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MANAGING REGULATORY BODY COMPETENCE

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FOREWORD

In 2001, the IAEA published TECDOC 1254, which examined the way in which the recognized functions of a regulatory body for nuclear facilities results in competence needs. Using the systematic approach to training (SAT), TECDOC 1254 provided a framework for regulatory bodies for managing training and developing and maintaining its competence. It has been successfully used by many regulators.

The IAEA has also introduced a methodology and an assessment tool — Guidelines for Systematic Assessment of Regulatory Competence Needs (SARCoN)¹ — which provide practical guidance on analysing the training and development needs of a regulatory body and, through a gap analysis, guidance on establishing competence needs and how to meet them.

In 2009, the IAEA established a steering committee (supported by a bureau) with the mission to advise the IAEA on how it could best assist Member States to develop suitable competence management systems for their regulatory bodies. The committee recommended the development of a safety report on managing staff competence as an integral part of a regulatory body's management system.

This Safety Report was developed in response to this request. It supersedes TECDOC 1254, broadens its application to regulatory bodies for all facilities and activities, and builds upon the experience gained through the application of TECDOC 1254 and SARCoN and the feedback received from Member States.

This Safety Report applies to the management of adequate competence as needs change, and as such is equally applicable to the needs of States 'embarking' on a nuclear power programme. Appendix 5 deals with the special case of building up the competence of regulatory bodies as part of the overall process of establishing an 'embarking' State's regulatory system.

The IAEA would like to express its appreciation to all of the experts who contributed to the development and review of this Safety Report. The IAEA officers responsible for this publication were M. J. Moracho Ramirez of the Division of Nuclear Installation Safety and H. Suman of the Division of Radiation, Transport and Waste Safety.

¹ See <http://www-ns.iaea.org/training/ni/tools-networking.asp?s=9&l=75>.

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1. INTRODUCTION

1.1. BACKGROUND

The ability of a regulatory body to fulfil its responsibilities depends largely on the competence of its staff. Building employees' skills and knowledge is an investment in each employee and in the future of the organization.

Safety requirements in IAEA Safety Standards Series No. GSR Part 1, Governmental, Legal and Regulatory Framework for Safety [1], address the issues of competences of the regulatory body by requiring that:

“A process shall be established to develop and maintain the necessary competence and skills of staff of the regulatory body, as an element of knowledge management. This process shall include the development of a specific training programme on the basis of an analysis of the necessary competence and skills. The training programme shall cover principles, concepts and technological aspects, as well as the procedures followed by the regulatory body for assessing applications for authorization, for inspecting facilities and activities, and for enforcing regulatory requirements” (para. 4.13 [1]).

Regulatory bodies are also required to have a management system for the management of their activities [1–3]. Competence management needs to be integrated into the management system. The transparency and auditability, inherent in such a system, facilitates self-assessment and supports the confidence of interested parties in the regulatory body's processes and competences.

In order to implement this requirement, a regulatory body needs to establish the related budgetary provisions. Competence management includes, in particular, an overall training and development programme that takes into account the operational and long term needs for specialists and managers, and a training and development plan for each employee which is tailored to the employee's needs and roles in the regulatory body.

Managing competent regulatory staff is difficult in many States due to retiring staff members and the challenges in recruitment and replacing them. Additionally, the reduction in higher education opportunities in the nuclear area and competitive market conditions have resulted in a reduced availability of qualified personnel for regulatory bodies.

Furthermore, States have declared interest in ‘embarking’ on or expanding nuclear power programmes (generally referred to as ‘embarking States’), putting further pressure on the existing pool of experienced regulatory staff. This increases the need to establish programmes to develop and to manage the competence of States' regulatory bodies.

This Safety Report provides generic guidance on managing the competence of regulatory bodies within their management system. It can be used as an example for Member States on how to meet the requirements of systematically assessing competence needs, in the near and long term, and delivering training and other elements of competence development, as well as continually improving this part of the management system.

Interrelated to competences is staffing of the regulatory body. According to Requirement 18 of IAEA Safety Standards Series No. GSR Part 1 [1], a regulatory body shall develop a human resources plan that states the number of staff necessary and the essential knowledge, skills and abilities for them to perform all the necessary regulatory functions. This responsibility can be given to senior management to review the functions that are required to be performed and that need to determine the size and composition necessary for the regulatory body to be able to fulfil its obligations.

The IAEA has produced a number of safety standards, other publications and working materials in which the competence of a regulatory body is addressed. These publications are listed in the References and have been drawn upon in preparing this Safety Report. This Safety Report supersedes TECDOC 1254 and broadens its application to regulatory bodies for all facilities and activities.

1.2. OBJECTIVE

The objective of this Safety Report is to provide guidance based on IAEA safety requirements on managing the competence of the regulatory body in order for it to perform its functions. Additionally, this publication gives guidance on establishing training and development programmes for regulatory staff.

There is a wide range of management and regulatory styles among regulatory bodies influenced by Member States' legislation and culture, jurisdiction of the regulatory body and ways of working. The guidance provides advice commensurate with the requirements of these different styles and jurisdictions and is broadly applicable to regulatory bodies responsible for all types of facilities and activities.

1.3. SCOPE

This Safety Report concentrates on managing the competence of staff members who perform primarily in the areas of review and assessment, authorization, inspection, enforcement, and development of regulations and guides, but it also considers other additional functions. It is possible to identify several categories of staff by virtue of their experience and capabilities: newly recruited staff (with basic knowledge); developing staff (working knowledge); and established staff, experts and managers (advanced knowledge). The guidance in this publication is applicable to all these categories.

This Safety Report also addresses the regulatory body's need to have adequate competence to make informed decisions when receiving external advice and to exercise an 'intelligent customer' capability when using external support.

The methodology in this Safety Report is not intended to cover fully, or be a direct substitute for, a regulator's personnel recruitment and personnel development processes, where fair human resources practices need to be used in line with the Member States' legislation and culture. However, this Safety Report may be used to inform such processes.

A number of embarking States are aspiring to develop nuclear power generation and this means that, among other things, regulatory bodies have to be established and rapidly expanded. This Safety Report provides guidance for such regulatory bodies in the initial establishment of competence management as part of their overall management system.

Appendix V outlines an approach to building and establishing the competence of the regulatory body while establishing the regulatory system.

The only mandatory statements in this text are the requirements quoted from the IAEA safety requirements publications IAEA Safety Standards Series No. GSR Part 1 [1] and No. GS-R-3 [2]. There are certain requirements in Refs [1, 2] that, when applied to specific practices, can be fulfilled mainly by means of one practical measure. In such cases, the relevant safety guides use a 'should' statement to indicate that this measure is recommended to be taken; if another measure is intended to be taken, an equivalent level of protection and safety should be achieved. In other cases, there may be more than one possible option which may be mentioned or described in a safety report.

Guidance provided here in the present tense indicative, describing good practices, represents expert opinion. This expert opinion is based on the work of the IAEA Steering Committee on Competence of Human Resources for Regulatory Bodies and of the IAEA Secretariat as well as on the contribution of senior experts from the Member States. It is also based on a research study conducted in 2010 within the Steering Committee and takes into consideration the answers of 20 regulators through a questionnaire designed to identify best practices in regulatory training systems.

1.4. STRUCTURE

Section 2 describes the part of a regulatory body's management system which integrates competence management.

In Section 3, a competence model is described, which is based on four major categories (quadrants) of competence areas for regulatory bodies. It can be used on the regulatory body as a whole or for any organizational subdivision, and it promotes a balanced approach to competence.

Section 4 describes a competence gap analysis whereby existing competence is compared with required competence. Existing competence is estimated, for example, through personal performance reviews and required competence is determined from the regulatory body's governance and planning processes. Managers prioritize the closing of gaps in the planning process. An IAEA tool known as SARCoN is described, which automates the gathering of data and analyses.

Section 5 describes how, having established a gap analysis and the associated short and long term priorities, the regulatory body implements a programme for addressing the competence gaps. In general, in addition to possibly reallocating competence within the organization, three main methods of acquiring competence are available: training and development programmes, recruitment and outsourcing. Each regulatory body will have differing views on the mixture to use.

Appendix I provides examples of tasks related to the main regulatory functions. Appendix II provides examples of the quadrant competence areas typically required to perform the regulatory functions. Appendix III outlines a model for assisting in identifying training needs and designing, planning, implementing and evaluating training programmes. The method known as systematic approach to training (SAT) [4] has been used in the last 20 years by several regulatory and governmental agencies, as well as several other organizations.

Appendix IV deals with the selection of options and methods of training and development of staff. In Appendix V, the needs of embarking States are considered in the context of IAEA Nuclear Energy Series No. NG-G-3.1, Milestones in the Development of a National Infrastructure for Nuclear Power [5] and, more specifically, in IAEA Safety Standards Series No. SSG-16, Establishing the Safety Infrastructure for a Nuclear Power Programme [6], which defines three phases of development of the legal and regulatory framework and the establishment of a competent regulatory body. Appendix V provides specific considerations for embarking States related to the development of competences during the phases [5] and in the framework of the competence model described in Section 3.

1.5. DEFINITIONS

The terms used in this publication have the meanings ascribed to them in the IAEA Safety Glossary: Terminology Used in Nuclear Safety and Radiation Protection (2007 Edition) [7], where applicable. Specific terms used in this publication are defined below for the purposes of this Safety Report:

- (a) **Competence** is the combination of knowledge, skills and attitudes (KSAs) needed by a person to perform a particular job. All three are important and interrelate.
- (b) **Knowledge** is familiarity with something and can include facts, descriptions and information acquired through experience or education. It can refer to both the theoretical or practical understanding of a subject.
- (c) **Skill** is the learned capacity to perform a task to a specified standard.
- (d) **Attitude** is the feelings, opinions, ways of thinking, perceptions, values, behaviour and interests of an individual which allow a job or task to be undertaken to the best ability of that individual. Attitudes cannot wholly be taught directly and are partly a consequence of organizational culture.
- (e) **Audit** is a documented activity performed to determine by investigation, examination and evaluation of objective evidence the adequacy of, and adherence to, established procedures, instructions, specifications, codes, standards, administrative or operational programmes and other applicable documents, and the effectiveness of implementation.
- (f) **Knowledgeable customer** is a customer of services who knows what is required, who fully understands the need for the contractor's services, and who can specify the requirements then supervise the work and technically review the output.

2. COMPETENCE MANAGEMENT

Regulatory bodies are required to have a management system for the organization and performance of their activities [2, 3]. The management of competence is a part of this and needs to be integral with the overall management of the regulatory body.

2.1. MANAGEMENT'S RESPONSIBILITIES FOR COMPETENCE MANAGEMENT

2.1.1. Management's commitment

In order to develop and to enhance a regulatory body's competence so as to achieve its mission objectives with efficiency and effectiveness, senior management needs to be committed to ensuring that the regulatory body has and maintains competence appropriate to its needs. In particular, since learning is a lifelong process, management needs to be committed to the ongoing development of a professional, competent, versatile and motivated workforce.

2.1.2. Competence policy

The senior management of the regulatory body needs to establish a vision and policy for competence management resulting in goals, strategies and plans for delivery. The competence policy is senior management's primary means of communicating its commitment, expectations and strategies for achieving the organization's objectives with regard to staff competence.

The policy needs to deal with establishing and maintaining adequate competences within the organization. It needs to deal with short term and long term aspects of developing adequate competence to meet the overall strategic plan of the regulatory body and also to seek to meet the personal aspirations staff have for their own development.

2.1.3. Planning

Planning is to ensure that there is the right number of people with the right competences at the right time to ensure timely responses by the regulatory body. The regulatory body needs to have an overall governance and strategic planning process [2, 3, 8, 9]. A review of the functions that are required to be performed, and such a review needs to consider both the external environment and factors within the regulatory body. A determination of the size and composition of the required regulatory body to fulfil its obligations needs to be part of this strategic planning process. This process is applicable to both short term and long term needs.

A strategic plan for developing and maintaining competence is typically an output of the planning process. It needs to cover training and development, staffing plans, use of external support and other methods of meeting competence needs — particularly to narrow competence gaps.

The training, development and learning element of the strategic plan needs to give special attention to circumstances where the long term planning and the associated long term gap analysis indicates the potential for the gap to widen, for example due to a planned increase of the facilities and activities. The strategic plan also needs to address and to indicate the mixture of the various training methods identified and the circumstances in which each method or mixture of methods is to be used. It also needs to identify the responsibilities and the project management arrangements for training.

For the training, development and learning element, some guiding principles are:

- (a) Enable employees to develop so they are capable of carrying out their current job responsibilities to corporately established levels of competences;
- (b) Provide adequate resources in the budget for training and development and a demonstrable commitment from the regulatory body management;
- (c) Establish relevant human and organizational arrangements for developing and maintaining competence;
- (d) Position the organization and its employees in such a way as to meet future regulatory needs and challenges;
- (e) Align learning activities with, and contribute to, the achievement of the regulatory body's mission;
- (f) Allocate learning activities in a fair and equitable manner in the light of priorities, operational needs, staff career aspirations and financial constraints;
- (g) Ensure that learning and development strategies enable staff, in particular expert staff and managers, to have equitable access to personal development opportunities;
- (h) Use a variety of training methods.

2.1.4. Responsibilities for competence management

Regulatory bodies need to define the organization, levels of authority, responsibilities and accountabilities for competence management processes. Each manager needs to be made accountable for all aspects of the competence building of their staff. A person, or team, needs to be appointed to be responsible for the processes of the competence management (see Section 2.2 for a definition of the competence management process) in the regulatory body. Additionally, senior managers need to seek to foster an organizational culture which supports individual staff members to recognize that they are accountable for the development of their own competence and to contribute to the development of the competence of the organization as a whole.

Depending on the size of the regulatory body, it may be appropriate that the individual, or individuals, responsible for the processes of competence management has other responsibilities within the organization. A dedicated person, team or unit may be designated. Responsibilities need to be allocated for the person responsible for coordinating the process of identifying competence 'gaps' in the organization as a whole and for individuals. This person (or the leader of the team) is sometimes referred to as the training coordinator (TC). Similarly, responsibilities need to be allocated for filling gaps by recruitment, training or outsourcing, as appropriate.

The regulatory body also needs to recognize that organizational design is an important feature when considering its overall competence. This organizational design needs to be considered at the senior management level to ensure that the individual people working in the regulatory body are able to develop and to deploy their KSAs effectively. This is to ensure that overall the regulatory body is effective and efficient.

2.1.5. Prioritization of needs

The competence required in a regulatory body depends on a range of factors, including the regulatory approach adopted, the legal framework, and the types of facilities and activities. A regulatory body performs a systematic analysis of competence gaps based on these factors. Senior management needs to prioritize the needs identified from the gap analysis and the ways by which they need to be addressed in accordance with the perceived risk to the regulatory body's objectives and the overall importance to safety.

2.1.6. Documentation for competence management

The regulatory body needs to establish a documentation system for its competence management processes and for the records that arise from them. Effective record keeping facilitates reviews and audits of the process implementation. The transparency of the overall process, and straightforward access to records, also provides staff with confidence in the fairness of the system.

The documentation system for competence management may include:

- Documented competences (i.e. necessary KSAs) for each task;
- Individual competence development plans;
- Competences possessed by individuals;
- Staff certification or qualifications;
- Records of training provided.

2.2. PROCESSES FOR COMPETENCE MANAGEMENT

The regulatory body needs to develop processes for its competence management. Developing processes could be in two stages: the first stage includes the identification and definition of the processes necessary for the regulatory body to exercise its competence management. The second stage details and documents the content of each individual process in the context of the overall structure of the management system.

Competence management processes are part of, and interface strongly with, other processes of the regulatory body — in particular with strategic planning, human resources and management processes such as responsibility assignment processes and financial processes. Typical processes related to competence management are:

- (a) Processes related to competence analysis:
 - (i) Task analysis process leading from the regulatory functions to the competences required to perform the task (Sections 4.1 and 4.2);
 - (ii) Gap analysis process (Section 4.3):
 - Personal performance review and assessment processes.
- (b) Processes related to filling competence gaps:
 - (i) Personal development plan (Section 5.1, Appendices I and II);
 - (ii) Processes associated with reorganization (reallocation of duties within the organization or replacement of staff members) (Section 5.3);
 - (iii) Processes associated with recruitment (Section 5.4);

- (iv) Processes related to managing the use of external support (Section 5.5);
- (v) Processes related to training (Appendix III):
 - Processes to establish training plans;
 - Processes for the delivery of training activities;
 - Processes for the evaluation of training activities.
- (c) Processes related to measurement, assessment and improvement of competence management (Section 2.3);
- (d) Processes related to knowledge capture and management, including participation in knowledge networks (Section 5.2).

The following sections elaborate on these processes: Section 3 outlines a competence model for the regulatory body; Section 4 addresses the competence gap analysis processes; and Section 5 addresses processes for filling the gaps

2.3. MEASUREMENT, ASSESSMENT AND IMPROVEMENT

2.3.1. Measurement

Metrics to measure the performance of each process need to be developed, in particular for the following:

- Effectiveness of training and development;
- Delivered training;
- Personal performance;
- Recruitment, reorganization and outsourcing;
- Review and audits.

2.3.2. Assessment

Assessment relating to competence management needs to take place at several levels: the personal level; the level of individual organizational subdivisions; and the level of the whole organization. Assessment uses the metrics derived from process implementation measurement or subjective means to make judgements. These assessments need to take place at periodic intervals and when substantial changes necessitate them. These assessments need to feed back to the relevant processes of the regulatory body's management system.

