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IAEA-TECDOC-1779

## **Integrated Nuclear Infrastructure Review (INIR) Missions: The First Six Years**



**IAEA**

International Atomic Energy Agency

INTEGRATED NUCLEAR  
INFRASTRUCTURE REVIEW (INIR)  
MISSIONS: THE FIRST SIX YEARS

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INTEGRATED NUCLEAR  
INFRASTRUCTURE REVIEW (INIR)  
MISSIONS: THE FIRST SIX YEARS

INTERNATIONAL ATOMIC ENERGY AGENCY  
VIENNA, 2015

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## FOREWORD

IAEA Integrated Nuclear Infrastructure Review (INIR) missions are designed to assist Member States in evaluating the status of their national infrastructure for the introduction of a nuclear power programme. INIR missions are conducted upon request from the Member State. Each INIR mission is coordinated and led by the IAEA and conducted by a team of IAEA staff and international experts drawn from Member States which have experience in different aspects of developing and deploying nuclear infrastructure.

INIR missions cover the 19 infrastructure issues described in Milestones in the Development of a National Infrastructure for Nuclear Power, IAEA Nuclear Energy Series No. NG-G-3.1, published in 2007 and revised in 2015, and the assessment is based on an analysis of a self-evaluation report prepared by the Member State, a review of the documents it provides and interviews with its key officials. Phase 1 INIR missions evaluate the status of the infrastructure to achieve Milestone 1 (Ready to make a knowledgeable commitment to a nuclear power programme). Phase 2 INIR missions evaluate the status of the infrastructure to achieve Milestone 2 (Ready to invite bids/negotiate a contract for the first nuclear power plant).

From 2009 to 2014, 14 IAEA INIR missions and follow-ups were conducted in States embarking on a nuclear power programme and one State expanding its programme. During this time, considerable experience was gained by the IAEA on the conduct of INIR missions, and this feedback has been used to continually improve the overall INIR methodology. The INIR methodology has thus evolved and is far more comprehensive today than in 2009.

Despite the limited number of INIR missions conducted, some common findings were identified in Member States embarking on nuclear power programmes. This publication summarizes the results of the missions and highlights the most significant areas in which recommendations were made.

The preparation of this publication was based upon contributions from both IAEA staff and external experts. The IAEA wishes to acknowledge the assistance provided by the many contributors listed at the end of this publication. The IAEA officers responsible for this publication were A. Starz and Y. Troshchenko of the Division of Nuclear Power.

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# 1. INTRODUCTION

## 1.1. BACKGROUND

The International Atomic Energy Agency (IAEA) developed and published in 2007 the Milestones document [1] as a guide to help countries interested in establishing a nuclear power programme to work in a systematic way. It defines milestones for the development of the national infrastructure for nuclear power and provides guidance on the activities that need to be carried out before each milestone is achieved. It identifies 19 infrastructure issues that need to be addressed in three phases of development. While each country is unique and will have specific challenges, countries also face common challenges as they progress in building their infrastructure.

Within a short time the Milestones document became widely accepted and used, and countries started requesting IAEA assistance to evaluate the status of their national infrastructure. In 2009, in response to these requests the IAEA created the Integrated Nuclear Infrastructure Review (INIR) mission.

## 1.2. INIR METHODOLOGY

An INIR mission is a holistic review conducted by a team of IAEA staff and international experts who have experience in nuclear infrastructure. The major objective of an INIR mission is to assist Member States in determining areas where further development is needed. While an INIR mission can be requested at any time during the development of the nuclear power programme, it is expected to be arranged in the following sequence:

- (a) Phase 1 mission (close to Milestone 1);
- (b) Follow-up (18 months to 2 years after the Phase 1 mission);
- (c) Phase 2 mission (close to Milestone 2);
- (d) Follow-up (18 months to 2 years after the Phase 2 mission).

Prior to an INIR mission, the country should prepare a self-evaluation report covering the 19 infrastructure issues. The basis for the self-evaluation is presented in the document entitled Evaluation of the Status of National Infrastructure Development [2] which defines the conditions to reach Milestones 1 and 2. Based on the self-evaluation, a country can identify, for each issue, if significant, minor or no actions are needed to reach the milestone and develop an action plan accordingly.

An analysis of the self-evaluation report is performed by the INIR team prior to the mission and areas requiring additional information/clarification are identified. During the INIR mission the team conducts interviews and reviews additional documents to draw its conclusions which may lead to a recommendation, a suggestion or a good practice. These terms are defined as follows [3]:

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

**Suggestions:** Suggestions may indicate useful expansions of existing programmes and point out possible better alternatives to current work. In general, suggestions stimulate the management and staff to consider new or different approaches to develop infrastructure and enhance performance. The bases for each suggestion are clearly documented in the mission report. Suggestions are formulated so that they are succinct and self-explanatory.

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

Experience from previous INIR missions shows that the cycle, which includes preparation of the self-evaluation report, mission preparation and implementation, development of the country action plan and a follow-up mission, can be a catalyst for all involved national organizations to work more closely together.

The INIR methodology itself has evolved from its original conception in 2009 to the refined scope and review process that has been used in the more recent INIR missions. In 2012, INIR missions began to use an updated evaluation methodology, made available as Addendum to the Evaluation of the Status of National Nuclear Infrastructure Development (Working Paper), while a more comprehensive revision of the document was being considered. One of the reasons for the revision was feedback from early missions that there was a significant amount of overlap between the various infrastructure issues and also that some issues were being evaluated in more detail than others. Other reasons for revising the evaluation methodology were to take account of the IAEA publication Establishing the Safety Infrastructure for a Nuclear Power Programme, Safety Standards Series No. SSG-16 [4], the initial lessons learned from the Fukushima-Daiichi accident and to recognize the use of intergovernmental agreements (IGAs) in some countries.

### 1.3. INIR MISSIONS CONDUCTED

Based on countries' requests, the Agency has conducted the INIR missions indicated in Table 1. Since the evaluation methodology was updated, there have been five missions covering Phase 2, and one mission considering only Phase 1.

In 2013, South Africa hosted an INIR mission, the first country with an operating nuclear power plant to do so. The INIR mission conducted in South Africa confirmed that the INIR methodology can be successfully applied in operating countries planning to expand their nuclear power capacity.

TABLE 1. CONDUCTED INIR MISSIONS

No.	Country	INIR mission	Year
1	Jordan	Phase 1&2	2009
2	Indonesia	Phase 1	2009
3	Vietnam	Phase 1	2009
4	Thailand	Phase 1	2010
5	UAE	Phase 2	2011
6	Bangladesh	Phase 1&2	2011
7	Jordan	Follow-up	2012
8	Vietnam	Phase 2	2012
9	Belarus	Phase 1&2	2012
10	South Africa	Phase 2	2013
11	Poland	Phase 1	2013
12	Turkey	Phase 2	2013
13	Jordan	Phase 2	2014
14	Vietnam	Follow-up	2014

#### 1.4. SUMMARY OF THE KEY AREAS FOR FURTHER ACTIONS

Since 2012, the INIR mission reports have included a summary of the key areas for further actions. A review of these summaries has identified five areas that are commonly noted (earlier mission reports also support the identification of these as key areas).

##### **1) The government should complete a national policy for the nuclear power programme.**

A national policy that sets out the national position, and provides the guiding principles to enable the successful introduction of nuclear power is required. National policies do not always clearly state the key principles addressing nuclear safety, nuclear security and non-proliferation; the independence of the regulatory body; responsibilities for waste management; and a commitment to public stakeholder involvement. The national policy should serve as the basis for the revised nuclear legislation. It will also serve as a roadmap for further development of the nuclear power programme and for further elaboration of national requirements for the future owner/operator organization, strategies for waste, stakeholder involvement, contracting strategy, etc.

##### **2) The regulatory framework to support the introduction of nuclear power needs enhancement.**

While the countries have gained experience through the regulation of their current programmes of research reactors and use of radiation sources, the regulatory framework should be strengthened to meet the requirements of the nuclear power programme.

In some countries the regulatory body has a reporting line that is not independent from organizations with promotional responsibilities and requires additional human and financial resources to undertake its regulatory functions.

In other countries the development of a comprehensive set of regulations and guides addressing nuclear safety, security and safeguards requires significant efforts. In addition, the regulatory body's process flows, and procedures for licensing are not always clearly defined.

Coordination among regulatory authorities is not always established and interface arrangements between them are not formalized, for example between the environmental agency and the nuclear regulator.

### **3) Management of the nuclear infrastructure development requires strengthening.**

The coordination between the government and the implementing organizations (the future owner and the regulatory body) does not always allow for timely decisions to be taken and implementation to be facilitated.

A national project plan that includes the relevant actions from national authorities responsible for infrastructure activities necessary for the NPP, timeframes and financial evaluations does not always exist in countries.

In some cases organizations are not well prepared to manage organizational changes as the programme progresses into the next stage after an intergovernmental agreement (IGA) and an organization needs to become a knowledgeable customer to negotiate with the vendor.

Some organizations need to develop comprehensive management systems in accordance with IAEA guidance. It was observed that basic elements for managing the programme, such as organizational structures and procedures may exist but well developed process descriptions, measures to evaluate effectiveness, and other elements of a comprehensive management system have not yet been developed. In addition, arrangements for managing communications between regulators, operators, TSOs and contractors or for defining how safety information will be reviewed in the respective organizations have not been included.

### **4) A comprehensive nuclear energy law should be developed. The relevant international legal instruments should be adhered to and implemented.**

The existing legislative framework in many countries is inadequate to support the planned nuclear power programme since it does not fully reflect the provisions of the relevant international legal instruments. It does not adequately address key areas such as independence of regulatory body, a clear delineation of responsibilities, adequate provisions on licensing, inspection and enforcement, prime responsibility for nuclear safety, emergency preparedness and response, transport of radioactive material, radioactive waste and spent fuel management, decommissioning, nuclear security, civil liability for nuclear damage, safeguards and import/export controls.

The majority of the reviewed countries adhered to the international legal instruments and considered their implementation as high priority. However, some of the conventions, for example, the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management and the Amendment to the Convention on the Physical Protection of Nuclear Material (CPPNM) are not yet adhered to by some of the countries.

### **5) An Integrated Approach to Human Resource Development is needed to support the national nuclear power programme.**

Generally, the key organizations and government departments involved in the nuclear power programme have individually identified their own human resource requirements. However, not all countries have a national plan that ensures that academic, educational and training activities will meet the combined human resource requirements of the government, regulatory bodies, operating organizations and appropriate national industrial organizations. Given the long lead times to educate and train nuclear professionals and specialists, coordination is needed at the national level to provide the necessary system enhancements, build capacity and

ensure that the necessary competent resources are available, consistent with the programme schedule.

More work needs to be done in some countries to finalize the detailed training requirements for staff in the different organizations/functions and to determine how this training will be provided. More coordination is needed between the education and training organizations and the main organizations involved in nuclear power development.

## **2. RESULTS OF THE INIR MISSIONS**

The sections of this chapter contain for each infrastructure issue a summary of the findings and lessons learned from INIR missions, followed by tables with Phase 1 and 2 recommendations and suggestions. For the purpose of this report the name of the country or organization has been removed from the examples of INIR mission recommendations and suggestions.

