



Forum of Nuclear Regulatory Bodies in Africa

**Thematic Working Group Regulatory Infrastructure for Nuclear Power
Plants (TWG3-NPP)**

**Report on Evaluation of Status of National Nuclear
Infrastructure Development in TWG3-NPP Participating
Countries**

Contents

| | | |
|---|--|----|
| 1 | Purpose..... | 3 |
| 2 | Background..... | 3 |
| 3 | Abbreviations..... | 4 |
| 4 | Survey Results..... | 5 |
| | 4.1 Methodology..... | 5 |
| | 4.2 Participation..... | 5 |
| | 4.3 Results: TWG3-NPP Perspective..... | 5 |
| | 4.4 Results: Country perspective..... | 7 |
| 5 | Summary..... | 8 |
| | Appendix A: Questionnaire..... | 10 |

1 PURPOSE

The purpose of the report is to document the outcome of a survey that was conducted amongst the TWG3-NPP participating countries on the status of the identified 19 infrastructure issues that needs to be addressed by a Member State that is considering the introduction of nuclear power programme in their country.

2 BACKGROUND

The Terms of Reference of the TWG3-NPP calls for the convergence on regulatory standards and practices of participating countries. This will be achieved through comparison of regulatory standards and practices of the participating countries and comparing with other international standards and practices such as those prescribed by the IAEA, WENRA, MDEP, USNRC, etc. Surveys in the form of questionnaires will be primarily used to solicit the required information from participating countries on various topics relating to the required regulatory infrastructure for Nuclear Power Plants.

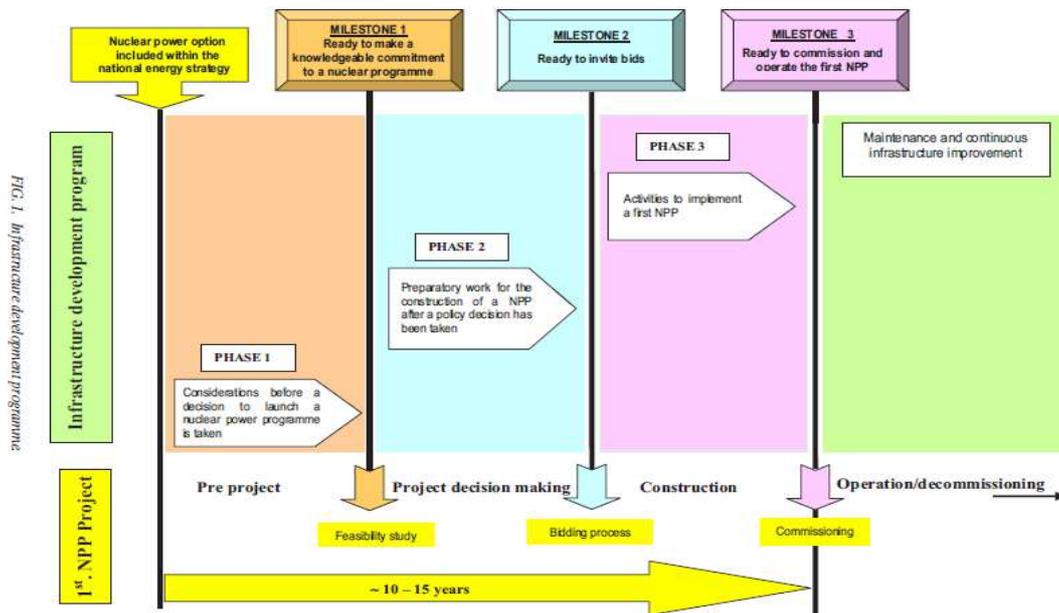
The TWG3-NPP Work Programme, agreed to during the planning meeting in Centurion, South Africa, on 22 November 2013, includes an initiative to determine the status of National Infrastructure for NPPs in participating countries. A survey was compiled and circulated on 11 June 2014. Responses were received by 26 August 2014 from 11 of the 17 TWG3-NPP participating countries.

The objectives of the survey were to:

- 1) determine the status of the national nuclear infrastructure development in participating countries;
- 2) identify areas where participating countries may need assistance; and
- 3) inform future activities of the working group.