Personal performance reviews can be done in one-to-one meetings between staff and line managers, covering strengths as well as weaknesses. They may include an element of self-appraisal (because the person appraised is the person who has the greatest knowledge of what he or she has actually done), and are even more effective as part of a management framework in which there are frequent discussions on performance. They provide feedback to assist in motivation and can satisfy needs for information on progress and facilitate comparison with expected performance. Personal performance reviews are an effective vehicle for formalizing the gathering of information on individuals' competences and identifying their further training needs and personal development requirements.

At the level of the unit and the organization as a whole, performance assessments may make use of metrics such as the efficacy and achievement of training and may be based on sound judgement. Self-assessment and independent peer reviews are well established techniques which may contribute to these assessments. The individual, or individuals, responsible for the processes of competence management needs to coordinate and to facilitate these assessments.

Senior management needs to assess competence management in the organization and the achievement of its goals in order to find opportunities for improvement. The changing circumstances and challenges need to be examined. These include in particular:

- Reorganization;
- Assignment of new regulatory functions;
- Recruitment of new staff;
- Changes in licensees' activities;
- Life cycle of regulated installations;
- Technological development.

2.3.3. Continual improvement

The regulatory body's competence management objectives need to include the continual improvement of its processes in order to enhance the organization's performance in competence management. Opportunities for improvement may be identified from the following:

- (a) The results of assessments, corrective and preventive actions, and reviews of competence management;
- (b) Feedback from interested parties in competence management;
- (c) Experience from outside organizations;
- (d) Technological developments necessitating new competences.

3. A COMPETENCE MODEL FOR THE REGULATORY BODY

This section describes a competence model for the regulatory body. It suggests a basis for assessing competence needs both for the near and longer term. By mapping existing competences and comparing them with required competences, a gap analysis can be conducted and priorities for action developed.

3.1. QUADRANT MODEL OF COMPETENCES

Each regulatory body needs to establish its own sets of competences, levels of competences and standards for evaluation. This Safety Report adopts a general competence model for this purpose. This model is a valuable instrument for competence management in the regulatory body. It is a significant input into the development of an effective regulatory body that responds to internal and external environments and the associated challenges.

Competences comprise different sets of knowledge, skills and attitudes (KSAs), and they need to be formally defined within the regulatory body. Levels of competences need to be established and communicated as appropriate to interested parties.

The competence model is based on a quadrant structure: Quadrant 1 contains the competences related to the legal, regulatory and organizational basis; Quadrant 2, the competences related to technical disciplines; Quadrant 3, the competences related to a regulatory body's practices; and Quadrant 4 contains the personal and behavioural competences. Each quadrant comprises a set of competence areas, as illustrated in Fig. 1, with a set of specific competences (KSAs). Examples of these KSAs are given in the following subsections. The quadrant model described here is generally applicable to all regulatory bodies. However, the specific KSAs associated with the quadrant competence areas need to be tailored to the individual characteristics of each regulatory body.

<p>1. Competences related to the legal, regulatory and organizational basis</p> <p>1.1. Legal basis 1.2. Regulatory policies and approaches 1.3. Regulations and regulatory guides 1.4. Management system</p>	<p>2. Technical disciplines competences</p> <p>2.1. Basic science and technology 2.2. Applied science and technology 2.3. Specialized science and technology</p>
<p>3. Competences related to a regulatory body's practices</p> <p>3.1. Review and assessment 3.2. Authorization 3.3. Inspection 3.4. Enforcement 3.5. Development of regulations and guides</p>	<p>4. Personal and behavioural competences</p> <p>4.1. Analytical thinking and problem-solving 4.2. Personal effectiveness and self-management 4.3. Communication 4.4. Team work 4.5. Managerial and leadership competences 4.6. Safety culture</p>

FIG. 1. Quadrant Model of Competences for regulatory bodies.

The regulatory body's practices referred to in Quadrant 3 are the operational processes, based on the Member State's legal system, culture and regulatory philosophy, whereby the regulator delivers specific tasks to achieve certain regulatory functions.

3.1.1. Quadrant 1: competences related to the legal, regulatory and organizational basis

3.1.1.1. Legal basis

This competence area is the knowledge of, and skills needed to comprehend and to use, relevant documents that establish the legal framework for regulatory control of facilities and activities. Typically, the regulatory body needs a certain knowledge of laws related to:

- Radiation and nuclear safety;
- Environmental protection;
- Public health and safety;
- Labour health and safety;
- Criminal law;

- Rights of individuals;
- Nuclear law;
- Liability.

The regulatory body may also need knowledge of relevant international instruments and documentation such as:

- Convention on Nuclear Safety;
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management;
- Convention on Early Notification of a Nuclear Accident;
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency;
- Code of Conduct on the Safety of Research Reactors;
- Code of Conduct on the Safety and Security of Radioactive Sources;
- IAEA safety standards.

Examples of KSAs could be:

- Comprehension of government laws and decrees relating to facilities and activities;
- Comprehension of other relevant laws and decrees;
- Comprehension of local authority laws and decrees relating to facilities and activities;
- Ability to apply legal provisions;
- Comprehension of the powers and authority of the regulatory body and its staff;
- Appreciation of the rights of all interested parties affected directly or indirectly by the provisions of the legal basis of the regulatory body.

3.1.1.2. Regulatory policies and approaches

This competence area is the knowledge of, and skills needed to comprehend and to apply, the regulatory policies and approaches in order to achieve the relevant regulatory objectives.

Examples of KSAs could be:

- Comprehension and appreciation of the mandate, mission and objectives of the regulatory body;
- Comprehension of the values of the regulatory body and the principles of good regulation (e.g. independence, openness, efficiency, clarity, objectivity, stability, proportionality, accountability and consistency);
- Comprehension of regulatory body governance regarding its short term and long term strategic objectives and goals;
- Comprehension of regulatory body policies and principles on which the regulatory processes are based;
- Appreciation of measures for implementing actions to achieve the short and long term strategic objectives and goals of the regulatory body.

3.1.1.3. Regulations and regulatory guides

This competence area is knowledge of, and skills needed to comprehend and to use, the regulations and regulatory guides. Regulation and regulatory guides typically cover:

(a) Nuclear safety areas:

- (i) Technical safety requirements for siting, design, construction, commissioning, operation, decommissioning and waste management of nuclear facilities or devices;
- (ii) Requirements on the safety analysis report (SAR);
- (iii) Operational limits and conditions, surveillance and maintenance;
- (iv) Emergency preparedness and response;
- (v) Requirements related to the periodic safety review.

(b) Radiation protection areas:

- (i) Requirements related to radioactive sources;
- (ii) Planned exposure situation;
- (iii) Occupational exposure;
- (iv) Medical exposure;
- (v) Public exposure;
- (vi) Existing exposure situations;
- (vii) Emergency exposure situations.

Examples of KSAs could be:

- Comprehension of regulations and regulatory guidance documents;
- Comprehension of industry codes and standards such as the American Society of Mechanical Engineers (ASME) and the Institute of Electrical and Electronics Engineers (IEEE);
- Appreciation of the requirements and implications of international and national safety and industrial standards;
- Awareness of the safety requirements applied in other States.

3.1.1.4. Management system

This competence area is the knowledge of, and skills needed to comprehend and to apply, the regulatory body's management system (see Ref. [2]).

Examples of KSAs could be:

- Comprehension of the structure of the regulatory body's management system;
- Comprehension of the regulatory body's strategic and other plans;
- Comprehension of the allocation of responsibilities and accountabilities within the regulatory body;
- Comprehension of the graded approach to the implementation of the management system;
- Comprehension of the regulatory body's system for the control of information, documentation and records;
- Comprehension of the regulatory body's processes and the interfaces between them;
- Appreciation of duties to process an application rigorously and in a timely manner.

3.1.2. Quadrant 2: technical disciplines competences

3.1.2.1. Basic science and technology

This competence area is the knowledge of, and skills needed to comprehend and to apply, science and engineering fundamentals in a particular field. Some typical science and engineering fields that are common to many regulatory bodies include:

- Mathematics;
- Physics;
- Chemical, electrical, civil and mechanical engineering;
- Chemistry, including radiation chemistry;
- Earth sciences, including geology, seismology, meteorology and hydrology;
- Computer science;
- Nuclear engineering, including nuclear reactor concepts, nuclear physics and reactor physics;
- Environmental engineering;
- Materials and metallurgical engineering;
- Radiography, including medical applications;
- Thermodynamics and thermohydraulics;
- Behavioural sciences.

Examples of KSAs could be:

- Comprehension of science and engineering fundamentals in a particular field.

3.1.2.2. Applied science and technology

This competence area is the additional knowledge of, and skills needed to comprehend and to apply, engineering and science concepts in specific areas. The main areas may include:

- Nuclear reactor and power plant technology;
- Nuclear fuel cycle technology;
- Nuclear safety technology;
- Technologies regarding the application of radiation in industry, research and agriculture;
- Medical physics;
- Radiation physics, including shielding;
- Health physics, radiation protection and naturally occurring radiation;
- Environmental sciences;
- Management systems, including safety management, safety culture and quality management.

Examples of KSAs could be:

- Comprehension of additional knowledge of engineering and science concepts in relation to the safety of facilities and activities;
- Ability to apply, fundamental engineering and science concepts in relation to the safety of facilities and activities.

3.1.2.3. Specialized science and technology

This competence area is the deep knowledge of, and skills needed to apply, specialized technology, engineering and science. Some typical specialized areas that are common to many regulatory bodies include:

- (a) Methodologies and analysis:
 - (i) Safety assessment methodology;
 - (ii) Deterministic accident analysis;
 - (iii) Probabilistic safety analysis;
 - (iv) Severe accident analysis;
 - (v) Reliability analysis;
 - (vi) Human and organizational factors and human performance;
 - (vii) Site evaluation;
 - (viii) Fire analysis and protection systems.

- (b) Specialized areas:
 - (i) Instrumentation and control systems of nuclear power plants (NPPs), including software reliability;
 - (ii) Criticality safety;
 - (iii) Materials, including radiation effects on materials, corrosion and corrosion chemistry;
 - (iv) Dosimetry.

- (c) Additional areas:
 - (i) Security, nuclear materials protection, control and accountability;
 - (ii) Safety in transportation of radioactive material;
 - (iii) Management of spent fuel and radioactive waste;
 - (iv) Decommissioning of nuclear plants;
 - (v) Industrial safety;
 - (vi) Radioecology.

A particular regulatory body may require specialized competences in other areas.

Examples of KSAs could be:

- Deep comprehension of a scientific field or specialized area to address and to resolve regulatory body technical issues;
- Ability to apply the knowledge of a scientific field or specialized area at a recognized high level of competence to be noted as an expert in the field or specialized area.

3.1.3. Quadrant 3: competences related to a regulatory body's practices

3.1.3.1. Review and assessment

This competence area is the ability to examine safety cases and other documentation submitted by licensees in support of their justifications regarding installations and the forming of judgments on the adequacy of the documents and the processes used by the licensees in producing them.

Examples of KSAs could be:

- Comprehension of the regulatory body's requirements for review and assessment;

- Ability to identify and to synthesize information relevant to the safety of a facility or activity (such as facility’s submission, past performance, and enforcement and inspection history);
- Ability to identify the need for further information in relation to review and assessment;
- Ability to initiate other regulatory processes when needed (such as inspection);
- Ability to take the outcomes of other regulatory processes into consideration in the review and assessment process;
- Ability to examine documentation and relevant information, recognize issues regarding the safety of a facility or activity and possible non-compliance, and to make judgments regarding the overall safety and compliance with regulatory requirements;
- Appreciation of the review and assessment process.

3.1.3.2. Authorization

This competence area is the capacity to ensure that the licence and the associated licensing documents are in compliance in form and contents with the regulatory requirements.

Examples of KSAs could be:

- Comprehension of the regulatory body’s process and procedures of authorization;
- Ability to identify and to synthesize information relevant to an authorization (such as applicant’s submission, past performance, and enforcement and inspection history);
- Ability to initiate other regulatory processes when needed (such as inspection or review and assessment);
- Ability to take the outcomes of other regulatory processes into consideration in the authorization process;
- Comprehension of the possible restrictions or conditions that may be imposed in an authorization;
- Ability to make judgments on granting, modifying, suspending or withdrawing authorizations.

3.1.3.3. Inspection

Inspection is the regulatory practice related to verifying that the authorized party is in compliance with the regulatory requirements and with the conditions specified in the authorization. This competence area is the independent gathering of information through objective review, observation and open communications, and determining acceptability of information by comparing it to established criteria.

Examples of KSAs could be:

- Comprehension of the regulatory body’s requirements and guides, processes and procedures for inspection;
- Ability to take the outcomes of other regulatory processes into consideration in the inspection process;
- Ability to produce an inspection plan for a specific facility or activity;
- Ability to recognize safety significant issues and possible non-compliance by observation;

- Ability to make judgments regarding the safety of a facility or activity and compliance with regulatory requirements;
- Ability to recognize when immediate actions are required to rectify non-compliance if there is imminent likelihood of a safety significant event;
- Comprehension of root cause analyses techniques;
- Appreciation of the most effective and efficient ways to undertake inspection activities.

3.1.3.4. Enforcement

This competence area is the provision of a supportable recommendation of enforcement action in accordance with regulatory body policy in responding to non-compliance by an authorized party with a regulatory requirement.

Examples of KSAs could be:

- Comprehension of the regulatory body's enforcement policy, requirements, processes and procedures and related guides;
- Ability to decide upon and to initiate enforcement actions because of non-compliance in a facility or activity (such as those identified in other regulatory processes or due to events);
- Ability to determine whether other regulatory processes are needed in order to support an enforcement action (such as inspection);
- Ability to determine whether actions of, or liaison with, other agencies are needed in order to support an enforcement action (such as evidence gathering by other law enforcement agencies, legal advice or other regulators);
- Ability to evaluate and to decide on the adequacy of corrective measures proposed by the facility or activity, and to confirm their effective implementation.

3.1.3.5. Development of regulations and guides

This competence area is the KSAs necessary to produce regulations and guidance documents, including policies and procedures, containing practical steps on how regulatory requirements could be satisfied by the licensees and be adjudicated by the regulatory staff.

Examples of KSAs could be:

- Comprehension of the regulatory body's process and procedures for developing regulations and guides;
- Ability to examine and to identify the need for new regulations and guides or the amendment of existing regulations and guides (e.g. based on feedback on the implementation of existing regulations, emerging technologies, changing standards and new laws);
- Ability to identify and to address appropriately interfaces with other laws, regulations and guides;
- Ability to draft regulations and guides so as to meet technical and legal requirements in ways which are thorough, consistent, understandable and practicable;
- Ability in drafting to adequately assess and incorporate, as applicable, comments received by interested parties.

3.1.4. Quadrant 4: personal and behavioural competences

3.1.4.1. Analytical thinking and problem-solving

This competence area is about approaching problems objectively, gathering and integrating information and developing a comprehensive understanding to reach conclusions.

Examples of KSAs could be:

- Ability to assimilate and to synthesize information gathered from various sources (such as interviewing, observation and examining documentation);
- Ability to analyse information and to identify key issues related to safety in facilities or activities;
- Ability to analyse problems;
- Ability to arrive at sound conclusions and to make sound judgments;
- Ability to assimilate information and data gathered from several sources and to give written recommendations to the regulatory body management.

3.1.4.2. Personal effectiveness and self-management

This competence area can be divided into three categories:

- (a) **Information technology competence:** this competence is using technology to create, gather, manipulate, communicate or to share information.
- (b) **Planning and organization of work competence:** this competence is effective and efficient coordination of tasks to achieve a desired objective.
- (c) **Self-management competence:** this competence is working independently, exercising judgment and exhibiting flexibility in the completion of activities, especially during difficult or challenging situations.

Examples of KSAs could be:

- (a) Information technology competence:
 - (i) Ability to use computer software for word processing, spread sheets, Internet communication and data storage.
- (b) Planning and organization of work competence:
 - (i) Ability to set priorities, organize work and to meet scheduled objectives;
 - (ii) Ability to find more effective ways of achieving objectives.
- (c) Self-management competence:
 - (i) Ability to adapt behaviour to accommodate the sensitivities of others, cope with stressful situations and to sustain mental effort to achieve objectives;
 - (ii) Ability to recognize one's own strengths and weaknesses and to plan accordingly for personal training;
 - (iii) Ability to assess periodically one's own performance and to work towards improvement.

3.1.4.3. Communication

This competence area is engaging in effective dialogue, representation and interaction with others (i.e. licensees, colleagues and the public) through committed listening, speaking, writing or delivery of presentations, understanding the true interests of people and delivering meaningful messages.

Examples of KSAs could be:

- Ability to talk effectively in small groups and to large audiences;
- Appreciation of the needs, interests and expectations of various groups;
- Ability to respond appropriately to questions and to provide factual answers consistent with regulatory body policy;
- Ability to communicate complex issues clearly;
- Ability to inform duty holders, employee and safety representatives and others of the outcome of investigations and actions proposed or required.

3.1.4.4. Team work

This competence area is working collaboratively with others to achieve common objectives

Examples of KSAs could be:

- Ability to cooperate well with other team members and to maintain a positive and productive atmosphere;
- Ability to show flexibility in response to change and to maintain commitment to team objectives even when one's own ideas are not supported.

3.1.4.5. Managerial and leadership competences

This competence area can be divided into four categories:

- (a) **Strategic management competence:** this competence area is a deep understanding of an organization, its strategies and high level goals, planning, work organization, follow-up activities and decision making;
- (b) **Leadership competence:** this competence area is exemplified by a practice of tolerance, objectivity, openness, fairness and ability to inspire others;
- (c) **Negotiation competence:** this competence area is to reconcile different views and to persuade others to accept a resolution;
- (d) **Project management competence:** this competence area is completing a set of complex tasks in a coordinated manner to a pre-set time, scope and budget.