### **2.1. NATIONAL POSITION**

One of the expectations at the end of Phase 1 is that there is a clear statement that any development of nuclear power fully recognizes the importance of safety, security and non-proliferation as well as evidence in the ongoing work programme. While the latter part is usually clearly evident it has not always been possible to find the ‘clear statement’. Countries are advised to include such a statement in a government policy on nuclear power and/or in their nuclear law.

As a country moves into Phase 2, the majority of the work required to develop the infrastructure moves from NEPIO to three key organisations: the government agency responsible for overseeing the nuclear programme, the regulatory body and the NPP owner/operator. Several countries have found that clearly defining these roles and responsibilities is not as straightforward as it seems. In some countries, no government agency has been established with clearly defined responsibilities for nuclear power development. In some countries, the National Atomic Energy Commission begins to fulfil the role of the owner of the NPP project and is also sometimes the regulatory body. Countries are advised to be clear on which part of government is responsible for the successful implementation of the programme, how and when the ownership of the project will be transferred to the owner/operator of the NPP and when an independent regulatory body for nuclear safety, security and safeguards will be established. The role of any technical support organisation also needs to be clear.

Coordination between these three key organisations is also essential and some countries have not found this easy as the NPP owner/operator and regulatory body become strong independent organisations. Several recommendations address the need to find an appropriate mechanism to fulfil the NEPIO function of co-ordinating the work of all the organisations involved. In some countries this has been through an inter-ministerial committee structure, in others through a secretariat. It is important to get the right balance of decision makers meeting to make key decisions, and working level support to ensure the decisions are based on technically sound input. Both are required for an effective NEPIO function.

Some countries have found that the government has agreed ‘in principle’ to develop a nuclear power programme but has not allocated the appropriate resources or confirmed roles and responsibilities for implementing the programme. Countries are advised to ensure that their

comprehensive report to government at the end of Phase 1 includes sufficient detail about what is needed to begin implementation of the programme.

It is important to explain the benefits of nuclear power as part of the national energy strategy. Some countries have found that it takes a long time to develop the nuclear power programme and the initial analysis that led to the decision to introduce nuclear power becomes out of date. Countries are advised to update their analysis from time to time to take account of new data.

Careful consideration to which contracting strategy(s) are appropriate for the country should be given. Some countries have found themselves revisiting the contracting strategy several times over the course of the planning process. While this may to an extent be inevitable as different options are tested in order of preference, countries are advised to put sufficient time and resource into early analysis and decisions on contracting strategy in order to avoid delays and wasted resources.

<b>NATIONAL POSITION</b>	<b>Phase 1</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• Basic principles regarding the safe, secure and peaceful uses of nuclear power for the long term should be demonstrated either specifically by the revision of the Nuclear Law/Atomic Energy Law or other appropriate official government statement.</li> <li>• The country should take steps to strengthen coordination, especially between the NEPIO, the regulatory body and the future owner/operator, with due respect to the regulatory body independence.</li> <li>• Define the responsibilities of organizations to be involved in Phase 2, by clarifying who is responsible for what part of the nuclear energy programme.</li> <li>• Enhance coordination among the organizations involved in the nuclear power programme in the country and with the IAEA.</li> <li>• The country should complete its planned update of the draft national nuclear power programme to reflect the latest considerations and proposed national policies, as well as country's commitment to nuclear safety, security and non-proliferation prior to its submission to the government for approval.</li> <li>• Create an inter-agency team to oversee and steer infrastructure development work.</li> <li>• Re-establish NEPIO with appropriate staff and budget as soon as possible in order to start the construction of the first NPP as scheduled.</li> <li>• Develop a detailed action plan for infrastructure development for Phase 2 (until invitation to bid is sent out) as part of longer term planning.</li> <li>• The national energy planning should be periodically updated for incorporation of the new development (economics data, grid interconnections, etc.) and continuous communications with IAEA will be kept.</li> <li>• Clarify the planning and decisions needed for a nuclear power programme and identify owner/operator.</li> <li>• The projects under the national plan should be reviewed to identify any missing element for comprehensive development of the national infrastructure and these projects should be approved as soon as possible. The responsibility of ministries and organizations assigned in the national plan should be reviewed to be consistent with the Atomic Energy Law.</li> </ul>	

**RECOMMENDATIONS AND SUGGESTIONS**

- The National Steering Committee should establish its technical sub-committees as early as possible.
- The government of the country should clarify the roles and responsibilities for nuclear policy development between the NEPIO and the regulatory body.
- The government of the country should continue strengthening NEPIO's role to ensure that the appropriate infrastructure is in place and aligned with the schedule to support the NPP projects.
- Self-evaluation should be conducted periodically to review the development status of nuclear power infrastructure and should be utilized in monitoring the activities.
- Country should consider inviting the NPP owner/operator to be a member of the Nuclear Energy Working Group.
- The country should finalize its contracting strategy for new NPP.
- The government of the country should finalize the draft national policy and strategy, as it can serve for a roadmap for the further development of the national nuclear programme. It should define the guiding principles and clarify roles and responsibilities and will cover among other topics, spent fuel and waste.
- Company responsible for the NPP project should finalize its organizational structure for fulfilling its NPP operator responsibilities, taking into account an operator's prime responsibility for safety, its interest in making use of the expertise of the foreign operator, and the national regulatory framework and international standards.
- The role of TSO should be clarified by the government considering the needs of the NPP operator and regulatory bodies. If TSO supports multiple organizations, those organizations should be mindful for potential conflict of interests.

## 2.2. NUCLEAR SAFETY

Phase 1 INIR missions have identified that in some newcomer countries leaders in key positions in the NEPIO and other organizations need training in leadership and nuclear safety management. They also identified that the NEPIO members and senior persons from government and other entities that may be involved in the development of the nuclear programme should heighten their awareness and knowledge of nuclear safety objectives, principles and concerns. INIR missions recommended that countries consider the need for training in this area.

Phase 1 recommendations also requested a clear statement on accepting the Global Nuclear Safety Regime and intention to become part of the IAEA Convention for Nuclear Safety.

Phase 2 INIR missions recommended clearer statements on the operating organisation's prime responsibility for safety.

Phase 2 missions noted that where the same organization is used to provide technical support to regulators and operators, clear separation mechanisms should be utilized to ensure there is no conflict of interest and that independence is maintained in making safety decisions.

Phase 2 missions also noted that it is important that safety culture programmes be implemented from the early stages of the nuclear programme development and at all levels of the involved parties. It should be an integrated part of the management system, and incorporated and implemented throughout the organizations that have safety-related functions or that will conduct safety-related activities.



INIR missions found that in several countries there were no defined protocols for communications between the regulatory body, the NPP operating organization, technical support organizations and the vendor. Formal processes should be established for review of safety-related information by the relevant organizations.

<b>NUCLEAR SAFETY</b>	<b>Phase 1</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• Country should commit to ensure the appointment of leaders with appropriate training and experience for leadership and the management of safety.</li> <li>• Country should enhance its understanding of the prime responsibility of the operator for safety.</li> <li>• Seminars on nuclear safety should be held for NEPIO members, managers and experts. They should cover general safety requirements: Governmental and Regulatory Framework, Leadership and Management of Safety, Radiation Protection, Safety Assessment, Emergency Preparedness and Response; as well as specific safety requirements: Site Evaluation for Nuclear Installations, Design, Construction, Commissioning and Operation for NPPs.</li> <li>• Regulatory body should:               <ul style="list-style-type: none"> <li>— Proceed with its existing plans to review and where appropriate revise its management system;</li> <li>— Give thought on where technical support would be available for the NPP programme implementation;</li> <li>— Explore the need for training for leadership and management of safety;</li> <li>— Look into the question of how to review contractors/suppliers management systems;</li> <li>— Explore where IAEA could provide support in the area of training.</li> </ul> </li> <li>• If the country government makes a decision to proceed with the introduction of nuclear power, then it should make a government statement on their acceptance of the Global Nuclear Safety Regime.</li> <li>• If the country government makes a decision to proceed with the introduction of nuclear power, then it should commit to join the Convention on Nuclear Safety.</li> <li>• Country should continue to work on the Global Nuclear Safety Regime and the Convention on Nuclear Safety.</li> </ul>	

<b>NUCLEAR SAFETY</b>	<b>Phase 2</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• An agreed protocol should be developed to define the interactions between the future NPP operator, the regulatory body, the NPP vendor and technical support organizations.</li> <li>• In consideration of its review of the legislative framework, the country should consider formulations that are fully consistent with the IAEA fundamental safety principles — specifically assigning prime responsibility to the NPP operator.</li> <li>• The regulatory body should expedite implementation of the existing draft Technical Code of Practice that addresses potential conflict of interest in the provision of technical support to both regulatory body and NPP operating organization. Further, the technical support organization should establish measures to minimize the possibility of conflict of interest regarding the provision of support to both NPP operating organization and regulatory body.</li> <li>• NPP operator and regulatory body organizations should finalize their processes for review of nuclear safety information.</li> </ul>	

- Protocols for communication between regulators and other relevant organizations (NPP operator, TSO, contractors, etc.) should be established.
- Safety culture programmes should be developed in each organization involved in nuclear power programme.
- In consideration of the future amendment to its nuclear legislation the country should explicitly address the fundamental safety principles, including assigning prime responsibility for safety to the NPP operator.
- The project company should ensure that it has the capability to review and take responsibility for licensing documentation and to manage the resolution of issues arising from the regulatory review.
- The technical support organization should consider establishing a structurally independent department dedicated to provide assistance to the regulatory body.
- The country should consider addressing the function of operating experience within future organizations of the NPP operator and regulatory body.
- The regulatory body should consider formally including safety culture in its management system.
- The project company should complete and agree the procedures for management of communications with the regulatory body and include them in its management system.
- The level of continued vendor involvement in supporting safe operation after completion of construction should be defined.

### 2.3. MANAGEMENT

At the end of Phase 1 most countries have an understanding of which organizations (various ministries, utilities, educational institutions, etc.) contribute to the development of the national nuclear programme. However, Phase 1 INIR missions identified that the roles and responsibilities are not always clearly documented and defined and this can lead to delays in implementing the Phase 2 activities.

Phase 2 INIR missions have identified the establishment of a NPP project management organisation as a critical activity that is often not well implemented. Even if a project organization is established it may lack sufficient qualified staff to handle the NPP project. The project management team needs to be highly competent with experience in managing major projects and expertise in areas like nuclear plant and other engineering disciplines, as well as legal and commercial aspects relevant for nuclear power projects. Such experience cannot be gained through educational institutions — on-the-job experience is needed.

Countries' most recent experience has involved single source contracts based on IGAs. Even in this case there is still a need to negotiate a contract with the selected NPP supplier and this requires a similar project organization and team competence as for a tendering process.

Regarding the management systems, Phase 1 INIR missions identified that in most cases there were no plans for the implementation of such systems in the key organizations involved in the national nuclear power programme. The management system in Phase 2 must have at least clear descriptions about roles and responsibilities of project team members and descriptions of all important processes needed. The requirement to establish and maintain a management system applies not only to the project management team of the NPP owner/operator but also to the regulatory body and all other institutions involved in the NPP project.

