ATOMIC ENERGY COUNCIL

GUIDELINES ON LICENSING OF THE FIRST NUCLEAR POWER PLANT IN UGANDA

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List of acronyms

AEC	Atomic Energy Council
AOO	Anticipated Operation Occurrences
IAEA	International Atomic Energy Agency
FSAR	Final Safety Analysis Report
PSAR	Preliminary Safety Analysis Report
PSR	Periodic Safety Review
R& D	Research and Development
SAR	Safety Analysis Report
SER	Safety Evaluation Report
SSC	Systems Structures Components
TSO	Technical Support Organizations

1. Introduction

1.1 Background

A major challenge in the deployment of the first nuclear power plant in a country is the development of the underlying nuclear safety infrastructure and knowledge base. The IAEA Fundamental Safety Principles state that regulating nuclear and radiation safety is a national responsibility and that an effective legal and governmental framework for safety, including an independent regulatory body, must be established and sustained. Therefore, establishment and development of the regulatory body must be addressed at an early stage of the nuclear power programme and must not be constrained by lack of resources.

Uganda is one of those Countries planning to include nuclear power plants in its national development plans but the country has less familiarity with nuclear reactor technology and safety principles. Uganda's main experience is limited to the application of radiation sources in medicine, agriculture, research and industry. The country will face a significant challenge in establishing the necessary safety infrastructure. Uganda should have, in general, a reasonable understanding of the role and responsibilities of both the operating organization and the regulatory body, should have a licensing process in place, and should be familiar with the need for high quality standards in nuclear activities. Additionally, Ugandashould have a core of human resources with a basic knowledge of nuclear technology and, in general, academic courses on nuclear science and technology should be available.

As new entrant country in nuclear power regulation, Uganda should secure a competent and fully functional regulatory body, in both human and financial, for licensing the first nuclear power plant. Therefore, the development of the regulatory body needs to be planned and implemented at an early stage of the programme. In particular, to conduct the licensing process as well as to provide oversight of the construction activities for the first nuclear power plant, the regulatory body needs to develop an extensive set of specialized competencies and processes to ensure an informed decision making process.

Uganda could use the 'reference plant' concept for its first nuclear units. Using this approach, the first nuclear plant would have essentially the same design and safety features as a plant already licensed by the regulatory body of a country with an established nuclear power programme. This approach would facilitate the licensing process in the country: AEC could learn considerably from the existing Safety Evaluation Report (SER) written as part of the licensing process for the reference plant and could obtain important insights from the results of various safety analyses that were completed for the reference plant.

1.2 Purpose

This guideline outlines some activities involved in nuclear power regulation. This guideline focuseson activities Atomic Energy Council (AEC) must carry out during phase 3 of the nuclear power deployment programme. During this phase, AEC will be required to review in depth a

substantial amount of specialized and highly technical information to support the decision to grant a construction license. However, the competency level of AECmay not be sufficient to perform this review at the time the construction license is required without substantial assistance. Therefore, a strategy should be proposed that uses some elements of prior assessment work performed by an experienced regulator in a country where the reference plant has already been licensed. The primary objectives of this strategy are:

(1) To achieve a high level of safety for the first nuclear power plant; and

(2) To establish an effective ongoing regulatory role early in the programme.

Achieving a fully competent and functional regulatory body for a nuclear power programme takes many years therefore external expert support will be needed for a considerable time period even after the power plant goes into operation to help maintain a high level of safety regulation. However, AECmust progressively enhance its technical competence so as to be able to take informed decisions without extensive reliance on support from an experienced regulator

1.3 Scope.

This guideline looks at activities that aAEC must carry out for licensing its first nuclear power plant:

- Establishment of the licensing framework;
- Approval of the site;
- Understanding of the design SER of the reference plant;
- Review of the design;
- Issue of a construction permit;
- Oversight of manufacturing and construction;
- Oversight of commissioning;
- Issue of an operating license;
- Oversight of operations

2 REGULATORY INFRASTRUCTURE

IAEA Safety Guide SSG-16 sets out the main phases of a nuclear power programme and identifies some important safety steps for each phase. The first three phases are summarized in the figure below