Examples of KSAs could be:

- (a) Strategic management competence:
 - (i) Ability to develop a viable strategic plan;
 - (ii) Ability to develop sound policies for the organization;
 - (iii) Ability to recognize the need to change policies and strategies;
 - (iv) Appreciation of external factors, and environmental and social issues.

- (b) Leadership competence:
 - (i) Ability to adjust the level of authority and support to suit individual circumstances;
 - (ii) Ability to convey confidence in others' abilities, give constructive feedback and coaching, and to inspire enthusiasm;
 - (iii) Ability to be approachable and open to suggestions from others.
- (c) Negotiation competence:
 - (i) Ability to resolve differences by encouraging alternative proposals, taking into account the positions of all interested parties and facilitating open discussion.
- (d) Project management competence:
 - (i) Ability to develop project plans, establish deliverables and success criteria, and to schedule activities;
 - (ii) Appreciation of potential problems, and ability to allocate resources and to identify alternative strategies;
 - (ii) Ability to provide accurate, complete and timely project status reports;
 - (iv) Ability to establish a strategy appropriate to the circumstance and to provide advice on measures to mitigate any immediate risk.

3.1.4.6. Safety culture competence

This competence area is the necessary KSAs to promote and to support a strong safety culture effectively [see Ref. 2].

Examples of KSAs could be:

- Comprehension of the key aspects of safety culture within the organization;
- Comprehension of the ITO concepts (individuals, technology and organization) in the regulatory body;
- Learning and questioning attitude;
- Comprehension of the importance to provide means by which the organization continually seeks to develop and to improve its safety culture.

4 SYSTEMATIC COMPETENCE ANALYSIS

The competence analysis can be used for different purposes. In this case, the competence model described in Section 3 suggests a basis for assessing competence needs both for the near and medium future. Managers of the regulatory body need to estimate existing competences. By comparing the existing with required competences, a gap analysis can be conducted and priorities for action developed (see Fig. 2).

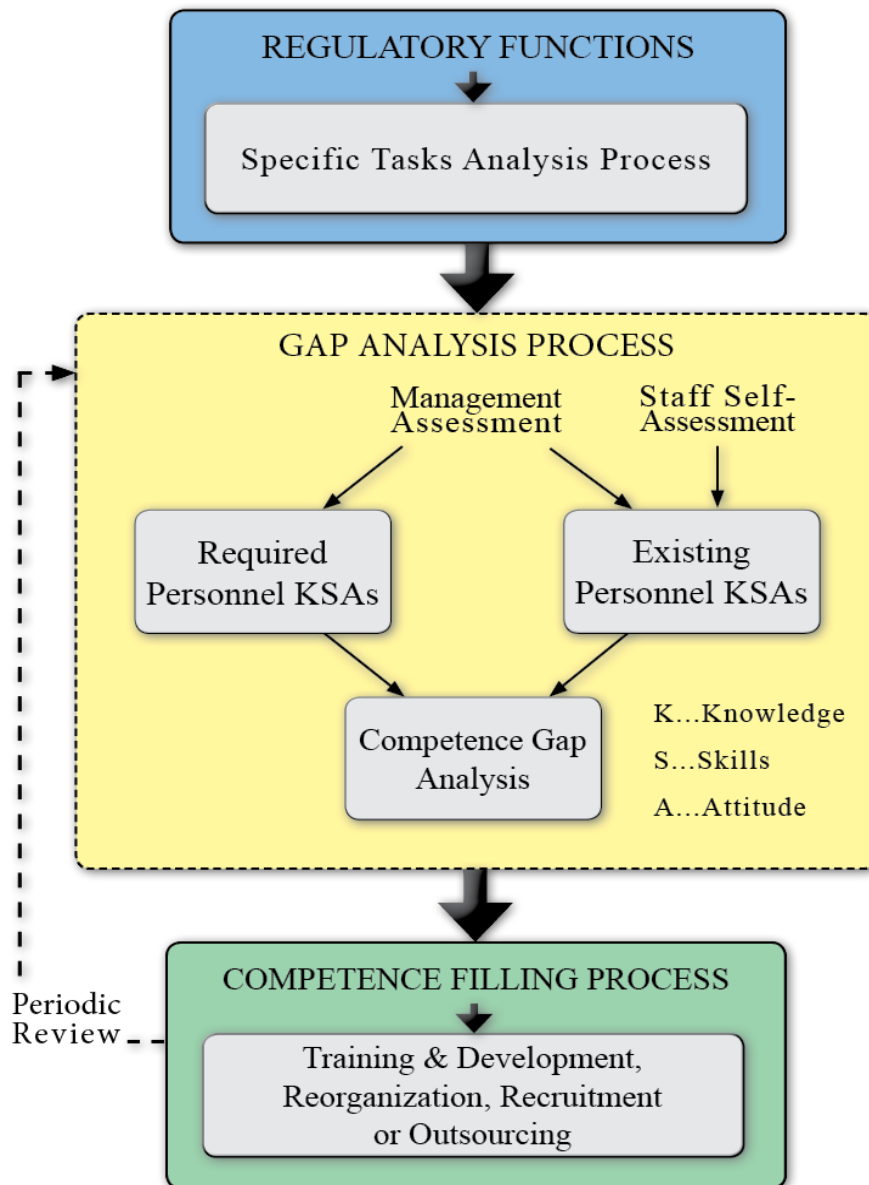


FIG. 2. A competence analysis flow chart.

4.1. FUNCTIONS AND RELATED TASKS OF A REGULATORY BODY

The functions of the regulatory body are described in IAEA Safety Standards Series No. GSR Part 1 (see Refs [1, 7]). The main regulatory functions are:

- Review and assessment;
- Authorization;
- Inspection;
- Enforcement;
- Development of regulations and guides.

Additional regulatory functions are, for example:

- Research and development;
- Emergency preparedness and response;
- International cooperation;
- Communication with interested parties, including the public

Regulatory functions have associated tasks which require certain sets of KSAs. Managers determine the necessary tasks to accomplish the function of the organizational unit. This may be done through a collective judgement by the manager and others involved. Appendix I provides examples of tasks and associated competence areas for the main regulatory functions.

Before going into the detailed analysis, it could be useful to develop an initial overview of the main quadrant competence areas required to perform the functions of the regulatory body. Appendix II provides an example of the quadrant competence areas required for a hypothetical regulatory body, according to its functions.

4.2. IDENTIFYING THE REQUIRED COMPETENCES (KSAS) ASSOCIATED WITH TASKS

Each of the tasks identified above requires a certain competence (KSAs). Managers have the responsibility to identify the KSAs associated with each task and to determine the level of competence necessary for a specific task, taking into account the functions and structure of the organization. When determining the current needs, future needs and aspirations of the organization can also be considered.

In the present model, the level of competence is rated high, medium or basic. However, a regulatory body may opt for using more than three levels and might choose different definitions. The levels can be defined as:

- (a) **Basic:** general competence in the area concerned;
- (b) **Medium:** a competence level sufficient in routine cases;
- (c) **High:** a competence level required for more sophisticated cases or at the strategic level within the regulatory body.

4.3. ANALYSING COMPETENCE GAPS

The following steps are to enable staff perform self-assessment. The self-assessment can be done by each individual or as the consolidated results of a team if there are various members performing similar tasks. A source of information to estimate the existing competence is personal performance reviews, as they examine each individual's competence and discuss proposed competence development.

The next step is to review and to evaluate the existing competences and to carry out gap analysis, taking into account the required competences. The competence gaps can be accumulated to reflect the staff's competence gaps at any organizational level or for the organization as a whole. In addition, knowledge gaps for the organization as a whole can be identified and remedied through knowledge management processes.

4.4. PRIORITIZATION OF COMPETENCE GAPS

Managers, with the necessary help and support from those involved in competence management, need to prioritize the gaps, taking into account their importance to the regulatory functions. The prioritization decided needs to impact the planning process.

4.5. SARCON: A TOOL FOR ASSESSING COMPETENCE NEEDS

The IAEA has produced a methodology² accompanied by a software based tool called SARCoN, which assists in the implementation of the approach described above. It helps in the gathering and analysing of information on competence needs, existing competences and the implementation of gap analyses.

The software tool includes a comprehensive question set to identify KSA gaps in each of the quadrant competence areas of the four-quadrant model outlined in Section 3. Additionally, it automates the gathering and processing of data.

5. METHODS OF ACQUIRING COMPETENCE

Having established a gap analysis and the associated short and long term priorities, the regulatory body now has to implement its programme for addressing the competence gaps. Managers may decide to acquire competence by training and developing existing staff, by reallocating existing competence within the organization to fill gaps, by recruiting or by outsourcing. Each regulatory body will have differing views on the exact composition to use. In modern society, the availability of information through electronic media and the ability to communicate widely and effectively throughout the world — either through direct personal interaction or through available media — mean that much knowledge can be gained from other regulators through networking.

5.1. ESTABLISHING TRAINING AND DEVELOPMENT PROGRAMMES

Managers, with the help of those involved in competence management, need to establish a training programme which takes into consideration the gaps that exist between the current and desired competences. A combination of self-study, formal training courses, workshops, seminars and on-the-job training (OJT) is the platform for the regulatory training programme. Appendix IV provides an overview of training methods and options. Available training programmes (internal and external, national and international) need to be reviewed and updated and the appropriate form of training established.

Training alone cannot ensure the required competence. Necessary work experience, continuing professional development and refresher training need to be included in competence development plans for individuals. The systematic approach to training (SAT), described in Appendix III, is a suitable technique that provides a logical progression from the identification of the competences required to perform a job to the design, development and implementation of training to achieve these competences, and subsequent evaluation of this training.

² See <http://www-ns.iaea.org/training/ni/tools-networking.asp?s=9&l=75>.

Development of more experienced staff may include cultivating them into experts (or expanding the expertise of existing experts) through attendance at conferences, attachment to specialist organizations, secondment to other relevant organizations, and international cooperation, among other things.

Regulatory staff need to make a habit of continuing professional development throughout their careers — a philosophy of ‘lifelong learning’. As part of its training and development plans, the regulatory body needs to encourage such development by providing opportunities for staff to take appropriate courses, visit facilities and organizations, and to participate in conferences and professional associations. Managers can take such development activities into account when making decisions on job assignments and promotions. Many States’ engineering and scientific institutions require continual professional development to maintain their members’ credentials.

5.2. PARTICIPATION IN KNOWLEDGE NETWORKS

An important method for acquiring knowledge and developing competence is the participation in knowledge networks. The IAEA, as well as other international organizations, and professional bodies and associations facilitate networking, exchanging information and mutual learning based on good practices and experience from different States.

The regulatory body would benefit from participation in knowledge networks at the national, regional or international level. National knowledge networks may involve technical support organizations (TSOs), professional bodies and educational institutions. Regional networks have also proved to be very effective in sharing information and training. The Asian Nuclear Safety Network (ANSN), for instance, has built over the years the Topical Group on Education and Training (ETTG), which has developed a harmonized approach to training, based on the IAEA safety standards. The ANSN/ETTG is supported by a web based platform which enables the sharing of training materials and learning aids on-line — including holding webinars. Networks such as the Ibero-American Forum of Radiological and Nuclear Regulatory Agencies (FORO) are also very active in supporting training and competence building, finding synergies among the States in the region and using the IAEA safety standards. Finally, the regulatory body’s involvement in international global nuclear safety frameworks provides opportunities for continual improvement and learning. For instance, the IAEA global nuclear safety framework fosters cooperation among Member States and facilitates participation of regulatory bodies in international peer review services, such as the Integrated Regulatory Review Service (IRRS)³, or in networks such as the International Regulatory Network (RegNet)⁴ and the Global Safety Assessment Network (GSAN)⁵.

5.3. REORGANIZATION AND REPLACEMENT

The analysis of competences needed may show some competence gaps at an individual or subdivisional level but no significant gap at the level of whole organization.

³ See <http://www-ns.iaea.org/reviews/rs-reviews.asp?s=7&l=47>.

⁴ See <http://gnssn.iaea.org/regnet/default.aspx>.

⁵ See <http://gsan.iaea.org>.

Revising the division of responsibilities and tasks within the organization or placing staff members in new positions may provide a method to address competence gaps. However, reorganization is always a challenging task and needs careful consideration as well as honest and open discussions with all affected staff members in order to ensure an optimum outcome. It may well be that some staff — even though competent enough to take over certain tasks — might themselves wish different types of duties. Management also needs to be empathetic to requests from staff members to broaden their experience by taking on new duties. It needs to ensure that staff members remain well motivated when any changes in their work content are envisaged.

5.4. RECRUITMENT

A second method of addressing competence gaps, particularly long term gaps, is recruitment based on established job specifications. The recruitment strategy within a regulatory body will depend on a number of factors. These factors are likely to change with time, and hence the regulatory body will need to review the strategy periodically to establish whether it is still appropriate and viable. Work experience, demonstrated competence, expert or specialist knowledge are important considerations in selecting personnel to staff the regulatory body.

If new, or relatively, new graduates or people from disciplines unrelated to nuclear facilities and activities are recruited, more extensive training programmes will be required to establish appropriate competences in scientific and technological areas. However, it is inevitable that all new staff will need training — even if they have the technical competences required by the regulatory body. This is because it is necessary to instil in such recruits the culture of the regulatory body and to establish in them some of the competences described in the competence model they may lack (particularly in Quadrants 1 and 3, see Section 3.1). Similarly, part of the overall strategy may be to move staff to new posts, but they may also need to acquire additional competences and appropriate training.

The availability of suitable candidates for recruitment may be limited due to many factors, for example:

- (a) The regulatory body is just being established, as will be the case, for example, in a State embarking on a nuclear power programme.
- (b) The educational infrastructure is limited.
- (c) The range or number of facilities and activities in the State is small.

When recruiting staff from organizations with regulated facilities or activities, consideration needs to be given to ensuring that they are not immediately placed in roles which might compromise the effective independence of the regulatory body. Sufficient time needs to elapse to ensure that the recruits no longer identify with the organization from which they were recruited.

Some States have an ageing profile of the regulatory body's staff. It has been necessary to deal with this issue, and programmes for capturing knowledge have been established. Older and more experienced members of staff are often involved in training.

5.5. USE OF EXTERNAL SUPPORT

The regulatory body needs to have the required competences to perform its functions. It may however be practicable for the regulatory body to use external support in some cases. Examples include:

- (a) Other governmental bodies, TSOs, technical societies or research institutes;
- (b) Consultants or members of advisory committees of recognized skill and experience — so long as they are effectively independent of the operator or its contractors;
- (c) Experts provided by or under the auspices of international organizations.

When using external support, it is important that the regulatory body have competences to enable it to be an ‘intelligent customer’ and to control the work done for it. It needs to have sufficient breadth and depth of knowledge and experience to:

- (a) Specify the work and devise project programmes;
- (b) Assess tenders and proposals;
- (c) Chose an appropriate contractor;
- (d) Supervise and manage the work;
- (e) Ensure contractor staff are suitably qualified, experienced and trained;
- (f) Interpret the results in the context of regulatory control;
- (g) Ensure the required product or work quality is delivered;
- (h) Monitor the performance of the contractor, taking appropriate action if inadequate.

APPENDIX I

SAMPLE TASKS AND ASSOCIATED COMPETENCE AREAS FOR THE MAIN REGULATORY FUNCTIONS

As outlined in Sections 4.1 and 4.2, the systematic competence analysis requires the determination of the tasks associated with each function of the regulatory body and the competences required to perform each task. The first step can be done by analysing the processes related to the respective function. An example of the outcome of a typical process-based task analysis is given in the following tables for the main regulatory functions. It is worth emphasizing that such analysis strongly depends on the organization and management of the regulatory body and the regulatory approach adopted.

The next step is the identification of competences needed to perform each task. The tables include an expert judgement of the main quadrant competences areas relevant to the identified tasks. Obviously, the level of competence needed varies, but this is not included here. At a more detailed level, the individual competences within each quadrant competence area are to be assigned to the specific tasks. SARCoN provides for this level of details (see

Section 4). The four quadrant competence areas are of particular interest, since they are generally applicable to all tasks of the regulatory body. However, the following tables highlight the ones considered most critical for the specific task.

TABLE 1. REVIEW AND ASSESSMENT

Sample tasks	Main quadrant competence areas required ^a			
	Q1	Q2	Q3	Q4
Identify and synthesize information relevant to the safety of a facility or activity (such as facility's submission, past performance, and enforcement and inspection history).	1.2 1.3 1.4	All	3.1	4.1 4.2
Examine documentation and relevant information and make judgments regarding the safety of facilities and activities and compliance with regulatory requirements.	1.2 1.3 1.4	All	3.1	4.1 4.2
Identify the need for further information in relation to review and assessment.	1.2 1.3 1.4	All	3.1	4.1 4.2
Initiate other regulatory processes when needed (such as inspection).	1.2 1.4	—	3.1	4.3 4.4
Take the outcomes of other regulatory processes into consideration in the review and assessment process.	—	—	3.1	4.1 4.3 4.4
Review and assess documentation and relevant information (such as the safety analysis report, commissioning records, safety cases, equipment specification) to recognize issues regarding the safety of a facility or activity and possible non-compliance, and to make judgments regarding the overall safety and compliance with regulatory requirements.	1.2 1.3 1.4	All	3.1	4.1 4.2 4.3 4.4
Formulate the conclusions and recommendations.	—	—	—	4.2 4.3

Quadrant competence areas required for review and assessment as a whole.	1.2	All	3.1	4.1
	1.3		4.2	
	1.4		4.3	
			4.4	

^a Even though no specific technical competences are indicated as required in this table, it is expected that regulatory body staff in charge of authorization have a baseline of technical skills.