<b>MANAGEMENT</b>	<b>Phase 1</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• Establish a management system based on the IAEA Safety Standards Series No. GS-R-3 (2006), IAEA Safety Standards Series No. GS-G-3.1 (2006) and in-house project management capabilities.</li> <li>• Management systems should be developed for all the key organizations involved in the nuclear power programme, including the regulatory bodies, and should promote strong safety and security culture. IAEA Safety Requirements, GSR-3, can serve as a useful reference.</li> <li>• Identify owner/operator of NPP(s) and determine its responsibilities in the development of the nuclear power infrastructure.</li> <li>• The basic plan for the integrated management system in the regulatory body and other future key organizations (TSO) should be produced early in Phase 2.</li> <li>• A plan for the implementation of the integrated management system in the involved organizations in the nuclear power programme (future NPP owner/operator, regulatory body, etc.) should be developed by each involved organization.</li> <li>• The government should start to prepare detailed plans and support for the transformation of the investment organization into the utility organization that will be in charge of the construction and operation of the first NPPs, with clear responsibilities for safety outlined.</li> <li>• National criteria for the first NPP should be reviewed and finalized before the bid invitation specification is prepared.</li> <li>• Continuously update national energy strategy using the latest information.</li> <li>• IAEA document The Management System for Facilities and Activities, IAEA Safety Standards Series No. GS-R-3, IAEA, Vienna (2006), and related IAEA guidance should be used for the preparation of the plan.</li> <li>• Organizations already involved in pre-feasibility study should be involved in the NPP ownership model definition which will be included in the future feasibility study developed with future pre-construction consultant.</li> <li>• A quality management group should be included in the Atomic Energy Commission organization chart reporting directly to the chairman, and having the main responsibility to develop policies for the Atomic Energy Commission Management System and to monitor the implementation.</li> </ul>	

<b>MANAGEMENT</b>	<b>Phase 2</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• The specifications for the first NPP should be developed in preparation for agreement/contract negotiations in order to provide to the selected NPP vendor with all of the country requirements to be included in the contract.</li> <li>• The full BIS needs to be developed once the feasibility study has been completed and the additional requirements have been identified. Separate specifications will need to be developed for any requirements not included in the scope of supply of the main contract (e.g. support for operations).</li> <li>• The BIS and related BIS evaluation criteria should be completed as a prerequisite for the tendering and procurement process.</li> <li>• The IAEA report Invitation and Evaluation of Bids for Nuclear Power Plants, NE Series. NG-T-3.9, IAEA, Vienna (2011), is suggested to be used by the Atomic Energy Commission for the specifications for the contract.</li> <li>• The organizations already involved in pre-feasibility study should be involved in the NPP ownership model definition which will be included in the future feasibility study</li> </ul>	

developed with future pre-construction consultant.

- The Atomic Energy Commission should expand the team designated to analyse for the NPP contract proposal which will be received from the selected NPP vendor. It should also plan and implement a specific training programme for the staff involved in the NPP contract negotiations.
- Development of a competent procurement team should be continued, including the planned use of international expertise.
- The designation of the procurement agency should be made in the near future so that it can initiate the necessary organizational provisions, including HR development.
- The Atomic Energy Commission is suggested to consider seeking expert advice for the first NPP contract proposal analyses.
- The Atomic Energy Commission should issue a specific procedure for the NPP contract proposal analyses which shall include the responsibilities of the involved national organizations as well as define the analyses processes, including evaluation criteria. This procedure should be approved by the appropriate authority.
- Training plans should be developed to meet the organizational requirements for the future NPP operating organization to supervise NPP construction. Based on the current plans of the future NPP operating organization, consultants to support these activities should be recruited.
- The project company should complete its plans to strengthen the operating function, taking account of the need to prepare for and carry out commissioning activities. In addition, the regulatory body and the project company should discuss and agree the requirements for the future NPP operating organization, in particular relating to outsourcing of operation activities to other entities and licensing of specific staff.
- Using the available experience, the Atomic Energy Commission should organize a NPP project management organization with clear roles, responsibilities and adequate staff to perform the activities planned for this phase (specifications for contracting, contract proposal analyses, development and implementation of the management systems, reporting system implementation, supervision of the activities in other national authorities and other involved stakeholders, etc.).
- A unique coordinator, identified as a project manager for the NPP, should be appointed in the atomic energy commission, leading the project management organization and being responsible and accountable for the NPP development.
- Coordination among the existing national committees and with the NPP project management organization, as implementing organization, should be strengthened to allow for timely decisions to be taken and implementation of the project to be facilitated.
- A leadership development programme should be developed and implemented, both in the project management organization and in the regulatory body.
- The Atomic Energy Commission should commit to ensure appointment of the leaders, both in project management organization and regulatory body, with appropriate training and experience for leadership and management of safety.
- Continuity of the key leadership positions in both the project management organization and regulatory body should be ensured and transitions of these organizations to their new roles should be carefully managed.
- The existing action plan, approved by the government of the country, should be revised to reflect the current status and plans.
- A specific document presenting and analysing the alternatives for the NPP ownership and contractual approach should be developed by the atomic energy commission. The document should evaluate the alternatives, including risks analyses and a recommendation should be made for approval by the government.

- Regulatory body should issue requirements for licensees' management system taking into account the relevant IAEA guidance, and future NPP operating organization should review its management system accordingly.
- Regulatory body and the technical support organization should develop and implement a management system taking into account the relevant IAEA guidance.
- Specific management systems should be developed and implemented in the involved organizations in the nuclear power programme (the future NPP owner/operator, regulatory body, etc.).
- The project organization should consider enhancement of its programme management tools in order to give a high level of assurance that all supporting infrastructure work is progressing satisfactorily.
- Regulatory body should ensure that it has adequate resources to develop and implement the plans as currently defined for development of its integrated management system (IMS) and revision of its regulations.
- The project company should begin a programme of work to develop and maintain a strong safety and security culture as soon as possible.
- The basic plan for the integrated management systems (including quality management) in the regulatory body and other future key organizations (e.g. TSO) should be produced.
- A quality management group should be included in the Atomic Energy Commission organization chart reporting directly to the chairman, and having the main responsibility to develop policies for its management system and to monitor the implementation.

## 2.4. FUNDING AND FINANCING

### 2.4.1. Funding

Phase 1 INIR missions found that while some of the studies for the comprehensive report are completed others have insufficient funding. This can result in delays and sometimes rework on these important studies. It is important that the funds required for the development and approval of the Phase 1 comprehensive report are recognized and made available by the government.

Phase 2 involves a lot of work that will need funding from the country, for example development of a competent regulatory body and NPP owner/operator organization, NPP siting and environmental impact assessment studies, grid analysis, stakeholder involvement, security, emergency preparedness, radioactive waste management strategy, etc. Whilst some countries approved a decision to introduce nuclear power, they did not identify and approve the funding that would be required to develop the required infrastructure in Phase 2. If the funding requirements are not clearly identified in the Phase 1 comprehensive report, it is important that at the start of Phase 2 all these funding needs are clearly specified and the source of funding defined and approved by the government. The licensing of the construction of the NPP will also require significant funding before there is any generation of NPP revenue and the country should be clear how this initial cost will be funded.

There is a need to develop a funding mechanism for long-term waste and decommissioning liabilities. Most countries clearly recognize the need for this but several find it hard to establish in Phase 2 a clear basis for the size of a levy, when the strategy and plans for waste management and decommissioning are unclear. The key need, identified by Phase 2 INIR missions, is to ensure that the requirements to establish one or more funds have a clear legal basis that the costs are recognized in any feasibility studies and that there are plans to define the levy before NPP operation begins.

## 2.4.2. Financing

One of the expectations at the end of Phase 1 is that the comprehensive report coordinated by the NEPIO should contain the strategy for NPP financing, which will consider the different ownership options for the first NPP (government ownership, national utility ownership, partnerships, BOOT, BOO, etc.) and give clear guidance on which approach or approaches should be developed in Phase 2 of the programme. Phase 1 INIR missions identified that this strategy for NPP financing is difficult in this phase and there are embarking countries that considered that this would be established in Phase 2. As part of this strategy for financing, embarking countries should consider the ability and capability of the country to provide equity or raise debt, recognizing that there will probably be a need for some government guarantees, either in the form of loan guarantees or electricity revenue guarantees.

Phase 2 INIR missions recommended that the financial model should be developed and regularly updated to inform the negotiations and agreements made early in Phase 3 with respect to the contract and the financing arrangement, including final investment decision.

Phase 2 INIR mission recommended that a financial risk management plan be developed, including the allocations of the key financial risks (e.g. capital cost increases, delays in NPP licensing and construction, NPP availability, variation in electricity price, etc.).

<b>FUNDING AND FINANCING</b>	<b>Phase 1</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"><li>• Strategies for NPP funding and financing should be established dependent on the NPP ownership model selected.</li><li>• The staffing and funding approach for the new NEPIO organization should be clearly defined.</li><li>• Risk management plans should be developed in Phase 2. In this context, more information from international experience and lessons learned should be collected and studied on the NPP project management and financial risk management.</li><li>• Projects under the master plan need to be reviewed for comprehensive coverage of issues of necessary infrastructure. Analysis identifying the funding requirements for those projects needs to be revisited.</li><li>• Identify the appropriate funding scheme for the selected NPP owner/operator.</li><li>• Cost evaluations for all activities associated with the nuclear power programme should be revised and updated based on the latest information available. A financing and funding strategy for the evaluated costs should be also revised and updated and subject to government approval.</li><li>• The ownership and financing options for the first NPP (government ownership, turnkey contract, BOOT, BOO, etc., funding mechanisms and risk assessments for each option) should be described in a specific report, prepared for the government.</li><li>• Fully secure resources (staffing and funding) should be presented by NPP owner/operator organization into a report to the national inter-agency team (NEPIO).</li><li>• Develop a funding method for long-term waste and decommissioning liabilities.</li><li>• Country should include estimates of the funding requirements for enhancements to emergency preparedness needed by the introduction of nuclear power in the updated nuclear power programme in order to have a full picture of the funding requirements for the national nuclear infrastructure development.</li></ul>	

**RECOMMENDATIONS AND SUGGESTIONS**

- If the government will be the owner of the first NPP and a turnkey contract should be selected, the level of intended borrowing amount and associated potential guarantees should be analysed and established.
- Financial risks studies on the proposed alternatives for the first NPP financing should be carried out.
- Project costs should be finalized and sources of financing for costs not covered by vendor countries should be secured.
- Key financial risks should be allocated to appropriate organizations via contracts and agreements.
- The feasibility study should be completed and the viability of the project confirmed, taking into account financial and other strategic factors.
- Once the contracting strategy has been finalized, the country should complete its financing arrangements for the new build programme.
- The country should consider developing a financial risk management plan. The financial consequences of common risks related to nuclear power programmes like delays in licensing or construction should be taken in consideration.
- The project company should finalize the financial model (planned for [the next year]) to confirm project viability.
- The project company should prepare a financial risk management plan to ensure there is a common view on how risks are being managed. Finalising the agreement on how the electricity price increase mechanism works is a key step in this regard.
- A funding and financing plan covering the estimated needs of the all future phases of the national nuclear power programme should be issued, approved and revised annually.
- Once the spent fuel and waste management strategy is agreed, the associated costs should be reviewed and included in the funding and financing plans.
- Mechanisms should be developed to integrate the budget and review expenditure for infrastructure development.
- The government of the country should complete the development of regulations to clarify the scope of and management arrangements for the national radioactive waste account.
- The country should consider finalizing its funding arrangements for expansion of regulatory body to undertake early licensing activities for the new nuclear power programme.

