Cab PRN CAPEG- Cab PM HANEA- Cab PRN
<b>2</b>	<b>Nuclear safety</b>	SIDIBE O. Mahamadou ALI Djibo LAWALI Fatima	ARSN HANEA ARSN
<b>3</b>	<b>Management</b>	DJIBO TAKOUBAKOYE Daouda BONAVENTURE TOHON Dina LAMINOU ABDOU Issoufou	HANEA HANEA HANEA
<b>4</b>	<b>Funding and financing</b>	Dr. SEYNI Almoustapha DJIBO TAKOUBAKOYE Daouda MM YOUSOUF MARIAMA Mme Ali HAOUA NASSIBIDO Mohamed SALEY Idé	Ministère du Plan HANEA Présidence de la République Ministère du Plan Assemblée Nationale Ministère des Finances
<b>5</b>	<b>Legal framework</b>	MME MAIGA ZEINABOU Labo SIDIBE O. Mahamadou KANE Issa KALLA Garba	Ministère de la Justice CNRP HANEA Ministère de la Justice
<b>6</b>	<b>Safeguards</b>	ALI Djibo MME MAIGA ZEINABOU Labo SIDIBE O. Mahamadou	ARSN Ministère de la Justice ARSN
<b>7</b>	<b>Regulatory framework</b>	SIDIBE O. Mahamadou MME MAIGA ZEINABOU Labo LAWALI Fatima	ARSN Ministère de la Justice ARSN
<b>8</b>	<b>Radiation protection</b>	SIDIBE O. Mahamadou MME MAIGA ZEINABOU Labo KANE Issa	ARSN Ministère de la Justice HANEA

9	<b>Electrical grid</b>	SOUMANA Amadou CISSE Alzouma SANOUSI ZABEIROU	Ministère de l’Energie NIGELEC Ministère de l’Energie Ministère de l’Energie
10	<b>Human resource development</b>	Pr. OUSMANE Manga NOMA Maazou MINDAOUDOU SOULEY Zeinabou	Université de Niamey Ministère des Transports HANEA
11	<b>Stakeholder involvement</b>	KEBE Ousmane YAROH Fatchima MALAM ISSA Rabiou YAROH Asma ZANGUINA Mariam Ousmane	Présidence de la République HANEA Société Civile Ministère de la Santé HANEA
12	<b>Site and supporting facilities</b>	DJIBO MAIGA Abdourwahab RABÉ Sanoussi DJIBO HAROUNA Abdou MME BAZI Khadidjatou M NI TAO	HANEA Ministère de l’Hydraulique Ministère de l’Environnement Ministère de l’Environnement SOMINA
13	<b>Environmental protection</b>	DJIBO HAROUNA Abdou MME BAZI Khadidjatou DJIBO MAIGA Abdourwahab Abdoulaye Hamidou	Ministère de l’Environnement Ministère de l’Environnement HANEA SOMAIR
14	<b>Emergency planning</b>	Colonel BAKO AbdoulKarim GREMA MADI Gagi LAWALI Fatima KANE Issa	Direction de la Protection Civile Présidence de la République ARSN HANEA
15	<b>Nuclear security</b>	SIDIBE O. Mahamadou CPP Abdoussalam CPP HAMBALI KANE Issa	ARSN Direction Générale de la Police Direction Générale de la Police HANEA
16	<b>Nuclear fuel cycle</b>	DJIBO Takoubakoye Daouda ABOUBACAR Almoustapha KABEIDOU AbdelNasser	HANEA Cabinet du Premier Ministre CAPEG

<b>17</b>	<b>Radioactive waste management</b>	KANE Issa Dr. MAIKANO	CNRP Ministère de l'élevage
<b>18</b>	<b>Industrial involvement</b>	ABOUBACAR Almoustapha DJIBO Takoubakoye Daouda KABEIDOU AbdelNasser Mme MAITOURARE Aminatou OUSMANE Chaibou  MOUSSA Mohamed Col. MAGAGI Seydou ZAKARI Abdoul-Kader	Cabinet du Premier Ministre HANEA CAPEG Ministère des Transports Ministère des enseignements secondaires Assemblée Nationale Dir. Centrale Génie Militaire Ministère de l'Industrie
<b>19</b>	<b>Procurement</b>	DJIBO Takoubakoye Daouda BONAVENTURE TOHON Dina LAMINOU ABDOU Issoufou	HANEA HANEA HANEA

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## APPENDIX 4: ABBREVIATIONS

ARSN	Autorité de Régulation et de Sûreté Nucléaire
CEDEAO	Communauté Economique Des Etats de l'Afrique de l'Ouest
CNRP	Centre National de Radioprotection
COSPEN	Comité d'Orientation Stratégique pour le Programme Electronucléaire
CPF	Country Programme Framework
CTNPEN	Comité Technique National pour le Programme Electronucléaire
EIA	Environmental Impact Assessment
EPC	Engineering, Procurement and Construction
EPR	Emergency Preparedness and Response
EPREV	Emergency Preparedness Review
FNRBA	Forum of Nuclear Regulatory Bodies in Africa
GOAPENIR	Groupe Ouest Africain pour le Programme Electronucléaire Intégré Régional
HANEA	Haute Autorité Nigérienne à l'Energie Atomique
HLW	High-Level Radioactive Waste
HR	Human Resources
IAEA	International Atomic Energy Agency
IMS	Integrated Management System
INIR	Integrated Nuclear Infrastructure Review
INSServ	International Nuclear Safety & Security Advisory Service
INSSP	Integrated Nuclear Security Support Plan
IPPAS	International Physical Protection Advisory Service
ISSAS	IAEA SSAC Advisory Service
LASDEL	Laboratoire d'Etudes et de Recherche sur les Dynamiques Sociales et le Développement
MME	Ministère des Mines et de l'Energie
MHA	Ministère de l'Hydraulique et de l'Assainissement

NEPIO	Nuclear Energy Programme Implementing Organization
NORM	Naturally Occurring Radioactive Material
NPP	Nuclear Power Plant
ORSEC	Organisation de la Réponse de Sécurité Civile
PDES	Plan de Développement Economique et Social
RCF	Regulatory Cooperation Forum
SER	Self-Evaluation Report
SSAC	State System of Accounting for and Control of nuclear material
SSUPEA	Sûreté, Sécurité et Utilisation Pacifique de l’Energie Atomique
TC	Technical Cooperation
TSO	Technical Support Organization
WAINPG	West African Integrated Nuclear Power Group
WAPP	West African Power Pool