TABLE 2. AUTHORIZATION

Sample tasks	Main quadrant competence areas required ^a			
	Q1	Q2	Q3	Q4
Identify and synthesize information relevant to an authorization (such as applicant’s submission, past performance, and enforcement and inspection history).	All	—	3.1 3.2	4.1 4.2
Initiate review and assessment process.	1.2 1.4	—	3.2	4.1 4.2
Initiate other regulatory processes when needed (such as inspection and public communication).	1.2 1.4	—	3.2	4.3 4.4
Take the outcomes of other regulatory processes (e.g. review and assessment) into consideration in the authorization process.	—	—	3.2	4.1 4.3 4.4
Identify restrictions or conditions that may be imposed in an authorization.	All	—	3.2	4.1
Make judgments on granting, modifying, suspending or withdrawing authorizations.	All	—	3.1 3.2	—
Quadrant competence areas required for authorization as a whole.	All	—	3.1 3.2	4.1 4.2 4.3

				4.4
				4.5

^a Even though no specific technical competences are indicated as required in this table, it is expected that regulatory body staff in charge of authorization have a baseline of technical skills.

TABLE 3. INSPECTION

Sample tasks	Main quadrant competence areas required			
	Q1	Q2	Q3	Q4
Identify required inspections and their scope either as planned inspections, resulting from events or initiated through other regulatory processes.	1.2	—	3.3	All
Identify and synthesize information relevant to the inspection (such as authorization, past performance, enforcement and inspection history, and work schedule of a facility or activity).	All	All	3.3	4.1 4.2
Take the outcomes of other regulatory processes into consideration in the inspection process.	—	—	3.3	4.1 4.3 4.4
Produce an inspection plan for a specific facility or activity.	—	—	3.3	All
Perform interviews with relevant personnel.	1.2 1.3	All	3.3	All
Make observation, measurements and take samples as needed.	1.2 1.3	All	3.3	All
Examine documentation, records and relevant information.	1.2 1.3	All	3.3	All
Make judgments regarding the safety of a facility or activity and compliance with regulatory requirements.	All	—	3.3	4.1

Assess the regulatory significance of inspection findings.	1.2	—	3.3	4.1
Recognize when immediate actions are required to rectify non-compliance if there is imminent likelihood of a safety significant event.	1.2	—	3.3 3.4	4.1
Initiate other regulatory processes when needed (such as review and assessment or enforcement).	1.2 1.4	—	3.3	4.3 4.4
Prepare inspection report.	1.2	—	3.3	4.1 4.2
Quadrant competence areas required for inspection as a whole.	All	All	3.3 3.4	All

TABLE 4. ENFORCEMENT

Sample tasks	Main quadrant competence areas needed ^a			
	Q1	Q2	Q3	Q4
Decide upon and initiate enforcement actions because of non-compliance in a facility or activity (such as those identified in other regulatory processes or due to events).	All	—	3.4	4.1
Determine whether other regulatory processes are needed in order to support an enforcement action (such as inspection).	All	—	3.4	4.1
Determine whether actions of, or liaison with, other agencies are needed in order to support an enforcement action (such as evidence gathering by other law enforcement agencies, legal advice and other regulators).	All	—	3.4	4.1
Make judgments on the significance for safety of non-compliance and commensurate enforcement actions (such as requests for corrective actions, verbal or written notifications, penalties and prosecutions).	1.2	—	3.4	4.1
Initiate other regulatory processes (such as inspection or review and assessment) to evaluate	1.2	—	3.4	4.1

and to decide on the adequacy of corrective measures proposed by the facility or activity, and to confirm their effective implementation.	1.3			4.2
	1.4			4.3
Quadrant competence areas required for enforcement as a whole.	All	—	3.4	4.1 4.2 4.3

^a Even though no specific technical competences are indicated as required in this table, it is expected that regulatory body staff in charge of authorization have a baseline of technical skills.

TABLE 5. DEVELOPMENT OF REGULATIONS AND GUIDES

Sample tasks	Main quadrant competence areas needed ^a			
	Q1	Q2	Q3	Q4
Examine and identify the need for new regulations and guides or the amendment of existing ones (based, for instance, on feedback on the implementation of existing regulations, emerging technologies, changing standards and new laws).	1.1 1.2 1.3 1.4	—	3.5	4.1 4.3 4.4 4.5
Consider relevant information in drafting or amending the regulations and guides (such as technical information, standards, other States' regulations and background studies).	1.1 1.2 1.3 1.4	—	3.5	All
Identify and appropriately address interfaces with other laws, regulations and guides.	1.1 1.2 1.3 1.4	—	3.5	—
Draft regulations and guides so as to meet technical and legal requirements in ways which are thorough, consistent, understandable and practicable.	All	All	3.5	All

Assess and incorporate, as applicable, comments received by interested parties.	All	All	3.5	4.1 4.3 4.4 4.5
Initiate the approval and issuance process for the prepared regulations or guides.	All	—	3.5	4.5
Quadrant competence areas required for development of regulations and guides as a whole.	All	All	3.5	All

^a Even though no specific technical competences are indicated as required in this table, it is expected that regulatory body staff in charge of authorization have a baseline of technical skills.

APPENDIX II

QUADRANT COMPETENCE AREAS TYPICALLY REQUIRED FOR REGULATORY FUNCTIONS

The following tables provide an example of possible links between the functions of the regulatory body and the quadrant competence areas based on expert judgement. This link is useful when developing an initial overview of the quadrant competence areas required to perform the functions of the regulatory body before going into the detailed analysis of functions, tasks and KSAs described in Section 4.

Table 6 provides the quadrant competence areas required to perform the main regulatory functions, while Table 7 provides the same for selected additional functions that might be assigned to a regulatory body. It is worth emphasizing that although the tables in this Appendix are based on general expert judgement, a regulatory body may need to adjust them in accordance with its organization, management and the regulatory approach adopted.

TABLE 6. QUADRANT COMPETENCE AREAS TYPICALLY REQUIRED FOR THE MAIN REGULATORY FUNCTIONS

	Review and assessment	Authorization	Inspection	Enforcement	Development of regulations and guides
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		Review and assessment	Authorization	Inspection	Enforcement	Development of regulations and guides
<i>1. Competence related to the legal, regulatory and organizational basis</i>						
1.1.	Legal basis	—	X	X	X	X
1.2.	Regulatory policies and approaches	X	X	X	X	X
1.3.	Regulations and regulatory guides	X	X	X	X	X
1.4.	Management system	X	X	X	X	X
<i>2. Technical disciplines competences</i>						
2.1.	Basic science and technology	X	—	X	—	X
2.2.	Applied science and technology	X	—	X	—	X
2.3.	Specialized science and technology	X	—	X	—	X
<i>3. Competences related to a regulatory body's practices^a</i>						
3.1.	Review and assessment	X	X	—	—	—
3.2.	Authorization	—	X	—	—	—
3.3.	Inspection	—	—	X	—	—
3.4.	Enforcement	—	—	X	X	—
3.5.	Development of regulations and guides	—	—	—	—	X
<i>4. Personal and behavioural competences</i>						
4.1.	Analytical thinking and problem-solving	X	X	X	X	X
4.2.	Personal effectiveness and self-management	X	X	X	X	X
4.3.	Communication	X	X	X	X	X
4.4.	Team work	X	X	X	—	X
4.5.	Managerial competences and leadership	—	X	X	—	X
4.6.	Safety culture competence	X	X	X	X	X

^a Please note that 3.1–3.5 refer to competences as explained in Section 3.1.3.

TABLE 7. QUADRANT COMPETENCE AREAS TYPICALLY REQUIRED FOR SOME ADDITIONAL FUNCTIONS OF THE REGULATORY BODY

	Research and development	Emergency preparedness	International cooperation	Public Communication
<i>1. Competence related to the legal, regulatory and organizational basis</i>				

		Research and development	Emergency preparedness	International cooperation	Public Communication
1.1.	Legal basis	—	X	X	X
1.2.	Regulatory policies and approaches	—	X	X	X
1.3.	Regulations and regulatory guides	—	X	X	X
1.4.	Management system	—	X	X	X
<i>2. Technical disciplines competences</i>					
2.1.	Basic science and technology	X	X	X	—
2.2.	Applied science and technology	X	X	X	—
2.3.	Specialized science and technology	X	—	—	—
<i>3. Competences related to a regulatory body's practices^a</i>					
3.1.	Review and assessment	—	X	X	—
3.2.	Authorization	—	X	X	—
3.3.	Inspection	—	—	X	—
3.4.	Enforcement	—	—	X	—
3.5.	Development of regulations and guides	—	—	X	—
<i>4. Personal and behavioural competences</i>					
4.1.	Analytical thinking and problem-solving	X	X	X	X
4.2.	Personal effectiveness and self-management	X	X	X	X
4.3.	Communication	—	X	X	X
4.4.	Team work	X	X	X	X
4.5.	Managerial competences and leadership	X	X	X	X
4.6.	Safety culture competence	X	X	X	X

^a Please note that 3.1–3.5 refer to competences as explained in Section 3.1.3.

APPENDIX III

SYSTEMATIC APPROACH TO TRAINING

The systematic approach to training (SAT) is recognized as a model for assisting in identifying the training needs and for designing, planning, implementing and evaluating training programmes. It has been used in the last 20 years by several regulatory and government agencies, as well as several other organizations.

The management of the regulatory body needs to assign the responsibilities for applying SAT. In some organizations, the person (or the leader of the team) is referred to as the training coordinator (TC). Typical roles and responsibilities of the TC include:

- (a) Planning the competence gap analysis referred to in Section 4;

- (b) Briefing the management and staff on the conduct of the competence gap analysis;
- (c) Organizing and supervising the implementation of each step of the competence gap analysis;
- (d) Considering how to fill the gaps by recruitment, training and outsourcing;
- (e) Reporting the results of the analysis and recommending means to fill the gaps to the regulatory body's management;
- (f) For those gaps to be filled by training, developing a programme to provide the training needed, in consultation with other staff and management;
- (g) Supervising the implementation of the training programme;
- (h) Evaluating the training results;
- (i) Suggesting future training actions or alternative measures to ensure regulatory competence in the short, medium and long term.

SAT consists of five interrelated phases as follows:

III.1. ANALYSIS

In this phase, the training needs are identified to cover those competence gaps that are to be acquired by training as determined by the gap analysis described in Section 4.3.

III.2. DESIGN

Training needs and learning points related to specific competences are converted to learning objectives, including evaluation strategies, which are then organized into training plans, taking into account the available options and methods for training.

An annual training programme for the regulatory body can be developed by the management with the assistance of the TC, based on the organizational strategies and the individual needs. Examples of options and methods for training are described in Appendix II.

III.3. DEVELOPMENT

In this phase, training materials and evaluation tools are prepared in accordance with the training plan produced in the design phase, so that the achievement of training objectives can be confirmed.

The work performed in this phase as well as in the design phase ensures that the intended training is both appropriate and adequate. This work includes, among other things, the production and modification of:

- Training plans;
- Training material (learner text, presentations and hand-outs);
- Instructor manuals;
- Evaluation tools.

III.4. IMPLEMENTATION

In this phase, training is conducted in a specific training environment, using the training materials that were created in the development phase. By design, specific delivery methods and tools would be used to ensure that training is delivered in an effective and efficient manner.

Typical activities in this phase are:

- (a) Deliver training through the training programme;
- (b) Use internal or external training facilities;
- (c) Contract and secure qualified trainers (lecturers, mentors, experts, etc.);
- (d) Use appropriate and adequate equipment;
- (e) Conduct training in accordance with the lesson plans;
- (f) Use evaluation tools developed.

III.5. EVALUATION

The training and development programme needs to be continually evaluated on the basis of data collected during each preceding phase. The evaluation provides feedback that can facilitate training and development programme improvements.

There are several sources of feedback:

- (a) Course evaluation by trainees;
- (b) Self-evaluation of performance improvement by trainees;
- (c) Course evaluation by trainers;
- (d) Feedback from line managers on how the training and development affected employee performance;
- (e) Feedback from interested parties, such as regulated facilities and activities, on regulatory staff performance.

APPENDIX IV

SELECTING OPTIONS AND METHODS OF TRAINING

In any given State, there are often commercial organizations that provide training suitable for the regulatory body. However, some regulatory bodies are beginning to prefer national or international cooperation to achieve staff training. There are many opportunities to obtain training in regulatory competences through international arrangements and courses that may be common to many States.

Although some elements of training programmes for regulatory body personnel may be similar to training programmes elsewhere, the overall training programmes will inevitably

be different, since the focus of regulatory staff is specific. It needs a regulatory perspective rather than an operational perspective. Many regulatory bodies favour the provision of training by in-house, experienced regulatory staff who design and deliver the training, and are able to ensure the training describes and encompasses the regulatory context. Even for training programme elements (such as technical elements) that would appear to be in common, it is often very useful if the regulatory staff training can be implemented with a regulatory perspective rather than an operational perspective. Particular care has to be taken in choosing external training packages.

Training will involve several methods, the choice of which will be determined by factors such as the geographical location of the participants, availability of leave for training purposes, and the costs and availability of equipment and materials.

Possible training modes include:

- Internal classroom training;
- External classroom training;
- Distance learning, using manuals, computers and videos, among others;
- On-the-job training (OJT);
- Structured self-study;
- Laboratory training, such as instrument use;
- Coaching and mentoring.

IV.1. CLASSROOM BASED TRAINING

Classroom based training is still the most frequently used method of training provision and is probably the most effective training mechanism for comprehensive levels of training. It facilitates direct communication and discussion between the trainer and the participants and enables the trainer to modify a range of factors, such as the depth of the course and the speed of delivery, depending on the capabilities and progress of the participants. A classroom based training course may include a series of short lectures on specific topics from a syllabus, reading material, practical exercises, videos, group discussions and case studies designed to reinforce the lecture content. However, the provision of such courses is relatively expensive, both in terms of the resources and efforts from the trainers and the time and subsistence costs for the participants.

IV.2. DISTANCE LEARNING

Distance learning may be an effective alternative to classroom based training, and it is particularly appropriate for people who live far from training centres or have insufficient time or funds to attend classroom based training. It may also be an effective use of training resources where only small numbers of people need training.

Distance-learning media cover a range of technologies, including paper correspondence courses, video lectures, video teleconferencing, courses on DVDs and Internet based classes. The role of the supervisor in distance learning will vary depending

upon the medium used. Correspondence courses, videotape lectures and most Internet based classes require little or no supervisor–participant interaction. Video teleconferencing, on the other hand, lets participants and supervisors interact, almost at a classroom level. The availability of cameras and microphones for Internet communications facilitates the access of personal computer users to Internet based distance learning.

A typical distance-learning package consists of a modular set of course notes, study guides and associated exercises based on specific topics from a syllabus. Participants complete the package at work or at home. The training includes the completion of assessment tasks (e.g. written examinations, research assignments and problem-solving exercises), which are then forwarded to a supervisor or tutor for marking and feedback. Distance learning may involve a residential programme, where the trainee spends some time at a training site. The residential programme can reinforce the course material, give practical work, conduct technical visits or provide examinations. The residential programme needs to provide sufficient time for the participants to acquire the required skills, problem-solving methods or other practical experiences. The role of the supervisor is important to the success of distance learning, and frequent interactions with the participants would be beneficial. Distance learning is relatively inexpensive and permits the participants to study at their own pace. However, its success depends on the self-motivation of the participants to complete the work with the minimum of direct supervision.

With the increased availability of personal computers around the world, many workers now have access to a computer. This has stimulated the development of computer-based training (CBT) packages, consisting of interactive training modules with question and answer sections. Computer based training modules usually incorporate photographs, diagrams, simulations and video sequences. The information can be accessed and searched easily and links can be provided to a glossary of terms. Printed learning material and study guides may be needed to support CBT.

IV.3. ON-THE-JOB TRAINING

Classroom based training or distance learning is unlikely to cover all the KSAs associated with regulatory tasks. Hence, on-the-job training (OJT) is a critical component of the overall training programme. In this form of training, the participant is either at work as normal or at a training site, under the direct supervision of an experienced person. A training plan based on identified competences will include a list of topics and tasks to be carried out. The participant's progress and achievements may be recorded on a checklist. The supervisor's role needs to ensure that the participant receives comprehensive training and is not just used as an extra pair of hands. With a staged approach, the participants progress from observing the task being performed by others, to assisting in the task and finally to carrying out the tasks themselves. On completion of training, the supervisor and participant prepare a comprehensive report describing the participant's progress, the areas of competence achieved and any further training needed.

IV.4. STRUCTURED SELF-STUDY

Most tasks require at least a working level knowledge of specific policies and procedures. Structured self-study can help the trainee acquire an appropriate level of knowledge. The same standards and controls that apply to formal classroom training (i.e. learning objectives, lesson plans and standards for successful course completion, etc.) are

implemented for self-study and OJT activities, which are more focused, structured and sequenced to increase their effectiveness. Self-study activities are most effective if they precede and tie directly to a subsequent formal course or OJT activity (i.e. the participant reads and studies the document, then has an opportunity to discuss and to apply it). A structured self-study guide is developed for each document for which a detailed knowledge or working level knowledge is desired. Each self-study guide may include the objectives, specific actions required by the participant, requirements for management involvement and oversight, review questions and measurable standards for acceptable completion of each activity. Related guides would be combined into a module that would link to a formal course and is required as a prerequisite for attending the following course. This can integrate and sequence learning activities so that each subsequent activity builds and expands on the previous activities.