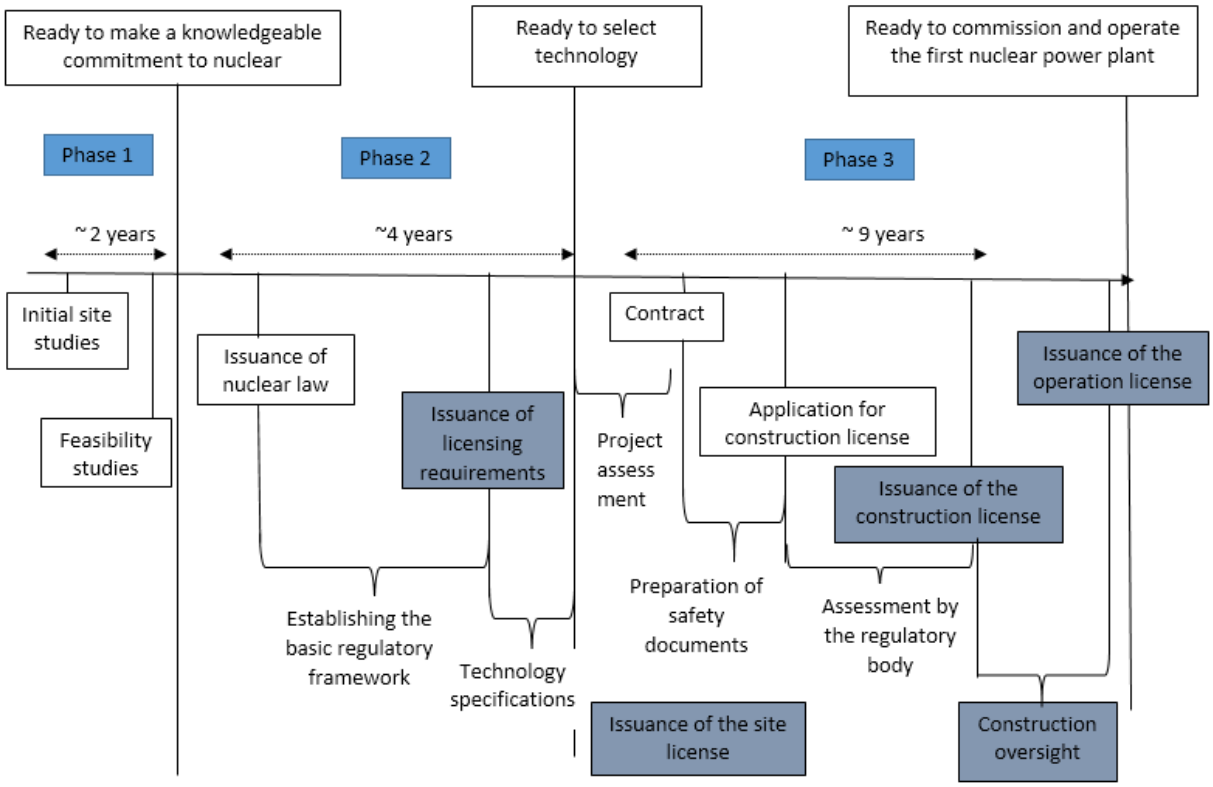

Figure 1: Summary of the first three phases of a nuclear Power Program

INSAG-22 identifies phase 2 as being critical for the establishment of the regulatory body.

Once Government adopts a nuclear law that provides AEC with a clear mandate and authority to carry out its mission, AEC needs

- To develop regulations and guides by which the nuclear power project will be assessed, and to develop a licensing process.
- Establish a strong human resources programme on the specialized areas of competence to conduct its activities in phases 2 and 3.
- Conduct the licensing process for the first nuclear power plant in an informed manner.

Figure 1 highlights the main tasks Atomic Energy Council (AEC) will perform in phase 2 and 3. For example, AEC must be capable of granting a construction license following a thorough evaluation of the preliminary safety analysis report (PSAR) submitted by the licensee (with considerable detailed technical content from the designer), and then the evaluation of an even more final safety analysis report (FSAR) in order to support the issuance of an operating license. The licensing process involves the development of a comprehensive safety evaluation report (SER)by AEC. To perform this work, AEC will need

staff with competencies in several technical areas. Many of those areas are specific to nuclear power technology and safety. Therefore, regulators must start very early to establish the required competencies.

2.1 REGULATORY FRAMEWORK

After government has taken decision to proceed with a nuclear power programme, an action plan for the establishment of the legal framework should be implemented. A main component of the action plan is the issuance of a nuclear law establishing fundamental principles and defining the responsibilities of the principal organizations comprising the nuclear power programme, particularly the operating organizations and the regulatory body. For the regulatory body, the nuclear law should address unambiguously, among other things,

(1) The scope of its responsibilities, functions, and authorities,

(2) The position of the regulatory body in the government structure, and

(3) The means for regulatory body financing.

One of the first activities of AEC will be the development of the regulatory framework. This framework should include the establishment of regulations and guides by which the nuclear power project will be assessed, definition of the licensing steps and corresponding documentation to be submitted by the applicant, and the implementation of an integrated management approach that fully incorporates a robust quality management system. This regulatory framework should ideally be established before the operating organization completes the project specifications because regulatory requirements should be incorporated into the technology selection process.