## 2.5. LEGISLATIVE FRAMEWORK

Phase 1 INIR missions identified that not all the embarking countries made a clear plan for adherence to the relevant international legal instruments and for development or revision of the nuclear law and other laws related to the nuclear power programme of the country.

Phase 2 INIR missions identified that most countries have established a single piece of legislation covering safety, security and safeguards, in line with IAEA views. However, INIR missions made recommendations regarding the establishment of an independent regulatory body and the delineation of State responsibilities for safety, security and safeguards, which in some Member States entails changes to long-standing institutional structures and practice.

Phase 2 INIR missions also made recommendations regarding signing and ratifying the international legal instruments where countries had not yet adhered to them.

Another issue that a number of countries found challenging was the establishment of funding mechanisms for radioactive waste management and decommissioning, and compensation for nuclear damage, which have features not previously addressed in their national legal system.

<b>LEGISLATIVE FRAMEWORK</b>	<b>Phase 1</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• The country should become party to:               <ul style="list-style-type: none"> <li>— Convention on the Physical protection of Nuclear Material;</li> <li>— The Amendment to the Convention on the Physical Protection of Nuclear Material;</li> <li>— The Vienna 1997 Convention on Civil Liability for Nuclear Damage;</li> <li>— The Joint Protocol relating to the Application of the Vienna Convention and the Paris Convention.</li> </ul> </li> <li>• The country should become party to the relevant international legal instruments, in particular:               <ul style="list-style-type: none"> <li>— Convention on Nuclear Safety;</li> <li>— Convention on the Physical Protection of Nuclear Material (CPPNM) and its Amendment;</li> <li>— Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management;</li> <li>— Vienna Convention on Civil Liability for Nuclear Damage.</li> </ul> </li> <li>• The country should finalize the ratification process for the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management and the Amendment to the Convention on the Physical Protection of Nuclear Material. Country should further clarify the situation concerning:               <ul style="list-style-type: none"> <li>— The Vienna 1997 Convention on Civil Liability for Nuclear Damage;</li> <li>— The Joint Protocol relating to the Application of the Vienna Convention and the Paris Convention.</li> </ul> </li> <li>• Should the government of the country make a decision to proceed with the introduction of nuclear power, country should decide on the plans to join the relevant international legal instruments, in particular the following:               <ul style="list-style-type: none"> <li>— Convention on Nuclear Safety;</li> <li>— Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management;</li> <li>— Convention on the Physical Protection of Nuclear Material (CPPNM) and its Amendment;</li> <li>— Vienna Convention on Civil Liability for Nuclear Damage.</li> </ul> </li> <li>• Review the nuclear and relevant non-nuclear legislation that will impact the nuclear power project.</li> <li>• The government should address the weaknesses in the Atomic Energy Law of 2008 as described in the Agency’s comments in 2009.</li> <li>• The government should develop the regulations, circulars, etc. required for the implementation of the Law on Atomic Energy in a timely manner.</li> </ul>	



**RECOMMENDATIONS AND SUGGESTIONS**

- It is recommended that the country join the Joint Convention, the Amendment to the CPPNM and the international legal instrument(s) on civil liability for nuclear damage.
- The country should join the relevant international legal instrument(s) on civil liability for nuclear damage.
- It is suggested that the country may wish to consider requesting further IAEA legislative assistance regarding the recommended international legal instruments.
- The country may consider accepting the Amendment to the Convention on Physical Protection of Nuclear Material adopted in 2005.
- The country should continue to take steps to become party to the Joint Convention and the relevant international legal instrument(s) on civil liability for nuclear damage.
- The country should join the Amendment to the CPPNM adopted in 2005.
- Although the country is party to the majority of the relevant international legal instruments, it should continue to take steps to adhere to and implement the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, the Amendment to the Convention on the Physical Protection of Nuclear Material and the 2004 Protocol to the Paris Convention on Third Party Liability in the Field of Nuclear Energy.
- It is strongly recommended that the country, as soon as possible, enact the Nuclear Act 2011.
- Considering that a number of issues such as the management of radioactive waste and spent fuel, civil liability for nuclear damage and the enforcement process are not adequately addressed the relevant legislation should be revised.
- The country should promptly revise and promulgate its Atomic Energy Law to adequately address a number of important issues described in Condition 5.2. including the need for:
  - An effectively independent regulatory body (from entities having responsibilities or interests for the development of a nuclear power programme) with the necessary authority and resources to fulfil its statutory responsibilities;
  - A clear delineation of responsibilities of authorities involved in the nuclear power programme;
  - Adequate provisions on emergency preparedness and response, radioactive waste and spent fuel management, decommissioning, nuclear security, safeguards and civil liability for nuclear damage.
- The country should complete the process of revising its legislative framework to address the independence of the regulatory body, nuclear security and civil liability for nuclear damage.
- The country should ensure that the comprehensive nuclear energy and radiation law is promulgated as soon as possible and adequately addresses a number of important issues including the need to:
  - Establish a regulatory body without promotional responsibilities and independent from entities having responsibilities or interests that could unduly influence its decision making;
  - Define the functions of the regulatory body and the responsibilities of authorized persons for safety, security and safeguards.
- The country may wish to consider providing the Nuclear Act to the IAEA for information, following its anticipated enactment.
- The country may wish to consider, at any appropriate time, requesting further IAEA legislative assistance to ensure consistency in national legislation with any international

instrument on civil liability the country adheres to in the future.

- The country should consider involving relevant ministries at the working level to ensure consensus on the legal issues to be addressed at the ministerial level.
- The country should continue to develop, review, amend and promulgate related legislation for its nuclear power programme, including the law on environmental protection, the law on construction, the law on land, the law on national security, the civil code and the criminal code.
- It is suggested to complete a formal arrangement to clarify roles and responsibilities between the regulatory body and the environmental agency planned. It is also suggested to consider amending the two laws to clearly delineate responsibilities in the longer term.
- It is suggested that the country continue to further investigate the relevant non-nuclear legislation that will have an impact on the nuclear power project, for example, laws governing foreign ownership, taxation, electricity pricing and other issues.
- The country should further pursue efforts to review and amend related laws to a nuclear power programme.
- The country should continue to review and amend other related legislation for its nuclear power programme, as necessary.

## 2.6. SAFEGUARDS

Phase 1 INIR missions identified the need to review the status of safeguards agreements. In particular, implementation issues with the comprehensive safeguards agreement (CSA), or encouraging the finalization and entry into force of the Additional Protocol, if the country has made a commitment to sign that agreement. Countries that have no nuclear facilities and have a small quantities protocol (SQP) together with their comprehensive safeguards agreement are encouraged, in Phase 1, to make plans for the rescinding of that Protocol as it will no longer be valid once a nuclear power plant receives nuclear fuel. Also in Phase 1, the need to enhance coordination between relevant bodies was identified to ensure that all organizations are aware of the countries' non-proliferation obligations, including the collection and reporting of safeguards information.

Phase 2 INIR missions focus on the fact that countries must begin to strengthen the State system on accounting for and control of nuclear materials (SSAC) commensurate with the additional requirements it will face with a nuclear power programme. Several recommendations identified the need to draft safeguards regulations and facility related procedures. INIR missions also identified that the safeguards authority and the future operator need to prepare themselves for an increased demand on human resources in order to ensure they are able to provide the information and access required for IAEA verification. Phase 2 INIR missions also advised that countries should ensure that safeguards-related functionality is specified in the reactor design during the bidding or negotiation stage. If a country is already in discussions with the chosen NPP vendor, preliminary information on the design can be submitted to the IAEA to facilitate the coordination that will be necessary between the country and the IAEA to ensure the efficient incorporation of safeguards equipment during Phase 3.

<b>SAFEGUARDS</b>	<b>Phase 1</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• Country should bring the Additional Protocol into force during Phase 2 and ensure that all legal obligations are transposed into law.</li> <li>• Regulatory body should continue to plan for the transition from its present status of SQP to a CSA for implementation of a NPP and/or research reactor.</li> <li>• The relevant part of subsidiary arrangements to the CSA needs to be concluded with the IAEA.</li> <li>• Material balance area (MBA) for locations outside facilities (LOFs) should be created in the country and all relevant nuclear material subject to safeguards should be properly accounted for at this MBA and reported to the IAEA.</li> <li>• As the number of entities having to provide safeguards relevant information may increase with the NPP programme, the country should enhance existing mechanisms to ensure that all entities having to provide the regulatory body with safeguards relevant information are aware of their obligation.</li> </ul>	

<b>SAFEGUARDS</b>	<b>Phase 2</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• The analysis of adequacy, consistency of the existing and development of the necessary new regulations which would allow full scope implementation of CSA and AP requirements, as applicable, should be completed (and reviewed by the IAEA, upon request).</li> <li>• To further strengthen the establishment and maintenance of the SSAC, the regulatory body might consider requesting the IAEA SSAC Advisory Service (ISSAS mission).</li> <li>• Despite the fact that subsidiary arrangements have not been completed, national regulatory body should consider the appropriate timing for submission to the IAEA of an updated early design information for the NPP ~ preliminary version of DIQ reflecting the status of pre-construction (design and planning) phase.</li> <li>• The regulatory body may consider requesting the IAEA to review the draft safeguards-related regulations, as planned.</li> <li>• The necessary safeguards-related regulations for the full scope implementation of CSA and Additional Protocol requirements should be finalized as planned.</li> <li>• After regulations are in place, it is suggested that the country request an International SSAC Advisory Service (ISSAS mission). ISSAS missions provide more in-depth review of the SSAC, including regulatory framework and facility safeguards implementation.</li> <li>• To strengthen its nuclear regulatory infrastructure in the area of safeguards implementation, the country should continue to pay attention to the completion of the AP ratification process.</li> <li>• To be ready for smooth implementation of safeguards in the constructed NPP, further consult safeguards related approaches conducted by other States constructing a new NPP and take active part in the relevant IAEA training courses (e.g. On Safeguards by Design, On Nuclear Material Accounting and Reporting).</li> <li>• The country may consider further assistance of the IAEA in implementing CSA and AP requirements, as applicable, through a national training course and/or an ISSAS mission.</li> <li>• The national responsible organization should initiate development of facility-level procedures in order to meet the requirements of the Nuclear Material Accounting and Control Regulation and country's obligations under the Comprehensive Safeguards Agreement and Additional Protocol.</li> <li>• The country should update its Additional Protocol, Article 2.a (x) declaration, to reflect the</li> </ul>	

planned developments of its nuclear power programme over the course of the next ten years. The update should provide preliminary design information which will enable the IAEA to work with the country and its chosen NPP vendor to ensure that safeguards requirements are included early in the design phase.

- The preliminary version of DIQ pre-construction phase should be submitted to the IAEA through the ordinary safeguards channels.

## 2.7. REGULATORY FRAMEWORK

Phase 1 INIR missions identified that the most important issues in embarking countries are related to the independence of the regulatory body, clear definition of the regulatory body functions and lack of planning for the implementation of an appropriate management system.