IV.5. COACHING AND MENTORING

Some regulatory bodies appoint mentors, particularly with new staff. Mentors are experienced members of staff, not necessarily from the same department as the person being mentored, who help to explain the culture and values of the organization and give advice about the informal aspects of the organization.

Coaching is generally carried out by line managers, and feedback needs to focus on easily identifiable issues and encompass specific characteristics of behaviour as described by Quadrant 4 of the competences. Effective managers coach in two ways: the directive coaching approach, where problem-solving is shared; and reflective, where the manager and the staff member together seek to understand joint experiences. Respect is vital to effective coaching — managers are able to influence the behaviour of others favourably if they are highly respected. Coaching and personal performance review processes are complementary because they comprise dialogue between staff member and line manager.

APPENDIX V

CONSIDERATIONS FOR APPLYING THE COMPETENCE MODEL TO EMBARKING STATES

V.1. BACKGROUND

IAEA Safety Standards Series No. GSR Part 1 (para. 4.13 of Ref. [1]) addresses the issues of competences of the regulatory body by requiring that a “process shall be established to develop and maintain the necessary competence and skills of staff of the regulatory body, as an element of knowledge management.”

IAEA Safety Standards Series No. SSG-16 [6] provides guidance in the form of actions to be implemented by a State embarking on a nuclear power programme to establish an appropriate infrastructure for safety. It states that a considerable period of time is needed to acquire the necessary competences and a strong safety culture before operating an NPP. While prime responsibility for safety must rest with the operating organization, the regulatory body has the responsibility of providing oversight of the overall programme and of authorizing its implementation through a stepwise licensing process.

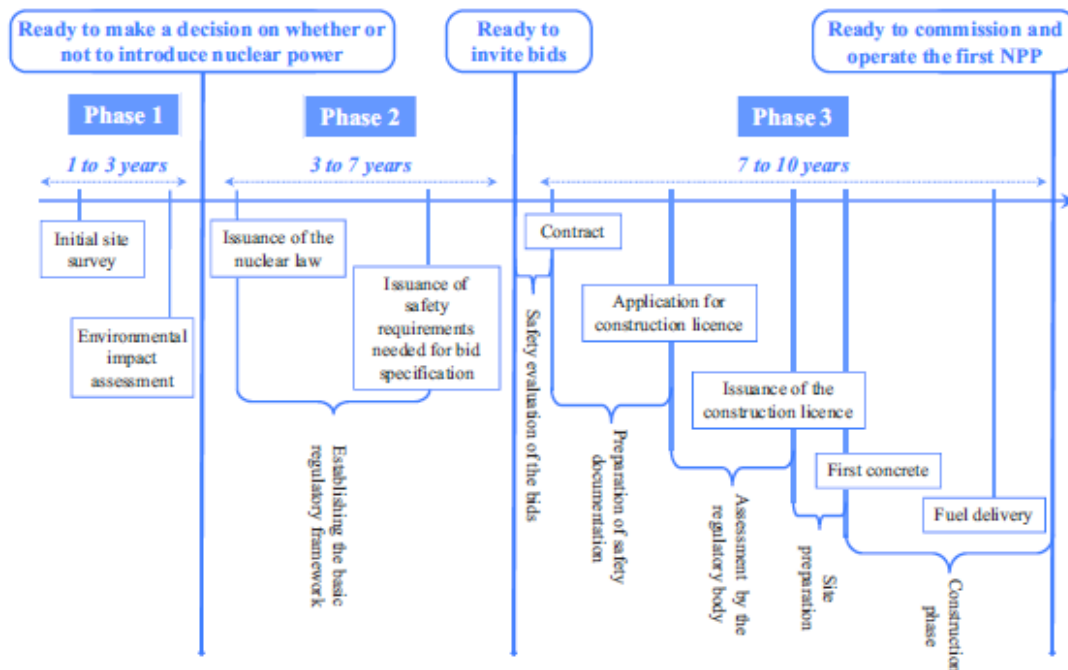


FIG. 3. Steps in the development of a nuclear power programme.

Figure 3, taken from IAEA Safety Standards Series No. SSG-16 [6], shows some typical steps in the development of a nuclear power programme that are divided in three major phases:

- Phase 1 is ‘Safety infrastructure before deciding to launch a nuclear power programme’ (average duration 1–3 years);
- Phase 2 is ‘Safety infrastructure preparatory work for construction of an NPP after a policy decision has been taken’ (average duration 3–7 years);
- Phase 3 is ‘Safety infrastructure during implementation of the first NPP’ (average duration 7–10 years).

To implement these steps, actions are needed from one or several organizations involved in the nuclear power programme. As an example, the initial site survey in Phase 1 is a step that has to be conducted at the very beginning of the programme by the government or by the future operating organization (if it has been already identified). The purpose is to consider potential sites based on existing data. This is not the site evaluation process that will take place later, probably in Phase 2, and that will require approval by the regulatory body.

Another example is the need to have the requirements necessary to support the bid specification issued in Phase 2. This is a regulatory body responsibility for developing or adopting regulations against which the bid responses will be assessed.

A major challenge that the regulatory body will face at the beginning of Phase 3 is the regulatory review and assessment of the application for the NPP construction. In general, this is done through the review of a preliminary safety analysis report (PSAR) and other safety related documents such as a probabilistic safety assessment (PSA). This activity requires competence in a broad range of technical areas that need several years to be developed. It is likely that the regulatory body at this stage will not have all the required competences, and a

strategy must be put in place to ensure that the review will be performed effectively by a competent technical team. This strategy can include the recruitment of staff with the required competences from other organizations that may be from inside or outside the State, contracting external support organizations to assist in the review process or developing its own competences through a training programme. The proper mix of these options needs to be chosen depending on the size and level of maturity of the organization. Section V-4 elaborates on the strategy to be adopted.

It is expected that the regulatory body will be adequately staffed and operational before the commissioning process starts, at the end of Phase 3. At that time, all internal processes and procedures and technical and managerial competences required to oversee the future reactor operation need to be in place. The resources, both human and financial, and time required to build a competent regulatory body need not to be underestimated.

In an embarking State, the application of the competence model needs to be done in conjunction with human resource planning. The organizational structure and staff numbers (head count) must be determined by senior managers using their (managerial) judgment and taking into account the scope of responsibility of the regulatory body, the legal arrangements in place, the regulatory approach adopted, the analysis of competences required and the availability of external technical support, among other things. Guidance on workforce planning in Phases 1, 2 and 3 is available in IAEA Nuclear Energy Series No. NG-T-3.10, “Workforce Planning for New Nuclear Power Programmes [10]. Examples of the scope of responsibility of regulatory bodies related to authorization process may be found in the Report of the Survey on the Review of New Reactor Applications [11].

This Appendix relies on the Quadrant Model of Competences introduced in Section 3 of this Safety Report. In addition, it elaborates on the competence model for embarking States and suggests a sequential approach for the development of a regulatory body consistent with the actions presented in IAEA Safety Standards Series No. SSG-16 [6].

V.2. CONSIDERATIONS TO APPLY THE COMPETENCE MODEL TO EMBARKING STATES

This section gives an overview of challenges and issues that might arise during the development phases. It is expected that a regulatory body of an embarking State will have all competences described in the competence model at the time of the NPP commissioning. However, these competences do not need to be developed all at the same time. As an example, competences required to establish the regulatory framework or those required for the site assessment need to be established before those related to inspection or to operation. Based on these competences, senior management can apply judgement to determine the number of experts and time frame to recruit and train or to pursue external support.

V.2.1. Quadrant 1: competences related to legal, regulatory and organizational basis

These competence areas are described in Section 3.1.1. The following is a collection of some considerations based on experience from embarking States.

V.2.1.1. *Legal basis*

The staff recruited by the regulatory body need to have a clear understanding of the responsibilities, scope of activities and power limitations of the regulatory body as stated in

the nuclear law. The legal framework varies from State to State, and acquiring competences in this field through an appropriate training programme is essential to all staff of the regulatory body, independent of their previous background and experience.

At the very early phase of the nuclear power programme (most probably just after the decision has been taken), the State will become party to international legal instruments such as the comprehensive safeguards agreement and additional protocol, the Nuclear Safety Convention, and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. It is important that the staff of the regulatory body have an overall understanding of those legal instruments and their obligations, since it will be in the frontline to respond to the State obligations.

Another element to be considered is the bilateral agreements that the State or the regulatory body will establish with States with mature nuclear power programmes. These arrangements create opportunities by receiving training support or by the exchange of experts to rapidly increase the competences of the embarking State. Of particular importance in this context is a bilateral agreement with a State that has licensed a similar facility (if the technology had already been defined). Information on the existence and scope of those agreements needs to be provided to the staff.

V.2.1.2. Regulatory policies and approaches

The staff responsible for establishing those policies and approaches (i.e. the senior management of the organization) have to develop a clear understanding of the functions and responsibilities of a regulatory body as stated in IAEA Safety Standards Series No. GSR Part 1 [1] and to be exposed to similar policies developed by other regulatory bodies.

Policies being developed need to state long term goals of the regulatory body, its main mission, core values and regulatory approach to achieve the goals for licensing, and human resource development, among others.

V.2.1.3. Regulations and regulatory guides

The regulatory body of an embarking State needs to understand the nature and scope of the IAEA Safety Standards, since it may be used as a basis for its own regulations. The IAEA Safety Standards are technologically neutral, allowing for an open bid process. However, for the detailed assessment that needs to be conducted in Phase 3, the embarking State may decide to complement the IAEA Safety Standards by a set of more prescriptive regulations. Those could be, for example, the regulations from a State that has licensed a similar facility. In that case, a good understanding of these regulations is also necessary.

V.2.1.4. Management system

The regulatory body needs to develop competent staff to effectively put in place a management system (see Ref. [2]). This would include among other aspects the ability to define a structure and hierarchy of documents as well as the approval process, and to generate documents under the management system as well as communicating its content to all the staff of the regulatory body.

V.2.2. Quadrant 2: technical disciplines competences

These competence areas are described in Section 3.1.2. The following is a collection of some considerations based on experience from embarking States.

V.2.2.1. Basic science and technology

It is likely that an embarking State has universities providing most of those basic competences, except possibly in the field of nuclear engineering. It is also likely that the management, with help from the recruitment staff of the regulatory body, will find professionals with the referred academic background and experience in other industries but not in the nuclear industry. In this case, training in a specific discipline at the level of ‘applied technology’ as described below needs to be provided before the new recruits engage in an activity at the regulatory body and related to that discipline.

V.2.2.2. Applied science and technology

This training is intended to provide an overview of the concepts and principles guiding the activities of the regulatory body. It is not expected that the staff will become fully operational at the end of the training.

In the early phases of a nuclear power programme, the regulatory body may not have the human resources to prepare and to conduct the training. In this case, it needs to find external support, which could be a local or external university, a more mature regulatory body, the IAEA or some international school specialized in the field of nuclear safety.

V.2.2.3. Specialized science and technology

Some typical scientific fields or specialized areas that are common to many regulatory bodies are those that are needed for the review and assessment of the safety analysis report (SAR) and that are described in the main part of this publication.

Training at the level of specialized technology needs to include mentoring and OJT, since the goal is to develop the KSAs at the necessary level of proficiency to allow the staff to perform the tasks under their responsibility in an autonomous way. It is expected that several years will be needed for a staff to acquire the competences at the specialized technology level. The experience from some regulatory bodies is that you may need several additional years to become a senior specialist in a particular area.

V.2.3. Quadrant 3: competences related to a regulatory body’s practices

These competence areas are described in Section 3.1.3. The following is a collection of some considerations based on experience from embarking States.

V.2.3.1. Review and assessment

Review and assessment is the review of technical documents submitted by the licensee (competences presented in Quadrant 3) that will be conducted over the lifetime of the NPP. In a nuclear power programme, review and assessment is a main responsibility of the regulatory body for the authorizations it has to give. The different stages in the lifetime of a nuclear installation may or may not have an authorization associated with them but could include (see Ref. [12]):

- Approving the site chosen by the licensee;
- Authorizing the construction;
- Authorizing the commissioning of the facility;
- Authorizing the commencement of operation of the facility;
- Authorizing modifications in the design or in the operation;

— Authorizing the conduct of other safety related activities, such as periodic safety reviews, and decommissioning, among others.

For each of the above review and assessment activities, it is expected that the regulatory body will develop documents — as part of its management system — explaining how these activities will be conducted. These documents can be written in terms of flow diagrams, procedures or work instructions, with the goal to provide detailed guidance to the staff of the regulatory body involved in the activity.

V.2.3.2. Authorization

In a nuclear power programme, an activity important for safety cannot be initiated without authorization from the regulatory body. The authorization for a particular activity is provided to the licensee on the basis of the review and assessment process described in Section 3.1.3. As an example, the pouring of concrete for safety related buildings cannot be initiated before the issuance of a construction licence by the regulatory body.

It is expected that the regulatory body will develop documents explaining the steps of the authorization process, the required documentation, the interface with the licensee and other concerned organizations and the estimated duration for the review and assessment process. This duration can be re-evaluated depending on the safety issues identified. Ideally, the authorization process needs to be defined before the bid process is conducted, which leads to the competences to conduct this activity occurring early in Phase 2.

V.2.3.3. Inspection

This competence area for an embarking State is the ability to understand the inspection process adopted by other States or suggested by the IAEA and, based on those, to develop its inspection process.

Inspections are conducted by the regulatory body at the construction phase — Phase 3 — and later during the operation phase of the NPP. The nature and competences required in both cases are not the same, showing that the competences of inspectors have to evolve as the nuclear power programme moves from construction to operation. In the former case, the inspections aim to verify that the facility is constructed in accordance with the licence and includes compliance with the industrial codes adopted in the design of the NPP; while in the latter, the focus is on operation in conformance with the licence and includes compliance with the approved operational programmes.

It is expected that early in Phase 3, the regulatory body will have the competences to build an inspection programme as well as to conduct inspections in some critical areas and that this process is described in documents under the management system.

V.2.3.4. Enforcement

Under the legal framework of various States, certain enforcement powers are conferred to the inspectors of the regulatory body and an internal process, under the management system, needs to be developed by the regulatory body to clarify how these powers will be exercised

V.2.3.5. Development of regulations and guides

For an embarking State, this competence area is the ability to understand the process for developing regulations and guides adopted by other States and based on those to develop its own development process.

Regulatory staff involved in the preparation of regulations need to have the ability to create and manage a plan, defining deadlines for the issuance regulations which are consistent with the nuclear power programme schedule. The plan needs to give priority to the regulations that are needed in Phase 2 (regulations describing the licensing process, site evaluation, and design and management system).

V.2.4. Quadrant 4: personal and behavioural competences

These competence areas are described in Section 3.1.4. The following is a collection of some considerations based on experience from embarking States. They are not specific to the nuclear field but they are relevant to any project oriented organization.

At an early phase of the nuclear power programme (Phase 2), the senior management of the regulatory body needs to take actions that will drive the future activities of the regulatory body. Some of the actions identified in IAEA Safety Standards Series No. SSG-16 [6] are presented below:

- Consider various regulatory approaches and establish its own;
- Preparation of a preliminary workforce plan;
- Establishment of the physical infrastructure required to have the regulatory body functional;
- Defining the licensing process;
- Preparing an initial training programme;
- Establishment of a management system.

All these actions require managers with strong competences in Quadrant 4, in particular in the ability to gather information, in developing a comprehensive understanding of the issues being addressed, and in preparing policies and programmes for the organization.

In Phase 3, the newly established regulatory body has to respond to the demands of the nuclear power programme by reviewing the NPP design and later by conducting inspections for the construction phase. Those regulatory functions cannot be conducted properly without strong competences in Quadrant 4 — in particular, by the ability of the staff to gather information, analyse the information and pass judgment on its acceptability, and finally by communicating the results to the regulatory body management and the future licensee.

V.3. REGULATORY BODY ACTIONS AND ASSOCIATED COMPETENCES

This section identifies the actions in IAEA Safety Standards Series No. SSG-16 [6] related to the main functions of the regulatory body. It also considers some of the additional functions of the regulatory body as well as its management system. Using the competence model described in Section 3, a few considerations are given for the associated tasks and competences for the introduction of a nuclear power programme.

This Appendix is more specific than the general discussion of competences for all facilities and activities. However, it is not intended to be exhaustive in identifying all the competences for each function, and the list of KSAs presented needs to be seen as illustrative only. Each entrant regulatory body needs to evaluate and to establish its own list of KSAs and

levels of proficiency. Note that KSAs may appear in more than one function, as the specific KSAs are applicable to multiple functions. This Appendix does not attempt to correlate the sample tasks presented in Appendix I; however, consistent with the phase approach, the regulatory body needs to arrive at the same end point.

IAEA Safety Standards Series No. GSR Part 1 [1] establishes requirements related to the responsibilities and functions of the regulatory body and also identifies certain important tasks that the regulatory body has to perform to fulfil these functions and discharge its responsibilities. In recent years, various Member States have shown their interest to embark on a nuclear power programme. This has highlighted the need to provide recommendations to these Member States on different phases of the development of nuclear power programme and their regulatory infrastructure. IAEA Safety Standards Series No. SSG-16 [6] recommends meeting safety requirements progressively during Phases 1, 2 and 3 in the form of sequential actions. These actions broadly cover the tasks that are needed to accomplish the functions of the regulatory body. These actions can be documented in a detailed task list.