An option that several new entrant countries have used in the past, AEC can develop their national regulations by adopting or adapting regulations from a country that has licensed the same type of nuclear power plant. However, if the Uganda intends to have an open technology selection process, the AEC should first establish technology neutral regulations, such as the IAEA Safety Standards, as the foundation. These technology neutral regulations can then be complemented by more design specific regulations after the technology is chosen. In addition, since nuclear power technology and the respective regulations will continue to advance, there should be provisions for accommodating these advances in future amendment of national regulations.

2.2 HUMAN RESOURCES DEVELOPMENT

There are four areas or “quadrants” of competencies that AEC should consider while developing its human resources. These areas are:

Quadrant 1: Legal basis, regulatory policy and approach;

Quadrant 2: Technical disciplines;

Quadrant 3: Regulatory practices;

Quadrant 4: Behavioural, managerial, leadership, communication.

The development of these competencies requires time, therefore AEC needs to plan for human resources development at a very early stage of the nuclear power programme.

AEC must establish a competent leadership and senior management core that has the expertise and commitment to develop a strong regulatory body. AECshould then identify the essential competencies required for thedifferent phases of the nuclear power programme. Among those competencies, some will be required within AEC itself and these should be the subject of a systematic and dedicated competency building programme. For others, AEC may identify outside organizations to act as technical support organizations (TSOs) and to provide nuclear safety research and development. These organizations should have access to appropriate nuclear safety research facilities and to international expertise. These outside organizations may be internal or external to the country.

Once the nuclear power plant technology has been selected, there is a need for formal arrangements between AEC and one or more experienced regulators that have licensed a similar facility. This should include early interaction between senior managers, followed by detailed training of selected staff who will form the technical core of AEC. Training should involve actual work through internships with the experienced regulator and/or its TSO. Participation of an experienced regulator's experts in design safety review meetings and in subsequent operational safety review meetings as advisors for a few years after the nuclear power plant starts operating is strongly encouraged. AEC should establish relationships for long term technical support in order to augment and reinforce the capabilities of its staff.

The human resources development programme for AEC could be based on a two track approach. The first track is intended to provide to the regulatory body the means to respond to the nuclear power project in a timely manner without compromising safety. It involves the extensive use of external support and, to a certain extent, relies on the work done by an experienced regulatory body that has licensed a similar facility. In this phase a training programme should be established by AEC aimed at providing a general understanding of the safety issues to be delt with and to allow the local staff render informed decisions with the support of external expertise. The second track is aimed at providing longer term sustainability of the regulatory body by developing the competencies required to regulate the future operation of the plant. These competencies should be available at the commissioning phase. The goals of the training programme in this case should be to provide the necessary skills to perform the regulatory functions by the end of the construction period with limited support from external experts.

The development plans should include extensive interactions with experienced nuclear countries. Those interactions might appropriately include the following:

1) Interactions with senior policy makers from experienced nuclear countries to develop understanding of the required nuclear power infrastructure.
2) Assignment of senior regulatory managers to an experienced regulator to understand regulatory management requirements and processes.
3) Assignment of selected senior staff to experienced regulatory bodies for gaining hands-on work experience; these experts would then train local staff.

4) Assignment of experienced regulatory staff to AECto assist with training, the development of processes, and assistance with the early regulatory activities.

If additional nuclear power plants will be constructed in Uganda in the future, the new nuclear power plant units may not be of the same design as the first nuclear plant. This should be taken into consideration when developing both the licensing methodologies and staff.

AECstaff can also obtain significant benefit from participation in international cooperation activities such as the Convention on Nuclear Safety, technical cooperation forums of regulatory bodies of countries having nuclear power plants of similar design, and the various technical cooperation activities conducted by international organizations, in particular the IAEA and the OECD/NEA.

2.3 Establishing the licensing process

AEC should define the licensing process and establish rules and regulations by which the project will be assessed in phase 2, since these elements are necessary for the technology selection process. In that regard, early in phase 2 AEC should recruit and train the staff that will be responsible for those developments. In phase 3,AECshould be prepared to assess the safety documentation provided by the future operator and to deliver licenses for construction at the beginning of phase 3 and for the start of nuclear power operation at the end of phase 3.

3 ROLE OF THE OPERATING ORGANIZATION

The first principle of the IAEA Fundamental Safety Principles states that "the prime responsibility for safety must rest with the person or organization responsible for facilities and activities that give rise to radiation risk". The licensee will retain this responsibility throughout the lifetime of the licensed facilities, and this responsibility cannot be delegated. There should be no confusion between the role of the operator and the role of the regulator: the operator will be responsible for safety, whereas the regulator will be responsible for approving and providing independent oversight of the operator's activities that could impact safety.