Countries are advised to consider the position of the regulatory body in the governmental structure along with the positions of other entities (other government agencies/entities, licensees, etc.) that have responsibility for using and/or promoting nuclear energy.

Another common issue found in Phase 2 INIR missions is that providing sufficient qualified and competent staff is very challenging, due to both the lack of available competent staff in the country and a lack of financial resources in the regulatory authorities. It is important that the regulatory authorities be given sufficient financial resources to recruit and train staff so that at the appropriate stages of the nuclear programme development there are regulatory staff that can carry out their statutory regulatory obligations in a competent and timely manner. The development and implementation of regulations, regulatory guides and an appropriate management system (including procedures), on a timescale consistent with the development of the national nuclear power programme, is a challenge.

<b>REGULATORY FRAMEWORK</b>	<b>Phase 1</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• It should be ensured that the regulatory body is responsible for licensing and is effectively independent from the entities having responsibility for the nuclear power promotion and operation.</li> <li>• Effective arrangements should be made to ensure that regulatory responsibilities and functions are clearly defined and coordinated.</li> <li>• An appropriate management system for the regulatory body should be developed.</li> <li>• Regulatory body should prepare a plan for the issuance of regulations in-line with the Atomic Energy Commission schedule and request support to the Agency for the review of the final draft documents before being sent to the government for issuance. However, since not all provisions of the EU Safeguards Regulation are directly relevant to country, regulatory body should consider starting coordination with the Agency in this area immediately.</li> <li>• Regulatory body should develop a clear set of requirements and guidance documents for radiation and nuclear safety, defining the assessment process when several authorities are involved.</li> <li>• While conducting regular reviews, as required in the atomic law, country should specifically review existing regulations in the area of nuclear security and safeguards for completeness and develop a plan to address any gaps identified.</li> <li>• With respect to further assistance an IAEA Integrated Regulatory Review Service (IRRS) mission could be considered at an appropriate time.</li> <li>• Regulatory body should develop and implement action plan to address recommendations and suggestions contained in the IAEA Expert Mission on NPP Licensing. In addressing</li> </ul>	

the findings, regulatory body should plan to issue revised regulations and rules early in Phase 2 and on a schedule commensurate with the overall national NPP project. In addition, it is suggested to refer to the Draft Safety Guide on Establishing the Safety Infrastructure for a Nuclear Power Programme (DS 424).

- The regulatory body should consider preparation of a specific plan for the development of regulatory guides for nuclear and radiation safety, security and safeguards.

## **REGULATORY FRAMEWORK**

## **Phase 2**

### **RECOMMENDATIONS AND SUGGESTIONS**

- The government should establish the independent regulatory body as soon as possible, with appropriate resources and empowered to regulate the safety, security and peaceful uses of nuclear installations.
- The regulatory body should ensure that the regulatory functions as defined in the IAEA GSR Part 1 are met.
- The country should provide the necessary human and financial resources to allow the regulatory body to perform its supervisory obligations related to the licensing and review and assessment of the first country's NPP. Funding provisions should also include any necessary contractual support services.
- The regulatory body should prioritize and expeditiously pursue the actions presented in draft action plan, especially those related to licensing and review and assessment of first country's NPP.
- The regulatory body should finalize regulations to support construction license application review process.
- The country should finalize the necessary revision to the relevant decree of the president of the country to provide necessary legal authority to carry out supervision/oversight activities.
- Regulations should be issued in a timely manner and consistent with the nuclear power programme requirements.
- The regulatory body should begin to develop its construction inspection programme, including inspection areas, schedules, and procedures.
- The regulatory body should continue to recruit and train staff, including on-the-job experience, to assure sufficient staff is available to support its current and future regulatory responsibilities.
- The country should complete regulations on nuclear security and safeguards.
- The government of the country should ensure the independence of the regulatory functions including during the licensing process.
- The regulatory body should complete the regulations necessary for a nuclear power programme.
- The regulatory body should finalize/implement its regulatory guidance, document management system, and the process related to the public availability of information that would directly support the licensing activities.
- After the regulatory body is established and has an opportunity to perform a self-assessment, the government should consider requesting an IAEA IRRS mission at an appropriate time.
- The country should consider expanding its bi-lateral cooperation to include technical expertise in the regulatory review of preliminary safety analysis report associated with licensing of first NPP.
- The regulatory body should consider including hold points during NPP construction.
- The country should continue the work to ensure timely completion of the actions identified

from the regulatory body's self-assessment, and consider inviting an IAEA IRRS Mission.

## 2.8. RADIATION PROTECTION

Most countries considering nuclear power have in place some infrastructure for radiation protection (RP), relating to existing national activities and facilities for nuclear non-power applications.

Experience from Phase 1 INIR missions shows that for some countries there is insufficient assessment of the new requirements that will arise with the introduction of the first NPP, and hence an absence of identification of the additional or enhanced infrastructure that needs to be developed.

Phase 2 INIR missions have identified the need to strengthen capabilities and resources of the national institutions in charge of radiation protection and dose assessment and the development of the specific operator's radiation protection plans.

<b>RADIATION PROTECTION</b>	<b>Phase 1</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• The master plan needs to be revised to include radiation protection for NPPs in all stages of NPP programmes in accordance with GS-R-1 and BSS.</li> <li>• Regulatory body should, in a systematic way, continue to investigate the impact of additional hazards that NPP programmes may introduce on existing regulation.</li> <li>• Set up an advisory committee to the chair of the regulatory body to discuss specific regulation drafts.</li> <li>• Country should consider including in the national nuclear power programme a clear commitment to assess the existing radiation protection technical and organizational infrastructure to identify how it needs to be enhanced to address hazards arising from the implementation of the national nuclear power programme and how the required enhancements will be delivered.</li> </ul>	

<b>RADIATION PROTECTION</b>	<b>Phase 2</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• The country should formalize the full implementation of the Code of Conduct on the Safety and Security or Radioactive Source.</li> <li>• Requirements on funds, staffing of specialist organizations involved in radiation protection activities should be regularly updated with respect to stage of implementation of the nuclear programme.</li> <li>• Country's Ministry of Health should consider strengthening its capabilities and allocate necessary resources (and organizational coordination) in the area of radiation protection and dose assessment.</li> <li>• The NPP operator's plan for radiation protection should be developed.</li> <li>• The systems for on-site radiation protection and monitoring should be developed in a manner that relevant data from the on-site systems will be possible to integrate in the national level radiation monitoring system.</li> </ul>	

## 2.9. ELECTRICAL GRID

Most countries have conducted studies in Phase 1 to understand the implications of installing a NPP. However, Phase 1 INIR missions identified the need for such studies in some cases. For Phase 2 more detailed studies were recommended for some countries and the importance

of regular updates to the studies was noted, particularly as the generation and demand are likely to change significantly over the period of developing the nuclear power programme.

Phase 2 INIR missions indicated the need for a clear plan and allocated resources for the implementation of the identified enhancements to the national electrical grid, in order for the system to be adequate for the installation of a NPP. For some countries this will include the construction of a significant amount of non-nuclear generation or interconnections with other countries. For most countries it will involve the construction of additional transmission infrastructure both to ensure redundancy in the lines available to export electricity from the NPP to the end users and in the routes for supply of electricity to the NPP.

Finally, INIR missions noted that the introduction of a NPP to the grid requires development of protocols for communications between the NPP and the grid operator and training for grid operations staff and these should be developed at the appropriate time.

<b>ELECTRICAL GRID</b>	<b>Phase 1</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• The characteristics of the national electric grid should be better analysed and the plans for the grid improvement developed.</li> <li>• All the proposed generation and transmission enhancements need to be carried out, in order for the system to have adequate capacity to install a NPP.</li> <li>• Continue to enhance analytical capability on the impact of NPPs on the electrical grid.</li> </ul>	

<b>ELECTRICAL GRID</b>	<b>Phase 2</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• It should be ensured that the total electricity generation capability is sufficiently increased to accommodate two nuclear power units prior to commercial operation.</li> <li>• Further studies of the improved grid system specifically related to the inclusion of the NPP should be completed once some of the planned generation and transmission improvements have been implemented. Any additional improvements to the grid arising from this study should be identified.</li> <li>• Plans for protocols and training for grid operations staff for introduction of NPP should be developed at the appropriate time.</li> <li>• The country should ensure adequate connections between the grid and the NPP.</li> <li>• The overall grid system stability and reliability should be analysed to identify any areas requiring improvement for safe operation of NPPs, and such information should be included in the BIS.</li> <li>• The grid enhancements need to be defined, funded and scheduled to be consistent with the NPP programme.</li> </ul>	

2.10. HUMAN RESOURCES

Phase 1 INIR missions recommended for most countries the development of an integrated human resources (HR) development plan, coordinated by the NEPIO. The plan should include numbers of staff, required competences and a timeline when the resources are needed, based on the overall programme needs. INIR missions also noted the importance of adequate financial resources to implement the plan, the need to recognize the long timescales for the training and development of a number of posts and the need to cover technician training as well as graduate training.

Phase 1 INIR missions have found that the national programme is often based more on the available capacities and competences in the national educational institutions like universities rather than on the needs, in terms of the scope of the training and the human resource capacity requirements of the various organizations involved in the programme. There is a tendency to focus on university based nuclear physics and science, rather than the considerably greater number of other engineering and technician disciplines needed in a nuclear programme.

In Phase 2, the focus is more on the HR activities of the various involved organizations and their plans to develop capability for the operating phase.

Several countries have struggled with the planning of the development of resources required for future operation. The development of staff for a number of posts in the NPP operating organization is often ensured by contractual arrangements with the NPP supplier country, but the development of other personnel required by an operating organization and personnel in the regulatory body must be managed by the organizations themselves, and they have not found this easy to achieve.