V.3.1. Review and assessment

The embarking States have to initiate developing competences of their staff for review and assessment in Phase 2 as part of its preparation to conduct the review of applicants' submissions in support of authorization applications in Phase 3 (see Sections 3.1.3, 4.1 and 4.2). The review of various parts of the submission needs staff with the specialized knowledge and skill in specific technical and management system areas. The regulatory body may not have competences in all areas during initial authorization phases, such as site authorization and construction authorization. Therefore, it may identify areas of support from outside organizations in certain specific areas and areas where its staff have to develop competences at an earlier stage and manage its activities accordingly. In developing competences on applied and specialized knowledge, the regulatory body may obtain support from another regulatory body that has already licensed an NPP of similar design — preferably the regulatory body of the vendor State. In such cases, the regulatory body needs to develop competences to evaluate their work and make a decision.

One of the key components of the regulatory body competence development programme is to reduce its dependency with time on outside organizations for review and assessment and to prepare its staff for review and assessment of authorization submissions for commissioning and operation phases. Early stages of Phase 3 are an appropriate time for starting this. However, if the State's regulatory model relies more on technical support organizations (TSOs) for conducting review and assessment, the regulatory body must develop expertise to make an independent judgement on the work of the TSOs.

V.3.1.1. Actions in SSG-16 [6]

In Phase 2:

- (a) The regulatory body should review and assess the radiological environmental impact analysis for the site selected, as appropriate (Action 111).
- (b) The operating organization, the regulatory body and external support organizations, as appropriate, should develop the expertise to prepare for the conduct or the review of safety assessments (Action 118).

- (c) The regulatory body should review and assess the site evaluation report, and should make a decision regarding the acceptability of the site selected and the site related design bases (Action 164).

In Phase 3:

- (a) The regulatory body should develop and manage the processes required in review and assessment, which typically include the following phases: siting, construction, commissioning and operation (Action 34).
- (b) The regulatory body should review and assess programmes to be implemented by the operating organization, as appropriate (Action 38).
- (c) The regulatory body should review and assess the operating organization's programme on safety management (Action 84).
- (d) The regulatory body should review and assess the operating organization's programme with regard to human resources management (Action 97).
- (e) The regulatory body should review and assess the operating organization's programmes with regard to radiation protection and relevant environmental protection, and should verify compliance with the regulatory requirements (Action 115).
- (f) The regulatory body should ensure that arrangements are in place for the monitoring of all releases from the NPP to the environment (Action 116).
- (g) The regulatory body should carry out a comprehensive review and an independent verification of the SARs submitted by the operating organization to verify compliance with the regulatory requirements (Action 120).
- (h) The operating organization or the regulatory body should obtain support from external support organizations or individual experts in performing or reviewing safety assessments, as necessary (Action 121).
- (i) The regulatory body should review and assess the operating organization's programmes for waste management and spent fuel management and for decommissioning, and should verify their compliance with the regulatory requirements (Action 129).
- (j) The regulatory body should review and assess the emergency programme and the emergency plans and procedures for NPPs, and should verify compliance with the regulatory requirements (Action 144).
- (k) The regulatory body should review and assess the safety documentation, such as the SARs, and should verify the compliance of the design with regulatory requirements (Action 182).
- (l) The regulatory body should review and assess the commissioning programme (Action 188).

V.3.1.2. Related competences

Major documents that the regulatory body reviews and assesses during various authorization stages include:

- Management system;
- Site evaluation report;

- SAR;
- PSA report;
- Commissioning programme;
- Operational limits and conditions;
- Emergency preparedness plan;
- Physical security plan;
- Radiation protection programme;
- Radioactive waste management programme;
- Environmental assessment report;
- Decommissioning plan.

The main tasks associated with the review and assessment include:

- Formation of review team keeping in view the scope of work and associated expertise involved;
- Managing external resources for technical support during the activity;
- Scheduling the activities;
- Establishing the process for review and assessment under the management system;
- Identifying acceptance bases and criteria;
- Establishing process and interface to communicate with the applicant for discussion and resolution of issues identified during the review process;
- Safety evaluation.

The review of application for major authorization phases, such as construction or operation licence, requires regulatory staff with a specialized knowledge of various disciplines of engineering and science.

Examples of KSAs could be:

- (a) Quadrant 1: competences related to the legal, regulatory and organizational basis:
 - (i) Comprehension of the regulatory framework (regulations and guides) for the safety and security of the facility;
 - (ii) Appreciation and comprehension of the interrelationship between regulatory documentation system such as regulations, regulatory guidance, codes and standards;
 - (iii) Comprehension of IAEA safety standards, particularly those relating to the licensing process as well as practices of other States with established nuclear power programmes;

- (iv) Comprehension of relevant policies, procedures, guidance documents and licensing documents that are used in conducting specific review and assessment tasks as defined in the legal basis.

(b) Quadrant 2: technical disciplines competences:

- (i) Deep comprehension of a scientific field or specialized area (e.g. reactor technology, engineering techniques or technical issues, nuclear safety, industrial codes and standards, and material sciences) that provides sufficiently expert knowledge to address and to resolve regulatory body technical issues;
- (ii) Demonstrated ability to apply the knowledge of a scientific field or specialized area with sufficient expertise;
- (iii) Comprehension of the design and operation of structures, systems and components of regulated facilities from a regulatory perspective;
- (iv) Comprehension of engineering techniques or technical issues that are applied at facilities within the jurisdiction of the regulatory body;
- (v) Comprehension and demonstrated ability in applying radiation protection principles at nuclear facilities;
- (vi) Comprehension of safety and risk assessment tools and techniques and how safety and risk assessment is applied within the regulatory framework of the regulatory body.

(c) Quadrant 3: competences related to a regulatory body's practices:

- (i) Comprehension of the main principles of the management system, relevant policies, procedures, guidance documents and regulatory documents that need to be established or are used in conducting review and assessment;
- (ii) Comprehension of assessment procedures;
- (iii) Comprehension of nuclear safety concepts (defence in depth, etc.);
- (iv) Comprehension of probabilistic safety assessment (PSA) and probabilistic risk assessment (PRA) concepts;
- (v) Demonstrated ability in the analysis of technical information;
- (vi) Demonstrated ability in the integration of technical information;
- (vii) Demonstrated ability in making recommendations that are supported by reliable information.

(c) Quadrant 4: personal and behavioural competences:

- (i) Demonstrated ability to gather information and also to rely on professional judgment and experience to arrive at sound conclusions;
- (ii) Demonstrated ability to make trade-offs based on a full and realistic assessment of the situation;
- (iii) Demonstrated ability to deliver quality work that is timely, complete and accurate;
- (iv) Demonstrated ability to effectively use standard computer software packages and special software programs that have become part of the regulatory body's business processes;
- (v) Demonstrated ability to record, store and retrieve information using electronic means;
- (vi) Demonstrated ability to manipulate and to integrate electronic information using appropriate software packages;
- (vii) Demonstrated ability to make adjustments in response to feedback;
- (viii) Demonstrated ability to understand organizational norms and expectations;
- (ix) Demonstrated ability to document important information and to keep accurate records;

- (x) Demonstrated ability to provide timely and relevant information to others;
- (xi) Demonstrated ability to communicate with authority and to maintain composure when challenged, producing explanations calmly and reasonably to achieve results.

V.3.2. Authorization

Staff involved in authorization will be dealing with defining the licensing steps, the associated documentation that an applicant has to submit during various stages of the licensing process, as well as establishing licensing process under the management system (see Section 3.1.3). Regulatory staff involved in authorization have to make a decision for issuing licence and formulating the licence conditions.

V.3.2.1. Actions in SSG-16 [6]

In Phase 2:

- (a) The regulatory body should decide and authorize the acceptability of site (Action 164).

In Phase 3:

- (a) The regulatory body should develop and manage the processes needed in licensing, which typically includes the following phases: siting, construction, commissioning and operation (Action 34).
- (b) The regulatory body should verify, as part of the licensing process, that the operating organization has sufficient financial resources (Action 59).
- (c) The operating organization and the regulatory body should implement their respective processes to address modifications made to the design during construction and afterwards (Action 184).

V.3.2.2. Related competences

Examples of KSAs could be:

- (a) Quadrant 1: competences related to the legal, regulatory and organizational basis:
 - (i) Comprehension of the central government's nuclear laws and decrees as well as other laws and decrees that apply to a licensed nuclear facility;
 - (ii) Appreciation and comprehension of the applicability to the nuclear industry of the laws and decrees of the local jurisdictions and authorities;
 - (iii) Comprehension and demonstrated use of the regulatory body's regulations within limits regarding interpretations offered by legal counsels and recorded experience;
 - (iv) Appreciation and demonstrated comprehension of the rights of all interested parties affected directly or indirectly by the provisions of the legal basis of the regulatory body;
 - (v) Demonstrated ability to relate legal requirements to routine tasks associated with the authorization process;
 - (vi) Appreciation and comprehension of the interrelationship between legal documents, regulatory guidance documents and licensing documents;

- (vii) Comprehension of IAEA safety standards, particularly those relating to the authorization process as well as practices of other States with established nuclear power programmes.
- (b) Quadrant 2: technical disciplines competences:
- (i) Basic understanding of technical aspects such as reactor technology, accident analysis, structures, systems and components related to safety, instrumentation and control.
- (c) Quadrant 3: competences related to a regulatory body's practices:
- (i) Comprehension of the main principles of the management system, relevant policies, procedures, guidance documents and licensing documents that need to be established or are used in carrying out authorization;
 - (ii) Appreciation of duties to process an application rigorously and in a timely manner;
 - (iii) Comprehension of the format and contents of a licence (such as requirements set by the regulatory body and recommendations in IAEA Safety Standards Series No. GS-G-1.4, Documenting for Use in Regulating Nuclear Facilities [13]);
 - (iv) Comprehension of the possible options of a licence;
 - (v) Demonstrated ability to take the licensing recommendations into consideration and include them in the body of the licence or in the accompanying licence conditions;
 - (vi) Awareness and comprehension of how the terms of a licence and the associated licence conditions could be transferred into a licensee's operating safety envelope that will be guiding the inspection activities at a later stage;
 - (vii) Awareness, appreciation and comprehension of the licensee's documents submitted to receive a licence and other relevant licensee's documents.
- (d) Quadrant 4: personal and behavioural competences:
- (i) Demonstrated ability to consider the linkages among various regulatory processes interacting with the authorization process and to evaluate the impact on authorization decision;
 - (ii) Demonstrated ability to gather information and also to rely on professional judgment and experience to arrive at sound conclusions;
 - (iii) Demonstrated ability to deliver quality work that is timely, complete and accurate;
 - (iv) Demonstrated ability to understand organizational norms and expectations;
 - (v) Demonstrated ability to document important information and to keep accurate records;
 - (vi) Demonstrated ability to display confidence and conviction in recommending difficult or unpopular decision to interested parties;
 - (vii) Demonstrated ability to ensure that the consequences of the decision are clearly understood by all;
 - (viii) Demonstrated ability to communicate with authority and to maintain composure when challenged, producing explanations calmly and reasonably to achieve results.

V.3.3. Inspection

The regulatory body of an embarking State needs to prepare its staff in conducting inspections during the construction phase of a nuclear installation (see Section 3.1.3).

Accordingly, the competence requirements are identified well in advance, training programmes for future inspectors are established and implementation is started in Phase 2. The inspections during construction will broadly involve compliance of design as given in IAEA Safety Standards Series No. GS-G-4.1, Format and Content of the Safety Analysis Report for Nuclear Power Plants [14], covering requirements for design and construction of safety related structures, systems and components, including:

- (a) Safety, seismic and quality classifications;
- (b) Design bases;
- (c) Design features;
- (d) Codes and standards;
- (e) Seismic and environmental qualification, codes and standards.

The inspections during the construction phase of a nuclear installation include inspection at the construction site as well as inspection during equipment manufacturing. In addition to the inspections of technical area, one of the main areas of focus for inspection by the regulatory body is the licensee's management system. Such inspections are conducted to verify that an effective management system is in place to ensure the safety and quality of the construction of the nuclear installation. In certain cases, it may not be possible for the regulatory body to develop fully the specialized knowledge of codes and standards and may consider using assistance from outside organizations and consultants — with the necessary competence and expertise — for inspection. However, the regulatory body needs to develop enough competences to understand and to make its own judgement on the work of such outside organizations and consultants.

V.3.3.1. Actions in SSG-16 [6]

In Phase 2:

- (a) The regulatory body should develop the inspection programme related to the site authorization process and identify inspections to be conducted during construction (Actions 30 and 31).

In Phase 3:

- (a) The regulatory body should plan and conduct inspections during the licensing process, including siting, construction, commissioning and operation, consistent with the regulatory approach that was selected (Action 34).
- (b) The regulatory body should implement its programme for inspection during construction including, as applicable, the design and manufacture of safety related components (Action 37).

V.3.3.2. Related competences

Inspections by the regulatory body involve:

- Establishing inspection policy and strategy;
- Preparation of necessary inspection documentation (including inspection programme and plan, inspection procedures, checklists and reports);

- Establishing interface and lines of communication with the licensee for information exchange;
- Identifying skills required for specific inspection and formulation of inspection team or assigned individual;
- Conducting inspections;
- Formulating inspection findings and reports;
- Delivery of inspection report to the licensee;
- Follow-up of the inspection;
- Determining the need for any enforcement action and initiating enforcement process accordingly.

Accordingly, competences need to be developed to conduct all of these activities effectively.

Examples of KSAs could be:

- (a) Quadrant 1: competences related to the legal, regulatory and organizational basis:
- (i) Comprehension of the central government's nuclear laws and decrees as well as other laws and decrees that apply to a licensed nuclear facility;
 - (ii) Appreciation and comprehension of the applicability to the nuclear industry of the laws and decrees of the local jurisdictions and authorities;
 - (iii) Comprehension and demonstrated use of the regulatory body's regulations within limits regarding interpretations offered by legal counsels and recorded experience;
 - (iv) Appreciation and demonstrated comprehension of the rights of all interested parties affected directly or indirectly by the provisions of the legal basis of the regulatory body;
 - (v) Demonstrated ability to interpret legal texts for application in the field;
 - (vi) Demonstrated ability to relate legal requirements to inspection tasks;
 - (vii) Appreciation and comprehension of the interrelationship between legal documents, regulatory guidance documents, licensing documents and codes and standards;
 - (viii) Comprehension of IAEA safety standards, particularly those relating to the inspection process as well as practices of other States with established nuclear power programmes;
 - (ix) Comprehension of relevant policies, procedures, guidance documents and licensing submissions of the facility approved by the regulatory body during the authorization process.
- (b) Quadrant 2: technical disciplines competences
- (i) Deep comprehension of a scientific field or specialized area (e.g. reactor technology, engineering techniques or technical issues, nuclear safety, industrial codes and standards, and material sciences) that provides sufficiently expert knowledge to address and to resolve regulatory body technical issues;

- (ii) Demonstrated ability to apply the knowledge of a scientific field or specialized area with sufficient expertise;
- (iii) Comprehension of the design and operation of structures, systems and components of regulated facilities from a regulatory perspective;
- (iv) Comprehension of engineering techniques or technical issues that are applied at facilities within the jurisdiction of the regulatory body;
- (v) Comprehension and demonstrated ability in applying radiation protection principles at nuclear facilities;
- (vi) Appreciation and comprehension of the requirements and implications of international and national safety and industrial standards;
- (vii) Comprehension of safety and risk assessment tools and techniques and how safety and risk assessment is applied within the regulatory framework of the regulatory body.

(c) Quadrant 3: competences related to a regulatory body's practices

- (i) Comprehension of inspection procedures;
- (ii) Comprehension of inspection techniques;
- (iii) Comprehension of industry codes and standards;
- (iv) Comprehension of regulations and regulatory guidance documents;
- (v) Comprehension of regulatory body policies and standards for facility inspection;
- (vi) Comprehension of plant specific or area specific technical information;
- (vii) Comprehension of PSA/PRA concepts;
- (viii) Comprehension of licensing documents, manuals and other reference material;
- (ix) Comprehension of the licensee's work schedule;
- (x) Comprehension of previous inspection reports, allegation reports, licensee event reports, self-assessments, responses to generic communications and third party reports;
- (xi) Comprehension of root cause analyses techniques;
- (xii) Comprehension of facility status;
- (xiii) Comprehension of regulatory body allegations procedures;
- (xiv) Comprehension of guidance for inspection reports;
- (xv) Comprehension of procedures for control of information (such as draft and allegation);
- (xvi) Demonstrated ability in assessing the regulatory significance of inspection findings;
- (xvii) Demonstrated ability in evaluating information;
- (xviii) Demonstrated ability in interviewing;
- (xix) Demonstrated ability in resolving issues;
- (xx) Demonstrated ability in observation;
- (xxi) Demonstrated ability in planning and organizing inspections;
- (xxii) Demonstrated ability in recognizing and addressing unusual or abnormal conditions;
- (xxiii) Appreciation of critical thinking and questioning approach;
- (xxiv) Appreciation of maintaining objectivity and independence;
- (xxv) Demonstrated ability in making recommendations that are supported by reliable information;
- (xxvi) Comprehension of the process of auditing and established standards and procedures;

- (xxvii) Comprehension of the technical aspects of the subject matter of the audit;
- (xxviii) Demonstrated ability in reviewing and analysing documents against current standards and procedures;
- (xxix) Demonstrated ability in communicating, informing, instructing, persuading and encouraging others;
- (xxx) Demonstrated ability in explaining and interpreting procedures that apply to investigations;
- (xxxi) Demonstrated ability in making decisions on when investigation is appropriate, based on receipt of information;
- (xxxii) Demonstrated ability in evaluating information and circumstances and making decisions if and when an inspection needs to become an investigation;
- (xxxiii) Demonstrated ability in identifying a strategy appropriate to the circumstance and providing advice on measures to mitigate the immediate risk;
- (xxxiv) Comprehension of established procedures to conduct investigations;
- (xxxv) Demonstrated ability in collecting information and making decisions on relevance to legal obligations;
- (xxxvi) Demonstrated ability in investigating complaints, incidents, ill health and accidents for regulatory purposes in external organizations;
- (xxxvii) Demonstrated ability in conducting investigations of work-related accidents, cases of ill health and incidents in external organizations for regulatory purposes;
- (xxxviii) Demonstrated ability in gathering and evaluating evidence in external organizations to determine ill health/accident/incident/complaint causation, appropriate enforcement action and any other action needed by the regulatory authority or duty holders;
- (xxxix) Demonstrated ability in informing duty holders, employee/safety representatives and others, of the outcome of the investigation and actions proposed or required;
- (xl) Demonstrated ability in securing appropriate reductions in risk in work activities and compliance with health and safety legislation in external organizations.