The responsibility for safety requires that the nuclear power operator in Uganda establish and maintain the necessary competencies of both staff and management for safe operations. This entails providing adequate training and effective knowledge management, establishing the culture and methodologies to maintain safety under all conditions, and verifying that all activities and processes are safe. The operator must also verify on a continuous basis, due to ageing and to nuclear power plant configuration changes over the operating period that the design and quality of facilities and equipment continue to meet safety requirements. In addition, the operator must take into account advancements in scientific and engineering knowledge and the potential effects of changes to the environment. All safety related issues must be identified and promptly addressed through operating experience (OPEX) and Research &Development (R&D). As a result, the operator will identify the external technical organizations required to sustain safe operations, particularly for R&D support to secure the ongoing effectiveness of the safety related structures, systems and components (SSCs) over the life of the nuclear power plant. The operator must also ensure the safe control of all radioactive material that is used, generated, stored, or transported. This includes provisions for the continuity of responsibilities and fulfilment of

funding requirements over the long term for waste management. To acertain that these responsibilities are met, the operator will establish early in the project how it will manage safety and perpetuate a safety culture that will underlie all its activities. Therefore, in the pre-project period the operator should develop robust safety policies, preferably with the assistance of an experienced and effective nuclear power plant operator, and communicate these to staff and stakeholders. The policies should include the organization's safety values, management's leadership of safety, and the safety behaviours that will prevail throughout the entire lifetime of the programme. These policies should extend beyond the organization's immediate staff to include the behaviour expected of all the stakeholders involved in the programme — contractors, suppliers, constructors, vendors, and support groups.

4 USING THE DESIGN SAFETY EVALUATION OFA REFERENCE PLANT

The review of a SAR is likely to be the major initial technical challenge faced by AEC. In a two-step licensing process, the PSAR will be submitted by the operating organization to support the construction license approval and the FSAR will be submitted to support the operating license approval.

The regulatory body needs several years to develop the specialized competencies required to assess a SAR fully. Therefore, at the time of the application for the construction license, support from an experienced regulatory body that has licensed a similar facility will very likely be needed. This support will considerably facilitate the licensing process in Uganda because the regulator can benefit from the analyses and decisions undertaken by the experienced regulatory body. However, AECmust recognize that that the responsibility for the authorization process cannot be delegated and that the final goal is to have a fully competent organization by the time of plant commissioning.

It should be recognized that every nuclear power plant must meet requirements for safety that result from local conditions. It may often be the case that modifications of the reference plant will be required so as to meet site specific circumstances, such as seismic conditions, differences in powerfrequency (i.e., 50 versus 60 Hz), the temperature and nature of the heat sink, local population density and distribution, and so forth. Because modifications of the design can have significant safety implications, the PSAR for the reference plant may be inapplicable in some respects for the nuclear power plant contemplated by the new entrant. AEC must be capable of assessing modifications of the reference plant, presumably with assistance from the experienced regulator.

5 SITE APPROVAL

Once a site has been selected and an application for a site license has been made, AEC will evaluate the site information as part of the licensing process.

Site approval in a form of a 'site license' or 'site permit' will be issued by AEC. It will be the first license for a nuclear power programme to be issued.At this point in the licensing process, the plant design details may not be known. However, an envelope of key generic characteristics

(such as the power generated by the plant) of the nuclear power plant should be specified that are consistent with the technology requirements as established by the operating organization.

AEC should establish Site criteria in the overall nuclear power programme (ideally at the beginning of phase 2), so that the future operating organization can specify the site characteristics in any documentation used to develop the project requirements with vendors. If this is not possible, then envelope conditions covering all potential sites should be specified.

At the stage of site approval it is also appropriate to undertake a thorough review to ensure that the site is acceptable from an overall environmental perspective. Such a review might typically include the assessment of the impacts of the proposed nuclear power plant on the environment, adverse environmental impacts that cannot be avoided, the consideration of alternatives, and any irreversible and irretrievable commitments of resources.

The IAEA Safety Requirements for site selection mandate that three aspects be considered:

a) The effects of external events, both human accidents and natural;
b) Characteristics of the site and its environment that could influence the transfer of radioactive material to persons and the environment; and
c) Population density and distribution and other characteristics of the external zone that might affect the implementation of emergency procedures.

If there are any deficiencies in these three areas that cannot be compensated for by means of design features, measures for site protection, or administrative procedures, then the site should be deemed unsuitable.

The site approval process also establishes the basis for longer term requirements that will remain in place throughout the lifetime of the plant. The pre-operational phase includes ongoing assessment work during construction to refine the characterization of the site. During the operational phase, continuous monitoring and assessment of site characteristics will be required as part of the operating license. Also, if there are any significant changes in population distributions or human activities surrounding the plant, or a change to the nuclear capacity on the site, these changes will have to be taken into consideration. AEC shouldestablish the authority and capacity to deal with site phenomena early in its development.