The IAEA Nuclear Energy Series NG-T-3.2 on Evaluation of the Status of National Nuclear Infrastructure Development was used as the basis for the survey. The scope of the survey is however limited to phase 1 of the milestones for embarking countries, i.e. whether the country is ready to make a knowledgeable commitment to nuclear power.

Report on the Evaluation of Status of National Nuclear Infrastructure Development in TWG3-NPP Participating Countries



The outcome of the exercise should inform the participating countries of their readiness to develop a nuclear power programme and the gaps that need to be addressed with regards to the 19 infrastructure issues.

All input/responses provided were treated as confidential. The report is general and does not list the specific countries that participated nor assign responses to specific countries.

3 ABBREVIATIONS

| | |
|-------|--|
| CSA | Comprehensive safeguards agreement |
| IAEA | International Atomic Energy Agency |
| NEPIO | Nuclear Energy Programme Implementing Organization |
| NPP | Nuclear Power Plant |
| NPT | Nuclear Nonproliferation Treaty |
| SSAC | State System of Accounting for and Control of nuclear material |
| TWG | Thematic Working Group |

4 SURVEY RESULTS

4.1 Methodology

The survey included questions on the 19 infrastructure issues important to the implementation of nuclear power in the country and had 36 questions in total. The list of 19 infrastructure issues, associated questions and the basis for the questions are provided in Appendix A.

The responses were categorized as either “Yes” or “No” or “Partial” or “?”. Where no responses were provided or responses were not clear they were categorized as “?”. Where there were no formalized document available or plans are in place, the responses were categorized as “Partial”.

Some of the questions required input from other role players such as the Nuclear Energy Programme Implementing Organization (NEPIO). One country indicated difficulty in obtaining relevant information to complete the questionnaire as the respondent is part of the respective Regulatory Body.

The responses provided were analysed to determine the readiness from an infrastructure issue perspective. Where there were more than one question per infrastructure issue, the response would be categorized as “Partial” if at least one of the responses to the specific questions were either “Yes” or “Partial”.

The responses were further analysed from a country perspective. A similar methodology was used as explained above to derive the status of the country per infrastructure issue.

4.2 Participation

Of the 17 TWG3-NPP participating countries 11 (about 65%) completed the survey. The results from the survey are summarized in the graphs below from an issue as well as a country perspective. The names of the countries are not specified.

4.3 Results: TWG3-NPP Perspective

Figure 1 depicts the number of “Yes” responses for each of the 36 questions in the survey indicating the readiness per question.

Report on the Evaluation of Status of National Nuclear Infrastructure Development in TWG3-NPP Participating Countries