(d) Quadrant 4: personal and behavioural competences:

- (i) Demonstrated ability to consider the linkages among various regulatory processes interacting with the inspection process and to evaluate the impact on inspection;
- (ii) Demonstrated ability to gather information and also to rely on professional judgment and experience to arrive at sound conclusions;
- (iii) Demonstrated ability to appraise situations to determine whether the priority is to solve a problem that has occurred, make a decision on a current situation or to prevent trouble in the future;
- (iv) Demonstrated ability to deliver quality work that is timely, complete and accurate;
- (v) Demonstrated ability to identify key issues, analyse and compare data from different sources, and clarify cause and effect relationships;
- (vi) Demonstrated ability to switch from one type of problem to another quickly and easily, distinguishing between essential and non-essential details;
- (vii) Demonstrated ability to analyse the risk and benefits of the best alternatives;

- (viii) Demonstrated ability to choose the alternatives;
- (ix) Demonstrated ability to record, store and retrieve information using electronic means;
- (x) Demonstrated ability to manipulate and to integrate electronic information using appropriate software packages;
- (xi) Demonstrated ability to make adjustments in response to feedback;
- (xii) Demonstrated ability to understand organizational norms and expectations;
- (xiii) Demonstrated ability to provide timely and relevant information to others;
- (xiv) Demonstrated ability to communicate with authority and to maintain composure when challenged, producing explanations calmly and reasonably to achieve results;
- (xv) Demonstrated ability to use effectively and to maintain formal and informal networks inside and outside the regulatory body to gather intelligence, seek input to problems or to build support for initiatives;
- (xvi) Demonstrated ability to produce clear, concise and informed written reports appropriate to the needs of the reader.

V.3.4. Enforcement

Enforcement is a function in which the regulatory body applies sanctions against an operator intended to correct and, as appropriate, penalize non-compliance with regulations, authorization bases and conditions of an authorization (see Sections 3.1.3 and 4.1). Enforcement function is closely linked with the inspection function as the outcome of inspections generally formed the basis for initiating enforcement process. Under the legal framework of various States, certain enforcement powers are conferred to the inspectors of the regulatory body.

V.3.4.1. Actions in SSG-16 [6]

In Phase 2, there are none.

In Phase 3, the regulatory body should implement its enforcement programme (Action 37).

V.3.4.2. Related competences

Enforcement function of the regulatory body involves establishing enforcement policy and strategy consistent with the legal provisions, developing necessary processes (including enforcement programme and procedures) for taking enforcement actions, establishing interface and lines of communication with other relevant authorities involved in the process (such as in case of prosecution and in some States for imposing civil penalties), taking enforcement actions, monitoring the effectiveness of enforcement process. Accordingly, competences need to be developed for all conducting all these activities effectively.

Examples of KSAs could be:

- (a) Quadrant 1: competences related to the legal, regulatory and organizational basis:
 - (i) Comprehension of the central government's nuclear laws and decrees as well as other laws and decrees that apply to a licensed nuclear facility;

- (ii) Appreciation and comprehension of the applicability to the nuclear industry of the laws and decrees of the local jurisdictions and authorities;
 - (iii) Comprehension and demonstrated use of the regulatory body's regulations within limits regarding interpretations offered by legal counsels and recorded experience;
 - (iv) Appreciation and demonstrated comprehension of the rights of all interested parties affected directly or indirectly by the provisions of the legal basis of the regulatory body;
 - (v) Demonstrated ability to interpret legal texts for application in the field;
 - (vi) Appreciation and comprehension of the interrelationship between legal documents, regulatory guidance documents and licensing documents
comprehension of the legal and regulatory framework (laws and regulations) for the safety and security of the facility;
 - (vii) Comprehension of enforcement policy and guidance;
 - (viii) Demonstrated ability in determining what regulation and supporting documents apply to specific situations;
 - (ix) Appreciation and comprehension of the laws, regulations and by-laws that protect the rights of individuals;
 - (x) Awareness and appreciation of the local criminal laws and their application.
- (b) Quadrant 2: technical disciplines competences:
- (i) Not applicable.
- (c) Quadrant 3: competences related to a regulatory body's practices:
- (i) Comprehension of an event or issue;
 - (ii) Comprehension of associated issues (plant performance data);
 - (iii) Comprehension of regulatory body procedures;
 - (iv) Demonstrated ability in identifying non-compliant situations during an inspection;
 - (v) Demonstrated ability in differentiating between minor and major violations;
 - (vi) Demonstrated ability in evaluating corrective measures proposed by the licensee and determining whether these will rectify identified items of non-compliance;
 - (vii) Demonstrated ability to secure corrective action by discussion and persuasion.
- (d) Quadrant 4: personal and behavioural competences:
- (i) Demonstrated ability to work with the local law enforcement units;
 - (ii) Demonstrated ability to consider the linkages among all parts of a problem and to evaluate the impacts of possible solutions;
 - (iii) Demonstrated ability to understand organizational norms and expectations;
 - (iv) Demonstrated ability to document important information and to keep accurate records;
 - (v) Demonstrated ability to adapt behaviour to cope with very stressful situations and to sustain mental effort to achieve objectives;
 - (vi) Demonstrated ability to communicate with authority and to maintain composure when challenged, producing explanations calmly and reasonably to achieve results;
 - (vii) Demonstrated ability to explain clearly and to articulate the regulatory body's position in a manner that instils commitment;
 - (viii) Demonstrated ability to respond appropriately to on-the-spot questions, using own knowledge where prepared answers are not available.

V.3.5. Development of regulations and guides

It is expected that the States embarking on nuclear power programmes develop or adopt the necessary regulations and guides well in advance of the bidding process. Accordingly, the regulatory bodies need to prioritize its plan for the establishment of regulations and guides, starting with the regulations describing the licensing process followed by regulations for site evaluation, design and management system. These regulations may be established during Phase 2. The regulations on construction, commissioning and operation may be established later in Phase 3.

If a State decides to develop its regulations and guides, it may take advantage of existing IAEA safety standards. It is understandable that during initial phases of developing regulations, the regulatory bodies of embarking States may not have adequate competence for the development of regulations and guides and, therefore, are likely to obtain support from some outside organizations and consultants with the expertise of the State's legal system. It is beneficial that the regulatory bodies may interact closely with the IAEA in developing their regulations, such as organizing reviews through IAEA support.

V.3.5.1. Actions in SSG-16 [6]

In Phase 2:

- (a) The regulatory body should start to issue regulations and guides for the various steps of the licensing process (Action 30).
- (b) The regulatory body should specify the safety requirements that should be known for the bidding process (Action 31).
- (c) The regulatory body should establish or approve, as appropriate, the limits and constraints regarding workers and the public both for normal and potential exposure situations in an NPP (Action 109).
- (d) The regulatory body should establish the necessary regulatory requirements on radioactive waste management, spent fuel management and decommissioning, as necessary for bid specifications (Action 126).
- (e) The regulatory body should develop basic regulations on emergency preparedness and response, as necessary for the development of infrastructure (Action 138).
- (f) The regulatory body should establish specific safety requirements for site evaluation, including requirements for the process for authorizing the site selected, in compliance with the relevant IAEA safety standards (Action 161).
- (g) The regulatory body should prepare and enact national safety regulations on design that are necessary for bid specification (Action 174).
- (h) All the relevant organizations should coordinate safety and security aspects from the early stages of development, establishing maximum synergy and, where necessary, integration (Action 194).

In Phase 3, the regulatory body should ensure that a full and comprehensive set of regulations and guides is in place for regulating construction, commissioning and operational activities at the appropriate time (Action 36).

V.3.5.2. Related competences

Development of regulations and guides require careful planning and prioritizing to ensure that regulations and guides are made available in time. The process provides for

involvement of other organizations and interested parties in the development, which in some cases are also binding within the State's legal system. In any case, involvement of other organizations and interested parties ensures transparency and openness in the regulatory processes, which is necessary for interested parties' confidence. The development of regulations may require support from outside organizations and consultants under the management system of the regulatory body.

Examples of KSAs could be:

- (a) Quadrant 1: competences related to the legal, regulatory and organizational basis:
 - (i) Comprehension of the central government's nuclear laws and decrees as well as other laws and decrees that apply to a licensed nuclear facility;
 - (ii) Appreciation and comprehension of the applicability to the nuclear industry of the laws and decrees of the local jurisdictions and authorities;
 - (iii) Comprehension and demonstrated use of the regulatory body's regulations within limits regarding interpretations offered by legal counsels and recorded experience;
 - (iv) Appreciation and comprehension of the interrelationship between legal documents, regulatory guidance documents and licensing documents;
 - (v) Appreciation of the mandate, mission and objectives of the organization;
 - (vi) Appreciation of adhering to the principles of good regulations, which means that the regulatory body carries out its activities in an independent, open, efficient, clear, reliable and fair manner.
- (b) Quadrant 2: technical disciplines competences:
 - (i) Deep comprehension of a scientific field or specialized area (e.g. reactor technology, engineering techniques or technical issues, nuclear safety, industrial codes and standards) that provides sufficiently expert knowledge to address and to resolve regulatory body technical issues;
 - (ii) Demonstrated ability to apply the knowledge of a scientific field or specialized area with sufficient expertise;
 - (iii) Comprehension and demonstrated ability in applying radiation protection principles at nuclear facilities;
 - (iv) Appreciation and comprehension of the requirements and implications of international and national safety and industrial standards.
- (c) Quadrant 3: competences related to a regulatory body's practices:
 - (i) Appreciation and demonstrated comprehension of the rights of all interested parties affected directly or indirectly by the provisions of the legal basis of the regulatory body;
 - (ii) Demonstrated ability to interpret legal texts for application in the field;
 - (iii) Demonstrated ability to relate legal requirements to routine tasks;
 - (iv) Appreciation and comprehension of the requirements and implications of international and national safety and industrial standards;
 - (v) Awareness of the safety requirements applied in other States;
 - (vi) Demonstrated ability to define technical safety requirements for siting, design, construction, commissioning, operation, decommissioning and waste management of nuclear facilities or devices;
 - (vii) Demonstrated ability to identify gaps and to confirm needs for the production of regulations and regulatory guidance documents;
 - (viii) Demonstrated proficiency in writing regulatory requirements in mandatory rules and regulations as well as in regulatory guidance documents;

- (ix) Demonstrated ability to transfer legal requirements into forms which can easily be understood and practical guidance texts;
 - (x) Demonstrated ability to produce regulations and regulatory guidance documents in accordance with established formats and formal textual styles;
 - (xi) Demonstrated ability to ensure consistency in terminology and format and to identify needs for, and justify new or modifications to, existing regulatory documents.
- (d) Quadrant 4: personal and behavioural competences:
- (i) Demonstrated ability to gather information and also to rely on professional judgment and experience to arrive at sound conclusions;
 - (ii) Demonstrated ability to make trade-offs based on a full and realistic assessment of the situation;
 - (iii) Demonstrated ability to analyse the risk and benefits of the best alternatives;
 - (iv) Demonstrated ability to choose the alternatives;
 - (v) Demonstrated ability to record, store and retrieve information using electronic means;
 - (vi) Demonstrated ability to set priorities and organizes work to meet established time frames in accordance with regulatory body's requirement;
 - (vii) Demonstrated ability to adapt schedule and to adjust priorities as changes occur;
 - (viii) Demonstrated ability to deliver quality work that is timely, complete and accurate;
 - (ix) Demonstrated ability to accept constructive criticism;
 - (x) Demonstrated ability to make realistic agreements with parties regarding expectations and solutions;
 - (xi) Demonstrated ability to interpret contradictory or competing messages;
 - (xii) Demonstrated ability to always explain the logic behind why things need to be done a certain way; and where no logic prevails, to investigate further to find rationale.

V.3.6. Emergency preparedness and response

Regulatory body deals with safety related matters in nuclear business. It has distinct regulatory role during routine time and in time of crises (i.e. during a nuclear or radiological emergency). Generally, it performs its own independent assessment during a nuclear or radiological emergency situation. Based on independent assessment, it provides proposals, suggestions and recommendations to the government and general public to cope with the emergency situation. The regulatory body is also supposed to provide a true picture of the incident to the general public, government and international community. Furthermore, it may also provide training to the emergency response teams (i.e. responders) in specific areas such as radiation protection and radiation monitoring, among other things. Therefore, the regulatory body needs to have clearly defined roles and responsibilities and interface with relevant government departments to perform its function related to emergency preparedness and response.

V.3.6.1. Actions in SSG-16 [6]

In Phase 2: the regulatory body should develop basic regulations on emergency preparedness and response as necessary for the development of infrastructure (Action 138).

In Phase 3:

- (a) The regulatory body should establish detailed regulations on emergency preparedness and response (Action 140).
- (b) The government and the regulatory body should develop and implement emergency preparedness programmes at the local, national and international levels (Action 142).
- (c) The government and the regulatory body should establish arrangements for coordination between the emergency response plan of the NPP and the plans of the relevant national institutions that would be involved in emergency response (Action 143).
- (d) The regulatory body should review and assess the emergency programme and the emergency plans and procedures for NPPs, and should verify compliance with the regulatory requirements (Action 144).
- (e) The government, the regulatory body and the operating organization should demonstrate emergency response capabilities by conducting appropriate exercises that include local authorities and local communities (Action 145).

V.3.6.2. Related competences

Although the design of NPPs is robust and the probability of any accident of severe nature is extremely low, accidents such as the Three Mile Island, Chernobyl and Fukushima have still occurred. Accordingly, the need for adequate preparedness at national and international levels for dealing with accidents and emergencies cannot be undermined. The role of the regulatory body is very important in this area, as it has to regulate to ensure that adequate measures have been taken and arrangements are in place to deal with any emergency situation and regular drills or exercises are conducted to demonstrate the adequacy of such measures and arrangements. In addition, the regulatory body also has to advise the government on necessary intervention measures, inform and communicate with the public and media on emergency situation, and interact with the international community for providing the necessary information about the emergency. The regulatory body is, therefore, required to develop necessary competences (KSAs) to perform these tasks.

Examples of KSAs could be:

- (a) Quadrant 1: competences related to the legal, regulatory and organizational basis:
 - (i) Appreciation of the mandate, mission and objectives of the organization;
 - (ii) Comprehension of the central government's nuclear laws and decrees as well as other laws and decrees that is applicable in case of nuclear and radiological emergencies;
 - (iii) Appreciation and comprehension of the applicability to the nuclear industry of the laws and decrees of the local jurisdictions and authorities that can provide assistance in case of nuclear and radiological emergencies;
 - (iv) Appreciation and comprehension of the roles and responsibilities of national and international organizations with legal or administrative roles in managing and responding to nuclear or radiological emergencies, including: emergency management organizations; law enforcement agencies; federal, provincial, state or local government; and organizations providing medical assistance;
 - (v) Demonstrated ability to relate legal requirements to routine tasks associated with the emergency preparedness and response;

- (vi) Comprehension of IAEA safety standards, particularly those relating to emergency preparedness and response, relevant international instruments as well as the practices of other States with established nuclear power programmes;
 - (vii) Comprehension and demonstrated use of the regulatory body's regulations within limits regarding interpretations offered by legal counsels and recorded experience;
 - (viii) Appreciation and demonstrated comprehension of the responsibilities and functions of all interested parties affected directly or indirectly by the provisions of the legal basis of the regulatory body;
 - (ix) Appreciation and comprehension of the interrelationship between legal documents, regulatory guidance documents and licensing documents;
 - (x) Comprehension of relevant policies, procedures, guidance documents and documents that are used in conducting specific regulatory tasks in relation to emergency preparedness and response as defined in the legal basis;
 - (xi) Appreciation of duties to respond to an emergency rigorously and in a timely manner.
- (b) Quadrant 2: technical disciplines competences:
- (i) Deep comprehension of defence concepts and application of relevant operating procedures and guidelines with respect to nuclear and radiological emergencies;
 - (ii) Comprehension of the application of radiation protection principles at nuclear facilities;
 - (iii) Comprehension of safety and risk assessment tools and techniques and how safety and risk assessment is applied within the regulatory framework of the regulatory body;
 - (iv) Comprehension of design basis accidents related to the specific design of nuclear facilities;
 - (v) Comprehension of plant procedures, especially those which lie under the scope of emergency planning and preparedness.
- (c) Quadrant 3: competences related to a regulatory body's practices:
- (i) Comprehension of the processes and procedures of the regulatory body, especially related to emergency preparedness;
 - (ii) Comprehension of regulations and regulatory guidance documents related to emergency preparedness;
 - (iii) Appreciation and comprehension of activities related to emergency preparedness during authorization, review and assessment and inspection processes;
 - (iv) Comprehension of inspection procedures, especially with respect to inspection of emergency drills and exercises.
- (d) Quadrant 4: personal and behavioural competences:
- (i) Demonstrated ability to build effective liaison with others at all levels inside and outside the organization to respond to the emergency effectively;
 - (ii) Demonstrated ability to adapt behaviour to cope with very stressful situations and to sustain mental effort to achieve objectives of the regulatory body in emergency situations;
 - (iii) Demonstrated ability to use effectively and maintain formal and informal networks inside and outside the regulatory body to gather data, seek input to the cause of an emergency, build consensus for any initiative to cope the emergency situation and evaluate the impacts of possible initiatives and solutions;

- (iv) Demonstrated ability to respond appropriately to media and to provide valuable recommendations (i.e. based on factual data and engineering judgment and out-of-the-box thinking) to government during nuclear and radiological emergencies;
- (v) Demonstrated ability to explain clearly and to articulate the regulatory body's position in a manner that avoids any misinterpretations in emergency circumstances;
- (vi) Demonstrated ability to communicate with authority and to maintain composure at time of emergency to disseminate information and achieve desired results.