<b>HUMAN RESOURCES</b>	<b>Phase 1</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• The national strategy for human resources development (HRD) and national plan should be developed and implemented under NEPIO coordination.</li> <li>• Country should develop and approve an integrated HR development plan based on the inputs of the main organizations and the current capabilities of educational and training establishments.</li> <li>• Country may wish to consider benefit from regional cooperation in some areas such as HRD, nuclear research reactor utilization and other supporting functions as per IAEA TECDOC-1522 recommendations.</li> <li>• Organization should urgently develop a comprehensive, phased HRD plan compatible with the national nuclear power project.</li> <li>• Human resource development should continue to be given appropriate funding and priority, in particular:               <ul style="list-style-type: none"> <li>— Long-term recruitment and training programmes for the key national organizations as well as the national plan developed by the ministry should be approved by the authorities as soon as possible, in accordance with the Article 16 of the Law on Atomic Energy;</li> <li>— The IAEA fellowship and scientific visit as well as bilateral agreements with other countries should be used in a systematic manner to provide scientific and technical on-the-job training;</li> <li>— The key organizations all carry out HRD planning. This should be a long term commitment including an adequate budget for overseas training;</li> <li>— The government should establish a mechanism by which all relevant institutions involved in nuclear and radiation safety will be provided with adequate financial resources.</li> </ul> </li> <li>• Consider enhancing the capability for training technicians.</li> <li>• Review, establish and implement the university bachelor level courses for nuclear power engineering.</li> <li>• Involve NPP owner/operator candidate organizations as soon as possible in planning for human resource development.</li> <li>• Develop a human resources plan for implementation in Phase 2 that includes a determination of national human resources required for the Phase 2.</li> </ul>	



**RECOMMENDATIONS AND SUGGESTIONS**

- An integrated national HRD plan should be developed.
- Capability to act as a ‘knowledgeable customer’ should be developed either through training and development of the Atomic Energy Commission personnel or by the use of external consultants.
- The workforce planning in the regulatory body and its TSOs, should be urgently and thoroughly reviewed and updated, taking in consideration the near term plans of issuing a construction license in [the next year] as well the international training projects scheduled concurrently for [the next two years]. Based on the results, subsequent activities for identification, funding, and contracting of external support could be initiated.
- The staffing of the regulatory body with graduates provided by the State universities and other educational institutions from [this year] onwards should become a high priority in the human resource action plans of the country.
- The country should integrate existing organizational plans to create a national human resource strategy and plan to include: all organizational resource requirements, timing, qualifications; design and implementation of the education, training and experience programmes; coordination of the placement of students after graduation/training; and educational and employment incentives to aid long term retention.
- The country should develop and implement a national human resources strategy and plan to address required improvements in: technical subjects at secondary school level; graduation rates for university engineering programmes; and training of artisans in areas relevant to nuclear industry.
- The Nuclear Energy Department should complete a national human resource development plan to define required activities and roles and responsibilities.
- The project company should initiate planning for recruitment and training, independent of the final decision on regulatory requirements for the operating organization.
- The regulatory body should accelerate their activities regarding recruitment of staff and contracting TSO support for the licensing and inspection of the NPP construction.
- The regulatory body should develop more job specific training plans for its new staff based on the Systematic Approach to Training.
- The country may wish to consider benefit from regional cooperation in some areas such as HRD, nuclear research reactor utilization and other supporting functions as per IAEA TECDOC-1522 recommendations.
- The country may wish to invite Agency’s mission to review the whole spectrum of human resources development for nuclear energy. Reference document for this mission is IAEA TECDOC-1581.
- The regulatory body should consider an early completion of licensing requirements related to the qualification of NPP personnel, that they can be considered by the operating organization workforce plans for Phase 3.
- The country should consider creating a formal mechanism at the working level to ensure effective coordination between the ‘customers’ (ministries, the future NPP operation organization, institutes, etc.) and ‘suppliers’ (universities, training centre).
- The future NPP operating organization should consider further developing a draft human resource training for NPP projects in the region to address the job specific training and experience requirements of the workforce and other recommendations of the IAEA expert mission report.

## 2.11. STAKEHOLDER INVOLVEMENT

It is expected that in Phase 1 the NEPIO develops stakeholder involvement plans that include engaging and involving relevant interested parties and informing the public about nuclear power, its benefits and risks, based on openness and transparency. Contrary to that expectation, experience from Phase 1 INIR missions has shown that a common early strategy of stakeholder involvement with the public at large has been to keep a low profile, which means not discussing widely the nuclear power option, the status of the feasibility study and so on. This is often due to concern about a negative reaction from the public. In practice, such information usually finds its way into the public domain in any case. For some Member States, it has then been difficult to get strong public support for the nuclear option and hence make significant progress into Phase 2 and beyond.

Phase 1 INIR missions recommended that countries carry out opinion surveys on a regular basis and continue doing so throughout the programme (every 1-2 years). Such surveys provide a baseline for public perception, measure the effectiveness of the stakeholder involvement and education plans, clarify what are the key concerns of the public and provide input to plans to address such concerns appropriately. Based on the input received during INIR missions, several countries appear reluctant or do not use professional organisations to ensure good quality surveys of public opinion.

Also, mainly in Phase 1, INIR missions identified that professionals in charge of stakeholder involvement may not have a communication background, or may not have experience or training in the field of nuclear power. INIR missions recommended that this issue be addressed with appropriate training, recruitment of suitable people or the use of external consultants/specialized agencies on public relations and communication. Furthermore, it is important to start providing media training on a regular basis to the spokespersons of the programme.

In Phase 2 the regulatory body and the future NPP owner/operator should already be established with each organization having a dedicated team responsible for stakeholder involvement and communication (taking into account the wide variety of key stakeholders). Phase 2 INIR missions recommended that the NEPIO, as the coordinator of the national nuclear programme, should create a similar team and that mechanisms to coordinate stakeholder involvement efforts are put in place.

Phase 2 INIR missions found that some embarking countries only initiate their evaluation of public perception in Phase 2. It is never too late to launch such activities but, as noted above, it is advisable to conduct surveys periodically from Phase 1 on. Engagement with neighboring countries should be considered from Phase 2.

<b>STAKEHOLDER INVOLVEMENT</b>	<b>Phase 1</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"><li>• A plan for interaction with the public, opinion leaders and other stakeholders, including neighbouring countries should be developed.</li><li>• Country should implement a programme of education to explain the role and benefits of nuclear energy for the next generation.</li><li>• Specific plans on how to involve the relevant stakeholders, including local communities, should be developed.</li><li>• Evaluate if public participation should be included in the decision making process, such as reactor licensing by the regulatory body.</li></ul>	

- Develop and implement comprehensive programmes for stakeholder involvement and public communication.
- Involve professional communicators in the development and implementation of plans.
- Implement national opinion surveys to determine the degree of public knowledge and attitudes towards nuclear power and evaluate effectiveness of communication efforts.
- Consider use of international expertise for continuous polling and analysis, and establish strategies based on the results of those public opinion surveys.
- More information from international experience and lessons learned should be collected and studied on stakeholder involvement.

## **STAKEHOLDER INVOLVEMENT**

**Phase 2**

### **RECOMMENDATIONS AND SUGGESTIONS**

- An interagency plan for public information involving the government, future NPP owner/operator and regulatory body, as well as strategies in each implementing organization should be developed.
- Stakeholder management programmes to track follow-up of stakeholder concerns and interests should be developed in both the regulatory body and in the future owner organization.
- The national project on public information and communication should be finalized and approved and, subsequently, each involved organization should implement its own plan and share it with the other organizations.
- The government of the country should define a national strategy for stakeholder involvement and informing the public, with a clear definition of roles and responsibilities.
- The government of the country should ensure that public entities assigned promotional or regulatory functions are adequately resourced (in terms of financial and expertise) for implementation of their respective communication activities.
- The energy company is encouraged to include representatives from throughout the country on its citizens advisory panel, to ensure involvement and feedback from across the country.
- The involved organisations should conduct periodic national surveys/polls to evaluate the perception and acceptance of the nuclear power programme.
- The country should improve engagement with neighbouring countries on its nuclear expansion plans within a reasonably short time frame.
- The regulatory body should consider how to communicate the upcoming restructuring of its function and structure to increase public confidence in its regulatory role.

## **2.12. SITE AND SUPPORTING FACILITIES**

One of the expectations of Phase 1 is that the identification of NPP candidate sites is properly undertaken and documented based on well-established processes, including a comprehensive set of exclusion, avoidance and ranking criteria. Phase 1 INIR missions identified that this was not always the case. Phase 1 INIR missions also recommended that countries consider and use the lessons learned from international experience related to NPP siting.

Depending on the specific licensing process of the Member State, site selection, evaluation and regulatory body's approval will probably be required early in Phase 2, so plans should be developed by the NEPIO or the future NPP owner/operator for the next phase.

As a country moves into Phase 2, the site characterisation should be completed and approved by the regulatory body. Phase 2 INIR missions identified that this often takes longer than countries expected.

Other Phase 2 INIR missions recommendations were related to the preparation of a plan for works on the selected site to prepare the physical infrastructure, and clarity over what should be included in the BIS.

<b>SITE AND SUPPORTING ACTIVITIES</b>	<b>Phase 1</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• The decision on NPP site-related issues and the activities to enable informed decision and implementation of decision should:               <ul style="list-style-type: none"> <li>— Be based on well-communicated schedule including establishment of nuclear safety criteria, licensing requirement and procedure;</li> <li>— Use the lessons learned from international experiences, for example as being compiled by the IAEA (such as seismic design, local area development, etc.).</li> </ul> </li> <li>• Update a site data report when owner/operator is identified.</li> <li>• Prepare a site evaluation report for the preferred site. Continued investigations of alternative sites.</li> </ul>	

<b>SITE AND SUPPORTING ACTIVITIES</b>	<b>Phase 2</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• It is suggested that the Atomic Energy Commission takes into account the lessons learned as they emerge from the Fukushima accident regarding external hazards of natural induced origins.</li> <li>• The Atomic Energy Commission should implement recommendations provided by the IAEA Siting Mission in 2011.</li> <li>• A detailed NPP site characterization should be completed and submitted for approval.</li> <li>• The NPP owner/operator should determine the approach for licensing (site license or combined license).</li> <li>• The project company should complete the NPP site parameters report based on the implemented site characterization investigations and submit for review and approval by the regulatory body.</li> <li>• The regulatory body should consider amending the guideline for site characterisation of nuclear facilities to cover nuclear security.</li> <li>• Plans to prepare physical infrastructure to support construction should be developed before issuing BIS.</li> <li>• Possible needs for other nuclear facilities on the selected nuclear sites should be analysed.</li> </ul>	

### 2.13. ENVIRONMENTAL PROTECTION

Phase 1 INIR missions noted the need to manage interfaces between the environmental ministry/agency and other national organizations involved in the nuclear power programme, including the regulatory body for nuclear safety, especially in the NPP licensing process. This issue also arose in Phase 2 INIR missions. Phase 1 INIR missions also identified the need to include positive environmental outcomes expected from the nuclear power programme in the comprehensive report.

Phase 2 requires the completion of the environmental impact assessment (EIA) process. Phase 2 INIR missions recommended the development of a regulation or guide to define the

content of the environmental impact assessment report for a NPP. The incorporation of the EIA results in the bid invitation specification (or NPP specification for contracting) was also recommended.

Phase 2 INIR missions also noted that, in most countries, the EIA process involves stakeholder consultation as per national legislation provisions, organized by environmental authorities or the future NPP owner/operator. Phase 2 INIR missions recommended completion in a timely manner of the necessary activities to close out the EIA process, in order to avoid delays to the project.