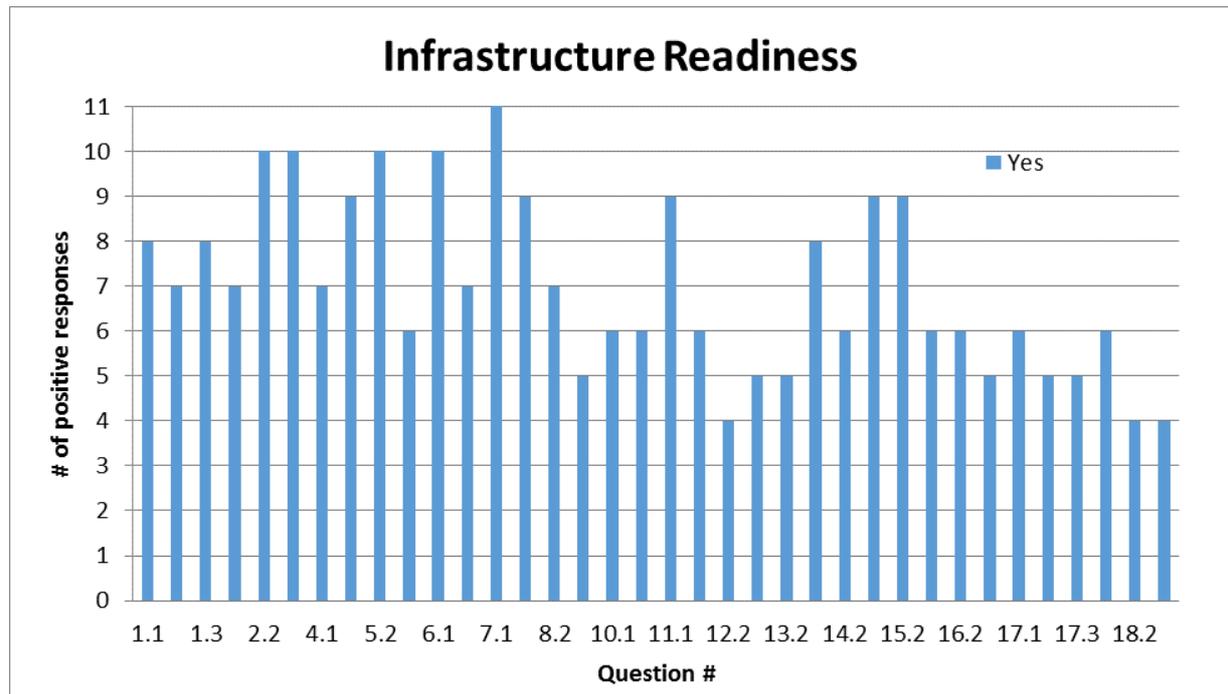


Figure 1: Positive ("Yes") responses to questions per question

Figure 2 summarizes the results per infrastructure issue and includes both the "Yes" and "Partial" responses.

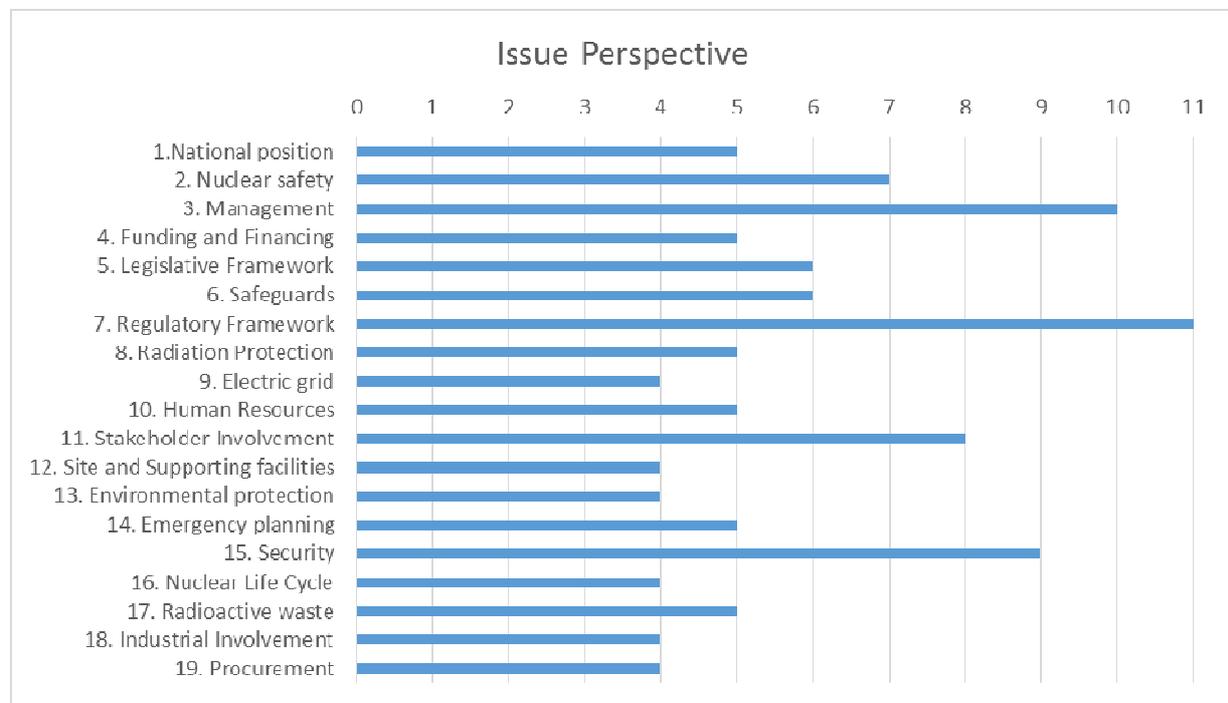


Figure 2: Positive ("Yes" and "Partial") responses per infrastructure issue

The results show that for 7 infrastructure issues, viz. Nuclear Safety, Management Systems, Legislative Framework, Safeguards, Regulatory Framework, Stakeholder Involvement and Security, the responses were mostly positive. The responses to the other 12 of the 19 infrastructure issues were mostly negative, indicating that most of the the TWG3-NPP participating countries have to develop their readiness on these issues before a knowledgeable decision is made on embarking on a nuclear power programme.