V.3.7. International cooperation

International cooperation is a function in which the regulatory body establishes arrangements for the exchange of safety related information to fulfil safety obligations and to promote cooperation. International cooperation consists of entering into international conventions and treaties (e.g. Convention on Nuclear Safety, Convention on Early Notification of a Nuclear Accident, etc.), exchange of information, mutual assistance in safety matters, staff training and other relevant matters.

V.3.7.1. Actions in SSG-16 [6]

In Phase 2:

- (a) All the relevant organizations should participate in the global nuclear safety framework (Action 14).
- (b) All relevant organizations should strengthen their cooperation on safety related matters with States with advanced nuclear power programmes (Action 16).
- (c) The regulatory body should begin establishing a suitable working relationship with the operating organization and with international organizations (Action 32).
- (d) All relevant organizations should support the safety related training of prospective nuclear staff in nuclear organizations in other States (Action 91).
- (e) The regulatory body and the organizations in charge of the transport of radioactive material should participate in international activities and networks to provide mutual support (Action 191).

In Phase 3:

- (a) All the relevant organizations should ensure continued participation in international activities and international networks for strengthening safety (Action 17).
- (b) The regulatory body should implement a cooperation programme with the vendor State and with other regulatory bodies that have experience of oversight of NPPs of the same type as that selected (Action 19).
- (c) All the relevant organizations should be aware of international efforts and progress with regard to the disposal of radioactive waste (Action 132).

V.3.7.2. *Related competences*

International cooperation requires knowledge of different international legal instruments, such as the Convention on Nuclear Safety, the Convention on Early Notification of a Nuclear Accident, the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, as well as the State's foreign policy. To develop good relations with the international nuclear community, there is a need to identify mutual areas of interest and to develop a mechanism for the mutual sharing of information, experience and assistance and to carry out combined research and development and training activities.

Examples of KSAs could be:

- (a) Quadrant 1: competences related to the legal, regulatory and organizational basis:
 - (i) Comprehension of international instruments including, among others:
 - Convention on Nuclear Safety;
 - Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management;
 - Convention on Early Notification of a Nuclear Accident;
 - Convention on Assistance in the case of a Nuclear Accident or Radiological Emergency.
 - (ii) Comprehension of the central government's nuclear laws and decrees as well as other laws and decrees that apply to a licensed nuclear facility;
 - (iii) Comprehension of the State's foreign policy and strategy;
 - (iv) Comprehension and appreciation of the State's international commitments;
 - (v) Comprehension and appreciation of the international obligations assigned or applied to the regulatory body;
 - (vi) Comprehension of the roles, responsibilities and mandate of the regulatory body;
 - (vii) Comprehension of the structure of the regulatory body's management system.
- (b) Quadrant 2: technical disciplines competences:
 - (i) Comprehension of one of the science fields at a basic level but not necessarily applied to nuclear industry applications, problems or situations;
 - (ii) Comprehension of one of the engineering fields at a basic level and but not necessarily applied to nuclear industry applications, problems or situations.
 - (iii) Basic understanding of the technical aspects of the NPP, such as reactor technology, accident analysis, structures, systems and components related to safety, instrumentation and control, among others.
- (c) Quadrant 3: competences related to a regulatory body's practices:
 - (i) Comprehension of the policies, practices and management system of the regulatory body;
 - (ii) Comprehension of regulations and regulatory guidance documents;
 - (iii) Comprehension of regulatory processes (i.e. authorization process, enforcement process, etc.).
- (d) Quadrant 4: personal and behavioural competences:
 - (i) Demonstrated ability to gather information and also to rely on professional judgment and experience to arrive at sound conclusions;
 - (ii) Demonstrated ability to deliver quality work that is timely, complete and accurate;

- (iii) Demonstrated ability to switch from one type of problem to another quickly and easily, distinguishing between essential and non-essential details;
- (iv) Demonstrated ability to make adjustments in response to feedback;
- (v) Demonstrated ability to understand organizational norms and expectations;
- (vi) Demonstrated ability to provide timely and relevant information to others;
- (vii) Demonstrated ability to use effectively and maintain formal and informal networks inside and outside the regulatory body to gather intelligence, seek input to problems or build support for initiatives;
- (viii) Demonstrated ability to produce clear, concise and informed written reports appropriate to the needs of the reader;
- (ix) Demonstrated ability to adapt behaviour to accommodate the sensitivities of others, cope with stressful situations and sustain mental effort to achieve objectives;
- (x) Demonstrated ability to talk effectively in small groups and to large audiences;
- (xi) Demonstrated ability of the needs, interests and expectations of various national and international groups and organizations;
- (xii) Demonstrated ability to communicate complex issues clearly and to understand the communication norms of international community practice;
- (xiii) Demonstrated ability to cooperate well with other team members and to maintain a positive and productive atmosphere;
- (xiv) Demonstrated ability to be approachable and open to suggestions from others;
- (xv) Demonstrated ability to resolve differences by encouraging alternative proposals, taking into account the positions of all interested parties, and facilitating open discussion;
- (xvi) Demonstrated ability to develop project plans, establish deliverables and success criteria and to schedule activities.

V.3.8. Communication with interested parties, including the public

The regulatory body has to communicate and to consult with interested parties such as the public media, government and non-governmental organizations to perform its legal obligations. This communication and consultation is commonly required during the preparation of regulations and guides, authorization process, and reporting on safety issues and events. In order to build a strong relationship with interested parties, proper communication and consultation mechanisms need to be developed and improved over time.

V.3.8.1. Actions in SSG-16 [6]

In Phase 2, all the relevant organizations should continue to inform the public and interested parties on safety issues, including the expected health and environmental impacts of a nuclear power programme (Action 42).

In Phase 3:

- (a) All relevant organizations should seek to establish and to maintain the confidence and trust of interested parties, including the public, on safety issues (Action 43).
- (b) All relevant organizations should continue to explain to interested parties the risks and benefits of the introduction of nuclear power and the measures taken to limit the risks (Action 44).

- (c) The regulatory body should communicate with interested parties about the licensing process, safety requirements and regulatory oversight (Action 45).
- (d) The operating organization and the regulatory body should communicate with interested parties about safety issues in construction and the commissioning programme (Action 46).

V.3.8.2. Related competences

A number of skills are required by the regulatory body to communicate and to consult with the interested parties. In this regard, designated individuals of the regulatory body need to be aware of legal requirements especially and, to some extent, international requirements. At the same time, good communication skills are required by these staff members.

Examples of KSAs could be:

- (a) Quadrant 1: competences related to the legal, regulatory and organizational basis:
 - (i) Comprehension of national laws related to:
 - Environmental protection;
 - Public health and safety;
 - Labour health and safety;
 - Rights of individuals.
 - (ii) Comprehension of the central government's nuclear laws and decrees as well as other laws and decrees that apply to a licensed nuclear facility;
 - (iii) Appreciation and comprehension of the applicability to the nuclear industry of the laws and decrees of the local jurisdictions and authorities;
 - (iv) Comprehension of the regulatory body's regulations within limits regarding interpretations offered by legal counsels and recorded experience;
 - (v) Appreciation and comprehension of the interrelationship between legal documents, regulatory guidance documents, licensing documents, and codes and standards;
 - (vi) Comprehension of IAEA safety standards as well as practices of other States with established nuclear power programmes;
 - (vii) Comprehension of relevant policies, procedures, guidance documents and licensing submissions of the facility approved by the regulatory body during the authorization process;
 - (viii) Comprehension of the structure of the regulatory body's management system.
- (b) Quadrant 2: technical disciplines competences:
 - (i) Not applicable.
- (c) Quadrant 3: competences related to a regulatory body's practices:
 - (i) Not applicable.
- (d) Quadrant 4: personal and behavioural competences:
 - (i) Demonstrated ability to switch from one type of problem to another quickly and easily, distinguishing between essential and non-essential details;
 - (ii) Demonstrated ability to understand organizational norms and expectations;
 - (iii) Demonstrated ability to provide timely and relevant information to others;

- (iv) Demonstrated ability to communicate with authority and to maintain composure when challenged, producing explanations calmly and reasonably to achieve results;
- (v) Demonstrated ability to adapt behaviour to accommodate the sensitivities of others, cope with stressful situations and sustain mental effort to achieve objectives;
- (vi) Demonstrated ability to talk effectively in small groups and to large audiences;
- (vii) Demonstrated ability of the needs, interests and expectations of various national and international groups and organizations;
- (viii) Demonstrated ability to communicate complex issues clearly and to understand the communication norms of international community practice;
- (ix) Demonstrated ability to cooperate well with other team members and to maintain a positive and productive atmosphere;
- (x) Demonstrated ability to be approachable and open to suggestions from others;
- (xi) Demonstrated ability to resolve differences by encouraging alternative proposals, taking into account the positions of all interested parties, and facilitating open discussion.

V.3.9. Management system

The regulatory body needs to have effective systems in place for performing its main and support functions and to improve continually its performance, effectiveness and efficiency. For effective management system, objectives are set to monitor the performance of processes and systems and outcomes communicated at all levels within the organization at regular intervals.

V.3.9.1. Actions in SSG-16 [6]

In Phase 2:

- (a) The regulatory body and the operating organization should start developing and implementing effective management systems in their respective organizations and should promote a strong safety culture (Action 75).
- (b) The regulatory body and the operating organization should make appropriate arrangements for measurement, assessment (both 'self-assessment' and independent assessment) and continual improvement of their management systems (Action 77).

In Phase 3:

- (a) The senior management of all the relevant organizations should provide effective leadership and effective management for safety to ensure a sustainable, high level of safety and a strong safety culture (Action 78).
- (b) All the relevant organizations should continue the implementation of a management system that promotes the concept that requirements for safety shall be paramount within the organization, overriding all other demands (Action 79).
- (c) The operating organization and the regulatory body should ensure that the effectiveness of their management systems is monitored and measured, and that self-assessments as well as independent assessments are conducted regularly for continual improvement (Action 80).

- (d) All the relevant organizations should ensure that appropriate arrangements for the management of safety related knowledge (including record management and report management) and knowledge transfer are in place (Action 81).
- (e) All the relevant organizations should ensure that leadership and succession development programmes are in place to develop future leaders with a strong emphasis on safety (Action 82).

V.3.9.2. Related competences

The management system provides a framework for the arrangements and processes necessary to address all the regulatory goals and acts as an efficient tool for effective management of regulatory activities. Maintenance and implementation of the management system will result in satisfaction of interested parties and will demonstrate the internal mechanisms of the regulatory body to ensure continual improvement, thus increasing effectiveness and efficiency of the regulatory activities and processes. Accordingly, competences need to be developed for implementing all activities related to the management system effectively.

Examples of KSAs could be:

- (a) Quadrant 1: competences related to the legal, regulatory and organizational basis:
 - (i) Appreciation of the mandate, mission and objectives of the organization;
 - (ii) Appreciation of measures for implementing actions to achieve the short and long term strategic objectives and goals of the regulatory body;
 - (iii) Comprehension of relevant policies, procedures and guidance documents that are used in conducting specific regulatory tasks as defined in the legal basis;
 - (iv) Comprehension of IAEA safety standards and other standards and practices (such as the ASME Nuclear Quality Assurance or the International Organization for Standardization) relating to the management system;
 - (v) Demonstrated ability to define responsibilities for the individual activities and processes and to define individual responsibilities with accountabilities and clear lines of reporting;
 - (vi) Demonstrated ability to establish guidance on the processes to be covered under the management system, including core and support processes;
 - (vii) Appreciation and comprehension of regulated industry and its associated norms;
 - (viii) Appreciation and comprehension of safety culture and its attributes;
 - (ix) Demonstrated ability to develop a mechanism of self-assessment;
 - (x) Appreciation of the principles, goals and processes of the management system;
 - (xi) Demonstrated ability of applying principles, goals and processes of the management system in core and support regulatory functions;
 - (xii) Appreciation and comprehension of the continual improvement processes.
- (b) Quadrant 2: technical disciplines competences:
 - (i) Comprehension of the basic design philosophy of nuclear reactors;
 - (ii) Comprehension of the safety and risk associated with nuclear industry and how safety and risk inputs are applied within the regulatory framework of the regulatory body.
- (c) Quadrant 3: competences related to a regulatory body's practices:

- (i) Comprehension and appreciation of the organization and its internal and external interfaces;
- (ii) Comprehension and appreciation of interested parties' interest and expectations;
- (iii) Comprehension of the processes and documentation system;
- (iv) Demonstrated ability in establishing and developing the processes and documentation system;
- (v) Comprehension of regulations and regulatory guidance documents to carry out the activities of the regulatory body;
- (vi) Comprehension of the main principles of the management system and relevant policies;
- (vii) Comprehension of assessment techniques, established practices and procedures;
- (viii) Demonstrated ability in establishing and applying assessment techniques, practices and procedures.

(d) Quadrant 4: personal and behavioural competences:

- (i) Demonstrated ability to understand organizational norms and expectations;
- (ii) Demonstrated ability to assess external and internal environments and consider results in decision making;
- (iii) Demonstrated ability to switch from one type of problem to another quickly and easily, distinguishing between essential and non-essential details;
- (iv) Demonstrated ability to remain optimistic when faced with adversity and attitude and to see the positive in difficult situations;
- (v) Demonstrated ability to document important information and to keep accurate records;
- (vi) Demonstrated ability to adapt behaviour to cope with very stressful situations and to sustain mental effort to achieve objectives;
- (vii) Demonstrated ability to consider the linkages among all parts of a problem and to evaluate the impacts of possible solutions;
- (viii) Demonstrated ability to build effective working relationships with others at all levels, inside and outside the work unit;
- (ix) Display the confidence to surrender control oriented processes in order that teams can take initiative and accept accountability for results;
- (x) Demonstrated ability to learn from past experience and mistakes and the willingness to help others learn from these experiences;
- (xi) Demonstrated ability to integrate and to use feedback, progress reports and lessons learned to ensure commitments are met.

V.4. ACQUIRING COMPETENCES IN EMBARKING STATES

The methods of acquiring competences described in the body of this Safety Report are relevant to a State embarking on a nuclear power programme. For a new entrant State, the main distinctions are not the lack of existing competences but the recognition that competences need to be developed in a systematic way so the regulatory body can perform as necessary. The competences needed for Phases 2 and 3 have been further developed, informed by the actions contained in IAEA Safety Standards Series No. SSG-16 [6]; however, the specific competences will vary depending on the Member State's licensing process and according to the framework of the NPP project schedule.

It is anticipated that "any construction by a new entrant will likely be based on the well proven technologies of an exporting country. It might be expected that the design has

been licensed by the regulatory body in the exporting country, perhaps with the benefit of analysis by other regulatory bodies” (para. 26 of Ref. [15]). This section identifies examples of how the methods could be incorporated into an overall strategy for acquiring competences.

V.4.1. Use of external support

The entrant regulatory body needs to establish bilateral and multilateral cooperation agreements with other regulatory bodies, mainly the regulatory body of the vendor State or of a State which has already licensed a similar plant which might serve as a reference, and with international organizations of regulators, such as the European Nuclear Safety Regulators Group, in order to have:

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

In addition, the entrant may consider receiving assistance with the early regulatory activities — such as the development of a regulatory framework that may be based on adopting existing regulations, and regulatory review and assessment leveraging regulatory decisions associated with the reference plant.

Within the method of use of external support, new entrants have particularly relied on support from the regulator of the vendor State or that of a regulator that had licensed the same reactor design. In this case, it is important for the new entrant to evaluate the regulatory framework of that regulatory body in the context of its own national legal and regulatory obligations. Any differences need to be properly addressed.

Regardless of the use of external support, the regulatory body must retain the decision making responsibility. It is recognized that as the embarking State further develops its competence, there will be a reduced reliance on this external support in performing regulatory activities.

V.4.2. Recruitment

Recruitment of experienced personnel from other national or international institutions will take place. The extent to which the regulatory body can recruit experienced personnel will influence the reliance of external support to perform regulatory functions. It needs to be recognized that this personnel will still need training in Quadrant 1 competences to familiarize them with specific aspects of the legal and regulatory framework and practices. In addition, there may be some training and sometimes a retraining in Quadrants 2, 3 and 4 to address issues specific to Member States.

V.4.3. Training

To assure the sustainability of the regulatory body in the longer term, the competences required to regulate the future operation of the plant must be available at the beginning of the

commissioning phase. The goals of the training programme in this case need to 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 regulatory body needs to define a core set of competences to receive priority during the training programme. The training programme itself will initially rely on that of the mature regulatory body.

V.4.4. Coordination at the national level

The availability of adequate numbers of suitable candidates for initial recruitment may probably need a reinforcement of the national universities and other professional institutions to increase the quantity and the quality of the graduates.

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