<b>ENVIRONMENTAL PROTECTION</b>	<b>Phase 1</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• More expertise and information on environmental impact assessment and public communication must be developed in Phase 2. In particular: water use, transporting materials, disposal of hazardous waste, additional environmental monitoring requirements, construction impact, and other issues should be considered.</li> <li>• Clarify the relationship between the Ministry of Environment and other organisations that are involved in the nuclear power programme.</li> <li>• The study on the positive environmental outcomes expected from the nuclear power programme should be included in the readiness report.</li> <li>• The national radiation monitoring network should be enhanced in Phase 2.</li> </ul>	

<b>ENVIRONMENTAL PROTECTION</b>	<b>Phase 2</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• Environmental impact assessment study should be finalized and approved.</li> <li>• The technical guidelines for setting up environmental impact assessment report for nuclear power plant projects should be made available in due time before finalization of the EIA report by consultants.</li> <li>• The complete assessment of the environmental impact of the proposed NPPs should be carried out.</li> <li>• Country's Ministry of Environment, as the governmental coordinating body, and the project company should complete the necessary activities to close out the EIA process in a timely manner.</li> <li>• The Ministry of Environment should define a standardized format of the EIA report for nuclear facilities.</li> <li>• The regulatory body should clarify with the NPP vendor the site preparatory work for the first NPP site.</li> <li>• Important environmental concerns should be identified in coordination with the Ministry of Environment and should be clearly defined in the contract specifications.</li> <li>• The technical specification of environmental site conditions, factors, characteristics and data should be included in BIS.</li> <li>• Revisions to regulations governing environmental protection should be completed, consistent with IAEA GSR Part 3.</li> <li>• An MOU defining clearly the roles and responsibilities in the oversight of environmental issues between the nuclear safety regulatory body and the Ministry of Environment should be concluded at the appropriate time.</li> <li>• The environmental law should be updated to reflect the radiological impact analysis requirements for NPPs to be performed in accordance with the national regulations.</li> <li>• The Ministry of Environment and the regulatory body for nuclear safety should strengthen</li> </ul>	

their cooperation and communication on environmental issues.

- The government of the country should clearly define the role and responsibilities of the Ministry of Environment for the NPP projects and the interface with the regulatory body.

#### 2.14. EMERGENCY PLANNING

Phase 1 INIR missions found that the need for greater awareness by the government and all organizations involved of the required expansion of the existing emergency preparedness and response (EPR) capabilities. This is important to ensure a common understanding of roles and responsibilities and to be ready for the development of detailed regulations.

Phase 2 INIR missions identified that, in some cases, regulations on emergency preparedness and response were not completed.

Phase 2 INIR missions also recommended that, in some cases, arrangements to coordinate emergency response plans with neighboring countries should be considered in the next phase.

<b>EMERGENCY PLANNING</b>	<b>Phase 1</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"><li>• The governmental and local authorities should be involved in the preparation of the emergency preparedness review process.</li><li>• The state notification network needs to be fully established in line with the IAEA requirements, including 24/7 availability. Country should then take part in exercises aimed at testing the system.</li><li>• Regulations and detailed roles and responsibilities for emergency preparedness plan for NPP should be developed during Phase 2.</li><li>• Radiation monitoring instrumentation and other equipment will be required in the future. Provision for establishing and maintaining the required QA programme for this equipment should be introduced at that time.</li><li>• Country should address the recommendations provided in the IAEA expert mission report, in a timeframe to support the national nuclear power project.</li><li>• Country should consider completing its survey on how the existing framework of emergency preparedness and response should be expanded to cover the needs arising from the national nuclear power programme, including an evaluation of additional resources required.</li></ul>	

<b>EMERGENCY PLANNING</b>	<b>Phase 2</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• National nuclear and radiological emergency response plan should be completed and approved.</li> <li>• The regulations under the draft national nuclear and radiological emergency response plan are suggested to be formulated.</li> <li>• Necessary arrangements should be made to coordinate emergency response plans with neighbouring countries which fall within the precautionary action zone or the urgent protective action planning zone.</li> <li>• The country should consider including arrangements for bilateral communication with neighbouring countries in its national emergency plan.</li> <li>• National regulatory body should consider activating its emergency control centre during national level emergency exercises.</li> <li>• The government should provide a strong support for implementing the action plan based on recommendations of the IAEA EPREV mission.</li> </ul>	

## 2.15. NUCLEAR SECURITY

Phase 1 INIR missions found that embarking countries did not always recognize that nuclear security is part of national security and therefore the national security and law enforcement authorities of a country need to be involved and coordinated, with clearly defined roles and responsibilities and a co-ordination mechanism. A lead organization for development of the design basis threat (DBT) needs to be defined. The need for a clear policy statement and a national plan to develop regulations and a strong security culture based on the IAEA guidance was also identified.

Phase 2 INIR missions found that further effort was required to develop physical protection requirements taking into account DBT. The missions also identified the need to be clear on security requirements and arrangements during construction. There are also recommendations to modify the existing personnel screening system in order to address NPP staff trustworthiness checks and to apply a graded approach so that persons with greater access undergo a more rigorous screening process.

<b>NUCLEAR SECURITY</b>	<b>Phase 1</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• The government of the country should define the ministries and organizations, and nominate the head organization that will perform the design basis threat development, risk assessment and modelling scenarios of illegal activities.</li> <li>• The government of the country should further elaborate a mechanism of interagency coordination and cooperation that addresses measures for strengthening nuclear security, including physical protection of nuclear material and radioactive sources, preventing incidents and accidents with radioactive materials, and responding to threats of nuclear terrorism.</li> <li>• It is advisable that a national committee to oversee nuclear security coordination across all government bodies is established and national training capability is developed.</li> <li>• Planning for nuclear security implementation should be continued, and where applicable, involve relevant stakeholder organizations.</li> <li>• A top-level policy or guidance statement should be developed to assist the subsequent expansion and enhancement of the national nuclear security framework for nuclear power.</li> <li>• A programme of strong security culture and regulation that addresses security</li> </ul>	

requirements to radioactive sources and waste should be developed guided by the IAEA Nuclear Security Series documents Nuclear Security Culture and Security of Radioactive Sources.

- New regulations on regulatory functions should define the scope of authority of regulatory bodies in the areas of nuclear security, including information reporting procedures and associated confidentiality, inspections, sanctions, licensing, scientific and technical support to regulatory activities, security culture and training capabilities.
- A programme of strong security culture and regulation that addresses security requirements to radioactive sources and waste should be reviewed, guided by the IAEA Nuclear Security Series documents Nuclear Security Culture and Security of Radioactive Sources. As many key people might leave shortly a staffing plan should be developed to ensure knowledge retention and seamless transitions in job positions.
- The government commissioner for nuclear power should, in consultation with relevant agencies involved in nuclear security, such as the regulatory body and the internal security agency, review the draft national nuclear power programme to ensure that all issues related to nuclear security are adequately addressed.
- Regulatory body should review the IAEA and international guidelines on security and report to the country's Ministry of Science and Technology on the need to develop or update national relevant regulation.
- Consequently, regulatory body should develop and enforce regulation on the physical protection of nuclear material and radioactive sources on the basis of INFCIRC 225/Rev.4 and the relevant IAEA Nuclear Security Series documents.
- Regulatory body should develop nuclear security related documents in a timely manner with adequate support of the country's Ministry of Science and Technology.
- The country should commit to ensuring appointment of leaders with appropriate training and experience for the leadership and management of security.
- The country should enhance its understanding of the prime responsibility of the NPP operator for nuclear security.
- The regulatory authority should consider beginning the process of developing physical protection regulations by defining two important threshold matters: the policy objectives sought to be achieved by the regulations and their scope of application. These determinations will guide the drafters of regulations throughout the entire process and fundamentally shape the form and content of the regulations and, therefore, should be defined as early as possible.
- Planning for nuclear security implementation should be continued, and where applicable, involve relevant stakeholder organizations. The recommendations provided from the sustainability missions should be followed up, in particular:
  - Development of security oversight and inspection capability in the regulatory body;
  - Development of a national nuclear security training capability for workers, management and security personnel at sites with nuclear and radioactive material;
  - Development of site-level DBT and documentation demonstrating that the site security systems are sufficient, as well as a review process for both.
- The government of the country should define organizations to participate in the review and update the national and site DBTs.



**RECOMMENDATIONS AND SUGGESTIONS**

- The country should introduce the threat assessment concept and DBT approach in the regulations and should take necessary steps to plan the DBT development.
- The development and enforcement of the planned legislative and regulatory documents should be finalized.
- When including the NPP in the list of important projects related to national security the possible conflicts between specific nuclear security requirements and general security requirements for important projects should be taken into account.
- The facility design basis threat (DBT) for the NPP should be defined (in Phase 2).
- The country should continue work on establishment of security requirements during NPP construction.
- The Terms of Reference on NPP physical protection design should be finalized in accordance with the DBT.
- The country should consider modifying the existing personnel screening system in order to meet the specific issues related to NPP staff trustworthiness check and to apply the graded approach so that persons with greater access undergo a more rigorous screening process.
- The country should prepare plans to develop nuclear security culture.
- To organize specific training of the off-site response forces for intervention at NPP (including knowledge of the facility and vital areas, radiation protection and restriction areas).
- The country may consider requesting an IAEA national training course on nuclear security culture.

**2.16. NUCLEAR FUEL CYCLE**

In Phase 1 a country embarking on nuclear power is expected to demonstrate good understanding of the potential options for the front-end and back-end of the nuclear fuel cycle and the short, mid and long term commitments related to these options, in order to be able to make strategic decisions on how the fuel cycle will be established.

Phase 1 INIR missions observed that the front end of the nuclear fuel cycle is usually addressed and options for fuel sourcing considered, but the back end of the nuclear fuel cycle is very often unclear. Phase 1 INIR missions recommended that embarking countries should collect more information from international experience on nuclear fuel cycle options in order to have a better understanding of the issues/options.

Phase 2 INIR missions recommended the development of a national policy on the nuclear fuel cycle, for the front-end and back-end, including the definition of the main roles and responsibilities of different organizations in the country.

Countries were also advised to develop the national strategy for spent fuel management based on analysis and consideration of the different options. In several countries it was observed that spent fuel is considered as an issue that can be addressed at a later time. Phase 2 INIR missions advised countries to develop their back end nuclear fuel cycle strategies prior to preparing their bid invitation specifications or to their IGA discussions.

It is also important that spent fuel storage options are included in the back end strategy and those storage capacities (including that of the spent fuel storage pool delivered with the NPP)

are consistent with other long term plans for spent fuel management. Phase 2 INIR missions found that some countries do not define these requirements in sufficient detail.

<b>NUCLEAR FUEL CYCLE</b>	<b>Phase 1</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• Country should collect and study more information from international experiences and lessons learned in the development of long-term policy and strategy of spent fuel (SF) and radioactive waste management. Work should start early on the activities of Phase 2, in particular a strategy and planning document should be developed for all aspects of the fuel cycle and ensure the appropriate inclusion in bidding documents.</li> <li>• Country should consider including in the final version of the national nuclear power programme the conclusion of its analysis on fuel cycle options.</li> </ul>	

<b>NUCLEAR FUEL CYCLE</b>	<b>Phase 2</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• A nuclear fuel cycle policy, addressing national priorities, responsibilities, structures and provisions of human and financial resources for front- and back-end of the nuclear fuel cycle should be finalized and approved.</li> <li>• Based on the nuclear fuel cycle policy a strategy/plan should be drafted, specifying practical actions and means of implementing the policy. It should address technical options, resources, financing scheme and arrangements for implementation and any other relevant issue.</li> <li>• Storage options and capacities (at the reactor and eventual away-from the reactor) in correlation with fuel take-back policy (frequency and timing of SF take-back) should be investigated and preferred option decided to prepare specifications for the contract.</li> <li>• The country should consider reviewing the existing legal framework in terms of policy for spent fuel management and incorporate the missing elements in the strategy for the management of spent fuel, which should be endorsed by the government of the country.</li> <li>• The country should develop a policy and strategy for the management of spent fuel and high level waste.</li> <li>• The country should develop an integrated national nuclear fuel cycle strategy, including spent fuel/high level waste disposal.</li> <li>• NEPIO should complete the work to define a national policy and strategy for the front and back-end of the nuclear fuel cycle, including clarification of the long-term technical responsibility for the management and disposal of spent fuel or high level waste.</li> </ul>	

## 2.17. RADIOACTIVE WASTE

Phase 1 INIR missions recommended that embarking countries should collect more information from international experience on the management of high level radioactive waste in order to have a better understanding of the issues/options.