4.4 Results: Country perspective

Figure 3 displays the number of positive responses for all the questions of the survey from a country perspective.

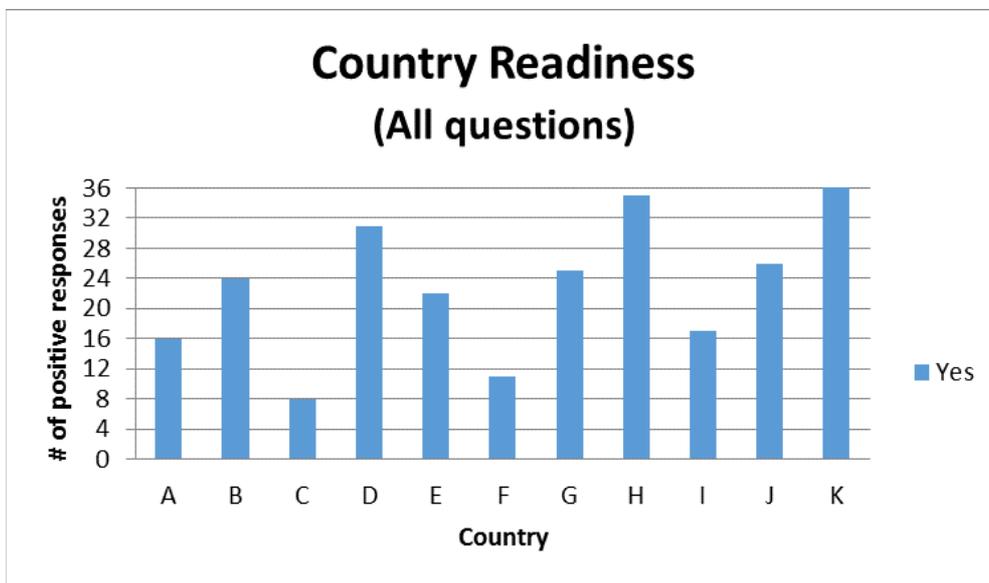


Figure 3: Country Readiness - all questions

Figure 4 depicts the results per country from an infrastructure issue perspective and includes the “Yes” and “Partial” responses.