AEC must have the means, authority and competence to evaluate all the submissions that relate to the approval of a site. This process will require a set of specialized competencies in areas that are not necessarily nuclear related, such as seismology, meteorology, hydrology, geochemistry, and geology. In developing the strategy to secure and maintain a technically competent regulatory body, AEC should make a decision early in phase 2 whether to recruit staff with those competencies or to outsource this activity to external experts. AEC requires a core technical group in the key disciplines to be able to understand and compile the information from the site evaluation reports as input to the site licensing process.

6 DESIGN REVIEW

The design review leading to issue of the construction license and the more detailed design review incident to an operating license are major undertakings for a nuclear power regulator. Such a review involves comprehensive assessment of the PSAR at the construction license stage and of the Final Safety Analysis Report (FSAR) at the operating license stage, as well as other highly technical supporting documentation, including R&D results and mathematical analysis.To ensure both high quality and timely regulatory decisions, extensive use of the Safety Evaluation Report (SER) for the reference plant may be essential. In addition, support from external expertise could facilitate and build confidence in the regulator's decisions. For other approvals, the nuclear Power regulator must take full responsibility for licensing the design, no matter what assistance AEC receives or the degree to which the regulator incorporates an experienced regulator's evaluations.

The design review is a formal systematic assessment procedure to determine whether the design meets the required national safety regulations. It is expected that the national safety regulations will be consistent with the IAEA Safety Standards. The IAEA Safety Standards constitute the international consensus on nuclear safety in the form of Principles, Requirements, and Guides and provide the basis for a high level of safety. These should be used as a reference for the development and review of the national safety standards against which the reactor design will be assessed.AEC may consider the use of the IAEA safety review services to review the compliance of reactor designs against the IAEA Safety Standards.

The design safety review work will involve industry codes and standards that are not specific to nuclear power plants. The use of established codes and standards from a country experienced in the use of nuclear power with the licensed reference nuclear power plant may be desirable. However, the degree to which Uganda can accept the codes and standards used in the design of the reference nuclear power plant must be evaluated very early in the design review process. Carrying out sample checks on the design using the codes and standards that are in use Uganda could also provide a good degree of confidence that the design meets the technical specifications.

Considerable technical information will be transferred from the vendor country to the Uganda for the safely assessments. If the languages of the vendor country and Uganda are different, then care has to be taken in deciding on the working language for the safety review, ensuring quality in the translation of documents, and interpreting the information.

AEC must also establish control of the design changes that will occur throughout the operating life of the nuclear power plant. The initial design approval is only the first step in ongoing design reviews that will occur over the operating life of the nuclear power plant. For example, as additional information becomes available from R&D or safety assessments, AEC must be prepared to evaluate this information and to determine its safety impact on the reference design. In addition, the operator will continue to make design changes to improve and upgrade plant performance.

AECshould establish ongoing formal arrangements with established regulators from countries with similar nuclear power plant technology to ensure that the regulator is well informed of any safety implications arising from external findings concerning the design of the plant.

7 MANUFACTURING ANDCONSTRUCTION OVERSIGHT

AEC needs to confirm that all the SSCs of the nuclear power plant are manufactured and constructed following established industry and quality standards and proven engineering practices. This is to ensure that the SSCs are able to perform their design intended functions during normal operational states and also under accident conditions. The confirmation is achieved through design document review and assessment, and by ensuring that appropriate audits and inspections are in place. A thorough design document review by the regulator is necessary regardless of whether the manufacturing and construction is done by local or foreign organizations.

AEC must be assured that audits and inspections are conducted in a systematic and organized manner to ensure that no items affecting safety are missed. In particular, special attention is required for the manufacturing and construction of components that will be subjected to high levels of neutron irradiation, as well as for those that are not easy to maintain, inspect or replace during operation. AEC may seek assurances that the licensee has robust procurement, inspection, and auditing processes in place. In some cases, however, the regulator may also perform independent audits and inspections. In that case, the designated regulatory staff must be trained and qualified as inspectors and the inspection procedures formally documented. Foreign or domestic accredited inspection organizations might also be used to conduct the inspections on behalf of AEC.

A graded approach should be employed in inspections whereby the rigour of inspection is commensurate with the level of importance to safety of the SSC being inspected. Deficiencies observed during inspections should be categorized according to their importance to safety and documented. Procedures and time frames for their correction should be agreed upon between the utility and the regulator. AEC staff should continue to follow up until the deficiencies are corrected or alternative methods for their resolution are approved and implemented.

It is recommended that some of the construction and manufacturing be carried out by local contractorsin order to involve the local industry in the nuclear power acquisition. But care must be taken to ensure that they are capable of meeting the stringent quality standards of the nuclear industry. Both licensees and regulators are encouraged to engage with contractors to provide the required knowledge and training.