In Phase 2 a country is expected to develop a strategy for radioactive waste management including responsibilities, time schedules, financing schemes, options for processing, storage and disposal, plans for a waste management organisation and needed national facilities. Experience shows this to be a challenging task and several Phase 2 INIR missions identified that strategies on radioactive waste management exist in draft form but need further development.

Phase 2 INIR missions also identified that some countries need to define their high level strategy and national requirements for decommissioning and request the vendor to prepare a preliminary decommissioning plan.

<b>RADIOACTIVE WASTE</b>	<b>Phase 1</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• Country should collect and study more information from international experiences and lessons learned in the development of long-term policy and strategy of spent fuel (SF) and radioactive waste management.</li> <li>• It would be useful to develop early a formal strategy and planning document for all aspects of waste management, including an appropriate funding (for decommissioning and spent fuel and waste management) to ensure the fund build up during NPP operation. It would further be useful to involve the prospective owner/operator of the NPP in this work.</li> <li>• Country should consider reviewing the existing legal framework in terms of policy for radioactive waste management and, when appropriate, incorporate the missing elements in the strategy for radioactive waste management.</li> <li>• The studies performed might consider co-disposal of intermediate and high level waste in a single facility at the national level.</li> </ul>	

<b>RADIOACTIVE WASTE</b>	<b>Phase 2</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• A policy document addressing national priorities, responsibilities, structures and provisions of human and financial resources for all radioactive waste generated in the country should be finalized and approved.</li> <li>• A radioactive waste management strategy should be prepared, considering: <ul style="list-style-type: none"> <li>— Processing and storage options and capacities for RW;</li> <li>— Disposal options for all types of generated waste including waste from decommissioning and institutional waste;</li> <li>— Time schedules with major milestones (processing facility, storage, repository);</li> <li>— Organizational and financial aspects.</li> </ul> </li> <li>• Due to the long-term commitment (liabilities) related to radioactive waste management, adequate financial arrangements should be developed and approved by the government.</li> <li>• The government of the country should endorse the strategy of radioactive waste management (in Phase 2).</li> <li>• Based on the policy for the management of radioactive waste, the country should assign responsibilities and develop clear plans for construction of facilities for processing, storage and disposal of radioactive waste.</li> <li>• The NPP project department should complete the work to define a national policy for all kinds of radioactive waste and to identify the responsibilities of a national waste management organization.</li> <li>• The government of the country should develop a long-term plan for activities and facilities needed for radioactive waste management.</li> <li>• For the future development of the nuclear programme, it is suggested that the government further develop the national strategy on long-term radioactive waste and spent fuel management including the early establishment of a State entity for the disposal of SF and LILW, and to proceed with the planning of LILW disposal.</li> <li>• The nuclear programme in the country is progressing rapidly, is well accepted and supported in the country. It would be prudent to initiate the siting of LILW disposal facility in the near term.</li> </ul>	

- The Atomic Energy Commission is suggested to improve its knowledge about waste processing technologies and storage capacities for the selected NPP technology.
- The Atomic Energy Commission is suggested to request from the NPP vendor a preliminary decommissioning plan for the NPP.
- While updating the draft strategy for radioactive waste management, creating a waste tracking system is proposed to be included.
- Radioactive waste classification system in the country should be harmonized with the IAEA's current system to involve disposal aspects and to enhance application of the IAEA recommendations in the country.
- Once established, the national waste management organization should consider design and safety issues for disposal facilities for low and intermediate level waste (LILW) to make possible the optimization of the full chain of LILW management.
- The country should define national strategy and criteria for the decommissioning of nuclear power plants.
- To consider approaches for long term management of waste which require disposal in subsurface facilities and incorporate them in the strategy for radioactive waste management.

## 2.18. INDUSTRIAL INVOLVEMENT

Phase 1 INIR missions concluded that most countries have carried out some activities in this area. Several countries have high expectations about local participation and economic impact of the nuclear power programme but did not put the effort required into analysing what they would intend to localize. Phase 1 INIR missions recommended that the comprehensive report issued by NEPIO at the end of Phase 1 should include the results of the survey of potential local suppliers for goods and services.

Phase 2 INIR missions recommended that information about potential local suppliers for goods and services should be included in the specification for contracting or the bid invitation specification package sent to potential NPP vendors.

Phase 2 INIR missions observed that this process of planning the participation of local suppliers for goods and services was mainly managed by the vendors and recommended that government should also be involved in analysing local capabilities and producing specific plans for promotion of local suppliers.

<b>INDUSTRIAL INVOLVEMENT</b>	<b>Phase 1</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• A national policy with respect to national and local industrial involvement should be defined based on the selection of options for first NPP ownership with pre-construction consultant and the potential local suppliers for goods and services for the first NPP should be investigated to determine their quality management system and a specific plan for implementation/improvement should be defined.</li> <li>• More information from international experience/lessons learned should be collected and studied on industrial involvement</li> <li>• Set up a target for local content for NPP construction utilizing the result of the survey of domestic industrial capability.</li> <li>• The recommendations of NEPIO for a national policy on national industrial involvement should be included in the readiness report, reflecting the survey conducted.</li> <li>• Consider developing a plan for the involvement of indigenous industry in component</li> </ul>	

manufacture and services.

- Develop relevant Phase 2 action plans.

## **INDUSTRIAL INVOLVEMENT**

## **Phase 2**

### **RECOMMENDATIONS AND SUGGESTIONS**

- The list of potential local suppliers for goods and services for the first NPP prepared [11 years ago] should be updated by the Atomic Energy Commission and included in the specification for contracting the first NPP.
- Capability to meet specific requirements for NPP (quality and schedule) of the potential local suppliers for goods and services should be analysed.
- Short and long-term programmes for increasing national and local participation for the future NPP should be developed after approval of the ownership and contractual approach for the first NPP and included in the specifications for contracting.
- The national programme for local industrial involvement should be developed based on the assessment of local industries' capability so that the contract will achieve the desired target of local industrial involvement.
- Communications between possible NPP vendors and the relevant ministries, the future operating organization and possible national suppliers should be adequately coordinated.
- The activities to come to an agreement between the project department and the project company on the scope and level of involvement of local industry participation should be intensified.
- Consider developing a target for national industry participation for future units.
- It is suggested to include a determination of the needs for future investment in the potential local suppliers for goods and services for the first NPP during the detailed survey to be performed by the Atomic Energy Commission together with selected NPP vendor.
- A desired target for the local and national involvement in the first NPP construction is suggested to be defined.
- It is suggested to invite the selected NPP vendor to be involved in the audits of the management systems (including quality control and assurance) of the potential local suppliers for goods and services.
- The development of the regulations on the application of international codes and standards for NPP construction should be coordinated with other NPP regulations.
- The country should define the desired extent of local industrial involvement, to be included in the BIS.

### **2.19. PROCUREMENT**

Phase 1 INIR missions recommended that countries plan the development of an appropriate management system for procurement activities (consultancy for developing the feasibility study, siting activities, EIA development, etc.).

During Phase 2, it is expected that the NPP owner/operator will need to establish a procurement capability for services related to the pre-project activities. Phase 2 INIR missions recommended development of appropriate arrangements by the NPP owner organizations for the procurement activities (selection of the consultants, procurement from international market and from sole source, etc.).

Phase 2 INIR missions also recommended development of plans for the transfer of knowledge from the main contractor (NPP vendor) to the NPP owner/operator, in order to assure the appropriate capabilities for the procurement during NPP operation.

<b>PROCUREMENT</b>	<b>Phase 1</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• The policy and plan for development of an appropriate management system (including quality control and assurance) for nuclear procurement along with the appropriate investment requirements should be defined with pre-construction consultant.</li> <li>• The specific procurement plan associated with purchasing nuclear equipment and services in the Phase 2 of the programme should be defined with the pre-construction consultant contract, based on the selected NPP ownership model.</li> <li>• International expertise should be utilized in the development of Terms of Reference for the future NPP owner/operator's feasibility study. The IAEA will provide its assistance in reviewing the draft Terms of Reference if requested.</li> <li>• In the process of specification for contracting preparation, Atomic Energy Commission should use experience of owners of similar NPP technology.</li> <li>• Experience of the national electricity utility in contracting for fossil plants should be used by the Atomic Energy Commission in the preparation of the specifications for the first NPP.</li> </ul>	

<b>PROCUREMENT</b>	<b>Phase 2</b>
<b>RECOMMENDATIONS AND SUGGESTIONS</b>	
<ul style="list-style-type: none"> <li>• The Atomic Energy Commission should establish a procurement department inside the Nuclear Power Division and train the staff for the development of the contract specifications and negotiations with the selected NPP vendor.</li> <li>• If BOOT approach will be selected for the first NPP ownership, the Atomic Energy Commission should prepare and agree with the selected NPP vendor a specific plan for technology transfer, including the creation of procurement capabilities in the eventual owner/operator for the NPP operation.</li> <li>• If the government will be the owner of the first NPP and a turnkey contract should be selected, a specific plan for development of the Atomic Energy Commission procurement capabilities for the NPP operation shall be developed with NPP vendor, and implemented in Phase 3 of the programme (during the construction and commissioning period).</li> <li>• The government of the country should enable public organizations to procure goods and services in a timely manner, recognizing that nuclear power programmes require contracting in an international market and sometimes from sole source suppliers.</li> <li>• In Phase 3, ensure successful knowledge transfer from the prime contractor to NPP owner/operator for the preparation of NPP operation.</li> <li>• It is suggested to participate in the NPP technology specific owners group (e.g. VVER) after contract for the first NPP becomes effective and construction activities begin.</li> </ul>	



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## ABBREVIATIONS

AP	Additional Protocol
BIS	Bid Invitation Specification
BOOT	Build-Own-Operate-Transfer
BOO	Build-Own-Operate
BSS	Basic Safety Standards
CSA	Comprehensive Safeguards Agreement
CPPNM	Convention on the Physical Protection of Nuclear Material
DIQ	Design Information Questionnaire
DBT	Design Base Threat
EIA	Environmental Impact Assessment
EPR	Emergency Preparedness and Response
EPREV	Emergency Preparedness and Response Review Mission
HLW	High Level Waste
HRD	Human Resources Development
IGA	Intergovernmental Agreement
IRRS	Integrated Regulatory Review Service Mission
LILW	Low and Intermediate Level Waste
LOFs	Locations Outside Facilities
NEPIO	Nuclear Energy Programme Implementing Organization
NPP	Nuclear Power Plant
MBA	Material Balance Area
MOU	Memorandum of Understanding
QA	Quality Assurance
RP	Radiation Protection
RW	Radioactive Waste
SF	Spent Fuel
SQP	Small Quantity Protocol
SSAC	State System on Accounting for and Control of Nuclear Materials
TSO	Technical Support Organization



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