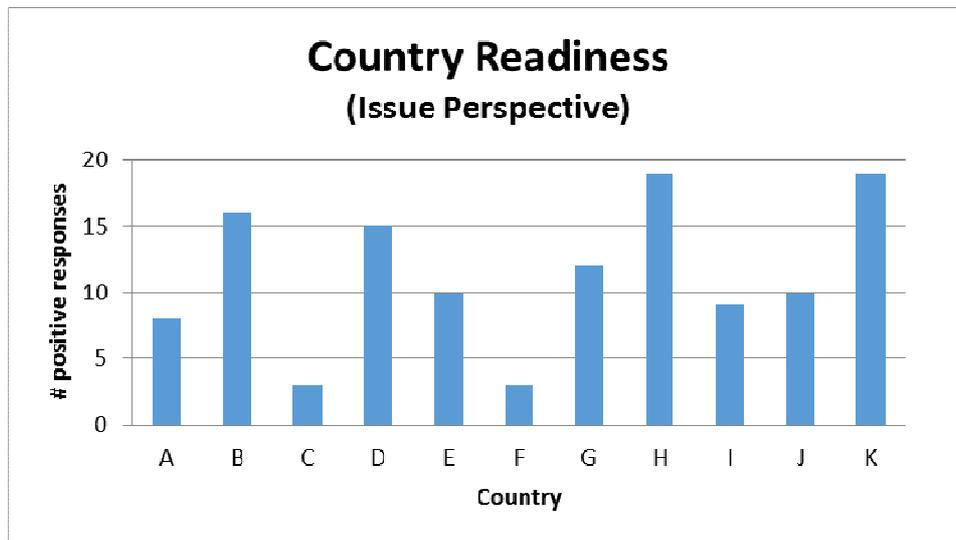


Figure 4: Country Readiness – Issue perspective

From figures 3 and 4 it is apparent that about 7 of the 11 responding countries are mostly ready to make an informed decision on nuclear power if all infrastructure issues are to be considered in the decision making process. The rest of the countries (4) will have to put plans in place to progress on the issues before an informed decision can be made on nuclear power.

5 SUMMARY

The analysis of the responses to the survey indicates that the following areas are not adequately developed in the majority of the TWG3-NPP countries:

- (a) National position;
- (b) Funding and financing;
- (c) Radiation Protection;
- (d) Electrical grid;
- (e) Human Resources;
- (f) Site and supporting facilities;
- (g) Environmental Protection;
- (h) Emergency planning;
- (i) Nuclear life cycle;
- (j) Radiation waste;
- (k) Industrial involvement; and
- (l) Procurement.

The survey also revealed that about 36% (4 out of 11) of the respondent countries have to put plans in place to further develop their readiness to be in a position to make a knowledgeable on nuclear power.

Report on the Evaluation of Status of National Nuclear Infrastructure Development in TWG3-NPP Participating Countries

It should however be noted that some of the countries indicated that there is an understanding of and appreciation for the infrastructure issues and that they are awaiting enactment of legislation so that progress can be made.

It is therefore recommended that the countries perform a formal self-assessment of its readiness against the IAEA milestone document, identify the gaps and put plans in place to address the gaps. Since nuclear power implementation is a national project, all role players should be involved. The process should be led by the relevant government department and should have buy-in and support at the highest levels of government.

Countries should also consider requesting the IAEA for INIR missions to give credibility to the process.

APPENDIX A: QUESTIONNAIRE

| Condition | # | Question | Basis |
|----------------------|-----|---|--|
| 1. National position | 1.1 | Safety, security and non-proliferation needs recognized – Is there an official documentation clearly demonstrating the Government’s commitment to the safe, secure and peaceful implementation of nuclear power for the long term? | Given its fundamental importance, there should be a clear statement that any development of nuclear power fully recognises the importance of safety, security and non-proliferation as well as evidence in the ongoing work programme. |
| | 1.2 | Has the NEPIO been established and staffed? | It is essential that the NEPIO: <ul style="list-style-type: none"> • has clear terms of reference which call for a comprehensive review of all the issues relevant to making a decision to proceed with a nuclear programme • is recognised by all relevant ministries as having that role • reports to a senior minister • is staffed with appropriate resources(including budget for external support) and expertise • Involves all relevant stakeholders, including the regulatory authority for radiation protection and future operators if already identified. • Has developed or is considering bilateral agreements as appropriate |
| | 1.3 | Has the national strategy been defined? | The output for milestone 1 is a comprehensive report, defining and justifying the national strategy for nuclear power. |
| 2. Nuclear safety | 2.1 | Are the key elements of nuclear safety understood by the NEPIO? | The key requirements for nuclear safety, specified in international standards must be understood by the NEPIO and other relevant stakeholders, and their implications recognized. |
| | 2.2 | Are there intentions to get support through international cooperation? | International co-operation and open exchange of information related to safety is an essential element of the Global Nuclear Safety Network. It needs to be demonstrated from the beginning |

Report on the Evaluation of Status of National Nuclear Infrastructure Development in TWG3-NPP Participating Countries