Some deviations from the design may become necessary during manufacturing and construction due to a variety of reasons. Methodologies for dealing with such deviations should be developed and communicated by the regulator before these activities start. Regulatory work associated with the construction and manufacturing of the first nuclear power plant will involve many new activities for the regulator and it is likely that external experts will be needed both for training and for implementation. Experts from an experienced regulator may be included as advisors in the regulatory inspection teams and in the review of the inspection reports. This will assist with

the efficiency and quality of regulatory oversight and in advancing the knowledge of the regulatory staff. The extent of involvement of the advisors may be progressively reduced as regulatory staff gain experience and improve their level of competence. In addition, other domestic or foreign accredited inspection organizations might be employed.

8 COMMISSIONING OVERSIGHT

Commissioning has a number of objectives. The SSCs of the nuclear power plant are prepared for operation and their design functions are verified. Also, confirmation is obtained that the performance of components and the integrated behaviour of systems both meet the design requirements for normal operation, anticipated operational occurrences, and design basis accidents. Verifying the design provisions for management of accidents beyond the design basis is done to the extent that this is feasible.

AEC should develop a detailed plan for review of commissioning work that ensures efficiency without any compromise in quality or safety.The review of commissioning activities provides a unique opportunity for the regulatory staff to gain deeper insights into the behaviour of the individual reactor systems and the nuclear power plant as a whole under different operating conditions. This is beyond the knowledge that can be acquired through training, including the study of the PSAR and FSAR and other technical documents. The regulator should utilize this opportunity not only for augmenting the technical skills of its staff, but also to use the information obtained from commissioning for fine tuning the regulatory requirements during operation, such as those related to operating procedures, in-service inspections, and surveillance of safety related SSCs.

For certain commissioning work, the regulatory staff together with the regulator's technical support personnel should be physically present at the site. For instance, AEC should witness the performance tests of safety systems. This establishes the role of the regulator for on-site regulatory oversight and also allows the regulator to gain first- hand information on important safety related commissioning activities required for approving the various stages of commissioning. These clearances can be given by AEC staff at the site themselves, if so authorized, or in consultation with designated senior regulatory officials, or after review by a safety committee. AEC should identify all such activities in advance and make appropriate arrangements, including logistics for ensuring their efficient and effective regulatory review.

The commissioning review conducted previously by an experienced regulator of the reference nuclear power plant or a plant of similar design can be gainfully utilized by AEC in its oversight of commissioning. It should, however, be understood that no two nuclear power plants are exactly the same and there are bound to exist some design differences due to specificities of the site and plant layout. Also, some modifications to the design of the reference nuclear power plant are likely based on operating experience and new information from ongoing research to enhance safety or operating efficiency.

Expertise from experienced regulators acting in an advisory capacity could be used in the oversight of commissioning to enhance the quality and efficiency of the AECwork.

9 OPERATIONS OVERSIGHT

For the operating license, AEC may require the operator to demonstrate how the operating safety envelope has been determined and how it will be maintained, or AEC may include the operational limits and conditions and in-service inspection, testing, surveillance and administrative requirements. These specifications are based on the SAR and other relevant documents that have been duly revised taking into account the commissioning results and the design changes made during construction to reflect correctly the as-built plant design. Various other licensing conditions are specified by the regulator, such as the radiation dose limits for plant personnel and members of the public, limits on radioactive discharges to the environment, and requirements on radiological surveys of the environment in the vicinity of the nuclear power plant.

9.1 LICENSING FOR OPERATION

The nuclear power plant is licensed for start of operation after confirmation that a sufficient number of trained and qualified operating personnel is available, operating procedures including emergency operating procedures are issued, requisite security measures are implemented, and emergency preparedness plans are in place and tested satisfactorily. It may be challenging for the Uganda's operator to assess the knowledge level of the control room operators and securing their licenses. This is one of many areas where the Uganda's operator would benefit from working with an experienced operator.

Following thorough commissioning of the various systems, the operating power of the nuclear power plant is raised in pre-identified steps and the plant parameters, especially the thermal and radiological parameters, are checked at various power levels. Some of the commissioning checks that have to be conducted with reactor at power are also carried out. After confirming the results of these commissioning tests and that the plant parameter values are consistent with the design, the regulator authorizes operation of the nuclear power plant at its rated power.

AEC will require substantial assistance from an experienced regulator for a quality review of the data on various plant parameters and the results of commissioning tests. Such assistance will also be necessary for a thorough review of the technical specifications for operation and to ensure that all other prerequisites for issuance of the operating license have been identified and completed. Comparison with the technical specifications approved by the experienced regulator and a review of their basis is recommended to enhance the knowledge of the regulator. This support from an experienced regulator is of great importance as the licensing conditions must comprehensively cover the safety requirements for operation of the nuclear power plant over a licensed period that is likely to extend to several decades.

The technical specifications for operation and other licensing conditions for the reference nuclear power plant or other plants of similar design can be used effectively for developing the operational safety requirements for the plant being licensed. However, care has to be taken that the design differences and site specific conditions are taken into account. Assistance from an experienced regulator will be of great value in the judicious use of such information from other nuclear power plants.

9.2 REGULATORY OVERSIGHT DURING OPERATION

Regulatory oversight of the nuclear power plant during its operational phase is a very long term activity, covering the licensed operating period as well as its possible future extension. The major activities of regulation during operation are review of routine operation and safety related incidents, review of activities during outages, control of plant configuration and safety related changes in hardware and procedures, and assessment of the aging status of SSCs. Periodic safety reviews are also conducted, typically every ten years, to verify that adequate safety margins are maintained and that the nuclear power plant meets the current applicable safety requirements.

Regulatory oversight during nuclear power plant operation should not be limited to verifying compliance with the licensing conditions, but should also strive to make a positive contribution to enhancing safety on a continuing basis. This includes giving adequate attention to operational issues, such as management systems and safety culture.

A high level of technical competence in a variety of technical and other disciplines is necessary in AEC and its technical support personnel to be able to discharge all regulatory responsibilities effectively over the entire operating life of the nuclear power plant. The technical knowledge and other capabilities acquired by the regulatory staff through initial training and participation in the licensing process for siting, construction and commissioning may be sufficient only for the regulatory oversight of normal operation of the nuclear power plant. Strong support from an experienced regulator is necessary for a few years to deal with off-normal situations; appropriate arrangements should be in place for ensuring such support. The assistance from the experienced regulator can be progressively reduced as the regulator gains experience and enhances its technical and managerial capabilities.

It may not be possible for AEC to develop fully its own safety standards for nuclear power plant operation in its formative period. Available international safety standards, such as the IAEA Safety Standards, could be adopted with suitable modifications as necessary. After gaining a few years of experience, the task of developing national safety standards can be undertaken by the regulator and its technical support organizations.

AEC should periodically inform the government, the public and the media about the safety status and the operating experience of the nuclear power plant. In the case of any safety related incident, information should be provided promptly, including information on corrective actions. It is important that staff acquire the necessary communication skills to be able to convey the information in simple and easily understandable language to a non-technical audience.

10 CONCLUSIONS AND RECOMMENDATIONS

The licensing of the first nuclear power plant requires early development of the regulatory body. The time, resources and complexity involved with this development are considerable and should not be underestimated. Development of the Uganda's nuclear power regulator must start as early as possible and should not be constrained by the failure to plan or to provide necessary resources. An overall plan should be established that is consistent with IAEA recommendations and that recognizes fully the necessary regulatory capabilities and capacities required to address the

successive stages of deploying and operating a nuclear power plant. The early stages of development of AEC are particularly important.

The knowledge requirement for each stage of licensing and regulatory oversight builds on the previous stages, but adds in additional requirements both in terms of technical knowledge and processes. For example, the regulatory oversight of operations not only requires that the regulator have a thorough understanding of the reactor design, achieved from an independent assessment of the PSAR and FSAR, but also requires new competence relating to reactor operations and inspections. For each stage, the Uganda's nuclear power regulator should make use of experienced regulators and other external expertise, although dependence should diminish over time.

The development of the regulatory body does not end with the licensing of the first plant. Continuing development should be an ongoing process throughout the entire life of a nuclear power programme. As safety technology, knowledge, and methodologies continue to evolve, the regulator must be able to incorporate this new information into its regulatory requirements and processes. Therefore, robust development programmes and the interaction of the regulator with the international safety and regulatory communities are both essential. The regulator must avoid complacency by continuously striving to maintain the characteristics of a mature regulatory body.

10.1 Recommendations

It is recommended that AEC and policy makers review the highlighted considerations in this guideline and take them into account early in the planning process. These plans could also include those areas where external assistance is desirable, such as:

a) Interactions with senior policy makers from experienced nuclear countries to develop understanding of the required nuclear power infrastructure; Assignment by senior regulatory managers of an experienced regulator to understand regulatory management requirements and processes;
b) Assignment of selected senior staff to experienced regulatory bodies for gaining hands-on work experience; these experts would then train local staff;
c) Assignment of experienced regulatory staff to the new entrant regulator to assist with training, the development of processes, and assistance with the early regulatory activities.

Reference

Licensing the First Nuclear Power Plant, INSAG-26.