| Condition | # | Question | Basis |
|--------------------------|-----|--|--|
| 3. Management | 3.1 | <p>Commitment to management systems that promote and support a strong safety culture, evident –</p> <p>Is there a plan to ensure that the management systems in the future organizations are designed in such a way that they provide structure and direction to the organization that permits and promotes the development of leadership and a strong safety culture?</p> | <p>Recognition of and commitment to leadership and management systems that will promote a strong safety culture.</p> |
| 4. Funding and Financing | 4.1 | <p>Strategies for funding and financing established</p> <p>Is there evidence that enough resources have been made available to the NEPIO to carry out an adequate review?</p> | <p>Establish how a range of key activities that are specific to a NPP (including items that may not be the fiscal responsibility of the owner/ operator) will be funded, taking into consideration the various possible sources of funding. They include:</p> <ul style="list-style-type: none"> a) the regulatory body for safety and security b) safeguards arrangements c) education, training and research d) emergency preparedness e) storage and disposal of radioactive waste f) management of spent fuel including spent fuel/high level waste disposal g) decommissioning. <p>Identify financial and strategic planning measures and risk management strategies, which together create sufficient confidence for investors to support an NPP project and ensure the long term viability of the operating organisation to effectively fulfil all its responsibilities with strong capabilities, skilled and trained staff. A large part of government's role in nuclear power financing, if the government is not directly a sponsor of the project, revolves around risk reduction.</p> |
| 5. Legislative Framework | 5.1 | <p>Adherence to all relevant international legal instruments planned - Is there a plan approved by government identifying the relevant international legal instruments to which the State will be party?</p> | <p>An understanding of the requirements of international legal instruments, the implications for the country and a commitment to adhere. As a minimum, the following instruments should be covered:</p> <ul style="list-style-type: none"> a) Convention on Early Notification of a Nuclear Accident b) Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency c) Convention on Nuclear Safety d) Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste management e) Convention of Physical Protection of Nuclear Material and its Amendment f) Vienna Convention on Civil Liability for Nuclear Damage, Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage and the Convention on Supplementary Compensation for Nuclear Damage |

Report on the Evaluation of Status of National Nuclear Infrastructure Development in TWG3-NPP Participating Countries

| Condition | # | Question | Basis |
|-------------------------|-----|---|---|
| | | | g) Comprehensive Safeguards Agreement between the State and the IAEA h) Revised Supplementary Agreement concerning the provision of Technical Assistance by the IAEA. |
| | 5.2 | Are the plans approved by the government; <ul style="list-style-type: none"> For completion of the national nuclear legislation Identifying other laws to be prepared or amended | An understanding of what legislation needs to be established, the timescales for its development and approval, together with a commitment from government to achieve the stated plan which should cover Safety, Security, Safeguards and Emergency Planning |
| | 5.3 | Is there documented evidence that relevant stakeholders have been identified and consulted and the resulting comments have been satisfied or actioned? | Effective stakeholder engagement and an on-going plan. |
| 6. Safeguards | 6.1 | Are obligations under NPT and non-proliferation treaties and other international instruments recognized and understood? | The Comprehensive Safeguards Agreement with associated Subsidiary Arrangements is in force with the IAEA. If the State currently has a Small Quantity Protocol (SQP) in force, a plan for rescinding the protocol in a timely manner is in place. The State is aware of the obligations of the Additional Protocol (AP) and, if it intends to ratify and has not already done so, a plan is in place for timely ratification. |
| | 6.2 | Are the plans produced by the NEPIO covering <ul style="list-style-type: none"> The conclusion of a comprehensive safeguards agreement (CSA) with the IAEA and establishment of a State system of accounting for and control of nuclear material (SSAC) with requisite authorities? The drafting, implementation and enforcement of national legislation, policies and procedures relevant to safeguards? | The State System on Accounting for and Control of Nuclear Materials (SSAC) has been established as required under the Comprehensive Safeguards Agreement. |
| 7. Regulatory Framework | 7.1 | Are there clear plans for the development of an adequate regulatory framework? Is there evidence that the functions of the proposed regulatory body will be developed with assistance and advice from those whose expertise is well established and recognized? | As work to establish the regulatory body will need to take place early in Phase 2, the prospective senior managers of the regulatory body should be identified in Phase 1. There should also be plans to develop a regulatory framework that matches the overall plan for the NPP. There should be clarity of the terms of reference of the regulator and the roles of and interfaces with existing regulators. Recognition of the need for integrating radiation protection regulations and new safety regulations for nuclear power plants. |
| 8. Radiation Protection | 8.1 | Are the hazards presented by the operation of nuclear power plant recognized? | There is probably an existing radiation protection programme associated with radiation sources. The condition is to identify how the existing programme will need to be enhanced |