Appendix

CHARACTERISTICS OF A FULLY FUNCTIONAL ANDEFFECTIVE REGULATORY BODY

	Characteristic	Description	Considerations
1	**Independence**	Regulator is independent of industry and licensees, and also independent of, but not isolated from, government. Regulator is responsible to government for performance.	Independence must be incorporated into national legislation. The regulator must also be provided with the financial and human resources to carry out its mandate. INSAG-17 is a definitive reference on regulatory independence.
2	**Transparencyandcommunication**	Must act in a reasonably transparent manner and communicate openly, clearly, and professionally with all stakeholders. A communications strategy for the licensing process should be in place.	Some regulatory functions, such as licensing hearings, should include public processes. Assessments and decisions must be understood by stakeholders and open to legitimate challenges. INSAG-20 discusses the role of stakeholder scrutiny.
3	**Authority tomake decisions**	Has the full authority to make informed licensing decisions for all licensing phases including site evaluation, design evaluation, construction, commissioning, operations, and decommissioning.	The regulator may request managerial and technical assistance from experienced regulators to help secure informed regulatory decisions. Such external assistance or support is of an advisory nature and does not in any way diminish the regulator's authority or responsibility to make licensing decisions.

4	**Technical andmanagerialcapacity**	Must be able to reach independent decisions during each licensing phase. This means that leadership, communication, behavioural, managerial, and technical capabilities are all present. Technical knowledge and leadership in the relevant disciplines are in place and there is access to TSO(s)and research, as appropriate. Has an ongoing human resources recruitment and development strategy inplace.	The full technical capacity for the regulator will take time to develop. This can be ameliorated in the short termby incorporating some generic(not site-specific) technical analyses with support from the experienced regulator that produced the analyses. The existing review of a SAR can be used as a staff development tool. Managerial and other attributes can be augmented by establishing strong relations with an experienced regulator, including staff exchanges to gain hands-on experience with managing regulatory processes and interfaces.
5	**Regulatoryownership**	Has the authority andresources to take fullownership of a licensee'ssafety case.	Safety cannot be outsourced.Even if the regulator incorporates technical analyses from established regulators, Uganda's regulator is still responsible for making regulatory decisions.
6	**Authority toobtaininformation**	The authority to request all information from a licenseethat is necessary to make informed decisions.	The regulator should take steps to ensure that accessto such information is explicitly included in contractual agreements between licensees and vendors.To provide the licensee with indisputable contractual arrangements, the authority to obtain

			information should be confirmed in legislation.
7	**Access toexpertise**	Access to one or moreTSOs with the appropriate technical resources toundertake detailed reviewsof the technical aspects of licensing evaluations.	The regulator should considerthe use of foreign TSOs andR&D results in the initial phasesof regulatory development. Formal relations between domestic and foreign R&D organizationsshould be encouraged.
8	**Access tolegal advice**	Access to legal expertise to ensure effective regulationand enforcement.	The regulatory infrastructure must be based on a robust legislative framework and a legal support system must be in place with the expertise to support regulatory activities.
9	**Capacity to meetinternationalobligations**	The government may assign responsibilities to the regulator to ensure that obligations arising from relevant international conventionsand treaties are met, in particular the Conventionon Nuclear Safety.	The Global Nuclear Safety Framework requires all countries to meet international obligations in safety, security, and safeguards.
10	**Regulatoryresearch**	The ability to access and tofund independent researchin support of regulation.	Ultimately, a regulatory body must be able to make decisions based on a firm technical understanding of the various phenomena affecting safety. Such understanding should be based on independent R&D that can point out new or unforeseen results.

			Mechanisms for funding the necessary R&D should be provided in legislation. INSAG-16 contains more information.
11	**Internationalcollaboration**	The capacity to carry out collaborative relationshipswith its international counterparts and international bodies such as the IAEA andthe OECD/NEA.	Participation in the international regulatory community is essential for development of the regulator. Regulation and safety technology are both constantly evolving.
12	**Capacity todeploy nationaland internationalstandards**	The capacity to understandthe relevant national and international standards.	The regulator must ultimatelybe responsible for incorporating international and national standards into its regulatory documents.
13	**Coordination withother nationalregulatoryagencies**	Mechanisms and practicesfor coordination of work with other regulatory agencies at all levels of government to ensure roles and responsibilities are clear.	This is particularly important where there could be jurisdiction questions that could impact safety or security. INSAG-24 describes the interfaces between safety and security.
14	**Qualitymanagementsystem**	Quality management processes for the conduct of all activities, including licensing, compliance, enforcement, safety evaluations, and decision making.	This is important for the conductof all regulatory activities. A new entrant regulator should obtain hands-on experience with an established regulator in each of these critical management areas. Ultimately, a regulator should develop the capacity for self-evaluation and audit, and agree to undertake international evaluations,

			such as an IRRS mission.