Report on the Evaluation of Status of National Nuclear Infrastructure Development in TWG3-NPP Participating Countries

| Condition | # | Question | Basis |
|---------------------|------|---|--|
| | 8.2 | Are there plans to enhance national regulations and infrastructure? | (both in scale and to cover new technical issues) to address hazards arising from NPP operation (including transport of radioactive materials and waste management) and to begin to consider how the required enhancements will be delivered. <i>This issue is closely linked to issue 7. In particular, the development of regulations and issue of whether the existing regulatory body will expand its role or whether the issues will be addressed by a separate organisation is covered in issue 7.</i> |
| 9. Electric grid | 9.1 | Have the following with regard to the electrical grid requirements been considered/investigated: <ul style="list-style-type: none"> • A complete analysis of the inclusion of a nuclear power plant into the existing and future electrical grid, • Potential location of the nuclear power plant • Potential for local or regional interconnections to improve the grid characteristics such as reliability, • The number of plants in the grid • Adequate measuring, monitoring and communications to be covered between the national grid controllers and the future nuclear power plant, • The need for an independent start-up line? | There are a number of criteria related to the grid: <ul style="list-style-type: none"> • The grid needs to be able to withstand loss of the output • The grid needs to be reliable to take the output from the NPP as a base load • The grid needs to be reliable to minimise demand on on-site supplies The potential impacts of the reliability of the national power grid on the design requirements for the safety of the plant should be considered. |
| 10. Human Resources | 10.1 | Has a sufficiently detailed analysis been conducted to identify the competencies needed by each of the future organizations | There needs to be an integrated approach to human resource (HR) development across all organisations. A national strategy needs to consider: <ul style="list-style-type: none"> • assessment of current national institutional and human resource capacity and education programmes including the additional education, competences and skills that will be required (gap analysis) • how appropriate staff will be attracted, trained and retained • what centres and programmes need to be established for education and training • what research capability needs to be developed • a senior leaders development programme. At this stage, this should be an integrated plan that can be developed, in a co-ordinated way, into plans for each organisation. |
| | 10.2 | Is there a human resources plan that identifies the resources needed by each of the future organizations? | |

Report on the Evaluation of Status of National Nuclear Infrastructure Development in TWG3-NPP Participating Countries

| Condition | # | Question | Basis |
|------------------------------------|------|--|--|
| 11. Stakeholder Involvement | 11.1 | Open and transparent stakeholder involvement programme initiated | Stakeholder involvement plans should be developed by the NEPIO and implemented through the relevant organisations. The public and other relevant interested parties should be informed about nuclear technology and, in particular, nuclear power, its benefits and risks, including the 'non-zero' potential for severe accidents, to facilitate stakeholder involvement based on transparency and openness. |
| 12. Site and Supporting facilities | 12.1 | Has a general survey of potential sites been conducted? | In Phase 1, it is necessary to identify the main exclusion and avoidance criteria (covering safety, security, cost, socio-economic, engineering and environment) and conduct regional analysis to identify candidate sites. These should include the impact of external hazards on security and emergency response capability. Depending on the specific authorisation process of the Member State, site selection, justification, and authorization by the regulatory body will probably be required early in Phase 2, so plans should exist for the next Phase. |
| | 12.2 | Is there justification for the selected sites? | |
| 13. Environmental protection | 13.1 | Environmental framework and key issues for nuclear power outlined | The NEPIO needs to be aware of international as well as national environmental requirements and to ensure that they are fully considered. Initial environmental studies should be conducted as appropriate for use in feasibility studies or siting studies (see issue 12). The basis will be a set of criteria derived from the environmental requirements at a regional scale and with the use of available data. <i>N.B Whilst control of radiological impact to people is considered under Issue 2, 7 and 8, there is a need to consider control of discharges to the environment and non-radiological impact.</i> |
| | 13.2 | Environmental studies production and communication recognized | |
| 14. Emergency planning | 14.1 | Appreciation of the need for emergency planning, developed | In Phase 1 the Government needs to be aware: <ul style="list-style-type: none"> • of the nature of what is required for Emergency Response • that significant resources will need to be expended to develop, maintain and demonstrate an Emergency Response capability • that it is responsible for the national emergency response plan and will need to define clear responsibilities for all organisations involved. The process of developing emergency response capability will be largely carried out in Phase 3. <i>NB the requirements of the Early Notification and Assistance Conventions are covered under issue 5.</i> |
| | 14.2 | Communication with and involvement of local and national government taken into account | |
| 15. Security | 15.1 | Conditions for nuclear security acknowledged | The need to establish legislation and a regulatory framework are addressed under issue 5 and 7. The NEPIO should recognise the importance of nuclear security and that it should be based on national threat assessments. It should ensure that a competent authority is designated for the preparation of the national threat assessment. The State should recognize that the design basis threat (DBT) should be used to define security at all nuclear facilities. Note: Nuclear security considerations including physical protection also need to include adequate consideration of safety and safeguards needs and vice versa. |
| | 15.2 | Necessary regulation identified | |

Report on the Evaluation of Status of National Nuclear Infrastructure Development in TWG3-NPP Participating Countries

| Condition | # | Question | Basis |
|----------------------------|------|--|---|
| 16. Nuclear Life Cycle | 16.1 | Knowledge of nuclear fuel cycle steps (front end and back end) and approaches developed | At a strategic level it is necessary to consider how the fuel cycle will be established. Options need to be considered for the front end of the fuel cycle addressing, sourcing uranium and fuel manufacture, and for the back end of the fuel cycle, covering all the spent fuel inventory in the country and addressing spent fuel storage (at-reactor and away-from-reactor) and eventual disposal/reprocessing. |
| | 16.2 | Need for at-reactor spent fuel storage recognized | The NEPIO needs to be aware of options for spent fuel storage or reprocessing and that it will need to decide a strategy during Phase 2 and include the need for interim storage requirements consistent with that strategy. |
| | 16.3 | Away-from-reactor spent fuel storage considered | |
| 17. Radioactive waste | 17.1 | Is there a document clear demonstrating that the NEPIO understands the significant implications and responsibilities related to high, intermediate and low level radioactive waste resulting from nuclear power generation? | The decision to embark on a nuclear power programme must take account of the need for the handling, storage and disposal of radioactive waste and develop a national strategy |
| | 17.2 | Is there a document clearly showing that the NEPIO has examined current capabilities for processing, storage and disposal of intermediate and low level radioactive waste and understands the options for addressing any shortfalls? | |
| | 17.3 | Is there a document that clearly indicates that the NEPIO understands options for final disposal of high level radioactive waste? | Although the ultimate route for disposal of high level waste can be decided later, it is important to understand the options for the different waste categories and to recognise that adequate options ultimately have to be selected |
| 18. Industrial Involvement | 18.1 | Is there a national policy which considers national and local industrial involvement and is there a summary of industries capable of participating in non-nuclear safety related construction or support services activities with any required actions and funding requirements? | A recommended policy for national involvement, covering availability of expertise, industrial capability and technical services for the overall programme (assuming more than one NPP is planned); the balance between capability, quality standards and intended industrial development should be recognized. Note: Typically the first NPP is constructed with very limited local industrial involvement. This can be introduced gradually as national experience increases and the programme develops |
| | 18.2 | Is the need for strict application of quality programmes for nuclear equipment and service recognized? | If the national policy in 18.1 supports national or local industrial involvement in construction or support services, there needs to be a clear intent to develop the required management systems and to meet the required standards. |

Report on the Evaluation of Status of National Nuclear Infrastructure Development in TWG3-NPP Participating Countries

| Condition | # | Question | Basis |
|--------------------|------|--|--|
| 19. Procurement | 19.1 | Is there <ul style="list-style-type: none"> • A clear recognition of issues related to procurement covering local, national and foreign supplies? • A recruitment training program to build up a procurement team? | <p>Procurement policies taken with full knowledge of the special requirements for nuclear procurement; recognition of the need for a procurement policy consistent with the industrial participation policy.</p> <p>A qualified team to write the request for proposal and BIS for the selection of the potential NPP supplier and contractor. The specification should match all the national legal and regulatory requirements.</p> <p>A strategy for procuring the equipment and services need be developed. Recognize the requirements of any procurement by the owner/operator outside of the main supply contract.</p> |